

# **Squam Lakes Watershed Plan**

**August 1991**



**New Hampshire Office of State Planning**

A picture of Squam Lake in 1906:

*“...ashes from the puffing steamers towing thin rafts of logs ... coal, broken bottles, tin cans, dead fish, dead puppies and kittens, unwanted sandwiches, orange peel, a broken dinner set (on deep Haven Reef). There were old boats sunk full of stones ... sawdust from the sawmill on White Oak Brook, which settled feet thick on the white sand bottom of Piper Cove, driftwood, half-sunken tree-tops ... sewage, old mattresses, broken chairs, house refuse of every conceivable kind, some a menace to health, much else equally menacing to navigation ... Later came automobile tires, pieces of damaged machinery and engine oil which fouled all the surface and killed fish as well as water plants ...”*

From A Condensed History of the Squam Lakes Association, edited by Susan Baker Keith

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State of New Hampshire  
Judd Gregg, Governor

Office of State Planning  
Jeffrey H. Taylor, Director

NEW HAMPSHIRE OFFICE OF STATE PLANNING

*Printed on Recycled Paper*

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## Chapter 1. Introduction - Description of the Planning Process

### History of Local Cooperative Action in the Squam Lakes Area

Any plan for the Squam Lakes watershed, if it is to succeed, must grow from the convictions of people who live and work in the Squam communities -- who appreciate at first hand the need to protect the Squam Lakes and hills. For in the end, a Squam area plan must be implemented locally. It must have the support of local boards and officials, and they must be backed, in turn, by a citizenry convinced that an area plan is important enough to warrant the cooperation, compromise and changes in use habits and expectations that will be required to make such a plan work.

Fortunately, the record in this respect is a strong one in the Squam region. There is a long history of local cooperative action for the benefit of the Squam Lakes, stretching back to the beginning of this century. At that time, Squam Lake was effectively reclaimed by a group of lake property owners who banded together in 1904 to form a new Squam Lake Improvement Association (now the Squam Lakes Association).

A picture of a Squam Lake badly in need of improvement is graphically described in this excerpt from A Condensed History of the S.L.A., edited by Susan Baker Keith, in which she talks about the origins of the "war against pollution" that began in 1906:

"... ashes from the puffing steamers towing thin rafts of logs... coal, broken bottles, tin cans, dead fish, dead puppies and kittens, unwanted sandwiches, orange peel, a broken dinner set (on Deep Haven Reef). There were old boats sunk full of stones... sawdust from the sawmill on White Oak Brook, which settled feet thick on the white sand bottom of Piper Cove, driftwood, half-sunken tree-tops... sewage, old mattresses, broken chairs, house refuse of every conceivable kind, some a menace to health, much else equally menacing to navigation... Later came automobile tires, pieces of damaged machinery and engine oil which fouled all the surface and killed fish as well as water plants..."

The same spirit that delivered Squam from such a degraded state clearly will be needed to deal with the ever-growing lake use and development pressures that lie ahead for the Squam watershed. That spirit of cooperation among all types of current and potential watershed interests -- shore property owners, town residents, visitors, developers, hillside dwellers, commercial enterprises, and other -- will have to be harnessed to the larger needs of watershed protection.

The history of such cooperative action in the interests of the Squam Lakes speaks well for the future. But the task will not be easy. The many contending -- and in some cases, competing -- uses that are projected for the lake surfaces and for the surrounding lands will have to be secondary to the overriding goal of watershed preservation. Such voluntary subordination of private interests to the larger needs of Squam as a whole will require not only sacrifices, but also a sense on everyone's part that the sacrifices are being fairly apportioned - that everyone is contributing equally to a commonly-held objective.

### **Background of the Squam Lakes Watershed Planning Process**

During the Summer of 1984, the New Hampshire Council on Resources and Economic Development (CORD), in response to a request from Governor Sununu, held a series of meetings in the Lakes Region to investigate growth related problems affecting the State's lakes. The result of these meetings was a report which addressed seven major issues of concern, namely: leasing of State land, docks and moorings, boating, water milfoil and aquatic weeds, old septic systems, growth management, and lake management planning. This report, prepared by CORD and submitted to the Governor in February, 1985 discussed the problems raised and also presented recommendations. With regard to lake management planning, the report recommended that the Office of State Planning, in cooperation with communities in a lake watershed, prepare a lake management plan. This plan would be designed to assure that activities on and around a lake would not exceed the capacity of that body of water to accommodate such activities.

In September, 1985 the boards of selectmen of the five towns abutting Squam and Little Squam Lakes wrote to the Governor requesting assistance in preparing a lake management plan for their watershed. Governor Sununu responded to their requests by directing OSP to initiate a project for the Squam Lakes. This initiative was reinforced in the spring of 1986, when the legislature enacted Chapter 45, which directed the Office of State Planning to establish a pilot watershed planning project with several towns contiguous to a great pond.

A brief chronology of the Squam Lakes watershed planning process is presented on pages 1-6 to 1-10.

### **Purposes of the Pilot Planning Project**

The purposes which have guided the development of the Squam Lakes Watershed Plan are the following:

- To develop, in collaboration with the municipalities affected, with conservation organizations and with State agencies, a lake management plan for the Squam Lakes watershed, whose purpose is to assure that activities permitted on and around the lakes will not exceed the capacity of the waterbodies to accommodate them.



- To develop a model lake watershed management plan for use as a guide for other watershed planning efforts in New Hampshire.
- To explore innovative land use planning and management approaches, and to propose recommendations for implementing these approaches at both State and local levels.
- To demonstrate applications of geographic information technology and the GRANIT data base to the watershed planning process.

### **Local Involvement in the Planning Process**

Local guidance was provided to the project through the Squam Lakes Watershed Advisory Committee (SLWAC), with representatives from each watershed town's board of selectmen, planning board and conservation commission. Committee membership also included conservation and other local organizations. Formal designation of members to the Committee by the respective organizations or local government was an important factor in assuring a sense of legitimacy to their participation. The names of individuals who participated in the project are found in Figure 1-1.

### **Working Goals and Objectives**

The Squam Lakes Watershed Advisory Committee began meeting informally during the spring and summer of 1988, and developed a working set of goals and objectives. Over the course of the project, these were refined and supplemented. The seven initial goals for the Squam Lakes watershed planning process addressed land and water capability, water quality, wildlife habitat, environmental education, access, land acquisition and the socio-economic implications of the watershed plan.

### **Inventory and Analysis**

The first step in any water resources planning project is to define the study area. The focus of this pilot project is the Squam Lakes and their watershed. Consideration of the entire Squam watershed is necessary in order to plan for and manage such a significant surface water resource. Since portions of six towns lie within the watershed, the study area serves as an example of how natural drainage divides seldom coincide with political boundaries. Intermunicipal cooperation is essential to effectively implement management plans for such watersheds.

One of the most basic, yet critical elements of any planning process is the data collection phase. It is important to make sure that the plan includes the solid, scientific and statistical basis for its recommendations.

Figure 1-1. Squam Lakes Watershed Advisory Committee

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<u>Member</u>	<u>Affiliation</u>
John Reeve	Ashland Board of Selectmen
Phil Preston	Ashland Planning Board
Norman Beane	Ashland Conservation Commission
Kenneth E. Sorlein	Centre Harbor Board of Selectmen
Kirk R. Meloney	Centre Harbor Planning Board
Susan H. Power	Centre Harbor Conservation Commission
Willis Holland	Holderness Board of Selectmen
Earl Hansen	Holderness Planning Board
Tink Taylor	Holderness Conservation Commission
David M. Morton	Moultonborough Board of Selectmen
Dave Erler	New Hampton Conservation Commission
Fred C. Rozelle	Sandwich Board of Selectmen
(for Robert N. Burrows)	
H. Benjamin Bullard	Sandwich Planning Board
Gordon Ford	Sandwich Conservation Commission
Betsy McCoy	Loon Preservation Committee - Audubon Society of New Hampshire
Sheila M. Page	Pemigewasset Valley Fish and Game Club
Woolsey Conover	Squam Lakes Association
John Hodsdon	Lakes Region Planning Commission
Peter Richards	Squam Lakes Conservation Society
 <u>Alternate Member</u>	
Jack Newsom	Squam Lakes Association
Sid Lovett	Squam Lakes Association
Rawson Wood	Audubon Society of New Hampshire
Syd Howe	Squam Lakes Conservation Society
Kim Koulet	Lakes Region Planning Commission
David Lorch	Lakes Region Planning Commission

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As part of the municipal master planning process, local officials are advised to compile and present information regarding land use, housing, transportation, public utilities, community facilities, recreation, and resource conservation and preservation. An intermunicipal watershed plan should consider some of this information, though in a more general fashion than is appropriate for municipal planning purposes. There should be an emphasis on how the physical and socio-economic characteristics of the communities interrelate within the watershed.

In order to address the goals of the Squam Lakes Watershed Plan with sound recommendations, data was compiled regarding soils, hydrology, land use, land cover, groundwater availability, geology, topography, wildlife habitat, lake water quality, and potential threats to water resources. Some of this data has come from existing sources, such as the USDA Soil Conservation Service County Soil Surveys for Belknap, Carroll and Grafton Counties, USGS topographic maps and the USGS Groundwater Availability maps for the Pemigewasset River Basin. Other information, such as the land use data, has been interpreted from aerial photographs to show changes in land use over time. Water quality monitoring data for Squam Lakes was available from the UNH Lakes Lay Monitoring Program and Freshwater Biology Group, and also from the NH Department of Environmental Services. Where needed information was not available, it was compiled by OSP staff, with assistance from technical experts. Examples are information on critical wildlife habitat areas, land in current use and potential threats to water resources throughout the watershed.

All of the data collected were mapped at a scale of 1:24,000 using USGS topographic quadrangle maps. The information was then digitized for entry into the State's computerized geographic information system, GRANIT. GRANIT is a computerized data base which utilizes ARC/INFO software. Mapped features such as roads and streams are entered into computer form as lines. Features such as land parcels, soil units and forest stands are entered as areas or closed polygons. Other features such as access sites or water quality monitoring sites are entered as points. Quantitative and qualitative characteristics associated with each of these geographic features are stored in the data base as well.

a

The Squam Lakes watershed planning project has offered a unique opportunity to test the analytical capabilities of the GRANIT system for watershed planning purposes. A good deal of time and effort was put into data base development for the Squam watershed over the period of fall 1988 through the spring of 1989. For this project, GRANIT has been used to select, overlay, compare and combine data layers, to put buffers around features, compute acreage, and display information in a variety of graphic forms. More detail about how these capabilities were used for Squam watershed planning is provided in various sections of the plan.

### **Watershed Plan Recommendations**

The Squam Lakes planning project was intended to be a prototype to guide communities in other watersheds statewide. Therefore, the Office of State Planning sought to explore a range of management options for consideration by the SLWAC. These alternatives were evaluated by the Committee to determine their

suitability for use in the watershed. Their applicability to other watersheds, having different needs and characteristics, must be determined by local officials in the communities potentially affected.

Many of the recommendations offered in this plan can be implemented by municipalities through the exercise of existing powers: by amending local zoning ordinances and subdivision regulations; by improving wetlands inventories; by acquiring conservation easements along streams and around wetlands; and by other means. Other recommendations would require legislative action, such as the establishment of lakes use zoning. The task of implementing these recommendations falls primarily to the communities in the watersheds and to the residents and property owners, concerned citizens and civic and conservation organizations, to support local officials and to urge State action where appropriate.

### **CHRONOLOGY OF SQUAM LAKES WATERSHED PLANNING PROJECT**

- |                  |  |
|------------------|--|
| Summer 1984      | At Governor Sununu's request, the NH Council on Resources and Development (CORD) began a study of the growth-related problems affecting New Hampshire's lakes.   |
| February, 1985   | CORD adopted a report, prepared by the NH Office of State Planning, which included recommendations that the NH Office of State Planning (OSP) define a planning process for lakes management for both State and local officials.   |
| March, 1985      | Selectmen from five Squam Lakes watershed area towns wrote to the Governor, who in turn directed OSP to initiate the Squam Lakes watershed planning project.   |
| May 5, 1986      | The Legislature approved a pilot program, to be developed by OSP, as a part of Chapter 45 of the Laws of 1986. The Legislature also established the Water Protection Assistance Program within OSP during that session. The purpose of the WPAP is to encourage and assist municipalities to plan for the management and protection of water resources in New Hampshire. |
| January 12, 1988 | OSP initiated the Squam Lakes watershed planning project, circulated a draft work program, and formed the Squam Lakes Watershed Advisory Committee (SLWAC).  |
| March, 1988      | OSP held two preliminary meetings with federal, State, regional and local parties to solicit technical input to the project and its work program.  |
| May 25, 1988     | The work program was finalized.  |

- June 15, 1988                    The first informal meeting of the SLWAC was held at the Science Center of NH, to discuss the development of goals and objectives. It was suggested that New Hampton be invited to join the project, even though the town has no lakeshore frontage. New Hampton joined shortly thereafter.
- June 22, 1988                    A subcommittee of interested individuals met in Center Harbor to refine goals and objectives for the project. They reported their findings back to the full Squam Lakes Watershed Advisory Committee on July 6, 1988.
- July 6, 1988                    The SLWAC met to discuss the goals formulated by the subcommittee. They also worked on strategies for developing the information that would be needed to address the issues behind the goals. Many individuals who were present volunteered to provide technical assistance. Plots of existing land use data generated by the State's geographic information system were also presented to the group at this meeting.
- August 3, 1988                    An informal SLWAC meeting was held, with participation from technical professionals from federal, State and private agencies. Individuals formed subcommittees to study each goal and identify what work either had been or needed to be done to address the issues. Available resources were identified, along with the appropriate parties to carry out recommended actions. A consensus was reached on the working goals for the project. Concern was expressed that the Committee should be formalized, with official appointments to be made by the planning board, conservation commission and board of selectmen for the six watershed towns and from each private interest group.
- August 10, 1988                    OSP staff met to discuss project strategies. Included in the discussions were the need for formalization of the Squam Lakes Advisory Committee, and the development of a schedule for data entry to NH GRANIT, so that geographic information system technology could be used during the project.
- September 1, 1988                    OSP drafted an outline for the watershed plan. A schedule was developed for data development and the analysis needed to address the project goals.
- September 21, 1988                    OSP met with selectmen from the watershed towns to discuss designation of official representatives for the Squam Lakes Watershed Advisory Committee. As a result of this meeting, formal appointments were made.

September, 1988 -  
August, 1989

OSP carried out extensive data collection and analysis. Work meetings were held to solicit input from technical professionals in the areas of land capability, water quality, wildlife habitat and access opportunities on the Squam Lakes. Analysis of the data was performed by the University of New Hampshire using the NH GRANIT technology.

August 2, 1989

A schedule of meetings was planned for OSP and the SLWAC so they could review the results of the analysis phase of the project. Based on these meetings, OSP planned to prepare a final report which would include recommendations designed to address the issues and needs of the Squam Lakes watershed.

A Draft Inventory Report including descriptive information about the Squam Lakes watershed was distributed to SLWAC members for review and comment. Two appendices were included: One summarized the existing local land use regulations within the Squam Lakes watershed. The second provided a list of State Statutes which authorize land and water use regulation in New Hampshire.

August 22, 1989

The first of the scheduled meetings was held with the SLWAC, in Centre Harbor. OSP received comments on the Draft Inventory chapter of the plan, and presented the first draft of the chapter on Land Capability.

September 12, 1989

The SLWAC met in Holderness, and provided comments concerning the chapter on Land Capability. The first drafts of the chapters on Water Quality and Wildlife Habitat were presented to the Committee for their review. The Committee discussed some of the possible means to achieve intermunicipal cooperation for water resource planning. OSP agreed to develop the concept further, and to provide the Committee with guidance as to how such cooperative planning and management might best be achieved.

September, 1989 -  
October, 1989

A chapter on Intermunicipal Cooperation for Water Resource Planning was mailed to Committee members in late September, 1990.

September 26, 1989

The SLWAC met in Centre Harbor. Comments were received from Committee members concerning the Water Quality and Wildlife Habitat chapters of the watershed plan. The first draft of the chapter on Access (which included Water Capability at that time) was presented to Committee members.



- May 8, 1990                      The SLWAC met in Centre Harbor. A revised draft of the chapter on Access was reviewed with the Committee, and comments were received concerning it. The first draft of the Executive Summary was mailed to Committee members prior to this meeting.
- May 22, 1990                      The SLWAC met in Centre Harbor. It was explained to the Committee that the text in the plan concerning Water Capability had been put back in the Access chapter, where it most legitimately belonged. The Committee was briefed on proposed changes to the Land Protection chapter which would make it more specific and useful. Discussion continued regarding the chapter on Access.
- June 11, 1990                      The SLWAC met in Centre Harbor. Discussion centered on the Executive Summary. Comments were received from Committee members concerning the content of the summary as well as its format and style.
- July 25, 1990                      The SLWAC met in Centre Harbor. Discussion continued on the chapter on Access, and it was finalized at this time.
- November 8, 1990                      The SLWAC met in Holderness, for their final meeting as a formal committee. At this time, they reviewed the final draft of the Squam Lakes Watershed Plan, which had been mailed to them 3 weeks prior. The Committee approved by unanimous vote each of the chapters of the plan.

Note: Final milestones include review by selectmen; public hearing(s) on draft; and publication of report.



## **Chapter 2. Executive Summary**

### **Introduction**

The goals and recommendations contained in the Squam Lakes Watershed Plan are brought together in this chapter, in order to provide a summary of the document's key points.

### **Land Use Consistent with Natural Capability of the Watershed**

#### **Summary**

The Squam Lakes watershed covers a total of 42,418 acres, of which 7,847 is water area. Chapter 4 of the plan addresses the need for balancing development of the land with its natural capabilities and limitations.

The first part of the chapter maps four environmentally sensitive land areas - wetlands, floodplains, steep slopes and shoreland areas, and recommends measures for controlling development in these areas. Approximately 39 percent of the land area is classified in one of these categories, more than half of which is steeply sloped. The remainder of the land area, except residential or other urban use, was subjected to a classification by lot size based on soils and local zoning. This process allowed the mapping of potential development density and an estimation of the maximum population which could be allowed under current land use regulations.

Chapter 4 also examines land areas possessing natural resource values which are important in meeting human needs. These include potential aquifer areas and surface water supplies, agricultural and prime farmland, and prime forest land. Recommendations to preserve these areas include encouraging current use taxation, conservation easements, cluster development and land acquisition.

**Goal:** Assure that the scale, type and location of development which take place in the Squam Lakes watershed are consistent with the natural capabilities of the watershed.

## **Recommendations**

### **Areas with Severe Environmental Limitations**

#### **Wetlands**

Communities should protect wetlands by regulating encroachments of development and by adopting wetlands overlay districts as part of their zoning ordinances.

Local conservation commissions should actively seek to protect wetlands through inventorying their wetlands and promoting added protection through acquisition, conservation easements and Prime Wetlands designation.

#### **Floodplains**

Communities should recognize floodplains as important resource areas deserving of protection, and discourage inappropriate land uses.

Communities should adopt floodplain overlay districts to local zoning as a means of regulating land use in these areas.

#### **Steep Slopes**

Municipal zoning ordinances should discourage development in areas with slopes in excess of 25 percent. Communities should limit development on slopes between 15 and 25 percent to areas having suitable house sites, and require special measures to control stormwater runoff and erosion, site clearing and planting practices, appropriate septic system design, and larger lot size minimums.

#### **Shoreland Overlay Districts**

A shoreland overlay district extending 250 feet landward from the mean high water level of all lakes and ponds is recommended to the municipalities in the Squam Lakes watershed. This should be incorporated as part of their zoning ordinances to achieve the public purposes listed below. The following performance standards are recommended as a requirement for this district.

##### **Vegetative Buffer**

A minimum buffer of 50 feet of natural vegetation from the shoreline should be required around lakes and ponds. Restrictions on clearing natural vegetation along the water's edge are an important measure, since these vegetated strips filter out pollutants from storm water run-off including sediments, nutrients from lawn fertilizers and agricultural pesticides. A buffer of natural vegetation also serves to

protect the aesthetic character of the shoreline, as well as provide limited wildlife habitat (travel corridors), and cooler water temperatures. Greater vegetative buffer distances are recommended in those shoreland areas possessing exceptional wildlife habitats, such as loon nesting or brooding areas. Within this buffer strip, selected and dispersed cutting of trees and understory growth may be allowed through special permit approval for wildlife management, or to create a view of the water.

To complement the maintenance of a 50 foot vegetative buffer through zoning, municipal conservation commissions should seek to secure additional distance setbacks of natural cover through landowner education, purchase of conservation easements and other strategies.

State timber harvesting laws limit the removal of trees to not more than 50 percent of the basal area of the standing timber within 150 feet of a great pond or navigable river, and within 50 feet of any stream or wetland (RSA 224:44a). With this State standard as a lower limit, the vegetative buffer should result in less disturbance in shoreland areas identified by the town as environmentally sensitive. The State legislature should amend RSA 224:44a to specify a time period of 15 years during which the cutting of 50 percent of basal area is calculated.

#### Septic System Setback

Subsurface disposal systems (leaching fields) for septic wastes shall not be permitted within 125 feet of mean high water mark of lakes in Class A watersheds. Within Class B and C watersheds, the 125 foot minimum for lakefront property may be waived provided that an applicant submits sufficient site specific evidence, such as soils, to indicate that a lesser setback will not adversely affect the water quality of the waterbody. The State should revise its regulations to reflect this recommendation.

#### Structure Setback

Shoreland overlay districts should require that residential structures be set on the lot substantially back from the shoreline.

#### Cluster Development

In shoreland areas where the 250 feet zone contains important wildlife habitat or areas of exceptional scientific and educational value, especially rare and unusual flora, fauna and other natural features, proposals for the subdivision of land into three or more lots for residential or other development should be required to utilize a cluster design, and to site development away from important natural resource areas.

### Shore Frontage

Municipal zoning ordinances should require that there be a minimum shore frontage of 200 feet for lots on public waters, this distance being the average of the straight line distances between the points where the side lot lines extend across the public boundary line and the curvilinear distance between these two points measured along the shoreland.

### Building Lot Size

Municipal zoning ordinances should require that lots abutting public waters be a minimum of 1 acre in area.

### Building Height

Municipal zoning ordinances should be amended to require that the maximum height of any structure within the shoreland district be 35 feet measured from average ground level around the structure to the highest point on the roof.

### Erosion Control

Municipal building codes should be amended to require that all new structures within the shoreland district be designed and constructed to minimize erosion and sedimentation of public waters, both during and after construction. Provisions should be added to the building codes to require that any erosion and sedimentation control structures or measures should be maintained by the landowner as a condition of the certificate of occupancy.

### Stormwater Management

Local subdivision and site plan review regulations and building codes should require that the design of drainage systems utilize open, vegetated drainage swales as opposed to pipes or culverts within the shoreland district to handle stormwater flows. Alternative structural measures should only be allowed where swales are not practical, such as under driveways or where there is a potential for contaminated run off to infiltrate the groundwater.

### Parking Lots, Driveway Surfaces

In order to keep impervious land cover to a minimum, driveways and parking lots within the shoreland district should be constructed of gravel or other natural material through which stormwater can percolate into the underlying soil. Municipal planning boards are urged to require the use of porous pavement, through their subdivision and site plan review regulations.

### Dug-in Boat Slips

Local planning boards and conservation commissions should adopt a position of discouraging the permitting of dug-in boat slips on shorefront property, because of the significant and permanent alteration of the natural shoreline which results, and the attendant siltation and dredging required to maintain these boating facilities. The State Wetlands Board should amend its rules to disallow dug-in boat slips.

### Fertilizers and Pesticides

The application of fertilizers, herbicides and pesticides for noncommercial, private purposes within the shoreland district should be discouraged. Through their subdivision and site plan review regulations, municipal planning boards can require that developers and landowners leave the natural vegetation and not plant lawns near the water's edge. This recommendation complements the requirement for a vegetative buffer, and furthers water quality goals. Commercial application of pesticides for agricultural purposes is subject to current State regulations, and should conform to best management practices as defined by SCS. Conservation commissions should promote best management practices by encouraging landowners to work with county cooperative extension agricultural agents and conservation districts to develop sound management plans for their property.

### Restricted Land Uses/Activities

Land uses or activities which pose a threat to surface or groundwater quality should be prohibited by municipal zoning from the shoreland district. Uses to be prohibited include: auto junkyards, salt storage piles, solid or hazardous waste facilities and underground storage tanks.

### Areas with Productive Resources

Municipalities should encourage the application for current use by landowners possessing parcels with productive agricultural and forest soils, as a means of protecting and managing these valuable areas. Written management plans for parcels under the forestry category in current use should be required as a condition, and monitored by the town selectmen.

Cluster development and other innovative land use control mechanisms should be encouraged, where suitable, as an alternative to tract subdivision, in order to preserve lands with valuable resources - surface water supplies, aquifers, prime forest soils and agricultural lands.

Town conservation commissions and private conservation organizations should encourage the acquisition of land and conservation easements to protect natural and scenic resources.

## **Information and Technical Assistance**

When implementing these recommendations, municipalities within the watershed are encouraged to consult with the Lakes Region Planning Commission, county conservation districts, and other agencies concerned with land use planning, for assistance.

## **Water Quality**

### **Summary**

The water quality of the Squam Lakes, and the watershed as a whole, is addressed in Chapter 5. The chapter focuses on water quality trends that have been determined based on a variety of monitoring data. The analysis of the data found that determining water quality trends for Squam Lake is somewhat more complicated than doing so for Little Squam Lake, because Squam includes a number of isolated cove areas, which make it hard to generalize about what is happening to the lake as a whole.

Generally speaking, the data shows that Squam Lake and Little Squam Lake both have excellent water quality, and can be classified as oligotrophic lakes (of low productivity). However, the data also shows subtle changes, over time, which indicate that their productivity is likely to be increasing. Chapter 5 emphasizes the importance of continuing to monitor the water quality of the Squam Lakes, as consistently as possible, in order to develop a clearer sense of what is happening to them.

Chapter 5 emphasizes the importance of monitoring changes in land use within the watershed which may contribute to changes in water quality. Many existing land uses have the potential to impact water quality. It is important, for planning purposes, to inventory uses of land which may be potential pollutant sources, and to enact local regulatory controls in order to minimize the potential of future land uses to adversely affect water quality. Such an inventory should include potential point sources of pollution, which can be traced to a distinct source. Potential nonpoint sources, which result from isolated disturbances of land and are therefore not as easily defined, should also be included both in the inventory and as the target for local regulatory controls.

The section of Chapter 5 which describes potential threats to water quality focuses on point and nonpoint pollutant sources. Included are: waste management facilities; commercial operations which manufacture, store or handle potentially hazardous materials; residential and commercial construction activities; urban runoff; resource extraction; agricultural and silvicultural activities; and alteration of hydrologic conditions or habitat.

Chapter 5 also discusses the possible usefulness of developing a water budget, along with a nutrient budget component, for the Squam watershed or at least some of its subwatersheds. Such analyses have the potential to relate water quality trends on the lakes to nutrient contributions from septic systems and other land uses. However, they are in no way required before developing management strategies to prevent threats to water quality. Any future water/nutrient budget data that is collected can be used to supplement planning efforts.

**Goal: Protect, maintain and improve water quality in the Squam Lakes watershed.**

## **Recommendations**

### **Severe Environmental Limitations**

Municipalities within the watershed should adopt overlay zoning ordinances to protect sensitive water resources, to include, but not be limited to wetland, floodplain, watershed, aquifer and shoreland zoning districts. Assistance to municipalities within the watershed interested in developing these ordinances is available from the Lakes Region Planning Commission.

### **Erosion and Sediment Control**

Planning boards within the watershed should evaluate the effectiveness of existing erosion and sediment control requirements in their subdivision regulations, and consider revisions to these requirements, based on standards contained in the 1987 publication prepared by the USDA Soil Conservation Service, in cooperation with the NH State Conservation Committee, the NH Association of Conservation Districts and the North Country Resource Conservation and Development Area entitled *Erosion and Sediment Control Design Handbook for Developing Areas of New Hampshire*. In the process of incorporating these requirements, planning boards should include provisions for bonding the construction of these control measures, and also for their inspection and maintenance following construction.

Planning boards within the watershed should adopt erosion and sediment control requirements to address water quality as part of their site plan review regulations, based on the standards referenced in the previous recommendation.

Planning boards with local excavation ordinances should adopt similar erosion and sediment control requirements to those recommended for inclusion in the subdivision and site plan review regulations, as part of their excavation ordinances.

### **Stormwater Management**

Planning boards within the watershed should adopt stormwater management requirements to address water quality, as part of their subdivision regulations, site plan review regulations and local excavation ordinances. These requirements should include provisions for bonding the construction of these control measures, and also for their inspection and maintenance following construction.

### **Potential Threats to Water Quality**

Municipalities within the watershed should undertake local inventories of potential threats to water quality and include this information in the local water resource management and protection portion of their municipal master plans.

Conservation commissioners and health officers in the watershed should perform an inventory of septic systems within the recommended shoreland protection district, and work with the landowners within that district to develop an ongoing septic system maintenance program for the district. The inventory should include the distance of existing systems from surface waters, wetlands and floodplains. Once compiled, the inventory can be used to develop priorities for septic system inspection and maintenance as required by local health ordinances.

As an adjunct to performing a field inventory, local health officers can request that DES provide them with access to the septic system permit files for their municipalities. Current files are located in the WSPCD regional office located in Gilford, New Hampshire. Included are plans for permit applications which are pending only. It would be necessary to obtain the WSPCD construction approval number for each septic system from local building permit records, in order to access this data. Once a permit system is installed, the plans which show actual location are archived in Concord.

Municipalities should adopt health ordinances which address the installation and maintenance of private septic systems, wells, underground storage tanks and land uses which have the potential to have adverse impacts on water quality.

Municipalities within the watershed should evaluate the adequacy of existing septage disposal practices and consider requiring periodic septic system inspection and maintenance through local health ordinances.

### **Wellhead Protection**

Municipalities within the watershed should consider the identification of the 58 possible wellhead protection areas in the watershed, and the performance of an inventory of potential threats to water quality in these possible wellhead areas. Consideration should be given to inspection and monitoring of potential threats identified as located within these wellhead areas.



### **Performance Standards**

Planning boards within the watershed should adopt performance standards as part of their site plan review regulations for land uses and facilities which have the potential to impact water quality, based on performance standards that are proposed to be developed through the NH Wellhead Protection Program.

Planning boards within the watershed should adopt performance standards for land use activities which have the potential to impact water quality, as part of their local excavation ordinances. It is recommended that those municipalities that do not have such ordinances consult with the Lakes Region Planning Commission for guidance in adopting one.

### **Best Management Practices**

Conservation commissions and planning boards within the watershed should work with and encourage local land owners to consult with USDA Cooperative Extension county foresters and county conservation districts to develop forest management plans which incorporate best management practices for silvicultural activities.

Conservation commissions and planning boards within the watershed should work with and encourage land owners to consult with USDA Cooperative Extension county agricultural agents and county conservation districts to develop land and waste management plans which incorporate best management practices for agricultural activities.

Selectmen within the watershed should develop and adopt a uniform road salt management policy, and work with their municipal road agents to assure its enforcement.

### **Water Quality Monitoring Recommendations**

#### **Water Budget**

A water budget should be prepared for the Squam Lakes watershed by the Department of Environmental Services in order to provide input and output flow information about the watershed. Participation of the UNH Lay Monitoring Program is encouraged in order to collect data on the various components of such a budget. The Department should prepare a nutrient component based on the water budget for the watershed, in order to gain an understanding of the nutrient contribution to the lakes from septic systems and other land uses.

#### **Tributary Sampling**

Tributary sampling should be done in order to better isolate inputs to the Squam Lakes from subwatersheds.

### Identification of Critical Areas

Critical areas of the lakes should be identified, based on water quality data collected over time, as well as on water and nutrient budget data. This information should be coordinated with other layers of information (land use, fisheries, wildlife habitat, soils, boating and other recreational use of the lakes, etc.). It then can be used for: the discussion of carrying capacity; to provide back-up for new or existing recreational water use regulations; to help identify appropriate public access sites; and to help identify areas that should be protected through some kind of land acquisition strategy.

### Consistency of Monitoring

In order to better discern long term water quality trends for the Squam Lakes, the Squam Lakes Association's lay monitoring program should make every effort to improve the consistency of its sampling of the lakes, in terms of locations sampled, timing of sampling, and techniques used.

### Chlorophyll a Sampling

More frequent chlorophyll a sampling should be done in late summer for both lakes at the metalimnion (middle depth zone), in order to monitor the phenomena of algae blooms which has been occurring there. Lay monitors can take the samples, and processing can be done by the UNH Freshwater Biology Group.

### Alkalinity Monitoring

Alkalinity monitoring recently undertaken as part of the lay monitoring program should be continued, as a way for local residents to monitor the buffering capacity of the Squam Lakes, and thus their vulnerability to the effects of acid rain.

### Monitoring of Cove Areas

There should be more detailed monitoring of cove areas, including more frequent and consistent shoreline surveys of vegetative abundance. Nuisance species such as milfoil should be watched for as part of this monitoring. A weed-watcher program should be established for individual cove areas of the Squam Lakes.

## Wildlife Habitat

### Summary

The presence of abundant wildlife in the Squam Lakes watershed contributes much to the special character of the region, and there is a deep concern there about protecting this rich wildlife heritage. The Squam Lakes Watershed Plan recognizes the need to carefully balance present and future human use of the watershed with wildlife habitat concerns. Land development and other land uses, as well as recreational use of the lakes, can have a potential negative impact on fish and wildlife habitat areas. As a result, the recommendations in Chapter 6 concerning wildlife are interrelated with concepts and recommendations developed in other chapters of this plan.

The chapter focuses on those habitats which are the most important and most vulnerable, and which accordingly should be given consideration in terms of preservation and protection efforts. Three categories of wildlife habitat are described and identified on maps. "Critical" wildlife habitat areas are to be considered as the most important, and in the context of the plan, are defined as possessing one or more of the following characteristics: important breeding habitat for rare, threatened, endangered species; important habitat for species, whether game or non-game, which are especially valued by humans; natural areas with a high degree of biological diversity; habitats which are threatened by development; and habitat which are difficult to re-create, if they are damaged or destroyed. "Significant" wildlife habitat is the second category, and is considered somewhat less important than critical areas for purposes of this plan. A distinct subcategory under significant habitat includes developed lake and river shoreline areas, which are considered of lesser value than other areas in the significant category only because of their development. The third category used to identify habitat is "General" wildlife habitat, a classification which recognizes that wildlife exist in other areas of the Squam watershed, but for various reasons, need not receive the intense focus that should be applied for critical areas, and to a somewhat lesser extent, significant areas.

The information contained in Chapter 6 should serve as a resource for Squam watershed communities in considering future land and water uses as well as present or proposed local ordinances and regulations which may affect wildlife. It also can be useful in developing innovative ways to protect wildlife through local regulatory processes, for example through cluster zoning, where open space which may be valuable wildlife habitat can be set aside. This information should also be used to determine where land protection efforts need to be focused. Much of it is therefore referred to in Chapter 10, Land Protection.

**Goal: Protect critical/significant wildlife habitat areas within the watershed.**

## **Recommendations**

### **Land Protection**

Local conservation organizations, conservation commissions, and responsible State agencies - the NH Fish and Game Department, DRED and LCIP should evaluate the results of the analysis developed in this chapter, and should use it as a tool to set priorities for protecting important wildlife habitat, and to guide land protection strategies.

### **Local Land Use Planning**

Planning boards in the watershed should adopt the maps and information which identify critical and significant wildlife habitat, as amendments to their municipal master plans. Lists of species that are likely to be found in those habitats, which were provided for the Squam Lakes Watershed Plan by the NH Fish and Game Department and NH Audubon Society, can be included as an appendix to a master plan for use by a planning board in performing site evaluations. It is recommended that local planning boards refer to these updated master plans that incorporate this information, and use the information in working with applicants through the local subdivision and site plan review processes.

### **Local Subdivision and Site Plan Review Process**

It is important to establish a formal link between the planning boards and conservation commissions within towns in the watershed, to assure that adequate consideration is given to important wildlife habitat in the local subdivision and site plan review processes.

Planning boards are encouraged to consult with the NH Fish and Game Department, USDA Cooperative Extension, Lakes Region Planning Commission, County Conservation Districts or NH Audubon Society personnel for assistance, and to work with applicants for subdivision and site plan review approvals to develop mutually acceptable plans with a minimal impact on important wildlife habitat.

### **Zoning**

Planning boards in the watershed should either reevaluate existing or adopt new provisions for cluster development in their zoning ordinances, to provide for open space and to allow flexibility in the design of projects to benefit wildlife habitat. The ordinance should specify that first priority areas to be left as open space include areas which provide critical and significant wildlife habitat. Critical and significant areas which are adjacent to land which is dedicated to permanent open space should receive second priority to be left open. Such areas would increase the amount of benefit which the adjacent permanent open space provides as wildlife travel corridors. Third priority for land to be dedicated as open space should be land adjacent to open areas that are not yet protected as permanent open space.

Communities may want to consider local regulatory mechanisms such as environmental overlay zoning, which may be useful in providing some degree of protection for important wildlife habitat.

### **Prime Wetlands**

Conservation commissions in the watershed are encouraged to inventory and map their wetlands and to consider proposing local adoption of Prime Wetlands that provide important wildlife habitat.

### **Information Transfer**

State and federal agencies should cooperate through the State geographic information system advisory committee to update information regarding wildlife habitat, and facilitate information transfer.

Because many local residents of the Squam Lakes watershed have demonstrated a strong interest in wildlife observation and study, it is recommended that these individuals and conservation organizations actively pursue the update of wildlife habitat information for the watershed. This information should then be transferred to the Lakes Region Planning Commission, which is linked to GRANIT, the State geographical information system, for dissemination to towns within the Squam Lakes watershed. Among many benefits of such an update, State agencies will have better access to this information.

Present travel corridors as well as historical corridors within the Squam Lakes watershed should be identified, through both State and local endeavors.

## **Access**

### **Summary**

Access by residents and visitors to the land and water resources in the Squam Lakes watershed has been one of the most important and contentious issues dealt with during the planning process. One concept which has been stressed is that access has many meanings, in addition to boat access, such as swimming, hiking, nature observation, fishing, and the passive enjoyment of the scenic beauty of the watershed.

The *Public Access Plan for New Hampshire's Lakes, Ponds and Rivers* presently being developed by the State's Public Access Advisory Committee has calculated that nine (9 ) public access points are appropriate for the Squam Lakes, based on shoreline length and surface water area. However, based on available water area, which excludes areas zoned as wildlife habitat, the Squam Lakes Watershed Plan states in the Access chapter that six (6) public accesses are appropriate for the Squam Lakes.

The Access chapter addresses the fact that under the present definition of public access in RSA 271:20a, which says that public access is only that which is provided by the State, there is presently no public access to the Squam Lakes. Also explained, however, is that opportunities to get on the lakes is provided through private marinas, municipal facilities, and conservation organization properties. An important premise of the chapter is therefore that the definition of access should be broadened to include access provided by public entities other than the State, as well as private entities. Such access may or may not involve a fee. Based on this premise, there are presently four public accesses to the Squam Lakes which are available to the public. Two or three additional public (State or local government) access points to Squam Lake for boating and/or swimming are recommended in the plan for the easterly portion of the lake.

Chapter 7 also advances the proposal that the State establish three boating activity zones for the surface waters of the Squam Lakes: nearshore zone (250 feet out from shore); wildlife protection zone (additional 250 feet out along shoreline containing known loon nesting sites); and a general activity zone (the remainder of the lakes). The 250 foot nearshore area is intended to function as a quiet zone, where swimming, non-motorized craft and motorized craft at headway speed are the primary permitted activities. The 500 foot wildlife protection area is intended to minimize the conflict between important wildlife areas, such as loon nesting areas, and boaters by requiring travel through these areas at headway speed. The remainder of the lake would be designated as a general activity zone.

Recommendations for lowering the size/horsepower of power boats, and the introduction of time zoning are offered as ways to accommodate increased public access while maintaining a quiet lake experience.

**Goal: Improve appropriate public access to the watershed's land and water resources.**

### **Recommendations**

The Legislature should change its definition of public access, to include access points which are provided by municipalities and, as appropriate, non-profit organizations, as long as they are available to a broad spectrum of the general public at a reasonable fee.

The Squam Lakes Association should continue to undertake an annual boat/facilities census, to include weekday as well as weekend use; undertake regular non-lake surveys; and provide this information as part of the ongoing review of the recommendations of this plan.

The State and municipalities in the watershed should accept standards for boat/surface water area use and public access similar to those developed for this report, and a methodology for calculating carrying capacity, as measures to preserve the unique natural qualities of the Squam Lakes for all lake users. These standards should be reviewed in light of changing conditions, and modified as necessary.

The State should endorse the need for six (6) public access sites as a reasonable goal for the Squam Lakes. These facilities should provide access to small boats and other lake users, and should include a variety of trails or carry-in boating sites, swimming and other recreational areas.

Of the six (6) recommended accesses, two or three new and/or rehabilitated public access points should be provided. These should include two new public accesses in the easterly portion of Squam Lake and the rehabilitation and enlargement of the existing site in Ashland, accompanied by dredging necessary to restore a navigable channel.

Municipalities should encourage the maintenance and upgrading of existing informal, untended boat access points.

Selection of new access sites should be based on a thorough investigation of alternative sites from an environmental perspective, and should incorporate careful site design to accommodate reasonable lake uses and to control parking.

The available parking facilities for transient boaters should be inventoried. State and local government should utilize parking capacity and availability as one means of assuring that the level of use does not exceed the recommendations of this plan.

Municipal governments should work with marina owners to improve existing conditions and to minimize problems associated with marina operations.

The State and the municipalities within the watershed should develop a long range plan to reduce the size and power of boats on the Squam Lakes, at the same time that improved public access opportunities are being expanded.

Limitations on boating activity in or near designated sensitive habitats or other critical areas are an integral part of the Squam Lakes Watershed plan. The State and municipalities should adopt the proposals to create three activity zones for the surface water of the Squam Lakes: a nearshore activity zone, a wildlife protection zone, and a general activity zone.

The access section of the Squam Lakes Watershed Plan should be reviewed and revised as needed, but at least once every five (5) years.

The Legislature should establish a powerboat operator licensing system to increase awareness and understanding of State laws and rules and, through required training and testing, to ensure a higher level of boat operating proficiency. Fees collected from the proposed operator license as well as present boat registration should be dedicated to the Department of Safety for boating education, safety and management purposes.

The State and the municipalities within the watershed should investigate the need for and the feasibility of time zoning as a means of regulating certain power boat activities.

New public access points should be well managed and should include sanitary facilities, provision for safe and adequate vehicular access and information/inspection programs for boating safety and environmental protection.

## **Land Management - Local Government**

### **Summary**

Due to the relationships between land use and land and water quality, the Squam Lakes Watershed Plan presents a wide variety of both regulatory and nonregulatory techniques that can be used to promote sound use and management of land within a watershed. Emphasis is placed on the land use planning and regulatory techniques that are available to municipal officials. The reason for this focus is that the authority to regulate uses of land is largely vested at the local level, in accordance with State statutes. Chapter 8 of the plan describes the importance of the local master plan as a tool to guide the future growth and development of a municipality in an orderly fashion. It also serves as the document which contains a compilation of the solid, scientific and statistical information, to serve as the basis for local ordinances and regulations designed to implement the recommendations of the plan. The statute which gives legislative guidance on master plans specifies that a local water resources management and protection component should be included. Municipalities are encouraged by statute to cooperate in preparing regional water plans and implementing ordinances to enhance their effectiveness, where water protection needs extend beyond municipal boundaries. This type of cooperation is appropriate for watershed management planning such as that undertaken for the Squam Lakes watershed.

The regulatory measures presented in the plan, as options for municipalities in the watershed to consider, cover a variety of existing permitting processes at the local level. Chapter 8 includes a discussion of



how these local ordinances and regulations can be strengthened to enhance protection of both groundwater and surface water resources. Specifically, zoning ordinances, subdivision and site plan review regulations, building codes, health ordinances, excavation regulations, police power bylaws and junkyard regulations are discussed.

Nonregulatory measures, such as best management practices and performance standards for land uses which are not otherwise regulated, are also presented in Chapter 8. The effectiveness of these practices is largely dependent upon the good faith efforts of consenting landowners. However, when combined with a strong education program, implementation of best management practices can be very effective in controlling land use and protecting water quality on a watershed basis. Other nonregulatory steps discussed include development and implementation of a road salt management policy, performing a local wetland inventory, and taking the necessary steps locally to designate Prime Wetlands.

This information has been compiled as background material to support some of the recommendations that were developed to address the planning project's first goal, relative to land and water capability. Many of these recommendations also address the goal concerning water quality. These goal statements are presented, followed by the recommendations from Chapter 8 that are specific to land management by local government.

**Goal: Assure that the scale, type and location of development which takes place in the Squam Lakes watershed are consistent with the natural capabilities of the watershed.**

**Goal: Protect, maintain and improve water quality in the Squam Lakes watershed.**

## **Recommendations**

### **Regulatory**

#### **Master Plans**

Watershed communities should review and update their master plans on a periodic basis. Every five years is recommended by RSA 674:2 VIII for local water resources management and protection plans.

#### **Local Water Resources Management and Protection Plans**

Municipalities within the watershed should enter into a formal cooperative effort to prepare a regional water resource management and protection plan that is consistent between municipalities. Planning boards should adopt the portion of that plan that pertains to their municipality as part of the conservation and preservation section of their master plans. (RSA 674:2, VIII).

### Consistency of Zoning Ordinances

The zoning ordinances of the towns in the Squam Lakes watershed should be consistent with one another, particularly with regard to permitted uses in zoning districts along common town boundaries. Also, distance requirements such as building setbacks and minimum frontage on waterbodies should adhere to commonly accepted standards among the towns in the watershed.

### Environmental Characteristics Zoning

Municipalities should adopt requirements in their zoning ordinances to allow applicants to provide, and planning boards to require site specific information, as part of the local review process for environmental overlay zones.

### Wetlands Zoning

Towns in the watershed should enact wetlands overlay zoning ordinances to increase protection of these important areas.

Planning boards in the watershed should be aware of the changes that are occurring in defining the methodologies for wetland delineation at the State and federal levels. Based on these changes, they should reevaluate the effectiveness of the provisions in their existing wetlands ordinances which outline the methodology for delineating the district boundary. Revisions should be proposed where they are determined to be appropriate.

Planning boards in the watershed should require that local approval of proposed projects in wetlands be conditioned upon approval of State and federal wetlands permits.

### Floodplain Zoning

Towns in the watershed should adopt local floodplain zoning ordinances which are more stringent than the minimum FEMA requirements. The purpose of these ordinances would be to take a resource protection oriented approach to regulating development in floodplains and to decrease the cumulative impacts of the disturbance of these sensitive areas on downstream property owners.

### Watershed Zoning

New Hampton should adopt a watershed protection district as an overlay zone for the Sky Pond and Jackson Pond drainage area.

### Aquifer Zoning

Towns are encouraged to adopt aquifer protection overlay districts as part of their zoning ordinances.

Towns should consider participation in the emerging State wellhead protection program by undertaking local inventories of potential threats to existing wells and adopting local protection measures to manage activities in wellhead areas.

### Steep Slopes Zoning

Towns should consider adoption of steep slope ordinances as a means of providing more explicit guidance to land owners as to the kinds of uses and minimum space standards which can be permitted in these areas.

### Shoreland Zoning

Towns should consider adopting shoreland protection districts adjacent to all waterbodies consistent with recommendations in Chapter 4. Where waterbodies traverse municipal boundaries, the towns sharing these resources should cooperate to adopt similar shoreland standards.

### Building Lot Size and Spatial Requirements

Planning boards in the watershed should reevaluate the lot size, density and setback requirements of their existing ordinances and regulations once the science based recommendations of the ad hoc committee examining the basis for lot size and density requirements are completed.

### Lot Coverage Standards

Planning boards within the watershed should reevaluate the maximum coverage requirements in their zoning ordinances, and consider revisions to these requirements to provide for consistency between the towns.

### Innovative Land Use Controls

Watershed communities should adopt cluster and/or other innovative land use controls as alternatives to traditional tract development in order to preserve resources such as prime forest and agricultural lands as open space, thus serving to enhance and protect the rural and aesthetic character of the landscape in the watershed.

### Subdivision Regulations

Planning boards within the watershed should evaluate the effectiveness of existing erosion and sediment control requirements in their subdivision regulations, and consider revisions to these requirements based on standards contained in the 1987 publication prepared by the USDA Soil Conservation Service, in cooperation with the NH

State Conservation Committee, the NH Association of Conservation Districts and the North Country Resource Conservation and Development Area entitled *Erosion and Sediment Control Design Handbook for Developing Areas of New Hampshire*. In the process of incorporating these requirements, planning boards should include provisions for bonding the construction of these control measures, and also for their inspection and maintenance following construction.

Planning boards within the watershed should adopt stormwater management control requirements to address water quality, as part of their subdivision regulations. These requirements should include provisions for bonding the construction of these management controls, and also for their inspection and maintenance following construction.

Planning boards should adopt provisions within their subdivision regulations that allow the planning board to require site specific and technical studies to be prepared by qualified consultants, at the expense of the applicant. These provisions should include the option for the planning board to require an independent review of those studies by a qualified consultant, hired by the planning board at the owner's expense.

Town planning boards in the watershed should amend their existing subdivision regulations to reflect changes that have been made to State statutes since their original adoption. RSA 676:4, entitled "Board's Procedures on Plats", details the following subdivision review procedures:

- (1) conceptual consultation is allowed as an option of the applicant, without notification to abutters;
- (2) design review is allowed before submission of a completed application, as an option of the applicant, with notification to abutters; and
- (3) the option is allowed for the applicant to initiate review by submission of a completed application.

Some planning boards in the watershed have amended their regulations to partially address the statutory changes. Others should amend their regulations to remove more of the outdated language. Included should be the provisions for "Abandonment of Preliminary Layouts".

#### Site Plan Review Regulations

Planning boards within the watershed should adopt erosion and sediment control requirements, to address water quality, as part of their site plan review regulations, based on standards contained in the 1987 publication prepared by the USDA Soil Conservation Service, in cooperation with the NH State Conservation Committee, the NH Association of Conservation Districts, and the North Country Resource Conservation and Development Area entitled *Erosion and Sedimentation Control Design Handbook for Developing Areas of New Hampshire*. In the process of incorporating these requirements, planning boards should include provisions for bonding the construction of these control measures, and also for their inspection and maintenance following construction.

Planning boards within the watershed should adopt stormwater management requirements, to address water quality, as part of their site plan review regulations. These requirements should include provisions for bonding the construction of these measures and also for their inspection and maintenance following construction.

Planning boards within the watershed should adopt performance standards as part of their site plan review regulations for land uses which have the potential to impact water quality. Updated performance standards for potential contaminant sources are proposed to be developed through the NH Wellhead Protection Program.

Planning boards should adopt provisions within their site plan regulations that allow the planning board to require technical studies to be prepared by qualified consultants at the expense of the applicant, as part of the local review process. These provisions should include the option for the planning board to require an independent review of those studies by a qualified consultant, hired by the planning board at the owner's expense.

#### Building Codes

Towns in the watershed which have not adopted a building code should either adopt the BOCA code or one that has similar requirements to section 112.1 of the BOCA code, which includes a requirement that the building inspector or code official reject any application that does not conform to the requirement of all pertinent laws. All towns in the watershed should enforce such a requirement.

#### Health Ordinances

Municipalities in the Squam Lakes watershed should maximize use of local health ordinances as effective water resources management and protection tools. Health ordinances should be designed to address the following:

- (1) Private well design and siting requirements, and setbacks;
- (2) Septic system design and siting requirements and setbacks;
- (3) Private well testing prior to transfer or rental of property or conversions of seasonal homes to year-round use;
- (4) Septic system requirements for conversion of seasonal homes to year-round use;
- (5) Mandatory periodic inspection and maintenance of septic systems, with a report filed with the local health officer on a regularly basis;
- (6) Design and siting requirements for containment structures for above ground storage of chemicals or petroleum products; and
- (7) Design and siting requirements for underground storage tanks < 1,100 gallons.

### Excavation Regulations, RSA 155-E

Planning boards within the watershed should adopt performance standards for land use activities which have the potential to impact water quality as part of their local excavation ordinances. It is recommended that those municipalities that do not have such ordinances, adopt one.

Planning boards within the watershed should adopt erosion and sediment control and stormwater management requirements, to address water quality, as part of their local excavation ordinances. These requirements should include provisions for bonding the construction of these control measures and also for their inspection and maintenance following construction.

Local excavation ordinances should incorporate provisions to include record of lawfully existing excavations, and requirements for reclamation (RSA 155 E:2, I (c) and (d).

Planning boards within the watershed should include requirements for periodic review and inspection of excavations and for finite time limitations for excavation permits, after which the operator must apply for a renewal.

### Police Power Bylaws, RSA 31:39

Municipalities within the Squam Lakes watershed should consider adoption of local police power bylaws in accordance with RSA 31:39 to protect water quality for the public health and safety.

### Junkyard Regulations, RSA 236:111-229

Selectmen within the Squam Lakes watershed should develop local junkyard regulations for adoption in accordance with one of the options listed above. The purpose of such regulations would be to provide Squam Lakes watershed selectmen with water quality related criteria and performance standards for issuance of junkyard licenses.

### Analysis of Local Ordinances and Regulations - Squam Lakes Watershed

Planning boards in the Squam Lakes watershed should evaluate the results of the analysis of their local ordinances and regulations and consider adopting the requirements and standards recommended in the Local Government - Land Management section of this chapter.

## Nonregulatory

### Road Salt Management

DES should develop best management practices for road salt management for use by DOT and local officials in the development of road salt management policies.

Municipalities within the Squam Lakes watershed should cooperate to develop and adopt a consistent road salt management policy for locally maintained roads within the watershed. Input from the selectmen, road agent, health officer, planning board and conservation commission in each town is advised.

### Wetlands Inventory

Local conservation commissions should undertake wetlands inventories in their respective towns and monitor the status of those wetlands identified as part of the inventory.

### Prime Wetlands

Towns should consider the designation of special wetlands which can be classified as Prime Wetlands under RSA 482-A:15 (formerly RSA 483-A:7).

### Recommendation Concerning Information and Technical Assistance

Towns should utilize the services of the Lakes Region Planning Commission, which has an extensive database and professional resources to assist municipalities with the local planning and regulatory measures suggested in this chapter. In addition, the LRPC has acquired capability in the use of geographic information systems technology, and can provide access to NH GRANIT, the State's geographic information system, for natural resources and land use planning.

## **Intermunicipal Cooperation**

### **Summary**

Local officials in the Squam Lakes watershed expressed a concern about the limitations of government personnel and financial resources to enforce State statutes and administrative rules, as well as local ordinances and regulations. They requested that OSP develop options for their consideration that would allow for State

and local enforcement responsibilities to be shared, for more efficient and effective enforcement of both State and local regulatory controls. To assure consistent enforcement on a watershed basis, it was suggested that the enforcement responsibility be vested at the regional level, between formally cooperating municipalities with a shared lake resource.

Chapter 9 of the Squam Lakes Watershed Plan presents a list of State and locally regulated activities for which municipalities within a watershed may wish to cooperate for enforcement purposes. Activities on this list which are currently regulated and enforced at the State level include: fill and dredge activities and shoreline structures, permitted by the Wetlands Board; boating activities, policed by the Department of Safety Services; design and installation of septic systems, permitted by the Water Supply and Pollution Control Division and alteration of greater than 100,000 square feet, permitted by the Water Supply and Pollution Control Division. Amendments to State statutes would be required to allow for shared enforcement of all of the regulations governing these activities except for the septic system regulations. The statutes currently authorize WSPCD to certify local officials to have concurrent jurisdiction in enforcement of septic system regulations.

Local responsibilities which could be shared between towns include enforcement capabilities for local subdivision and site plan review regulations. It would also be useful to share enforcement capabilities for local zoning, police power, and excavation and health ordinances. Municipalities are currently authorized to cooperate for enforcement of their local land use controls, and often share regional "circuit rider" staff for planning purposes. Chapter 9 presents two mechanisms authorized by State statute to allow municipalities to work cooperatively for their mutual benefit. RSA 53-A authorizes municipalities to form intermunicipal agreements. RSA 52 authorizes selectmen to fix the boundaries of a precinct, to be approved by the voters of that district. The advantages and disadvantages to municipalities that choose to cooperate in accordance with each of these mechanisms are summarized in Chapter 9. Methods for financing the efforts of towns in cooperating on an intermunicipal basis are also discussed.

The goal statement which led to the development of Chapter 9 follows, with recommendations for a phased approach to intermunicipal cooperation, to be used by municipalities in the Squam Lakes watershed.

**Goal: Develop recommendations for changes to existing federal, State and local regulatory processes to improve the effectiveness of such regulations on the use of land and surface water in the watershed.**

## **Recommendations**

### **Intermunicipal Cooperation for Enforcement of State Regulatory Requirements in Accordance with Existing State Statutes**

Municipalities in the Squam Lakes watershed should take local action to either enter into an intermunicipal agreement in accordance with RSA 53-A, form a watershed precinct in accordance with RSA 52, or develop



a program with the Lakes Region Planning Commission for the coordination and enforcement of zoning and subdivision regulations in accordance with RSA 36:47. This regional cooperative effort should be used as a mechanism to request that WSPCD certify each of the municipalities for concurrent jurisdiction for enforcement of the septic system laws. The cooperative effort should be used to hire regional staff to perform consistent, more efficient enforcement activities.

Municipalities within the Squam Lakes watershed should demonstrate that a regional cooperative effort can, in fact, provide for consistent, more efficient enforcement activities through regional staff for a period of at least one year.

#### **Proposed Legislation to Authorize Shared Government Enforcement Capabilities**

Use the example of successful implementation of intermunicipal cooperation for enforcement of State regulatory requirements, as the basis for recommending legislative changes to:

Authorize concurrent jurisdiction for enforcement of other State statutes; and/or

Authorize pass through to local officials of funds for enforcement activities from existing and proposed permit fees, administrative fines and administrative penalties.

Legislation proposed to authorize certification of regional concurrent jurisdiction and the pass through of State funds should include language to condition that certification upon:

The municipalities establishing either an intermunicipal agreement, watershed precinct or regional planning commission program, and the municipalities demonstrating successful cooperation for enforcement of the State septic system laws through that agreement, precinct or program for a period of at least one year.

## **Land Protection**

### **Summary**

The Squam Lakes Watershed Plan recognizes that in order to preserve and protect the special character of the Squam Lakes region, it will be important for local municipalities and conservation organizations to join together and continue to develop a workable and comprehensive land conservation strategy. Addressed both to conservation organizations and local communities, Chapter 10 explains that a variety of goals can be addressed

simultaneously, with such a strategy: protection and preservation of wildlife habitat; protection of water quality; preservation of views and trails; provision of possible public access areas for passive and active recreation; preservation of areas that should be available as productive resources for watershed residents now and in the future. The chapter describes previous vision and action on the part of local conservation organizations and communities, which have already resulted in the protection, through acquisition and purchase of conservation easements, of several important natural areas in the Squam Lakes watershed. The chapter then identifies the kinds of land areas that should be given priority for further land protection efforts.

Chapter 10 briefly describes the various land acquisition methods that can be used to protect land, placing emphasis on the importance of conservation easements in achieving a variety of land protection goals.

**Goal: Encourage innovative methods of land protection for environmentally sensitive areas within the watershed.**

## **Recommendations**

### **Priority Areas for Land Protection**

Both private, non-profit conservation groups and local conservation commissions within the Squam Lakes watershed should consider islands, shorelines, wetlands and wetland buffers, unique natural areas, habitat for threatened or endangered species, and wildlife travel corridors as priority areas for their land acquisition programs.

Conservation commissions and conservation organizations in the watershed municipalities should utilize the maps contained in this plan which show important wildlife areas, unique natural areas and other features not currently protected, as one source of information in developing priorities for their land acquisition programs.

Communities in the watershed should consider dedication for open space acquisition of penalty fees that are returned as a result of land being removed from the Current Use program.

The Squam Lakes Association, town conservation commissions, the Appalachian Mountain Club, and appropriate State agencies should join together to provide information and encouragement to trail landowners to donate or sell permanent trail corridor easements to public or non-profit agencies.

Each preserved open space area (including public use areas) should be designated and marked with signs, identifying them as components of a Squam Lakes Reserve. Reserve properties could include private lands under easement (with the owner's consent), and various nonprofit and public ownerships. Public information should be developed about use areas in the Reserve in order to promote broad public recognition of and respect for preserved lands.

## **Education**

### **Summary**

The Squam Lakes Watershed Plan recognizes the important role education has to play in achieving many of its goals and recommendations. The protection and preservation of the resources of the watershed is a long-term undertaking, and will require an awareness and understanding of various resource issues by many people, not just a committed few.

As Chapter 11 indicates, there are a number of informal, local environmental education opportunities in the watershed for both children and adults. The presence of the Science Center of New Hampshire in the region is especially useful in helping to focus on the Squam watershed and its resources, for the benefit of both residents and non-residents. The chapter explains in detail that more formal environmental educational opportunities for young people in the watershed do not appear to be as readily available.

The Education chapter addresses the importance of informing the public about recreational access opportunities in the Squam watershed, as well as about boating regulations and other related issues. There is a discussion of some of the important elements of an effective public information program, and also discussion of the present availability of this kind of information in the watershed.

Chapter 11 also addresses the fact that though there are a variety of informal opportunities for adults in the Squam watershed to learn about resource issues, it may be more difficult for them to obtain as well as understand the more formal, technical information they need in order to make informed land and water resource management decisions. It may also be difficult to determine, often among an assortment of related kinds of information, which is the most accurate, readily available and useful information for town officials, landowners and others for a particular purpose. The Education chapter therefore provides a list and description of parties that would realistically be expected to provide technical information concerning some of the key issues addressed in the Squam Lakes Watershed Plan, and also indicates those who could provide guidance concerning information management.

**Goal: Promote environmental appreciation, awareness, and education relating to the Squam Lakes and their watershed.**

## **Recommendations**

### **Young People**

Upper elementary and middle school teachers in the Squam Lakes watershed should be encouraged to use the curriculum developed by the New Hampshire Waters program, which parallels Cooperative Extension's adult-oriented Water Quality Program. The program provides young people with a strong background in watershed dynamics and water quality issues facing New Hampshire. This background can be reinforced and enlarged upon by Extension's adult Water Quality program.

Lower and upper elementary schools in the Squam watershed should encourage local teachers to attend workshops put on by such programs as Project WILD, Project WILD Aquatic, Project Learning Tree, Project Conserve and Audubon Society's Awareness to Action Program. If for some reason local teachers are unable to implement supplementary environmental curricula, local schools should provide the opportunity for DOCENTS to come to local schools to present this information to young people.

High school teachers in the Squam Lakes watershed should be encouraged by their local school districts to become involved in the Merrimack River Watershed Education Project. This program provides specific, technical instruction to young people concerning water resources and water quality issues facing New Hampshire, and more specifically, the Merrimack River watershed.

Local schools should seek input from local science teachers in biology, chemistry and other areas to refine the basic curricula that have been developed by the above programs. This input is essential to the success of implementing these curriculums, because teachers in the watershed need to feel that they have a personal stake in them, and are able to maximize their own strengths and local resources in helping to make the programs a reality.

Local organizations such as the Science Center of NH, the Squam Lakes Association, the Lakes Region Conservation Trust, and the Loon Preservation Committee should develop background information about the watershed to be included in the above supplementary curriculums. For example, the Science Center is especially helpful in providing information on local animal and plant species and their habitats. The SLA could provide useful historical information and perspective about the watershed, as well as up-to-date water quality information derived from the lay monitoring program. Knowledgeable, concerned local citizens can also provide schools with background information about the watershed.

Local conservation commissions should promote a "Conservation Teacher of the Year" award in their towns.

A greater number of recreational activities should be available on the Squam Lakes for young people living in the watershed, who may or may not have regular access to the lakes. Activities such as sailing, rowing, and fishing competitions can be an effective way to motivate young people to learn about their watershed, and to care enough about it to want to help protect it. As part of this education, young people should be taught about boating laws, boating safety, and water safety in general.

### Adults

#### Public Information

Information should be provided to the public, including year round residents, seasonal residents or visitors, concerns recreational access opportunities in the Squam Lakes watershed, and the possible consequences of their recreational activities, including possible negative impacts on the environment. If a Squam Lakes Reserve is established, one of its functions should be to organize and conduct a coordinated public information program.

Residents and visitors to the Squam Lakes of all ages also should be kept informed about various boating regulations and other related issues: providing practical and readily available information on boating safety and boating laws, geared to both State residents and out-of-staters. It should also give the public specific information on the location and extent of the lake zones proposed in the chapter on Access, if they are established on Squam Lake, as well as information about time zoning, if it is put into effect.

#### Technical Information

Coordinated efforts among natural resource agencies, and between these agencies and private organizations should be continued in order to promote information transfer and awareness of important local as well as non-local environmental issues. This will assure that educational resources are used efficiently and effectively, and will avoid duplication of effort.

#### Land Capability

Local conservation districts, SCS and the Lakes Region Planning Commission should be called upon by town officials, landowners and land managers to provide technical information needed to make land use planning and management decisions affecting the Squam Lakes watershed.

#### Water Quality

SLA and local municipalities should promote landowner awareness and understanding, particularly in those areas bordering surface waters, concerning land management practices which protect water quality. Septic system maintenance and proper use of pesticides and fertilizers are some of the practices that can be promoted in this way.

Town officials, landowners and land managers should utilize Cooperative Extension's Water Quality Program.

Awareness and understanding of Extension's Lakes Lay Monitoring Program should be expanded to include a greater number of the watershed's population.

The Fish and Game Department's new Aquatic Resources Program should also be utilized by local towns.

#### Wildlife

The educational effort that the Loon Preservation Committee has put forth, both in terms of collection and transfer of information should serve as a model for local education concerning other wildlife species. The Squam Lakes Association can be effective in making lake users aware of wildlife habitat areas and the need for their protection. Organizations such as the NH Municipal Association, the Office of State Planning and the Lakes Region Planning Commission should provide general guidance for town officials, landowners, and land managers concerning the kinds of information they need in order to make specific planning and management decisions.

#### General

The Science Center of New Hampshire, the local Chambers of Commerce, and the local towns should provide easily accessible materials which interpret the natural resources, cultural aspects, and economic factors within the watershed. For example, if a visitor did not have time to follow a trail to a specific location, he/she should have the opportunity to short-cut the process by driving to various locations on existing road and observing specific sites and reading interpretive information. In this way, a visitor could obtain a limited but accurate understanding and appreciation of the watershed.

## Chapter 3. Description of Squam Lakes Watershed

### Natural Resources

#### Geography

The Squam Lakes watershed is located in the Lakes Region of central New Hampshire, and covers 42,418 acres. The watershed centers on Squam Lake and Little Squam Lake, and includes parts of eight towns: Ashland, Campton, Centre Harbor, Holderness, Meredith, Moultonborough, New Hampton, and Sandwich (see Map 3-1). Two of these towns, Campton and Meredith, have relatively insignificant amounts of acreage in the watershed, and will not be focused on in this study. The watershed includes the Squam Lakes themselves and the land containing all of the surface water which flows into them. It also includes the subwatersheds which drain into the Squam River. Approximately 34,571 acres of the Squam Lakes watershed is land, while a fairly large percentage of it, 7,847 acres, is water.

Table 3-1 indicates that in the Town of Ashland, the Squam watershed boundary contains 4,308 acres, including approximately one third of Little Squam Lake, the entire Squam River and the densely developed town village. The town of Holderness shares the other two thirds of Little Squam Lake and also contains a large portion of Squam Lake. Holderness has 17,477 acres in the watershed, with the Squam Mountain Range serving as the northern boundary. The Squam Range extends into the southwestern corner of the town of Sandwich and this section is also in the watershed, 7,983 acres, including a small part of Squam Lake centering on Sandwich Bay and Hoag Island. The watershed does not include Center Sandwich.

**Table 3-1. Percent of Watershed Acreage in Each Town (Land and Water)**










Town	Acres	Percent
Ashland	4,308	10.2
Campton	714	1.7
Centre Harbor	5,790	13.6
Holderness	17,477	41.2
Meredith	123	0.3
Moultonborough	2,698	6.3
New Hampton	3,325	7.8
Sandwich	7,983	18.8
Total	42,418	99.9*

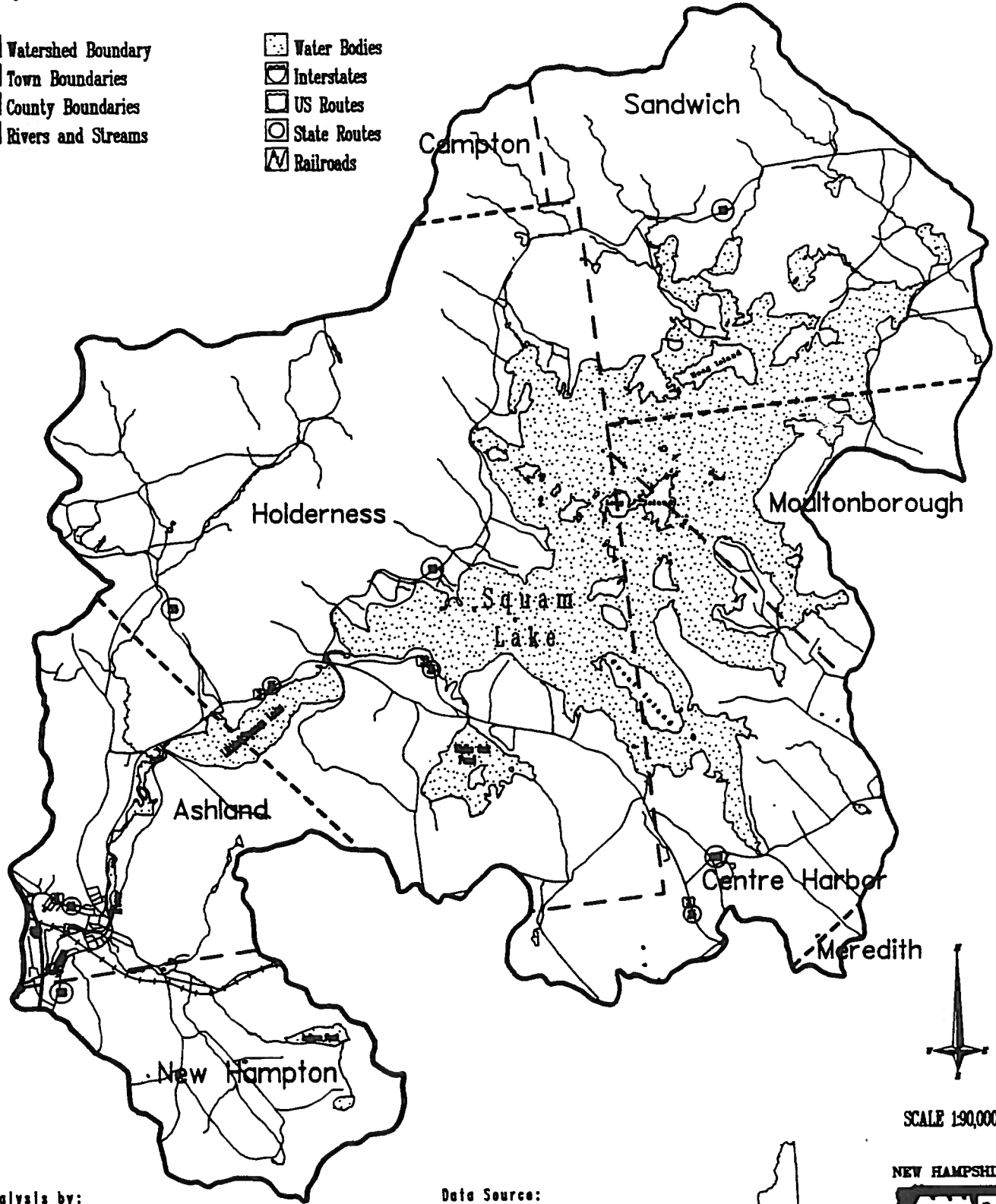
Note: \* totals do not equal 100% due to rounding.

Source: Complex System Research Center, UNH, 1989.

# SQUAM LAKES WATERSHED

Map 3-1. Base Map

- |  |  |
|--|--|
|  Watershed Boundary |  Water Bodies |
|  Town Boundaries    |  Interstates  |
|  County Boundaries  |  US Routes    |
|  Rivers and Streams |  State Routes |
|  |  Railroads    |



SCALE 1:90,000



Analysis by:  
 Complex Systems Research Center,  
 University of New Hampshire,  
 January, 1990.

Data Source:  
 U.S. Geologic Survey,  
 7.5 minute topographic  
 quadrangles, 1:24,000.



The watershed also extends into Moultonborough, although only 2,698 acres of land in the town are actually in the watershed, with Red Hill and Pine Hill serving as the watershed boundaries. The watershed contains 5,790 acres of land in the town of Centre Harbor, including approximately half of High Haith, Centre Harbor Neck, Dog Cove and Sturtevant Bay. The town village is located just outside of the watershed, on the shores of Lake Winnepesaukee. Only 3,325 acres of New Hampton is in the watershed. The town is located well to the southwest of the Squam Lakes, and thus has no frontage on them.

### Terrain

The Squam Lakes watershed is in large part characterized by its rugged mountains. The Squam Mountain Range, the Rattlesnake Mountains, Red Hill, Eagle Cliff and other peaks provide a sharp contrast to the lakes which they surround. The land north of the lakes rises into the steep foothills of the White Mountains, while much of the land to the south forms a comparatively low-lying plateau with scattered hilly areas. A wide range in topography is found, indicating considerable variation as to land use options and developmental capabilities (Map 3-2). Table 3-2 provides the amount of acreage in the watershed occurring in each of five slope percentage categories.












**Table 3-2. Terrain**

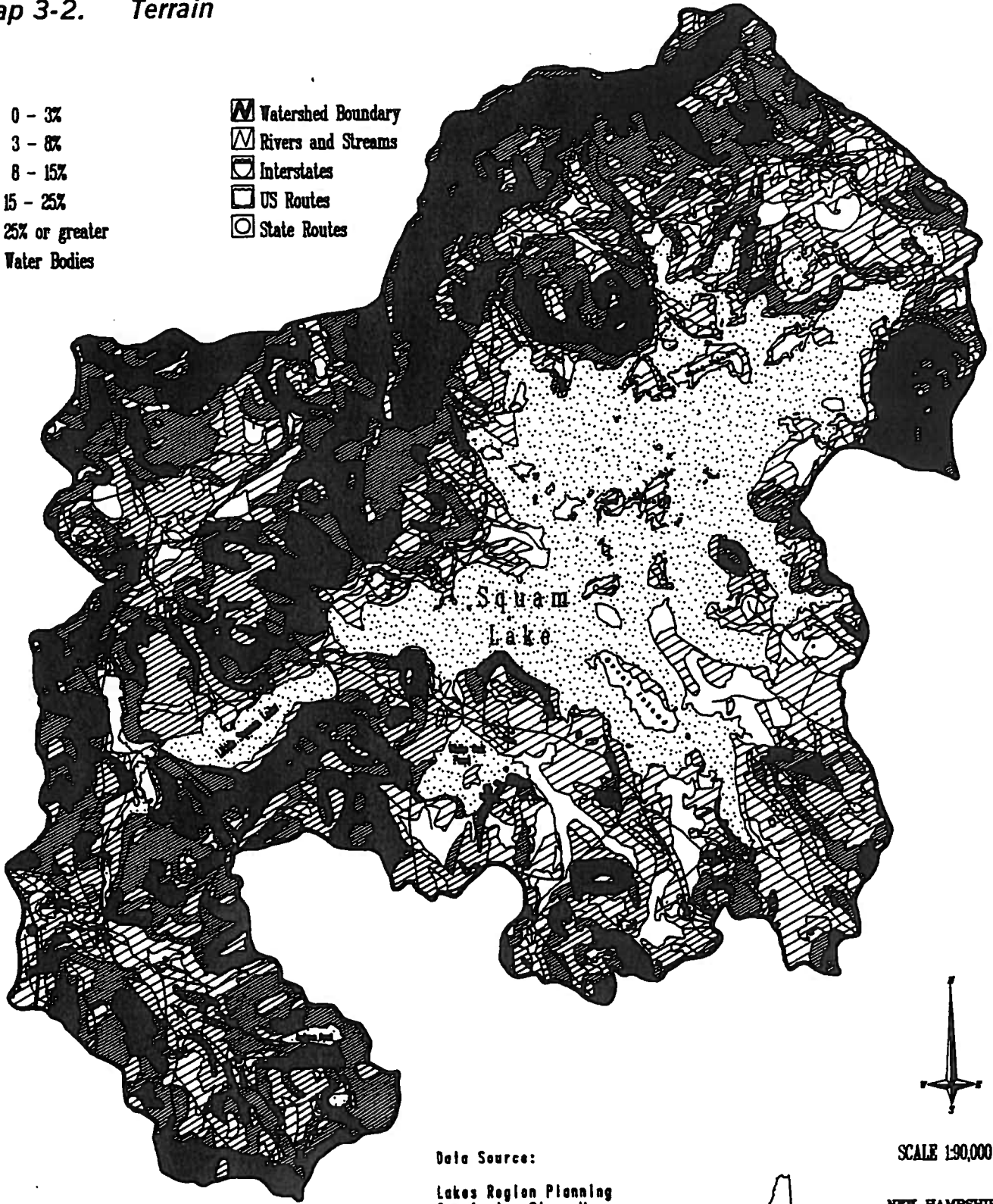
Slope %	Acreage	% of Land Area	% of Watershed
0 - 3	2,575	7.4	6.1
3 - 8	7,013	20.3	16.5
8 - 15	7,554	21.9	17.8
15 - 25	8,728	25.2	20.6
>25	8,701	25.2	20.5
Water	7,847	---	18.5
Total	42,418	100.0	100.0

Source: Lakes Region Planning Commission, (1974) Slope Mapping, Squam Lakes Watershed.

# SQUAM LAKES WATERSHED

Map 3-2. Terrain

- |  |  |
|--|--|
|  0 - 3%         |  Watershed Boundary |
|  3 - 8%         |  Rivers and Streams |
|  8 - 15%        |  Interstates        |
|  15 - 25%       |  US Routes          |
|  25% or greater |  State Routes       |
|  Water Bodies   |  |



Analysis by:

Complex Systems Research Center,  
University of New Hampshire,  
January, 1990.

Data Source:

Lakes Region Planning  
Commission Slope Map,  
1:24,000, 1970's.

U.S. Geological Survey,  
7.5 minute topographic  
quadrangles, 1:24,000.



SCALE 190,000

NEW HAMPSHIRE



Geographically Referenced Analysis  
and Information Transfer System

Squam Lake and Little Squam Lake both lie at 562 feet above sea level. In addition to the lakes and their shorelines, the primary lowland areas stretch from White Oak Pond in Holderness up to the entrance to Sandwich Bay. Included are portions of Centre Harbor, Moultonborough (except Eagle Cliff and Red Hill) and the lower part of Sandwich in the vicinity of Kusumpe Pond and Barville Pond. Further west, in the Owl Brook subwatershed, the Squam River drainage area and town center of Ashland also constitute a narrowly defined area of low elevations. The lowest point in the watershed is the outlet of the Squam River into the Pemigewasset River, at an elevation of approximately 450 feet.

Hilly terrains (from 800 to 1,400 feet) are found as scattered clusters throughout the watershed, serving as a transition from the lowlands to the steepest elevations. Hills southeast of Squam Lake include Gilman Hill in Meredith and Sunset Hill in Centre Harbor. More directly south of Squam Lake is Pine Hill in Holderness, McGrillis Hill in Centre Harbor, and a ridge in New Hampton which centers on Beech Hill. Just south of Little Squam Lake in Holderness and Ashland is Leavitt Hill. Hills northwest of the lakes include Hicks Hill and Cotton Mountain in Holderness, while the twin peaks of the Rattlesnakes dominate the north central section of the watershed. To the northeast, in Sandwich, is found Buzzell Ridge.

Still higher mountains, ranging from 1,400-2,400 feet, are found in the southwestern portion of the watershed. Beech Hill is in New Hampton, while to the west, in Holderness, are found the Button and Mount Prospect. To the east are found Red Hill in Moultonborough and Eagle Cliff in Sandwich. The highest elevations in the watershed lie in the Squam Mountain Range. This crest of mountains above Squam Lake extends northeastward from Mount Livermore in Holderness to Doublehead Mountain in Sandwich, and includes Mount Webster, Mount Morgan, Mount Percival and Mount Squam. (All elevations taken from USGS topographic maps and *Mountains of New Hampshire*, 1949, by Mary Louise Hancock.)

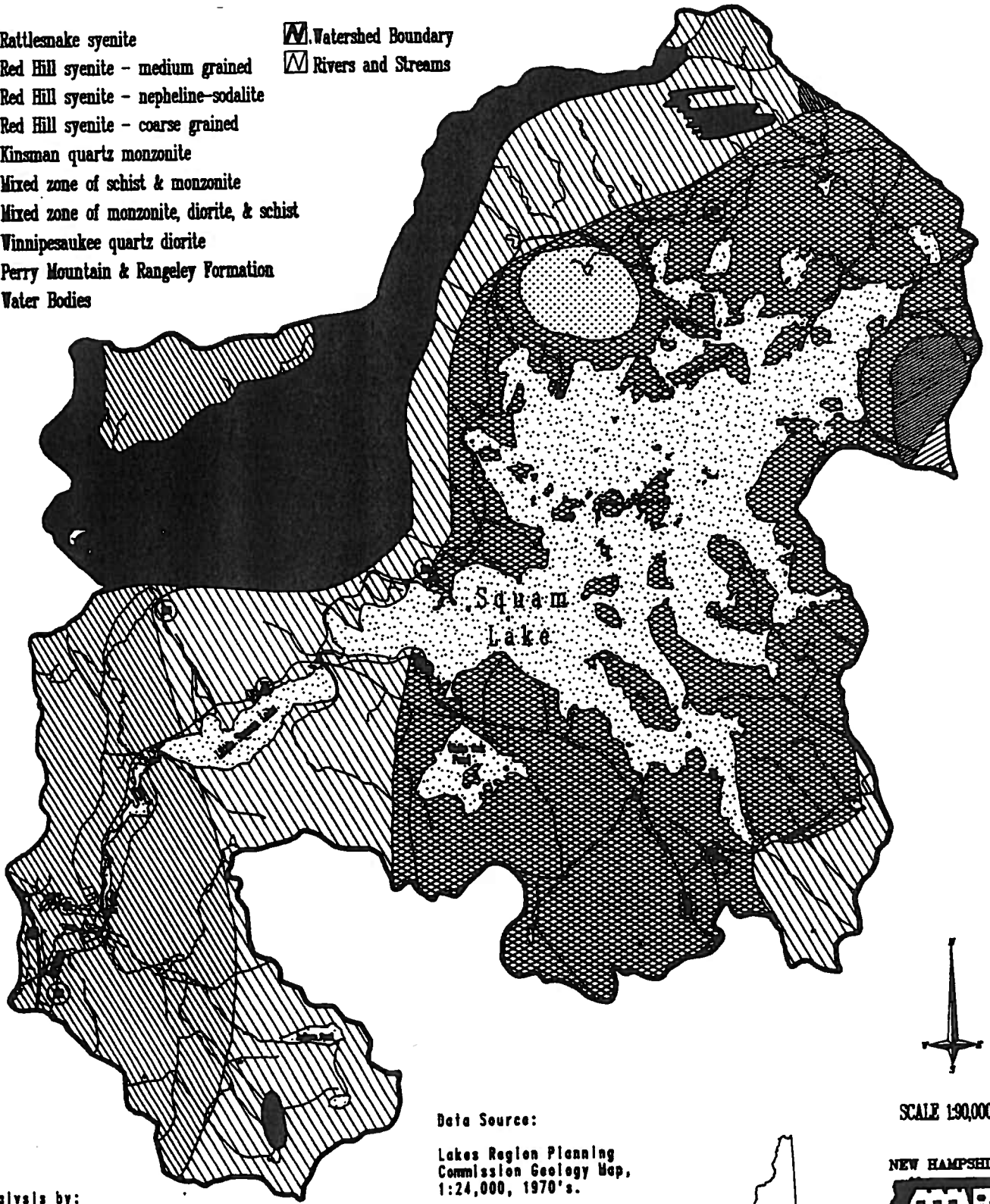
## Geology

The bedrock and surficial geology of the Squam Lakes region plays an important role in determining the physical environment of the watershed. For management planning purposes, the significance of geological factors lies in their impact on land use, building activities and developmental capabilities. Surficial material, the unconsolidated material deposited by glacial action and from which soils are formed, determines the mineralogical and chemical composition of soil, and thus its suitability for various purposes. Surficial information can also give an indication of the type of stratified sand and gravel deposits that may be available within the watershed to provide groundwater. The influence of both bedrock and surficial geology can be seen in the topography. The topography helps to determine drainage conditions, rate of soil formation/erosion, and other physical processes occurring in the watershed.

# SQUAM LAKES WATERSHED

## Map 3-3. Bedrock Geology

- |  |  |  |                    |
|--|--|--|--------------------|
|  | Rattlesnake syenite                        |  | Watershed Boundary |
|  | Red Hill syenite - medium grained          |  | Rivers and Streams |
|  | Red Hill syenite - nepheline-sodalite      |  |                    |
|  | Red Hill syenite - coarse grained          |  |                    |
|  | Kinsman quartz monzonite                   |  |                    |
|  | Mixed zone of schist & monzonite           |  |                    |
|  | Mixed zone of monzonite, diorite, & schist |  |                    |
|  | Winnepesaukee quartz diorite               |  |                    |
|  | Perry Mountain & Rangeley Formation        |  |                    |
|  | Water Bodies                               |  |                    |



Analysis by:

Complex Systems Research Center,  
University of New Hampshire,  
May, 1990.

Data Source:

Lakes Region Planning  
Commission Geology Map,  
1:24,000, 1970's.

U.S. Geological Survey,  
7.5 minute topographic  
quadrangles, 1:24,000.



SCALE 1:90,000

NEW HAMPSHIRE



Geographic Information Systems  
and Cartography, University of New Hampshire

Like the rest of New Hampshire, the Squam Lakes watershed is part of the Appalachian Highlands, which extend from Alabama to the southwest to New Foundland to the northeast. The watershed is underlain by igneous rocks of Devonian and Jurassic age, (approximately 380 and 160 million years old respectively) and metamorphic rocks of Silurian age, which are over 400 million years old.<sup>1</sup>

The Squam Mountain Range is underlain by metamorphic rocks of the Perry Mountain and Rangeley Formation. These quartzites, pelitic schists, and calc-silicate granofels are resistant to weathering, forming the high ridges of the west side of the watershed. Littleton Schist comprises much of this area. It is the youngest metamorphic unit and the most resistant rock found in the watershed. Kinsman Quartz Monzonite, a granitic rock of igneous origin, is found in a narrow belt, stretching from the lower elevations of the Squam Range in Holderness to Little Squam Lake in Ashland, to Jackson Pond and Beech Hill in New Hampton. Most of Little Squam Lake and the western tip of Squam Lake are underlain by Kinsman Quartz Monzonite, as is an outer section of the watershed located in Centre Harbor. In the western-most part of the watershed, the Littleton Schist was intruded by the Kinsman Quartz Monzonite, and partially melted, producing a migmatite ("mixed rock"). This geological area includes the Owl Brook-Squam River drainage area in Holderness and Ashland, and part of New Hampton, centering on the Scribner Fellows State Forest.<sup>2</sup>

Within the watershed, the rock showing the least resistance to weathering is the Devonian-age Winnepesaukee Quartz Diorite. This igneous rock forms a broad belt which underlies most of Big Squam Lake, including all islands, and the south-central portion of the watershed, which centers on White Oak Pond. Rattlesnake and Red Hill syenite is the youngest kind of bedrock found in the watershed. Red Hill is composed of several kinds of igneous rock, including syenite and granite of Jurassic age. Syenite also forms the peaks of the Rattlesnakes and Eagle Cliff (extending up the northwest slope of Red Hill). Outcroppings of the bedrock exist on the peaks of the Squam Mountain Range, Eagle Cliff, and the Rattlesnakes. The nepheline-sodalite-hastingsite syenite exposed at Red Hill is an unusual and distinctive rock type not commonly found elsewhere in New Hampshire.<sup>3</sup> See Table 3-3 for percentages of the different rock formations in the watershed, and Map 3-3, Bedrock Geology, for their locations.

The NH State Geologist has developed the following description of the geologic history of the Squam Lakes watershed. This description has evolved from detailed historical as well as recent investigation and analysis.

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<sup>1</sup> C. Raymo and M.E. Raymo, *Written in Stone, A Geological History of the Northeast United States*, 1989, p. 3.

<sup>2</sup> Interim Geologic Map of NH, 1986.

<sup>3</sup> New Hampshire State Geologist, 1989.

**Table 3-3. Bedrock Geology**

Bedrock	Acres	% of Land	% of Watershed
Rattlesnake Syenite	563	1.6	1.3
Red Hill Syenite - Medium Grained	13	0.0	0.0
Red Hill Syenite - Nepheline Sodalite	75	0.02	0.02
Red Hill Syenite - Coarse Grained	445	1.3	1.0
Kinsman Quartz Monzonite	8,518	24.6	20.1
Mixed Zone of Schist and Monzonite	6,313	18.3	14.9
Mixed Zone of Monzonite, Diorite and Schist	39	0.1	0.1
Winnepesaukee Quartz Diorite	12,788	37.0	30.1
Perry Mountain and Rangeley Formation	5,817	16.2	13.7

Source: Complex Systems Research Center, UNH, 1989.

The geologic history of the region begins with the deposition of sandstone and shale in the region during the Silurian and Lower Devonian periods, about 400 million years ago. The sediment was derived from the continent to the west and island areas to the east, and it accumulated in a deep trough on the continent. Beginning about 385 million years ago, New England underwent a continental collision called the Acadian Orogeny. The previously deposited rocks were deeply buried in the crust, and were subjected to high temperature and pressure. This caused the sediments to be metamorphosed (fundamentally recrystallized) into schists and related rocks which were intensely folded. The heat was supplied by an elevated crustal gradient. The Kinsman Quartz Monzonite locally intruded the metamorphic rocks in a bed-by-bed fashion, creating the area of "mixed" metamorphic and igneous rocks on the west side of the Squam Lakes area. Geophysical studies have shown that these igneous units are thin sheet-like intrusions. The overall shape of the intrusion is that of a saucer with the edges slightly upturned, accounting for the overall presence of the Squam-Winnepesaukee basin. These igneous rocks, intruded during the early part of the Acadian Orogeny, were brittly deformed by later events. The region may have been subjected to additional compression and thermal overprint during the Alleghanian event about 325 million years ago, but this event has not been clearly documented in central New Hampshire. During the Jurassic period (about 180 million years ago) igneous rocks of the White Mountains intrusive-volcanic suite were emplaced at Red Hill and the Rattlesnakes. The rocks presently exposed at the surface represent the magma chambers of volcanoes that dotted New Hampshire's landscape.

Glaciation in the region began one million years ago, following erosion of about five kilometers of the earth's crust. The long period of erosion has allowed the topographic adjustment to the bedrock to occur. The bedrock surface we see today reflects the pre-glacial topography, which has been modified slightly by glacial erosion and deposition.<sup>4</sup>

The landscape of the Squam Lakes watershed that is partially formed by the surficial geology tends to modify the pre-existing bedrock landscapes. The uplands in the Squam Lake watershed are covered with glacial till which ranges from a thin veneer to greater thicknesses in lowlands and drumlins. The till is soil and rock that was redeposited by the glacier. This material was deposited in a mostly unstratified mass containing fragments of all sizes, ranging from clay to boulders. Till can range in composition from sandy to compact, the latter being relatively impermeable. The depth to bedrock can be unpredictable, because the glacial deposits in many places are able to completely mask the irregular surface of the underlying bedrock.

Stratified glacial deposits which were formed by meltwater streams carrying debris from the wasting glacier are present in some of the lowland areas. These deposits are highly porous and potentially contain important surficial aquifers. Some of the resulting features that have been mapped include kame terraces and deltas. Kame terraces were deposited by the glacier when meltwater streams came in direct contact with the ice, and can be found to the northwest of Barville Pond and on the northeastern shore of Little Squam Lake. A former delta (deposited where streams entered glacial lakes) has been identified at Point Finisterre on Squam Lake. Two glacial pothole sites in bedrock have been identified, one in southwestern New Hampton and the other near Mount Squam in the Squam Range.<sup>5</sup>

## Soils

The primary material on which the soils within the Squam watershed developed is glacial till, which is especially common on the upland areas of the watershed (see Map 3-4). As Table 3-4 indicates, 73.2 percent of the watershed is comprised of these glacial till soils. A wide range of till soils are represented, from loose mixes of loamy sand and sand textures to firm, compact, platy mixes of fine sandy loam textures. These glacial till soils vary considerably in terms of drainage characteristics, productivity, and management potential, not only because of their different soil textures but also because of their relative positions on the landscape, and depth to bedrock. For example, Monadnock and Moosilauke soils both formed in loose till of loamy sand and sand textures, but Monadnock soil is generally well-drained because it is commonly found on higher positions or on steeper slopes, for example, on the slopes of the Squam Mountains. Moosilauke soils, on the other hand, are poorly drained. They are found on level to gently sloping areas, or in depressions occurring in upland areas.

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<sup>4</sup> H.E. Wright, Jr., and D.G. Frey, Ed, *The Quaternary of the United States*, 1965, p. 115.

<sup>5</sup> Lisa Saranson, LRPC, *The Geology of the Squam Lakes Watershed*, 1974, p. 6.

Less common but also occurring in the Squam watershed are soils which are derived from stratified glacial outwash deposits, representing 6.3 percent of the watershed. A good example of these sand and gravel soils are Adams soils, which can be found, among other places, west of the Squam River near the village center of Ashland, as well as directly north of Cotton Cove, along Squam Lake.

**Table 3-4. Major Soils Categories**

Soils	Acres	% of Watershed	% of Land
Floodplain	263	0.6	0.8
Glacial Outwash	2,689	6.3	7.8
Glacial Till	31,053	73.2	89.9
Organic Soils	448	1.1	1.3
Rock Outcrops	5	0.0	0.0
Marsh	50	0.1	0.1
Gravel Pits	15	0.0	0.0
Udorthents	10	0.0	0.0

Source: Soil Conservation Service, County Soil Surveys for Belknap, Carroll and Grafton Counties: 1968; 1977; unpublished, due out in 1991.













Floodplain soils, which developed from relatively recently deposited stream sediments, and account for 0.6 percent of the watershed, are found along some rivers and streams. Podunk soils, for example, are found along the Squam River, including the location where the river meets up with the Pemigewasset River. There are two muck and peat soils in the watershed, Greenwood and Chocura, as well as a sizeable number of wet soils that are either poorly drained or very poorly drained, often due to the existence of a hardpan and/or lower slope position.

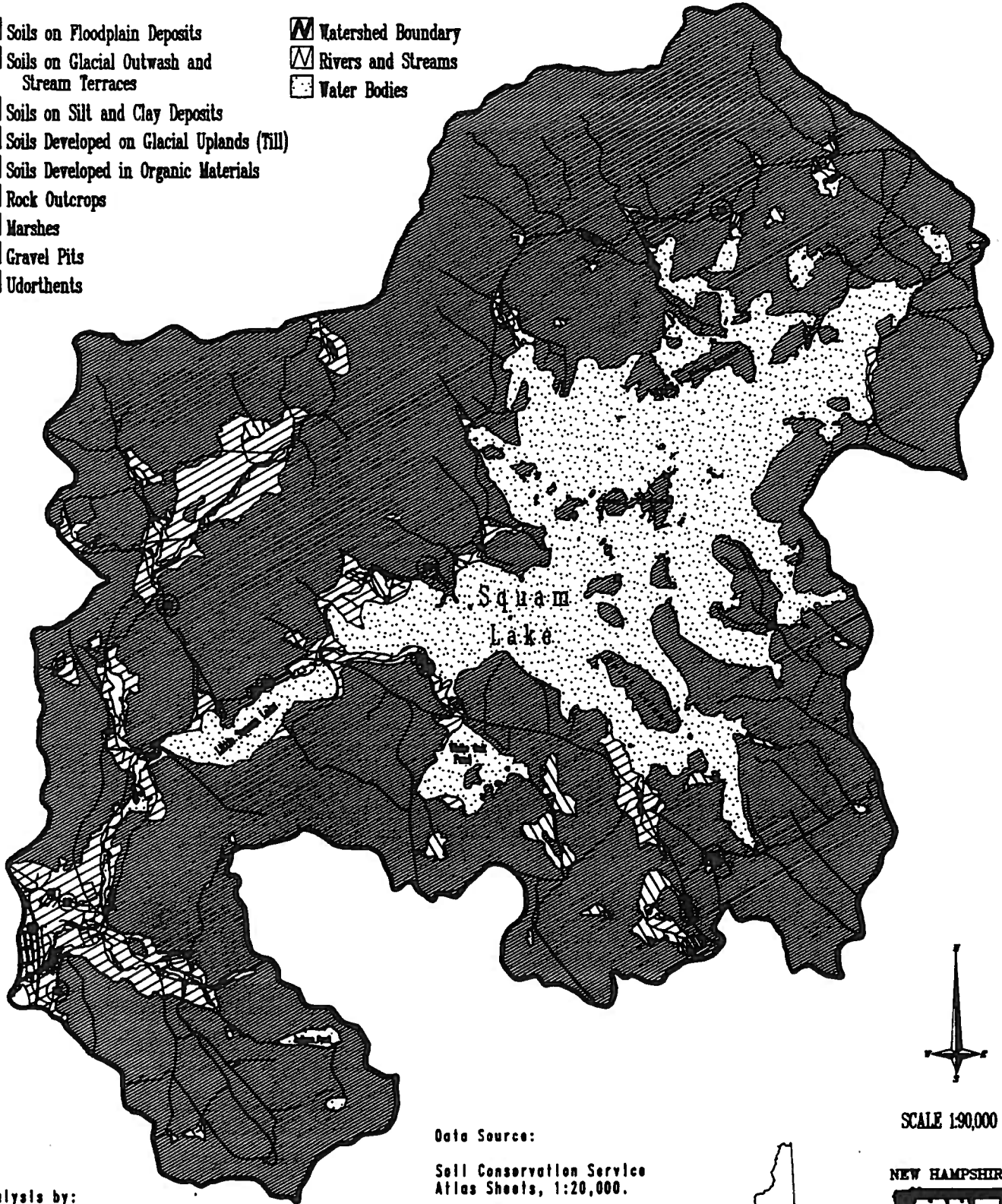
Soils in the Squam watershed are known to differ widely in their depth to bedrock, a factor which can have a significant influence on a soil's suitability for various purposes. The Lyman soils, for example, occurring on Red Hill, are only within one to two feet of bedrock. Colton soils, on the other hand, are generally greater than eight feet deep.



# SQUAM LAKES WATERSHED

Map 3-4. Generalized Soils

-  Soils on Floodplain Deposits
-  Soils on Glacial Outwash and Stream Terraces
-  Soils on Silt and Clay Deposits
-  Soils Developed on Glacial Uplands (Till)
-  Soils Developed in Organic Materials
-  Rock Outcrops
-  Marshes
-  Gravel Pits
-  Udorthents
-  Watershed Boundary
-  Rivers and Streams
-  Water Bodies



SCALE 1:90,000

Analysis by:

Complex Systems Research Center,  
University of New Hampshire,  
January, 1990.

Data Source:

Soil Conservation Service  
Atlas Sheets, 1:20,000.

U.S. Geological Survey,  
7.5 minute topographic  
quadrangles, 1:24,000.



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Interpretations concerning the potential of soils in the watershed for development, agriculture, and forestry purposes are found in Chapter 4, Land Capability, and in Appendices B and C.

## Hydrology

### Surface Water

The drainage pattern of the Squam Lakes watershed consists of numerous brooks and ponds which flow into three main waterbodies: Squam Lake, Little Squam Lake and the Squam River. These three waterbodies have a combined surface area of 7,183 acres, making the Squam Lakes the second largest lake system totally within the State of New Hampshire. The watershed can be broken down into three interdependent sections of surface flow. Squam Lake, which contains most of the surface water drains into Little Squam Lake through a short channel in Holderness, which in turn drains into the Squam River. The watershed extends to the point where the Squam River meets the Pemigewasset River. The Pemi has its headwaters in the White Mountains, and flows south past Ashland where it meets the Squam River, to Franklin, where it becomes the Merrimack River. The Merrimack drains all of central New Hampshire and then flows into Massachusetts, where it empties into the Atlantic Ocean at Newburyport.

The two Squam Lakes have contrasting physical features, as Table 3-5 demonstrates. Squam Lake is a larger and deeper lake with a very irregular shape. Little Squam is smaller and more compact, and was formed as the result of a dam. Both lakes were legislatively classified as "A" in 1959, designating them as suitable for both drinking and recreation. This classification is still valid today, with water quality generally remaining at this high level.<sup>6</sup> However, developmental pressures exist around both lakes. Chapter 5 provides more detail concerning the water quality of the Squam Lakes.

Squam Lake is characterized by its many coves and islands, its jagged, scenic shoreline, its significant variability in depth, and the rugged hills which surround it. Eighteen brooks and four ponds of various sizes and capacities drain into the lake. Map 3-5 shows the subwatersheds which together make up the Squam watershed, and Table 3-6 names the principal brook or pond for these subwatersheds, as well as their acreages.

Little Squam Lake is characterized by its compact size and by its regular and more developed shoreline. The lake lies partially in Holderness and partially in Ashland, with only two brooks flowing into the waterbody, and flows into the Squam River in Ashland. The Squam River has a surface area of 10.4 acres and provides the link between the Squam Lakes and the Pemigewasset River. It can be characterized by its changing

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<sup>6</sup> NHDES, WSPCD, *New Hampshire Water Quality Report to Congress 305(b)*, April 1988.

**Table 3-5. Comparison of the Squam Lakes**

Lake	Size(Acres)	Avg. Depth(Ft)	Max. Depth(Ft)	Shoreline(Mi)
Squam	6,765	36	98	60.5 miles; irregular with many coves, bays and islands
Little Squam	408	23	84	4.3 miles; elongated, regular

Source: Lakes Region Planning Commission, *Squam Lakes Water Quality Report*, 1974.

morphology and its steep drop of 107 feet in a little over a mile. In past years, Ashland had six hydroelectric dams on the river as it ran through the center of the town's industrial area.<sup>7</sup> An important feature of the river is its 18 foot concrete dam, which controls the water levels on both of the Squam Lakes.

White Oak Pond is found in one of the larger subwatersheds. Located in the town of Holderness, south of Squam Lake, the pond has a surface area of 291 acres and drains into Squam Lake at Piper's Cove via White Oak Pond Brook. Within the Burrow's Brook subwatershed, Barville Pond (39 acres) is drained by the small Barville Pond Brook, which flows into Squam Lake at Sandwich Bay. Kusumpe Pond (56 acres) is to the west of Barville Pond in Sandwich, and its subwatershed drains into Sandwich Bay. Intervale Pond (43 acres) is found in a subwatershed northwest of Squam Cove. Sky Pond is a 16 acre protected pond which drains north into Jackson Pond, whose exact acreage has been disputed. Figures of 39 acres and 54 acres have been used at different times. Ames Brook drains Jackson Pond, and eventually flows into the Squam River. Both Sky Pond and Jackson Pond serve as the source for Ashland's municipal water supply.<sup>8</sup>

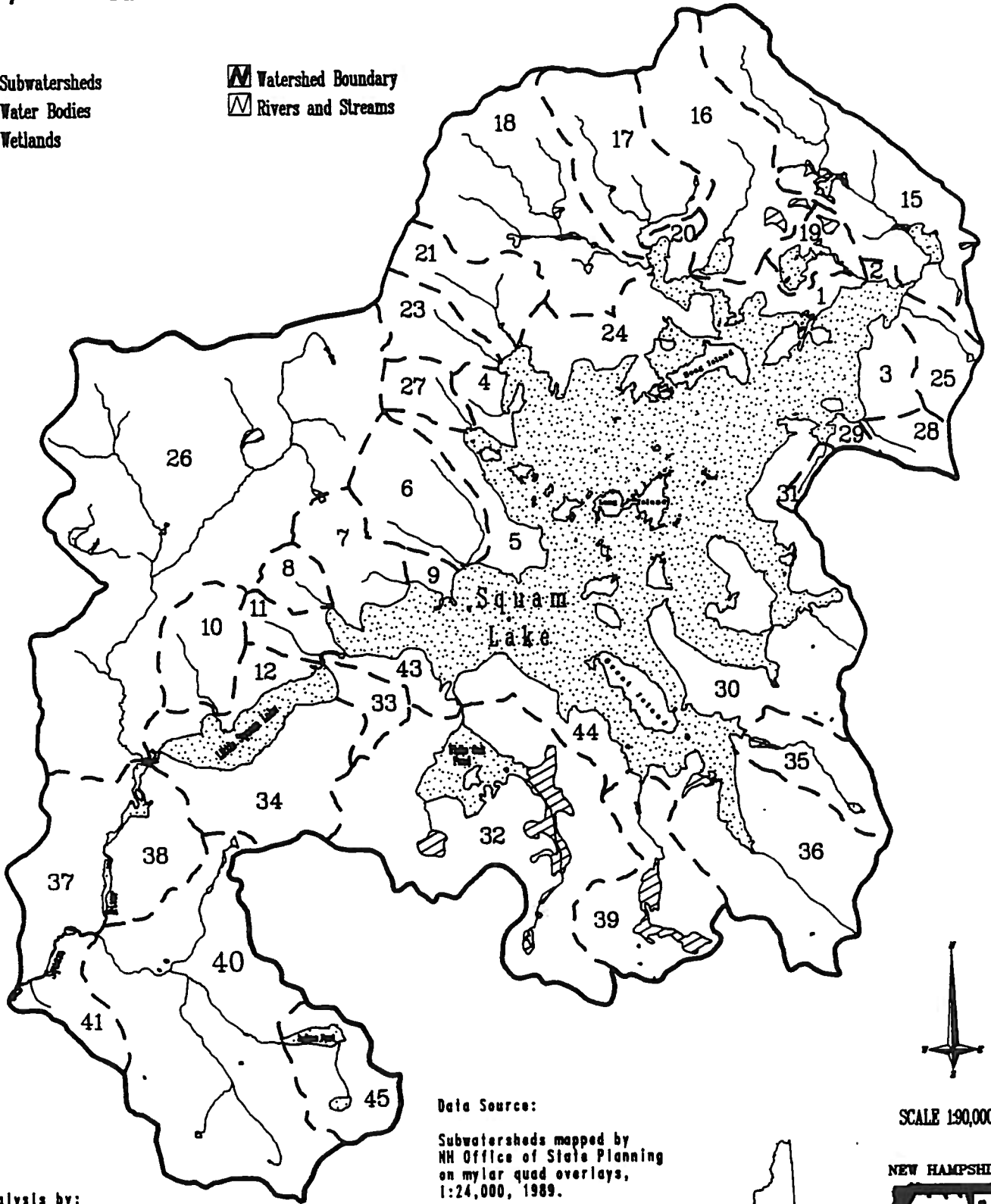
<sup>7</sup> Susan Backer Keath, *A Condensed History of the Squam Lakes Association*, 1963.

<sup>8</sup> 1984 Ashland Master Plan, amended 1986.

# SQUAM LAKES WATERSHED

Map 3-5. Subwatersheds

-  Subwatersheds
-  Water Bodies
-  Wetlands
-  Watershed Boundary
-  Rivers and Streams



Analysis by:

Complex Systems Research Center,  
University of New Hampshire,  
January, 1990.

Data Source:

Subwatersheds mapped by  
NH Office of State Planning  
on mylar quad overlays,  
1:24,000, 1989.

U.S. Geological Survey,  
7.5 minute topographic  
quadrangles, 1:24,000.



SCALE 190,000

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**Table 3-6. Principal Subwatershed Tributary**

Subwatershed Number	Stream/Subwatershed Name	Subwatershed Acreage
1	Shoreline Drainage, Otter Cove - Sandwich Bay	328
2	Shoreline Drainage, Sandwich Bay	43
3	Shoreline Drainage, Eagle Cliff	302
4	Veerie Cove Brook	209
5	Shoreline Drainage, Mooney Point	372
6	Livermore Brooks 1 and 2	832
7	Finisterre Point Brook	560
8	Cotton Cove Brook	222
9	Shoreline Drainage, Point Finisterre	106
10	North Brook	569
11	Science Center Brook	266
12	Shoreline Drainage, Little Squam Lake	333
15	Burrows Brook	1,845
16	Intervale Pond Brook	1,351
17	Eastman Brook	1,058
18	Smith Brook	1,750
19	Kusumpe Pond Brook	314
20	Shoreline Drainage, Squaw Cove	214
21	Bennett Brook	617
23	West Brook	434
24	Shoreline Drainage, the Rattlesnakes	717
25	unnamed brook	366
26	Owl Brook	5,542
27	Carn's Cove Brook	284
28	unnamed brook	245
29	Shoreline Drainage, Kent Island	62
30	Shoreline Drainage, Sturtevant Bay	1,601
31	unnamed brook	76
32	White Oak Pond Brook	3,102
33	Shoreline Drainage, Little Squam Lake	246
34	Shoreline Drainage, Little Squam Lake	1,032
35	unnamed brook	590
36	Shoreline Drainage, Dog Cove	1,629
37	Shoreline Drainage, Squam River	886
38	Shoreline Drainage, Squam River	588
39	Swainey Brook	1,130
40	Ames Brook	3,092
41	Shoreline Drainage, Squam River	411
43	Shoreline Drainage, west of Piper Cove	226
44	Shoreline Drainage, Sunset Point	431
45	Jackson/Sky Ponds	666

Source: Complex Systems Research Center, UNH, 1989.

## Groundwater Availability

According to the US Geological Survey Groundwater Availability Maps, the Squam Lakes watershed contains eight areas which have a medium to high potential for groundwater yield (see Map 3-6). The actual extent of the aquifers in these areas may be larger than is indicated on the USGS maps, which only show general areas of low-to-high potential for groundwater yield. These maps also involve only stratified drift (sand and gravel) aquifers. More detailed NH/USGS groundwater mapping for this part of the State is expected to be completed by 1992. The new maps will show transmissivity, saturated thickness, water table elevations and direction of groundwater flow. See Chapter 4, p. 4-26 and 4-27 for more detailed information on groundwater availability within the watershed.

## Land Cover/Vegetation

The majority of land in the Squam Lakes watershed which is presently undeveloped is forested (approximately 93.0 percent), with only a small percentage (4.0 percent) used for agricultural purposes, almost 3.0 percent swamp, and less than one percent categorized as idle.<sup>9</sup> The watershed contains a diversity of forest types, at least in part because it occurs within a zone of transition between southern and northern hardwood forests. What follows is a very broad description of forested areas found throughout the region.

The outer reaches of the northern portion of the watershed are covered predominantly by a mixed hardwood forest. In the southern portion of the Squam Mountain Range, red and white oak are common, though this area is located in close proximity to the northern limit for white oak. Other hardwoods found in the Squam Range are other typical northern species, for example, - beech, yellow birch, sugar maple, mountain alder, white birch. Much of this hardwood acreage is rather scrubby woods, which have developed on land that was cleared in the past, and has now reverted back to forest.<sup>10</sup> Also found in the Squam Range, but less common, are pure stands of white pine, as well as mixed pine/hardwood stands. Lower elevations north of Squam Lake generally contain a mix of forest types, with pure pine stands and mixed conifer-hardwoods occurring more frequently than mixed hardwoods.










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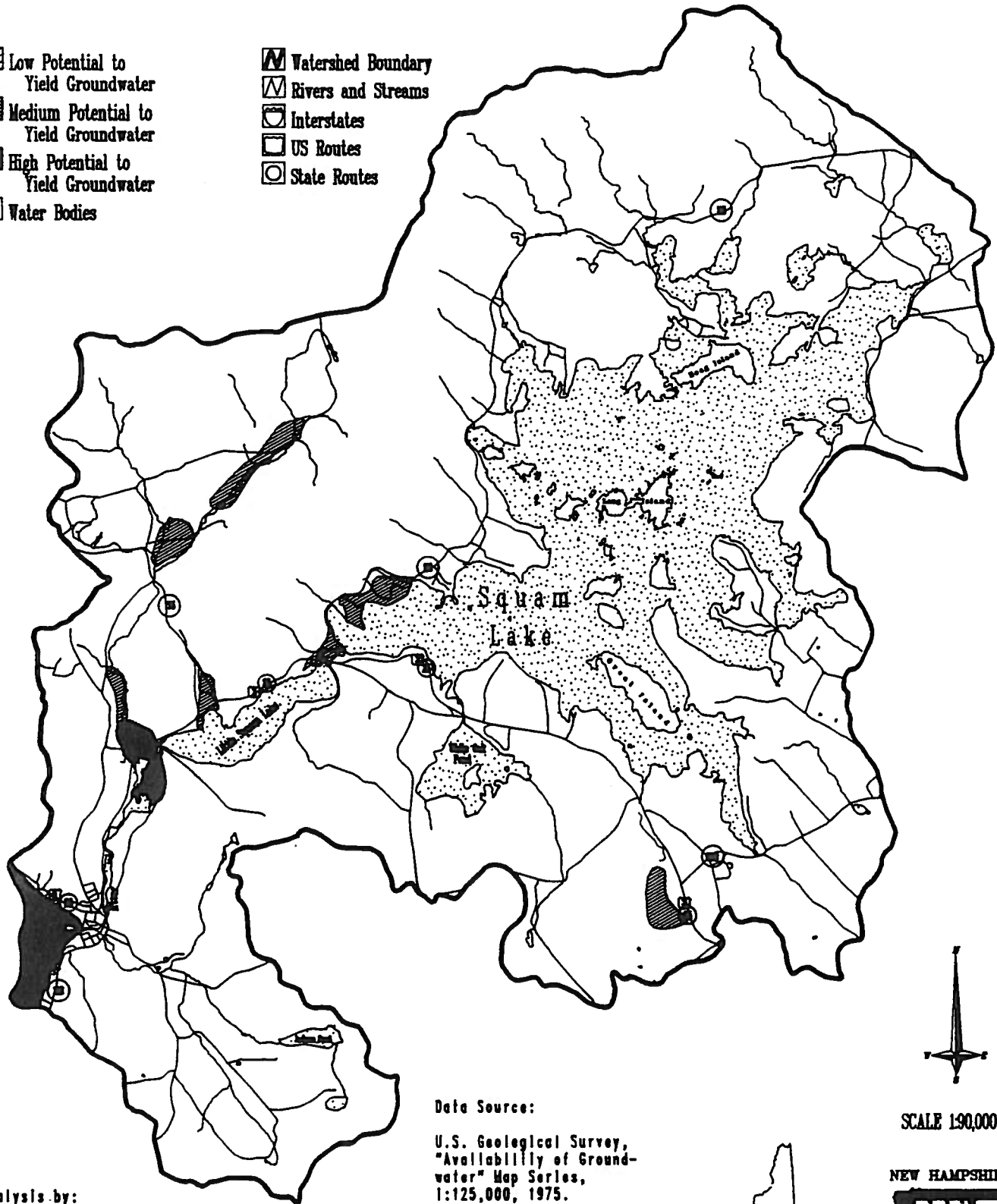
<sup>9</sup> Forest Resources Department, UNH, interpretation of 1988 aerial photography; and Complex Systems Research Center, UNH, 1990.

<sup>10</sup> SLA, *Squam Lakes Association Trails Guide*, 1973.

# SQUAM LAKES WATERSHED

Map 3-6. Groundwater

- |   |  |
|---|--|
|  Low Potential to Yield Groundwater    |  Watershed Boundary |
|  Medium Potential to Yield Groundwater |  Rivers and Streams |
|  High Potential to Yield Groundwater   |  Interstates        |
|  Water Bodies                          |  US Routes          |
|   |  State Routes       |



Data Source:

U.S. Geological Survey,  
"Availability of Ground-  
water" Map Series,  
1:125,000, 1975.

U.S. Geological Survey,  
7.5 minute topographic  
quadrangles, 1:24,000.

Analysis by:

Complex Systems Research Center,  
University of New Hampshire,  
January, 1990.



SCALE 1:90,000

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White pine forests and mixed conifer-hardwood stands dominate the southern and eastern portions of the watershed, especially directly south of Squam Lake and to the southeast of it. White pine is especially dominant on the islands and shoreline areas. Hardwood species that make their appearance in these areas of the watershed include red maple, gray birch, aspen, american elm and tupelo. The more extensive forested wetland areas in the watershed are also found south of Squam Lake, to the east of White Oak Pond.

In the southwestern section of the watershed, large concentrations of hardwoods are found both north and south of Little Squam Lake, as well as in areas on either side of the Squam River in Ashland and the subwatersheds containing Jackson and Sky Ponds. These hardwood areas are interspersed mainly with mixed conifer-hardwood stands, and occasionally with pure pine stands. Most of the western portion of the watershed is a mix of forest types, but white pine represents the largest amount of acreage there.

### **Natural Heritage Inventory**

The New Hampshire Natural Inventory, an agency of the New Hampshire Department of Resources and Economic Development, collects and analyzes data on the status, location and distribution of rare or declining native plant and animal species and exemplary natural communities ("elements" of natural diversity) in the State. Records in the Heritage Inventory database indicate that the Squam Lakes watershed contains several areas of ecological significance which support rare species and/or exemplary natural communities. The Natural Heritage Inventory has not conducted an on-site field investigation of the Squam Lakes watershed, and therefore cannot provide a definitive statement on the presence, absence, or status of species or natural communities in the area under consideration. It should be noted however that more data on this area may become available in the future as the inventory expands with ongoing fieldwork and research.

The areas which support habitats for significant plants and animals are shown on Map 3-7. In order to provide protection for sensitive species, their specific locations are not identified on the map. Several of the areas are clustered together between Route 113 and Squam Lake in the area of the Rattlesnake Mountain peaks, indicating the special significance of this portion of the watershed.

The NH Natural Heritage Inventory has also provided a list of rare plants, animals and natural communities which occur in these areas (see Figure 3-1), along with their State and federal status. In addition, the Inventory has indicated the historic presence of other rare elements within the Squam Lakes watershed (Figure 3-2) whose location is not precisely known.

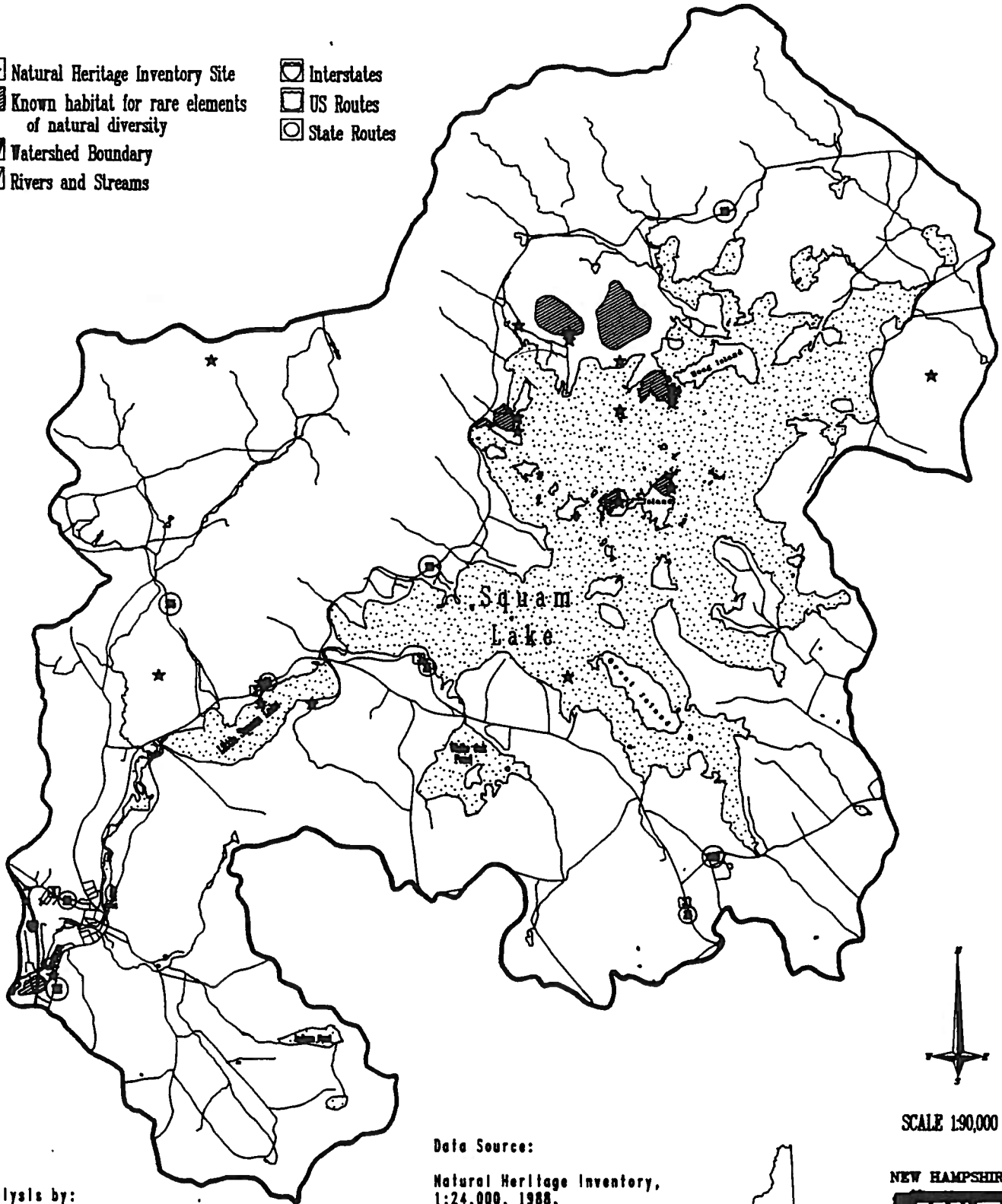
Chapter 6, **Wildlife Habitat**, makes use of the Natural Heritage Inventory information in addressing wildlife habitat areas in the Squam Lakes watershed, and Chapter 10, **Land Protection**, discusses the importance of protecting these areas.



# SQUAM LAKES WATERSHED

Map 3-7. Natural Heritage Inventory Data

- |  |                |
|--|----------------|
| ★ Natural Heritage Inventory Site                      | ⊖ Interstates  |
| ▨ Known habitat for rare elements of natural diversity | □ US Routes    |
| ▩ Watershed Boundary                                   | ○ State Routes |
| ▮ Rivers and Streams                                   |                |



Analysis by:

Complex Systems Research Center,  
University of New Hampshire,  
January, 1990.

Data Source:

Natural Heritage Inventory,  
1:24,000, 1988.

U.S. Geological Survey,  
7.5 minute topographic  
quadrangles, 1:24,000.



SCALE 1:90,000

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Geographically Referenced Analysis  
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**Figure 3-1. NH Natural Heritage Inventory Rare Plants, Animals and Natural Communities**  
(see Map 3-7 for general locations within the watershed)

Common Name	Status
<i>Rare Animals:</i>	
Grasshopper Sparrow	
Great Blue Heron	
Lake Whitefish	
Bluegray Gnatcatcher	
Common Loon	State Threatened
<i>Rare Plants:</i>	
Missouri Rock-cress	State Threatened*
Wiegand's Sedge	State Threatened
Purple Crowberry	
Rock Sandwort	State Endangered*
<i>Natural Communities:</i>	
Central New England Mesic Transitional Forest on Acidic Bedrock or Till	
Inland New England Acidic Pond Shore/Lake Shore Community	
Southern New England Circum-Neutral Rocky Summit/Rocky Outcrop Community	
Note: * Two occurrences known within the watershed.	
Source: NH Natural Heritage Inventory, DRED, 1990.	

**Figure 3-2. Natural Heritage Inventory List for Historically Know Rare Plants Within the Squam Lakes Watershed**

Common Name	Status
Three-seeded Mercury	State Threatened
Hidden Sedge	State Endangered
Lens Sedge	
Wild Senna	State Endangered
Small Yellow Lady's-slipper	State Endangered
Stiff Gentian	
Small-flowered Hemicarpha	
Small Whorled Pogonia	State and Federally Endangered
Green Adder's-mouth	State Threatened
Water Marigold	
Ginseng	State Threatened
Douglas's Knotweed	State Threatened
Erect Knotweed	State Endangered
Flatstem Pondweed	State Threatened
Vasey's Pondweed	State Threatened
Source: NH Natural Heritage Inventory, DRED, 1990.	

## Socioeconomic Characteristics - Cultural Resources

### Population<sup>11</sup>

#### Settlement Patterns in the Squam Lakes - An Overview

Settlement in the Squam Lakes watershed began in the 1760's, when Governor Benning Wentworth granted land to the towns. Holderness was first settled in 1762, and settlement of the other watershed towns followed in 1765. All of the towns became incorporated between the years 1763 and 1868, and grew slowly, but steadily during this time. The watershed population reached an early population peak in the 1820's and 1830's, in an era where mills and farming supplied most of the employment opportunities for the local population. During the 1840's, the population of watershed towns began to decline, as New England cities began to industrialize, and attracted an increasing number of workers from rural areas. At the same time, highly productive land to the west became accessible to New Englanders, and many could not resist the call.

It has taken over 100 years for the population of towns in the Squam watershed to recover from this population decrease, and to begin to match the population levels of the early 1800's. Recent decades have shown great expansion for these towns. It should be noted that while each has grown significantly during the 1980's, this growth does not compare to the rapid expansion which took place in the 1970's.

Despite recent changes, the watershed remains an area where population growth is somewhat limited by its natural resources. Steep terrains, along with a large percentage of soils that have limitations for development, restrict the amount of land which can be used for housing and roads. There is also a relatively large amount of shoreland area in the watershed, specially around the Squam Lakes, which has significance far beyond its value for development purposes. Relatively large amounts of acreage are contained in individual ownerships surrounding the lakes, which has served to provide significant protection for them as well as surrounding areas in the past. The watershed today still has a predominantly rural population, with many of the dwelling units located in small villages, and along major roads. The Squam region also has a large number of seasonal residents, and is strongly influenced by the influx of camp owners, predominantly in the summer months, but during other seasons of the year as well.

Tables 3-7 through 3-11 provide various population characteristics for the towns in the Squam Lakes watershed. It should be noted that the numbers in these tables represent population figures for entire towns, not just for the acreage of each town which is contained within the watershed.

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<sup>11</sup> The information on population which follows is taken predominately from town master plans, as well as NH Office of State Planning Population reports and U.S. Census Bureau information.

Ashland - Ashland is currently the most densely populated town in the watershed, and most residents live there year-round. The town became incorporated in 1868, after it separated from Holderness. Its population has increased steadily since being incorporated, averaging approximately an 8 percent population increase each decade. Ashland currently has 2,106 residents, and averages 184.7 persons per square mile, which is a population density not often found in such a small and rural town.

Centre Harbor - Centre Harbor was a part of New Hampton until 1797, when the small town became incorporated on its own. Its early peak population occurred in 1840, when there were 579 residents. The population then declined to 355 in 1940, but has steadily risen since this time. During the 1970's, the population of Centre Harbor grew by 49.6 percent. As of 1987, the town had 968 residents, and an average density of 85.7 persons per square mile.

Holderness - Holderness was settled in 1763, the first such settlement in the watershed, although the town was not incorporated until 1816. Holderness reached an early population peak of 572 people in 1820. Population then declined until 1940, when the town had only 151 people, in part because Ashland split off in 1868, but also because some local people moved to the cities during this time period. Since the 1940's, Holderness has experienced rapid growth, especially during the 1960's and 1970's. The town grew by 53 percent in the 1960's and by 39.5 percent in the 1970's. Population in the 1980's also increased, but at a growth rate which was slower than for previous decades. Holderness currently has 1,713 residents, most of whom live in the watershed year-round with an average of 55.6 people per square mile.

Moultonborough - Historically, the Town of Moultonborough followed a growth pattern similar to that of Sandwich, yet its population today is very different from Sandwich's. Moultonborough was incorporated in 1777, and reached its early peak in 1840, with 1,752 people. Population then declined until 1930, but has grown dramatically since the 1960's. The town has experienced the largest recent population growth in the watershed, with a 55.9 percent increase in the 1960's and a 68.4 percent increase in the 1970's. As of 1987, 2,727 people lived in Moultonborough, with an average of 47 persons per square mile. The town continues to experience growth, but it is mainly centered on Lake Winnepesaukee, the other major lake in Moultonborough. Only a very small portion of the town's population is actually in the Squam Lakes watershed.

New Hampton - The town was incorporated in 1777, and included Centre Harbor at that time. It has grown in a pattern similar to that of the rest of the watershed towns. Reaching its peak in 1830 with 1,905 people, New Hampton then had a population decline until 1930. Since the 1930's, the town's population has slowly been increasing, and grew by 32 percent in the 1970's. Currently, New Hampton has 1,455 residents, with 39 persons per square mile, the second lowest density in the watershed.

Sandwich - Sandwich became the first incorporated town in the watershed in 1763. One of the largest towns in New Hampshire in terms of physical size, Sandwich experienced unparalleled growth in the early 1800's, with the population reaching its peak in 1830 at 2,744. From 1830 to 1950, however, the town steadily lost its

residents, and in the process, became the most sparsely populated town in the watershed. Since 1950, the population of Sandwich has grown an average of 12.7 percent each decade, reaching a year-round population of 966 in 1987. With a population density of only 10.6 persons per square mile, Sandwich is easily the most sparsely populated town in the Squam Lakes watershed, in part because it contains 15,272 acres of the White Mountain National Forest, but also because the town is not easily accessible by present transportation routes.

**Table 3-7. Characteristics of the Population in the Watershed Towns**

Town	Year of Early Population Peak (and Number)	1987 Population	Number of Per- sons Per Square Mile in 1987
Ashland	1910; 1,412 people	2,106	184.7
Centre Harbor	1840; 579 people	968	85.7
Holderness	1820; 572 people	1,713	55.6
Moultonborough	1840; 1,752 people	2,727	47.0
New Hampton	1830; 1,905 people	1,455	38.9
Sandwich	1830; 2,744 people	966	10.6

Source: Population of New Hampshire; Part 1:1623-1940; NH State Planning and Development Commission, Concord, 1946; Office of State Planning Estimates: 1987.

### Current Population

The total population of the watershed communities was estimated to be 9,935 in 1987. Moultonborough is the largest town based on population, and Sandwich is the smallest. As Table 3-8 indicates, these size relationships have changed over time, as different towns have experienced growth at varying rates. For example, twenty years ago, Ashland had the highest population and Centre Harbor had the lowest. Yet Moultonborough had the highest growth rate of population in both the 1960-1970 and 1970-1980 decades, which allowed it to exceed the population of Ashland.

Table 3-8 indicates that as a whole, the watershed population has increased over time, with a growth rate of 20.9 percent from 1960 to 1970 and almost twice that rate, 40.1 percent during the 1970 -1980 decade. The growth rate from 1980 to 1987 was less than in the previous two decades, 16.0 percent.

**Table 3-8. Squam Lake Watershed Population Changes; Percent Change**

Town	1960	1970	1980	1987	% Change 60-70	% Change 70-80	% Change 80-87
Ashland	1,473	1,599	1,807	2,106	8.6	13.0	16.5
Centre Harbor	511	540	808	968	5.7	49.6	19.8
Holderness	749	1,048	1,586	1,713	39.9	51.3	8.0
Moultonborough	840	1,310	2,206	2,727	56.0	68.4	23.6
New Hampton	862	946	1,249	1,455	9.7	32.0	16.5
Sandwich	620	666	905	966	7.4	35.9	6.7
Totals	5,055	6,109	8,561	9,935	20.9	40.1	16.0

Source: US Census (1960, 1970, 1980); NH Office of State Planning Estimates: 1987.

## Population Projections

The NH Office of State Planning prepares population projections for the State and its cities and towns on a regular basis. These figures provide an indication of how population will develop if existing trends continue, and are used as a guide for planning efforts. Projections for the Squam Lakes watershed for 1990 to 2010 generally show a continuation of the trends experienced during the past two decades, with 24 and 31 percent growth expected for the 1990 to 2000 and 2000 to 2010 time periods respectively. These figures represent year-round residents of the six watershed towns. Seasonal population, as indicated by the number of seasonal housing units, is also expected to increase. However, it should be noted that the growth in these housing units during the 1970 to 1980 period (34 percent) was half of the growth in year-round housing units during the same period (68 percent). This was in contrast to the previous decade, when seasonal homes increased at about the same rate as year-round units. Population projections for the watershed towns are included in Table 3-9.

**Table 3-9. Population Projections, 1990 - 2010**

Town	1990	1995	2000	2005	2010
Ashland	2,023	2,156	2,302	2,451	2,642
Centre Harbor	994	1,126	1,245	1,373	1,522
Holderness	2,122	2,496	2,383	3,303	3,795
Moultonborough	3,106	3,823	4,460	5,146	6,011
New Hampton	1,471	1,630	1,778	1,942	2,138
Sandwich	987	1,054	1,117	1,191	1,298
Totals	10,703	12,285	13,285	15,406	17,406

Source: NH Office of State Planning, *New Hampshire Population Projections - Total Populations for Cities and Towns, 1980 - 2010*, 1987.

## Population Density

The number of persons per square mile has been calculated for each watershed town, over the last 30 years. The population density of a given area is a valuable descriptive statistic, allowing realistic comparisons among towns, and indicates more than total numbers do. For example, based on population, the towns of Centre Harbor (968 people) and Sandwich (966 people) appear to be the same size. However, given the land areas of 11.3 square miles for Centre Harbor, and 91.3 square miles for Sandwich, the 1987 population estimates show 85.7 persons per square mile in Centre Harbor and 10.6 persons per square mile in Sandwich. These numbers provide a different picture for each of the two towns. Population density figures for the six communities are reproduced in Table 3-10. The increase in the aggregate density for the watershed over time is also shown. The numbers in parentheses are the land area in square miles for each community.

**Table 3-10. Population Density; Persons Per Square Mile**

Town	Area Sq. miles	1960 # persons	1970 # persons	1980 # persons	1987 # persons
Ashland	(11.1)	129.0	140.0	163.0	189.9
Centre Harbor	(11.3)	45.2	47.8	71.5	85.6
Holderness	(30.8)	24.3	34.0	51.5	55.6
Moultonborough	(58.0)	14.5	22.6	38.0	47.0
New Hampton	(37.4)	23.0	25.3	33.4	38.9
Sandwich	(91.3)	6.8	7.3	9.9	10.6
Totals	(239.9)	21.1	25.5	35.7	41.4

Source: US Census (1960, 1970, 1980); *State Planning Project Report #3, 1966; Analysis* - NH Office of State Planning.



### Population by Age

Information on numbers of people by age group is an important statistic for planning purposes. For example, a large pre-school population in the watershed would indicate a need to look at the adequacy of school space and other necessary facilities. The most recent year for which data on age is available is 1984. As expected, the working-age population (18-64) was the age category with the largest number of people for each of the watershed towns, representing 63 percent of the total. Population by age figures are shown in Table 3-11.

**Table 3-11. Population by Age, 1984**

Town	Birth-5	6-17	18-64	65+	Total
Ashland	167	304	1,215	253	1,939
Centre Harbor	71	144	575	133	923
Holderness	116	281	938	189	1,524
Moultonborough	116	327	1,519	372	2,334
New Hampton	116	227	906	162	1,411
Sandwich	31	105	582	220	938
Totals	617	1,388	5,735	1,329	9,069

Source: NH Office of State Planning, *1984 Estimates by Age*, February, 1986.

## Housing

As Table 3-12 indicates, the supply of housing in Squam Lakes communities has expanded in recent years as their populations have increased, and as expected, those towns with higher rates of growth in population have also seen a corresponding growth in housing. The estimates of changes in the housing supply since 1980, also found in Table 3-12, have been made by the Office of State Planning, based on data on building permits. These estimates represent housing for entire towns, not just for the portion of each town within the Squam watershed. Figures soon to come out from the 1990 US Census can be used to update Table 3-12.

**Table 3-12. Housing Supply 1980 - 1987**  
1980 Census; 1980-87 Building Permits Issued

Town	1980 Census	1980 BPI	1981 BPI	1982 BPI	1983 BPI	1984 BPI	1985 BPI	1986 BPI	1987 BPI	1988 BPI	Total
Ashland	817	31	16	7	15	16	44	24	26	50	1,046
Centre Harbor	419	10	13	6	8	7	18	15	20	13	529
Holderness	708	7	0	6	9	11	18	32	40	56	887
Moultonborough	958	62	0	0	77	107	133	179	156	111	1,783
New Hampton	512	0	6	0	0	6	9	22	32	26	613
Sandwich	399	4	7	11	10	14	18	19	27	17	526
<b>Totals</b>	<b>3,813</b>	<b>114</b>	<b>42</b>	<b>30</b>	<b>119</b>	<b>161</b>	<b>240</b>	<b>291</b>	<b>301</b>	<b>273</b>	<b>5,384</b>

Source: 1980 Census of Housing; Office of State Planning, *Current Estimates and Trends in New Hampshire's Housing Supply*, 1989.

Table 3-13 shows housing growth rates for each of the watershed towns from 1980-1988. As shown, Moultonborough has clearly seen the most significant increase in housing over this period, with a growth rate of 86.1 percent. New Hampton has had the slowest increase, with 19.7 percent. All together, the housing growth rate for towns in the Squam Lakes watershed has been 41.2 percent during this time period.

**Table 3-13. Housing Supply Growth 1980 - 1988**

Town	Percentage Change 1980 - 1988
Ashland	28.0
Centre Harbor	26.3
Holderness	25.3
Moultonborough	86.1
New Hampton	19.7
Sandwich	31.8
Totals	41.2

Source: Analysis, NH Office of State Planning, 1989.

## Seasonal Fluctuations

An important factor in the economy of the Lakes Region in general, and this watershed in particular, is the influence of seasonal fluctuations in population and housing. Some of the watershed communities have a large portion of total housing units devoted to seasonal use, and it is therefore not uncommon to have high population levels for the summer months and relatively low population levels for the remainder of the year. Such fluctuations can lead to inconsistencies in the demand for infrastructure and other services, as well as uncertainties as to existing economic conditions. The information in Table 3-14 is presented to highlight seasonal influences on population.

As shown, Moultonborough, with frontage on both Lake Winnepesaukee and Squam Lake, has the highest concentration of seasonal homes. Centre Harbor, Holderness and Sandwich also appear to have a considerable number of them. Ashland and New Hampton on the other hand have a comparatively smaller number of seasonal homes than the other watershed communities, since seasonal units generally are located around waterfronts, and there is only a portion of Little Squam Lake that falls within Ashland's borders, and no lakefront property in New Hampton.

It should be noted that the figures in Table 3-14 reflect seasonal populations of entire towns, not just that portion of a town that is within the Squam watershed. These figures differ from those in Chapter 4, Table 4-8, which reflect only seasonal housing within the watershed and are therefore more useful for analysis purposes.

**Table 3-14. Seasonal Housing Units - Percent of Total Housing**

	1960	1970	1980
Ashland	103 (19%)	130 (19%)	212 (23%)
Centre Harbor	90 (38%)	87 (32%)	208 (42%)
Holderness	231 (50%)	341 (54%)	371 (38%)
Moultonborough	1120 (80%)	1405 (76%)	1980 (69%)
New Hampton	141 (35%)	155 (35%)	161 (26%)
Sandwich	244 (50%)	315 (58%)	333 (46%)
Totals	1924 (55%)	2433 (55%)	3265 (50%)

Source: US Census (1960, 1970 and 1980), Census of Housing.

## Income

Per capita income levels for Squam watershed communities are available for 1979 and 1985. In 1985, the Town of Moultonborough had the highest income level in the watershed, with an average of \$12,571 per person. The lowest income level, \$9,459, was recorded for Ashland. Per capita incomes for the other towns in 1985 are listed in Table 3-15, along with other relevant statistics for the watershed towns. While relatively dated, this information can be useful as a comparative tool.

**Table 3-15. Community Income Statistics, 1979**

Town	1985 Per Capita Income	1979 Per Capita Income	1979 Median Family Income	1979 Median HH Income	1979 % Persons In Poverty
Ashland	\$ 9,459	\$5,983	\$15,353	\$13,384	13.4
Centre Harbor	9,915	5,495	14,844	13,333	15.5
Holderness	10,470	6,071	15,381	13,979	12.2
Moultonborough	12,571	7,471	16,420	15,548	10.2
New Hampton	9,993	6,355	16,767	14,123	14.6
Sandwich	12,293	8,274	16,728	14,315	8.9
State	\$11,659	\$6,966	\$19,723	\$17,013	8.5

Source: US Census Bureau, and NH Office of State Planning, *Selected Economic Characteristics of New Hampshire Municipalities*, 1980.

## Property Values

Property value comparisons among towns in New Hampshire are most accurately made with data on equalized valuation, which is prepared by the Department of Revenue Administration (DRA). The equalized valuation figures are calculated by DRA, using local assessment information from the various towns and making adjustments based on property value surveys to allow town to town comparisons. When this data is calculated on a per capita basis, comparisons among communities are more meaningful. Equalized valuation per capita figures for Squam watershed communities are included in Table 3-16 for selected years. The table points out the dramatic increases during the 1986-1987 period for property values in these towns.

**Table 3-16. Equalized Valuation Per Capita; Percent Change**

Town	1980	1983	1986	% Change 80-83	% Change 83-86
Ashland	21,947	24,708	36,162	12.6	46.4
Centre Harbor	46,749	60,485	92,303	29.4	52.6
Holderness	43,877	66,553	79,067	51.7	18.8
Moultonborough	105,913	152,755	267,144	44.2	74.9
New Hampton	25,524	31,751	40,894	24.4	28.8
Sandwich	63,276	69,551	101,502	9.9	45.9

Source: NH Office of State Planning, *Taxation Valuation Per Person in NH Communities, 1980 - 1986, 1987.*

## Land Use

During the 1970's, the rate of growth within the Squam Lakes watershed towns exceeded the growth rate for the State of New Hampshire as a whole, as well as growth within other rapidly changing areas of the State. As Table 3-18 indicates, prior to 1955, 8.5 percent of the land in the watershed had been developed, but by 1982, this figure had approximately doubled, to 16.8 percent. As of 1988, 21.3 percent of land in the watershed was developed, with growth occurring largely as a result of seasonal home conversion and immigration.

**Table 3-17. Land Use as of 1988**

Description	Acreage	% of Watershed	% of Land
Housing	6,847	16.1	19.9
Commercial	92	0.2	0.3
Industrial	66	0.2	0.2
Other Urban	293	0.7	0.9
Agricultural	1,157	2.7	3.4
Forest	25,176	59.4	73.0
Idle Land	116	0.3	0.3
Water	7,952	18.7	---
Swamp	719	1.7	2.1
<b>Totals</b>	<b>42,418</b>	<b>100.0</b>	<b>100.0</b>

**Table 3-18. Developed Land Use 1955 to 1988**

Years	Change in Acres in Development*	% of Watershed	% of Land	Acres	Cumulative % of Watershed	Cumulative % of Land
< 1955	2,929	6.9	8.5	1955 2,929	6.9	8.5
1955 - 1974	1,449	3.4	4.2	1974 4,378	10.3	12.7
1974 - 1982	1,447	3.4	4.2	1982 5,825	13.7	16.8
1982 - 1988	1,476	3.5	4.5	1988 7,301	17.2	21.3

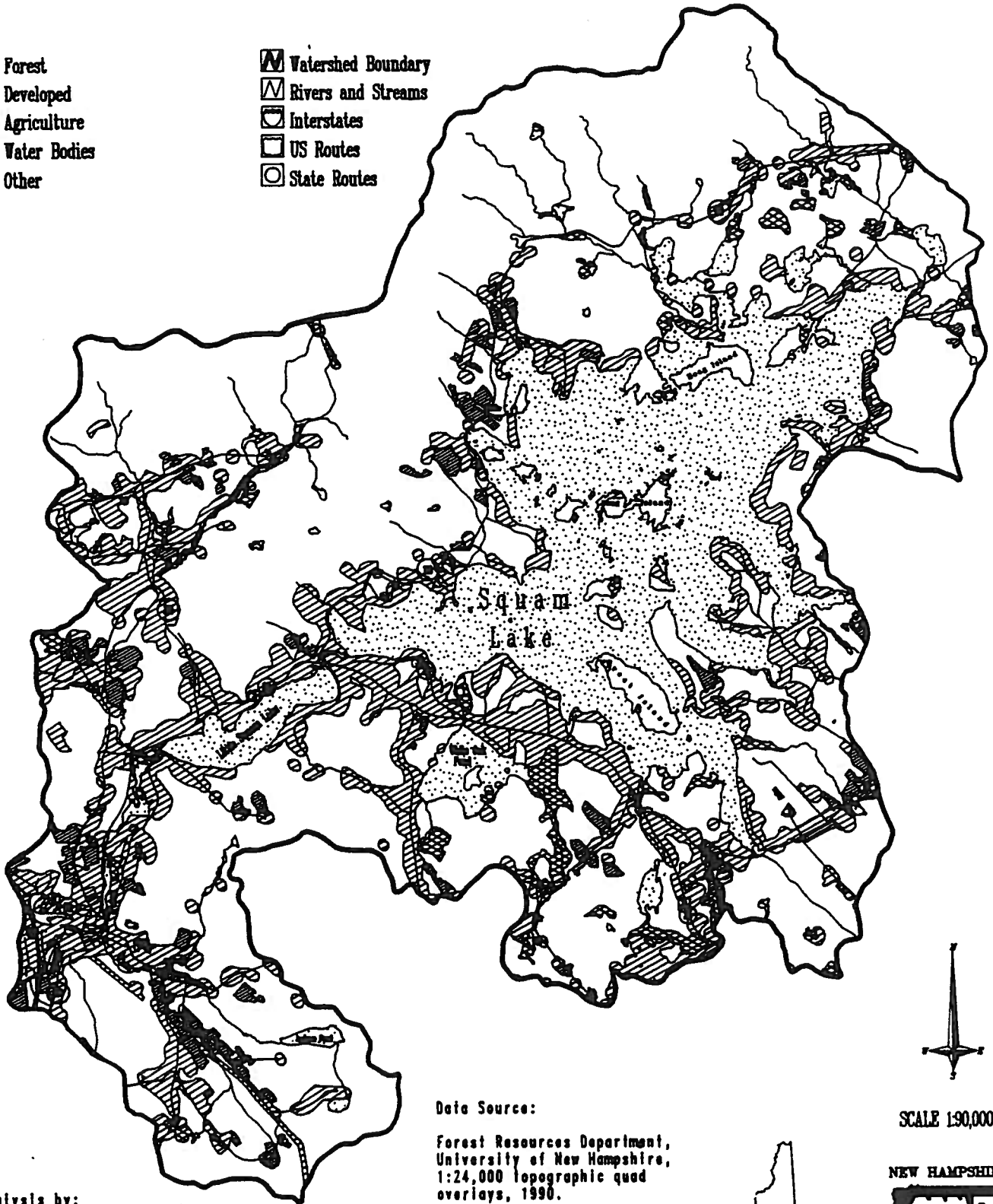
Note: \* Includes Housing, Commercial, Industrial and Other Urban Categories.

Source: Complex Systems Research Center, UNH, 1989-90.

# SQUAM LAKES WATERSHED

Map 3-8. Land Use - 1988

- |  |  |
|--|--|
|  Forest       |  Watershed Boundary |
|  Developed    |  Rivers and Streams |
|  Agriculture  |  Interstates        |
|  Water Bodies |  US Routes          |
|  Other        |  State Routes       |



Analysis by:

Complex Systems Research Center,  
University of New Hampshire,  
June, 1990.

Data Source:

Forest Resources Department,  
University of New Hampshire,  
1:24,000 topographic quad  
overlays, 1990.

U.S. Geological Survey,  
7.5 minute topographic  
quadrangles, 1:24,000.



SCALE 1:90,000

NEW HAMPSHIRE



Geographically Referenced Analysis  
and Information Transfer System



As of 1982, 58.1 percent of the increased acreage in developed areas within the Squam Lakes watershed over the last thirty years had come from the forest category. Between 1982 and 1988, an additional 2,235 acres was converted from forest land to development, most of it for housing purposes. Interestingly, the amount of forested land in the watershed today (25,176 acres), as compared to 1955, (24,912) is approximately the same, because the amount of idle farm land reverting back to forest land has balanced the amount of forest land being converted for development purposes. This present equilibrium, however, is not expected to remain. The absorption of forest land by development in the watershed is expected to continue.

A gradual decline in the amount of land in the Squam Lakes watershed used for agricultural purposes has occurred within the last 30 years. As compared to 3,226 acres in 1955 and 2,653 acres in 1974, 2,228 acres remained in agriculture in 1982, and only 1,157 acres remained as of 1988. As of 1982, 491 acres that had been removed from agricultural use over the last 30 years had been developed, while 462 acres had been categorized as either idle, forested or swamp land. Between 1982 and 1988, approximately 768 acres of agricultural land was converted for development, and the large majority of it, 763 acres, was used for housing.

Land use changes for each of the towns in the Squam Lakes watershed are described below. These figures have been obtained from the Lakes Region Planning Commission as well as town master plans, and the numbers reflect changes in land use for the towns as a whole, not just the portion that is within the Squam watershed. Since the time these figures were obtained in the 1980's, there have undoubtedly been additional land use changes in the watershed towns.

#### Ashland

Ashland is one of the smallest watershed towns in land area, yet it supports the most concentrated as well as the most diverse land use. As of 1982, 13.23 percent of the town was developed and of this, 750 acres was high-density urban development.<sup>12</sup> Ashland has comparatively high densities of housing and roads, combined with a sizable commercial/industrial base. This diversification is complemented by its community facilities (19 percent of the town's developed land), and seasonal housing (5 percent).<sup>13</sup>

A significant trend in Ashland, as well as in the other watershed towns, is the decline in agricultural and open land, combined with the rise of residential land<sup>14</sup>. Between 1967 and 1986, agricultural/open land in Ashland decreased by 1,835 acres, while residential land use increased by 382 acres. Commercial, transport,

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<sup>12</sup> Lakes Region Planning Commission, *Regional Land Use Plan*, 1987.

<sup>13</sup> LRPC, Amended, 1986, *Comprehensive Master Plan for the Town of Ashland, New Hampshire*, 1984.

<sup>14</sup> LRPC, Loc. cit.

industrial and forest land uses also gained land during this time period. This conversion signifies the increasing development of open space to provide services for a growing population as well as forest conservation. Currently, Ashland has 6,076 acres of forested land, 164 acres of agricultural land and 86 acres of open space. In addition, the town has 256 acres of water.

### **Centre Harbor**

Centre Harbor is the smallest town in the watershed, but it has parts of five waterbodies within its boundaries: Squam Lake, Lake Winnepesaukee, Winona Lake, Lake Waukewan and Hawkins Pond. In fact, the town has more water (1,600 acres) than developed land (875 acres). This relatively large percentage of water area has had a significant impact on land use within the town. Residential land use accounts for 250 acres and roads account for 164 acres, while commercial/industrial land use covers only 45 acres. Undeveloped land in Centre Harbor is mostly forested, although the town does have a substantial amount of agricultural land (10.8 percent of land area) and wetlands (13.3 percent).

### **Holderness**

Holderness is a rural town, with low density development stretching out along the roadways and along the Squam Lakes. In addition, Holderness has a fairly large seasonal population, and there is also a small commercial district between the two lakes. The town has 32.5 percent of its developed land in year-round housing, 30.8 percent in highways/streets and 18.7 percent in seasonal housing. Residential land use increased 160 percent between 1972 and 1986, to meet the high demand for seasonal housing.<sup>15</sup> In addition, Holderness has 3,584 acres of water. As with several other towns in the Squam Lakes watershed, this relatively large amount of water area has impacted upon land use within Holderness.

### **Moultonborough**

Moultonborough is the second largest town in the watershed, with 37,120 acres of land and 9,600 acres of water. Activity in the town is highly seasonal, as a section of Squam Lake and a substantial part of Lake Winnepesaukee are within the town boundaries. In Moultonborough, 11.7 percent of the land is developed. Approximately half of this developed land is devoted to residential housing (22 percent year-round, 14 percent seasonal and 11 percent with conversion potential), and 38 percent is devoted to commercial use, including both businesses and recreational enterprises like marinas and resorts. Land use changes in Moultonborough between 1972 and 1986 are reflected in dramatic increases in the number of residential units, as land acreage with housing has increased by 1,638 acres during that time period.

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<sup>15</sup> Lakes Region Planning Commission, *Regional Land Use Plan*, 1987.

## New Hampton

New Hampton is the third largest town within the watershed; almost 94 percent of the town is undeveloped. The town also has the most agricultural land of the watershed towns, although it lost 1,233 acres between the 1950's and the 1980's. As of 1985, only 1,057 acres were used for agriculture, compared to 2,290 acres in the 1950's.<sup>16</sup> Most of this land has been converted to residential and transport uses, as housing (472 acres) and roads (520 acres) are the two leading land uses today. The town does have a very small commercial/industrial base, which accounts for less than 2 percent of the developed land area.

## Sandwich

Sandwich's land use has shown little diversification. The Town is the third largest in New Hampshire, with 59,485 acres of land. Yet 97 percent of this is undeveloped land, including a 15,272 acre portion of the federally-owned White Mountain National Forest. Of Sandwich's three percent of developed land, residential use accounts for most of this (401 acres in year-round and 344 acres in seasonal housing), while transportation uses 558 acres of land. Less than 100 acres each are used for community facilities and in commercial/industrial use.

**Table 3-18. Land Use for Watershed Towns**

Town	Total Land Area (Acres)	Percent of Land	
		Developed	Undeveloped
Ashland	7,296	13.3	86.7
Centre Harbor	7,232	12.1	87.9
Holderness	19,712	6.9	93.1
Moultonborough	37,120	11.7	88.3
New Hampton	23,936	5.6	94.0
Sandwich	59,485	2.9	97.0
Total	154,781	7.0	93.0

Source: Town Master Plans Developed for Watershed Towns in the 1980's.

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<sup>16</sup> Lakes Region Planning Commission, *Annual Report*, 1979.

## Infrastructure

### Transportation<sup>17</sup>

The transportation network for the towns of the Squam Lakes watershed has shaped the past and continues to shape present activities within the watershed, directly influencing the character of the region. This network of highways, railroads and airways has had a significant impact on growth and development in the area, affecting and in turn being affected by settlement patterns, industry, services and recreation. The highway network serves as an important link between the six watershed communities, and connects them with the other surrounding towns as well. Since the turn of the century the major transportation facilities within the watershed have been the town highways. More recently, Interstate 93 has played a major role in providing access to and from the watershed for residents and non-residents. The busiest and most important roads presently serving the watershed are as follows: Interstate 93, which runs north south, just within the western border of the watershed; Route 113 (from Holderness through Sandwich); Routes 3 and 25 (from Meredith and the south to Ashland and parts north); Route 25B (from Centre Harbor toward Holderness) and Bean Road (from Centre Harbor through Moultonborough, to Sandwich.

Two factors are important in characterizing the road network of the Squam Lakes Watershed. First, road travel is strongly influenced by large seasonal fluctuations in road use and climate. The road network endures its heaviest use in the summer months, with the influx of both local people and tourists. The roads are used much less frequently during the winter months, with the close of seasonal camps and the increasing presence of snow and other bad weather conditions. Another important factor in the watershed is the relatively large number of side roads. These roads often lead down to camps on the lakes or up to houses at higher elevations, and are important to the local makeup of the individual town road systems.

Local road systems within the watershed vary from town to town. Each town has one road agent and additional employees who maintain the town roads. In the Town of Ashland, the road system is centralized, with several collectors serving the densely populated town village. Ashland has 33 miles of roadway, which serve a population of almost 2,106. Interstate 93 (with an interchange serving Ashland and the Squam Lakes area) runs north to south east of the town center. Route 3 travels east from I-93, heading north after it passes through the town center. NH Route 132 travels north to south, making a loop as it also passes through the town center.

The road network in Holderness differs from that of Ashland's. It serves a smaller, but more widely dispersed population over a much larger land area. Holderness has almost three times as much land area as Ashland, so the road system has more extensions than in Ashland. Routes 3/25 run northwest from Meredith and Center Harbor, passing through Holderness in a westerly direction and then heading south through Ashland

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<sup>17</sup> The information that follows is taken for the most part from the Lakes Region Planning Commission, *Lakes Region Transportation Report*, 1986.

before heading north again. Interstate 93 also runs through a small portion of northern Holderness. Other connectors in Holderness include NH Route 175, which connects north Holderness with the Squam watershed, and Route 113, which runs generally along Squam Lake from the center of Holderness through Sandwich. Routes 113 and 3/25 also have numerous secondary roads which branch off to Squam Lake.

Sandwich has a unique road system within the watershed, as the town maintains an extensive road network to serve a relatively small population. There were 97 roadway miles in 1985 to serve a population of 966. The main roads near Squam Lake in Sandwich include Route 113 from Holderness and Bean Road from Centre Harbor. Both of these roads also have many side roads which lead to Squam Lake. Routes 25, 109 and 113A converge in Center Sandwich, and serve various parts of Sandwich, also linking the town with other towns further east.

Moultonborough also has an extensive road network (85 miles), designed primarily to provide access to waterbodies in the town. Route 25, which extends north from Meredith to Ossipee, is the major road in the town. Routes 109 and 171 are collectors, which branch off Route 25 towards parts of Lake Winnepesaukee. Bean Road is the main link in Moultonborough to Squam Lake, running between Red Hill and the lake.

Centre Harbor has a small road network, consisting of 27 roadway miles. Major roads in the town include Route 3 from Meredith, Route 25 from Moultonborough and Route 25B. Route 25B and its side roads are the main roads in the Centre Harbor section of the watershed, serving as a shortcut between Routes 3 and 25.

New Hampton has 79 miles of roadway which center on Interstate 93 and Route 104. Collector Route 132 and Winona Road start in the heart of Ashland and run through New Hampton to link this corner with the rest of the watershed.

In comparison to the extensive road network which influences the Squam Lakes watershed, other modes of transportation have had a limited influence on the area. There is bus service from New Hampshire to Boston, with several stops near the watershed - the town center in Centre Harbor, and the junction of Routes 109 and 25 in Moultonborough. Taxi service is available in the Meredith area.

Railroads have also had a limited role in providing transportation for the Squam watershed population. The State of New Hampshire owns the 72 mile Concord to Lincoln line operated by New England Southern Railroad, which runs through the watershed in the lower part of Ashland. No freight service exists on the line, and no rail passenger service is currently available either, although the Winnepesaukee Railroad does operate a tourist passenger service between Laconia and Meredith in the summer and fall. The Concord-Lincoln line meets with the Boston and Maine Railroad in Concord for a southern connection.

The watershed is also served by limited air transport. The Laconia Municipal Airport is the closest airport, but offers only regional flights, including flights to Boston. Boston's Logan Airport is a 2.5 hour drive from the watershed, but continues to be the major air terminal for the Lakes region, although the airport in

Manchester, NH is growing in importance. Two private airports with limited facilities/use are located near the watershed. Tab Aviation owns the Moultonborough Airport (a private field that the public can use) near the junction of Routes 25 and 109, and the privately-owned Riverside Airport in northern Ashland has a 2000 foot turf runway with no facilities.

In addition, limited trucking, shipping and express services can be found at various points in the watershed area. Federal Express also serves portions of the region.

### **Water, Sewer and Solid Waste**

Water, sewer and solid waste systems are other important elements of the infrastructure of the Squam Lakes watershed. Because of the rural character of the area, most of the population depends on private wells for their drinking water supply, and on-site septic systems to process domestic wastewater, although public water supply and sewer systems are found in portions of the watershed. Most of the municipalities rely upon transfer stations to dispose of solid wastes (see Figure 3-3).

Ashland - Ashland has a unique municipal infrastructure for its size and location. Much of the population is serviced by a water supply provided by Jackson Pond and Sky Pond, which are both located southeast of Ashland in New Hampton, at an elevation of 200 feet above the town.<sup>18</sup> Water from the ponds flows into Ames Brook, and the average daily withdrawal from Ames Brook for the Ashland water supply is 210,000 gallons per day. This water is discharged into the Ashland Wastewater Treatment Plant. The Packard Mill is registered to withdraw an average of 370,000 gallons per day from the Squam River in Ashland for processing purposes. The town also has a number of smaller public water supply systems, both community and non-community in nature, as defined by RSA 485:1 XIV.

Ashland's municipal sewer system serves most of the built-up areas within the town, using a gravity feed operation. Some areas of Ashland still use private systems, but the sewer system has expanded to include most of the activity in the town. The town's watershed treatment plant was built in 1969-1970 to replace individual septic tanks which had discharged into the Squam River. The plant is located west of I-93, in an area of potential high yield groundwater. The wastewater is treated by secondary aerated lagoons and a Hinde aeration system, and the clarified effluent is then chlorinated and discharged into the Squam River. The maximum capacity of the treatment plant is 1.6 million gallons of wastewater per day. Flows presently average approximately 400,000 gallons per day.<sup>19</sup>

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<sup>18</sup> 1984 Ashland Master Plan, updated in 1986.

<sup>19</sup> Interview with superintendent, Ashland Wastewater Treatment Facility, 1990.

Ashland has an active landfill which has been in service since 1975. Wastes disposed of at the site include garbage/refuse and factory residues. The landfill covers 50 acres, and is located to the south of the Town village, adjacent to I-93, very close to the Squam River. The landfill is also within the area of potential high groundwater yield. The Town also has an abandoned dump which was in service for approximately 100 years, and served a population of approximately 1,200.<sup>20</sup>

Holderness - Most Holderness residents rely on private wells and septic systems. There are, however, a number of public water supply systems located in the vicinity of Little Squam Lake, and to a lesser extent along Squam Lake. These water supplies are primarily non-community in nature, serving seasonal residents. One small portion of upper Holderness outside of the watershed is connected to the Plymouth wastewater treatment facility. Approximately 40 locations are connected to this system, serving 172 residents and 200 non-residents.<sup>21</sup>

Holderness maintains a transfer station to deal with the town's solid waste. Located off Route 3 about 2.5 miles from Holderness Village, the site was once an open burning dump. All waste at the transfer station is compacted and hauled to the Sanco Landfill in Bethlehem, NH. Tires, white ware, and scrap metal are recycled.<sup>22</sup>

Sandwich - There is no municipal water supply within the town, and residents therefore depend on individual wells and/or springs. Wastewater disposal is handled in two different ways, depending on proximity to the center of town. Since July of 1987, the town village has been served by a community septic system which uses subsurface leachbeds. The facility is located outside of the watershed on Squam Lakes Road, near Creamery Brook, and it's design capacity is 30,000 GPD. The system serves 212 residents and 28 seasonal residents.<sup>23</sup> The remaining portion of the town uses individual septic systems. Septage is sent to Lamprey Lagoons, in Moultonborough.

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<sup>20</sup> Squam Lakes Watershed Advisory Committee, 1989.

<sup>21</sup> NH Department of Environmental Services, WSPCD, 1988.

<sup>22</sup> Squam Lakes Watershed Advisory Committee, 1989.

<sup>23</sup> NH Department of Environmental Services, WSPCD, Community Septic Data, 1988.

**Figure 3-3. Water, Sewer and Solid Waste Infrastructure for the Squam Lakes Watershed**

Town	Water Supply	Sewer	Solid Waste
Ashland	Municipal system (surface water) serves built up areas; rest of residences have private wells; some small public water supply areas (groundwater).	Municipal system serves built up areas; provides secondary treatment; as of 1989, no longer accepts septage; rest of town have private septic systems.	Landfill in service since 1972, garbage/refuse and factory residues disposed of; monitoring wells in place. Abandoned dump has no monitoring wells in place.
Centre Harbor	Private wells.	Bay District serves small portion; rest have private systems.	Town has door-to-door pick up, and uses transfer station/recycling center in Meredith (refuse then goes to trash-to-energy facility in Claremont, NH).
Holderness	Mostly private wells; some public wells in the vicinity of Little Squam and Squam Lakes.	Private systems except for an area outside of the watershed in upper Holderness which is linked to the Plymouth wastewater treatment system.	Transfer station exists on former dump site; Lakes Region Disposal Company, Inc. of Laconia transfers waste to Sanco Landfill, Bethlehem, NH.
Moultonborough	Private community public water supply for Paradise Shores (groundwater and other scattered public systems); rest of residents use private wells.	Bay District serves small portion; rest have private systems; septage goes to Lamprey Lagoons, Moultonborough.	Landfill - located outside watershed; abandoned dump also outside of watershed.
New Hampton	New Hampton Village Precinct serves village; Ashland provides some services; rest have private wells.	Village Precinct serves village; rest have private systems.	Landfill - located outside watershed; closure plans are proceeding.
Sandwich	Private wells.	Community septic system and leachfields to service town center; rest of residences use private systems; septage goes to Lamprey Lagoons, Moultonborough.	Transfer station, with recycling, brushburning. Monitoring wells in place; wastes transferred to Rochester, NH landfill.



Sandwich maintains a transfer station/recycling facility within the watershed off of Route 113, near Chick's Corner. Brush burning is allowed at the site. Dumpsters are provided for non-recyclable solid waste, which is transferred to Rochester, NH.<sup>24</sup>

Moultonborough/Centre Harbor - The majority of Moultonborough residents use private wells and septic tanks for water and wastewater management, yet scattered areas are linked to public systems. For example, the Lakes Region Water Company, Inc., a privately-owned water supply which uses three wells as its source, serves 400 residences (90 percent are seasonal) in the Paradise Shores development on Lake Winnepesaukee.<sup>25</sup> Centre Harbor residents get all of their water from private wells.

A small portion of both Moultonborough and Centre Harbor have combined to form the Bay District for wastewater disposal. The district was formed in 1967 and is funded by user fees<sup>26</sup>. The Bay District serves an area of 272 acres in Moultonborough and 140 acres in Centre Harbor. The wastewater treatment system consists of a plant with a chlorinator, three lagoons, and two pumping stations, with a 0.25 MGD design flow capacity. The lagoons discharge on a semi-annual basis, once in April-May and once more in October-November, after chlorination has occurred. The system serves 1,111 residents and 500 seasonal residents. A two year freeze on any new sewer connections was voted on in 1988, at the District's Annual meeting. The lagoons have a combined total area of 16 acres and a capacity of 31 million gallons. Construction of the Winnepesaukee River Basin Project is expected to be completed in 1990, at which time treated effluent from the existing lagoons will be pumped to the project's interceptor in Meredith<sup>27</sup>. The remaining parts of Moultonborough and Centre Harbor use private wastewater disposal systems.

Moultonborough maintains a landfill outside of the watershed on Route 109, just south of the Sandwich town line. The site is located next to a tributary of Berry Pond, which feeds into Lake Winnepesaukee<sup>28</sup>. Septage is sent to Lamprey Lagoons, located on Holland Street in Moultonborough. The town also has an abandoned dump, located on the opposite side of Route 109 from the present active landfill. It is also next to the tributary that feeds Lake Winnepesaukee.

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<sup>24</sup> Squam Lakes Watershed Advisory Committee, 1989.

<sup>25</sup> NH DES, WSPCD, Water Supply Data, 1988.

<sup>26</sup> Centre Harbor Master Plan, 1983.

<sup>27</sup> NH Department of Environmental Services, Wastewater Facility Data, 1988.

<sup>28</sup> NH DES Solid Waste Division, Data, 1988.

Centre Harbor generally has door to door trash pick up, and contracts with the town of Meredith to use their transfer station, which has recycling. Solid waste is transferred from this site to the trash-to-energy facility located in Claremont, NH. The town of Centre Harbor also has an old landfill which is presently being closed. Monitoring wells have been installed at the site, located on Norris Bartlett Road, and south of Dog Cove, and are being maintained by Dunn Geoscience Co.<sup>29</sup>

New Hampton - The sewer and water infrastructure of New Hampton is similar to that of Ashland's, through it exists on a smaller scale. The New Hampton Village Precinct provides a water supply as well as sewage treatment for the town village, which is outside of the watershed. The water supply serves 510 people or 115 services, and uses Mountain Pond (22 acres) as its water source<sup>30</sup>. The Precinct also provides sewage treatment to approximately 277 residents and 200 New Hampton School students. The New Hampton Wastewater Treatment Facility, outside the Squam watershed, provides sewage treatment for homes within the boundaries of the New Hampton Village Precinct-both sides of Route 132, from the community school to north of the centerline of Route 104 to the west side of I-93. Treatment at the plant is by means of infiltration lagoons, with no discharge occurring. The plant's capacity is 80,000 gallons per day.

The site of New Hampton's landfill is also outside of the watershed, adjacent to the Pemigewasset River. This landfill does not have much space left, and will have to be closed soon. DuBois & King environmental consultants are working with the town and are proceeding with closure plans. An old abandoned dump is located here as well.

#### **Public Utilities**

Of the six towns in the Squam Lakes watershed, two have municipal electric departments: Ashland's municipal system provides electricity to most of the town and the New Hampton Village Precinct provides electricity for its village area. The rest of the watershed is served by the NH Electric Cooperative. As of April 1988, the cooperative maintained 5.5 miles of power lines in Ashland, 102.9 miles in Holderness, 106.9 miles in Sandwich, 267 miles in Moultonborough and 55.5 in Centre Harbor. The cooperative also maintains 50 miles of power lines in New Hampton, while Public Service Company of New Hampshire provides several small areas of the town with electricity. According to the Cooperative, 95 percent of these power lines are above-ground and 5 percent are below-ground. Above-ground lines are more cost-effective, but lines within 100 feet of power stations are located below the ground for aesthetic purposes.

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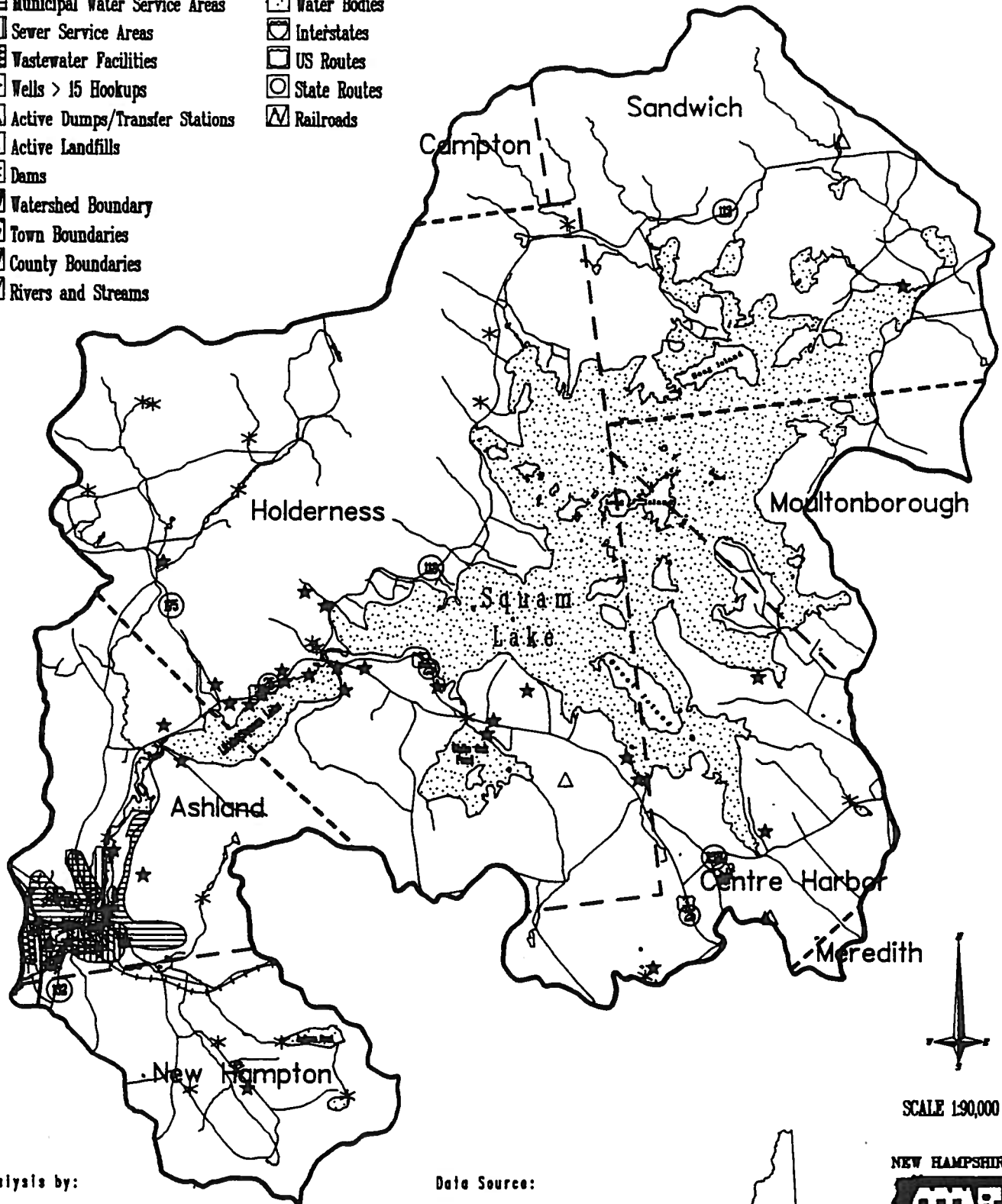
<sup>29</sup> Squam Lakes Watershed Advisory Committee, 1989.

<sup>30</sup> NHDES, WSPCD, Water Supply Data, 1988.

# SQUAM LAKES WATERSHED

## Map 3-9. Infrastructure

- |  |                                |  |              |
|--|--------------------------------|--|--------------|
|  | Municipal Water Service Areas  |  | Water Bodies |
|  | Sewer Service Areas            |  | Interstates  |
|  | Wastewater Facilities          |  | US Routes    |
|  | Wells > 15 Hookups             |  | State Routes |
|  | Active Dumps/Transfer Stations |  | Railroads    |
|  | Active Landfills               |  |              |
|  | Dams                           |  |              |
|  | Watershed Boundary             |  |              |
|  | Town Boundaries                |  |              |
|  | County Boundaries              |  |              |
|  | Rivers and Streams             |  |              |



SCALE 1:90,000

NEW HAMPSHIRE



Geographically Referenced Analysis and Information Transfer System

Analysis by:  
 Complex Systems Research Center,  
 University of New Hampshire,  
 August, 1990.

Data Source:  
 U.S. Geologic Survey,  
 7.5 minute topographic  
 quadrangles, 1:24,000.





## **Chapter 4. Land Use Consistent with Natural Capability of the Watershed**

### **Introduction**

The first goal for the Squam Lakes Watershed Plan is to assure that the scale, type and location of development which takes place in the watershed is consistent with its natural capabilities.

Geographic information technology has been employed extensively in mapping and analyzing watershed soils, land cover and land uses, wildlife habitats, hydrologic resources, and other features which are important to the discussion of a land/water resource management plan. New Hampshire's GRANIT, Geographically Referenced Analysis and Information Transfer system, was utilized to automate all of the mapped data collected, and to analyze the data through the production of a series of maps and tabular reports.

The following series of analytical mapping operations are presented as part of this report:

- . Mapping of land which has severe environmental constraints and which should not be developed: wetlands, floodplains, steep slopes, and associated buffer zones.
- . Mapping the balance of land with regard to its capability to support development, after removing publicly-owned and already developed land.
- . Developing estimates of housing and population potential on this land under different regulatory assumptions.
- . Mapping land which contains productive natural resources and indicating where communities should exercise care in allowing development.
- . A separate mapping of important wildlife habitat is presented in Chapters 6.

## **Land Capability**

Soil and slope conditions play a major role in determining whether development is appropriate for an area. A soil type's development capability is determined in part by its physical characteristics, for example, texture and stoniness, as well as by factors related to a soil's placement on the landscape, e.g., depth to bedrock and slope. A site's drainage properties also figure prominently in determining its appropriateness for development, and evolve from varying combinations of soil characteristics and locational factors. Generally, the lower a soil's development capacity, the larger the lot size necessary to support development. In some cases, for example on wetland and floodplain soils, development is often prohibited by municipalities, and these soils are classified as critical resources.

The Squam Lakes watershed contains a relatively small amount of land area that can be considered to have a high development capability. Most of its soils have various kinds of limitations for development. The better soils in the watershed are the glacial till soils without a hardpan, for example, Berkshire and Charlton soils. Hardpan layers are commonly found in several of the other glacial till soils (Beckett and Marlow soils, for example). In order to be suitable for development, these soils require septic tank leachfields that are specially designed and installed. A sizeable number of glacial till soils also have severely limited development capability due to steep slope and shallowness to bedrock, for example, the Tunbridge-Lyman-Rock outcrop complex found in the vicinity of Piper's Cove, along the southwest shore of Squam Lake.

The glacial outwash soils in the watershed are generally excessively drained, for example, the sandy Adams soils and the more gravelly Colton soils. Though they may pose few limitations for most development purposes, septic systems built on them may be subject to seepage. This potential seepage should be kept in mind, especially because of the likelihood that some of these areas have the potential to provide significant quantities of groundwater for public water supply systems. These excessively drained outwash soils are also subject to erosion, especially those that are found on the steeper slopes. Significant problems can potentially result, especially along lake shore areas. The shoreline northeast of Cotton Cove along Squam Lake, for example, is vulnerable to such erosion. Intensive site preparation measures are needed to avoid erosion and sedimentation problems in such areas. Those glacial outwash soils in the watershed that are not excessively drained are for the most part poorly drained due to a high water table, which poses another set of development limitations, and requires corrective measures which may or may not be adequate. See Appendix B for the classification of development capability for each of the soil units found within the Squam Lakes watershed.

### **Areas with Severe Environmental Limitations**

Among the towns in the Squam Lakes watershed, there is a general recognition that development should be subject to restraints in areas which are unsuitable because of their inherent physical limitations. Within the watershed, three types of land areas have been mapped in this plan as unsuited for development, reflecting town land use control ordinances. These are: wetland and floodplain soils, steep slopes and areas immediately

adjacent to waterbodies and wetlands (See Appendix A for specific requirements in local zoning ordinances for each of the watershed towns). Maps 4-1, 4-2 and 4-3 depict these types of land features. The following section discusses these areas in terms of their values, and the importance of protecting them from inappropriate development.

### **Wetlands**

Wetlands are known to provide a variety of important functions, including the retention of flood waters and regulation of flow within a watershed, the absorption of nutrients to help prevent pollution of waterbodies, and the provision of habitat for many kinds of wildlife. In addition, the year-round high water table characteristic of wetlands makes them unsuitable for development purposes. All of the zoning ordinances of towns in the watershed prohibit the approval of septic systems on designated soils which have poor drainage properties or are peat or muck, or hydric in nature, thus discouraging development from being located in and around these areas. Assisted by the Lakes Region Planning Commission and the Soil Conservation Service (SCS), watershed towns have adopted local zoning provisions which are based on soils criteria. The definitions employed are generally consistent throughout the watershed. Two towns, Sandwich and Centre Harbor, have adopted wetlands conservation ordinances which define wetlands more comprehensively, and provide increased protection from inappropriate uses. Table 4-1 contains acreage estimates of hydric soils, based on SCS soils mapping, that the towns have defined as wetlands.

### **Floodplains**

Floodplains are low-lying areas next to rivers and streams which are periodically flooded. These areas play an important role in providing storage for water during periods of high water flooding. They are also likely to contain alluvial soils with good potential for agriculture, especially where sound management is practiced. Floodplains are also known to be important travel corridors for various kinds of wildlife. Development in floodplains is considered unwise because of a high probability of property damage due to flood water inundation. Equally important is the fact that land filling operations associated with development in a floodplain tend to decrease a stream's water storage capacity, thereby increasing the potential for upstream or downstream flood damage. Development in floodplains also increases the chance of erosion, causing greater turbidity of rivers and streams.

**Table 4-1. Squam Lakes Watershed - Hydric/Alluvial Soils**

Town	Total Acreage of Hydric Soils Subject to Flooding	Poorly Drained	Very Poorly Drained	Muck & Peat, Marsh	Floodplain Soils not Wetlands
Ashland	180	119	0	0	61
Campton	0	0	0	0	0
Centre Harbor	647	463	58	126	0
Holderness	1,021	715	306	0	0
Meredith	17	17	0	0	0
Moultonborough	58	52	0	6	0
New Hampton	181	154	0	13	14
Sandwich	283	186	47	36	14
<b>Total</b>	<b>2,387</b>	<b>1,706</b>	<b>411</b>	<b>181</b>	<b>89</b>

Source: UNH Complex Systems Research Center; Soil Conservation Service, 1989.

### Steep Slopes

Development on steep slopes can have a number of detrimental effects, such as increased soil erosion and sedimentation, more rapid stormwater runoff, and greater costs for road construction and maintenance. The installation of septic systems on steep slopes is not recommended. There is the potential for ground and surface water pollution due to the inability of septic systems, in general, to assimilate wastes adequately under these conditions. The most desirable slopes for development are those between 3 and 15 percent, while those between 15-25 percent are considered suitable only for limited development. Development on slopes of 15-25 percent requires careful planning and management in order to control potential problems. Development (septic system installation) is not permitted on slopes of 25 percent and over in any of the watershed towns. To be consistent with local zoning, the mapping of steep slope areas employed SCS soil units with slopes of 25 percent or more. These areas within the Squam Lakes watershed are identified in Map 4-2.



## **Shoreline Buffer Zones**

On-site septic systems are generally not permitted by watershed towns within setback distances ranging from 75 to 125 feet adjacent to waterbodies. Figure 4-1 lists the septic setbacks from waterbodies which have been established by each of the towns in the Squam watershed. The principal reason for prohibiting septic systems within these areas is to protect water quality from contamination by a failed or inadequately designed system. In addition to local restrictions on septic systems in the shoreline areas, the five watershed towns with lake frontage also require setbacks for buildings, although these distances are generally not as great as for septic. Sandwich requires 100 feet setbacks for buildings except garages, for which 50 feet is required. Ashland, Holderness and Moultonborough require a 50 foot setback for buildings and Centre Harbor, 40 feet. Map 4-1 shows the septic setbacks as a buffer zone for waterbodies, including streams, in the watershed. The zone varies, depending on a particular town's setback requirements.

Also shown on Map 4-1 are wetlands, (and floodplains) and their buffer zones. (For purposes of this project, wetlands and floodplains definitions are consistent with local zoning ordinances, on the basis of soils mapping prepared by SCS.) These buffer zones, also based on local setback distances required for septic systems, are important for water quality protection.

Recommendations concerning those areas in the Squam Lakes watershed which have severe environmental limitations are found at the end of this chapter.

Figure 4-1. Existing Shoreline Zoning Requirements in the Squam Lakes Watershed, 1989\*

	Minimum Shoreline Frontage	Shoreline Structure Setback	Shoreline Septic Setback	Waterfront Parking	Sanitary Facilities	Docking Structures	Waterfront Access
Ashland	200 ft.	50 ft. lake 200 ft. in Pemi district	125 ft.	300 sf/unit	1/10 units		200 ft. for first 10 units, then 20 ft per additional unit
Centre Harbor	150 ft. plus 50 ft. /additional unit (for >2 units)	40 ft.	100 ft. wetlands setback	300 sf/unit	1/5-10 units 2/11-50 units Other for >50 units		800 sf/unit or 200 sf/person
Holderness	200 ft.; Pemi-200 ft., plus 20 ft./ additional unit (> 10 units)	50 ft. any shoreline 200 ft. Pemi district	125 ft. leachfield 75 ft. tank	300 sf/unit	1 per 2 to 25 units	1 dock per 25 ft. of shoreline	200 ft. frontage/ up to 10 units 20 ft./Additional unit (> 10 units) plus 30 sf parking /unit
Moultonborough	100 ft., plus 50 ft. /additional unit	50 ft.	75 ft.			20 ft. from lot line	no dwelling units on waterfront lots
New Hampton	200 ft. (Pemi.) 150 ft. generally		125 ft. (Pemi.) 75 ft. generally				
Sandwich	320 ft./unit	100 ft.-waste generating struc- ture; 50 ft. for garages and other detached struc- tures	125 ft.	1 space for unit which is > then 0.5 miles away			320 ft. frontage/ unit plus 50 ft. frontage/additional unit; no deeded access for multi- unit nonwaterfront properties










Note: \* = See Appendix A for more specific details of zoning ordinances for each of the towns.

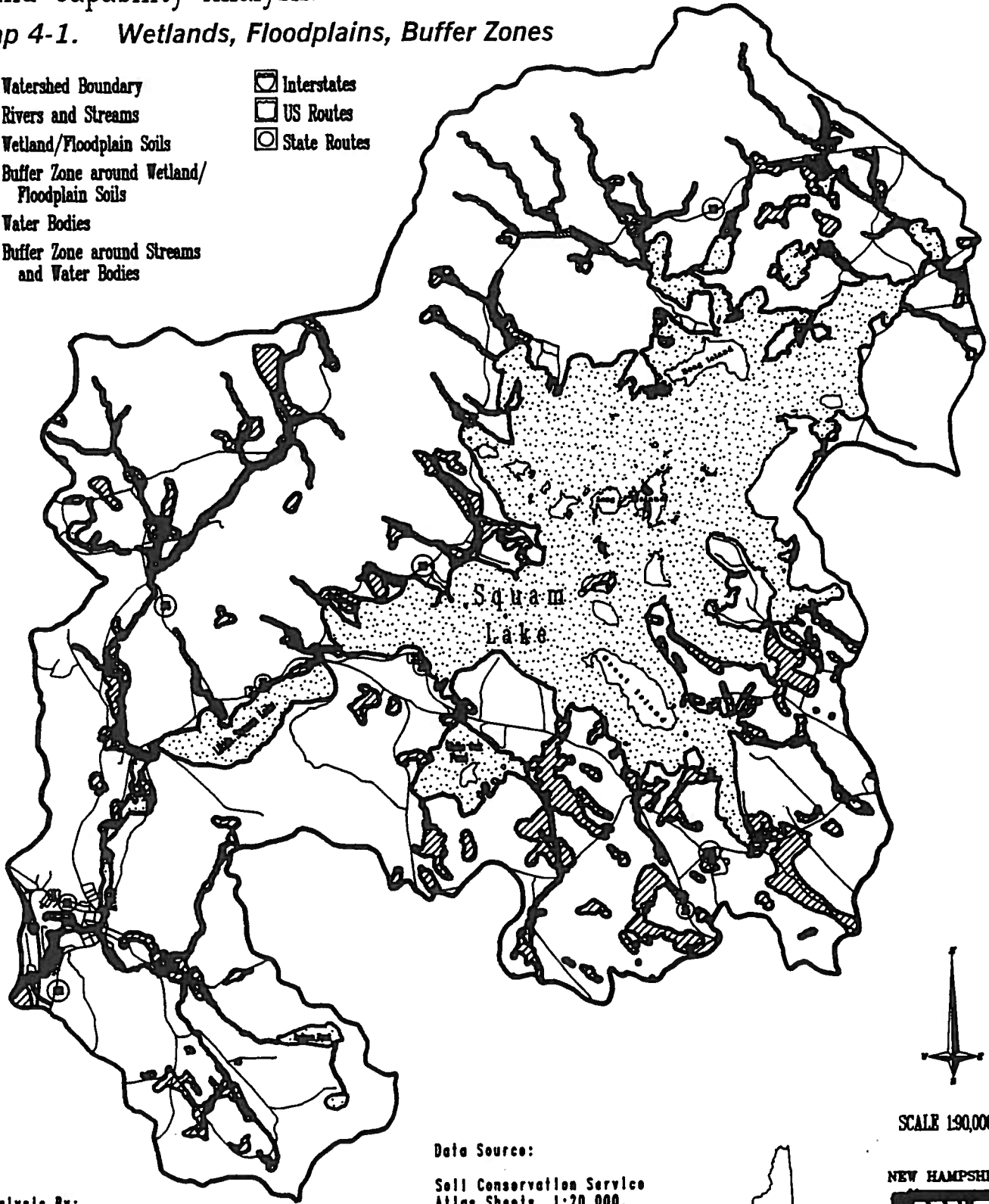
Source: NH Office of State Planning, *Summary of Local Land Use Controls in the Squam Lakes Watershed, 1989.*

# SQUAM LAKES WATERSHED

## Land Capability Analysis:

Map 4-1. Wetlands, Floodplains, Buffer Zones

- |   |  |
|---|--|
|  Watershed Boundary                              |  Interstates  |
|  Rivers and Streams                              |  US Routes    |
|  Wetland/Floodplain Soils                        |  State Routes |
|  Buffer Zone around Wetland/<br>Floodplain Soils |  |
|  Water Bodies                                    |  |
|  Buffer Zone around Streams<br>and Water Bodies  |  |



SCALE 1:90,000

Analysis By:  
Complex Systems Research Center,  
University of New Hampshire,  
January 1990.

Data Source:  
Soil Conservation Service  
Atlas Sheets, 1:20,000.  
U.S. Geological Survey,  
7.5 minute topographic  
quadrangles, 1:24,000.



NEW HAMPSHIRE










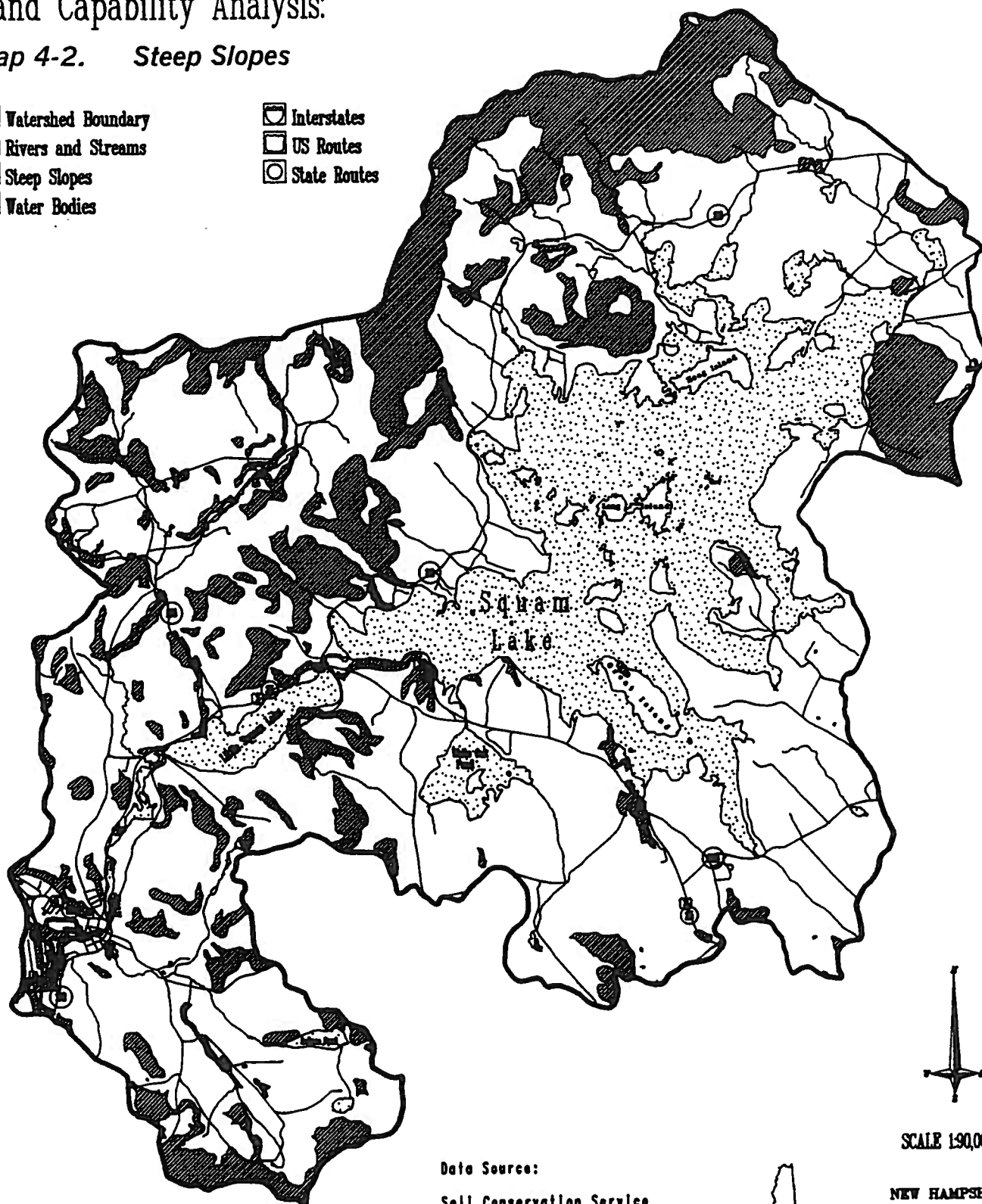
Geographically Referenced Analysis  
and Information Transfer System

# SQUAM LAKES WATERSHED

## Land Capability Analysis:

### Map 4-2. Steep Slopes

- |  |  |
|--|--|
|  Watershed Boundary |  Interstates  |
|  Rivers and Streams |  US Routes    |
|  Steep Slopes       |  State Routes |
|  Water Bodies       |  |



Analysis By:

Complex-Systems Research Center,  
University of New Hampshire,  
January 1990.

Data Source:

Soil Conservation Service  
Atlas Sheets, 1:20,000.

U.S. Geological Survey,  
7.5 minute topographic  
quadrangles, 1:24,000.



SCALE 190,000

NEW HAMPSHIRE



Geographically Referenced Analysis  
and Information Transfer System

**Table 4-2. Area with Severe Environmental Limitations (in Acres)**

Name	Acreage	Water	Water Buffer	Wetlands	Wetland Buffer	Slopes	Total Excluded <sup>1</sup>
Ashland	4,308	243	273	180	167	705	1,404
(Percentage) <sup>2</sup>		5.6	6.3	4.2	3.9	16.4	32.6
Campton	714	-0-	48	-0-	-0-	409	437
(Percentage)		-0-	6.7	-0-	-0-	57.3	61.2
Centre Harbor	5,790	1,366	205	647	407	175	2,710
(Percentage)		23.6	3.5	11.2	7.0	3.0	46.8
Holderness	17,477	3,373	1,090	1,021	809	3,345	8,999
(Percentage)		19.3	6.2	5.8	4.6	19.1	51.5
Meredith	123	-0-	-0-	17	4	8	29
(Percentage)		-0-	-0-	13.8	3.3	6.5	23.6
Moultonborough	2,698	1,325	106	58	42	425	1,918
(Percentage)		49.1	3.9	2.1	1.6	15.8	71.1
New Hampton	3,325	70	133	181	97	719	1,113
(Percentage)		2.1	4.0	5.4	2.9	21.6	33.5
Sandwich	7,983	1,470	728	283	288	2,279	4,774
(Percentage)		18.4	9.1	3.5	3.6	28.5	59.8
Total Watershed	42,418	7,847	2,583	2,387	1,814	8,065	21,384
(Percentage)		18.5	6.1	5.6	4.3	19.0	50.4

<sup>1</sup> "Total Excluded" area is less than the sum of the areas of the individual categories due to overlapping buffers.

<sup>2</sup> Percentages are based on total acreage.

Source: UNH, Complex System Research Center, 1989.

## Development Capability Based on Existing Local Zoning

Table 4-2 presented the acreage with severe environmental limitations for development for each watershed town. The percentages shown in the table are based on the total acreage of each town's area within the watershed, including lakes and ponds. The table indicates that just over half of the total area of the watershed is in categories where development is subject to severe restrictions, according to local ordinances.

If just the land area of each watershed town is considered, a somewhat different assessment results. Table 4-3 presents these land area figures, and the areas themselves are found in Map 4-3.

**Table 4-3. Land Area Excluded Due to Severe Limitations**

Town	Land Area	Land Area Excluded	Percent Land Area Excluded
Ashland	4,065	1,161	28.6
Campton	714	437	61.2
Centre Harbor	4,424	1,344	30.4
Holderness	14,104	5,626	39.9
Meredith	123	29	23.6
Moultonborough	1,373	593	43.2
New Hampton	3,255	1,043	32.0
Sandwich	6,513	3,304	50.7
Total	34,571	13,537	39.2








Source: UNH Complex Systems Research Center, 1989.

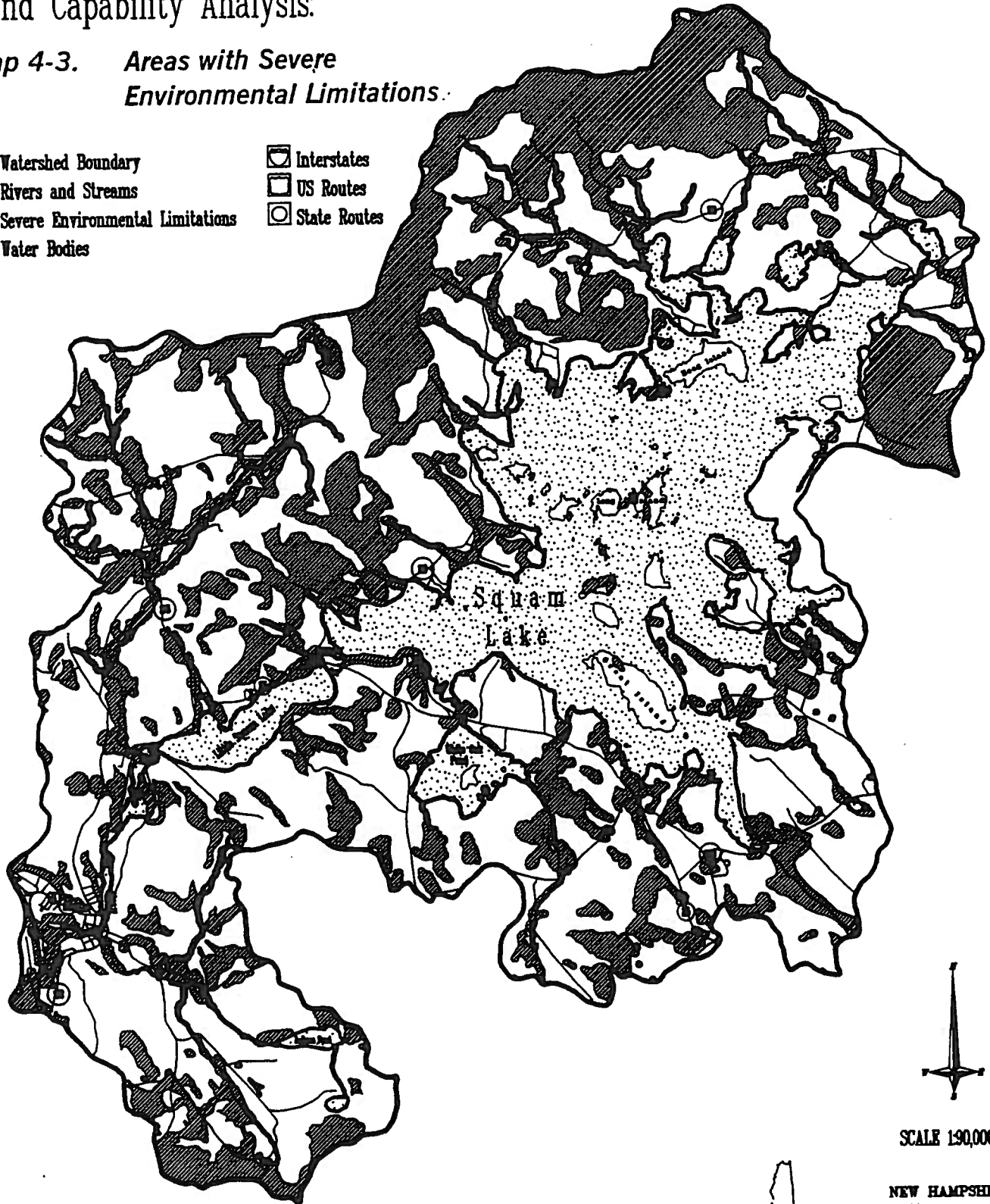
This table clearly illustrates the extent of existing restrictions that are placed on development in areas of the Squam watershed which are unsuited to such development because of their natural limitations. It should be noted, however, that this mapping is based on generalized SCS soil surveys, which do not claim to be accurate on a site specific basis. Therefore, scattered individual parcels of land within these areas that have been mapped as having severe limitations may be developable under local regulations.

# SQUAM LAKES WATERSHED

## Land Capability Analysis:

Map 4-3. Areas with Severe Environmental Limitations.

- |  |  |
|--|--|
|  Watershed Boundary               |  Interstates  |
|  Rivers and Streams               |  US Routes    |
|  Severe Environmental Limitations |  State Routes |
|  Water Bodies                     |  |



SCALE 1:90,000

NEW HAMPSHIRE



Geospatial Information Systems and Information Transfer System



Analysis By:

Complex Systems Research Center,  
University of New Hampshire,  
January 1990.

For all land in the watershed not subject to severe environmental limitations, lot size ranges have been assigned, based on the natural capability of the land to support long term operation of on-site sanitary facilities, as well as other development related considerations (road and foundation stability, for instance). Lot size criteria by soil type are defined by each town in their respective zoning ordinances. Six categories of lot size are used in Map 4-4, and reflect these local requirements. The first two categories of up to one acre lots apply to those areas of a town served by municipal sewer and water. After delineating the watershed acreage within the six lot size categories, land already developed or protected through public/conservation ownerships (Map 4-5) was subtracted out, and the final land capacity map was produced (Map 4-6).

The lot size categories used are:

1. Less than 1/2 acre per dwelling unit
2. 1/2 to 1 acre per dwelling unit
3. 1 to 1.5 acres per dwelling unit
4. 1.5 to 2.0 acres per dwelling unit
5. 2.0 to 2.5 acres per dwelling unit
6. 2.5 acres or more per dwelling unit

Most of the towns in the watershed are similar as to the lot sizes permitted based on soil/slope characteristics. The town of Sandwich stands out as generally requiring larger lots on a given soil type than the other towns.

Table 4-4 contains a breakdown of the developable watershed area, after accounting for land with severe environmental constraints as well as acreage already developed (as of 1982) or in public/conservation ownership.

Table 4-5 presents the remaining acreage within the watershed by town, according to each of the lot size categories that were mapped. These acreage figures were subject to two adjustments. First, those parcels that were smaller than the minimum size for each development class were eliminated from consideration. This affected about one percent of developable land. Second, the acreage was also adjusted to account for new streets and roads necessary to provide access. Area for new roads was calculated according to the following assumptions. Twenty percent of developable land in categories 1 and 2, fifteen percent in categories 3 and 4, and ten percent in categories 5 and 6 were assumed to be required for road construction in a fully developed scenario.



**Table 4-4. Developable Acreage by Town**

Town	Total Acreage	Initial <sup>1</sup>		Acreage <sup>2</sup>		Remaining Developable	
		Acreage	Percent	Developed	Percent	Acreage	Percent
Ashland	14,038	2,871	66.6	869	20.2	2,002	14.3
Campton	714	43	6.0	0	0.0	43	6.0
Centre Harbor	5,790	3,076	53.1	925	16.0	2,151	37.2
Holderness	17,477	8,228	47.1	1,941	11.1	6,286	36.0
Meredith	123	94	76.4	6	4.9	88	71.5
Moultonborough	2,698	779	28.9	207	7.7	571	21.2
New Hampton	3,325	2,211	66.5	431	13.0	1,780	53.5
Sandwich	7,983	3,208	40.2	486	6.1	2,722	34.1
<b>Total</b>	<b>42,418</b>	<b>20,509</b>	<b>48.3</b>	<b>4,865</b>	<b>11.5</b>	<b>15,643</b>	<b>36.9</b>

Source: UNH Complex Systems Research Center, 1989.

**Table 4-5. Developable Acreage by Lot Size**

Town	Lot Size 1	Lot Size 2	Lot Size 3	Lot Size 4	Lot Size 5	Lot Size 6	Total
	<.5 Acre	.5-1 Acre	1-1.5 Acre	1.5-2 Acre	2-2.5 Acre	2.5+ Acre	
Ashland	6	0	250	527	401	538	1,722
Campton	0	0	35	2	0	0	37
Centre Harbor	0	0	1,221	432	79	79	1,811
Holderness	0	0	1,029	1,593	1,422	1,391	5,435
Meredith	0	0	58	11	4	3	76
Moultonborough	0	0	258	35	103	88	484
New Hampton	0	0	848	459	40	149	1,496
Sandwich	0	0	0	0	1,670	745	2,415
<b>Total</b>	<b>6</b>	<b>0</b>	<b>3,699</b>	<b>3,059</b>	<b>3,719</b>	<b>2,993</b>	<b>13,476</b>

Source: UNH Complex Systems Research Center, 1989.















<sup>1</sup> Acreage remaining by town after Severe Environmental Constraints/Development Capabilities analysis.

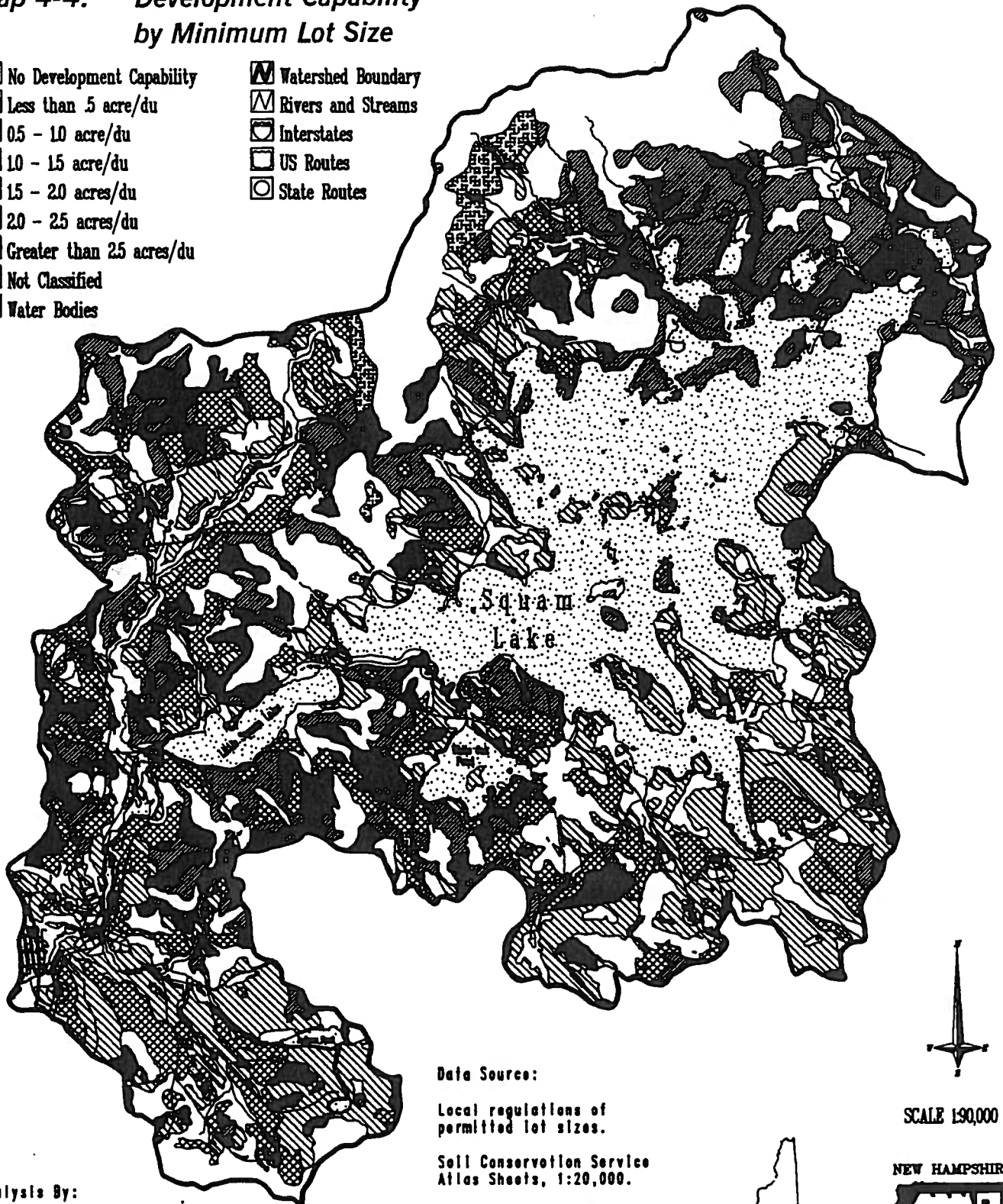
<sup>2</sup> Acreage currently developed based on the UNH Forestry Department land use data and buffer zones of 20 feet, 50 feet, and 100 feet around town, state/US, and interstate routes respectively. This figure also includes any acreage currently protected by public ownership.

# SQUAM LAKES WATERSHED

## Land Capability Analysis:

### Map 4-4. Development Capability by Minimum Lot Size

- |   |  |
|---|--|
|  No Development Capability |  Watershed Boundary |
|  Less than 5 acre/du       |  Rivers and Streams |
|  0.5 - 10 acre/du          |  Interstates        |
|  10 - 15 acre/du           |  US Routes          |
|  15 - 20 acres/du          |  State Routes       |
|  20 - 25 acres/du          |  |
|  Greater than 25 acres/du  |  |
|  Not Classified            |  |
|  Water Bodies              |  |



Analysis By:

Complex Systems Research Center,  
University of New Hampshire,  
January 1990.

#### Data Source:

Local regulations of  
permitted lot sizes.

Soil Conservation Service  
Atlas Sheets, 1:20,000.

U.S. Geological Survey,  
7.5 minute topographic  
quadrangles, 1:24,000.



SCALE 1:30,000



NEW HAMPSHIRE











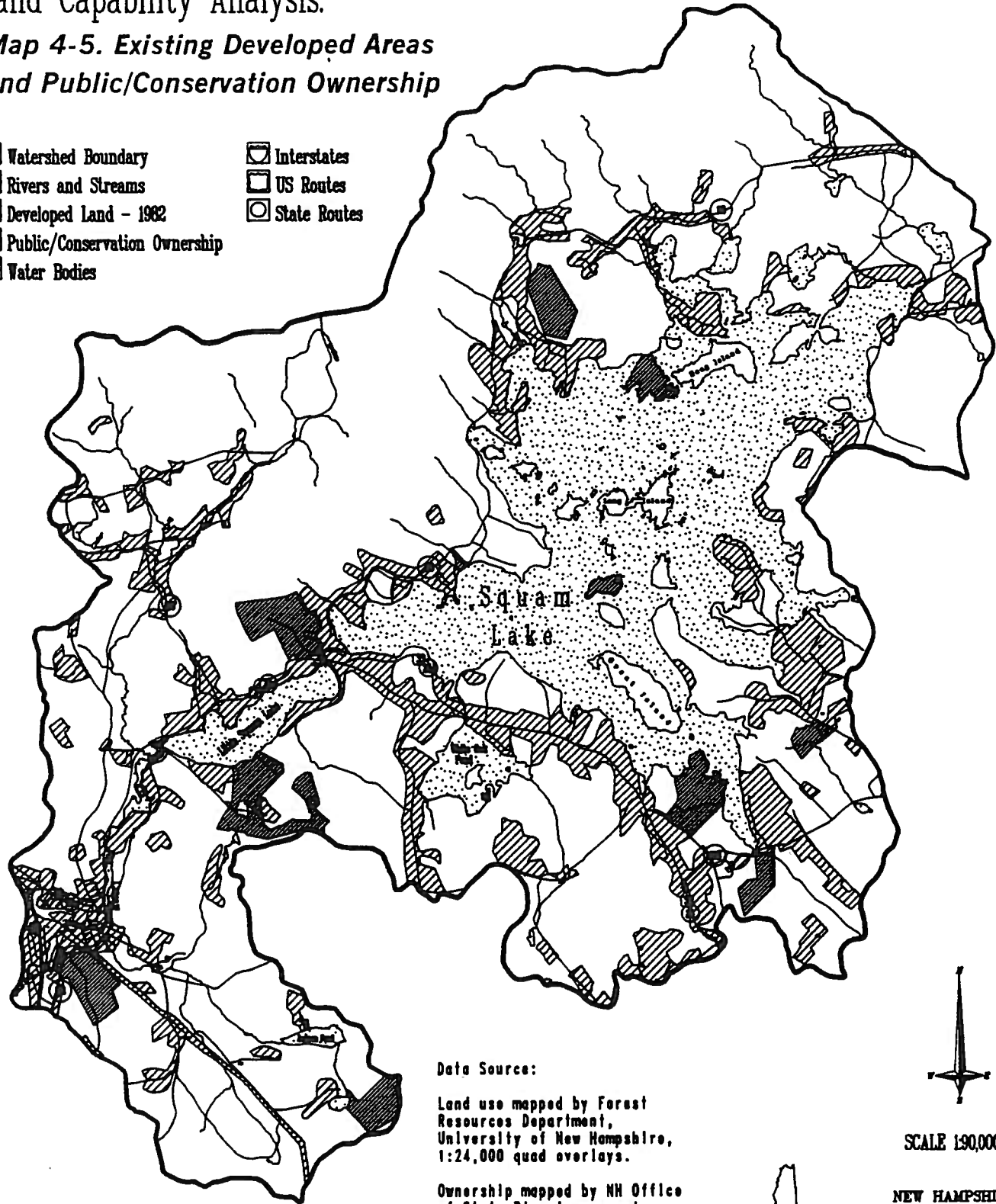
Geographically Referenced Analysis  
and Information Transfer System

# SQUAM LAKES WATERSHED

## Land Capability Analysis:

### Map 4-5. Existing Developed Areas and Public/Conservation Ownership

- |   |  |
|---|--|
|  Watershed Boundary            |  Interstates  |
|  Rivers and Streams            |  US Routes    |
|  Developed Land - 1982         |  State Routes |
|  Public/Conservation Ownership |  |
|  Water Bodies                  |  |



**Data Source:**

Land use mapped by Forest Resources Department, University of New Hampshire, 1:24,000 quad overlays.

Ownership mapped by NH Office of State Planning on mylar quad overlays, 1:24,000, 1989.

U.S. Geological Survey, 7.5 minute topographic quadrangles, 1:24,000.

**Analysis By:**

Complex Systems Research Center,  
University of New Hampshire,  
August 1990.



SCALE 1:90,000



NEW HAMPSHIRE
















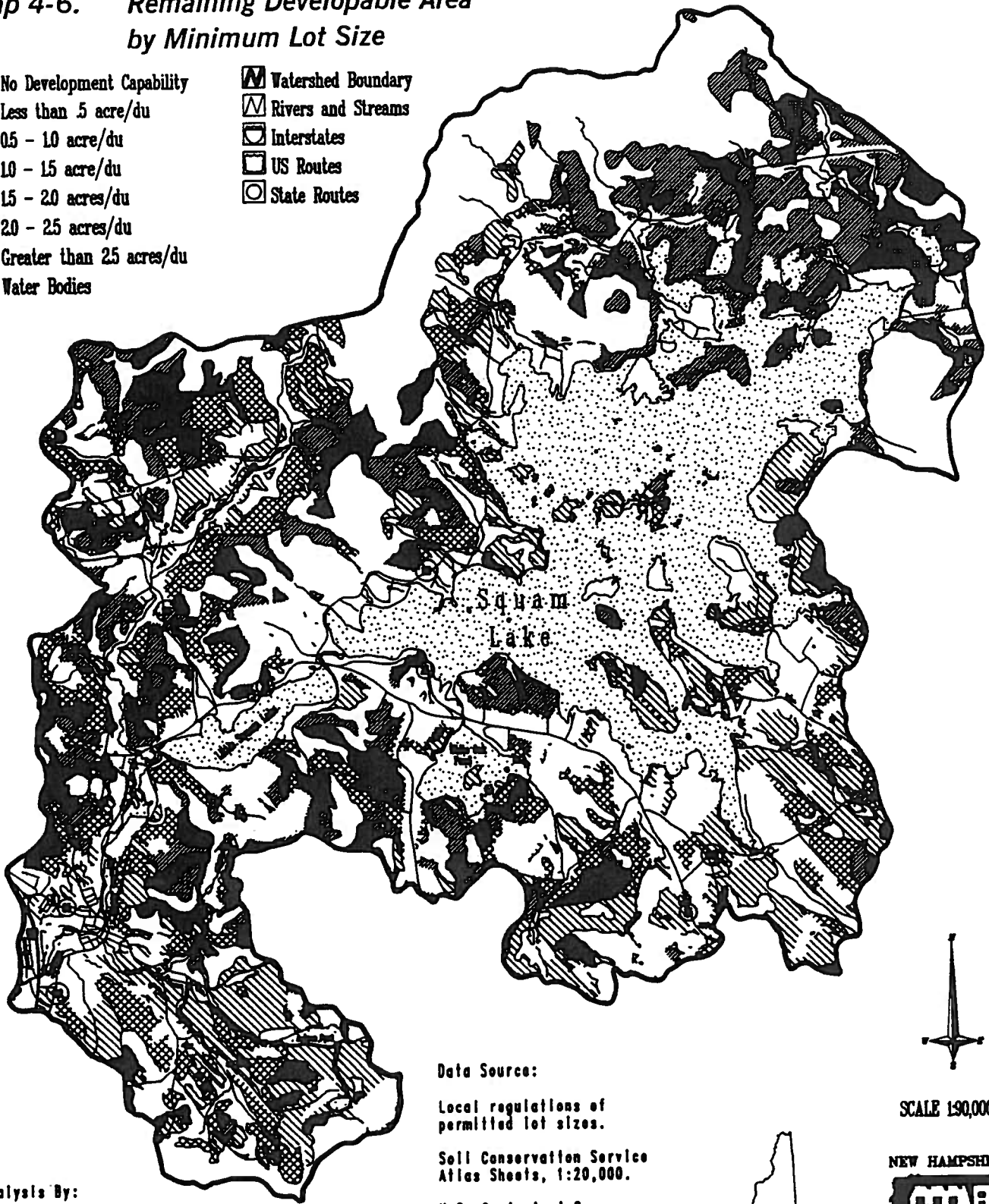
Geographically Referenced Analysis and Information Transfer System

# SQUAM LAKES WATERSHED

## Land Capability Analysis:

### Map 4-6. Remaining Developable Area by Minimum Lot Size

- |   |  |
|---|--|
|  No Development Capability |  Watershed Boundary |
|  Less than 5 acre/du       |  Rivers and Streams |
|  0.5 - 1.0 acre/du         |  Interstates        |
|  1.0 - 1.5 acre/du         |  US Routes          |
|  1.5 - 2.0 acres/du        |  State Routes       |
|  2.0 - 2.5 acres/du        |  |
|  Greater than 2.5 acres/du |  |
|  Water Bodies              |  |



#### Data Source:

Local regulations of permitted lot sizes.

Soil Conservation Service  
Atlas Sheets, 1:20,000.

U.S. Geological Survey,  
7.5 minute topographic  
quadrangles, 1:24,000.

#### Analysis By:

Complex Systems Research Center,  
University of New Hampshire,  
January 1990.



SCALE 130,000

NEW HAMPSHIRE



Geographically Referenced Analysis  
and Information Management System



In order to examine this mapping from the perspective of the maximum number of single family dwellings that would be allowed, these acreages were converted into dwelling units by taking the lower limit of each class interval, except for the first lot size category, and dividing it into the total number of acres in that class. (In this first category, 1/4 acre per unit was used.) For example, in Centre Harbor, there were 432 acres of lot size 4 land available. Dividing this acreage by 1.5 acres per unit, a maximum of 288 single family dwellings could be accommodated on those areas of Centre Harbor according to local zoning. The results of these calculations are presented in Table 4-6.

With regard to Sandwich, the minimum lot size is 100,000 square feet, which is just below the 2.5 acre threshold for lot size 6. Therefore, a majority of the soils in Sandwich appear in the lot size 5 category. This probably overstates the maximum number of lots and housing units which could be built in the town. If all of the area had been classified as lot size 6, then the maximum number of lots would be 966, not 1,133 as shown in Table 4-6.

**Table 4-6. Number of New Single Family Units by Town Assuming Maximum Development**

Town	Lot Size 1 < .5 Acre	Lot Size 2 .5-1 Acre	Lot Size 3 1-1.5 Acre	Lot Size 4 1.5-2 Acre	Lot Size 5 2-2.5 Acre	Lot Size 6 2.5+ Acre	Total
Ashland	24	0	250	351	200	215	1,040
Campton	0	0	35	1	0	0	36
Centre Harbor	0	0	1,221	288	40	32	1,581
Holderness	0	0	1,029	1,062	711	556	3,358
Meredith	0	0	58	7	2	1	68
Moultonborough	0	0	258	23	51	35	367
New Hampton	0	0	848	306	20	60	1,234
Sandwich	0	0	0	0	835	298	1,133
Total	24	0	3,699	2,038	1,859	1,197	8,817

Source: UNH Complex Systems Research Center, 1989.

If the dwelling units calculated are assumed to house year-round residents, the total number of people added to the watershed can be calculated by multiplying the units in Table 4-6 by persons per household estimates. The following single family, person per household estimates were assumed:

Ashland	2.7 persons per household
Campton	2.5 persons per household
Centre Harbor	2.6 persons per household
Holderness	2.6 persons per household
Meredith	2.5 persons per household
Moultonborough	2.4 persons per household
New Hampton	2.6 persons per household
Sandwich	2.1 persons per household

These estimates were derived from actual counts in each town from the 1980 US Census, and have been adjusted to 1987 in order to reflect decreasing household sizes on the basis of national trends. Table 4-7 presents these estimates of the increases in resident population that would occur in the Squam watershed under a maximum development condition.

**Table 4-7. Estimated Increased Year-Round Population by Town Assuming Maximum Development**

Town	Lot Size 1 <.5 Acre	Lot Size 2 .5-1 Acre	Lot Size 3 1-1.5 Acre	Lot Size 4 1.5-2 Acre	Lot Size 5 2-2.5 Acre	Lot Size 6 2.5+ Acre	Total
Ashland	65	0	675	948	540	581	2,809
Campton	0	0	88	3	0	0	91
Centre Harbor	0	0	3,175	749	104	83	4,111
Holderness	0	0	2,675	2,761	1,849	1,446	8,731
Meredith	0	0	145	18	5	3	171
Moultonborough	0	0	619	55	122	84	880
New Hampton	0	0	2,205	796	52	156	3,209
Sandwich	0	0	0	0	1,754	626	2,380
<b>Total</b>	<b>65</b>	<b>0</b>	<b>9,582</b>	<b>5,330</b>	<b>4,426</b>	<b>2,979</b>	<b>22,382</b>

Source: UNH Complex Systems Research Center, 1989.

According to this analysis, more than twenty-two thousand additional residents could be accommodated in the watershed under maximum development. The overall density of the developable land in the watershed, approximately 37 percent of the land area, would be 915 persons per square mile.

To provide some measure of comparison to these estimated population and housing projections, Table 4-8 was prepared using 1980 census data by census enumeration district. These districts provide an approximation of the watershed, but do include some population and dwelling units lying outside as well. According to these figures, there was a year-round population count of 4,578 persons living in the Squam watershed in 1980. Thus, the maximum build-out population of 22,382 is about four to five times the size of the latest census estimate of the watershed population. In addition, the number of year-round dwelling units (8,817) projected under the build-out scenario is more than five times the number of occupied year-round units in 1980 (1,713).

Table 4-8 also shows a breakdown of seasonal housing, and comes closer to the actual number of units within the Squam watershed than figures presented in the descriptive section (Chapter 3), which represent seasonal units for entire towns. A 1971 recreational study done by the Office of State Planning indicated that the typical New Hampshire vacation home was occupied by an average of 6.2 residents.<sup>3</sup> Using this number as a rough guide, along with the number of seasonal housing units in the Squam watershed as of 1980 (Table 4-8), the seasonal population of the watershed as of 1980 can be estimated as approximately 7,322 people.

**Table 4-8. 1980 Census Population and Household Data for the Watershed Portions of Towns**

Entire Town	Total Dwelling Units	Occupied Year-Round Dwelling Units	Year-Round Population	Seasonal Dwelling Units
Ashland (ED's 141 & 143)*	653	457	1190	181
Centre Harbor (ED1)*	501	292	808	208
Holderness (ED's 139 & 140)*	968	587	1,586	371
Moultonborough (ED 133)*	392	172	470	216
New Hampton (ED 12)*	231	132	357	97
Sandwich (ED 116)*	182	73	167	108
<b>Total</b>	<b>2,927</b>	<b>1,713</b>	<b>4,578</b>	<b>1,181</b>

Note: \* These are 1980 census enumeration districts (ED's), which approximate the part of each town which lies within the Squam watershed.

Campton and Meredith have not been included here due to the smallness of their areas in the watershed.

Source: US Bureau of Census, 1980 Census of Population and Housing, STF1A.

<sup>3</sup> NH Office of State Planning, *Impact of Recreation and Travel - 1954, 1963, 1970; 1971.*

Another facet of the maximum development scenario is the town-by-town comparison of densities, in persons per acre, which would result if such development were to occur. The right hand column of Table 4-9 compares the densities projected for each town's portion of the watershed. These densities apply only to the developable acreage as shown in Table 4-4, and the population which would result from a maximum build-out of these areas under existing zoning,

**Table 4-9. Population Density for Town Area within the Watershed under Maximum Development**

	Developable Acreage	Projected Population	Population Density
Ashland	2,002	2,809	1.40
Centre Harbor	2,151	4,111	1.91
Holderness	6,286	8,731	1.39
Moultonborough	571	880	1.50
New Hampton	1,780	3,209	1.80
Sandwich	2,722	2,380	0.87
Total	15,512	22,120	1.43

Note: Campton and Meredith have not been included here due to the smallness of their areas in the watershed.

Source: UNH Complex Systems Research Center, 1989.

#### **Alternative Maximum Development Scenarios**

Two additional maximum development scenarios have been calculated for the towns with acreage within the Squam Lakes watershed. The first of these scenarios assumes that multi-family housing would be the predominant housing type if a town's zoning allowed it. For Centre Harbor and New Hampton, which do not allow multi-family units, the numbers for the single family scenario were used. The result of this simulation, shown in the second column of Table 4-10, maximizes population growth in the watershed.

The second alternative assumes that the minimum lot sizes for single family detached housing which exist in the Sandwich Zoning Ordinance are common in the town regulations throughout the Squam Lakes watershed. The third column of Table 4-10 presents the results of this simulation. Both of these alternatives are compared to the population increase which would be allowed under the build-out scenario based on existing zoning (the first column).



The three different build-out scenarios all represent potential increases in population over that which exists in the watershed now. Using the first set of numbers as a base projection, the maximum population increase resulting from the multi-family scenario is 31 percent above and the low density single family scenario is 29 percent below the base projection.

**Table 4-10. Estimated Population Increases by Town Under Different Zoning and Residential Type Assumptions**

	Single Family Exist. Zoning	Multi-Family Exist. Zoning	Single Family "Sandwich" Zoning
Ashland	2,809	3,484	2,130
Centre Harbor	4,111	4,111	2,376
Holderness	8,731	12,887	6,349
Moultonborough	880	1,016	530
New Hampton	3,209	3,209	1,833
Sandwich	2,380	4,303	2,380
Total	22,120	29,010	15,598

Note: Campton and Meredith have not been included here due to the smallness of their areas in the watershed.

Source: UNH Complex Systems Research Center, 1989.

Recommendations for controlling the type and intensity of land use in the Squam watershed communities, based on development capability, are addressed in Chapter 8. These include recommendations concerning master plans, subdivision and site plan review regulations, as well as other local land use management powers.

## **Land Suitability**

The previous section addressed the capability of land in the Squam Lakes watershed to support development, and identified areas which should not be developed due to inherent environmental limitations. Equally important in sound land use planning practice is the concept of land suitability, that is, the identification of areas which ought not to be developed because of intrinsic resource values that make them more suited to meeting important human needs.

Three different land suitability values are discussed in this section: potential aquifer and surface water supply areas, soils with significant agricultural productivity, and productive forest soils. Acreage estimates for these three areas are presented in Table 4-11.

### **Potential Aquifer Areas/Surface Water Supplies**

The Squam Lakes watershed contains a fairly limited extent of underground high potential yield stratified drift aquifer deposits. High potential yield areas are considered to be sufficiently saturated to be able to yield larger volumes of water, including enough quantity to meet or add to municipal and/or industrial demands. Two areas of the watershed are inferred to have this high potential for groundwater yield, based on US Geological Survey Groundwater Availability Maps, completed in 1975. The largest of these potential sites lies in the area surrounding the confluence of the Squam and Pemigewasset Rivers, straddling the Towns of Ashland and New Hampton, with most of the area lying within Ashland. Another high potential site occurs at the western end of Little Squam Lake in Ashland, where the lake flows into the Squam River, as well as north of it, along Owl Brook.

Medium potential groundwater yield sites may contain enough saturated thickness to provide water for small municipal and rural water districts, as well as commercial or light industrial use. Six relatively small and scattered areas with medium groundwater yield potential are found in the Squam watershed. Ashland and Holderness share such a groundwater area where Route 175 meets Route 3, just north of Little Squam Lake, and Holderness and Centre Harbor share a site near the Swainey Brook swamp area, west of Route 3 on the town lines. The other three potential groundwater locations are in Holderness: the area near Cotton Cove, between Route 113 and Squam Lake, the area where Squam Lake meets Little Squam Lake, and land in proximity to the central section of Owl Brook. A total of 915 acres, 2.6 percent of the watershed land area, are presently mapped as having potential to supply quantities of water that are sufficient to meet high and medium municipal demands. Map 4-7 indicates these areas. As Table 4-11 notes, 16 acres of these potential aquifer areas are overlain by sewage disposal ponds, thereby decreasing their potential to provide groundwater of high quality. No stratified drift aquifers with a low potential to yield groundwater are found in the watershed.

**Table 4-11. Areas of Value as Natural Resources**

		Acreage	Percent of Watershed	Percent of Land
Prime Farmland	1	388	0.9	1.1
Soils:	2	14	0.0	0.0
Important Forest	IA	11,489	27.1	33.2
Soil Groups:	IB	7,583	17.9	21.9
	IC	1,647	3.9	4.8
Medium and High Potential Yield Aquifers		899*	2.1	2.6
Surface Water Supplies (subwatershed drainage area)		666	1.6	1.9
Water		7,863	18.5	0.0

All criteria: Forest group (IA, IB, IC), Prime Farmland, Potential Aquifers and Surface Water Supplies yield 22,703 acres, representing 53.5 percent of the watershed and 65.7 percent of the land area.

\* Aquifer acreage reflects subtraction of 16 acres which are potential aquifers, but which are overlaid by sewage disposal ponds. This 16 acres was included instead in the water category.

Source: US Soil Conservation Service, Belknap, Carroll and Grafton County Soil Surveys; 1968; 1977; unpublished, due out in 1991. Important Forest Soils Mapping done at UNH Complex Systems, 1990.

Groundwater exists in bedrock and glacial till throughout the rest of the watershed, but these areas would be considered to have lower water yield potentials. Wells in glacial till areas generally yield enough water for single family use. Some bedrock wells may yield enough water to provide a public water supply, as defined by RSA 485:1 XIV.

Another public water supply feature which has been taken into account in considering land suitability is the surface water supply for the town of Ashland, Jackson Pond and Sky Pond in New Hampton. All of the land which drains into these waterbodies has been included on Map 4-8. The concern is that land uses and activities which can have adverse impacts on the water quality of these ponds should be regulated.

## **Agricultural/Prime Farmland Soils**

Areas in the watershed with agricultural suitability are those whose soil and slope characteristics are most favorable for the production of food and fiber on a continuous or nearly continuous basis. Map 4-9 shows the location of these areas. The category 1 areas are those soils which are designated by SCS as prime farmland, and category 2 includes soils which are prime but require special treatment measures such as draining to make them most productive. Appendix C lists the names of soils which are included as prime farmland. There are 402 acres of prime farmland located in the Squam Lakes watershed. Most of these areas were in agricultural production or were cleared fields, evidence of recent agricultural use, according to the interpretation of 1988 aerial photography.

Generally, the soils of the Squam Lakes watershed have limitations for agricultural purposes. A relatively small percentage of the area has soils of high natural fertility, and management limitations are common due to slope, general stoniness, poor drainage, rock outcrops, and erosive potential. Areas that have been used for farming tend to be on floodplains, or on the more productive glacial till soils, such as Charlton, where stones have been consistently removed and where management practice have been carried out. Non-stony Becket and Marlow soils on gentle slopes are some glacial till soils occurring in the watershed which are considered to be prime farmland soils. Proper attention needs to be given to avoid potential erosion problems on the more sloping cultivated areas of the watershed, to insure their long term productivity. Productive floodplain soils in the watershed are restricted primarily to Podunk and Ondowa soils, which are deep, and moderately well drained and well drained respectively. They are better able to absorb floodwater than some of the other floodplain soils in the watershed, such as Limerick soils, which have a high water table through June.

It is significant that in their master plans, all of the towns in the Squam Lakes watershed recognize the importance of preserving their existing and potential farmland. The New Hampton Master Plan, 1985, for instance, lists the following as benefits to the town which come from farmland preservation:

- . helps maintain a town's rural character
- . provides open space and scenic views, while making use of the land
- . provides edge effect for wildlife
- . allows a productive use of floodlands
- . preserves groundwater recharge areas; reduces surface runoff in some areas
- . ensures agricultural land will be there if demand for local products increases
- . keeps local money in the local economy

The New Hampton Master Plan also states that the town's current regulations tend to encourage development of agricultural land. "Instead, the town should provide incentives to prevent the development of these lands." The plan has a number of recommendations to preserve and encourage agriculture, including the encouragement of the current use tax incentive by local farmers, the purchase of development rights of key local farms, and the encouragement of cluster zoning.

The 1990 Centre Harbor Master Plan states: "Centre Harbor has little good agricultural land. The town needs to protect what little is available." The plan lists the benefits of preserving farmland, and provides a number of recommendations to preserve open space for agricultural as well as other purposes. A conservation district is proposed to zone critical resources, including agricultural land. There is also a recommendation that the town encourage the acquisition of conservation easements, as well as outright acquisition of important agricultural areas. Another important recommendation is that the town should maximize the percentage of the land use change tax to be used for the purchase of important agricultural lands.

In Moultonborough, prime agricultural soils are mapped as a critical resource in the town's 1982 master plan. Accordingly, the plan says: "The town should encourage protection of its prime agricultural soils and farmland and should establish incentives for retaining its largest remaining agricultural areas. These incentives could include differential taxation and density bonuses for development which is deliberately planned for non-agricultural areas." The future land use section of the master plan designates about 600 acres that is generally undeveloped, and contains the town's best agricultural soils, as an agricultural preservation area.

The 1990 update of the Sandwich Master Plan recommends that the town should encourage and preserve agriculture. Specifics in the plan as to how to accomplish this focus on mapping productive soils that are currently protected in some way, in order to assess which are still in need of protection.

The importance of determining prime agricultural soils is mentioned in both the Ashland and Holderness Master Plans, but relatively little attention is paid to protection of agricultural land in either of these plans.

### **Productive Forest Soils**

Much of the Squam Lakes watershed is well-suited to forests. Some of the more productive glacial till soils, Berkshire, Becket, Marlow, Charlton, and Paxton, are common throughout the watershed, and can support the more favored hardwood species, such as sugar maple. Steep slopes, surface boulders, excessive surface stones, bedrock outcrops and erosiveness, however, can limit their management potential in some areas. The glacial outwash soils - Adams and Colton, for example, are more suited to softwood production, especially white pine. They are somewhat less productive than the previously mentioned soils, but are subject to few management limitations, including competition from hardwoods.

Using existing soil survey information for NH soils, the US Soil Conservation Service has developed Important Forest Soils Mapping, which categorizes these soils in terms of their expected forest productivity and management potential. Map 4-10 is based in part on these categorizations, and indicates soils in the watershed which are the most suited for forest and timber production. There is substantial overlap between these areas and those with high agricultural potential. In general, however, areas having good forest potential may include additional soils, and/or may be found on moderate slopes which are not conducive to agricultural production.

Three forest soil groups are shown on the map. Group IA includes deeper, loamy textured soils which are moderately well and well drained. These soils cover 11,489 acres within the watershed, or 33.2 percent of the total land area. They are suited primarily for hardwoods, and have few limitations for forest management. Group IB soils, including 7,583 acres (21.9 percent of land area), are characterized by sandy and loamy over sandy textures, and moderately well and well drained conditions. They are also primarily hardwood sites. These soils are somewhat less productive than Group IA soils, but offer few severe limitations for forest management. Group IC includes 1,647 acres (4.8 percent of land area) of sands and gravel derived from deposits of glacial outwash, and are excessively and/or somewhat excessively well drained soils. They are less productive than both IA and IB soils, and are well suited for softwood production, especially white pine, with few limitations for forest management. See Appendix C for the names of soils found within each of these three categories.

Soils which offer the most suitable conditions for the growth of forest and timber can also be considered important in providing the best wildlife habitat.

### **Land Suitability Analysis**

Each of the resource areas has been mapped utilizing the GRANIT system, and analyzed in a series of steps in order to identify their protective status. That is, the composite of all of these resource areas was joined with the layer containing property boundaries of parcels in public/conservation ownership or under current use assessment. The following describes each of the maps in this series.

Groundwater Resources, Map 4-7 - is based on the USGS Groundwater Availability map series by John Cotton. It displays all potential aquifers, i.e. those features rated as having medium or high potential to yield groundwater. Total area of potential aquifers = 915 acres, or 2.2 percent of the watershed.

Surface Water Supply Watershed, Map 4-8 - shows the drainage area for the only surface water supply source within the watershed. The Jackson Pond/Sky Pond drainage area is 666 acres, or 1.6 percent of the watershed.

Agricultural Soils and Land Use, Map 4-9 - is based on two source data layers. The first source coverage is the watershed soils layer. All soil types rated as being agriculturally productive according to SCS were extracted from this layer (see Appendix C). The resultant areas are: 388 acres of unrestricted agricultural soils (or .9 percent of watershed), and 14 acres of restricted agricultural soils (or 0.0 percent of watershed). The second data layer displayed is agricultural land use, and was subsetted from the 1982 land use data layer. Total area in agricultural use in 1982 was 2,288 acres, or 5.4 percent of the watershed.

Productive Forest Soils, Map 4-10 - is based on the watershed soils layer. All soils rated as important forest soils by SCS were extracted from the soils data, resulting in 20,719 acres, or 48.9 percent of the watershed.

Productive Resources (Composite), Map 4-11 - represents all productive resources in the watershed, and was generated by "unioning" maps 4-7 through 4-10, as described above. The total area of productive resources as displayed on this map is 22,703 acres, or 53.5 percent of the watershed. Note that the sum of the individual acreages listed above exceeds this total, due to substantial feature overlap.

Currently Developed Land, Map 4-12 - displays all lands considered to be developed in 1982 - housing, commercial, industrial, and other urban land, based on aerial photo interpretation, supplemented by field checks. A total of 5,824 acres, or 13.7 percent of the watershed, falls within this category.

Remaining Productive Resources, Map 4-13 - displays undeveloped productive resources for the watershed. It was generated by subtracting Map 4-12 from Map 4-11, i.e. all developed lands were subtracted from the productive resources map. The map displays 17,161 acres, or 40.5 percent of the watershed, of undeveloped resources. It should be noted that 1,454 acres of developed land are not coincident with productive resources acreage.









Protective Status, Map 4-14 - represents lands protected by public/conservation ownership or easement, or lands in current use. A total of 2,030 acres, or 6.9 percent of the watershed are under public/conservation ownership or easement and 13,345 acres, 38.6 percent are in current use.

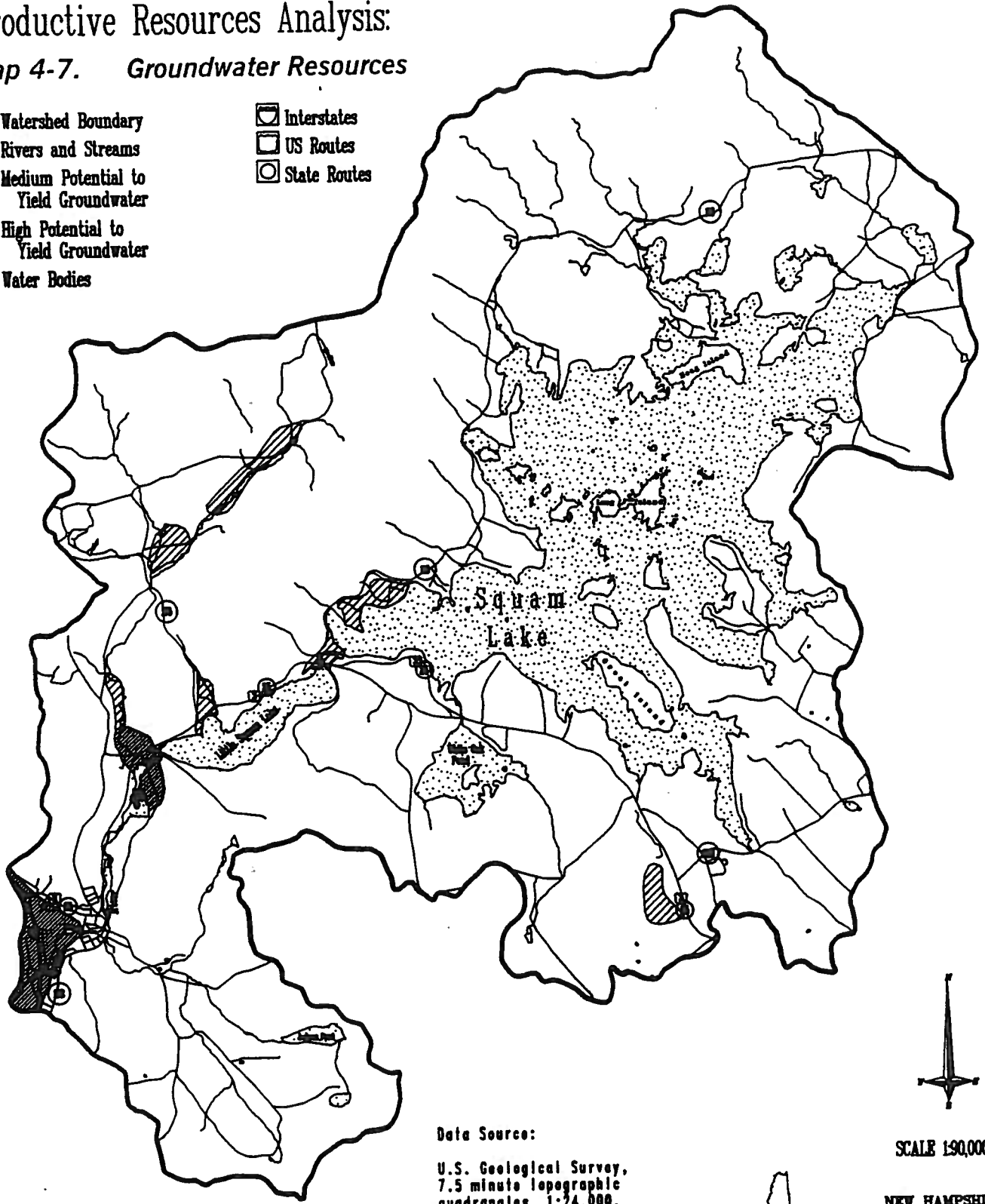
Productive Resources Not Protected or in Current Use, Map 4-15 - This map was generated by subtracting Map 4-14 from Map 4-13. The total acreage of unprotected resources is 9,300 acres, or 21.9 percent of the watershed.

# SQUAM LAKES WATERSHED

## Productive Resources Analysis:

### Map 4-7. Groundwater Resources

- |   |  |
|---|--|
|  Watershed Boundary                    |  Interstates  |
|  Rivers and Streams                    |  US Routes    |
|  Medium Potential to Yield Groundwater |  State Routes |
|  High Potential to Yield Groundwater   |  |
|  Water Bodies                          |  |



**Data Source:**

U.S. Geological Survey,  
7.5 minute topographic  
quadrangles, 1:24,000.

U.S. Geological Survey,  
"Availability of Ground-  
water" Map Series,  
1:125,000, 1975.

**Analysis By:**

Complex Systems Research Center,  
University of New Hampshire,  
January 1990.

SCALE 1:90,000

NEW HAMPSHIRE



Geographically Enhanced Analysis  
and Information Transfer System










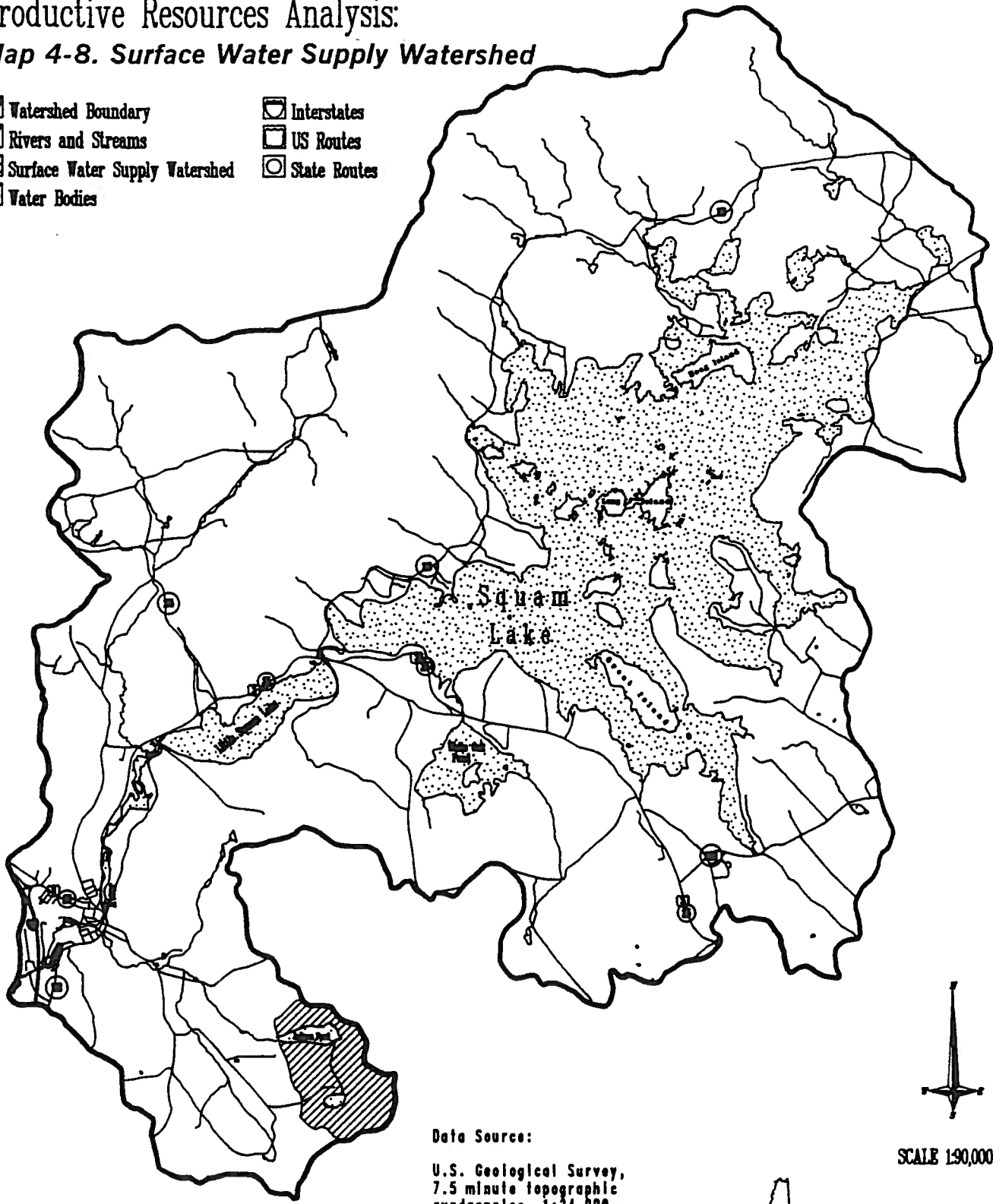


# SQUAM LAKES WATERSHED

## Productive Resources Analysis:

### Map 4-8. Surface Water Supply Watershed

- |  |  |
|--|--|
|  Watershed Boundary             |  Interstates  |
|  Rivers and Streams             |  US Routes    |
|  Surface Water Supply Watershed |  State Routes |
|  Water Bodies                   |  |



#### Data Source:

U.S. Geological Survey,  
7.5 minute topographic  
quadrangles, 1:24,000.

Water Supply Area mapped  
by NH Office of State  
Planning on mylar quad  
overlays, 1:24,000, 1989.

#### Analysis By:

Complex Systems Research Center,  
University of New Hampshire,  
May 1990.

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Center for Regional and Interdisciplinary Studies

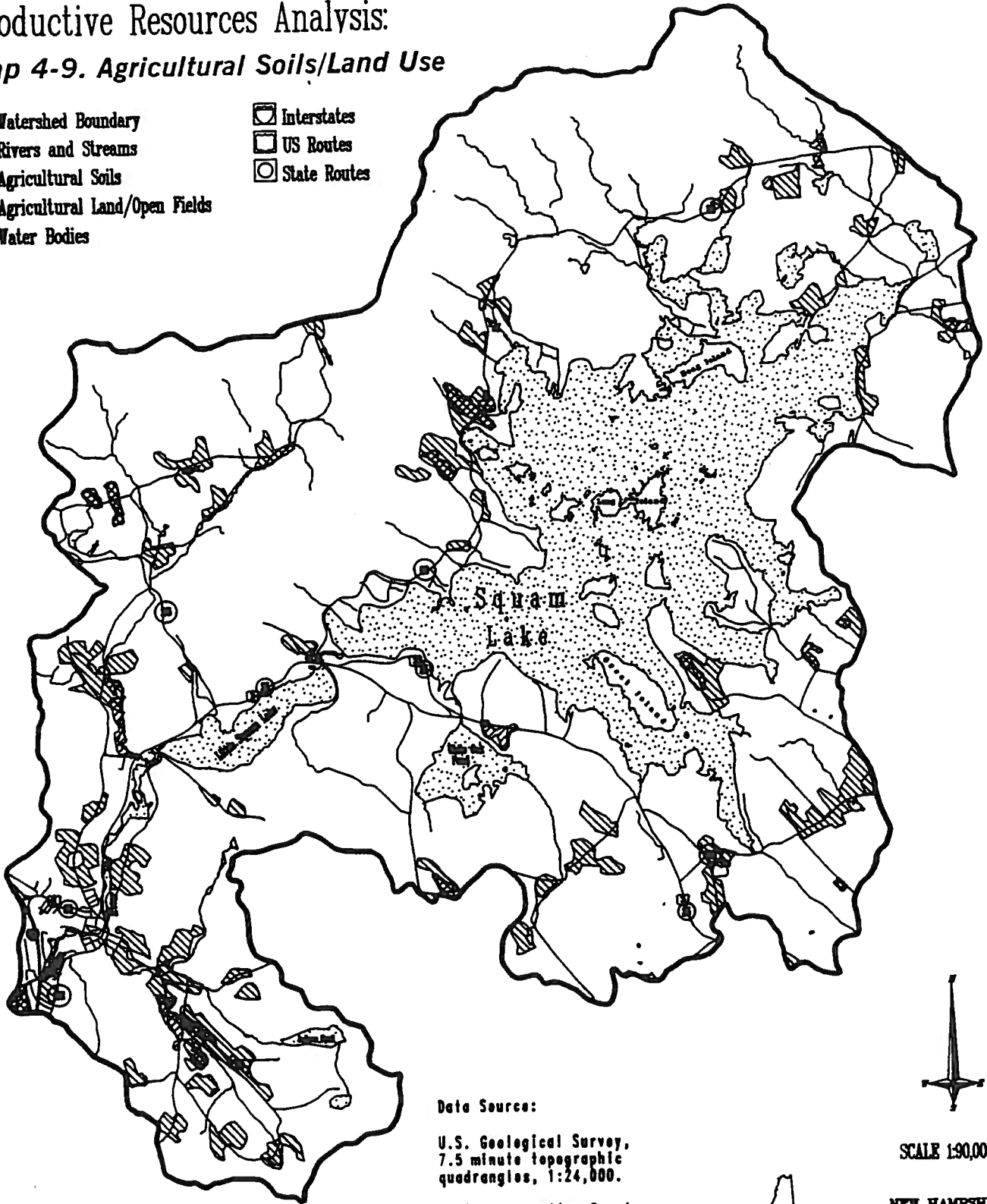


# SQUAM LAKES WATERSHED

## Productive Resources Analysis:

### Map 4-9. Agricultural Soils/Land Use

- |   |  |
|---|--|
|  Watershed Boundary            |  Interstates  |
|  Rivers and Streams            |  US Routes    |
|  Agricultural Soils            |  State Routes |
|  Agricultural Land/Open Fields |  |
|  Water Bodies                  |  |



#### Analysis By:

Complex Systems Research Center,  
University of New Hampshire,  
May 1990.

#### Data Source:

U.S. Geological Survey,  
7.5 minute topographic  
quadrangles, 1:24,000.

Soil Conservation Service  
Atlas Sheets, 1:20,000.

Forest Resources Department,  
University of New Hampshire,  
1:24,000 quad overlays.



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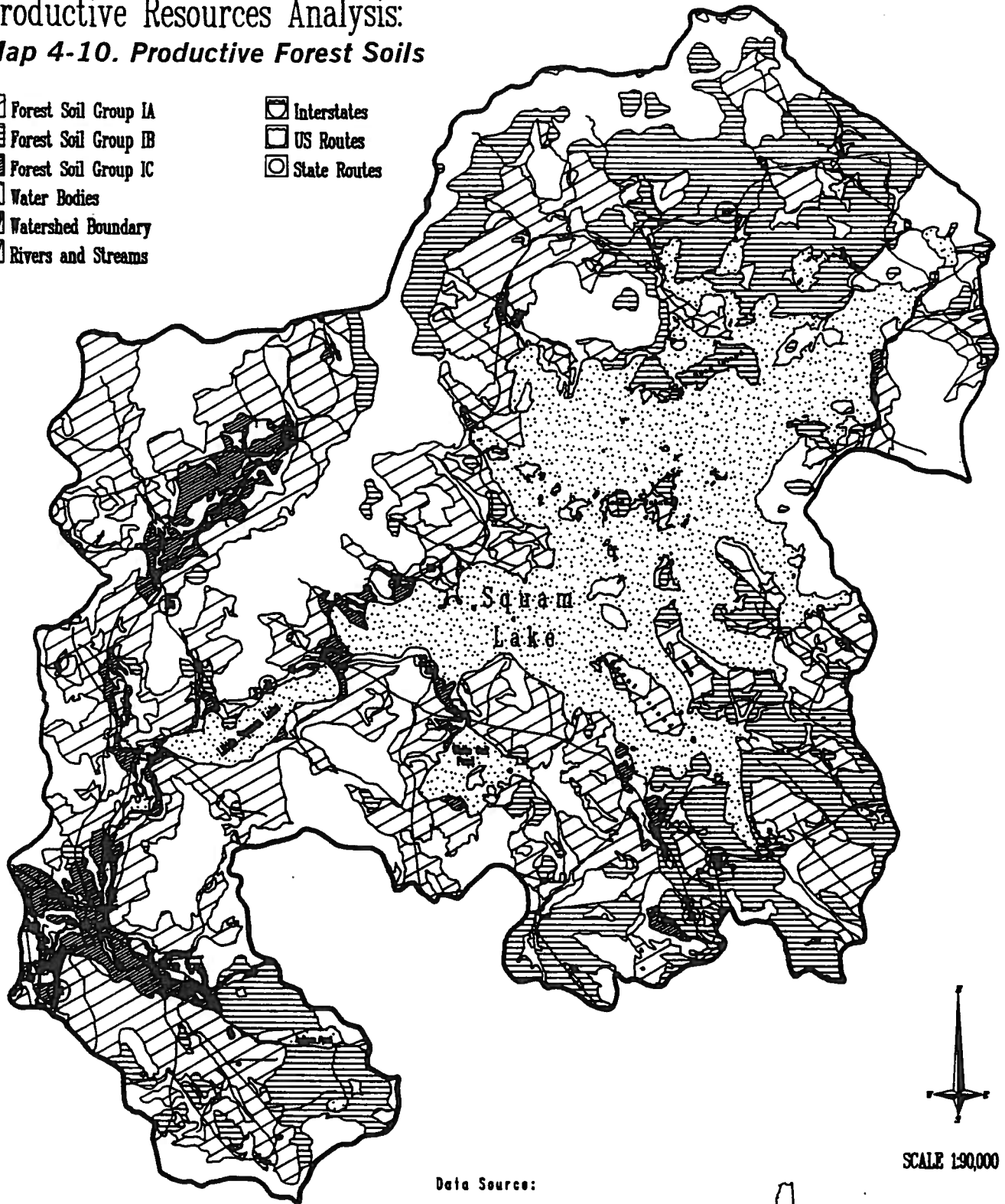
Geospatial Information Analysis  
and Information Transfer System

# SQUAM LAKES WATERSHED

## Productive Resources Analysis:

### Map 4-10. Productive Forest Soils

- ▨ Forest Soil Group IA
- ▨ Forest Soil Group IB
- ▨ Forest Soil Group IC
- ◻ Water Bodies
- ▮ Watershed Boundary
- ▮ Rivers and Streams
- ▭ Interstates
- ▭ US Routes
- State Routes



Analysis By:

Complex Systems Research Center,  
University of New Hampshire,  
August 1990.

Data Source:

U.S. Geological Survey,  
7.5 minute topographic  
quadrangles, 1:24,000.

Soil Conservation Service  
Atlas Sheets, 1:20,000.



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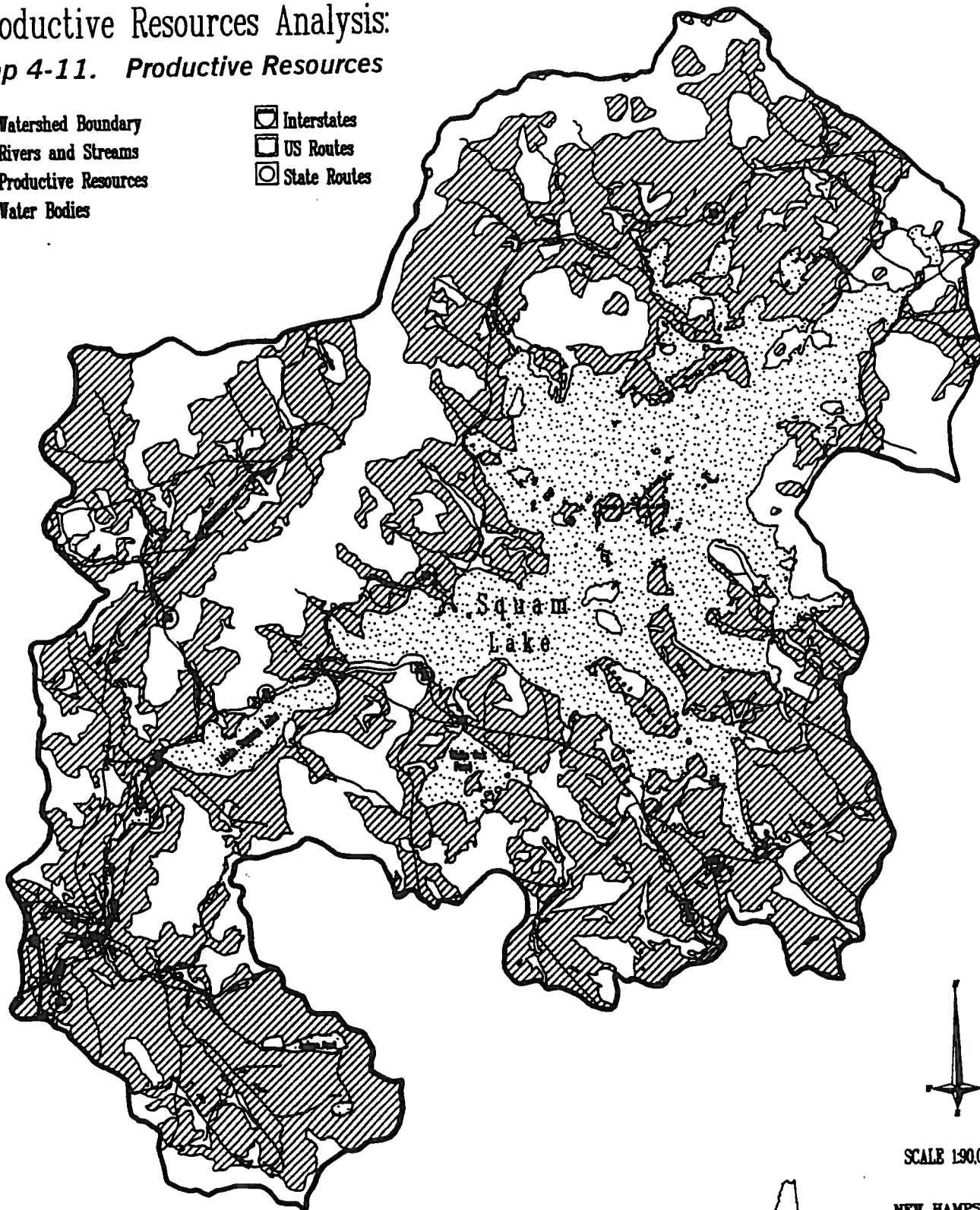
Geographically Referenced Analysis  
and Information Transfer System

# SQUAM LAKES WATERSHED

## Productive Resources Analysis:

### Map 4-11. Productive Resources

- |  |  |
|--|--|
|  Watershed Boundary   |  Interstates  |
|  Rivers and Streams   |  US Routes    |
|  Productive Resources |  State Routes |
|  Water Bodies         |  |



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Complex Systems Research Center,  
University of New Hampshire,  
January 1990.



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







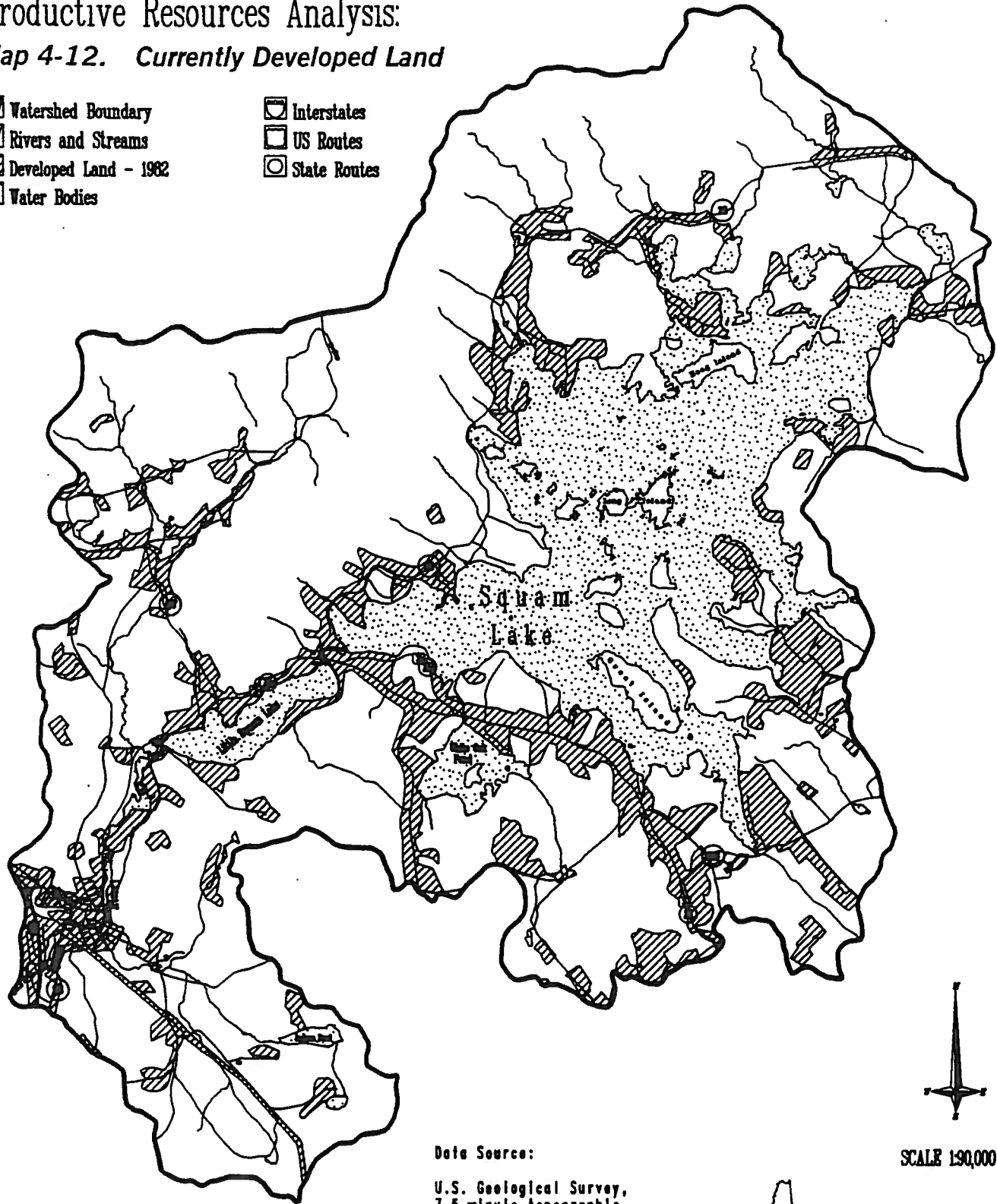
Geographically Referenced Analysis  
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# SQUAM LAKES WATERSHED

## Productive Resources Analysis:

### Map 4-12. Currently Developed Land

-  Watershed Boundary
-  Rivers and Streams
-  Developed Land - 1982
-  Water Bodies
-  Interstates
-  US Routes
-  State Routes



SCALE 1:90,000

Data Source:  
U.S. Geological Survey,  
7.5 minute topographic  
quadrangles, 1:24,000.

Forest Resources Department,  
University of New Hampshire,  
1:24,000 quad overlays.



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Geographically Referenced Analysis  
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Analysis By:

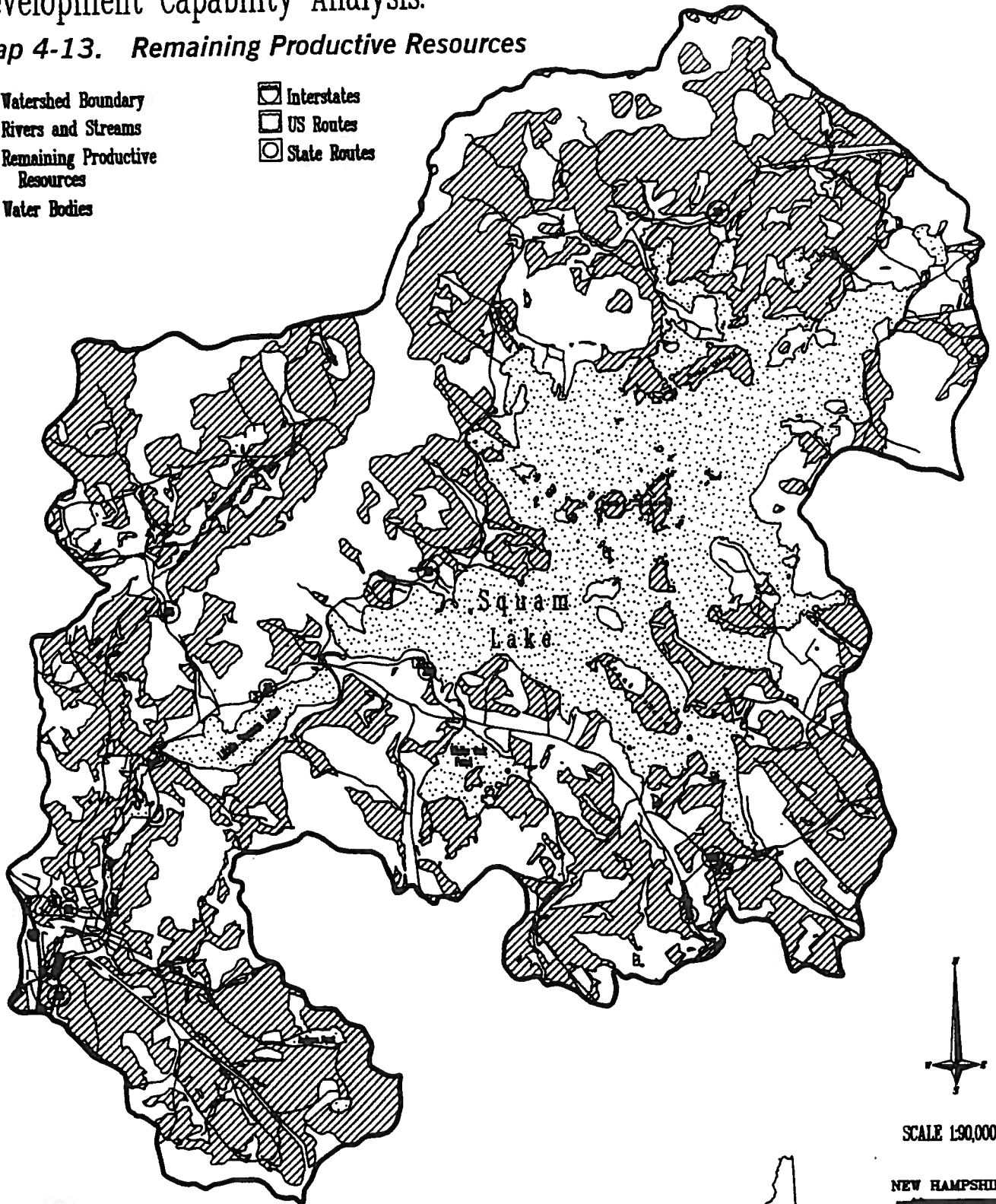
Complex Systems Research Center,  
University of New Hampshire,  
January 1990.

# SQUAM LAKES WATERSHED

## Development Capability Analysis:

### Map 4-13. Remaining Productive Resources

-  Watershed Boundary
-  Rivers and Streams
-  Remaining Productive Resources
-  Water Bodies
-  Interstates
-  US Routes
-  State Routes



Analysis By:

Complex Systems Research Center,  
University of New Hampshire,  
January 1990



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Geographic Information Systems  
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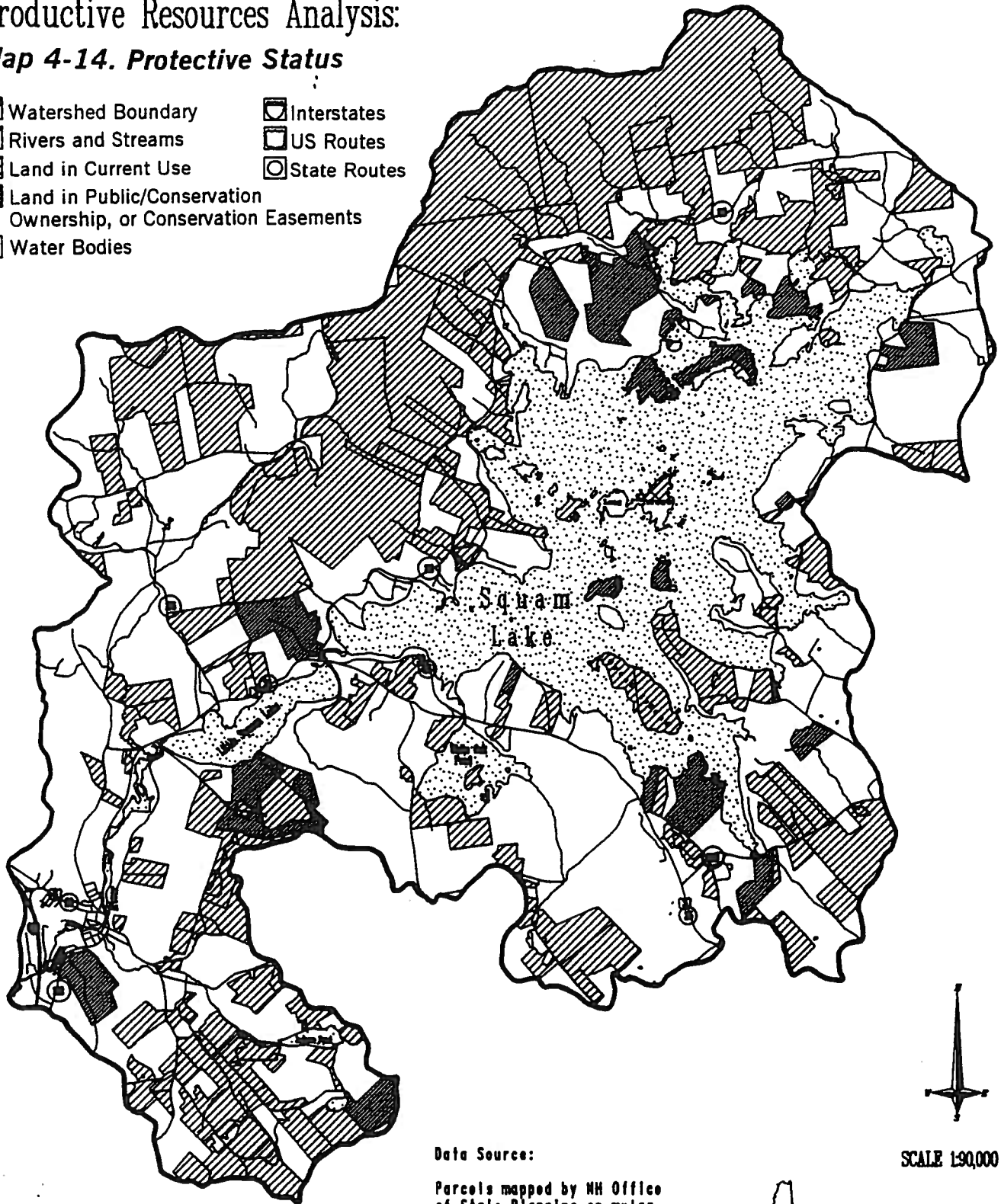


# SQUAM LAKES WATERSHED

## Productive Resources Analysis:

### Map 4-14. Protective Status

-  Watershed Boundary
-  Rivers and Streams
-  Land in Current Use
-  Land in Public/Conservation Ownership, or Conservation Easements
-  Water Bodies
-  Interstates
-  US Routes
-  State Routes



#### Data Source:

Parcels mapped by NH Office of State Planning on mylar quad overlays, 1:24,000, 1989.

U.S. Geological Survey, 7.5 minute topographic quadrangles, 1:24,000.



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#### Analysis By:

Complex Systems Research Center,  
University of New Hampshire,  
May 1990.



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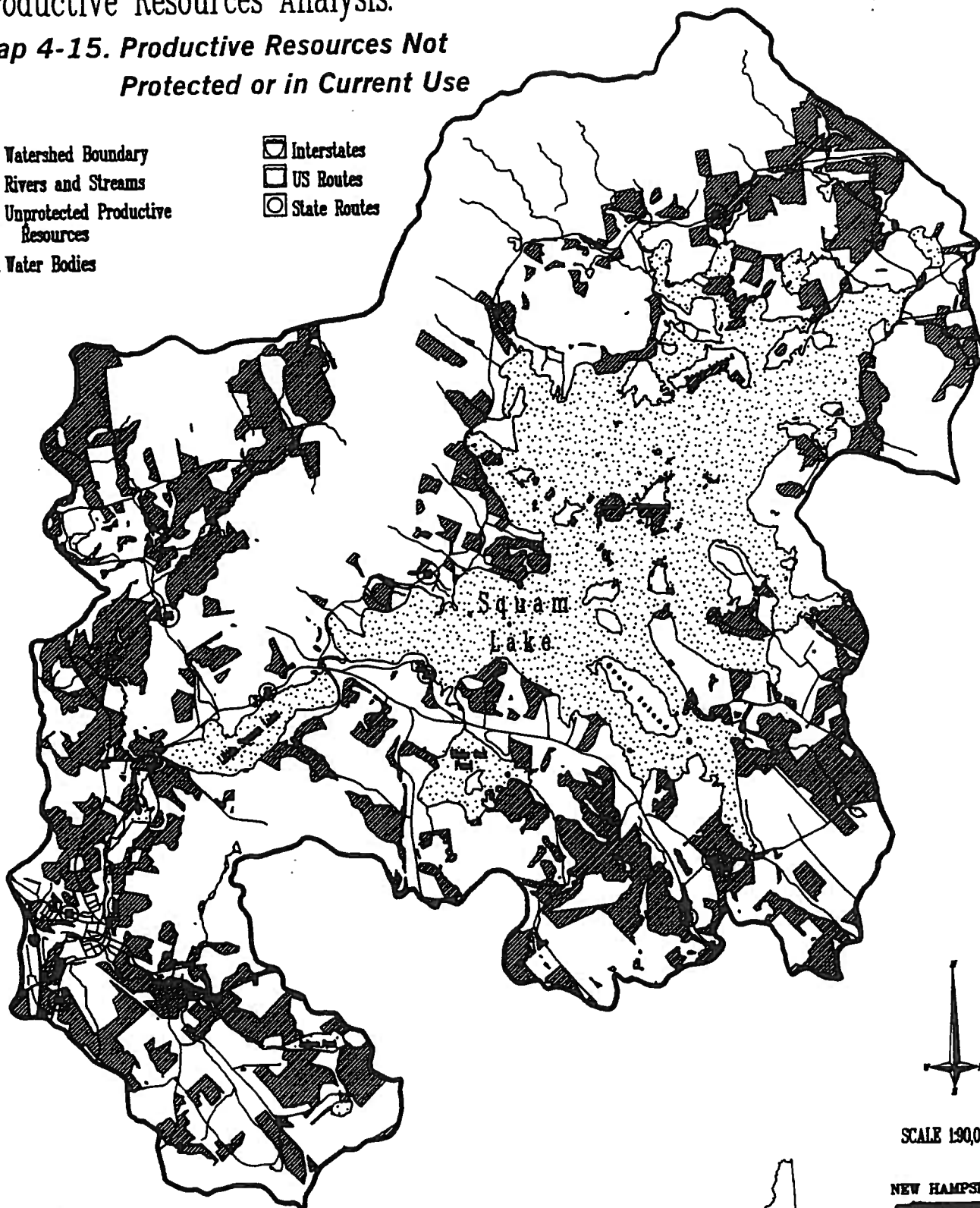
Geographically Referenced Analysis and Information Transfer System

# SQUAM LAKES WATERSHED

## Productive Resources Analysis:

### Map 4-15. Productive Resources Not Protected or in Current Use

- |  |  |
|--|--|
|  Watershed Boundary               |  Interstates  |
|  Rivers and Streams               |  US Routes    |
|  Unprotected Productive Resources |  State Routes |
|  Water Bodies                     |  |



Analysis By:

Complex Systems Research Center,  
University of New Hampshire,  
January 1990.

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Complex Systems Research Center  
and Watershed Studies System





## **Recommendations**

### **Areas with Severe Environmental Limitations**

The following recommendations address the need for consistency between the environmental limitations present in the areas identified in Table 4-2, and the density and type of development allowed in these areas.

#### **Wetlands**

**Communities should protect wetlands by regulating encroachments of development and by adopting wetlands overlay districts as part of their zoning ordinances.**

**Local conservation commissions should actively seek to protect wetlands through inventorying their wetlands and promoting added protection through acquisition, conservation easements and Prime Wetlands designation.**

#### **Floodplains**

**Communities should recognize floodplains as important resource areas deserving of protection, and discourage inappropriate land uses.**

**Communities should adopt floodplain overlay districts to local zoning as a means of regulating land use in these areas.**

#### **Steep Slopes**

**Municipal zoning ordinances should discourage development in areas with slopes in excess of 25 percent. Communities should limit development on slopes between 15 and 25 percent to areas having suitable house sites, and require special measures for stormwater runoff and erosion control, site clearing and planting practices, appropriate septic system design, and larger lot size minimums.**

#### **Shoreland Overlay Districts**

**A shoreland overlay district extending 250 feet landward from the mean high water level of all lakes and ponds is recommended to the municipalities in the Squam Lakes watershed. This should be incorporated as part of their zoning ordinances to achieve the public purposes listed below. The following performance standards are recommended as a requirement for this district:**

### Vegetative Buffer

A minimum buffer of 50 feet of natural vegetation from the shoreland should be required around lakes and ponds. Restrictions on clearing natural vegetation along the water's edge are an important measure, since these vegetated strips filter out pollutants from stormwater runoff including sediments, nutrients from lawn fertilizers and agricultural pesticides. A buffer of natural vegetation also serves to protect the aesthetic character of the shoreline, as well as provide limited wildlife habitat (travel corridors), and cooler water temperatures. Greater vegetative buffer distances are recommended in those shoreland areas possessing exceptional wildlife habitats, such as loon nesting or brooding areas. Within this buffer strip, selected and dispersed cutting of trees and understory growth may be allowed through special permit approval for wildlife management, or to create a view of the water.

To complement the maintenance of a 50 foot vegetative buffer through zoning, municipal conservation commissions should seek to secure additional distance setbacks of natural cover through landowner education, purchase of conservation easements and other strategies.

State timber harvesting laws limit the removal of trees to not more than 50 percent of the basal area of the standing timber within 150 feet of a great pond or navigable river, and within 50 feet of any stream or wetland (RSA 224:44a). With this State standard as a lower limit, the vegetative buffer should result in less disturbance in shoreland areas identified by the town as environmentally sensitive. The State legislature should amend RSA 224:44a to specify a time period of 15 years during which the cutting of 50 percent of basal area is calculated.

### Septic System Setback

Subsurface disposal systems (leaching fields) for septic wastes should not be permitted within 125 feet of the mean high water mark of lakes in Class A watersheds. Within Class B and C watersheds, the 125 foot minimum for lakefront property may be waived provided that an applicant submits sufficient site specific evidence, such as soils, to indicate that a lesser setback will not adversely affect the water quality of the waterbody. The State should revise its regulations to reflect this recommendation.

### Structure Setback

Shoreland overlay districts should require that residential structures be set on the lot substantially back from the shoreline.

### **Cluster Development**

In shoreland areas where the 250 feet zone contains important wildlife habitat or areas of exceptional scientific and educational value, especially rare and unusual flora, fauna and other natural features, proposals for the subdivision of land into three or more lots for residential or other development should be required to utilize a cluster design, and to site development away from important natural resource areas.

### **Shore Frontage**

Municipal zoning ordinances should require that there be a minimum shore frontage of 200 feet for lots on public waters, this distance being the average of the straight line distances between the points where the side lot lines extend across the public boundary line and the curvilinear distance between these two points measured along the shoreland.

### **Building Lot Size**

Municipal zoning ordinances should require that lots abutting public waters be a minimum of 1 acre in area.

### **Building Height**

Municipal zoning ordinances should be amended to require that the maximum height of any structure within the shoreland district be 35 feet measured from average ground level around the structure to the highest point on the roof.

### **Erosion Control**

Municipal building codes should be amended to require that all new structures within the shoreland district be designed and constructed to minimize erosion and sedimentation of public waters, both during and after construction. Provisions should be added to the building codes to require that any erosion and sedimentation control structures or measures should be maintained by the landowner as a condition of the certificate of occupancy.

### **Stormwater Management**

Local subdivision and site plan review regulations and building codes should require that the design of drainage systems utilize open, vegetated drainage swales as opposed to pipes or culverts within the shoreland district to handle stormwater flows. Alternative structural measures should only be allowed where swales are not practical, such as under driveways or where there is a potential for contaminated runoff to infiltrate the groundwater.

### **Parking Lots, Driveway Surfaces**

In order to keep impervious land cover to a minimum, driveways and parking lots within the shoreland district should be constructed of gravel or other natural material through which stormwater can percolate into the underlying soil. Municipal planning boards are urged to require the use of porous pavement, through their subdivision and site plan review regulations.

### **Dug-in Boat Slips**

Local planning boards and conservation commissions should adopt a position of discouraging the permitting of dug-in boat slips on shorefront property, because of the significant and permanent alteration of the natural shoreline which results, and the attendant siltation and dredging required to maintain these boating facilities. The State Wetlands Board should amend its rules to disallow dug-in boat slips.

### **Fertilizers and Pesticides**

The application of fertilizers, herbicides and pesticides for noncommercial, private purposes within the shoreland district should be discouraged. Through their subdivision and site plan review regulations, municipal planning boards can require that developers and landowners leave the natural vegetation and not plant lawns near the water's edge. This recommendation complements the requirement for a vegetative buffer, and furthers water quality goals. Commercial application of pesticides for agricultural purposes is subject to current State regulations, and should conform to best management practices as defined by SCS. Conservation commissions should promote best management practices by encouraging landowners to work with county cooperative extension agricultural agents and conservation districts to develop sound management plans for their property.

### **Restricted Land Uses/Activities**

**Land uses or activities which pose a threat to surface or groundwater quality should be prohibited by municipal zoning from the shoreland district. Uses to be prohibited include: auto junkyards, salt storage piles, solid or hazardous waste facilities and underground storage tanks.**

### **Areas with Productive Resources**

The following are recommendations concerning measures by which towns can act to protect areas possessing important productive resource values.

**Municipalities should encourage the application for current use by landowners who possess parcels with productive agricultural and forest soils, as a means of protecting and managing these valuable areas. Written management plans for parcels under the forestry category in current use should be required as a condition, and monitored by the town selectmen.**

**Cluster development and other innovative land use control mechanisms should be encouraged, where suitable, as an alternative to tract subdivision, in order to preserve lands with valuable resources - surface water supplies, aquifers, areas with prime forest soils and agricultural lands.**

**Town conservation commissions and private conservation organizations should encourage the acquisition of land and conservation easements to protect natural and scenic resources.**

### **Information and Technical Assistance**

**When implementing the recommendations for this chapter, municipalities within the Squam Lakes watershed are encouraged to seek assistance from the Lakes Region Planning Commission, county conservation districts, and other agencies concerned with land use planning.**



## Chapter 5. Water Quality

### Lake Water Quality Trends

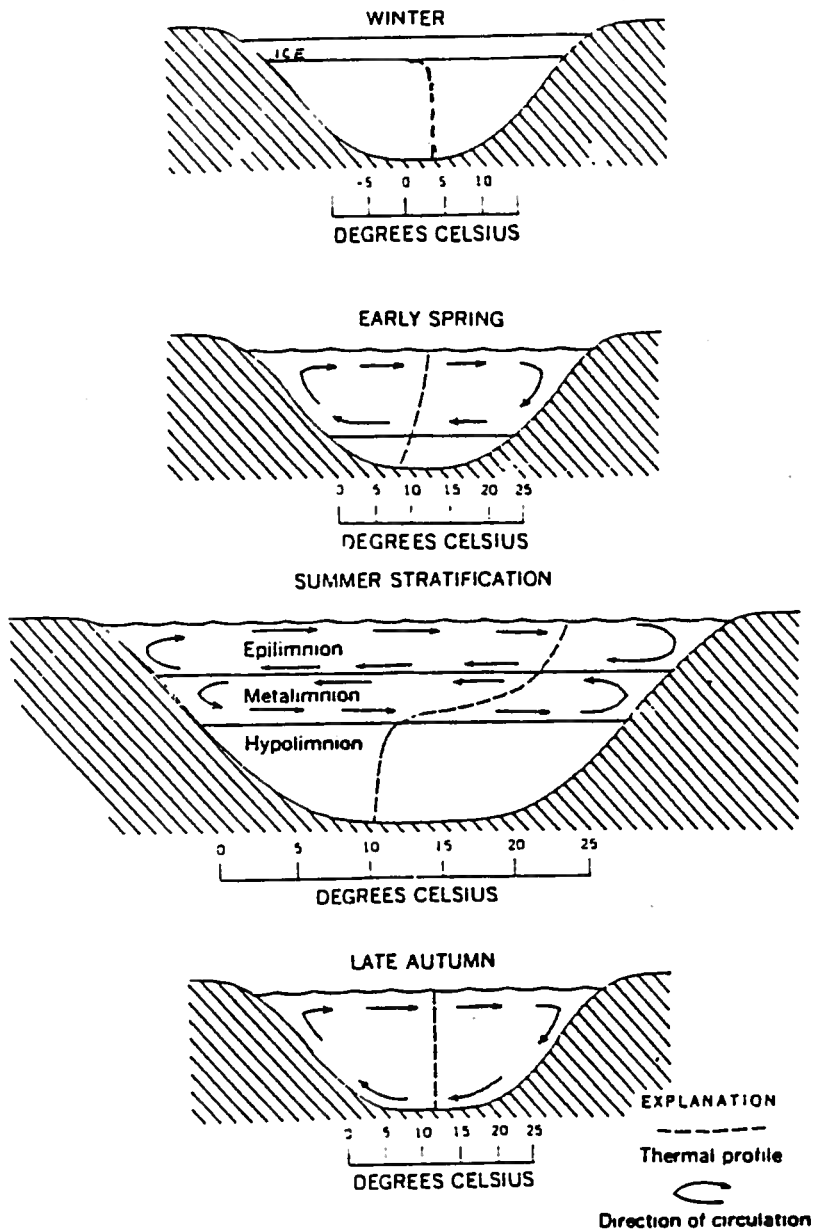
#### Overview

In order to obtain an accurate overall perspective about the water quality of Squam Lake, it is important to consider the lake's morphology. As noted in Chapter 3, Squam Lake has an extremely irregular shape, with numerous cove and bay areas, and significant variability in depth. Over time, these areas have been found to function somewhat independently of each other, and of the deeper sites of the lake. They allow significant vertical mixing of the water column, but do not permit complete exchange with the rest of the lake. Also, because the subwatersheds that provide drainage into Squam's cove areas differ widely in terms of elevation and drainage characteristics, there are likely to be differences among them in terms of nutrient inputs, both natural and man-made. For example, the lake receives inflow from many perennial streams in the northwest portion of the Squam watershed, but only from intermittent streams in the southwestern area. Two other characteristics of the watershed that are especially likely to have water quality impacts are the relative steepness of the area, and the large percentage of the watershed which is composed of the lakes themselves, almost twenty percent. Development in steeply sloped areas generally presents greater risks of surface water pollution. On the other hand, the relatively low ratio of land to water in the watershed works in favor of maintaining surface water quality, since there is less land area where development can take place, as compared to many other lake watersheds with greater land to water ratios.

In terms of nutrient dynamics, the deeper sites of Squam Lakes are distinct from the shallower cove areas. The open water areas are deeper basins that can assimilate a larger nutrient load. These areas of the lake generally become stratified during the summer, so that the lower water layers cannot mix with the surface waters, a pattern typical of a northern dimictic lake. The upper and lower layer circulate independently, and have different chemistries. One result of this is that nutrients are trapped within the bottom water layer, or hypolimnion.

Because of these differences between the deeper and shallower areas of Squam Lake, it is important to consider water quality trends for Squam Lake as a whole, as well as possible water quality trends in Squam's cove areas. This is necessary in order to consider possible subtle changes that may be occurring in these relatively isolated areas of Squam Lake, changes that cumulatively, over time, may impact upon the lake as a whole. It is for similar reasons that the UNH Lakes Lay Monitoring program considers it important to monitor several sites on Squam Lake each summer, both deep and shallow, in order to provide an accurate analysis of the lake's water quality.

Figure 5-1. Lake Stratification



Source: Britton, Averett and Ferriera, *An Introduction to the Process, Problems and Management of Urban Lakes*, 1977.



Such a dual analysis is not necessary for Little Squam Lake, whose water quality can be assessed adequately from data taken consistently at a few points, since the lake is smaller in size, and has a regular, more uniform shape and depth than Squam Lake.

Measurements of several lake parameters have been taken every year at Squam Lake for the last 11 years, though data had also been collected periodically for the lake since the 1950's. Data on chlorophyll a, water transparency and dissolved color have been obtained every one to two weeks in the summer by local volunteers participating in the UNH Lakes Lay Monitoring Program. Lay monitors have also done sampling for alkalinity two to three times per summer. The processing of samples is done by the UNH Freshwater Biology Group, which coordinates the lay monitoring program and also does sampling for the above parameters two to three times per summer. At those times, UNH personnel also obtain data on dissolved oxygen, temperature, total phosphorus, pH, specific conductivity, carbon dioxide, phytoplankton and zooplankton. The Biology Bureau of the Water Supply and Pollution Control Division of the Department of Environmental Services monitors the Squam Lakes once every several years. Both the UNH and DES programs, including their respective lay monitoring programs, have an important role to play in protecting the water quality of New Hampshire lakes, and their cooperation and coordination is key in achieving this protection.

Various parameters - chlorophyll a, water transparency, phosphorus, dissolved oxygen, and vascular plant and phytoplankton species can be used to classify lakes in terms of their productivity, or trophic level.<sup>1</sup> However, the UNH Lakes Lay Monitoring Program has focused on three of these parameters, chlorophyll a, water transparency and phosphorus, in order to try to identify trophic levels. Data on these three parameters can be obtained more conveniently, consistently, and inexpensively than data on the other water quality parameters listed. Also, UNH feels that these parameters allow for the investigation of seasonal variations in productivity, while the summer averages afford a commonly accepted trophic classification scheme.<sup>2</sup> Local lay monitors can take weekly secchi disk readings, get chlorophyll a water samples and do partial processing of samples themselves. On the other hand, obtaining data on dissolved oxygen and plant species/abundance requires more complicated sampling and/or analysis methods. Since Squam Lake has relatively little aquatic plant growth, algae (phytoplankton) represent the majority of the lake's productivity, and thus chlorophyll a measurements are considered a better productivity or trophic state indicator.

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<sup>1</sup> NH Department of Environmental Services, WSPCD, Biology Bureau, *NH Lakes and Ponds Inventory, Vol IV, 1988.*

<sup>2</sup> UNH Lakes Lay Monitoring Program, 1989.

## **Chlorophyll a**

Chlorophyll a is the green pigment found in all plants, and is fundamental to photosynthesis, the process by which green plants produce the food which is necessary for their survival. The greater the concentration of chlorophyll a that is measured in lake water, the larger the algal population is likely to be. Algae blooms can result in increases in chlorophyll a levels at various times, from spring through fall. Levels would be expected to be higher in relatively pristine lakes like Squam after lake turnover, when more nutrients become available to phytoplankton because of the mixing that occurs. In lakes that experience a sizeable amount of nutrient loading in the summer months due to human activity, algae density would be likely to remain high throughout the season.<sup>3</sup>

## **Water Transparency**

The transparency of a lake depends on the amount of dissolved and/or particulate matter which is available to absorb and scatter light. This particulate matter is comprised of both living as well as non-living particles. A secchi disk is used to measure water transparency. The greater the depth at which the disk disappears, the clearer the lake is. Clear, less productive lakes are known to have secchi disk depths of greater than 4.0 meters. Increases in dissolved color can lower water transparency, and this can make a lake appear to be more productive than it actually is. Sediment loading resulting from poor soil conservation practices for various land use activities can also decrease water transparency. Transparency is known to fluctuate throughout a sampling season due to variations in lake productivity. This highlights the importance of consistently taking measurements over time.

## **Phosphorus**

Phosphorus is considered to be the primary limiting factor for plant growth in a New Hampshire lake. While it is normally present in lakes, its presence in relatively high concentrations (levels over 15 parts per billion) is considered to encourage productivity of phytoplankton species. Phosphorus levels are known to fluctuate widely throughout a sampling season, and from site to site due to variations in lake dynamics and plant activity. This makes it difficult to compare phosphorus data taken at different times. In order to obtain statistically valid numbers that can indicate the true influence of phosphorus levels on lake productivity, phosphorus sampling should be done frequently and consistently at the same sites over time.

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<sup>3</sup> Ibid.

It takes approximately 4.3 years for the waters of the Squam Lake to be flushed out and replaced.<sup>4</sup> This means that dilution and dispersion of phosphorus and other nutrients will be relatively slow, making it more likely that the water quality of Squam Lake will be affected by development occurring within the watershed.

Table 5-1a describes the trophic classification system used by the UNH Lakes Lay Monitoring Program, based on chlorophyll *a*, secchi disk and total phosphorus. The Department of Environmental Service's classification system is found in Table 5-1b. As can be seen, the two systems use somewhat different combinations of parameters to determine lake productivity, and also use different methods for calculating trophic status.

**Table 5-1a. Trophic Classification - UNH Lakes Lay Monitoring Program**

	Chlorophyll <i>a</i> (mg/m <sup>3</sup> )	Water Transparency (m)	Total Phosphorus (ppb)
Eutrophic	>7.0 mg/m <sup>3</sup>	< 1.8	>25.0*
Mesotrophic	3.0 - 7.0 mg/m <sup>3</sup>	1.8 - 4.0	15.0 - 25.0*
Oligotrophic	<3.0 mg/m <sup>3</sup>	>4.0	<15.0

Note: \* Concentrations above 15.0 ppb can cause algae blooms

Source: UNH LLMP, 1989

#### Dissolved Color

A lake's dissolved color is generally determined by the amount of dissolved organic matter present from humic substances, which are leached from decayed vegetation. Lakes with a higher amount of such substances are likely to have a tea color, but their water quality is not likely to be affected unless there is a significant decrease in the amount of sunlight penetration into the deeper water. Deforestation and resulting soil erosion can also cause increased dissolved color.

<sup>4</sup> NH WSPCD, *Classification and Priority Listing of NH Lakes*, 1981.

**Table 5-1b. DES Trophic Classification System for New Hampshire Lakes and Ponds**

		<b>TROPHIC POINTS</b>
<b>1. Summer Bottom Dissolved Oxygen:</b>		
a.	D.O. $\geq$ 5mg/l .....	0
b.	2mg/l $\leq$ D.O. < 5mg/l & <30 foot depth .....	1
c.	2mg/l $\leq$ D.O. < 5mg/l & $\geq$ 30 foot depth .....	2
d.	.5mg/l $\leq$ D.O. < 2mg/l & <30 foot depth .....	3
e.	.5mg/l $\leq$ D.O. < 2mg/l & $\geq$ 30 foot depth .....	4
f.	D.O. < .5mg/l & <30 foot depth .....	5
g.	D.O. < .5mg/l & $\geq$ 30 foot depth .....	6
<b>2. Summer Secchi Disk Transparency:</b>		
a.	> 24 feet .....	0
b.	> 12 feet to 24 feet .....	1
c.	> 6 feet to 12 feet .....	2
d.	> 3 feet to 6 feet .....	3
e.	> 1 foot to 3 feet .....	4
f.	> .5 foot to 1 foot .....	5
g.	$\leq$ .5 foot .....	6
<b>3. Aquatic Vascular Plant Abundance:</b>		
a.	Sparse .....	0
b.	Scattered .....	1
c.	Common .....	2
d.	Abundant .....	3
e.	Very Abundant .....	4
<b>4. Summer Epilimnetic Chlorophyll <u>a</u> (mg/M<sup>3</sup>):</b>		
a.	Chl <u>a</u> < 5 .....	0
b.	5 $\leq$ Chl <u>a</u> < 10 .....	1
c.	10 $\leq$ Chl <u>a</u> < 20 .....	3
d.	Chl <u>a</u> $\geq$ 20 .....	5

<u>TROPHIC CLASSIFICATION</u>	<b>TROPHIC POINTS</b>	
	<u>STRATIFIED</u>	<u>*UNSTRATIFIED</u>
Oligotrophic	0-5	0-3
Mesotrophic	6-10	4-6
Eutrophic	11-21	7-15

\* Unstratified lakes are not evaluated by the bottom dissolved oxygen criterion.

## Water Quality Trends - Squam Lake

Total phosphorus levels have fluctuated from year to year in Squam Lake, but have generally stayed well below the 15.0 ppb (parts per billion) level. Recent phosphorus values obtained in 1987 for the lake as a whole (9 sites were sampled) have been in the range of 1.0 to 7.0 ppb, with an average of 3.0 ppb. In 1988 the range was 1.0 - 11.0 ppb, with average total phosphorus values of 5.0 ppb, and in 1989, all samples were in the range of 0.2 to 9.5 ppb. These values are a likely indication that generally speaking, Squam is not receiving significant nutrient loading. However, there have occasionally been some rather high phosphorus values obtained at both Deep Haven and Loon Reef (over 15.0 ppb). UNH is monitoring these areas, especially because stratifications of algae have been spotted by divers in these same areas in recent years, in the metalimnion, the layer that separates the warmer upper layer of water from the lower colder layer. Observations of nuisance blue-green algae have also been documented at deep sites in DES's 1988 inventory of Squam Lake, as well as a Harvard Study and a study done by the Lakes Region Planning Commission in the 1970's (see Appendix D). At present, there is a need for tributary data in order to develop a clearer picture of the amount of phosphorus loading that is occurring in Squam Lake.

The Biology Bureau of DES WSPCD (Water Supply and Pollution Control Division) obtained total phosphorus data for Squam Lake in its two surveys (1979 and 1988) done within the past 10 years. The sampling was done at three sites, all of them deep: off of Moon Island, at Deep Haven, and off of Hoag Island. Total phosphorus values ranged from 1.0 to 5.0 ppb in 1979 and 7.3 to 9.0 ppb in 1988. These numbers are within the range determined by UNH in recent years.

Within the last eleven years, the water transparency of Squam Lake as a whole has been very good, with average transparency values per season ranging from 6.4 to 8.3 meters. This is an indication that generally, the lake is clear and of low productivity. The most recent lay monitoring data for 1987 and 1988 has fallen well within the ranges for previous years. In 1987, water transparency at the deep sites was in the range of 5.5 to 10.0 meters, with an average of 8.3 meters. In 1988, Squam Lake's water transparency was generally equal to or greater than the average of 1979-1988 values. Average transparency values were a full meter lower in 1989, which might be an indication of a substantial decrease in water transparency, but also could be due to the fact that the 1989 sampling session was more limited.

The Biology Bureau of DES obtained water transparency values for Squam Lake in its two different surveys of Squam Lake in recent years (1979 and 1988). Sampling of values for all three sites ranged from 6.1 to 7.7 meters in 1979, and from 7.7 to 8.1 meters in 1988. Due to the limited number of observations, it is not possible to discern trends. However, these figures do support the UNH lay monitoring data, though it should be noted that sampling methods between DES and UNH differ somewhat. UNH lay monitors use a scope when observing secchi disk depth to avoid glare, while UNH does not.


Average chlorophyll a values, obtained from the Lakes Lay Monitoring data for Squam Lake as a whole, have been fairly consistent. They range from 0.7 to 2.5 mg/m<sup>3</sup> since frequent sampling was begun in 1979. These

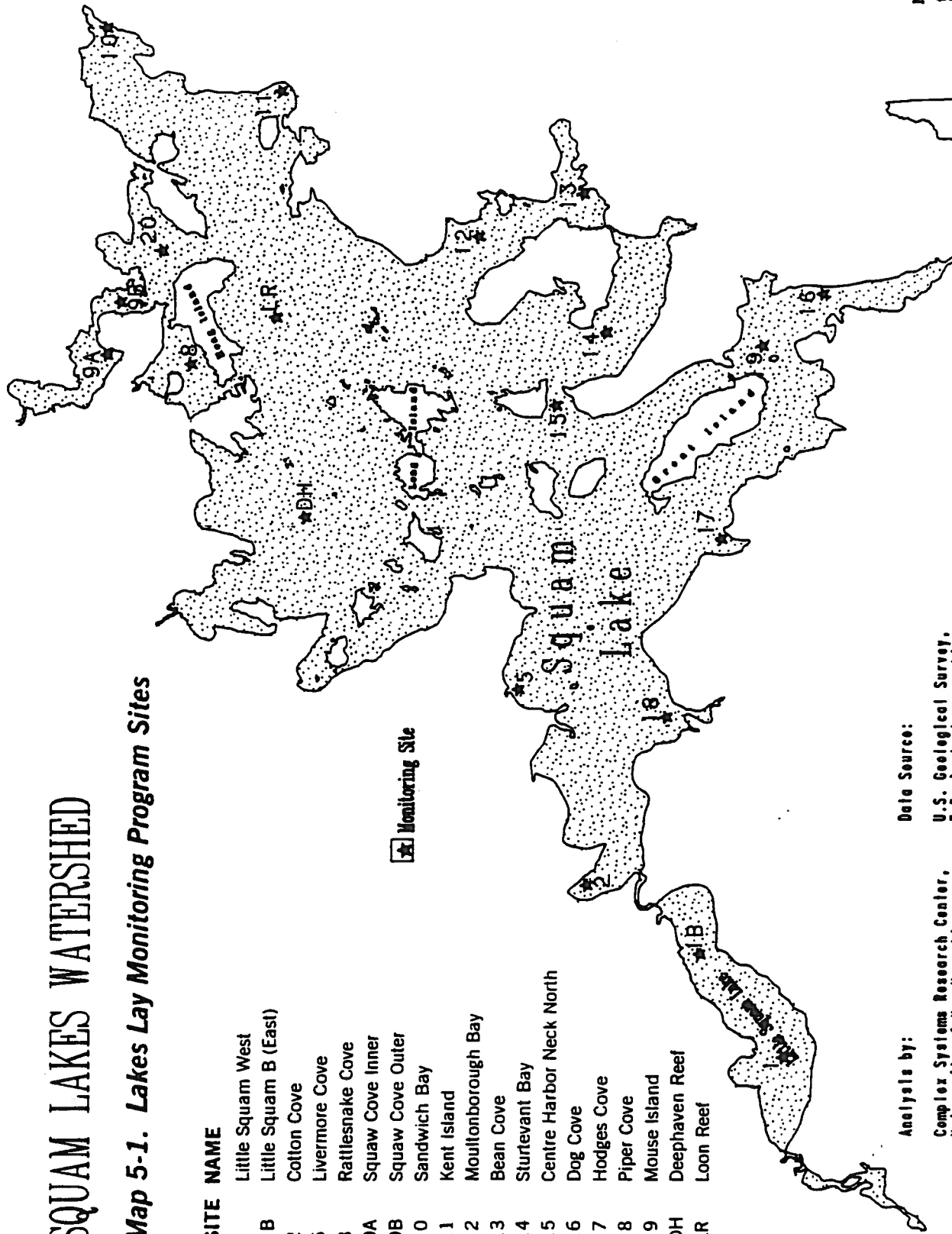
# SQUAM LAKES WATERSHED

Map 5-1. Lakes Lay Monitoring Program Sites

**SITE NAME**

- 1 Little Squam West
- 1B Little Squam B (East)
- 2 Cotton Cove
- 5 Livermore Cove
- 8 Rattlesnake Cove
- 9A Squaw Cove Inner
- 9B Squaw Cove Outer
- 10 Sandwich Bay
- 11 Kent Island
- 12 Moultonborough Bay
- 13 Bean Cove
- 14 Sturtevant Bay
- 15 Centre Harbor Neck North
- 16 Dog Cove
- 17 Hodges Cove
- 18 Piper Cove
- 19 Mouse Island
- DH Deephaven Reef
- LR Loon Reef

 Monitoring Site



SCALE 1:60,000



Data Source:

U.S. Geological Survey,  
7.5 minute topographic  
quadrangle, 1:24,000.

Analysis by:

Complex Systems Research Center,  
University of New Hampshire,  
January, 1990.

values are generally indicative of an oligotrophic lake. The 1987 average values fell within the low end of this range, 0.7 mg/m<sup>3</sup>. The 1988 chlorophyll a values for the lake as a whole were consistent with the average 1980-1987 values. Deep sites measured within the range of 1.4 to 1.8 mg/m<sup>3</sup>, and coves and bays ranged from 0.9 to 13.8 mg/m<sup>3</sup>. The lake average was 2.5 mg/m<sup>3</sup>. According to UNH, the 1989 average chlorophyll a value was slightly lower than the 1988 average, but greater than previous years' averages at all sites sampled except Dog Cove. State Biology Bureau chlorophyll a data obtained in 1979 at three sites ranged from 1.7 to 2.2 mg/m<sup>3</sup>; values for data obtained in 1988 ranged from 1.88 to 5.24 mg/m<sup>3</sup>. It should be noted here as well that DES and UNH use different methodologies to analyze chlorophyll a.

Dissolved color concentrations for Squam Lake, measured at the deep sites, as a whole have been very low since lay monitoring began 11 years ago. Average dissolved color values were 15.0 ptu (platinum color units) in 1988, and 9.0 ptu in 1989.

Relatively low dissolved oxygen levels at the lower depths of deep sites on Squam Lake have been reported by late August since 1980. In the last few years, depletion of dissolved oxygen at the hypolimnion has occurred somewhat more rapidly than in past years.<sup>5</sup> An increase in metalimnetic oxygen was also found at Squam Lake during July and August sampling in 1987, and was observed in 1988 and 1989 as well. This increase is usually caused by photosynthesizing algal populations. Because the upper layer of Squam Lake is so clear, sunlight is readily available to algae at the metalimnion (middle layer). Also, nutrients are known to infiltrate from the bottom waters of the lake across the metalimnion. Algae that are able to take advantage of these conditions experience a sharp rise in population and produce the oxygen "peak" that is observed in the metalimnion.<sup>6</sup>

Average alkalinity values obtained for Squam Lake by the UNH Freshwater Biology Group a few times every year since 1980 have ranged from 3.6 - 8.1 mg/l CaCO<sub>3</sub>. For more than half of the last eleven years, alkalinity values for Squam have averaged less than 5.0 mg/l CaCO<sub>3</sub>. These values are low compared to average alkalinity values for New Hampshire Lakes in general. The average alkalinity figure reported by DES is 6.4 mg/l CaCO<sub>3</sub> based on samples of 491 NH lakes taken in recent years. UNH reports a figure of 6.6 mg/l CaCO<sub>3</sub>, based on lay monitoring data obtained for NH lakes for the last 10 years. The Squam values show a decrease in alkalinity compared to historical values for the lake, which means that Squams buffering capacity is likely to be decreasing. If this is the case, a gradual lowering of pH may be expected. It should be noted that such a decrease has not yet been noted in pH data obtained within the last ten years.

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<sup>5</sup> UNH Lakes Lay Monitoring Program, 1989.

<sup>6</sup> Ibid.

## Water Quality - Cove Areas of Squam Lake

Several of the cove areas of Squam Lake are relatively shallow, for example Squaw Cove (5.0 meters) and Cotton Cove (8.7 meters). As previously described, there is generally an absence of thermal stratification in these and other cove areas because of their shallower depths, which allow more frequent mixing of the water column. There is thus a greater recycling of nutrients needed for plant growth, nutrients that otherwise would be lost to the lower depths. As some of the earlier studies of Squam Lake indicate, it has been observed that areas of localized productivity can occur at Squam Lake despite the fact that the lake as a whole is still relatively unproductive. The effects of isolated areas of nutrient inputs to Squam Lake may thus be obscured by the average water quality measurements for the whole lake. This may be one factor in explaining why the lake has been labeled as oligotrophic, oligotrophic-mesotrophic, and mesotrophic by various researchers over time.

Several of the shallow cove areas of Squam Lake are considered to be susceptible to eutrophication if a significant increase in nutrients occurs. One area which has been receiving increased inputs is Squaw Cove, a relatively shallow sunny basin. In 1988 and 1989 the two Squaw Cove sites had average water transparency values that were well below their 11 year averages, indicating that a change in water quality has been occurring. Chlorophyll a levels were relatively high at both sites of Squaw Cove in July and August of 1987. Values ranged from 1.4 to 3.7 mg/m<sup>3</sup>, with an average concentration of 2.6 mg/m<sup>3</sup>. The 1988 values for these same sites were also greater than the average chlorophyll a values for the years 1980-1987, ranging from 0.9 to 13.8 mg/m<sup>3</sup>. There was no chlorophyll a sampling of Squaw Cove in 1989. The UNH Freshwater Biology Group has been paying close attention to these two sites, along with several other cove areas of Squam Lake since 1979. Squaw Cove has been observed to have relatively high chlorophyll a levels at some point in the season almost every year.

Other cove areas of Squam Lake have occasionally reached chlorophyll a levels above 3.0 mg/m<sup>3</sup>, for example, Livermore Cove, Sandwich Cove, Sturtevant Bay, Piper Cove, Center Harbor Neck, Dog Cove, Hodges Cove, Cotton Cove, and Mouse Island. It should be noted that these are not average values, but rather are occasional occurrences, and some of these cove areas showed a fairly wide variation in chlorophyll a concentrations throughout a particular season. This variation may possibly have resulted from short-lived algal blooms, which are often an early sign of increasing nutrient enrichment. Such blooms are common to most lakes in early summer, as a result of the renewal of nutrients in the surface water, warmer temperatures and increased light intensity. Their occurrence later in the season may signify that additional nutrients are being introduced into a particular cove area, or they could also be due to rising metalimnetic populations, benthic populations or decreases in zooplankton grazers because of fish predation.<sup>7</sup>

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<sup>7</sup> UNH LLMP, 1989.



Aquatic vegetation, which is also used as an indicator of an increase in the productivity of a lake, has not been monitored in cove area of Squam Lake on a regular basis, either as part of the UNH Lakes Lay Monitoring Program or by the Biology Bureau at DES. But there have been unofficial reports by lake residents of such vegetation in cove areas.<sup>8</sup>

### Water Quality - Little Squam Lake

Two sites on Little Squam Lake have been consistently sampled in the last 10 years. In 1987, average secchi disk readings at these sites ranged from 6.3 to 9.0 meters, with an average of 7.2 to 7.3 meters for both. As with Squam Lake, transparency fluctuated throughout the sampling season, with no consistent pattern, but never dipped below 4.0 meters. A comparison of the 1987 data to that of all years 1979-1987 pooled indicated that transparency was slightly lower than the combined averages for these years, by about 0.5 meters. The 1988 and 1989 data indicated that transparency levels were again slightly lower than the 10 year average, but greater than 1987 values (i.e. water clarity was better, but still was lower than the 10 year average).

The average chlorophyll a concentration for Little Squam Lake in 1987 was 1.9 mg/m<sup>3</sup>. However, mesotrophic levels were reached in mid-August. According to the LLMP, "the 5.3 mg/m<sup>3</sup> concentration measured mid-August at Little Squam is the maximum value ever recorded for this site, and the 1987 averages at Little Squam were greater than all previous years' averages." Averages for 1988 were 2.1 mg/m<sup>3</sup>, slightly greater than the 1987 average, and the 1989 chlorophyll a average was similar to that of 1988. For both years chlorophyll a averages were greater than the 11 year average.

Chlorophyll a concentrations in the metalimnion of Little Squam Lake reached 19.2 mg/m<sup>3</sup> in 1987. These concentrations are corrected for chlorophyll pigments from dead plant cells that might have floated down and collected there. Also, a phytoplankton sample taken at the metalimnion reported a cell count of 4754 per milliliter, and the sample was dominated by a species of golden colonial algae. Another colonial golden algae and a flagellated green algae were the sub-dominant species: According to the 1987 LLMP study, "while these species are not generally nuisance algae, their accumulation at the metalimnion of Little Squam Lake may be an indication of increased nutrient loading into the lake, and should be continually monitored." Data obtained by the UNH Freshwater Biology Group in 1988 and 1989 further confirms their statement made in 1987 concerning metalimnion chlorophyll a concentrations.

Average total phosphorus values for Little Squam have ranged from 1.0 - 20.0 ppb since yearly sampling was begun at one deep site in 1980, with wide fluctuations observed.

According to UNH, supersaturated oxygen levels have frequently been observed at Little Squam Lake once stratification occurs in the summer. These high levels of dissolved oxygen in the metalimnion are usually caused by photosynthesizing algal populations. Also, the lower depths of the lake have been found to be

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<sup>8</sup> Squam Lakes Watershed Advisory Committee, 1989.

depleted of dissolved oxygen in late summer 30 of the 37 times that dissolved oxygen profiles have been taken for Little Squam in the past 11 years. In addition, this depletion has occurred earlier in the season in recent years.

Average alkalinity levels for Little Squam have ranged from 3.5 - 8.3 mg/lCaCO<sub>3</sub> since 1980, and as with Squam Lake, these levels appear to be getting lower, indicating a gradual decrease in the buffering capacity of the lake.

## **Summary**

As a whole, Squam Lake and Little Squam Lake both have excellent water quality. They can still be classified as oligotrophic lakes, of low productivity. Average values for phosphorus, chlorophyll a, and water transparency, obtained from several sites over time on both lakes indicate that this classification still is appropriate. However, the lakes are at the upper end of the oligotrophic range (closer to mesotrophic) than they were 10-20 years ago. On the basis of existing water quality sampling data, it can be said that subtle changes appear to be occurring on both lakes, especially on Little Squam Lake, changes which indicate that their productivity is likely to be increasing. These changes are summarized as follows:

### **Squam Lake**

- a. Higher chlorophyll a values and lower water transparency values have been obtained in some cove areas of Squam Lake at various times. Squaw Cove has had increasing higher chlorophyll a values, and lower transparency values within the last 10 years.
- b. Depletion of dissolved oxygen at deep sites that have been monitored (for example, at Deep Haven Reef) has been observed at a somewhat more rapid rate.
- c. High metalimnetic chlorophyll a levels have been observed from time to time, along with supersaturated oxygen peaks.
- d. Colonies of nuisance algae have been sighted by the UNH Freshwater Biology Group and the State Biology Bureau from time to time.

### **Little Squam Lake**

- a. Higher average chlorophyll a values and lower water transparency values have been obtained in recent years, and are approaching mesotrophic levels, though the lake can still be classified as oligotrophic.

- b. Depletion of dissolved oxygen at the bottom of Little Squam Lake has occurred earlier in the season in recent years. The depleted zone in Little Squam Lake is much more extensive, in terms of percentage of total volume, than that of Squam Lake. The difference in the morphology of the two lakes is not enough to explain this larger zone for Little Squam Lake.
- c. High chlorophyll a levels have been observed in the metalimnion from time to time, along with supersaturated oxygen peaks. There have been more consistent observations of this at Little Squam Lake than at Squam Lake.
- d. Colonies of nuisance algae have been sighted relatively frequently by the UNH Freshwater Biology Group in the past few years.

It is important that these subtle changes be monitored closely. Due to Squam Lake's morphology, a number of changes in the lake may be occurring which may not be reflected in average measurements for the lake as a whole.

### **Potential Threats to Water Quality**

Any use of the land or water resources within a lake watershed has the potential to impact water quality within that watershed. The nature of the hydrologic cycle makes it impossible to separate surface and groundwater quality issues, particularly in a small lake watershed like Squam which is bounded by mountainous ridges. Water is introduced to the system through precipitation. As precipitation falls to the earth, it either infiltrates the soil to become groundwater or flows overland and through drainage ways. Velocity is often reduced by wetlands within the natural surface water drainage systems. Some water is lost directly by evaporation or left in ponded conditions in upland depressions. Water also flows through the stream networks in the watershed to discharge to the lake itself. Depending upon hydrologic conditions, the water that infiltrates the soil may flow with the natural groundwater system or return to the atmosphere through evapotranspiration by plants. The cyclical process is completed when humidity builds to the dewpoint to cause precipitation.

Pollutants can either be point or nonpoint in nature. A point pollution source is one that can be linked to a site specific contaminant or discharge. Point sources are generally confined to an identifiable site or facility that can be physically located or delineated. Other land uses that are potential sources of pollution are more difficult to document and trace to a specific responsible party. This may be due to lack of a visible point of release, as with on-site subsurface disposal systems, or to difficulty in assessing the site specific impact of common practices which involve the disturbance of land. Such activities are considered to be nonpoint pollution sources. The following section will discuss both types of potential pollutant sources in more detail.

## **Potential Point Pollution Sources - Groundwater**

Because point pollution sources are either site or facility specific, they are relatively easy to identify and monitor. Many are permitted through either State or local regulatory processes and are subject to performance standards. In New Hampshire, industrial and municipal discharges, and privately owned waste management and wastewater treatment facilities which may have a potential to impact water quality due to a direct discharge to groundwaters are regulated by the Water Supply and Pollution Control Division of the Department of Environmental Services (WSPCD-DES). Waste discharges are strictly regulated by the groundwater discharge permitting program. Also prohibited are injection of fluids through wells below drinking water aquifers. In accordance with Ws 410, groundwater discharge permits are required for such land uses as sludge storage and/or treatment facilities, land based disposal of solid waste, irrigation facilities which utilize sewage or wastewater, wastewater lagoon systems, subsurface sewage disposal facilities with a capacity of greater than 20,000 gallons per day, and septage disposal facilities which utilize land based disposal techniques. A limited zone of degradation is allowed on site. One of the requirements for issuance of a groundwater discharge permit is that groundwater quality at the site boundary meet, at a minimum, the maximum contaminant levels established in the State rules for drinking water quality (Ws 200-299).

Under the groundwater discharge permitting program, on-site monitoring wells are required to document the existing quantity, quality and direction of groundwater flow. The owners of permitted facilities are required to inform DES, in writing, at least 30 days in advance of any significant changes in process or production affecting the character and quality of the discharge. This would allow for DES to adjust permit requirements, where appropriate, before a potential water quality problem develops.

The intent of the State regulatory program is to not allow groundwater quality to be altered in any way that would make it unsuitable as a source of drinking water. However, permit violations do occur and unpermitted groundwater discharges may exist until detected, reported and brought under regulatory control. It is important that municipalities within the Squam Lakes watershed identify and locate the regulated facilities that may have a potential to impact their groundwater resources. These facilities are required to report monitoring well data to DES on a regular basis. This allows for existing water quality to be documented and changes to be noted over time. For planning purposes, it is useful to compare the location of these sites with the location of stratified sand and gravel deposits that may either currently serve or have the potential to serve as sources of municipal drinking water supply. There are currently no permitted groundwater discharges within the Squam Lakes watershed according to the DES.

## **Potential Point Pollution Sources - Surface Waters**

A pipe discharge of liquid waste to receiving surface waters is a classic example of a potential point pollution source. As a result of federal efforts in the 1970's, most point pollution sources with the potential to impact surface waters are now treated and required to meet water quality standards prior to discharge. Any discharge to surface waters in New Hampshire requires a National Pollution Discharge Elimination System

(NPDES) permit. NPDES permits are issued by EPA after review and approval by WSPCD-DES. The outfalls of municipal and industrial wastewater treatment facilities are the most commonly permitted discharges. However, other discharges such as noncontact cooling waters, fire pump test waters or discharges from groundwater remediation sites are becoming more common. Facility owners are required to sample their discharges on a regular basis and report information to EPA and WSPCD about such water quality parameters as total suspended solids, total coliform counts and biological oxygen demand (BOD). The nature and average volume of the discharges are also reported.

Water quality standards established by the State's legislative classification system dictate the level of water quality required for permitted discharges. No discharges are allowed in Class A surface waters because they have the potential to be used for drinking water supplies after disinfection. Of particular interest to lake watersheds are the water quality standards contained in Ws 432.10(c), which do not allow new discharges of water containing phosphorus to lakes or ponds. New discharges of wastewater containing phosphorus that would encourage eutrophication are also not permitted to tributaries to lakes or ponds. Any discharges allowed to Class B or C waters must meet the legislative requirements of those classifications. A water quality study may be required by DES, prior to their concurrence with the EPA drafted NPDES permit. Where the water is deemed to be a high quality water, a public participation process regarding invoking an antidegradation policy must also be followed (Ws 439). The purpose of the study is to determine if the proposed discharge would exceed the assimilative capacity of the receiving waters. Where there would be a detrimental impact, the permit is not approved.

It is not uncommon for surface water, and wastewater discharges in particular, to exceed the maximum contaminant levels allowed by their permit requirements at some time during the year. An example would be combined sewer overflows occurring as a result of major storm events. In addition, NPDES permits allow for water quality degradation when stream flows are less than an established minimum standard ("less than 7 Q10"). It is therefore important, for planning purposes, to note where known surface water discharges are located in relationship to surface waters that are critical to fish and wildlife. It is particularly important to determine where they occur with respect to withdrawals of that water for human use. Many receiving waters also serve as either primary or secondary drinking water supplies.

The Ashland Wastewater Treatment Facility is the only NPDES permitted facility within the Squam watershed. Since the facility is located down gradient, any problems with the plant would not impact the Squam Lakes, but rather would affect the lower portion of the Squam River. Concerning the operation of the plant, sludge that has built up in its lagoon will be removed starting in April of 1990. Once this project is completed, the plant's aeration system will be updated.<sup>9</sup>

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<sup>9</sup> Conversation with Ashland Wastewater Treatment Plant Superintendent, 1990.

## Potential Nonpoint Pollution Sources

General land use practices which are widespread throughout the Squam watershed also may have a cumulative long-term impact on both groundwater and surface water quality. Such diffuse practices are considered nonpoint pollutant sources because it is difficult to identify a specific, confined discharge from a discrete location. The major impacts associated with most nonpoint sources are generally storm event related, where the surface of land has been disturbed. Included are both temporary and permanent alterations of terrain. Somewhat temporary practices include agriculture, silviculture, construction, resource extraction and hydrologic habitat modification. More permanent storm related sources that do not generally require land disturbance include urban runoff in developed areas. Land based disposal of waste is also considered to be a more permanent potential nonpoint pollution source. Some nonpoint pollution sources are regulated at the State and local levels. Others are not formally controlled, other than by good faith efforts on the part of landowners to follow best management practices.

One of the problems inherent in the management of potential nonpoint pollution sources is the lack of adequate documentation of actual contamination. This is because many nonpoint sources tend to impact water quality through an unmonitored loading of contaminants, which results in a cumulative impact over time. Others may show a significant but temporary precipitation related impact, with no water quality sampling to document conditions.

As part of the Squam Lakes Planning project OSP commissioned the University of New Hampshire to interpret land use through an established set of categories, from four separate coverages of aerial photography dated 1955, 1974, 1982 and 1988. Table 5-2 provides a summary of the acreage within the Squam Lakes watershed that was interpreted to be in each land use category for each of the four coverages. In order to consider which of these land uses may have the potential to exhibit nonpoint pollution sources, the land use categories were grouped as either urban runoff or open space potential sources.

Table 5-3 gives a listing of the major potential nonpoint pollution source categories and subcategories that were identified by the EPA as part of their guidance to states for state water quality assessments. A general description of these categories follows. Included within the discussion of each category is a summary of land use activities in the Squam Lakes watershed which may have the potential to be nonpoint pollution sources, based on a limited review by OSP of existing DES files and input from the SLWAC. It is important, for planning purposes, to consider the location of such land uses as they relate to critical environmental resources within the watershed.

It is possible to identify future potential nonpoint pollution sources through the local regulatory process. Many land uses which may pose potential threats to water resources are reviewed by planning boards through the local nonresidential site plan review process. Table 5-4 lists a number of land uses that were identified for inclusion in local inventories of potential contaminant sources by the NH Wellhead Protection Program. Performance standards for the design, operation and maintenance of such activities can be included in local site plan review regulations.

**Table 5-2. Changes in Potential Nonpoint Pollution Source Land Uses  
Between 1955, 1974, 1982 and 1988**

	1955		1974		1982		1988	
	Acreage	% of Land	Acreage	% of Land	Acreage	% of Land	Acreage	% of Land
<b>Urban Runoff Potential Source</b>								
Housing	2,673	7.7	3,995	11.6	5,333	15.4	6,847	19.9
Commercial	132	0.4	132	0.4	234	0.7	92	0.3
Industrial	13	0.0	48	0.1	48	0.1	66	0.2
Other Urban	110	0.3	203	0.6	209	0.6	293	0.9
<b>Total Urban</b>	<b>2,928</b>	<b>8.4</b>	<b>4,378</b>	<b>12.7</b>	<b>5,824</b>	<b>16.8</b>	<b>7,298</b>	<b>21.3</b>
<b>Open Space Potential Source</b>								
Agricultural	3,226	9.3	2,668	7.7	2,288	6.6	1,157	3.4
Silvicultural	24,912	72.1	25,844	74.8	24,633	71.3	25,176	73.0
Idle	2,923	8.5	1,082	3.1	1,195	3.5	116	0.3
<b>Total Open Space</b>	<b>31,061</b>	<b>89.9</b>	<b>29,594</b>	<b>85.6</b>	<b>28,116</b>	<b>81.4</b>	<b>26,449</b>	<b>76.7</b>

Source: Aerial Photography 1955, 1974, 1982, 1988 Interpreted by the University of New Hampshire, 1989.

It is recommended that planning boards use the information presented in Table 5-2, in conjunction with the most recent land use information shown in Chapter 3 on Map 3-8 to make an initial assessment of where potential point and nonpoint pollution sources might exist within the Squam watershed. This initial assessment should be verified by a field inventory. The lists presented in Tables 5-3 and 5-4 can be used by planning board members as a guide to the type of land use activities that should be noted in the inventory.

### **Agriculture**

Agricultural use of random tracts of land throughout a watershed may include a number of practices which disturb the soil for periods of time during the growing season. Land may be managed to introduce crops, fertilizer and manure that add organic matter and increase productivity, and to introduce pesticides and herbicides that assure economically viable crop productivity. The site specific source of some impacts, such as siltation in localized streams, may be evident during storm events. However, in New Hampshire storm event

sampling does not commonly occur. Therefore, site specific sources of overall changes in water quality, such as nitrate levels in groundwater, are difficult to pinpoint.

Other nutrient rich potential pollution sources generally associated with agricultural land uses include manure storage and spreading areas and milk house wastes. Land application of manure is not regulated by the State in the same manner as the storage, disposal and application of sludge and septage. According to the 1989 New Hampshire Nonpoint Source Pollution Assessment Report, "agriculture is not a significant statewide nonpoint source pollution problem in New Hampshire." In part, this may be due to the proactive technical assistance to landowners from the district offices of NH Cooperative Extension and the Soil Conservation Service. Another factor is that active agricultural land use has been on the decline in New Hampshire. This is also true in the Squam Lakes watershed. Based on aerial photography interpretation, performed by UNH for this project, agricultural land use declined from 3,266 acres, or 9.3 percent of the land in the watershed in 1955 to 2,228 or 7.7 percent in 1982. More recent photography of the watershed, flown in 1988 shows that the surge in development during the six year period since 1982 has resulted in a change in use of more agricultural land. As of 1988, agricultural land had been further reduced, down to 1,157 acres. Best management practices should be encouraged on the remaining active land.

#### **Silviculture**

Silvicultural practices related to timber harvesting and reforestation may cause disturbance of land. This, in turn, may result in erosion and sedimentation problems. The construction and maintenance of logging roads often includes multiple stream and wetland crossings. These are often temporary disturbances over a finite time period. The overall impact to water quality would most likely also be temporary and storm event related. Natural stabilization often occurs following completion of logging activities. The key to minimizing the potential impacts of silvicultural activities is good technical assistance and guidance to landowners to implement best management practices while such activities are in progress, and after cessation.

An intent to cut form for commercial logging operations must be filed locally, prior to commencement of activities, in accordance with the Department of Revenue Administration's (DRA) specifications. Landowner/operator agreement that best management practices will be followed is a signed and enforceable condition of the intent to cut form. The Department of Resources and Economic Development (DRED) provides guidance to landowners relative to best management practices for silvicultural operations. They also inspect commercial operations and report water quality infractions relative to alteration of terrain or wetlands to DES. As a result of cooperative efforts between DRED and the Wetlands Board, the legislature has recently amended the statutes to allow for the permit requirement for minimum impact wetland projects to be reduced to a simple notification to the board by the landowner. Implementation of best management practices is also an enforceable condition of that notice. Assistance with best management practices is also available through the Cooperative Extension county offices and the US Forest Service. According to the NHNPS Assessment



**Table 5-3. Major Nonpoint Source (NPS) Pollution Categories and Subcategories**

10	<u>Agriculture</u>	60	<u>Land Disposal</u>
	11: Nonirrigated crop production		61: Sludge
	12: Irrigated crop production		62: Wastewater
	13: Specialty crop production (e.g. truck farms and orchards)		63: Landfills
	14: Pasture land		64: Industrial land treatment
	15: Range land		65: On-site wastewater systems (septic tanks, etc.)
	16: Feedlots - all types		66: Hazardous waste
	17: Aquaculture		
	18: Animal holding/management areas	70	<u>Hydrologic/Habitat Modifications</u>
20	<u>Silviculture</u>		71: Channelization
	21: Harvesting, reforestation, residue management		72: Dredging
	22: Forest management		73: Dam construction
	23: Road construction/maintenance		74: Flow regulation/modification
			75: Bridge construction
			76: Removal of riparian vegetation
			77: Streambank modification/ destabilization
30	<u>Construction</u>	80	<u>Other</u>
	31: Highway/road/bridge		81: Atmospheric deposition
	32: Land development		82: Waste storage/storage tank leaks
40	<u>Urban Runoff</u>		83: Highway maintenance and runoff
	41: Storm sewers (source control)		84: Spills
	42: Combined sewers (source control)		85: In-place contaminants
	43: Surface runoff		86: Natural
50	<u>Resource Extraction</u>	90	<u>Source Unknown</u>
	51: Surface mining		
	52: Subsurface mining		
	53: Place mining		
	54: Dredge mining		
	55: Petroleum activities		
	56: Mill tailings		
	57: Mine tailings		

Source: US EPA, *Guidelines for the Preparation of the 1988 State Water Quality Assessment (305(b) Report)*, April 1, 1987.

Report, silviculture is not a significant statewide nonpoint source pollution problem. However, problems associated with erosion and sedimentation as a result of forestry operations in individual sub-basins have been reported. In most cases, this was due to inappropriate or inadequate application of recommended best management practices. The fact that silvicultural practices are not seen as significant nonpoint pollution sources may be due to the combined educational efforts of State and federal programs in New Hampshire. The requirements of RSA 485-A:17, (formerly RSA 149-8:a) also apply to logging activities.

Forest land makes up a significant portion of the Squam Lakes watershed. There were 25,176 forested acres, (73.0 percent of the land in the watershed) in 1988. It is difficult to determine the extent of that acreage that is actively managed, either privately or commercially. It is also difficult to predict when land disturbance will occur as part of a particular landowner's forest management program.

From a planning perspective, it is significant to note the extent of forest land which could be converted for development. Clear cutting of land without reforestation could result in an increase in runoff, erosion and sedimentation potential. This could be compounded by the introduction of impervious material, such as roads, roofs and driveways which generally accompany development. Forest soils, in their natural state, generally have good groundwater recharge potential. This might be significantly reduced if development were to change the land use.

### Construction

The type of potential nonpoint pollution sources that may show the most evidence of immediate impact are often disturbances of land which take place over a finite time span. This would include such activities as site preparation and the construction of roads, highways, bridges and associated subdivision developments. Although erosion and sedimentation are likely to occur temporarily as a result of such activities, site stabilization often occurs after their conclusion. It is well established that temporary site disturbances can result in localized acute and ephemeral impacts on water quality. Not well documented are the long term basin-wide cumulative effects that development can have due to the numbers of temporary occurrences that happen over time, resulting in chronic and lasting impacts on water quality. There was an increase in construction in the Squam watershed, with the upswing in New Hampshire's economy during the 1980's. The impact this construction may have had on water quality is not well documented by storm event sampling.

To a certain extent, there is State control over disturbance of land for construction, logging and mining. Alteration of greater than 100,000 square feet of contiguous land requires a permit from the WSPCD-DES, in accordance with RSA 485-A:17, (formerly RSA 149-8:a) and Ws 415 of the NH Code of Administrative Rules. Site plans are required for such alterations. A general rule of thumb is that this applies to any subdivision with a roadway with a 50 foot right-of-way that is greater than 2,000 feet long or possibly less with the inclusion of building sites and driveways. More detailed earth moving plans are required for greater than 200,000 contiguous square feet of disturbance. The focus of the site plan is to provide for on-site control of erosion, and to prevent sedimentation of surface waters. Detailed drainage calculations are required to determine adequate stormwater

**Table 5-4. Potential Contamination Sources which may be Subject to Non-residential Site Plan Review**

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| <p>1. Transportation Services and Repair</p> <ul style="list-style-type: none"> <li>- gas stations/service stations</li> <li>- auto/truck/equipment repair shops</li> <li>- maintenance bays</li> <li>- auto rustproofing shops</li> <li>- auto body shops</li> <li>- airport maintenance/fuel areas</li> </ul> <p>2. Service and Repair Shops which use Chemicals</p> <ul style="list-style-type: none"> <li>- furniture stripping/painting/refinishing</li> <li>- photographic processing</li> <li>- printers</li> <li>- appliance repair</li> <li>- small engine repair</li> <li>- boat building/repair/refinishing</li> <li>- refrigeration/HVAC shops</li> <li>- dry cleaners</li> </ul> <p>3. Metalworking Shops</p> <ul style="list-style-type: none"> <li>- machine shops</li> <li>- metal plating/heat treating/smelting</li> <li>- jewelry making</li> </ul> <p>4. Manufacturing</p> <ul style="list-style-type: none"> <li>- chemical manufacturing/processing/reclaiming/storage</li> <li>- paper/leather/textiles</li> <li>- electrical/electronic equipment</li> <li>- plastic/fiberglass/rubber/silicone/glass</li> <li>- pharmaceuticals</li> <li>- pesticides/herbicides</li> <li>- wood preservers</li> </ul> <p>5. Underground Storage Tanks</p> <p>6. Waste or Scrap Processing/Storage</p> <ul style="list-style-type: none"> <li>- junk/scrap/auto salvage yards</li> <li>- wastewater treatment plants - industrial/ municipal</li> <li>- landfills/dumps/transfer stations</li> <li>- wastewater lagoons</li> </ul> | <p>7. Transportation Corridor</p> <ul style="list-style-type: none"> <li>- Highways</li> <li>- Railroads</li> </ul> <p>8. Septic System</p> <p>9. Laboratories and Professional Offices</p> <ul style="list-style-type: none"> <li>- medical/dental/veterinary offices</li> <li>- research/medical/analytical laboratories</li> </ul> <p>10. Agricultural Fertilizer/Pesticide/Herbicide Use</p> <ul style="list-style-type: none"> <li>- golf courses</li> <li>- feed lots/kennels/piggeries/manure stockpiles</li> <li>- parks</li> <li>- nurseries/sod farms</li> <li>- other intensive agricultural practices</li> <li>- areas of pesticide use</li> </ul> <p>11. Cleaning Services</p> <ul style="list-style-type: none"> <li>- laundromats</li> <li>- beauty salons</li> <li>- car washes</li> </ul> <p>12. Food Processing Plants</p> <ul style="list-style-type: none"> <li>- meat packers/slaughterhouses</li> <li>- dairy products</li> <li>- processed foods</li> </ul> <p>13. Other</p> <ul style="list-style-type: none"> <li>- snow dumps</li> <li>- concrete/asphalt/tar plants</li> <li>- cemeteries</li> <li>- mining of sand/gravel</li> <li>- detention ponds</li> <li>- salt storage and usage</li> <li>- power lines</li> <li>- pipe lines</li> <li>- stormwater infiltration/retention ponds</li> </ul> |
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Source: NH Wellhead Protection Program - DES-WSPCD Groundwater Protection Bureau, July, 1990.

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design capacities for flood protection. Permanent runoff treatment measures that are required include grass swales and sedimentation basins designed for a minimum of ten year storm flow capacity. Temporary erosion control measures required while the alteration of terrain is in progress are based on site specific conditions, and may vary from project to project.

As was discussed in Chapter 4, virtually all of the land within the Squam watershed that is not protected by ownership or easement may be subject to some form of construction activity. Interpretations from 1988 aerial photos for the land use categories of agriculture, forest, and idle land combined show a total of 26,449 acres or 76.7 percent of the land in the watershed within these categories of open space. Although general, this information gives a spatial conception of the importance of existing and future local regulatory controls in managing potential impacts of development in the watershed over time.

### **Urban Runoff**

Stormwater runoff has the potential to impact water quality in developed areas. During a storm event, precipitation falls to the earth and flows over land to either natural or man made drainage ways. A broad range of potential contaminants can be introduced to surface waters by urban runoff. To a certain extent, this depends on the velocity of the water and the surface use of the land over which it flows. It is common to find concentrations of nitrogen, phosphorus, chlorides, oils, phenols, lead and volatile organics in runoff in highly urbanized areas. During storm events, these contaminants are carried with runoff from roads, parking lots and other impervious land covers associated with high density residential, commercial and industrial land uses. In urbanized areas, the surface runoff generally flows to catch basins for storm sewers. Many structural storm-water collection systems discharge directly to surface waters without treatment. Oil, grease and sediment traps can be installed in catchment basins to lessen the impact of discharges on receiving waters. Such structural management tools require periodic maintenance to be effective. Sedimentation basins and treatment swales are nonstructural, and require less intensive maintenance for stormwater management. They are often used in relatively open, low density residential areas that have more open space. Both structural and nonstructural stormwater collection systems are often designed to handle the volume and rate of flow anticipated to occur at a particular storm level frequency, without regard to water quality. It is important for planners to recognize the need for erosion and sediment control and water quality treatment provisions in addition to the standard volumetric flow requirements in local regulatory controls.

The total land acreage of the combined categories of housing, commercial, industrial and other urban from 1988 aerial photo coverage equals 7,298 acres, or 21.3 percent of the land within the Squam Lakes watershed. These figures may be interpreted to imply that the potential impact of urban runoff within the watershed is slight. However, the extent to which urban runoff presents a problem is not well documented by sampling.

One known surface runoff location is in the vicinity of the Ashland Town Beach. Runoff flows down and along Leavitt Hill Road, then flows across the Town Beach and directly into Little Squam Lake, causing some erosion of the back area.<sup>10</sup> Other runoff problems are reported to occur along the Squam River and also along Ames Brook in both Ashland and New Hampton.<sup>11</sup>

### Resource Extraction

Disturbance of the earth's surface for extraction of resources may have many of the same impacts on water quality that are associated with development and construction. Petroleum extraction activities are not common in New Hampshire, due to the nature of the area geology. However, extraction of sand and gravel for construction aggregate is a significant activity in the State. This is partially due to the abundance of glacial outwash and ice contact deposits within New Hampshire. Another factor involved is the increase in demand for such materials, associated with the increase in development that occurred in the 1980's.

Some concerns that are related to excavations include erosion and sedimentation from exposed areas during storm events. Others stem from the occurrence of groundwater, in significant quantities, within the same surficial materials that have good potential for use as construction aggregate. There is the potential for contamination of groundwater if proper management practices are not applied on site. During the operation of sand and gravel excavation, there is often the presence of heavy sorting and crushing equipment, as well as the vehicles that are required for transport of commercially marketable materials. This equipment and vehicles will require washing, routine maintenance, changing of lubricants, etc. The potential these activities may have to impact water quality can be greatly reduced if they occur off-site in an environment where spills can be contained. Open gravel pits are also somewhat unobtrusive places where storage of potentially threatening materials used at other job sites may occur. This could include heavy equipment, building materials, chemicals or explosives. Due to the environmental sensitivity of exposed sand and gravel areas, such uses may be incompatible with these areas. Many of the same best management practices for erosion and sediment control and stormwater management that are appropriate for other land disturbances are applicable to extraction of resource materials as well. Good performance standards for closure plans are of particular importance in maintaining the future quality of water resources surrounding excavation sites.

There has been much debate on the issue of whether or not removal of the overburden has an impact on the quality or quantity of the groundwater that remains after excavation. Removal of the aggregate materials does reduce the natural filtration capability of the overburden. From a planning perspective, it is important to carefully consider the future land use that is allowed in such areas, after the cessation of extraction activity. The surficial depth to the water table has been artificially reduced, while the permeability and transmissivity of the sites are both relatively high. Good performance standards for future land uses and other innovative land use

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<sup>10</sup> Discussion with J. Rollins, Office of State Planning, January, 1990.

<sup>11</sup> SLWAC, 1989.

controls should be considered for former excavation sites. At the local level, planning boards permit sand and gravel excavations, in accordance with RSA 155-E. The board is authorized to adopt regulations to specify requirements which the excavation must meet during operation and for closure. The legislature amended the statute in 1989 to allow for planning boards to require plans to be filed for grandfathered operations, among other things. Three gravel pits have been mapped as being within the Squam watershed. One of these, the Howe Gravel Pit on Route 113, is an area which has been greatly expanded in recent years.<sup>12</sup>

### **Land Disposal**

Many types of waste are disposed of either below or on the surface of land. Waste disposal facilities which are located and discharge below the earth's surface, such as individual septic systems, are considered to be potential nonpoint sources. The reason for this is that it is difficult to identify the specific source or even to document contamination without some form of site specific data. There are also waste disposal facilities that can be located on the land surface that may produce leachate that infiltrates into the ground. Depending on the hydrogeology of the area, it may be difficult to trace contaminant flow from the site, or to assess the interrelationship between the discharge and pumping wells in the area. Solid waste is often disposed of in land based landfills which may produce and introduce leachate to groundwater. Sludge and septage may be managed in pits, ponds or lagoons or directly applied to the surface of the land at a permitted site. Industries may also utilize land based systems to either treat their wastes or pretreat wastewater prior to discharge to a municipal collection system for further treatment. Most of these facilities are also regulated at the State level under RSA 149-M and the solid waste rules.

Junkyards are one of the few land based disposal practices not regulated by DES. They pose a potential threat to water quality due to the toxic organics, metals, solvents, oil and grease associated with the storage and salvage of motor vehicles. At the State level, junkyards are regulated and licensed by the Department of Transportation (DOT), in accordance with Tra 605. The requirements of the rules do not address water quality degradation. At the local level, a license and certificate of approval is required in accordance with RSA 236:115, in order for the local governing body to locate a junkyard. The emphasis is on setbacks, fencing, aesthetics, and impact on neighboring properties, rather than water quality. During 1990 and 1991, WSPCD-DES will draft and adopt regulations for the siting, design, construction and operation of new and existing junkyard facilities. The rules will require a site plan review process for permitting, operational requirements, and closure plans for permitted facilities. The intent of the proposed rules is to protect and improve water quality from contamination resulting from junk and salvage yard operations.

Although not well documented, the potential for nonpoint pollution from on site septic systems has raised particular concern in watersheds for small lakes and ponds. This perceived problem has been compounded by the increase in demand for shorefront properties, and the conversion of seasonal homes to year-round occupancy. From a planning perspective, it is important to note where concentrations of old septic

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<sup>12</sup> Ibid.

systems and undersized lots exist. More stringent requirements than those in the State's subsurface rules can be included in local health ordinances.

Within the Squam watershed, there is an infiltration lagoon at Camp Hale in Sandwich which receives effluent that has received some treatment from the septic tanks located at the camp. The lagoon is located approximately 150 yards from Squam Lake.<sup>13</sup> The following are areas within the watershed which may have the potential to pose nonpoint pollution problems because of their septic systems:

Holderness Village Area - An area where there are small concentrated lots on limited soils, for present systems.<sup>14</sup>

Motels, Cottages in Ashland and Holderness - Inadequate septic systems are suspected in these concentrated areas.<sup>15</sup>

Some wastewater facilities utilize land based lagoon systems for treatment prior to discharge of effluent to receiving waters. Within the watershed, the Ashland Wastewater Treatment Facility is such a land based lagoon system, which discharges effluent into the Squam River.<sup>16</sup> There is the potential for filtration of wastewater into the groundwater system as well as for effluent overflows during storm events.

There are several solid waste facilities which are presently operating in the Squam Lakes watershed, including the Ashland Landfill, the Holderness Transfer Station, and the Sandwich Transfer Station. See Chapter 3, Infrastructure, for more on these facilities. There is also an inactive dump located at the site of the present Holderness Transfer Station, an inactive landfill at the site of what was more recently a brush and stump dump in Centre Harbor, and an inactive landfill at the site of the present Sandwich Transfer Station.<sup>17</sup>

One junkyard in the watershed, Royer's Auto Junkyard, located in the Town of Holderness, has a large number of autos stockpiled at the site.<sup>18</sup>

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<sup>13</sup> Ibid.

<sup>14</sup> J. Rollins, OSP, 1990.

<sup>15</sup> Ibid.

<sup>16</sup> Ibid.

<sup>17</sup> Ibid.

<sup>18</sup> Ibid.

## Hydrologic/Habitat Modifications

Many changes to the natural drainage system in a watershed, that are thought of as improvements, have an impact on water quality and distribution. Structural channelization of natural surface water drainage systems, for example, can result in increases in velocity during storm events, bypassing or eliminating valuable riverine habitat. Riverine wetland systems provide stormwater and sediment control, nutrient assimilation, and wildlife habitat. The removal of riparian vegetation is likely to increase shoreline erosion potential and also cause thermal changes in the water due to a reduction in shade cover. Filling and dredging of inland, palustrine wetlands will also result in changes in their hydrologic capabilities to perform important functions within a watershed.

The construction of impoundments on rivers may impact the ability of anadromous species of fish to spawn and maintain sustained, reproducing populations. If dams are regulated for hydroelectric production, there are also likely to be flow modifications which result in alteration of water table elevations both up and down stream of the dam. This may impact the assimilative capabilities of down stream waters for wastewater discharges. This may also have a public health effect on downstream drinking water supply withdrawals. Artificial fluctuations in water levels may cause streambank erosion or cause other modifications. The Federal Emergency Regulatory Commission (FERC) regulates hydroelectric dams. Depending upon the nature of the project, a variety of State regulatory controls may come into play, to include alteration of wetlands or terrain under RSA 485-A (formerly RSA 483-A) and RSA 485-A:17, (formerly RSA 149-8:a.), or water quality certificates issued by WSPCD under section 401 of the federal Clean Water Act. The FERC permitting process includes a mechanism for municipal input. Map 3-9 shows existing dams within the Squam Lakes watershed.

The acreage within categories of "swamp" and "open water" from the aerial photo interpretations were combined and the total changes compared for 1955, 1974, 1982 and 1988. It is interesting to note that the acreage of "swamps" in the watershed has actually increased between time intervals, from 582 in 1956 to 719 in 1988. Changes in the Unsworth property near Brown's Point may account for this.

An example of a hydrologic modification in the Squam Lakes watershed occurs annually when the Town of Ashland replenishes sand at the Town beach at the outlet of Little Squam Lake. Some of this sand washes from the beach and into the Squam River every year because of a swift current following the shoreline which deposits the sand near the mouth of the channel and also within the channel. It has previously been recommended that a jetty be built to help deal with the erosion/sedimentation problem. Wetlands Board approval would be required for construction of this type of shoreline structure. At present the Ashland Conservation Commission is looking for corrective action by the Town within the next year.<sup>19</sup> It will be important that they study the patterns of erosion and deposition that are related to shoreline currents in that specific area, prior to deciding upon the appropriate action to pursue.

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<sup>19</sup> Ibid.



### **Other/Highway Maintenance**

The application of sand mixed with sodium chloride for roadway deicing purposes may have the potential to impact water quality and contaminate drinking water wells. According to the 1989 Nonpoint Source Assessment Report, highway maintenance is the only nonpoint source category that is not regulated by New Hampshire State law. DOT has adopted a "bare road" salt policy, with motorist safety in mind. This includes direct application of road salt during storm events with poor road conditions. DOT has guidelines for the application of road salt deicing materials, and is working toward better calibration of their salt spreaders. The transportation network in the Squam Lakes watershed is largely interconnected by State controlled roads that are maintained in accordance with DOT policy. Municipalities have control over the winter maintenance and application of deicing materials for town approved and maintained roads. It is important to note where these roads are located with respect to surface waters, wetlands and potential aquifer areas throughout the watershed. Table 5-5 summarizes general highway deicing practices and their effects on water quality.

A number of salt piles are located within the Squam watershed. Information on them was obtained from the SLWAC. The Town of Ashland maintains a covered salt shed at the highway garage between Collins Street and the railroad tracks. The shed is three-sided, and has a concrete slab foundation. Ashland's road salting policy is to apply one bucket of salt to every ten yards of sand, on black top roads. No straight salt is applied.

Holderness has an uncovered salt pile within the watershed, located off of Route 3/25, in close proximity to Squam Lake. The salt pile does not have an impervious base, and there is no controlled drainage of the site. The Town also has a covered salt pile at the town shed, also located off of Route 3/25. Holderness has no official salt policy for its roads, other than that the road agent is asked to "go light" on salt application.

The Town of Centre Harbor has a State approved salt pile within the watershed, located adjacent to the new town garage, near the junction of Routes 25B and 3. The salt pile is located in fairly close proximity to Swainey Brook and the wetland area connected to it. The Town's salt policy is to apply salt/sand in a ratio of 1/10, although occasionally, direct salting of roads is done, depending on the temperature.

### **Other/Underground Storage Tanks**

Subsurface storage of petroleum products and other chemicals may pose a contamination problem if the tanks in which the products are stored leak. Underground storage tanks greater than 1,100 gallons are regulated by DES in accordance with Ws 411. The US EPA currently regulates other chemical underground tanks. Minimum standards for new tanks include leak monitoring devices, reinforced walls, secondary containment structures and protected piping systems. They are subject to testing and the owners must keep accurate stock inventory records. The maximum life of a new tank is 25 years. The removal requirement and

maximum tank life requirements do not apply to unregulated tanks that are less than 1,100 gallons. All regulated tanks that were existing when the rules took effect in 1986 are subject to tightness testing and a replacement schedule that is based on the size of the tank.

Underground storage tanks less than 1,100 gallons in size and residential fuel oil tanks in basements are not regulated by the State. They may be found on farms, institutional properties and at a variety of small businesses. They may exist in residential areas, either installed for homeowner use or in areas where the land use has changed from a more intensive use to residential, with the tanks remaining. Unreported and/or abandoned underground tanks that may be greater than 1,100 gallons may have escaped detection and therefore regulation. It is not uncommon for small country and agricultural supply stores that once had gas pumps to have undetected or abandoned tanks.

It is important, for water quality planning purposes, to note the location of these and other tanks with relationship to surface waters, wetlands and potential aquifers in particular, within the Squam Lakes watershed. The following are locations where such underground tanks are known to occur within the watershed:

A clustering of underground tanks is located in the Holderness village area, in close proximity to both of the Squam Lakes as well as the portion of the Squam River which joins them. Several are also located along the shore of Little Squam Lake, especially the northern side. A number of tanks can be found in the area between White Oak Pond and Squam Lake, fairly close to one or the other of those two waterbodies. There is a known tank in the vicinity at Piper's Cove, in Holderness, as well as two tanks upstream from Cotton Cove, also in Holderness. A couple of tanks are also located along Squam Lake, slightly west of where Swainey Brook comes into the lake. In the vicinity of Sturtevant Bay, Dog Cove and also Sandwich Bay (near Camp Hale), tanks can also be found. Underground tanks are known to exist in the following locations: close to where Carr Brook and Owl Brook converge, in Holderness, east of the Squam River in Ashland, and fairly close to a tributary of Ames Brook, in New Hampton.<sup>20</sup>

#### **Other/Human Activity on Surface Waters**

Some potential pollution sources are directly related to human activities which actually occur on or in surface waters. Boating wakes and other water impacts are considered nonpoint pollution sources. This is due to the finite time periods during which they occur, and the broad locations of individual occurrences either on one or multiple waterbodies. The potential pollution associated with human use of surface waters includes contamination from fuel from combustion engines of watercraft, litter and sanitary wastes from both boating and fishing activities. Increased wave and other water action may cause shoreline erosion and sedimentation and disruption of bottom sediments, which could be considered nonpoint sources. The issue of surface water use, and the need for compatibility with the natural capability of the surface waterbody to sustain such use, is addressed in more detail in Chapter 7.

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<sup>20</sup> DES - WSPCD - Groundwater Protection Bureau, 1988.

**Table 5-5. Highway Deicing-Associated Practices and Water Quality**

Activity	Potential Impact on Groundwater	Potential Impact on Surface Water
<b>Salt Application</b>		
- Surface Runoff		Increased chloride, sodium, calcium, other ions. Concentrations of chloride increased to 10 ppm - not serious except in smaller streams and ponds.
- Leaching	Elevated chlorides, sodium and other ion concentrations - generally not serious except along salted roads where concentrations of chloride may exceed standards.	same as above
<b>Salt Storage</b>		
- Surface Runoff		Increased chloride and sodium concentrations. Significant impact on small streams with chloride concentrations as high as 100+ ppm.
- Leachate	Significantly increased chloride concentrations with reported levels reaching 200 ppm or greater.	same as above
<b>Snow Dumping</b>		
- In Water		Significantly elevated chlorides, sodium, lead, and other pollutants.
- On Land	Elevated chloride, sodium and other concentrations, not necessarily significant.	

Source: NHWSPCC, *Interim Report, Deicing Salt and Water Quality*, March, 1979.

## **Other**

It is difficult to assess or control the impact to water quality due to atmospheric deposition in the form of acid rain. Although acid rain is not perceived to be a major problem within the Squam watershed, it should be considered in general, in relationship to the limited buffering capacity of the lake. Other potential nonpoint sources include unforeseen spills that could result from a wide range of human activities, to include generation, handling, storage and transportation of potentially harmful materials.

The recommendations contained at the end of this chapter will discuss a series of alternative management practices that can be employed to help mitigate and/or alleviate the impacts of both point and nonpoint pollution sources.

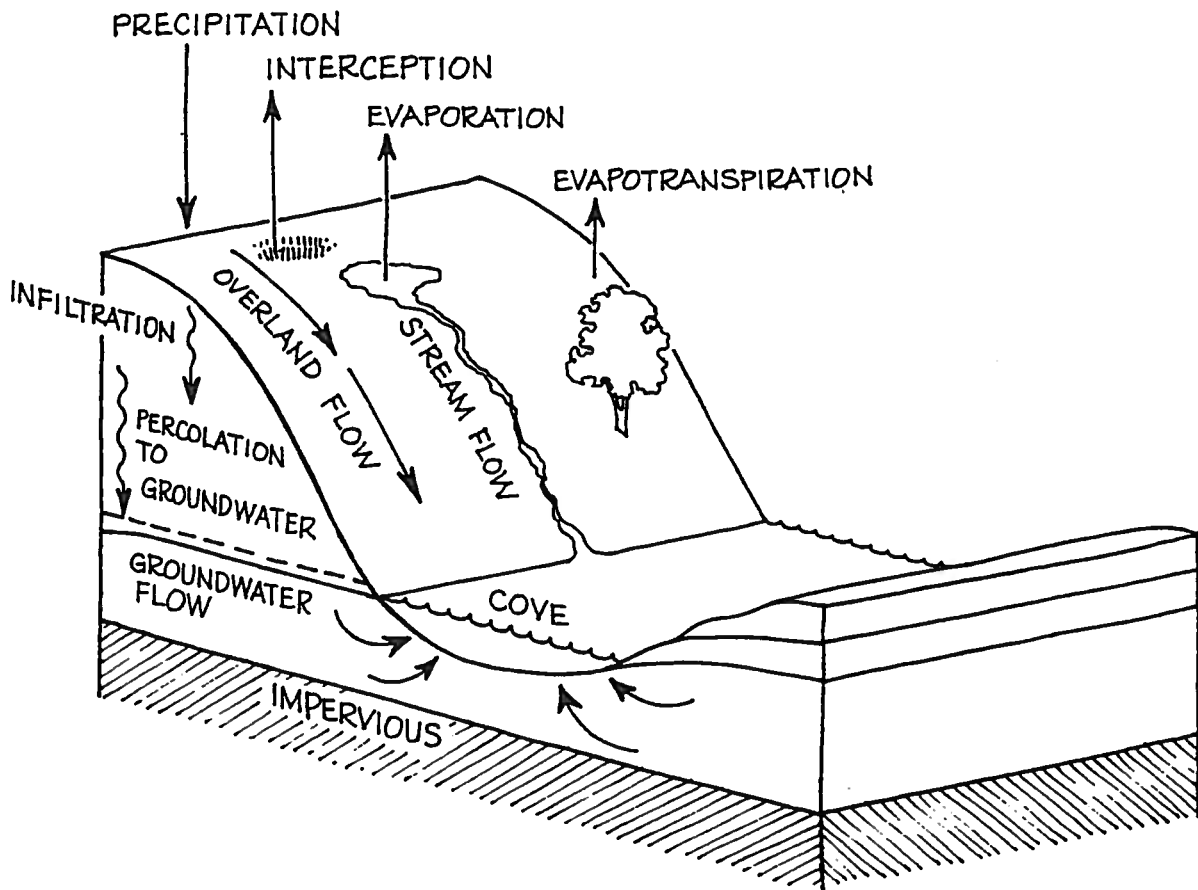
## **The Concept of a Water Budget**

This chapter has described water quality trends for the Squam Lakes, based on long-term data collection, and has also provided general information about the various possible threats to the watershed's water quality. Missing however is a mechanism for linking land use and other activities to their possible impacts on water quality. During the planning process, the Squam Lakes Watershed Advisory Committee expressed an interest in getting a better sense of the actual nonpoint source pollution that may be occurring in the watershed.

Water has the ability to transport a wide variety of pollutants throughout a watershed. An understanding of the dynamics of water movement, and thus the dynamics of sediment and nutrient interchange within the Squam watershed requires the preparation of a water budget. A water budget is essentially a summary of water input and output flow in a watershed or subwatershed. Figure 5-2 illustrates the parameters that are used in developing such a budget. The information in a water budget can be used for a variety of purposes, such as estimating the quantity of water that is likely to be available for a water supply. More important for the purposes of the Squam Lakes watershed, it can also be used as the basis for estimating the volume of pollutants that are transported by water in a watershed or subwatershed. This kind of analysis is termed a nutrient budget, phosphorus being the nutrient most often quantified. In reality, it can be difficult to obtain data for all of the water and nutrient parameters at work, especially for larger drainage areas. It is therefore important, before undertaking a water budget and a nutrient budget, to carefully determine the watershed divide for which the information is needed, and for which it can realistically be expected to be obtained. It is also important to develop an in-depth understanding of the hydrological system for the area to be studied.

Depending on the subwatershed of interest, the focus of a water budget and nutrient budget might vary, although the basic components would be essentially the same. For example, a water budget for each of the subwatersheds that drain into Squaw Cove could be developed, based on the flow parameters outlined in Figure 5-2. This portion of the Squam Lakes watershed is relatively undeveloped. Yet, as the previous section of this chapter noted, water quality data obtained for Squaw Cove in recent years indicates that a certain amount of

Figure 5-2. Components of a Water Budget



Source: New Hampshire Office of State Planning

nutrient loading appears to be taking place, although its source has not yet been identified. One of the subwatersheds which drains into the upper reaches of Squaw Cove is that of Smith Brook. This area is comprised of glacial till soils, and is fairly steeply sloped. A significant portion of the water budget for this subwatershed would be comprised of flow from Smith Brook itself, and it would be expected that a significant amount of evapotranspiration (the release of water vapor from the pores of plant leaves) would also occur in this heavily forested area. The other budget parameters whose importance in the Squaw Cove watershed is not immediately apparent, such as the extent of groundwater recharge, and overland flow, would need to be quantified in developing such a budget. Once data for all the parameters are in place, a nutrient budget could be produced to quantify the concentrations of phosphorus being transported in various ways by water in this area. Similar water/nutrient budgets could be developed for the other subwatersheds providing drainage into Squaw Cove.

Significant information could be obtained through the development of a water/nutrient budget for the Squam Lakes watershed, or one or more of its subwatersheds. It is important, however, to keep in mind that data from such an analysis is in no way required before developing management strategies to prevent threats to water quality. Though it maybe desirable to have a detailed analysis of the hydrology of an area, in reality, it may be difficult to undertake such an analysis, for both financial and logistical reasons. Much nonpoint source pollution is often related to storm events, and it is especially important to do sampling consistently during such storms. Obtaining accurate data concerning the various water flow parameters identified in Figure 5-2 can thus be very difficult, and very expensive. Planning should therefore proceed for the Squam watershed, and any future water/nutrient budget data can be used to supplement planning efforts.

## **Recommendations**

### **Severe Environmental Limitations**

Municipalities within the watershed should adopt overlay zoning ordinances to protect sensitive water resources, to include, but not be limited to wetland, floodplain, watershed, aquifer and shoreland zoning districts. Assistance to municipalities within the watershed interested in developing these ordinances is available from the Lakes Region Planning Commission.

### **Erosion and Sediment Control**

Planning boards within the watershed should evaluate the effectiveness of existing erosion and sediment control requirements in their subdivision regulations, and consider revisions to these requirements, based on standards contained in the 1987 publication prepared by the USDA Soil Conservation Service, in cooperation with the NH State Conservation Committee, the NH Association of Conservation Districts and the North Country Resource Conservation and Development Area entitled *Erosion and Sediment Control Design Handbook for Developing Areas of New Hampshire*. In the process of incorporating these requirements, planning boards should include provisions for bonding the construction of these control measures, and also for their inspection and maintenance following construction.

Planning boards within the watershed should adopt erosion and sediment control requirements to address water quality as part of their site plan review regulations, based on the standards referenced in the previous recommendation.

Planning boards with local excavation ordinances should adopt similar erosion and sediment control requirements to those recommended for inclusion in the subdivision and site plan review regulations, as part of their excavation ordinances.

### **Stormwater Management**

Planning boards within the watershed should adopt stormwater management requirements to address water quality, as part of their subdivision regulations, site plan review regulations and local excavation ordinances. These requirements should include provisions for bonding the construction of these control measures, and also for their inspection and maintenance following construction.

### **Potential Threats to Water Quality**

**Municipalities within the watershed should undertake local inventories of potential threats to water quality and include this information in the local water resource management and protection portion of their municipal master plans.**

**Conservation commissioners and health officers in the watershed should perform an inventory of septic systems within the recommended shoreland protection district, and work with the landowners within that district to develop an ongoing septic system maintenance program for the district. The inventory should include the distance of existing systems from surface waters, wetlands and floodplains. Once compiled, the inventory can be used to develop priorities for septic system inspection and maintenance as required by local health ordinances.**

**As an adjunct to performing a field inventory, local health officers can request that DES provide them with access to the septic system permit files for their municipalities. Current files are located in the WSPCD regional office located in Gilford, New Hampshire. Included are plans for permit applications which are pending only. It would be necessary to obtain the WSPCD construction approval number for each septic system from local building permit records, in order to access this data. Once a permit system is installed, the plans which show actual location are archived in Concord.**

**Municipalities should adopt health ordinances which address the installation and maintenance of private septic systems, wells, underground storage tanks and land uses which have the potential to have adverse impacts on water quality.**

**Municipalities within the watershed should evaluate the adequacy of existing septage disposal practices and consider requiring periodic septic system inspection and maintenance through local health ordinances.**

### **Wellhead Protection**

**Municipalities within the watershed should consider the identification of the 58 possible wellhead protection areas in the watershed, and the performance of an inventory of potential threats to water quality in these possible wellhead areas. Consideration should be given to inspection and monitoring of potential threats identified as located within these wellhead areas.**

### **Performance Standards**

**Planning boards within the watershed should adopt performance standards as part of their site plan review regulations for land uses and facilities which have the potential to impact water quality, based on performance standards that are proposed to be developed through the NH Wellhead Protection Program.**



Planning boards within the watershed should adopt performance standards for land use activities which have the potential to impact water quality, as part of their local excavation ordinances. It is recommended that those municipalities that do not have such ordinances consult with the Lakes Region Planning Commission for guidance in adopting one.

### Best Management Practices

Conservation commissions and planning boards within the watershed should work with and encourage local land owners to consult with USDA Cooperative Extension county foresters and county conservation districts to develop forest management plans which incorporate best management practices for silvicultural activities.

Conservation commissions and planning boards within the watershed should work with and encourage land owners to consult with USDA Cooperative Extension county agricultural agents and county conservation districts to develop land and waste management plans which incorporate best management practices for agricultural activities.

Selectmen within the watershed should develop and adopt a uniform road salt management policy, and work with their municipal road agents to assure its enforcement.

### Water Quality Monitoring Recommendations

#### Water Budget

A water budget should be prepared for the Squam Lakes watershed by the Department of Environmental Services in order to provide input and output flow information about the watershed. Participation of the UNH Lay Monitoring Program is encouraged in order to collect data on the various components of such a budget. The Department should prepare a nutrient component based on the water budget for the watershed, in order to gain an understanding of the nutrient contribution to the lakes from septic systems and other land uses.

#### Tributary Sampling

Tributary sampling should be done in order to better isolate inputs to the Squam Lakes from subwatersheds.

#### Identification of Critical Areas

Critical areas of the lakes should be identified, based on water quality data collected over time, as well as on water and nutrient budget data. This information should be coordinated with other layers of information (land use, fisheries, wildlife habitat, soils, boating and other recreational use of the lakes, etc.). It then can be used for: the discussion of carrying capacity; to provide back-up for new or existing recreational water use regulations; to help identify appropriate public access sites; and to help identify areas that should be protected through some kind of land acquisition strategy.

### Consistency of Monitoring

In order to better discern long term water quality trends for the Squam Lakes, the Squam Lakes Association's lay monitoring program should make every effort to improve the consistency of its sampling of the lakes, in terms of locations sampled, timing of sampling, and techniques used.

### Chlorophyll a Sampling

More frequent chlorophyll a sampling should be done in late summer for both lakes at the metalimnion (middle depth zone), in order to monitor the phenomena of algae blooms which has been occurring there. Lay monitors can take the samples, and processing can be done by the UNH Freshwater Biology Group.

### Alkalinity Monitoring

Alkalinity monitoring recently undertaken as part of the lay monitoring program should be continued, as a way for local residents to monitor the buffering capacity of the Squam Lakes, and thus their vulnerability to the effects of acid rain.

### Monitoring of Cove Areas

There should be more detailed monitoring of cove areas, including more frequent and consistent shoreline surveys of vegetative abundance. Nuisance species such as milfoil should be watched for as part of this monitoring. A weed-watcher program should be established for individual cove areas of the Squam Lakes.

## **Chapter 6. Wildlife Habitat**

### **Introduction**

Fish and wildlife resources are abundant in the Squam Lakes watershed, due to its diversity of habitats and relatively undeveloped character. Many Squam area residents recognize the special natural heritage that surrounds them, and some have been directly involved in managing and protecting particular species, through efforts such as those of the Loon Preservation Committee. Such local publications as *Birds of the Squam Lakes Region* and *The SLA Trails Guide* highlight the fact that it is wildlife, as much as any other factor, that makes the Squam region so special.

This plan emphasizes the need to balance present and future human use of the watershed with wildlife habitat concerns. Land development and other land uses, as well as recreational use of the lakes, can have a negative impact on wildlife and wildlife habitat. As a result, the issues raised here and especially the recommendations in this chapter are linked directly to concepts and recommendations developed in the other chapters of this plan.

In order to focus on those habitats which are the most important and most vulnerable, and which accordingly should be given consideration in terms of preservation and protection efforts, three categories of wildlife habitat have been identified in this plan, - critical, significant and general. The categories were developed based on discussions with wildlife biologists from the NH Fish and Game Department and the Audubon Society of New Hampshire.

"Critical" wildlife habitat areas are to be considered the most important. In the context of this plan, critical wildlife habitat areas are defined as possessing one or more of the following characteristics: important breeding habitat for rare, threatened, endangered species; important habitat for species, whether game or non-game, which are especially valued by humans; natural areas with a high degree of biological diversity; habitats which are threatened by development; and habitats which are difficult to re-create if damaged or destroyed. Critical wildlife habitats in the Squam watershed include the following:

- 1) Potential habitat for rare, threatened and endangered species, and areas of high natural diversity
- 2) Deer wintering areas
- 3) Land area within 250 feet of undeveloped lake shoreline

- 4) Undeveloped islands or portions of islands
- 5) Wetlands and 300 feet buffers around them

"Significant" wildlife habitats are considered somewhat less valuable than critical areas, yet play important roles in maintaining the biological diversity of the Squam watershed, and as connecting travel corridors for wildlife. This category includes:

- 1) Land area within 150 feet of rivers and streams in the watershed.
- 2) Developed islands or portions of islands.
- 3) Large contiguous forest tracts, defined for mapping and analysis purposes as forested areas at least 250 acres in size, which are at least 300 feet away from developed areas.
- 4) Spruce-fir stands, which are very uncommon within the watershed.
- 5) Abandoned Pasture/Open Land, as identified by 1988 land use data categories agricultural and idle.

A distinct subcategory under significant wildlife habitat includes developed lake and river shoreline. These areas possess special wildlife habitat values because of the land/water interface, but the presence of development compromises their value. They are therefore considered less valuable than other areas under the significant category.

- 1) Land area within 250 feet of developed lake shoreline

The third category which will be used to identify habitat is "General" wildlife habitat, a classification which recognizes that wildlife exists in other areas of the Squam watershed, but for various reasons, need not receive the intense focus that should be applied for critical areas, and to a somewhat lesser extent, significant areas.

#### **Lakeshore and Island Habitat**

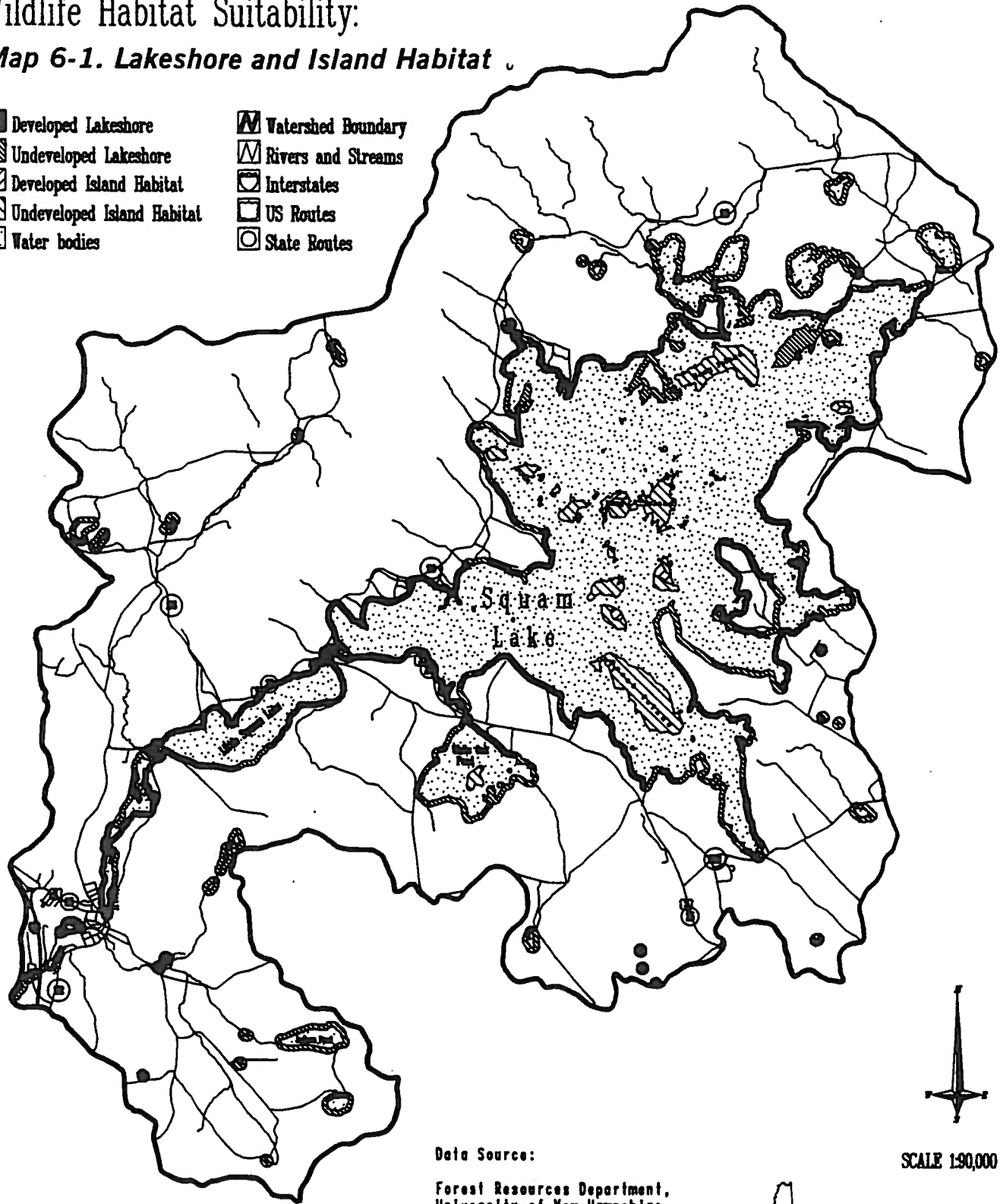
Lakeshore areas surrounding the Squam Lakes provide important habitat for a wide number of wildlife species. The land/water interface can be very productive, especially in areas where aquatic vegetation grades gradually up to dry land. These transition zones can support a great variety of plant species, and therefore

# SQUAM LAKES WATERSHED

## Wildlife Habitat Suitability:

Map 6-1. Lakeshore and Island Habitat

- |                              |                      |
|------------------------------|----------------------|
| ■ Developed Lakeshore        | ▤ Watershed Boundary |
| ▨ Undeveloped Lakeshore      | ▧ Rivers and Streams |
| ▧ Developed Island Habitat   | ⊖ Interstates        |
| ▨ Undeveloped Island Habitat | □ US Routes          |
| □ Water bodies               | ○ State Routes       |



Analysis By:  
 Complex Systems Research Center,  
 University of New Hampshire,  
 September, 1990.

Data Source:  
 Forest Resources Department,  
 University of New Hampshire,  
 1:24,000 quad overlays.  
 U.S. Geological Survey,  
 7.5 minute topographic  
 quadrangles, 1:24,000.



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support a wide diversity of animals. Among other things, lakeshore areas provide nesting and brooding areas for waterfowl, stopover habitat for migratory birds, and banks in which wildlife can make dens. They also serve as travel corridors for wide ranging species such as deer.

The many islands scattered around Squam Lake also provide important habitat for wildlife. Because they have a water/land interface, they are likely to have a good diversity of food and cover, while their relative isolation from human activity provides greater protection from disturbance.

Increased human use of lakeshore and island areas in the watershed poses threats in terms of habitat alteration as well as interruption of wildlife travel patterns and breeding cycles. As lakeshore and island lots are developed, natural vegetation may be removed and replaced by seeded lawns and/or artificial beaches. Destabilization of lakeshore areas may also occur, resulting in erosion. Such actions eliminate important sources of food, shelter and breeding habitat for various species. Water level fluctuations on the lakes also can have serious negative impacts on nesting areas for loons and waterfowl. Finally, recreational activity on the lakes and in proximity to islands often disturbs wildlife. Island species become especially vulnerable to predators and disturbance because they have no place to escape to, other than to leave the island completely.

Undeveloped islands in the Squam watershed provide important nesting areas for various bird species, most notably the common loon and great blue heron. Loons, though officially a threatened species in New Hampshire, have a significant number of nesting areas around the shoreline of Squam Lake and its islands, and one island has contained a large great blue heron rookery within a wetland for more than 80 years.

The bald eagle is now a very rare summer visitor to the Squam Lakes watershed, but nested in the area historically. The future potential for nesting of eagles on undisturbed forested islands or other shoreline areas around the lakes is considered to be very real as the regional population recovers, if potential breeding areas are protected. Local breeding of the osprey, a threatened species in New Hampshire which has been a very uncommon but regular migrant in the Squam Lakes region, is also considered to be a real possibility if potential breeding areas are protected.

The NH Fish and Game Department and Audubon Society of New Hampshire have developed a list of mammals, birds, reptiles and amphibians species, including the species discussed above, that are likely to occur within the watershed within lakeshore and island habitats. These are found in Appendix E.

The 250 foot shoreland zone recommended in Chapter 4 is used to define the limit of critical as well as significant lakeshore habitat. Although wildlife biologists have recommended a 300 foot shoreline habitat area, the 250 foot figure is used for purposes of consistency with the concepts presented in Chapter 4. Critical shoreline habitat will be distinguished as undeveloped acreage within this 250 foot zone, while developed lake shoreline will be identified as significant habitat, in recognition of the fact that though developed, this zone still provides viable and important habitat for many wildlife species. As indicated in the introduction to this chapter, this developed lakeshore is to be considered a distinct subcategory under the significant category. A recent Fish

and Game field analysis of lakeshore areas surrounding the Squam Lakes found that there was a good deal of variation in the degree of development actually occurring in lakeshore areas that were labeled as developed on the 1988 Land Use Map. Their perspective was that because these lakeshore areas are inherently productive, they continue to be valuable to wildlife for many reasons, despite human presence, but they feel that this presence needs to be a factor in characterizing such areas. Undeveloped islands, determined with the help of 1988 land use data, are identified as critical wildlife habitat in this plan. As with developed shoreline, developed islands will be identified as significant habitat. Map 6-1 indicates all of these areas.

Chapter 10 - Land Protection discusses the most appropriate methods for protecting those lakeshore and island areas of the watershed that are still undeveloped.

### **Wetlands/Floodplains/Riparian Habitat<sup>1</sup>**

The wetland and floodplain habitats within the Squam Lakes watershed have been combined for purposes of analysis, primarily because of the limited size of floodplain areas here, and because wetlands are often found in floodplain areas. Both are extremely difficult to replicate if they are damaged or destroyed. Wetlands and floodplains generally contain open water, shoreline, and riparian areas - edges which grade into upland areas. Whether adjacent to the lakes or inland, these areas are biologically productive ecosystems. Wetlands that have an irregular wetland-open water edge are especially likely to provide diverse food and cover for wildlife. They provide essential breeding, spawning, nursery, nesting, migratory and/or wintering habitat for migratory and resident fish and wildlife species.

Various human activities can have detrimental effects on wetlands. Outright elimination of wetlands occurs, for example, when they are filled to accommodate development. Valuable wildlife habitat for feeding, nesting and brooding is lost when this occurs. Also, while wetland vegetation is known to serve as a valuable filter, holding sediments which otherwise would enter lakes and streams, there is a limit to how much filtration they can provide. If too much sedimentation occurs from erosion due to land use activities in upland areas adjacent to wetlands, eventually the mechanism will break down. This will result in a decline in their filtration capacity as well as their productivity. Excessive sedimentation can actually lead to a rise in the elevation of a wetland, and thus can accelerate its conversion to upland. Functional assessment of wetlands is a focus of the Audubon Society of New Hampshire's Wetlands Program. The three-year project, which began in 1989, includes field testing and refinement of a model to assess wetlands, as well as training programs for lay people in its use.

Riparian areas adjacent to wetlands provide habitat for wildlife that is equally as important as the wetland habitat itself. Various species feed in wetlands but nest on the upland edge, including numerous water-










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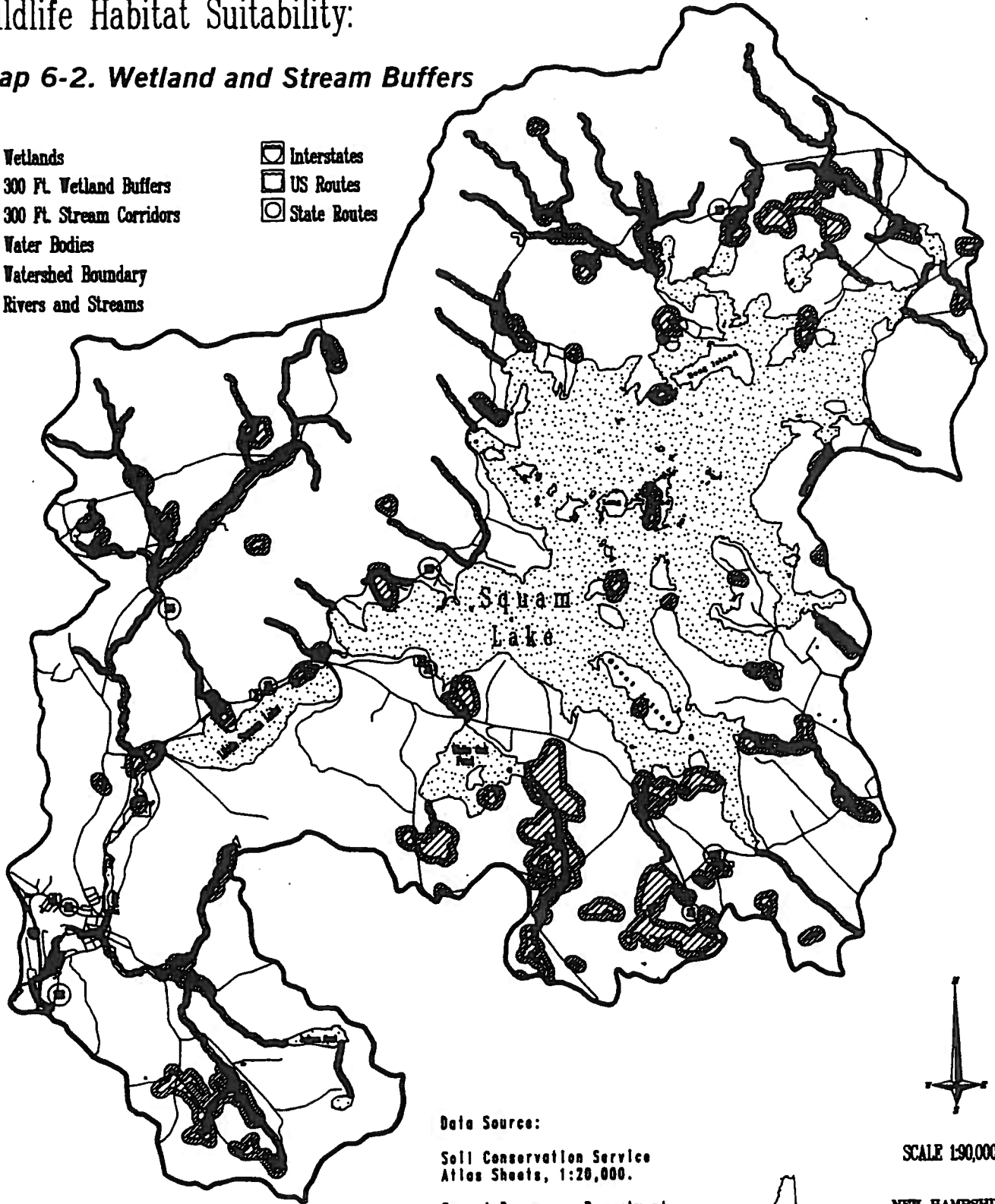
<sup>1</sup> Based on discussions with the Audubon Society of NH and NH Fish and Game Department, 1989-90.

# SQUAM LAKES WATERSHED

## Wildlife Habitat Suitability:

**Map 6-2. Wetland and Stream Buffers**

- |  |  |
|--|--|
|  Wetlands                 |  Interstates  |
|  300 Ft. Wetland Buffers  |  US Routes    |
|  300 Ft. Stream Corridors |  State Routes |
|  Water Bodies             |  |
|  Watershed Boundary       |  |
|  Rivers and Streams       |  |



**Analysis By:**

Complex Systems Research Center,  
University of New Hampshire,  
September, 1990.

**Data Source:**

Soil Conservation Service  
Atlas Sheets, 1:20,000.

Forest Resources Department,  
University of New Hampshire,  
1:24,000 quad overlays.

U.S. Geological Survey,  
7.5 minute topographic  
quadrangles, 1:24,000.



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fowl and songbird species. Studies indicate that waterfowl commonly nest up to 100 yards from the water's edge, and may nest up to 500 yards away, emphasizing the need for a protective buffer for these wetland and riparian areas.

Floodplains, which are the periodically flooded areas next to rivers and streams, provide important habitat and travel corridors for wildlife. They serve as stopover points where long distance migratory wildlife can find food, water, and shelter. Like wetlands, these areas are highly productive ecosystems. Their rich bottomland soils support many tree and shrub species, providing abundant food for nesting and migratory species. Several species depend on the open water for food, while nesting some distance from the shore. Removal of riparian vegetation destroys wildlife habitat. In a fully functioning floodplain, the soils and vegetation help to regulate flow at times of high water by slowing the water as it spreads out over the land. This reduces peak flows by distributing a lower level of discharge over a longer period of time. If this capacity is altered, the concentrated energy of the river or stream is much more likely to damage or destroy property or wildlife habitat downstream.

Waterfowl, wading birds, songbirds and raptors are some of the different kinds of birds that use wetlands within the Squam Lakes watershed for nesting and feeding. Mammals, such as beaver, mink, muskrat, otter, moose, deer and black bears are also attracted to these areas because of their abundant food and cover. Wetlands and floodplains also support a rich variety of amphibians, reptiles, invertebrates and fish, which are important in maintaining regional biodiversity, and provide essential links in the food chains of these aquatic systems. Appendix E provides a complete listing of species occurring in wetland/floodplain/riparian areas of the Squam Lakes watershed.

The great blue heron is one of the more spectacular wetland bird species found in the Squam watershed. Herons are very vulnerable to the effects of pollutants over time, and as with many other birds species, they tend to accumulate chemicals from the water and bottom sediments, and concentrate it in their tissues. Although they seem to be holding their own at present in New Hampshire, the species has been reduced to the point of extinction in some states.<sup>2</sup> The most important factor which will allow the continued presence of the great blue heron and other wading birds is the availability of undisturbed nesting sites, and undisturbed and unpolluted feeding areas. Disturbance of nesting areas by humans at critical times can cause abandonment of entire colonies, mortality of eggs and young in their nests, and mortality of young which may attempt to leave the nest before they are able to fly.

A variety of wetland types are found in the Squam Lakes watershed. They differ as to average water depth, permanency of standing water and vegetation. Some wildlife species are equally at home in more than one wetland type, while others may have very specific habitat preferences.

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<sup>2</sup> Maine Department of Inland Fisheries Wildlife, *Significant Fish and Wildlife Resources of Mid-Coastal Maine*, 1989.

Marshes are areas of non-woody vegetation which are flooded at least part of the year. Permanent deep water marshes may support extensive areas of emergent vegetation, including cattails, burr reed, grasses, sedges and rushes. They provide valuable all-purpose waterfowl habitat, while providing food and cover for many mammals. Shallow marshes generally contain excellent quantity and diversity of vegetation that provides food and cover, especially important for waterfowl. Bogs are another wetland type found in the watershed, and are characterized by a floating mat of vegetation that is supported by a thick layer of sphagnum moss. They are frequented by a wide variety of song birds.

Wooded swamps, an additional wetland type found in the Squam watershed, generally have water-logged soils, but may be covered with a foot or more of water on a seasonal basis. Wise silvicultural management of wooded swamps, besides assuring a continued source of cordwood, can stimulate growth of vegetation which white-tailed deer can make good use of. If left as they are, dead "snag" trees in these wetland areas can provide important nest sites for numerous wildlife species.

Vernal pools, yet another wetland type, are small confined basins which contain standing water for only part of the year. They are considered a unique wetland type because they are not connected to any permanent waterbodies. Since they dry up during part of the year, they therefore cannot support fish populations, and thus provide important predation-free breeding habitat for amphibians.

The wetland/floodplain/riparian areas within the Squam Lakes watershed are found on Map 6-2, and are based on Soil Conservation Service Soil Survey data. The protection of these areas, primarily through regulatory measures, is addressed in Chapters 4, 5 and 8 of this plan. The riparian edges of wetlands and floodplain areas have been identified by allowing a buffer of 300 foot upland from them. This distance is generally supported by wildlife studies for specific wetland species, and by the Fish and Game Department and the Audubon Society of New Hampshire. The importance of protecting these buffer areas, most appropriately through non-regulatory means such as acquisition of conservation easements, is addressed in Chapter 10 - Land Protection.

### **Upland Habitat**

Upland habitat in the Squam Lakes watershed includes any land that is at a higher elevation than lowland areas such as lakes, lakeshores, floodplains, wetlands and their riparian areas. A variety of critical and significant upland habitat types have been identified for the Squam Lakes watershed, including deer wintering areas, large contiguous forested areas of various kinds, abandoned farmland and travel corridors along upstream streams. For purposes of this plan, some of these upland areas have been mapped based on land cover type, as determined by interpretation of aerial photos taken in 1988 (see Map 6-4). Deer wintering areas were mapped by the NH Fish and Game Department (see Map 6-3).

### **Deer Wintering Areas (Deeryards)<sup>3</sup>**

One of the most popular wildlife species, white-tailed deer are very adaptable, and have adjusted well to changing land use patterns. However, New Hampshire is near the northern limit of the white-tail's range, and our harsh winter weather challenges the deer's ability to survive. Winter is a time of high energy demands and low availability of nutritious food. Winter food supplies are so low in nutrition that they can only slow the consumption rate of energy reserves stored as fat during fall feeding.

To survive this most difficult time of year, deer have evolved a number of physiological and behavioral adaptations through which they conserve energy. Their primary behavioral adaptation is the restriction of their movements to softwood stands with dense evergreen canopies. These stands are referred to as deer wintering areas, or deeryards. The dense canopy in these stands, averaging about 70 percent softwood crown closure, intercepts much of the falling snow. The decreased snow depths that result allow deer to move much more easily within these areas than in adjoining hardwood stands with deep snow. The softwood canopy also reduces wind velocity and temperature fluctuations within the stand, and the shelter thus provided allows deer easier movement, while minimizing heat loss. These factors help reduce energy needs, and slow the rate at which the deer consumes its stored energy reserves. Good quality winter habitat frequently makes the difference between survival or death.

Deer wintering areas within the Squam Lakes watershed are considered critical wildlife habitat, and are found on Map 6-3. Criteria important in identifying deer wintering areas include tree species composition, stand size, and aspect. Areas with mature softwood (especially eastern hemlock), softwood canopy closure between 60-80 percent, and a generally southern exposure can provide optimal shelter. Areas displaying these characteristics have been field checked by the Fish and Game Department for evidence of winter use, such as bark stripping on young hemlocks, deer pellet groups, and deer trails. High quality deer wintering areas generally display evidence of many years of use. The most appropriate methods for protecting deer wintering areas are addressed in Chapter 10.

### **Upland Stream Corridors**

Those land areas in the Squam watershed which adjoin upland streams are categorized as significant in this plan because they are especially important as travel corridors, allowing wildlife to move between undeveloped tracts of land. Stream corridors also provide a unique habitat for wildlife species such as water oriented mammals, especially furbearers and other small mammals, which are almost exclusively limited to riparian areas of streams, rivers and lakes.








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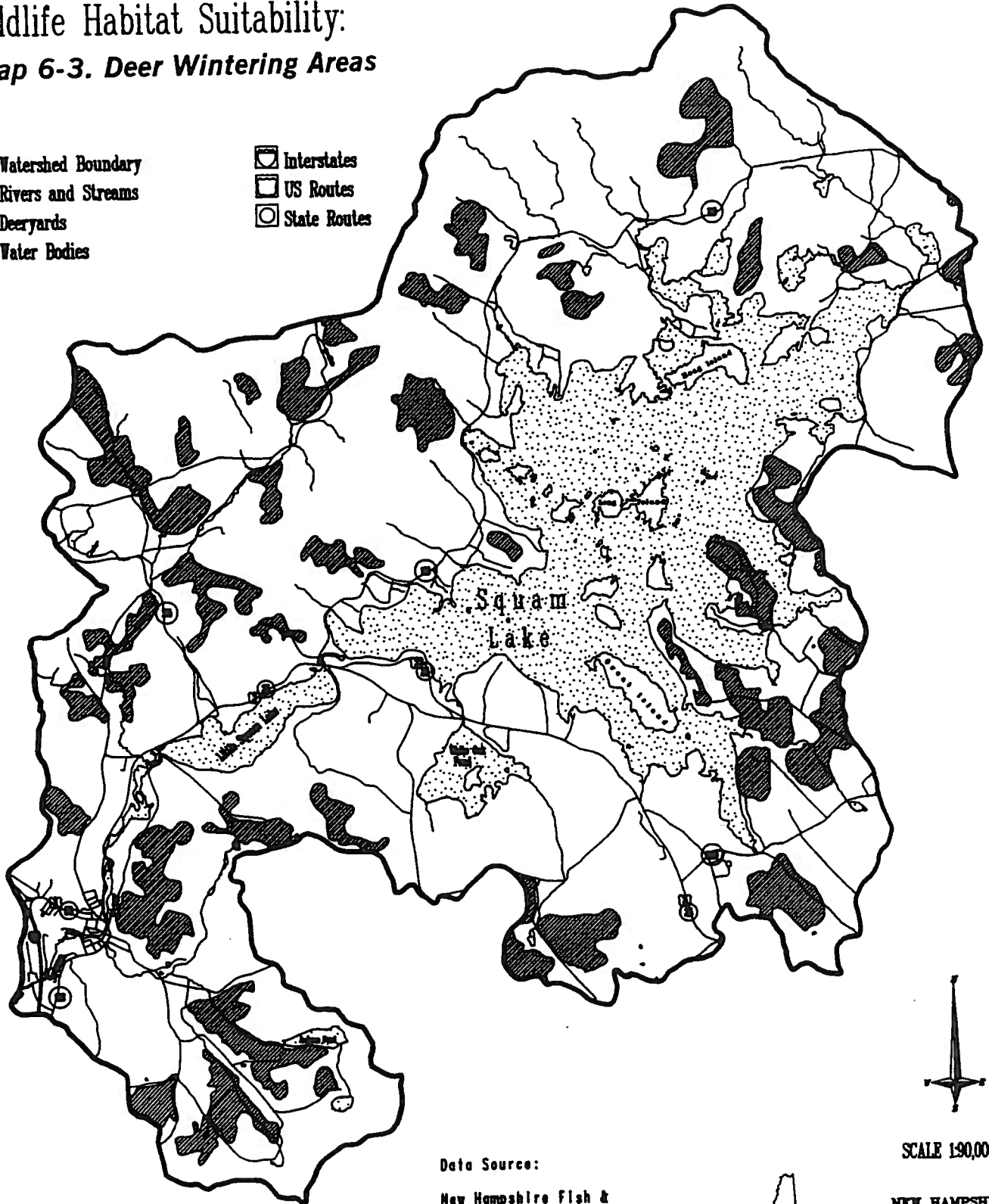
<sup>3</sup> Provided in large part by NH Fish and Game Department, 1990.

# SQUAM LAKES WATERSHED

## Wildlife Habitat Suitability:

### Map 6-3. Deer Wintering Areas

-  Watershed Boundary
-  Rivers and Streams
-  Deeryards
-  Water Bodies
-  Interstates
-  US Routes
-  State Routes



Analysis By:

Complex Systems Research Center,  
University of New Hampshire,  
September, 1990.

Data Source:

New Hampshire Fish &  
Game, 1:24,000 quad  
overlays, 1989.

U.S. Geological Survey,  
7.5 minute topographic  
quadrangles, 1:24,000.



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Wildlife researchers agree that managing and protecting species in riparian areas can be difficult because of the areas' large edge to area ratio, since wildlife here are subjected to numerous disturbances from surrounding areas which can affect water quality, and nesting and feeding habitat. No standardized methodologies have yet been developed to determine the sizes of buffers that are effective in protecting upland stream riparian areas. This is not surprising, since studies indicate that the optimum size of a buffer will depend on the particular species in a given corridor, as well as the spatial arrangement and general availability of food and cover in that particular area. The wildlife literature thus suggests a range of values for buffers, reflecting the different species whose needs are being considered, as well as their locations.

A recent Maine wildlife report<sup>4</sup> summarized the results of several field studies that have been done concerning the importance of maintaining water quality of streams and rivers in order to protect fisheries habitat. The studies<sup>5</sup> generally indicated that the size of a riparian buffer whose intent is to protect water quality is determined by soil characteristics, pollutant characteristics, desired water quality standards, and the type of waterbody. These characteristics were found to vary widely from stream to stream and region to region, and even within a particular stream's watercourse. The Maine study quotes a range of buffer widths, from 90-130 feet, that were recommended in these other studies. It, however recommended a 250 foot buffer for high and moderate value fisheries, and a 100 foot buffer for low value fisheries.

Studies concerned with buffers to protect riparian habitat for bird species generally agree that the larger the buffer provided, the more species will be able to obtain feeding, nesting and roosting habitat, including less common species. As buffer strips become narrower, the variety of species that can make use of these areas declines, and it is only the most common birds, which are more flexible in their requirements, that endure. The previously quoted Maine Study indicates that buffer widths ranging from 200 to 600 feet have been reported in the literature as necessary to maintain some breeding bird populations.

Riparian areas along upland streams are also recognized as important habitat for mammals. A survey done in Maine indicated that 85 percent of 350 known wintering deer wintering areas were located in riparian conifer stands, because of the shelter these areas provided from low temperatures and high winds. Other studies indicate that furbearers also prefer riparian habitats to adjacent areas. One study<sup>6</sup> determined that 85 percent of furbearers that were located were found within 300 feet of water, and another found that mammal species such as

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<sup>4</sup> Maine Department of Inland Fisheries and Wildlife, *Significant Fish and Wildlife Resources of Mid-Coastal Maine*, 1989.

<sup>5</sup> J.A. Ferwada, R.O. Rourke and K.G. Stratton, *Soil Suitability Guide for Land Use Planning in Maine*, Univ. of Maine Coop. Extension Service Misc. Publication 667, 1975.

<sup>6</sup> F.J. DiBelo, *Furbearer Use of Waterways in Maine*, Unpublished report Maine Coop. Research Unit, 1982.

coyote, bobcat, red fox, fisher and marten feed within approximately 60 feet from the water.<sup>7</sup> The Maine study found that buffers recommended for mammals in the wildlife literature were 300 feet for large mammals, and ranged from 200 to 280 feet for small mammals.

The NH Fish and Game Department has recommended that the buffer for upland streams should be 300 feet, which is consistent with their recommendations for wetland buffers. For purposes of this plan, a buffer of 150 feet of land on each side of streams in the Squam watershed was mapped as significant wildlife habitat. Appropriate methods for protecting these areas are found in Chapter 10.

### **Spruce-Fir Forested Area**

This upland habitat type comprises only 42 acres within the Squam watershed. The 1988 land cover/use data indicated that there are seven small parcels of spruce fir, averaging about 6 acres each. None are at especially high elevations, and only one is known to contain rare elements of natural diversity. Because of this, and because extensive spruce-fir habitat exists outside of the Squam watershed, the habitat is categorized here as significant, but not critical.

### **Abandoned Pasture/Other Open Areas**

Abandoned pasture/other open areas were mapped, for purposes of this plan, using the categories agricultural and idle from the 1988 land cover/use data. Map 6-3 indicates that a relatively small amount of such land exists in the Squam watershed. As wildlife habitat, these areas are categorized as significant, but not critical because though important, they provide relatively less biodiversity than those habitats considered critical. Also, although at present relatively little of this habitat exists in the watershed, a good deal more could be created if this was desired. The protection of these areas is addressed in Chapter 10, as part of the discussion on the watershed's productive natural resources.

### **Large Contiguous Forested Areas<sup>8</sup>**

A number of wildlife species require large tracts of contiguous forest in order to maintain viable populations. Some of these species have specialized habitat requirements, while others range over large areas. All display some level of sensitivity to forest fragmentation and human disturbance, and this influences their use of an area, and their ability to successfully reproduce and raise young there.

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<sup>7</sup> Brinson et al, "Riparian Ecosystems; Their Ecology and Status", US Fish and Wildlife Service Report, 1981.

<sup>8</sup> Provided in large part by NH Fish and Game Department, 1990.

One such group of sensitive species is referred to as forest interior birds. These birds generally migrate long distances, have a relatively short breeding season with only one brood per year, and are more specialized in their habitat requirements than birds that are year-round residents. Any nest failure caused by predation or other factors therefore has a more severe impact on the productivity of this group than on resident species. Forest interior birds include such species as ovenbirds, black-throated blue warblers, hermit and wood thrushes, and many other neotropical species that migrate to the region.

Studies have shown that the nesting success of forest interior birds is associated with the size of undeveloped tracts of forest. As the size of the forested area decreases, so does the nesting success of these species. Studies in the mid-Atlantic states suggest that contiguous forested areas as large as 7500 acres may be necessary to maintain the full complement of forest interior breeding birds. These studies indicate that the probability of detecting many bird species within particular forested tracts increases with increasing size of the forested areas. For many species, the probability of finding them begins to level off as forest size exceeds 250 acres. It should be noted that New Hampshire in general, and the Squam Lakes watershed in particular, are more heavily forested regions than the areas in these studies. However, their figures do serve as potential targets in the face of increasing development.

Mammals with large home ranges (total area needed to meet their life requirements) are especially sensitive to forest fragmentation caused by development. Examples from the watershed include the black bear and the fisher. Black bears have home ranges of up to 19 square miles for females, to over 50 square miles for males.<sup>9</sup> Fisher require large areas of contiguous overhead cover, and males and females may range over 8 and 6 square miles respectively.<sup>10</sup> Because these species are wide-ranging and occur in relatively low densities, their population levels and growth rates are sensitive to increases in road densities and human related development.

Large contiguous forested areas within the Squam Lakes watershed are indicated on Map 6-4 as significant habitat. To delineate these areas, 1988 land use data categories were used, including: white pine, spruce-fir, hardwood, and mixed pine-hardwood. The data layer was created by combining the acreage for these categories, then subtracting out a 300 ft. buffer around developed areas (housing, commercial, industrial). Remaining forested tracts had to be at least 250 acres in order to qualify as a large contiguous forested area.

Recommendations in recent studies<sup>11</sup> to protect contiguous forested areas from excessive fragmentation are listed below. The protection of contiguous forest in the Squam watershed is addressed in Chapter 10.

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<sup>9</sup> Chapman and Feldham, *Wild Mammals of North America*, 1982.











<sup>10</sup> Martyn Obbard and Bruce Malloch, *Wild Furbearer Management and Conservation*, 1987.

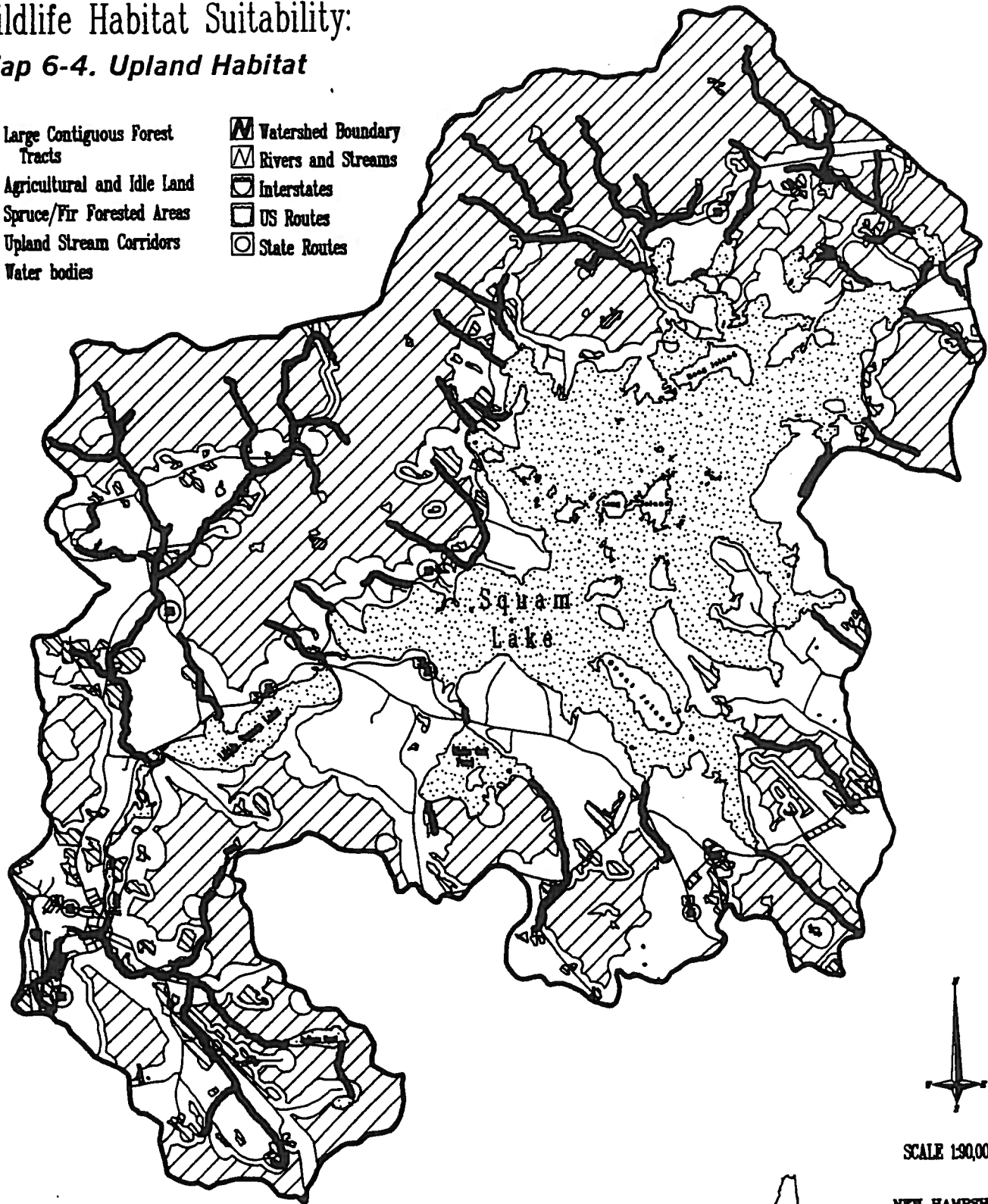
<sup>11</sup> The Wildlife Society, *Habitat Area Requirements of Breeding Birds of the Middle Atlantic States*, 1989.

# SQUAM LAKES WATERSHED

## Wildlife Habitat Suitability:

### Map 6-4. Upland Habitat

- |  |  |
|--|--|
|  Large Contiguous Forest Tracts |  Watershed Boundary |
|  Agricultural and Idle Land     |  Rivers and Streams |
|  Spruce/Fir Forested Areas      |  Interstates        |
|  Upland Stream Corridors        |  US Routes          |
|  Water bodies                   |  State Routes       |



Analysis By:

Complex Systems Research Center,  
University of New Hampshire,  
September, 1990.

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- \* Concentrate or restrict of residential development in wooded areas to their perimeters, or to woodlands less than 100 acres in size. Fragmentation of extensive woodlands should be avoided. Minimize right-of-way corridors and roads through extensive forested acres to reduce edge creation. Place utility corridors and roads along the edges of forested tracts.
- \* Retain uncut forested buffers along streams, shorelines, and roadsides. The wider the buffer, the more protection it provides for forest interior birds.

## Travel Corridors

Travel corridors are important wildlife habitat because animals must travel over varying distances to find food, protection from predators or humans, to find mates, to alleviate competition, and to disperse their populations. They play an important role in maintaining healthy wild populations by allowing dispersal of juvenile animals, which is necessary for population expansion, as well as to avoid inbreeding or localized overpopulation. By enabling wildlife to move from one habitat to another, travel corridors counteract the effects of habitat fragmentation, which occurs as a result of many human activities. This fragmentation tends to restrict and isolate wildlife populations because of a decrease in the amount of the landscape in which animals can move about freely, with major consequences such as: negative genetic effects; loss of species occurring only in large patches of interrupted habitat; endangerment of low density, wide ranging species; and invasion of alien species. Protecting undisturbed corridors between large areas of breeding habitat lessens the negative impacts of habitat fragmentation.

Areas within the Squam Lakes watershed that are used as travel corridors include many of the critical and significant habitats already discussed in this chapter: wetlands and streams, and their buffers; deer wintering areas and adjacent blocks of contiguous forest; lakeshores and islands; and abandoned pasture/cropland and woodland edges. They can best be visualized in terms of the species that use them and what they use them for. For example, deer use daily corridors to move between feeding and resting areas. Seasonal migration corridors in the watershed are used by such species as black bear, which may use a consistent route to travel between fall breeding habitat and their winter den site, and amphibians, which travel to vernal pools to breed.<sup>12</sup>

Stopover areas in the Squam Lakes watershed are also important components of long distance travel corridors for migratory wildlife. These areas include the lakes themselves, ponds, wetlands, rivers, streams, and their adjacent uplands. These areas serve as geographic guides, as well as foraging and resting places for species which travel long distances between their breeding and wintering ranges.<sup>13</sup>

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<sup>12</sup> ASNH, "Why Protect Our River Corridors?" Position paper prepared by Carol Foss, Wildlife Programs Director.

<sup>13</sup> Ibid.

Little information is presently available that specifically identifies known travel corridors within the Squam Lakes watershed. The development of a strategy to conserve wildlife corridors should therefore focus on the habitat types identified as critical and significant earlier in this chapter which provide such corridors (see Maps 6-1 through 6-4). An important consideration in identifying and protecting important travel corridors is to determine their proximity to areas of critical and significant habitat that are already protected. In this way, land conservation strategies, whether regulatory or non-regulatory, could work to connect and add to large protected blocks of wildlife habitat. Chapter 10 discusses strategies for protecting travel corridors.

### **Habitat for Rare, Threatened and Endangered Species**

As indicated by the list that follows, the Squam Lakes watershed supports a number of wildlife species which are either endangered or threatened. The habitat they presently use, or could use at some point in the future, is categorized as critical, for purposes of this plan. Loons are a much beloved bird species in the Squam region, and are presently considered threatened in New Hampshire. Data on their present nesting habitat in the watershed has been provided by the Loon Preservation Committee (see Map 6-5). Possible locations of Rare Elements of Natural Diversity, based on information provided by the Natural Heritage Inventory, are also found on Map 6-5. Much of the Natural Heritage Inventory information is in need of field verification at the present time.

The following descriptions of threatened and endangered bird occurrence are based on information in Bev Ridgely's book *Birds of the Squam Lakes Region*. The information provides a valuable focus for further information gathering which needs to be undertaken for these species. The species listed here reflect the official State list of threatened and endangered species. According to the Audubon Society of NH, the only species listed which are currently breeding in the Squam Lakes watershed, or likely to do so in the foreseeable future, are the bald eagle, pied-billed grebe, osprey, sedge wren, common loon, and cooper's hawk.

#### **Bald Eagle - Endangered (State and Federal)**

The bald eagle is a very rare summer visitor and migrant to the region. At least one non-breeding adult summered along Squam from the late 1950's to 1975. Recent records are all of single adults: eagles have been sighted over Squam Lake, off Brown Point in Moultonborough, and at Deep Haven Camp. No immature eagles have been seen here since 1977, when one was spotted at High Haith. Bald eagles build large stick nests, most often in either tall white pines or spruce trees located within a mile or so of aquatic environments. In addition to nesting areas, bald eagles require perch sites and nocturnal roosts located near nests and feeding areas. The population of bald eagles was decimated in the past because of habitat loss, and direct destruction by humans through shooting as well as the accumulation of pesticides in their systems. Since the species was placed on the Endangered Species list in 1972, and DDT and other pesticides known to be harmful to predators were banned

in 1978, the eagle has made a slow comeback. It is recognized that protection of traditional nesting areas in the Squam watershed, as in other areas of New Hampshire and the Northeast, is a key factor in the long-term recovery of the bald eagle population. Several studies have shown that bald eagles are known to return and nest at sites that they had long ago abandoned.<sup>14</sup>

**Pied-billed Grebe - Endangered (State)**

This endangered species nests on ponds and dense emergent shoreline vegetation, in marshes with stretches of open water, and around marshy lake inlets. In the Squam watershed, the bird is most likely to be found in marshy lake cove areas or in ponds with much aquatic vegetation. Sightings have occurred at Squaw Cove and the Unsworth Preserve.

**Upland Sandpiper - Endangered (State)**

This species was once a common summer resident of pastures and hayfields, but its numbers dwindled as farming declined during the late 19th century, because of a loss of breeding habitat to reforestation and development, widespread slaughter by market hunters before 1914, and continued hunting pressure on the South American wintering grounds. Very few successful nestings have been confirmed in New Hampshire in recent years; the only known records in the Squam Lakes region were in 1971 and 1981.

**Common Tern - Endangered (State)**

The common tern is a very uncommon but fairly regular visitor to island shores and open expanses of Squam Lake. Its population in general has declined because of a loss of habitat, competition for nest sites with gulls, and human disturbance of colonies.

**Henslow's Sparrow - Endangered (State)**

The only known record of a sighting in the Squam Lakes region was in 1971.









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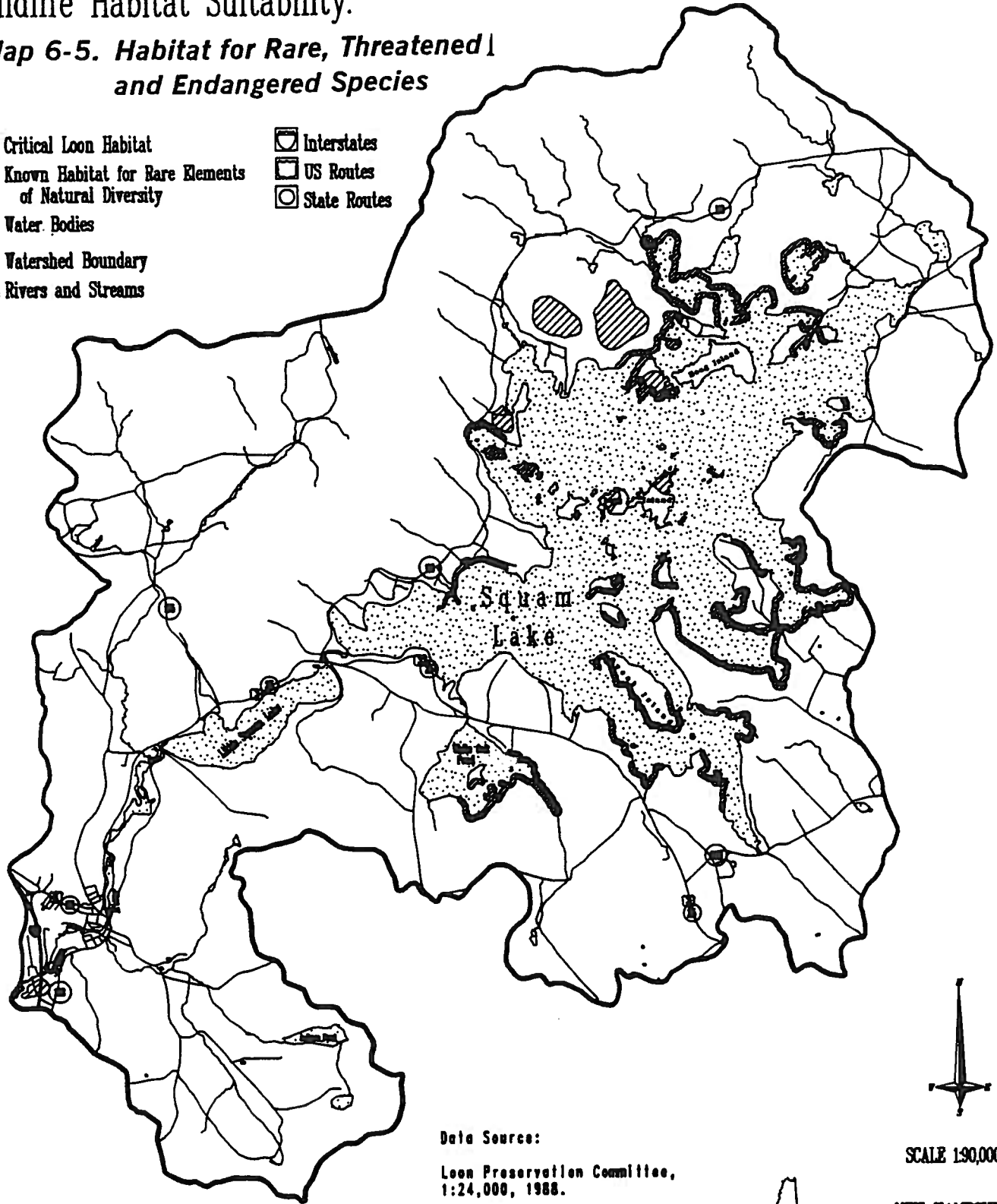
<sup>14</sup> C. Todd and R.B. Owen, "Management of Bald Eagle and Osprey Nest Site", in *Is Good Forestry Good Wildlife Management?* Maine Agricultural Experiment Station Miscellaneous Publication 689, 1986.

# SQUAM LAKES WATERSHED

## Wildlife Habitat Suitability:

### Map 6-5. Habitat for Rare, Threatened and Endangered Species

- |  |  |
|--|--|
|  Critical Loon Habitat                                |  Interstates  |
|  Known Habitat for Rare Elements of Natural Diversity |  US Routes    |
|  Water Bodies   |  State Routes |
|  Watershed Boundary                                   |  |
|  Rivers and Streams                                   |  |



**Analysis By:**

Complex Systems Research Center,  
University of New Hampshire,  
September, 1990.

**Data Source:**

Loon Preservation Committee,  
1:24,000, 1988.

Natural Heritage Inventory,  
1:24,000, 1988.

U.S. Geological Survey,  
7.5 minute topographic  
quadrangles, 1:24,000.

SCALE 1:90,000

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Geographic Information System  
and Information Transfer System



### **Sedge Wren - Endangered (State)**

This species was once a rare summer resident in the area, but now is probably a casual visitor. It is found in specialized habitats such as wet grassy or sedge meadows.

### **Osprey - Threatened (State)**

The osprey has been a very uncommon but regular migrant to the Squam Lakes region. The few that still migrate through the area are usually seen flying over the lake, especially in and around Lily Cove, or along river valleys or mountain ridges.

### **Common Nighthawk - Threatened (State)**

The nighthawk may nest within the Squam Lakes region occasionally, though this is not confirmed. The species nests in open or semi-open rural situations, and on flat, graveled rooftops in cities and towns.

### **Purple Martin - Threatened (State)**

This species is a casual migrant and visitor, and used to be an uncommon summer resident. It prefers open and semi-open country near water.

### **Northern Harrier - Threatened (State)**

The northern harrier, or marsh hawk is a very uncommon migrant, with no known nesting in the Squam area. The species breeds in marshes, wet meadows, or open country.

### **Cooper's Hawk - Threatened (State)**

This hawk is a very uncommon migrant to the Squam region. It possibly nests here, but this has been unconfirmed in recent years. The species' preferred habitat is mature open woodland.

### **Common Loon - Threatened (State)**

The common loon is officially a threatened species, and protected under the New Hampshire Endangered Species Conservation Act (RSA 212:A). Loons and their habitat have faced and continue to face a number of problems. On Squam Lake as in other areas of the State, loon habitat has been threatened to a certain extent by shoreline development. Land development can cause direct disturbance of nesting and brooding loons on the habitat that still exists. Another threat to loons is egg predation by raccoons and gulls, both of which have increased as a result of increases in human population, since more forage has become











available to these species. Water level management, which can cause unnatural fluctuations in water levels, can also be very harmful to nesting loons. Increases in water levels of six inches or more can cause flooding of loon nests, while decreases of one foot can cause stranding of nests, since loons are practically immobile on land and are therefore extremely vulnerable when so much of the shore is exposed. Loons are also vulnerable to lead poisoning from ingestion of small fishing sinkers, strangling in monofilament fishing line, and swallowing fishing lures. Statewide data on loons has been collected by the LPC since 1976, and management tools have been derived from extensive research that the Committee has done. Topics studied have included nesting chronology, causes of reproductive failure and other aspects of loon ecology.

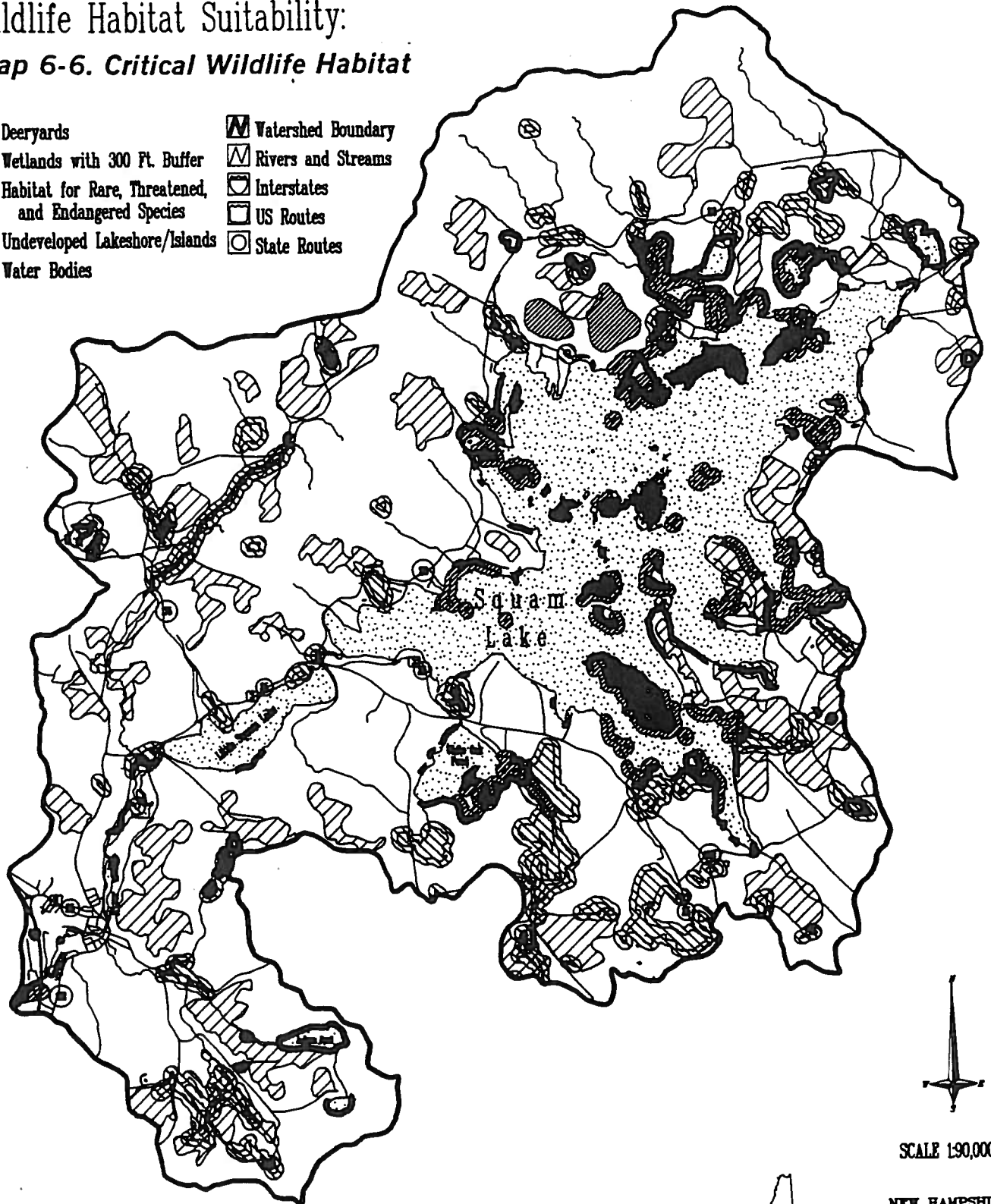
The Loon Preservation Committee's management program for loon habitat has focused on two goals: the reduction of unnatural pressures on the loon which have a negative effect on survival and productivity; and the improvement in successful hatching of loon eggs. Direct protection of nesting sites has thus been one of the Committee's prime management functions. Nesting sites on Squam Lake are actively managed by The Loon Preservation Committee, in conjunction with the Squam Lakes Association. The sites are patrolled frequently and consistently, and floatlines and large signs indicating loon nesting areas are used to keep the public away from them. In order to protect loon habitat from development, the Loon Preservation Committee uses several approaches: they sometimes work directly with individuals and organizations interested in obtaining easements for areas containing loon habitat; occasionally they obtain conservation easements on important habitat areas; and on rare occasions, they purchase loon nest sites.

# SQUAM LAKES WATERSHED

## Wildlife Habitat Suitability:

### Map 6-6. Critical Wildlife Habitat

- |  |  |
|--|--|
|  Deeryards  |  Watershed Boundary |
|  Wetlands with 300 Ft. Buffer                         |  Rivers and Streams |
|  Habitat for Rare, Threatened, and Endangered Species |  Interstates        |
|  Undeveloped Lakeshore/Islands                        |  US Routes          |
|  Water Bodies   |  State Routes       |



SCALE 1:90,000











Analysis By:  
Complex Systems Research Center,  
University of New Hampshire,  
September, 1990.

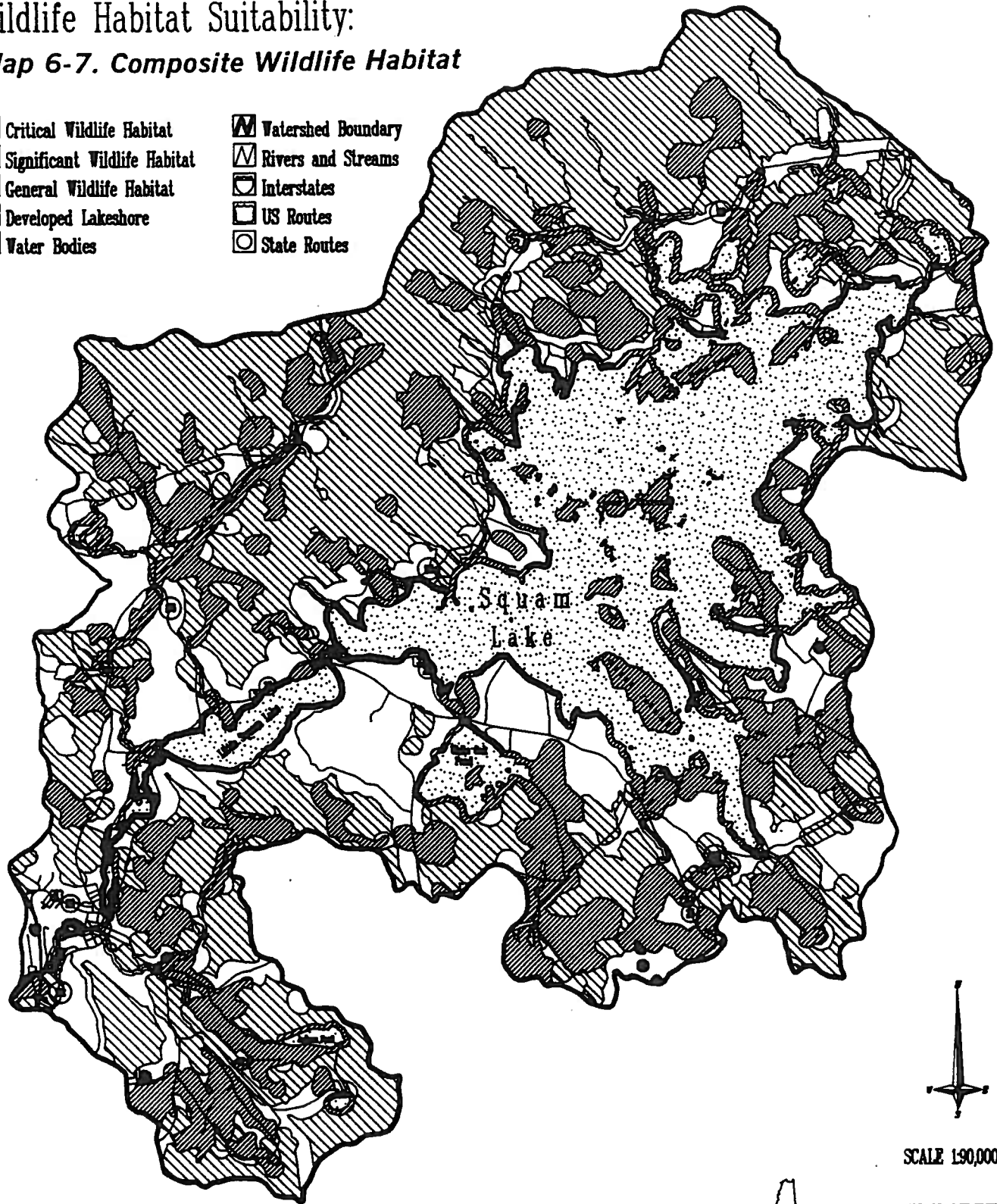


# SQUAM LAKES WATERSHED

## Wildlife Habitat Suitability:

### Map 6-7. Composite Wildlife Habitat

- |  |  |
|--|--|
|  Critical Wildlife Habitat    |  Watershed Boundary |
|  Significant Wildlife Habitat |  Rivers and Streams |
|  General Wildlife Habitat     |  Interstates        |
|  Developed Lakeshore          |  US Routes          |
|  Water Bodies                 |  State Routes       |



SCALE 1:90,000

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Geographically Referenced Analysis and Information System

Analysis By:

Complex Systems Research Center,  
University of New Hampshire,  
September, 1990.





## **Lake Habitat**

The open waters of the Squam Lakes contain a diversity of aquatic wildlife habitat. The deeper areas of the lakes provide suitable temperatures for lake trout, landlocked salmon, rainbow smelt and whitefish. However, considering the large extent of open water at Squam, a relatively small percentage of the lakes contains these deeper basins. Habitat for cold water species is therefore somewhat limited, especially in summer, when these species are restricted to the deepest water.

The lakes' extensive shallow water areas are ideal for warm-water fish species, including bass and perch. Shallow water reefs provide spawning areas and aquatic vegetation provides cover for fish fry. Shallow areas provide important foraging habitat for aquatic mammals feeders such as otters and muskrats. The bottom sediments provides a home for benthic organisms such as crayfish, freshwater mussels, and other invertebrates. The lake also provides a breeding habitat for aquatic insects upon which fish, waterfowl and songbirds feed.

Increased use of the Squam Lakes for recreational purposes may have a number of immediate negative consequences for aquatic wildlife. For example, fish spawning areas may be disrupted by power boats traveling in shallow areas. Loons and loon chicks have been killed by power boats operating in nearshore brooding areas. Water quality may decline because of increases in nutrient loading, changes in vegetation, increases in water temperatures, and pollution from various types of motors. Water level management, designed in part to enhance boating recreation and protect docks and shoreline property; can have serious negative impacts on lake trout spawning areas. If drawdown occurs after trout have spawned in late fall, exposure of eggs can result in heavy mortality. As previously indicated, decreases in lake water levels can also affect loons, rendering nests inaccessible to adults. On the other hand, if the water level is raised after loons have laid their eggs, this can cause flooding of nests.

### **Major Fish Species**

The following information on the fisheries of the Squam Lakes was obtained from the NH Fish and Game Department, in reports and through conversations with agency personnel. Spawning sites and/or sites where particular species generally can be found on the Squam Lakes was also provided by Fish and Game, and are identified in Map 6-8. Department personnel currently are finalizing a long-term fisheries management plan for the lakes, which will be available in the fall of 1990. This plan will provide more specific information than could be provided for purposes of this report.

Landlocked Salmon - The landlocked salmon was first introduced into the Squam Lakes in 1867, and presently is managed as a put-grow and take fishery. Growth rate data for salmon, much of it recently obtained, as well as creel census data obtained in the early 1980's, has indicated better growth at Squam than that achieved by landlocked salmon in other New Hampshire lakes. This is largely due to the fact that good forage is provided for salmon through rainbow smelt management.

A 1959 Fish and Game study on the Squam Lakes indicated that the natural propagation of salmon was of small consequence. At that time, stocking was "holding the salmon fishing up by the boot straps." The 1959 study concluded that there were not enough spawning sites in the lakes. More recent data collected on the Squam Lakes salmon population from 1985-1989 has shown that all salmon captured were from hatchery origin. There appear to be a number of reasons why natural reproduction does not contribute significantly to the salmon population. The Squam Lakes occupy a relatively small drainage area, and landlocked salmon need suitable tributaries which contain gravel substrates in order to spawn. Also, salmon nursery habitat requirements include water temperatures which can rarely exceed 75°F during the young salmon's 6 months to 2 years of stream life. In addition, low water levels in late fall affect salmon spawning, by making tributaries inaccessible.

The only recent documentation of salmon spawning has been in Barville Brook. In the spring of 1989, spawning areas on Squam Lake covering a few hundred yards were identified by the Fish and Game Department. However, any large tributary to the Squam Lakes which is gravel-bottomed could conceivably be utilized by spawning landlocked salmon. More documentation is needed concerning use of Squam tributaries for salmon spawning.

The future management strategy for the salmon population of Squam Lake is likely to focus on maintaining the recently instituted minimum legal harvest length of 18 inches, which replaced the previous limit of 15 inches established prior to the 1950's. The Department's strategy is to manage the Squam Lakes for a "quality" salmon fishery, with trophy fishery potential, since growth rates for Squam's landlocked salmon have consistently been faster than growth obtained for salmon in other New Hampshire lakes. This strategy would essentially maintain the track record Squam already has regarding salmon. Because salmon on the Squam Lakes must share their habitat with other salmonoid species, trout, whitefish and smelt, there are not a lot of them on the lakes. But because the smelt population is healthy, and managed carefully, many of those salmon that exist are of a good size.

The present stocking rate for the lakes is 5,000 spring yearlings per year. These salmon are stocked at a size that ranges between 8 and 12 fish to the pound. As part of the future management strategy, the population will be sustained by use of hatchery reared fish, and the numbers introduced each year will be regulated according to smelt availability. Forage management will thus be interrelated with salmon management. The Fish and Game report due out later this year will give more specifics on this management strategy.

As far as other management issues related to salmon are concerned, it has never been legal to harvest salmon during the ice fishing season, though illegal harvest does occur. According to the Fish and Game Department, this is a continuing law enforcement concern at Squam Lake. Another management issue concerns the possibility of having a no-kill salmon fishing season from September 30th to freeze-up on the lakes, when use of a single, barbless hook would be required. The Fish and Game Department's position is that such a season would cause law enforcement problems, and equally important, would submit salmon to additional stress at a time when they are preparing to spawn. Still another management issue relates to the increased use of downriggers so that fishermen can reach salmon at greater depths later in the season. This practice essentially lengthens the period during which salmon are caught, and its implications concerning management, at a time of increased pressure for public access to the Squam Lakes, is currently being considered by the Fish and Game Department. It is understood that if Squam is to be managed for salmon with trophy potential, the species has got to have the opportunity to reach the higher growth stages.

Lake Trout - The Squam Lakes are two of only six lakes in New Hampshire to which the lake trout is native. According to the Fish and Game Department, the population of lake trout in the lakes has never been abundant, most likely because the species must share available habitat with other cold water species, and has generally been vulnerable to fishing pressures because it is long-lived and slow growing. On Squam Lake, it takes a lake trout approximately 3 years to grow to 16 inches. It takes a male lake trout 4-6 years and a female 5-7 years to become sexually mature. The 1959 Fish and Game study determined that the annual survival rate of lake trout was 33.7 percent, with a full two thirds of each mature age class being removed each year. The 1959 Fish and Game study found that the large growth rates measured for trout in the lakes were due to the fact that a high percentage of immature fish entering the fishery each year. According to the study this indicated a low population with respect to actual carrying capacity. Reduced numbers of larger fish were thought to be due to the minimum keeping length of 15 inches, that is, too many immature lake trout were being harvested.

However, the Fish and Game Department has noted that there are other factors which the literature suggests can cause a decline in lake trout populations. One important factor is lake water draw down, if it occurs after lake trout have spawned. According to the Department, lake trout will spawn in waters as shallow as one foot in depth. Spawning occurs on the Squam Lakes in late October to early November, during an approximately 20 day period, occurring only in lake bottom areas of clean gravel and rubble which must be free of sand and mud. Such areas provide crevices which serve to protect the eggs, since adults do not bury them, as well as protecting trout fry. The peak of the spawning period coincides with the period after fall overturn of the lake, when water conditions, including temperature, have become relatively consistent at all depths. The eggs hatch in the spring and the young disperse to deeper waters later in the summer. Significant lake drawdown during the spawning period will cause exposure of eggs, with heavy mortality as a result. There will then be poor survival for the specific year class, and perhaps for other fish as well. Another factor which may have negative impacts for lake trout populations is inter-specific competition for limited habitat. The relatively limited amount of deep water basins, and the existence of other salmonoids such as rainbow smelt, salmon and whitefish appear to be limiting factors for lake trout on Squam Lake. Map 6-8 identifies lake trout reefs on Squam Lake.

After the 1959 Fish and Game Study, management of lake trout consisted of annual stocking. This annual stocking was ended in 1981 because the Department made it an official policy to manage all of the State's lake trout populations as self-sustaining, through natural reproduction. However, it is now recognized by the Fish and Game Department that this management policy has had a severe impact on the Squam Lakes' lake trout population. A recent assessment of the fishery indicated that there has been a strong increase in angling pressure, and that the harvest has drastically decreased. In a 1986 survey of the Lakes, it was found that the fishery relied heavily on hatchery reared fish. As a result of these assessments, the Fish and Game Department has altered its management strategy to one in which, starting in 1990, the lake trout population is to be supplemented each year with 8,000 hatchery reared yearlings. In addition to stocking, the Department has considered increasing the minimum legal length to 23 inches, although no decision to implement this regulatory change has yet been made.

In recognition of angling pressure on trout as well as competition with other species, the future lake trout management strategy will include continued supplementation of the population with hatchery reared yearlings, and an increase of the minimum length to 23 inches, if this is seen as necessary.

Smallmouth Bass - The smallmouth bass is not native to the Squam Lakes, and it is generally thought that the species was introduced from Lake Champlain. Stocking records date back to 1878. Though not native, the species has adapted very well to the lakes, and has been considered an important sport fishery here. The Fish and Game Department presently manages smallmouth bass at Squam Lake on a statewide basis, the same as it does for all lakes in the State of New Hampshire.















Spawning of smallmouth bass on the lakes occurs in spring along rocky shores or among stones of open water reefs. See Map 6-8 for specific spawning areas. Nests generally are placed at depths of 3-8 feet, though they can occur in as much as twelve feet of water. Their preference is gravel and rocky or sandy bottomed areas with adequate cover, for example, in shore areas where trees have blown down. Males protect females for a short while. After dispersion of bass fry occurs, young fish can be found throughout the shallower waters of the lakes. Bass experience competition from sunfish for choice spawning sites, it is often bass who move out as a result of this competition.

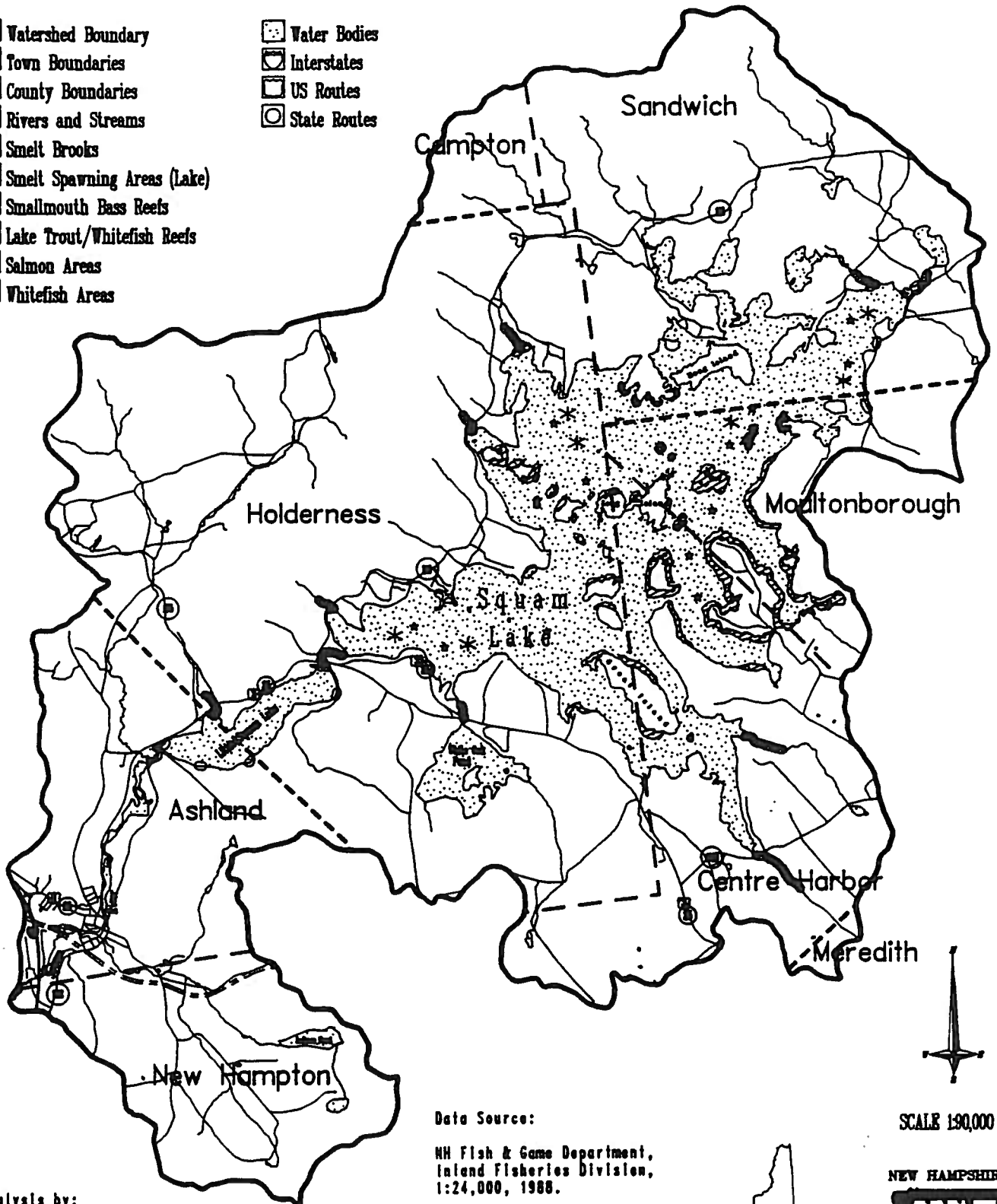
The 1959 Fish and Game study indicated that an average of fifty thousand hours were spent by anglers fishing for bass on the Squam Lakes, with 4-7 tons of bass harvested each year. These figures fluctuated, depending on the timing of summer visitors and weather conditions. Factors affecting production of bass are known to be weather, temperature, parasitism, and predation. The study indicated that the Squam Lakes' "annual recruitment of young fish was of a sufficient volume to insure a self perpetuating population, and one which would exceed anticipated capture by at least two tons at the time each age class enters the fishery."

According to a more recent Fish and Game study on smallmouth bass, done in 1978, bass spawning activity in the 1970's was about the same as that found in the 1950's study. However, there was a lower growth rate for bass than was determined in the 1950's. Possible reasons for lower growth rates for smallmouth bass

# SQUAM LAKES WATERSHED

## Map 6-8. Fish Resources

- |   |  |
|---|--|
|  Watershed Boundary          |  Water Bodies |
|  Town Boundaries             |  Interstates  |
|  County Boundaries           |  US Routes    |
|  Rivers and Streams          |  State Routes |
|  Smelt Brooks                |  |
|  Smelt Spawning Areas (Lake) |  |
|  Smallmouth Bass Reefs       |  |
|  Lake Trout/Whitefish Reefs  |  |
|  Salmon Areas                |  |
|  Whitefish Areas             |  |



Data Source:

NH Fish & Game Department,  
Inland Fisheries Division,  
1:24,000, 1988.

U.S. Geological Survey,  
7.5 minute topographic  
quadrangles, 1:24,000.



SCALE 1:90,000

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and Information Transfer System

Analysis by:

Complex Systems Research Center,  
University of New Hampshire,  
May, 1990.

in general are water temperature, availability of food, population size, predators, water quality fluctuations, and habitat. The size of the bass harvest during the 1970's was also found to be significantly lower than during the 1950's, but it was determined that this was a short term phenomena, caused by bad weather that had occurred over a two year period. There had been a decline in population numbers for two age classes, and fishing activity slowed down for a short period when this decline in numbers was felt.

In line with a long-term strategy for bass management, one of the 1978 study's recommendations called for a removal of the existing closed season from May 1 - June 30, in order to open up bass fishing on the Squam Lakes more. Prior to this time, Squam Lake had been one of the only lakes in the State that had a closed season from May 1 to June 30th. It was also recommended at this time that there continue to be no restrictions on length and weight.

The current management strategy for smallmouth bass on the lakes focuses on regulating creel limits, and there is no minimum legal length limit. The legal creel number varies during different parts of the year. There is a two fish limit from ice-in through March 31, from April 1 through May 14 and from June 16 through June 30. From May 15 through June 15, catch and immediate release only is permitted. From July 1 to ice-in there is a five fish limit. Future management of bass will focus on continuing to manage the species on a statewide basis. There will continue to be no closed season, and regulation of creel limits will also continue.

Rainbow Smelt - As previously indicated, this species occupies a very important place in the food chain of the Squam Lakes, serving as forage for several important species, including salmon, lake trout and whitefish. Smelt are most important as forage in the summer, when they are forced to seek deeper colder waters just as salmon and lake trout are. Smelt populations are susceptible to dramatic fluctuations for various reasons, some of which are not well understood. Factors thought to be related to such fluctuations include fish predation, water level fluctuations, the presence of human activity in spawning tributaries, food availability and intra-specific competition.

Smelt spawn in spring some time in April on the Squam Lakes, generally when the ice goes out, although it is not always completely out when spawning occurs. They may deposit their eggs in brooks, where they adhere to aquatic vegetation, sticks and stones, or along lakeshores, around the mouths of tributaries. Factors other than water temperature are thought to control the timing of spawning. A contributing factor as to which brooks will be used as spawning sites is thought to be lake level, since low water levels make certain habitats unavailable.

The 1959 Fish and Game study indicated that the population of smelt on the Squam Lakes was "healthy and numerous." It was noted that new runs appeared to be establishing themselves in areas which previously had been depleted of smelt because of the stocking of chinook salmon. The absence of these salmon was felt to be connected with the renewal of the smelt population in areas where they had not been seen for years.

The 1959 study also found that heavy fishing for smelt in brooks during spawning season was likely to cause severe depletion of the population. Negative effects resulted not from removal of adult fish, but from the trampling and covering with sediment of eggs, as a result of shore area disturbance. The Squam Lakes have been closed to smelt dipping during spawning runs since 1949. A continued ban on dipping was recommended in 1959, in order to protect spawning smelt, so that they could continue to provide forage for the fish populations on Squam that depend on smelt for their food. This ban continues today.

Updated information on the smelt population of the Squam Lakes will be presented in the upcoming Fish and Game study due out this fall. According to the Department, most of the recent data on smelt has been obtained in the fall during the period of spawning activity, while there has not been much study of actual survival of eggs after spawning occurs. In order to get a better sense of survival rates, Fish and Game plans to do pelagic (bottom) sampling of smelt in the summer, as well as sampling year class strength of smelt through the ice in the winter. They say that by obtaining this data, they will be in a better position to determine quickly and accurately the health of the smelt population, and thus how many salmon to stock, thereby ensuring better regulation of the salmon population. Pelagic sampling is an especially useful method because it allows the release of fish unharmed, once measurements have been taken. Incidental to obtaining the smelt data, this sampling method will also be able to provide useful data on juveniles of other species, such as whitefish and trout.

In recent years, water level fluctuations in the Squam Lakes have posed a problem in allowing access or attracting smelt to certain spawning tributaries. If lake levels differ from year to year, locations used one year may not be used at all the following year because of changes in water current patterns. According to Fish and Game, the exact location of spawning aggregations is chosen in response to these current patterns. More information is needed on tributaries that are currently being used by smelt, as well as the impacts on tributary spawning sites as a result of water level fluctuations and other changes to shoreline areas.

Tributary spawning sites for rainbow smelt, shown on Map 6-8 are listed below:

- . Brook North of Little Squam Lake
- . Where Squam River connects Big and Little Squam Lake
- . Brook Feeding Cotton Cove
- . Stream Feeding Carn's Cove
- . Bennett Brook; feeding Bennett Cove; along shore of Bennett Cove
- . Brook connecting Barville pond with Squam Lake
- . Brook connecting Kusumpe Pond with Squam Lake
- . Smelt shore spawning habitat, various parts of Little Squam Lake, and along a few shore areas of Squam Lake

Whitefish (Shad) - Whitefish are another cold water species that normally inhabits the deeper waters of Squam Lake. Because of over-exploitation of the species, today Squam Lake is one of only three lakes in New Hampshire (the others being Winnepesaukee and Wentworth) where whitefish are found. However, there is currently limited knowledge of their actual abundance in Squam. According to the 1959 Fish and Game Study, the whitefish population on Squam Lake was healthy after having made a come back from the results of chinook salmon predation. The species was popular with fishermen on Squam Lake, in both summer and winter. Presently, the Fish and Game Department considers it possible that competition between whitefish and rainbow smelt may be having a negative impact on the survival of whitefish.

Whitefish usually spawn in early December on Squam Lake, and are versatile as to suitable spawning sites. Unlike other salmonoid species on the Squam Lakes, whitefish are filter feeders, at least in part, getting much of their nourishment from zooplankton. They also eat other fish, including smelt, most likely as a result of chumming. Whitefish reefs are identified on Map 6-8.

The type of management that should occur in order to increase the whitefish population on the Squam Lakes will be addressed in management plans being developed by the Fish and Game Department which are due out this year for Squam and other lakes in the State.

#### Other Fish Species

Rainbow Trout - This species has been introduced to a number of lakes in New Hampshire in recent years. Introduction of the rainbow to the Squam Lakes began in the spring of 1990, primarily to provide fishermen with more fishing opportunities, especially through the ice. The species is generally more versatile than most other cold water fish species in terms of its food requirements, which means that it will be less likely to cause severe competition with these species. The rainbow population will be maintained at Squam by hatchery reproduction, because the relatively acidic nature of the lake and its streams appears to inhibit natural reproduction.

Chain pickerel - The 1959 Fish and Game study said that there was a sufficient pickerel population for the angler. Lack of success in catching the fish was more likely to be the result of poor angling technique than lack of fish. The size of the pickerel population is unknown at the present time. It is generally thought that if the species is limited in abundance, this is probably related to an unavailability of its preferred habitat.

Brown Bullhead (Horned Pout) - A partial control of this species was recommended in the 1959 Fish and Game study. The species was thought to provide competition for food with game species, since it feeds almost entirely on crayfish and insects. A more generous opinion of bullhead has recently been expressed by the Fish and Game Department. "The brown bullhead is well adapted to survive many types of habitats, is an



opportunistic feeder and may, in certain situations, pose a problem when management of other species is desirable." Fish and Game refutes the presumption made in the 1959 study that brown bullhead are a serious predator on lake trout and salmon eggs. The Department says there is no documented evidence to support this.

Sunfish (Common and Redbreasted) - The 1959 Fish and Game study recommended eradication of adults as well as fry. The study addressed on imbalance which had occurred between sunfish and bass. Because of selective fishing, many sunfish were returned to the lake, giving them a competitive advantage over bass. As the bass were removed by anglers, the sunfish tended to take over the habitat. The imbalance discussed in the 1959 study was not seen as severe. However, the study warned that a severe imbalance could occur, if preventative methods were not used. Actual management efforts for the species, including possible eradication, have been minimal. The Fish and Game Department is presently not concerned with the balance between sunfish and smallmouth bass on the Squam Lakes.

Yellow Perch - This species is popular on the Squam Lakes, especially in the winter, when it is a favorite of ice fishermen. It is a popular eating fish, both for humans as well as game fish. When not harvested sufficiently by these predators, the yellow perch can become a nuisance to fishermen as well as competing with other more important species for food and space.

## Recommendations

### Land Protection

Local conservation organizations, conservation commissions, and responsible State agencies - the NH Fish and Game Department, DRED and LCIP should evaluate the results of the analysis developed in this chapter, and should use it as a tool to set priorities for protecting important wildlife habitat, and to guide land protection strategies.

### Local Land Use Planning

Planning boards in the watershed should adopt the maps and information which identify critical and significant wildlife habitat, as amendments to their municipal master plans. Lists of species that are likely to be found in those habitats, which were provided for the Squam Lakes Watershed Plan by the NH Fish and Game Department and NH Audubon Society, can be included as an appendix to a master plan for use by a planning board in performing site evaluations. It is recommended that local planning boards refer to these updated master plans that incorporate this information, and use the information in working with applicants through the local subdivision and site plan review processes.

### Local Subdivision and Site Plan Review Process

It is important to establish a formal link between the planning boards and conservation commissions within towns in the watershed, to assure that adequate consideration is given to important wildlife habitat in the local subdivision and site plan review processes.

Planning boards are encouraged to consult with the NH Fish and Game Department, USDA Cooperative Extension, Lakes Region Planning Commission, County Conservation Districts or NH Audubon Society personnel for assistance, and to work with applicants for subdivision and site plan review approvals to develop mutually acceptable plans with a minimal impact on important wildlife habitat.

### Zoning

Planning boards in the watershed should either reevaluate existing or adopt new provisions for cluster development in their zoning ordinances, to provide for open space and to allow flexibility in the design of projects to benefit wildlife habitat. The ordinance should specify that first priority areas to be left as open space include areas which provide critical and significant wildlife habitat. Critical and significant areas which are adjacent to land which is dedicated to permanent open space should receive second priority to be left open.

Such areas would increase the amount of benefit which the adjacent permanent open space provides as wildlife travel corridors. Third priority for land to be dedicated as open space should be land adjacent to open areas that are not yet protected as permanent open space.

Communities may want to consider local regulatory mechanisms such as environmental overlay zoning, which may be useful in providing some degree of protection for important wildlife habitat.

**Prime Wetlands**

Conservation commissions in the watershed are encouraged to inventory and map their wetlands and to consider proposing local adoption of Prime Wetlands that provide important wildlife habitat.

**Information Transfer**

State and federal agencies should cooperate through the State geographic information system advisory committee to update information regarding wildlife habitat, and facilitate information transfer.

Because many local residents of the Squam Lakes watershed have demonstrated a strong interest in wildlife observation and study, it is recommended that these individuals and conservation organizations actively pursue the update of wildlife habitat information for the watershed. This information should then be transferred to the Lakes Region Planning Commission, which is linked to GRANIT, the State geographical information system, for dissemination to towns within the Squam Lakes watershed. Among many benefits of such an update, State agencies will have better access to this information.

Present travel corridors as well as historical corridors within the Squam Lakes watershed should be identified, through both State and local endeavors.



## **Chapter 7. Access**

### **Background**

The previous chapters evaluate existing conditions within the Squam Lakes watershed, and provide recommendations relating to land use and land capability, water quality, and natural resources. Chapter 7 focuses attention on the issue of access. The chapter includes a review and appropriate recommendations relating to existing access opportunities; the need for improved public access, including launch facilities; the provision of appropriate design standards to govern the development of such boating access; long term management objectives; and recommendations for monitoring and policing of existing access sites.

Governor Gregg in a March 10, 1989 memorandum to the Director of the Office of State Planning requested that a Public Access Plan be prepared for the State of New Hampshire. His concerns ranged across the full gamut of public access activities, and included boating, swimming, fishing and related recreational and environmental objectives. He asked that the plan include facilities for car-top boats and walk-in use as well as parks and beaches. The resulting plan is also to provide for an inventory of existing facilities, related costs and potential funding sources.

The Squam Lakes Watershed Plan, which has been in preparation for over two years, is also concerned with these issues. This portion of the plan will focus public discussion on the general issue of access within the Squam Lakes watershed, as well as the need for improved public access to the lakes. The solutions being evaluated as part of the Squam Lakes Watershed Plan will provide information regarding the need for improved public access facilities across the State.

In summary, the Squam Lakes Watershed Plan and program is vitally concerned with improving the quality of access by the public. Clearly however, such improvements must be accompanied by adequate and appropriate management controls which provide a reasonable assurance that the quality of the Squam Lakes and their setting, both natural and man made, will be maintained and improved as a result of this process.

## **Access Within the Squam Lakes Watershed**

### **Introduction**

Access to the natural resources within the Squam Lakes watershed can take on a different meaning depending on the individual to whom one speaks. To the avid fisherman, access means the opportunity to enjoy a day of fishing for trout, salmon or bass, depending on the special interest of the individual; another person may wish to have access to the water for the purpose of swimming and/or obtaining a suntan; the wildlife enthusiast may feel that the best form of access can be found in the opportunity to observe birds and wildlife in a quiet natural setting; still others may feel that the best way to provide access is through a trail system which skirts the water and traverses the foothills and adjacent mountains; an elderly or less athletic individual may be perfectly satisfied with the opportunity to sit quietly and enjoy a picnic on a highway turnout or overlook, while taking in the lake and mountain panorama that spreads out before them; the winter sports enthusiast may define suitable access as providing the opportunity for cross country skiing, ice fishing or snowmobiling; and finally a large number of individuals define access as the opportunity to place boats in the water for a multitude of purposes, ranging from paddling, rowing, sailing and fishing to cruising, racing and water skiing.

Each type of access is important to at least one segment of the public, and it is likely that an individual will be interested in several types. The recommendations of this chapter attempt to provide a reasonable balance between these various activities. It is clear that consideration of the issue of access to the natural and man-made resources of the Squam Lakes watershed requires the recognition that there is no single correct solution. The needs are many and diverse. On a day to day basis these activities and others take place simultaneously.

Ultimately it seems that the discussion of access turns to the question of boating and boat use. This is usually due to the fact that such use takes place at highly visible locations, and involves the potential for noise, congestion and conflict among a variety of users. This conflict may be the result of a lack of understanding of the differing user objectives or interests. Boating will be discussed extensively in the following sections. However, it is important that the highly visible and at times controversial requirements of the boating community not be allowed to obscure the importance of, and need to respond to, non-boating access needs of the general public.

What follows is a list of areas where access to the Squam Lakes and their watershed is presently provided. Also included are their locations, as indicated on Map 7-1.

### **Swimming**

Swimming is one of the most popular recreation activities, estimated to have a participation rate of over 60 percent of the population.<sup>1</sup> Swimming access to the Squam Lakes is provided for the residents by individual towns, as the list below indicates. The location of each site on Map 7-1 is shown in parentheses on this list.

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<sup>1</sup> Source: US Department of the Interior, 1977 National Outdoor Recreation Survey.

Ashland Town Beach - Swimming; camping across the street on 27-30 sites; campers have access to the town beach and those desiring boating access use site on Squam River. Town residents pay \$1 per day, \$10 per season; non-residents pay \$1 per day, \$30 per season. (#1)

Holderness Town Beach - Residents and tax payers only, swimming no boats allowed. (#2)

Centre Harbor Town Beach - Residents and tax payers only, swimming; limited boat launching; ice fishing access during winter. (#3)

Sandwich Town Beach - Residents and tax payers only, swimming June 15 - September 15; boating allowed before and after this period; ice fishing access during winter. (#4)

### **Wildlife and Birding**

Access for the purpose of observing wildlife and birds in a natural setting is provided by several major properties in the Squam watershed. These include:

The Science Center of New Hampshire The Science Center, located in Holderness on 285 acres of land, is devoted to environmental education. It provides opportunities to observe and learn about the flora and fauna of the area and to obtain vistas of the Squam Lakes along wooded mountainside trails. (#5)

The New England Forestry Foundation Association (NEFFA) Property The NEFFA property includes approximately 200 acres of land which provide access to a variety of habitats along approximately 6 miles of trails, on the westerly side of Dog Cove. There are docks on either side of the point, which are available for use by persons arriving by boat or by foot along the trail. No dogs or motor vehicles are permitted. (#6)

Five Finger Point and West Rattlesnake, owned by the University of New Hampshire Five Finger Point is located on the northeasterly side of Squam. This property was given to the University of New Hampshire in 1965 as an ecological area. The site is utilized for educational purposes; there are no facilities for swimming or boating. The point can be accessed both from the shore and along the Pasture Trail up West Rattlesnake Mountain. West Rattlesnake is a tract of land covering the western nob of the twin Rattlesnake peaks. (#7)

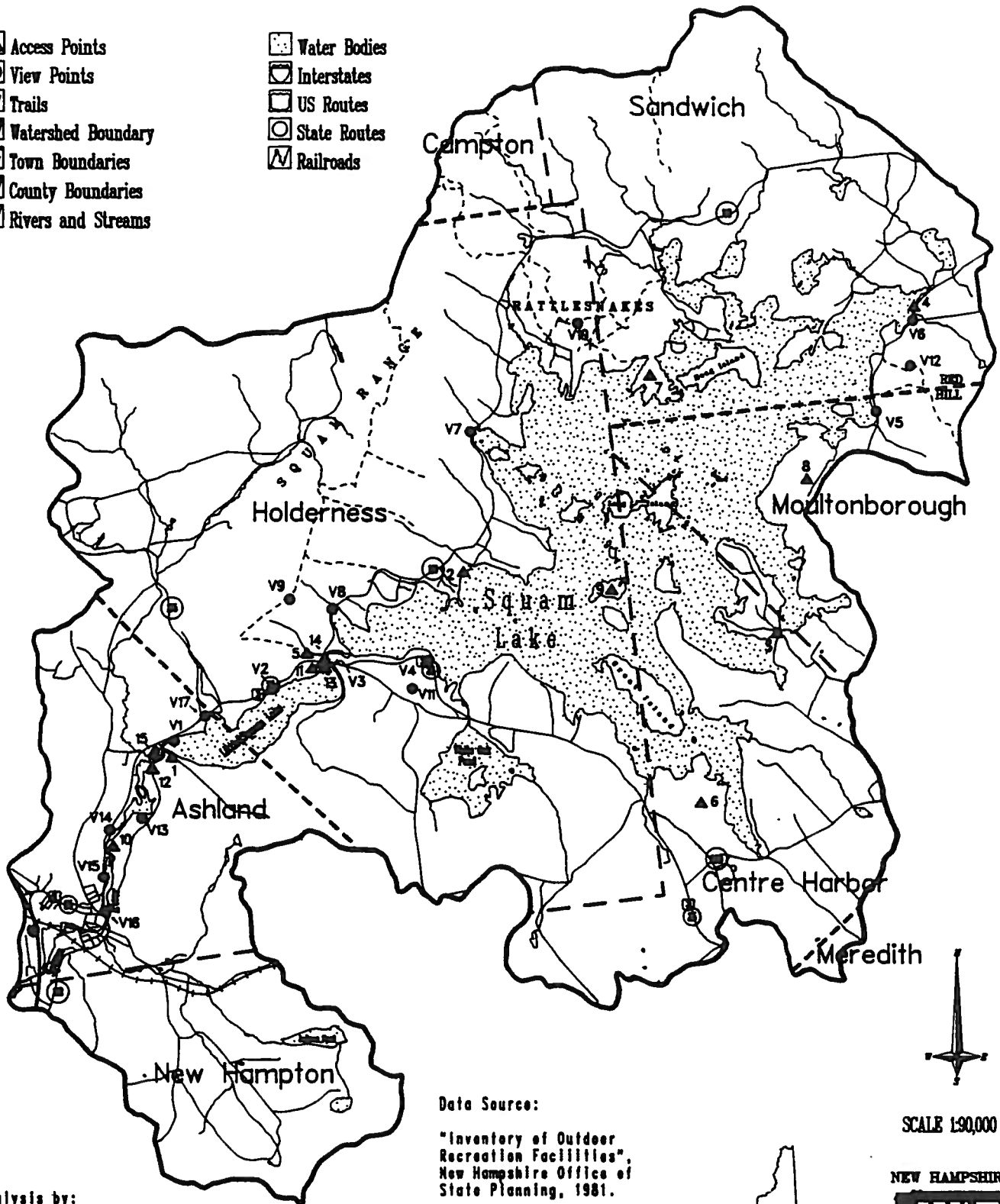
The Unsworth Preserve, owned by the Squam Lakes Conservation Society The Unsworth Preserve was given to the Squam Lakes Conservation Society by Mrs. Arthur Unsworth in 1980. This property includes 180 acres of hardwoods, wooded swamps and a large pond. Marked trails allow one the opportunity to walk through the property and observe a variety of birds and wildlife. No vehicles or camping are permitted. (#8)

Moon Island Moon Island is owned by the Squam Lakes Association and is available to boaters to visit and observe wildlife. (#9)

# SQUAM LAKES WATERSHED

Map 7-1. Access Points

- |                      |                |
|----------------------|----------------|
| ▲ Access Points      | ▨ Water Bodies |
| ● View Points        | ⊖ Interstates  |
| ▤ Trails             | ▭ US Routes    |
| ▭ Watershed Boundary | ○ State Routes |
| ▭ Town Boundaries    | ▭ Railroads    |
| ▭ County Boundaries  |                |
| ▭ Rivers and Streams |                |



Analysis by:

Complex Systems Research Center,  
University of New Hampshire,  
September, 1990.

Data Source:

"Inventory of Outdoor  
Recreation Facilities",  
New Hampshire Office of  
State Planning, 1981.

U.S. Geologic Survey,  
7.5 minute topographic  
quadrangles, 1:24,000.



SCALE 190,000

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Geographically Referenced Analysis  
and Information Transfer System





## Hiking, Walking and Camping

For those who enjoy a reasonable level of exercise in a setting of unequalled beauty, the Squam Lakes Association maintains a variety of hiking trails along the Squam Range and the Rattlesnake Mountains, and also on Red Hill. These trails provide marvelous vistas of the Squam Lakes and adjoining mountain ranges. The photographic opportunities are outstanding, and hikers find it relaxing to enjoy a picnic lunch high above the surface of the sparkling lakes. Map 7-1 shows the trails which are available in the watershed. The trails include the following:

### Squam Range

- \* Ridgepole Trail
- \* Gephart Trail
- \* Davison Trail
- \* Cotton Mountain Trail
- \* Prescott Trail
- \* Old Mt. Road Trail
- \* Mt. Morgan Trail
- \* Mt. Percival Trail
- \* Doublehead Trail

### Rattlesnakes

- \* Old Bridle Trail
- \* Ridge Trail
- \* Col Trail
- \* Butterworth Trail
- \* E. Rattlesnake Trail
- \* Five Finger Point Trail
- \* Pasture Trail
- \* Ramsey Trail
- \* Undercut Trail

### Eagle Cliff/Red Hill Region

- \* Portion of Eagle Cliff Trail-Red Hill Trail that connects the two peaks
- \* Teedie Trail

Camping which provides access to the Squam Lakes is allowed at various locations throughout the watershed: reserve camping at the NEFFA property, on Loon Island and Moon Island; at the Town of Ashland site, across the street from the town beach (27-30 sites); at Rockywold Deephaven (with permission); and at several other private campgrounds in the watershed.

### Scenic Vistas

There are glimpses of the Squam Lakes and the Squam River as one drives along the main highways (Routes 3 & 25, & 113) and along the Bean Road in Moultonborough. However, there are few if any points where one can pull off the highway at an overlook, stay for awhile and enjoy the natural setting over a picnic lunch. There is a general need to reopen old views and to open new vistas of these lovely lakes. Map 7-1 shows points from which dramatic views of the lakes can be seen.

### Squam River Views

Ashland Memorial Park: Visual access of Squam River and Mill Pond. Short pedestrian walkway along river frontage offering view up and down river to hillside and red mill buildings. Public paved parking area. Benches along river. (#V16)

River Views along Routes 3 and 25. Nice view of river and opposite shoreline with pastoral view of rising open land and distant buildings. Highly photographed in the fall season. (#V15)

River view along Routes 3 and 25. Nice down view of river pond area with small boat houses on opposite side of river and hillside. Particularly nice in the fall with its brilliant color. (#V14)

More distant view of river from River Street and Thompson Street. Nice distant down view, very picturesque with mountains and hills in background. (#V13)

### Little Squam Lake Views

From Routes 3 and 25, also River Street at southwest end of lake. Great panorama view of lake and opposite shore. Squam River covered bridge at end of lake provides outstanding view for photographer. Opportunity to stop vehicle along side of road exists. Possible location for improved highway turnout. (#V1)

Lake view from Routes 3 and 25 opposite Black Horse Motel. Small beach along highway, private, no trespassing. (#V17)

Beautiful stone wall between Routes 3 and 25 and lake with highway turnoff adjacent to roadway. Nice lake view, across from Squam Lakeside Farm. (#V2)

Little Squam Lake and Squam Channel views from Holderness bridge and adjacent area. Curb side parking and sidewalk available. (#V3)

### Squam Lake View Spots

Perhaps the finest view of Squam Lake from the public highway (Routes 3 and 25). Great panorama and depth view of lake with Squam and Sandwich mountains in background. Excellent highway turnoff available. Brush and trees beginning to grow in along shoreline and obstructing view. Selective cutting needed. A potential site for perhaps two or three picnic tables. (#V4)

Northwesterly view of lake from Bean Road. Nice vista, no parking or public access for stopping. (#V5)

View of Sandwich Bay near and at Sandwich Town Beach located on Bean Road. Limited parking along roadway. (#V6)

Very beautiful but limited view of Squam Lake looking through narrow cove toward several islands, including building and boat house on small close to shore island. Private property, no real safe opportunity for parking and photo taking (Route 113). (#V7)

Nice view of Cotton Cove from Route 113. Limited view of lake with Shepard Hill in background. Roadway very narrow and curve. No opportunity to park vehicle. Private property, no trespassing signs adjacent to lake. (#V8)

Outstanding vista looking down on and across lake to mountain views. Located on trail of Science Center of New Hampshire property. (#V9)

Spectacular panorama as one looks down on most of the lake surface and islands, with mountains in background. Located on Rattlesnake from hiking trail entered from Route 113. Perhaps the most popular short trail and view in the region. Limited off road parking available. (#V10)

Exceptional vista looking down on a portion of the lake, islands and mountains. Private property at the site of former Asquam Hotel located on top of Shepard Hill. Used for limited public gatherings with permission of property owner. (#V11)

View from Red Hill, Moultonborough off Bean Road. (#V12)

#### **Winter Access**

Not surprisingly, the need for access to the Squam Lakes watershed doesn't go away with the leaves. A growing number of individuals are enjoying winter activities within the region. These activities include cross country skiing, snowshoeing, ice fishing and snowmobiling. Facilities which provide access during summer months can provide for winter use with minimal modifications. Beaches and launch ramps can meet the needs of skiers, snowmobilers, and ice fisherman alike. Some hiking trails might also be utilized by skiers and snowshoers.

#### **Boating Access**

Finally, there are a number of access points and a variety of support services available on the Squam Lakes for boating. These boat access and servicing areas are provided mainly by private marinas. During August, 1988 the Squam Lakes Association carried out a comprehensive shoreline census to document existing uses and water-related activities around both lakes. The census indicated that there were a total of twenty-eight

shoreline uses, other than single family residences, which provide access to the lakes for a variety of groups and activities. Included were 13 motels with a total of 16 docks; 2 camps with 6 docks; 6 marinas;<sup>2</sup> 3 campgrounds; and 4 public beaches. The census did not identify any public access facilities. Listed below are the 4 private marinas, as well as a site with limited boating access on the Squam River in Ashland.

1. Site on the Squam River, Ashland - This site is quite limited, with no supporting facilities, is not widely known or signed and has limited parking. (#10)
2. Kimbell Marine Services, Holderness - This is the smallest of the three commercial marinas located on Little Squam Lake, in an area that was dredged to create a basin area. This marina includes boat sales and rentals, and service for clients only. (#11)
3. Riveredge Marina, Ashland - This marina is located on the Squam River adjacent to the Squam River covered bridge. The marina provides boat sales, rentals and services, as well as boat launching and storage, and is open to the public. (#12)
4. Squam Boats Inc., Holderness - The location directly on Little Squam Lake, near the outlet of Squam Lake, enables this marina to provide support facilities to the public for boats on both lakes (Map 7-1, #13). In addition to sales and service, the company is operated as a partnership with an individual who owns launching and storage facilities on Route 113 and the Squam Channel. (#14)
5. Squam Bridge Landing, Ashland - This marina sells boats, has fueling capacity, and provides dockage and launch facilities at the bridge crossing the Squam River in Ashland. (#15)

## Conclusions

The Squam Lakes watershed is blessed with a variety of opportunities for access to the full range of natural and man made resources contained within the region. These access opportunities provide for hiking, walking, wildlife observation, photography, swimming, boating, fishing and during the winter months, cross country skiing, snowmobiling, snow shoeing and ice fishing.

These opportunities are generally provided by municipal, private and non-profit organizations. Provision of appropriate facilities, particularly in the non-profit sector, relies heavily on the voluntary efforts of seasonal residents for management and maintenance. It is significant that except for swimming and boating, the majority of access opportunities are available to the general public, and even swimming is provided to the public for a minimal fee by the Town of Ashland.

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<sup>2</sup> The SLA census called a group of boats at the Sandwich end of the lake a marina. This site is not included.

An important conclusion which surfaces from this discussion is that the provision of access is a complex and variable process. Existing activities must be closely coordinated so that these programs, and any new activities which may be proposed, do not conflict or contribute to the destruction or exclusion of other uses. The provision of new facilities such as those proposed in the following section on boating and lake access must be carefully related to the existing programs so that the various facilities can be provided in a logical, cost effective and environmentally sensitive manner. The need for an institutional mechanism to coordinate these activities should be evaluated.

## **Boating and Lake Access**

### **Definition of Public Access**

The extent of recreational access in the Squam watershed was discussed briefly in the preceding section. Concern has been expressed about the lack of public access to the Squam Lakes, and particularly the lack of public access to the lakes for boating purposes. The following section will therefore focus primarily on the issue of boating access.

Public access is defined by the State of New Hampshire as follows:

"Legal passage to any of the public waters of the State by way of designated contiguous land, owned or controlled by a State agency assuring that all members of the public shall have access to and use of the public waters for recreational purposes."

The 1990 legislature codified this definition within the New Hampshire statutes (RSA 271:20 a). The definition focuses on the role of government, primarily State government, in the provision of public access.

There are however a multitude of "publics",<sup>3</sup> and any discussion should look at the role of the private sector in providing access through the development and operation of marinas, launch facilities, mooring fields, campgrounds, swimming areas and other reasonably related facilities. These facilities all provide opportunities for access, and the cumulative impact of public and non-public access must be evaluated. Visual access is another subtle but important part of this subject. As noted previously, the idea of rest areas, and picnic areas located for purposes of enjoying views of great ponds such as the Squam Lakes must also be considered. Such access is especially important for those who may not be able to actively participate.

In addition, the role of non-profit organizations such as the Society for the Protection of NH Forests, NH Audubon Society, the Squam Lakes Association, the Squam Lakes Conservation Society and the New England Forestry Foundation, to name a few, must also be woven into the fabric of any program designed to

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<sup>3</sup> Within the broader whole "Public" there are a number of individually defined groups which make up the whole, each of which has specific needs or interests. For purposes of public access these groups may include, but not necessarily be limited to, power, wind and muscle power boat users, fishermen, swimmers, bird and wildlife watchers and those who just enjoy the scenery.

provide better access to natural resources which are of special interest to each organization. These organizations have the ability to acquire open space and recreational lands, and several have a proven track record when it comes to the management of such lands. The importance of private and non-profit recreational and conservation facilities which are utilized by the public for the Squam Lakes was discussed in the previous section, and the concept is well established in New Hampshire.

In order to accommodate the multitude of interests and the legitimate number of potential actors concerning the subject of access to the Squam Lakes, the term "access" for purposes of the Squam Lakes Watershed Plan is defined as follows:

**Legal passage by way of designated land, owned or controlled by public or private entities for the purpose of providing active or passive recreational opportunities and/or use of the public waters of the State, and which use may, or may not, involve a fee.**

Where the term "public access" is used, it will refer to the statutory definition, which does not include access opportunities provided by municipal government, the private sector or non-profit organizations. When the term "access" is utilized it will refer to the broader definition. Based on the statutory definition, there is no public access to the Squam Lakes.

### **Existing Lake Access**

The definition of access recommended for use in the Squam Lakes Watershed Plan recognizes that land owned by municipal governments and non-profit organizations may also provide access to the public. Under that definition the following facilities provide access for the public on the Squam Lakes.

1. Site on the Squam River, owned by Town of Ashland
2. Five Finger Point, Sandwich - UNH
3. Ashland Town Beach
4. Holderness Town Beach
5. Centre Harbor Town Beach
6. Sandwich Town Beach
7. NEFFA property, Centre Harbor

To summarize, there is no access on the Squam Lakes which complies with the recently adopted State definition of public access. There are presently seven (7) accesses which are owned and/or controlled by a local governmental or non-profit entity. Each of these is considered inadequate as a boating access point based on the physical standards presently being developed in the *Public Access Plan for New Hampshire's Lakes, Ponds and Rivers*. They are, however, suitable for the usage intended. In large part, they are available to those members of the public who either reside or pay taxes locally.

## **Existing Marinas**

In order to understand the discussion which follows, it is appropriate at this juncture to list again the private marina facilities which are available for the Squam Lakes. The location and extent of these facilities was described on page 7-8.

1. Kimbell Marine Services, Holderness
2. Riveredge Marina, Ashland
3. Squam Boats Inc., Holderness
4. Squam Bridge Landing

These existing marinas are located between the outlet of Big Squam Lake and the Squam River. All power boats located on either lake must travel from their dock or mooring area to the marinas when servicing is required. It appears that these marinas have adequate capacity to handle the approximately 1200 power boats on the Squam Lakes, and that there is no need for additional marina facilities.

## **Present Boating Use of Squam Lakes**

### **Squam Lakes Association Shoreline Census**

In August 1988 a shoreline census was undertaken by the Squam Lakes Association. This census determined that two thousand one hundred and sixty seven boats (2,167) were moored, in storage, at docks or in use on the Squam Lakes.

This total included: 29 very large (cabin cruisers), 943 large (probably 20 horsepower and more) and 218 small power boats; 142 large and 278 small sail boats; and 557 canoe/row boats. One jet ski was observed at the time of the census. The number and variety of motorized and non-motorized craft activity on the lakes would indicate that the launch facilities necessary for this level of boating use are available. The location of these facilities on the western end of the lakes indicates that traffic problems might exist in constricted portions of them, based on discussions with SLWAC members.

The census also identified the variety of existing boat facilities. Included were 810 docks that were observed, of which 296 appear to be non-conforming under current State regulations, 83 boat houses, 281 single moorings, 80 moorings in fields, 309 marina slips and 480 marina storage spaces. Based on the preceding figures and the assumption that two boats can be placed at each dock and boat house, this report concludes that 2,936 boats could be docked, moored or stored on the Squam Lakes as of the date of the census. Table 7-1 lists the activities and uses that were identified during the census, and Map 7-2 indicates the sub-areas utilized for the census. Careful review of the census data indicates a significant range of potential use in the various sub-areas, with particularly heavy concentrations located in sub-areas 1, 2 and 3, which comprise the westerly portions of the lakes.

## **Squam Lakes Association On-Lake Surveys**

On four occasions in 1988 the SLA undertook on-lake surveys to determine the level of boat use. The surveys were done on Saturday, July 2; Sunday, July 3 (Table 7-2a); Saturday, August 13 and Sunday, August 14 (Table 7-2b). Three of the four days were warm and conducive to lake use. July 2nd was cold (64°) and threatened rain. Map 7-3 indicates the sub-areas utilized for the on-water surveys. Again on a weekend in July and also in August, 1990, the SLA carried out a similar survey of boating activity (see Tables 7-3a and 7-3b).

The level of use determined during these surveys suggests that a rule of thumb may be present regarding boating participation rates. This would be a rate of use that might be assumed at any point in time, based on observed activity and knowledge of the number of boats which are available. For example, the SLA census determined that 943 large power boats were located on the lakes, while the 1988 on-lake survey indicated that 94 large boats were in use on July 2nd; 195 were in use on July 3rd; 170 were in use on August 13th; and 169 were in use on August 14th. This is a participation rate of 10, 21, 18, and 18 percent respectively. If the one cold, threatening day is excluded, the overall participation rate of actual vs. potential use is 19 percent. Applying the same approach to the small power boats yields a rate of 15 percent. Interestingly, for the 420 large and small sail boats, the actual participation rate was 6 percent, or 25 sail boats on each day. Table 7-2a and 7-2b list the results of the four days of surveys in 1988. For purposes of developing boating capacity projections, a participation rate of 20 percent will be utilized.

Upon examination of the results of the 1990 boating surveys, it is apparent that the participation rates based on observation from two summers past are still valid. Overall boating activity has not increased significantly. Table 3a indicates that the total boats counted in the July 1990 survey were 282 on Saturday and 323 on Sunday. This compares to 143 and 362 boats on the two days of the July 1988 weekend, and 266 and 292 boats on the August 1988 weekend. Table 3b indicates that 116 boats were counted on a rainy day in August, 1990, and 378 boats were counted the next day, which was sunny.












TABLE 7-1. SQUAM SHORELINE CENSUS - August, 1988

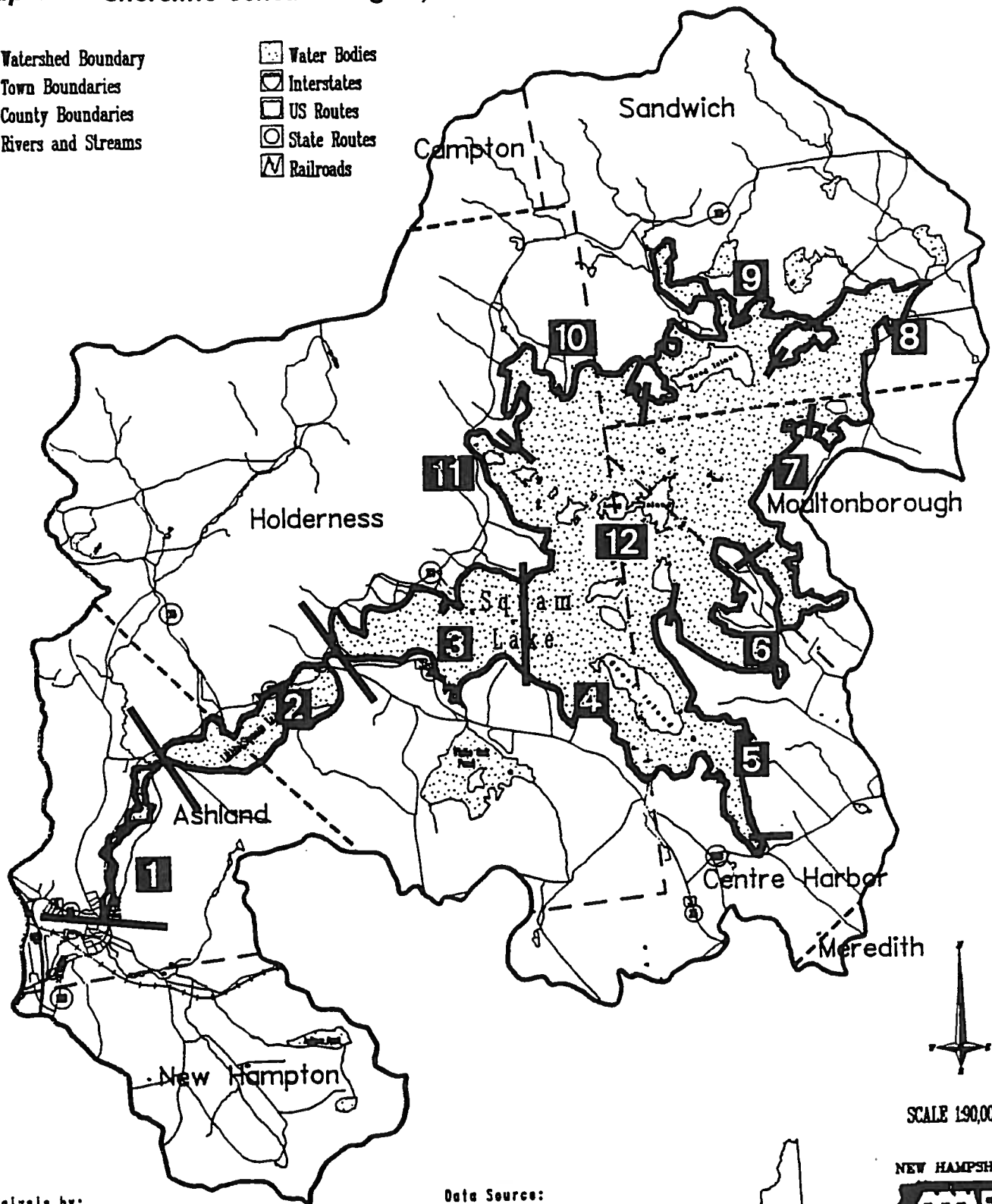
AREA NO.	MAIN VISIBLE RESIDENCES												VERY LARGE WITH CABIN	SMALL POWER	CANOE/ROWBOAT	SMALL SAILBOAT	LARGER SAILBOAT	JET SKI	ACCESS POINTS									
	CONFORMING DOCK	NON-CONFORMING DOCK	BOAT HOUSES	BOAT HOUSES	SWIM RAFTS	SINGLE MOORING	MOORINGS IN FIELDS	MOTELS	MOTEL DOCKS	SUMMER CAMPS	CAMP DOCKS	MARINAS								MARINA SLIPS	MARINA STORAGE	CAMP GROUNDS	PUBLIC BEACHES	VISIBLE BOATS	LARGE POWER			
1	26	6	6	44			2					2	170	80				225	5	17	16	4	2	2				
2	91	58	16	125	23	58	6	8				2	94	400	2	1		252	18	26	73	29	6	1	4			
3	95	84	12	143	33	67	4	8	1	5	1	1	16					162	2	37	100	48	49		4			
4	53	26	11	72	24	47	1											70		28	48	39	12		1			
5	25	5	3	17	6	11												12		4	12	7	7					
6	29	6	4	42	7	28									1	1		26		6	19	9	4		1			
7	25	11	3	42	4	20												28	2	17	51	22	8					
8	28	27	11	40	16	27			1	1	1	1	29			1		65		33	67	32	34		4			
9	29	9	5	29	5	9												17		10	30	10	4		1			
10	68	27	4	75	24	9												30		22	83	47	4					
11	21	26	3	44	9	3										1		38		13	34	21	8					
12	24	11	5	28	8	2												18	2	5	24	10	4					
Totals	514	296	83	701	159	281	13	16	2	6	6	6	309	480	3	4		943	29	218	557	278	142	1	17			

Source: Squam Lakes Association, 1988.

# SQUAM LAKES WATERSHED

Map 7-2. Shoreline Census - August, 1988

- |  |  |
|--|--|
|  Watershed Boundary |  Water Bodies |
|  Town Boundaries    |  Interstates  |
|  County Boundaries  |  US Routes    |
|  Rivers and Streams |  State Routes |
|  |  Railroads    |



Analysis by:

Complex Systems Research Center,  
University of New Hampshire,  
January, 1990.

Data Source:

U.S. Geologic Survey,  
7.5 minute topographic  
quadrangles, 1:24,000.



SCALE 1:90,000




NEW HAMPSHIRE

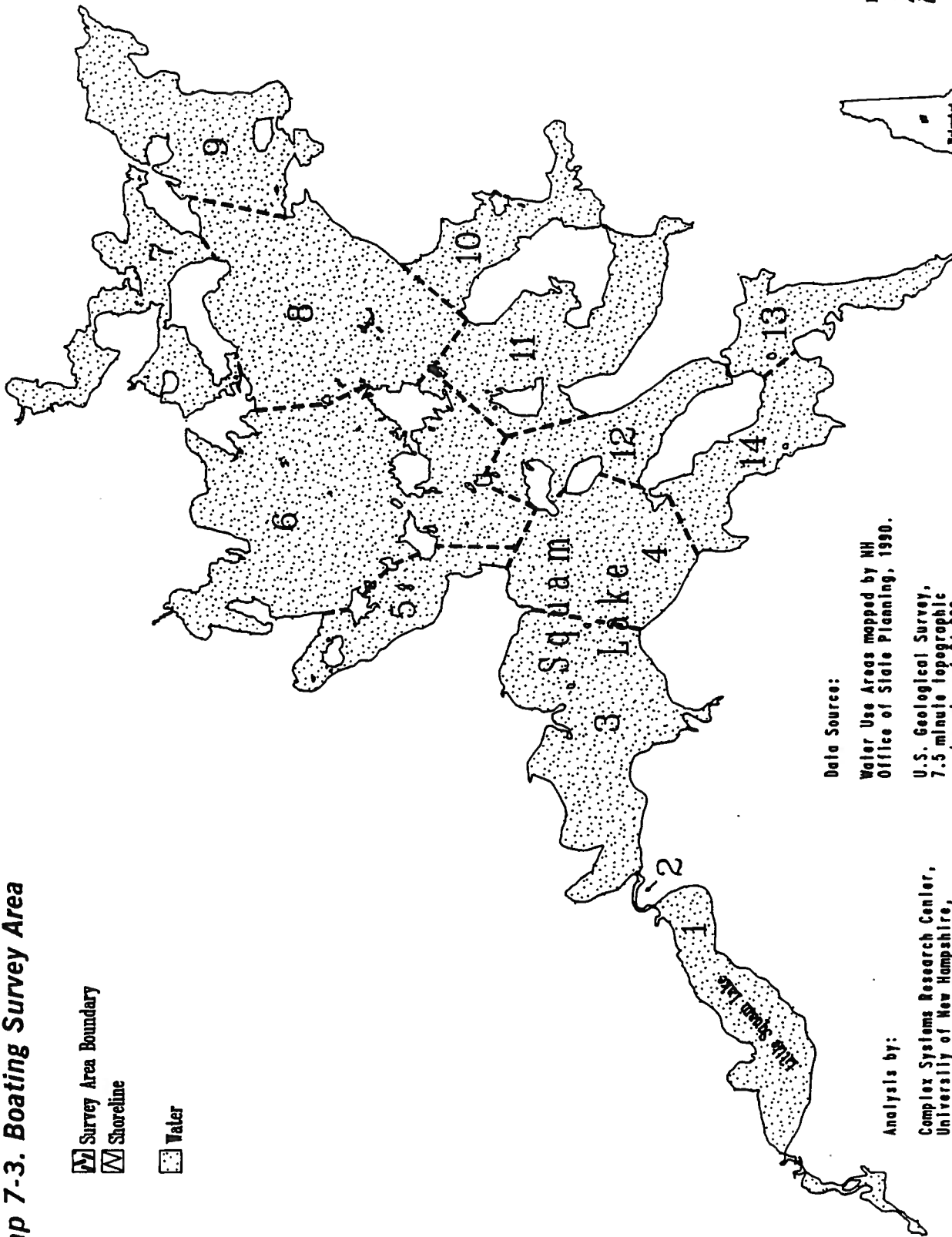


Geographically Referenced Analysis  
and Information Transfer System

# SQUAM LAKES WATERSHED

## Map 7-3. Boating Survey Area

-  Survey Area Boundary
-  Shoreline
-  Water



**Data Source:**  
Water Use Areas mapped by NH  
Office of State Planning, 1990.  
U.S. Geological Survey,  
7.5 minute topographic  
quadrangles, 1:24,000.

**Analysis by:**  
Complex Systems Research Center,  
University of New Hampshire,  
September, 1990.



SCALE 1:60,000



**TABLE 7-2a. SQUAM LAKES ASSOCIATION BOATING SURVEY**

**3:00 P.M.  
Saturday, July 2, 1988**

AREA NO.	WINDSURFER	SAILBOAT	CANOE/ROWBOAT	LARGE POWER BOAT	SMALL POWER BOAT	WATER SKI	JET SKI	TOTAL
1				4	1			5
2				10				10
3		4	2	7	1			24
4				10	3			13
5				9	7			16
6	1			7	3			11
7				6	1			7
8				4	1			5
9		5		3	6	2		16
10		1	1	2	1			5
11	1		1	9	2			13
12			1	7	2			10
13			2	3	1			6
14				3	3			6
<b>Total</b>	<b>2</b>	<b>10</b>	<b>7</b>	<b>94</b>	<b>32</b>	<b>2</b>	<b>0</b>	<b>147</b>

Cold, 64 degrees, Threatening Rain;  
Water Temperature 69 degrees;  
Very Windy

**2 - 3:00 P.M.  
Sunday, July 3, 1988**

WINDSURFER	SAILBOAT	CANOE/ROWBOAT	LARGE POWER BOAT	SMALL POWER BOAT	WATER SKI	JET SKI	TOTAL
2		1	11	2	4	1	21
		2	12	1			15
2	2	8	20	2	1		35
		1	21	12	4		38
		1	19	4	3		27
6		11	14	4	1		36
		3	22	6	2		33
2		3	11	1	1		18
3		8	15	8		1	35
		5	7	1			13
3	1	3	5	2	3		17
2	1	3	26	7	1		40
2	4	3	9	3	1		22
3		3	3	1	2		12
<b>25</b>	<b>8</b>	<b>55</b>	<b>195</b>	<b>54</b>	<b>23</b>	<b>2</b>	<b>362</b>

80 degrees, Rain shower one hour prior  
to count but clear at 3 PM;  
Calm, Water Temperature 69 degrees

**TABLE 7-2b. SQUAM LAKES ASSOCIATION BOATING SURVEY**

**2 - 3:00 P.M.  
Saturday, August 13, 1988**

AREA NO.	WINDSURFER	SAILBOAT	CANOE/ROWBOAT	LARGE POWER BOAT	SMALL POWER BOAT	WATER SKI	JET SKI	TOTAL
1		2		19	1	4		26
2			11	2				14
3		3	4	18	2	2		29
4	1	2	3	21	2			29
5	1	2	1	20	1	3		28
6		2		8				10
7			5	21	1	11		28
8		4	1	10	2			17
9		5		6	3	2		16
10		1		2	2			5
11	1		1	4				8
12		1	1	13		2		17
13	1	1	2	7	2	3	1	17
14	1	3	4	10		4		22
<b>Total</b>	<b>5</b>	<b>26</b>	<b>23</b>	<b>170</b>	<b>18</b>	<b>23</b>	<b>1</b>	<b>266</b>

Sunny  
Temperature 90 degrees and humid  
Wind speed at 10 mph

**2 - 3:00 P.M.  
Sunday, August 14, 1988**

WINDSURFER	SAILBOAT	CANOE/ROWBOAT	LARGE POWER BOAT	SMALL POWER BOAT	WATER SKI	JET SKI	TOTAL
2	1	11	15	2	4		35
		1	10	2			13
	12	5	16	1	1		35
	5	1	18	1	2		27
			11		2		13
		1	10	4	2		17
		8	17	3			28
		1	7	6	1		15
1	1	2	11	2	4		21
		2	2	1			5
	3		6	1	1		11
	1	1	22	1	1		26
	2	2	11		5		20
	4	7	13	1	1		26
3	29	42	169	25	24	0	292

Cloudy  
Temperature 87 degrees, very humid  
Wind SW at 10-15 mph  
Calm in northern coves

**TABLE 7-3a. SQUAM LAKES ASSOCIATION BOATING SURVEY**

**3:00 P.M.**  
**Saturday, July 2, 1990**

AREA NO.	SAILBOAT	WIND SURFING	CANOE/ROWBOAT	LARGE POWER BOAT	SMALL POWER BOAT	WATER SKI	TOTAL
1				21	3	3	27
2				5	1		6
3	8	1	5	11	13	1	39
4	5			5	4	1	15
5			1	16	2	2	21
6	4	2	1	19	3	1	30
7	1		6	20			27
8	2		1	10	5		18
9	2	2	3	1	8		16
10			3	2		1	6
11	2		3	5	2	2	14
12				14	3		17
13	2	1	1	7	3	4	18
14	2	1		16	3	6	28
<b>Total</b>	<b>28</b>	<b>7</b>	<b>24</b>	<b>152</b>	<b>50</b>	<b>21</b>	<b>282</b>

(No weather information)

**3:00 P.M.**  
**Sunday, July 3, 1990**

SAILBOAT	WIND SURFING	CANOE/ROWBOAT	LARGE POWER BOAT	SMALL POWER BOAT	WATER SKI	TOTAL
2	1	6	55	13	7	84
			4	4		8
3		10	18	6	2	39
8		1	6	4	1	20
			14	4		18
5		3	22	9	4	43
			24	5		29
2		1	8	5	1	17
2			5	4	3	14
		1		2	1	4
2		4	7	1	2	16
1			4	1		6
1		1	8	2		12
1			10	2		13
<b>25</b>	<b>1</b>	<b>27</b>	<b>185</b>	<b>62</b>	<b>21</b>	<b>323</b>

(No weather information)

Source: Squam Lakes Association, 1990

**TABLE 7-3b. SQUAM LAKES ASSOCIATION BOATING SURVEY**

**3:00 P.M.  
Saturday, August 11, 1990**

AREA NO.	WINDSURFER	SAILBOAT	CANOE/ROWBOAT	LARGE POWER BOAT	SMALL POWER BOAT	WATER SKI	TOTAL
1							0
2				5	1		6
3			2	9	4	1	16
4	1			4	1		6
5			1	6	2		9
6	1		4	7	4	1	17
7				5	1		6
8				4	3		7
9			1	6	4	3	14
10			2	3		1	6
11				1		1	2
12	1		1	3		2	7
13			3	3	1	1	8
14	1		1	6	2	2	12
<b>Total</b>	<b>4</b>	<b>0</b>	<b>15</b>	<b>62</b>	<b>23</b>	<b>12</b>	<b>116</b>

Rainy until 2:30 p.m., just before count

**3:00 P.M.  
Sunday, August 12, 1990**

WINDSURFER	SAILBOAT	CANOE/ROWBOAT	LARGE POWER BOAT	SMALL POWER BOAT	WATER SKI	TOTAL
4	2		73	11	5	95
1			11	1		13
6	1	4	16	3	4	34
12	1	1	10	2		26
3		1	20	3		27
7		3	12	4	2	28
		1	36	3		40
12		1	15	5	1	34
3	2	1	14	3	4	27
1		1	3		1	6
1			2		2	5
		1	4		1	6
1		1	7	6	2	17
5		2	11	1	1	20
<b>56</b>	<b>6</b>	<b>17</b>	<b>234</b>	<b>42</b>	<b>23</b>	<b>378</b>

Weather was fair and warm

Source: Squam Lakes Association, 1990

### **Boating Concentrations by Sub-Area**

To determine the difference in the magnitude of boat concentrations in the various sub-areas of the Squam Lakes, an analysis was undertaken to relate the number of boats to the acreage of water. Table 7-4 lists the total water area by survey sub-area, and breaks the total area into area by activity zone (the concept of activity zones is proposed in the next section.) The water area used in this calculation included only the general activity zone and the nearshore activity zone that are shown in Table 7-4, to allow for a comparison with the capacity calculations. The results are found in Table 7-5, which indicates the number of acres of water per boat count for each sub-area, and the lakewide average boat count for the eight days during which the boat surveys were done.

Several points can be made from this analysis. Not surprisingly, the sub-area with the highest density is Area 2, including the channel at Holderness between Squam and Little Squam Lake. This is the area where there is the greatest concern about congestion, and is the point where the principal boating services are located.

The sub-areas ranking second in density of boating are generally the smaller coves, including #5, 7, 12, 13, 14. Contrary to much discussion regarding Little Squam Lake, it appears to have a density of boating which was close to the overall average for the lakes on the days of the survey. Finally, as one might expect, the sub-area with the largest expanse of open water has one of the lowest boating densities. Other than the channel at Holderness and the main part of Squam Lake, the highest densities range from 4.8 to 34.1 acres of water per boat, in comparison to a lake wide average of 19.2 acres of water per boat.



**Table 7-4. Squam Lakes Watershed  
Water Use Sub-Area Acreage Estimates**

Area Number	Total Water Acreage	General Activity Zone	Wildlife Protection Zone	Nearshore Activity Zone
1	455	268	0	187
2	5	0	0	5
3	784	534	109	140
4	543	457	48	38
5	277	104	101	71
6	1,369	947	127	295
7	435	109	230	96
8	987	792	84	111
9	589	356	117	116
10	283	101	153	29
11	580	276	280	25
12	333	174	98	61
13	268	76	146	46
14	344	150	155	39
Total	7,251	4,344	1,648	1,260

Source: GRANTT calculations of areas by water use sub-area.

**Table 7-5. Concentration of Boats by Survey Sub-Area**

Area #	Acres Per Boat	
	High	Average
1	4.8	12.4
2	0.3	0.5
3	20.1	25.0
4	14.3	25.0
5	9.9	13.9
6	31.8	57.0
7	10.9	17.6
8	29.0	60.3
9	16.8	29.6
10	21.8	45.3
11	34.1	54.0
12	8.3	20.7
13	12.2	17.9
14	<u>12.3</u>	<u>19.8</u>
Lake Wide Average	19.2	26.8

Source: NH Office of State Planning calculations; boating data from Tables 7-2a, 7-2b, 7-3a and 7-3b; sub-area data from Table 7-4.

### **Boating Capacity of Squam Lakes**

The objective of this section is first to present a proposal for identifying areas of the Squam Lakes in terms of their capacity to accommodate boating activity of various types, and secondly to calculate a maximum allowable level of boating use for these areas. Such an approach is useful as a long term planning figure. The recommendations presented in this chapter include a phased program coupled with a review of the program over increments of five years.

#### **Boat Carrying Capacity**

The determination of the carrying capacity of a lake to accommodate recreational boating activity has not been as well developed or utilized as the determination of the capability of land for development. A recent report undertaken by the US Army Corps of Engineers at OSP's request reviews a number of studies of lake carrying capacity around the country. See Appendix F for a summary of this report. Information and data collected from other sources have been used to develop an approach which is suited to New Hampshire.

The objective of this approach is two-fold. First, certain parts of the Squam Lakes are proposed to be regulated as to the type of boating activity which would be permitted. Second, this plan addresses the issue of

limits on the number and size of boats. Several basic principles are advanced to justify these proposed restrictions:

- a. The Squam Lakes are public waters and therefore should be accessible to the public. This principle includes the assumption that the lakes must be accessible to the general public to the extent that the quality of the lake (and the lake experience) is not diminished.
- b. The Squam Lakes are classified as Class A waters. Present water quality must not be degraded and, to the extent possible, water quality as measured by regular monitoring should be improved.
- c. Important natural resources, wildlife and wildlife habitat must be protected and maintained.
- d. The desired intensity of lake use, overall, should be kept close to that which currently exists, rather than approaching the maximum level as calculated in this report.
- e. As public access opportunities increase, the overall intensity of water use must be monitored to evaluate the impacts resulting from this increased access.
- f. When warranted by changing conditions, the intensity at which individuals use the lakes should be reduced, to assure that water quality and the "quality of lake experience" are maintained and, to the degree possible, improved.
- g. The role of the public and private sectors in providing opportunities for public access and public use of the Squam Lakes must be clearly defined.






### **Water Use Activity Zones**

The surface waters of the Squam Lakes watershed, particularly the nearshore waters, are utilized for a variety of purposes. These range from recreational uses such as swimming and boating, to habitat and feeding areas for important wildlife and plant communities. The nearshore waters contain the maximum number of potential points of user conflict, receive the greatest direct impact from nearshore land users and are usually the first place where water quality stress indicators can be seen. The basic proposal for water use includes three activity zones. Map 7-4 illustrates the three zones.

- a. a nearshore activity zone, extending 250 feet out from and parallel to the shoreline, which functions as a "quiet" zone;

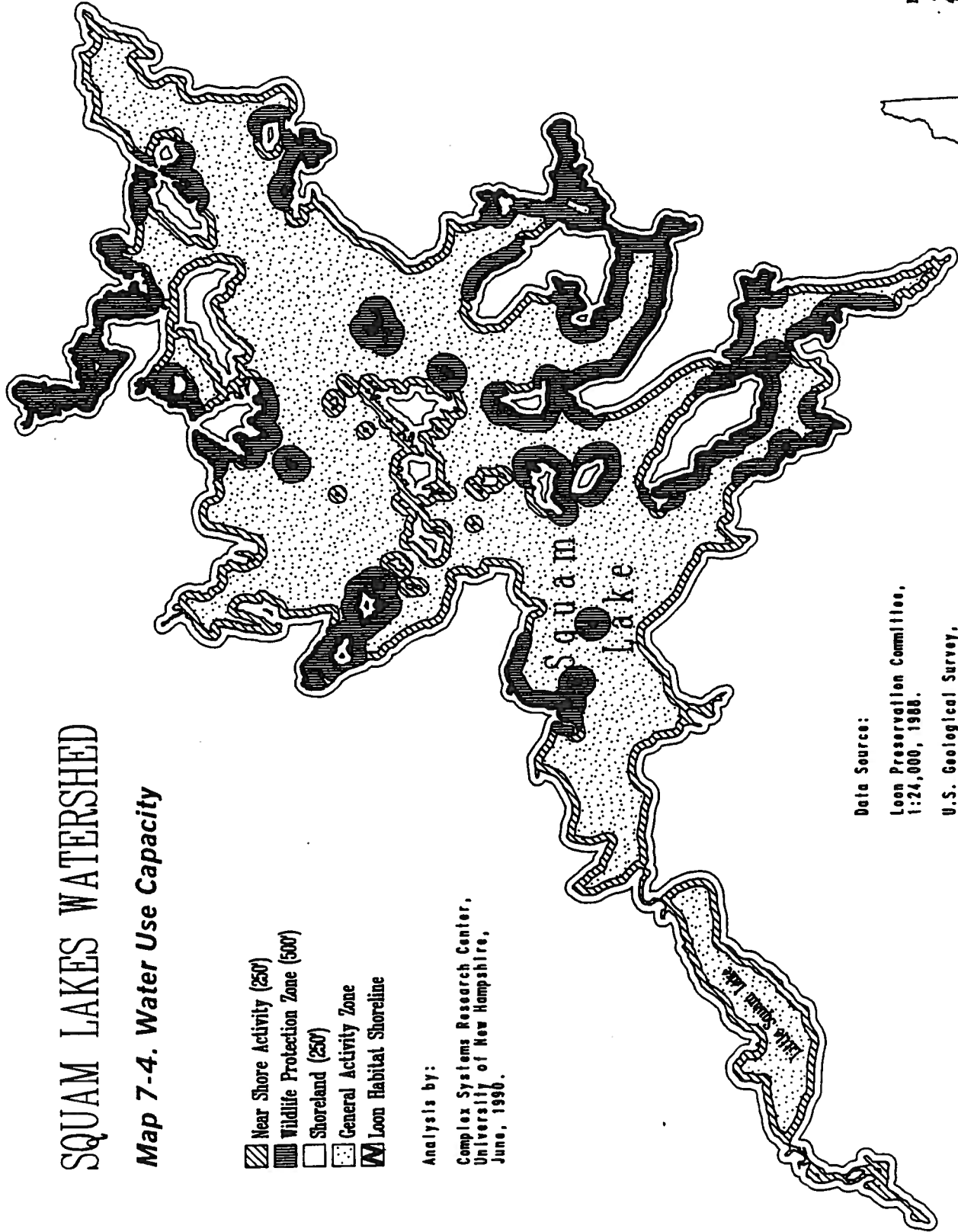
# SQUAM LAKES WATERSHED

Map 7-4. Water Use Capacity

-  Near Shore Activity (250')
-  Wildlife Protection Zone (500')
-  Shoreland (250')
-  General Activity Zone
-  Loon Habitat Shoreline

Analysis by:

Complex Systems Research Center,  
University of New Hampshire,  
June, 1990.



Data Source:

Loon Preservation Committee,  
1:24,000, 1988.

U.S. Geological Survey,  
7.5 minute topographic  
quadrangles, 1:24,000.



SCALE 1:60,000

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- . a wildlife protection zone, extending an additional 250 feet out from and parallel to the nearshore activity zone (total of 500 feet), along shoreline containing known loon nesting sites; and
- . a general activity zone, covering the remainder of the lakes.

The extent and rationale for each of these proposed water use zones is described below.

### **Nearshore Activity Zone**

Shallow, nearshore water areas are especially important to lake quality. It is here that the impact of adjacent land uses on the water may be first identified. The nearshore area is one which is very sensitive to human development and activities. Erosion from landside activities creates sedimentation; nearshore fertilization of lawns contributes unwanted nutrients; boating can lead to waterside erosion and sedimentation; walking and hiking can destroy vegetation; and human intrusion in sensitive areas may destroy important wildlife habitats and travel corridors. The nearshore zone is also the portion of the lake where all water uses originate, whether swimming, boating, fishing or waterskiing.

Several studies have indicated that shallow areas around the lake's perimeter are especially sensitive to boat propeller action. Propellers tend to stir up sediments and resuspend nutrients in the water column. A study in 1979 on Florida lakes<sup>4</sup> suggests that this resuspension may occur to a depth of 15 feet with a 50 horsepower engine. Regardless of the precise implications of the cited studies, there is substantial support for the conclusion that the impacts of land and water use are quite significant in the nearshore zone. By examining Map 7-5, a portion of Squam Lake, closely, one can see that the shoal line, approximately five feet in depth, along many shoreline areas is at or beyond the 250 foot distance from shore, and in some cases is close to the 500 foot distance.








This surface water zone is intended to function essentially as a "quiet" zone. Within the zone recreational activities - swimming, non-motorized or muscle-power craft, and motorized craft moving through this zone at headway speed (approx. 5 MPH) will be the primary permitted uses. The extent of this zone shall be 250 feet out from and parallel to the shoreline. Regularly spaced markers should be employed to identify the extent of the zone. Table 7-4, which is based on a computer analysis of the Squam Lakes indicated that the 250' quiet zone around the shore of the mainland encompasses 1,260 acres.

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<sup>4</sup> Y. A. Yousef, "Changes in Phosphorus Concentrations Due to Mixing by Motorboats in Shallow Lakes", North American Lakes Management Conference, Kellogg Center for Continuing Education, Michigan State University, 1979.

# SQUAM LAKES WATERSHED

Map 7-5. Water Use Capacity - Shoreline Enlargement

-  Near Shore Activity (250')
-  Wildlife Protection Zone (500')
-  Shoreland (250')
-  General Activity Zone
-  Loon Habitat Shoreline
-  Ten Foot Depth Contour
-  Shoal Line

Analysis by:  
 Complex Systems Research Center,  
 University of New Hampshire,  
 June, 1990.

Data Source:  
 Boston Museum of Science and  
 Squam Lakes Association,  
 1:12,500, 1988, recomplied onto  
 1:24,000 mylar quad overlays.  
 Loon Preservation Committee,  
 1:24,000, 1988.  
 U.S. Geological Survey,  
 7.5 minute topographic  
 quadrangles, 1:24,000.



SCALE 1:25,000



### **Wildlife Protection Zone**

The uniqueness of the Squam Lakes experience results from the special interplay of lakes, islands, mountain setting, vegetation and wildlife. Of these characteristics, perhaps the most unique is the special attraction of the wildlife community. Unfortunately, one of the first impacts of man's activities is the loss or diminution of this very special characteristic of the watershed. This plan therefore must place emphasis on the protection and preservation of the special values of the wildlife resource.

With the valued assistance of the Audubon Society of NH, the Loon Preservation Society, the NH Fish and Game Department, NH Natural Heritage Inventory, and the Squam Lakes Advisory Watershed Committee, important wildlife resources have been identified and mapped. While the majority of the water-related habitat areas will be protected within the proposed nearshore water zone, an additional 250 foot buffer area is proposed along shoreline with known loon nesting sites, for a total of 500 feet parallel to the shoreline. Map 7-4 illustrates the extent of this 500 foot wildlife protection zone. The zone comprises 1,648 acres of water, and is intended to establish a water area which will minimize the conflict between boaters and important wildlife areas, i.e., such as loon nesting areas, by requiring that movement through these zones be at a reduced or headway speed. The limits of this zone could be identified with suitable markers. Since the critical time for nesting loons is the period when the chicks are being raised in the spring and early summer, the additional buffer is actually unnecessary for the remainder of the year. However, given the difficulty of educating the public relative to the need for protecting these critical sites, it is felt that a district which changed in size on a seasonal basis would be confusing and difficult to administer. Thus, a permanent 500 feet buffer zone is recommended along these shoreline habitats. The water areas of the following coves are almost entirely covered by this wildlife protection zone: Squam Cove, Bear Cove and Carns Cove and, to a large extent, Dog Cove.

### **General Activity Zone**

Under the proposal to create activity zones for the Squam Lakes, the remainder of the lake would be designated as a General Activity Zone. Speed limits, types of use and related impacts would be governed by existing statutes and rules.

## Boating Use Standards

The area of surface water required or used by boats of different sizes is based on standards as reported by OSP in 1985.<sup>5</sup> Table 7-6 summarizes the results of applying these standards to the number of watercraft identified during the 1988 Squam Lakes Association shoreline census, and each of the eight boating surveys conducted in 1988 and 1990. There are two columns for the census and two columns for each boating survey. The first column in each case indicates the number of watercraft, identified by type, and the second column indicates the number of acres of water surface required by each type of boat, as a result of applying the appropriate standards to each type.

Recognizing that the sampling presented is limited, several preliminary conclusions have been drawn from Table 7-6. The first column shows that if all the water craft identified in the Squam Lakes Association census were in use at the same moment, the capacity of the lakes would have been exceeded by approximately 50 percent based on the proposed standards. The total area of water surface required would exceed 12,137 acres. It is important to remember however that the prior section determined that at no time did the participation rate or number of boats in use exceed 20 percent. (The one poor weather day saw a use rate of 10 percent).

Additional conclusions from Table 7-6 more clearly define characteristics of boating use. Obviously, poor or threatening weather reduces the level of boating or allocated lake use activities. All the activities which were identified on July 2, 1988 could have taken place on a pond of approximately 1000 acres without exceeding the capacity of that pond.

Finally, by calculating boating area needs based on the 20 percent participation rate (see discussion under Present Boating Use on page 7-11 and 7-12), and comparing that use with the total available water area, a conclusion is that it is unlikely that the overall boating capacity of the Squam Lakes is exceeded during the summer season, based on the proposed standards.

As stated earlier, these conclusions are based on limited data. It is extremely important that the Squam Lakes Association continue to take an annual census and regular surveys of on-lake use, and that the results be reevaluated each year. Verification of the concept of a participation rate, or a boat use ratio, will be valuable as OSP attempts to evaluate use levels on other lakes and great ponds. This updated information will assist the agency charged with regular review of this Plan as well.

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<sup>5</sup> *Lakes and Great Ponds Report, 1984 - 1985, Volume 2: Report to the General Court; New Hampshire Office of State Planning, May 1985.* This report provided standards, based on several studies, which indicated that large power boats require/use an area of approximately 8.8 acres; small power boats require/use an area of approximately 4.3 acres; and non-power boats require/use approximately 1.5 acres. These numbers were specifically derived from a Bureau of Outdoor Recreation publication based on interviews, field observations, and reviews of State Comprehensive Outdoor Recreation Plans.



Table 7-6. Lake Boating Use (Based on SLA Census/Surveys)

1988 SLA Shoreline Census	SLA Boating Surveys																	
	Boats	Acres	07/02/88 Boats	Acres	07/03/88 Boats	Acres	08/13/88 Boats	Acres	08/14/88 Boats	Acres	07/02/90 Boats	Acres	07/03/90 Boats	Acres	08/11/90 Boats	Acres	08/12/90 Boats	Acres
Large Power (8.8)	972	8,554	94	827	195	1,716	170	1,496	169	1,487	152	1,338	185	1,628	62	546	234	2,059
Small Power (4.3)	218	937	32	138	54	232	18	77	25	108	50	215	62	267	23	99	42	181
Canoe/Rowboat (1.5)	557	836	7	11	55	83	23	35	42	63	24	36	27	41	15	23	17	26
Sailboat (4.3)	420	1,806	12	52	33	142	31	133	32	138	35	151	26	112	4	17	62	267
Waterski (8.8)	0	0	2	18	23	202	23	202	24	211	21	185	21	185	12	106	23	202
Jetski (4.3)	1	4	0	0	2	9	23	99	0	0	0	0	0	0	0	0	0	0
Total	2,168	12,137	147	1,045	362	2,384	288	2,043	292	2,007	282	1,924	321	2,232	116	790	378	2,734

Note: Acreage derived by multiplying the number of boats by the acres per boat standards in parenthesis.

Table 7-7 includes the results of boat carrying capacity calculations for the nearshore and general activity zones respectively. The table indicates that the maximum number of large power boats in use on the main body of the lake, or general activity zone, at any one time should not exceed 395. This calculation assumes that the mix of use between large and small boats would be approximately the same as determined during the surveys. Additionally, the general activity zone could support no more than 202 small power boats, or a maximum of 597 power boats in this zone. This total is two to three times greater than the total number of power boats observed in the 1988 and 1990 surveys.

The nearshore activity zone could support up to an additional 170 small power boats (this assumes headway speed) and 353 muscle or wind power small craft based on the suggested standards. The total number of craft that could operate in the two zones under the suggested standards, without exceeding the lakes capacity, would be 1,120.

**Table 7-7. Boat Carrying Capacity by Lake Area and Boat Type<sup>6</sup>**

	Lake Area	Watercraft
General Activity Zone	4,344 Acres	
(8.8 <sup>AC</sup> ) Large Boats - 80%	3,475 Acres	395
(4.3 <sup>AC</sup> ) Small Boats - 20%	869 Acres	<u>202</u>
		597
Nearshore Activity Zone	1,260 Acres	
(4.3 <sup>AC</sup> ) Small Power - 58%	731 Acres	170
(1.5 <sup>AC</sup> ) Muscle/Wind Power - 42%	<u>529 Acres</u>	<u>353</u>
		<u>523</u>
		1,120

The preceding numbers are based upon the suggested standards and the existing mix of boats. The total number of boats could increase from 767 to approximately 1,180 if the number of large power boats were reduced to zero and only small power and non-power boats remained. This suggests a range of numbers that could be considered. Furthermore, these calculations indicate that an increase in access coupled with a decrease in boat size would enable the lake to accommodate more users with minimal, if any, increase in impact.

<sup>6</sup> The acreage of water included in the wildlife protection zone (1,648<sup>AC</sup>) was deleted from the total water area (7,251<sup>AC</sup>) prior to calculating boat use capacity.

## Calculated Requirement for Public Access Points to the Lakes

The State's Public Access Advisory Committee is presently revising the Office of State Planning's preliminary draft report on public access for New Hampshire, which among other things proposes a basis for public access points to great ponds with over 1,000 acres of surface water. The draft report proposes that public access points should occur on an average of one for each five miles of shoreline, and further, suggests that each public access should serve approximately 1,000 acres of surface water. (This figure ranges from 700<sup>AC</sup> to 1,200<sup>AC</sup>.) These two standards are combined to account for the variety of shapes of particular waterbodies. For example, a highly irregular shoreline would result in an excessive number of accesses, based on shoreline calculations despite the fact that the surface water acreage might be relatively low.

The preliminary report also contains a calculation of the optimum number of public access points for each lake with an area in excess of 2,500 acres. Table 7-8 reproduces the information included in that report.

**Table 7-8. Public Access Points Recommended by  
Public Access for New Hampshire Preliminary Draft**

### Great Ponds in Excess of 2,500 Acres

	Surface Water Acres	Shoreline Miles	Accesses	Surface Water Area Service
First Connecticut	2,807	19.4	4	700
Massabesic	2,512	26.2	3	840
Newfound	4,105	19.8	4	1,025
Ossipee	3,091	10.6	3	1,030
Squam	6,764	60.5	9	750
Sunapee	4,085	29.6	5	820
Umbagog <sup>1</sup> (NH)	4,532	25.1	5	910
Wentworth	3,017	14.0	3	1,005
Winnisquam (38,029)	4,264	28.2	6	710
Winnepesaukee	<u>44,586</u>	<u>240.0</u>	<u>48</u>	930
	79,763	473.4	90	

<sup>1</sup>Total Area = 7,850

Total Shoreline = 43.2 mi

Figures shown are for the New Hampshire portion.

Source: NH Office of State Planning, *Public Access for New Hampshire* preliminary draft, January, 1990.

Table 7-8 indicates that 9 public access points were initially calculated as appropriate for the Squam Lakes, based on the combined standards. While no public access points presently exist on the lakes, based on the current definition of public access in RSA 271:20, which is limited to State-owned or controlled access to public waters, the inventory on page 7-10 of this chapter identifies seven (7) accesses on the Squam Lakes. This chapter suggests that areas zoned as wildlife habitat should generally be restricted to headway speed, and that at critical times (i.e. hatching/brooding for loons) there should be no boating activity. Table 7-7 indicates that the available water area, or the area excluding wildlife habitat protected areas, is 5,604 acres (4,344 acres + 1,260 acres). If this available water area figure is used in place of surface water acres in Table 7-8, then the number of public accesses recommended for Squam Lake would be six (6).

Based on the assumptions and standards which have been employed above, it appears that the use of available water area recognizes the sensitive nature of the lakes, and that the location of six (6) public access points on the Squam Lakes is reasonable. In order to achieve this, it is assumed that the State definition of public access would be broadened, to include access provided by public entities other than the State and private entities, possibly for a fee. Given this assumption, the near term development and/or rehabilitation of 2-3 public accesses in combination with the four (4) existing access points available to the public<sup>7</sup> would meet the foreseeable needs of the Squam Lakes. Careful consideration needs to be given to how the opportunity for multiple use at public access sites is provided. Such sites might incorporate picnicking, boating and/or swimming.

### **Boating Program for Squam Lakes**

The carrying capacity levels for boating calculated for the Squam Lakes, if realized, would result in a substantial increase in existing boat density. These calculations are intended to reflect a reasonable or optimum capacity for boating in the long term. A primary conclusion to be made from these calculations would be that a reasonable increase in the number of boats over a period of time would not be likely to have a negative impact, if this were accompanied by measures which focus on controlling the actual areas under use. Such measures would include continuing operating limitations such as boat speed, particularly the headway speed proposals in the nearshore and wildlife protection zones. A key recommendation is that appropriate controls as outlined in this plan be put into place as new boating opportunities are developed.

It is appropriate to consider increasing public access through the mechanism of new boat access. The program being recommended would assure that improvements would occur in boating operations and monitoring as new public accesses were developed. The addition of 2-3 public access points is recommended over the next five years, and would result in an increase of 30 boats per new access facility, over and above the present level of boating, or a change of about 10-15 percent. The total increase in boating resulting from this recommendation would approach 30 percent spread over a period of five years, assuming that the new public access facilities could be developed in that time frame.

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<sup>7</sup> Of the seven lake access areas listed on page 7-10, the following can be used by members of the public who are not residents of watershed towns: 1) site on the Squam River; 2) Five Finger Point; 3) Ashland Town Beach; 4) NEFFA property.

The number of small and large power boats identified during the SLA census as presently being located on the Squam Lakes is approximately 1,200. This number of power boats is presently being serviced and provided access by existing marinas and launch facilities. These marinas can continue to service the number of such boats that might be active at the level of use indicated in Table 7-7. As a result, there does not appear to be a need for the public sector to be concerned with large boat access at this time, as the private sector can continue to provide for these needs. Therefore, it is further recommended that the public sector focus its scarce resources on providing access to small boats and other lake users, and on creating a better distribution of the users.

#### **Location of Additional Lake Access Sites**

Another concern involves the location of the existing marinas, and consequently, the boat storage areas at the westerly end of Squam Lake. Providing additional access to the lake in this area would only exacerbate the density and congestion problems that exist. The need expressed for additional access to Squam Lake stems partly from the fact that fishermen or other recreational boaters must traverse its entire length in order to fish, to sail, or canoe. The provision of additional lake access points which might be designed for small power and carry-in or car-top boats hikers and/or swimmers could provide for these needs.

Finally, the careful location of public access points, and the location and control of parking facilities, can be utilized as methods for assuring that access levels remain within the ability of the lakes to absorb such uses.

The location and size of existing access facilities on Little Squam Lake and at the channel at Holderness are adequate for the existing boating population in these locations, although these facilities may need to be modernized and modified as part of the overall watershed access program. They serve the immediate needs of the boating public, despite the fact that their location tends to concentrate all users on the westerly end of Squam Lake. This report does not include a recommendation for adding additional access points which would involve the level of servicing, maintenance or storage facilities which are presently in existence. Municipal governments should work with the existing operators to improve the marinas and to encourage elimination of any existing or potential problems.

Two new public access points with boat ramps should be located on Squam Lake. The site design of these facilities, including adequate parking, should be consistent with standards for small and multi-use public access points being developed by the Public Access Committee and contained in the Committee's report, *Public Access Plan for New Hampshire's Lakes, Ponds and River*. Environmental assessment studies of any potential sites should be carried out as recommended in this report. Locations for public access should be considered for the southeastern, and/or northeasterly sections of Squam Lake, in areas where there would be minimal impact on the wildlife community and existing development. The location of these facilities on the noted areas of Squam would provide public access opportunities which would meet State standards as they are presently being considered.

There is an existing boat access on the Squam River which is difficult to find. It is recommended that an effort be made to incorporate nearby State land adjacent to a dam into this site for parking and/or additional purposes. This might result in a third public access point, in Ashland, which would include adequate parking, a picnic site and signage as an historic site.

Finally, carry-in boat launching and/or trail access facilities should be located at various locations over time to provide additional public access to the Squam Lakes.

New access points must be carefully managed so as to maintain water quality and avoid adverse impacts on the public health, safety and welfare. Adequate parking facilities must be provided, as well as safe entrance ways into sites from public thoroughfares. Consideration should also be given to the provision of public toilets, pump-out facilities and information/education programs concerning boating safety and environmental awareness. Inspections of boats for the presence of aquatic milfoil should also be incorporated as a means of limiting the spread of this nuisance plant in the Squam Lakes.

### **Boating Safety**

In addition to issues such as numbers and sizes of boats, provision of access to public waters, and concern for protecting shoreline and natural habitats, this plan needs to address the issue of boating safety. Because of the growing intensity of boating use on Little Squam and parts of Squam Lake, and to a greater extent, other lakes in New Hampshire, it is recommended that the State of New Hampshire institute a program of licensing power boat operators. The purposes for the recommendations are to widen familiarity with State boating laws, and to promote an increased proficiency in boat handling on the part of power boat operators. The proceeds from licensing fees should be dedicated to the support of educational programs to improve safety, and to otherwise manage boating on the Squam Lakes as well as other public waters of the State. Power boat operator licensing is proposed as a statewide system, not limited to the Squam Lakes area. This licensing program could be considered to apply to persons operating larger power boats, e.g. in excess of 40 horsepower engines.

### **Time Zoning**

The concept of time zoning as a measure to control or regulate boating activity received some consideration during the development of this plan. While no specific recommendations are included here as to how time zoning might be applied to the Squam Lakes, or for that matter, whether it is needed, the following ideas are offered to stimulate discussion about this approach.

Time zoning or time restrictions seem to fall into two types: restriction as to time of day and restrictions relating to the day of the week. Certain uses of power boats, such as waterskiing or high speed cruising, could

be restricted to mid-day hours as a way of limiting the impacts of these activities (noise, speed, and wake) on shoreline property owners, swimmers and other boat operators. Many lakes in New Hampshire employ either formal or informal restrictions of this kind during late afternoon or evening hours, and these are especially suited to the enjoyment of a peaceful lake boating experience.

The second form of time zoning would restrict the use of power boats on certain days of the week, particularly weekend days when problems associated with boat congestion and use seem to occur most frequently. An alternate day approach, where certain boating uses or boat speeds are regulated on one day and not on the next, might be a solution to problems associated with heavy boat use on a lake or part of a lake. One means of implementing an alternate day zoning approach could be to restrict the launching of large power boats on the restricted day(s) at any new public boat ramps.

These ideas are intended to stimulate thoughtful discussion among the Squam Lakes community as to the need for and nature of such restrictions.

## Conclusions

1. Extensive access facilities within the Squam Lakes watershed are provided by municipal, private and non-profit organizations. They include access for boating, swimming, camping, fishing, hiking, picnicking, birdwatching, visual enjoyment, or similar recreational activities.
2. Based on the definition of public access adopted by the legislature as RSA 270:20a there is no public access to the Squam Lakes. This definition requires that a public access be "controlled or owned by a State agency."
3. There are seven (7) access points on the Squam Lakes which are owned or controlled by a governmental entity or non-profit organization.
4. The State's definition is overly restrictive to the extent that it does not recognize access provided by another government or a non-profit organization as public access.
5. Concerns related to boating on the Squam Lakes include difficulties connected with boat distribution and congestion, in addition to the usual concerns related to location of ramps, speed, and safety.
6. The problems of boat distribution and congestion are at least partially due to the location of the marinas at the westerly end of Squam Lake.
7. The existing marinas presently provide, and should be able to continue to provide, services to the largest boats.
8. The Squam Lakes Association census and surveys provide a basis for establishing a potential boat use or participation rate of 20 percent for Squam. The concept of a participation rate is useful in determining the potential impact of additional access to public waters.
9. Existing literature reviewed by OSP based on field investigations, user interviews and reviews of State Comprehensive Outdoor Recreation Plans, provides reasonable standards for use in calculating boat carrying capacity for the Squam Lakes. Such a calculation is helpful when considering the impacts of additional lake access facilities.
10. Standards developed by the Office of State Planning for determining the number of access facilities, which are related to length of shoreline and surface water service area, provide the basis for determining the number of accesses which are generally appropriate for the State's lakes and great ponds.
11. The application of these standards, modified to recognize the sensitive nature of the Squam Lakes by applying the concept of "available surface water area," results in a calculated need of six (6) public access points for the Squam Lakes.



12. **Given the number of existing accesses, there should be 2-3 new or rehabilitated public accesses on the Squam Lakes. These public accesses should include opportunities for boating, picnicking and swimming. Additional public access facilities incorporating trails and opportunities carry-in small boats and canoes should be provided over time.**
13. **Public access can also be gained by providing for scenic overlooks and opening scenic views.**
14. **Improved and/or increased access by boats to the Squam Lakes could result in negative impacts on the resource and the potential for additional safety problems.**
15. **These potentially negative impacts must be minimized or eliminated through careful environmental controls, planning, the increased presence of safety services personnel, and provision of information to the public about boating regulations and other related issues.**
16. **The level of boating or potential increases in boating can be controlled by locating and limiting transient parking areas in such a way that the capacity of the lake will not be exceeded.**

## Recommendations

The Legislature should change its definition of public access, to include access points which are provided by municipalities and, as appropriate, non-profit organizations, as long as they are available to a broad spectrum of the general public at a reasonable fee.

The Squam Lakes Association should continue to undertake an annual boat/facilities census, to include weekday as well as weekend use; undertake regular non-lake surveys; and provide this information as part of the ongoing review of the recommendations of this plan.

The State and municipalities in the watershed should accept standards for boat/surface water area use and public access similar to those developed for this report, and a methodology for calculating carrying capacity, as measures to preserve the unique natural qualities of the Squam Lakes for all lake users. These standards should be reviewed in light of changing conditions, and modified as necessary.

The State should endorse the need for six (6) public access sites as a reasonable goal for the Squam Lakes. These facilities should provide access to small boats and other lake users, and should include a variety of trails or carry-in boating sites, swimming and other recreational areas.

Of the six (6) recommended accesses, two or three new and/or rehabilitated public access points should be provided. These should include two new public accesses in the easterly portion of Squam Lake and the rehabilitation and enlargement of the existing site in Ashland, accompanied by dredging necessary to restore a navigable channel.

Municipalities should encourage the maintenance and upgrading of existing informal, untended boat access points.

Selection of new access sites should be based on a thorough investigation of alternative sites from an environmental perspective, and should incorporate careful site design to accommodate reasonable lake uses and to control parking.

The available parking facilities for transient boaters should be inventoried. State and local government should utilize parking capacity and availability as one means of assuring that the level of use does not exceed the recommendations of this plan.

Municipal governments should work with marina owners to improve existing conditions and to minimize problems associated with marina operations.

The State and the municipalities within the watershed should develop a long range plan to reduce the size and power of boats on the Squam Lakes, at the same time that improved public access opportunities are being expanded.

**Limitations on boating activity in or near designated sensitive habitats or other critical areas are an integral part of the Squam Lakes Watershed plan. The State and municipalities should adopt the proposals to create three activity zones for the surface water of the Squam Lakes: a nearshore activity zone, a wildlife protection zone, and a general activity zone.**

**The access section of the Squam Lakes Watershed Plan should be reviewed and revised as needed, but at least once every five (5) years.**

**The Legislature should establish a powerboat operator licensing system to increase awareness and understanding of State laws and rules and, through required training and testing, to ensure a higher level of boat operating proficiency. Fees collected from the proposed operator license as well as present boat registration should be dedicated to the Department of Safety for boating education, safety and management purposes.**

**The State and the municipalities within the watershed should investigate the need for and the feasibility of time zoning as a means of regulating certain power boat activities.**

**New public access points should be well managed and should include sanitary facilities, provision for safe and adequate vehicular access and information/inspection programs for boating safety and environmental protection.**



## **Chapter 8. Land Management - Local Government**

### **Introduction**

Chapters 4 through 7 of this report address four substantive areas of the Squam Lakes Watershed Plan:

Land Use Consistent with the Natural Capability of the Watershed  
Water Quality  
Wildlife Habitat  
Access

These chapters describe existing conditions, identify issues, problems and opportunities and present goals and policies for the watershed management planning process. This chapter presents implementing actions which are recommended for consideration by local governments. These recommendations are highlighted at the end of the individual sections which follow, as well as at the end of the chapter.

### **Master Plans**

All of the towns in the Squam Lakes watershed have master plans which are relatively current, ranging from 1981 to 1990 (Table 8-1). These plans and the planning process on which they are based are important expressions of community desires for guiding future land use in the respective towns. As conditions change, it is important for communities to reassess and revise the goals and policies which lie at the heart of their land use plans. There are important legal reasons for maintaining a current master plan, since it serves as the basis for land use regulations and capital improvement programs for the town.

**Watershed communities should review and update their master plans on a periodic basis. Every five years is recommended by RSA 674:2 VIII for local water resources management and protection plans.**

**Table 8-1. Regulations by Town**

	Master Plan	Zoning <sup>1</sup> Ordinance	Subdivision <sup>1</sup> Regulations	Site Plan <sup>1</sup> Review Regulations	Capital Improvements Program
Ashland	1986	1985/90	1974/89	1986/87	-
Centre Harbor	1990	1969/90	1967/90	1976/86	-
Holderness	1984	1985/90	1970/89		1989
Moultonborough	1982	1985/88	1973/88	1986	1989
New Hampton	1985	1986/90	1971/89	1986/1980 <sup>2</sup>	1989
Sandwich	1990	1969/90	1967/90	1983/90	-

Source: NH Office of State Planning, 1990

### Local Water Resources Management and Protection Plans

In 1986, the legislature established the Water Protection Assistance Program within the Office of State Planning (RSA 4-C:19). The purpose of the program is to encourage municipalities to evaluate their water resources and to develop measures for the protection of both groundwater and surface water. The statute directed OSP to develop administrative rules to provide guidance for municipalities in the development of local water resources management and protection plans, to be adopted as part of the conservation and preservation section of their master plans. The original rules took effect on January 20, 1988. Subsequent revisions to the rules were made on August 20, 1990, to simplify and add flexibility to the planning process. According to the rules, a local water plan should provide a descriptive evaluation of a municipality's surface water watersheds to include the wetlands, floodplains, lakes, ponds, rivers and perennial streams. Groundwater resources within the town should also be evaluated, to include bedrock as well as stratified drift aquifers. The water plan should identify potential threats to water resources and project the municipality's future need for these resources. After providing an analysis of the town's existing regulatory framework, the plan should present a strategy of both regulatory and non-regulatory mechanisms for the long term management and protection of the town's water resources. A local water plan must be submitted to OSP for review and written comment relative to its consistency with the State rules, prior to local adoption.

Municipalities are further encouraged by the Water Protection Assistance Program to adopt local land use controls with which to implement their local water plans. An amendment to the statutes, RSA 4-C:23 took

<sup>1</sup> Date of Adoption/Date of most recent update.

<sup>2</sup> Mobile Home Park/Earth Excavation.

effect on June 30, 1989. The new section is entitled Regional Water Resources Management and Protection Plans. This statute authorizes and encourages municipalities to enter into agreements with other municipalities for the purpose of developing and implementing regional water plans and ordinances. The purpose of these regional plans is to enhance the effectiveness of local water plans, where the need for protective measures extends beyond municipal boundaries. The statute specifies that an intermunicipal agreement to develop regional water plans must be adopted pursuant to RSA 53-A. Each municipality would have to make a commitment in the form of an ordinance, resolution or other action to enter into the agreement. This authority, which has not yet been utilized by New Hampshire municipalities, would be an appropriate mechanism for watershed management planning in the Squam Lakes watershed.

Most of the data required to develop local water resources management and protection plans has been compiled and entered into NH GRANIT as part of the inventory phase of this project. The Lakes Region Planning Commission (LRPC) now has a PC ARC/INFO workstation, and therefore has access to the GRANIT data base. It is recommended that the planning boards in the Squam Lakes watershed work with the LRPC, either individually or cooperatively, to prepare local water plans for inclusion in their municipal master plans. If the option of entering into an intermunicipal agreement for watershed planning is chosen, the planning boards will be breaking new ground. Their efforts would serve as an example for municipalities in other lake watersheds statewide.

**Municipalities within the watershed should enter into a formal cooperative effort to prepare a regional water resource management and protection plan that is consistent between municipalities. Planning boards should adopt the portion of that plan that pertains to their municipality as part of the conservation and preservation section of their master plans (RSA 674:2,VIII).**

### **Local Regulatory Measures**

#### **Zoning**

RSA 674:16 authorizes the local legislative body of a city or town to adopt and amend a zoning ordinance for the purpose of promoting the health, safety or general welfare of the community. Such ordinances are designed to regulate and restrict the use of land within the municipality. They often include maximum limitations for the density, height, number of stories and sizes of buildings and other structures. They specify areas, or zones, within the municipality where land and structures can be used for business, industrial, residential and other purposes. A listing of land uses that are permitted and prohibited, or permitted by special exception, is usually included for each zone within the community.

The purpose of a zoning ordinance is to regulate the use of land in a manner that promotes the health and welfare of a municipality. It should include requirements to lessen congestion in the streets, secure safety from fires, panic and other dangers, to provide adequate light and air, to prevent the overcrowding of land and to avoid undue concentrations of populations. The ordinance should be designed to facilitate adequate provision

of an infrastructure to meet municipal needs for such services as transportation, solid waste facilities, water, sewerage, schools and parks. Map 8-1 illustrates the existing zoning districts in the watershed towns. See Appendix A for more specific details of zoning ordinances for each of the towns.

### **Consistency of Zoning Ordinances**

Table 8-2 compares the dimensional requirements contained in the local zoning ordinances, other than those related to shoreline or waterfront development, which are found in Chapter 4.

**The zoning ordinances of the towns in the Squam Lakes watershed should be consistent with one another, particularly with regard to permitted uses in zoning districts along common town boundaries. Also, distance requirements such as building setbacks and minimum frontage on waterbodies should adhere to commonly accepted standards among the towns in the watershed.**

### **Environmental Characteristics Zoning**












Overlay Districts for Natural Resources Protection and Management - It is common for municipalities to recognize the importance of critical resource areas by adding protective overlay districts to their townwide zoning ordinances. An overlay zone is so called because it adds special protective requirements or higher standards within an area that is delineated as a special resource. The boundaries of that resource usually do not coincide with those of the regular zoning districts. Where the requirements of the districts differ, the more stringent of the two apply. This type of zoning has traditionally been used to protect wetlands, floodplains, watersheds, aquifers, steep slopes and shorelines. Table 8-3 presents a summary of the types of requirements that are likely to be found in overlay zoning ordinances to address these resources.

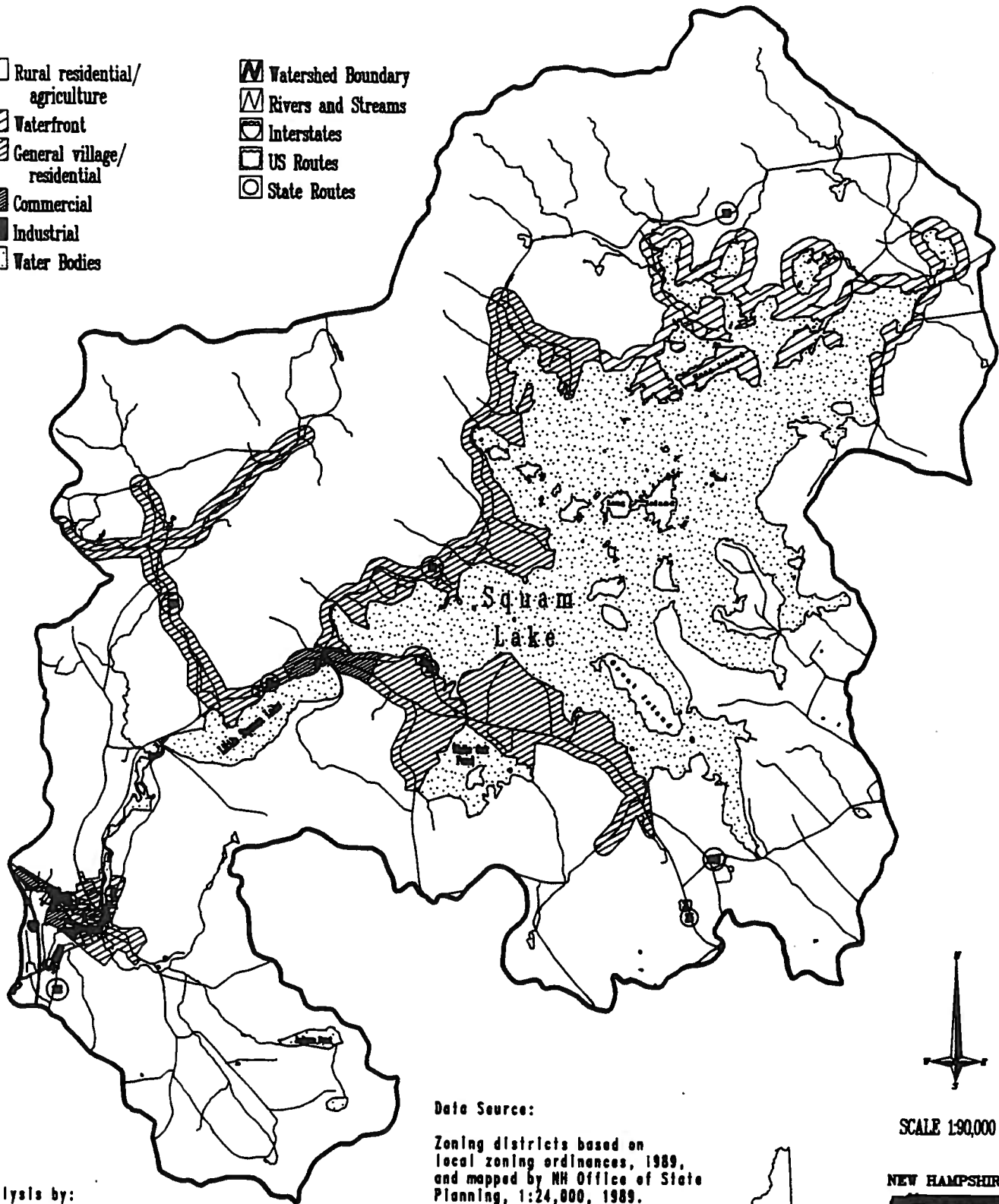
Delineation of the environmental overlay zoning districts usually depends upon existing maps and data prepared by federal agencies such as the Soil Conservation Service, United States Geological Survey, Federal Emergency Management Agency and others. Although such maps provide the planning board with a general idea of the extent of the resource in question, they are generally not sufficient in detail to identify a precise location of the district boundary. Where this is the case, it is important for the overlay zoning ordinance to allow applicants to provide the planning board with more technical, site specific information to delineate the boundary. It is helpful to both the planning board and applicants if that section of the ordinance clearly defines the methodology or options for methodologies to be used to delineate the district in the field. The ordinance may provide for an independent review of the data which has been provided by the applicant, or by a qualified consultant hired by the planning board at the applicant's expense. This type of review and professional consultation assists the planning board in making an informed decision based on technical information about the sensitive resource that the ordinance aims to protect. The ordinance may also spell out conditions under which the planning board may require site specific investigations.



# SQUAM LAKES WATERSHED

Map 8-1. Existing Zoning

- |   |  |
|---|--|
|  Rural residential/<br>agriculture |  Watershed Boundary |
|  Waterfront                        |  Rivers and Streams |
|  General village/<br>residential   |  Interstates        |
|  Commercial                        |  US Routes          |
|  Industrial                        |  State Routes       |
|  Water Bodies                      |  |



**Data Source:**

Zoning districts based on local zoning ordinances, 1989, and mapped by NH Office of State Planning, 1:24,000, 1989.

U.S. Geological Survey, 7.5 minute topographic quadrangles, 1:24,000.

**Analysis by:**

Complex Systems Research Center,  
University of New Hampshire,  
January, 1990.



SCALE 1:90,000

NEW HAMPSHIRE



Geographic Information System  
and Information Transfer System



**TABLE 8-2. SUMMARY OF ZONING ORDINANCE DIMENSIONAL REQUIREMENTS**

	Minimum Lot Size	Lot Line Setback (septic)	Lot Line Setback (building)	Unit Density	Minimum % for Greenspace
<b>Ashland</b>	40,000 s.f. subj. to soils/slope table Pemi: 2 acres (1)	septic tank, or leachfield - 15 ft.	15 - 35 ft.	7,500 - 40,000 s.f./unit Pemi: 60,000 s.f./unit	10%, except for rural residential
<b>Centre Harbor</b>	40,000 s.f. - non-scwered area (2)	—	15 ft.	10,000 - 40,000 s.f./family (3)	—
<b>Holderness</b>	1 acre, and HISS table Pemi: 2 acres (4)	septic system 35 ft.	35 ft. Dock: 10 ft.	1 s.f. unit/lot, unless subdiv. or site plan	minimum - 30%, for cluster development
<b>Moultonborough</b>	40,000 s.f. subj. to soil/slope table	—	building - 20 ft. dock: 20 ft.	1 unit/lot, unless subdiv. or site plan	25 ft. buffer between commercial building and right-of-way
<b>New Hampton</b>	1 acre/unit subj. to soil/slope table in Subdiv. Regs. Pemi: 2 acres	20 ft.	20 - 50 ft. 100 ft. - industrial park	1 unit/acre	—
<b>Sandwich</b>	100,000 s.f. subj. to soils/slope table (5)	—	waste gener. - 50 ft. structure - 25 ft.	1 unit/lot (single family)	—
	Lot Frontage	% of Lot Covered by Building	Obnoxious Use/Junkyard	Off Street Parking	Height Restrictions
<b>Ashland</b>	100 - 150 ft.	30 - 35%	prohibited	200 s.f./space 2 sp/unit - residential	40 ft., or 3 stories
<b>Centre Harbor</b>	100 - 150 ft.	30%, except commercial dist.	prohibited	200 s.f./space 2 sp/unit - residential	35 ft., or 3 stories
<b>Holderness</b>	100 - 300 ft.	15 - 50%	need permit	200 sf./space 2 sp/unit - residential	35 ft.
<b>Moultonborough</b>	—	50% - commercial lots	junkyards may not be offensive	200 s.f./space 2 sp/unit - residential	32 ft. - or 2 stories
<b>New Hampton</b>	150 ft.	20 - 50%	junkyards permitted by spec. exception	200 s.f./space 2 sp/unit - residential	35 ft.
<b>Sandwich</b>	160 ft.	50% max - commercial district	no more than 2 unlicensed vehicles, unless approved	20 ft/unit single family	32 ft.

**Municipalities should adopt requirements in their zoning ordinances to allow applicants to provide, and planning boards to require site specific information, as part of the local review process for environmental overlay zones.**

Wetlands Zoning - Many municipalities adopt wetlands overlay zoning regulations to protect the natural functions or values which make wetlands critical resources within a watershed. These important functions include flood protection and flow stabilization, wildlife habitat, filtration of nutrients, trapping of sediments, and ecological productivity. Such ordinances need to define or delineate the extent of the overlay district boundary. There are a number of different ways of establishing the extent of wetland boundaries, the most commonly used criteria being soils, vegetation, and hydrology. Wetland overlay ordinances typically have requirements for setbacks from wetlands for the location of septic system tanks and leachfields, roads and structures. Some ordinances establish buffers around wetlands within which land uses are either restricted or required to adhere to performance standards. It is common for wetland ordinances to allow the planning board to require that site specific information relative to the location of the wetland boundary be supplied by the applicant. This is usually reserved for sites where considerable acreage of wetlands is proposed for alteration or the wetlands exhibit particular resource values that are of significance to the municipality.

The Towns of Centre Harbor and Sandwich within the Squam Lakes watershed have adopted local wetlands zoning ordinances. Sandwich contains a significant amount of wetlands acreage, though much of it is to the east of the Squam watershed boundary. Most of Centre Harbor's wetland acreage, in contrast, is within the Squam watershed. Both of the ordinances define wetlands as poorly and very poorly drained soils based on SCS County Soil Surveys, as well as areas that are likely to support a prevalence of wetlands vegetation, such as marshes, swamps and bogs. They also designate uses which are appropriate, and provide guidelines for management practices that will protect wetlands during such use.

Fundamental to a good wetlands ordinance is an accurate and consistent basis for the determination of land in a town which should be classified as wetlands. The Sandwich Wetlands Conservation Ordinance describes a wetlands district as "an area of one acre or more (or less if next to surface waters, such as lakes, ponds or streams) subject to high water tables for extended periods of time. A district includes, but is not limited to, all such areas delineated as wetlands on the current Sandwich Wetlands Maps, on file in the Town Office". Where the wetlands conservation district is superimposed over another zoning district, the more restrictive regulations shall apply. Conflicts concerning the legitimacy of wetland delineations are to be resolved by the planning board, after the study of the town Wetlands maps, or after on-site investigation or research by a qualified plant or soil scientist (who is to be paid by the landowner or developer).

The only permitted uses in wetlands are those that do not require buildings and will not alter the natural surface configuration. Such uses include forestry and agriculture, as long as best management practices are used to protect wetlands from pollution and sedimentation. Wildlife refuges, parks, conservation areas as well as other low impact uses are also permitted. Special provisions of the Sandwich Ordinance include a 125 foot setback for septic tank or leach fields, a 100 foot setback for structures, as well as exclusion of wetlands from the other area of a subdivision. The Sandwich Wetlands Ordinance also includes special provisions for the Prime Wetlands that were adopted by the Town.

The Centre Harbor Wetlands Conservation Ordinance is similar to the Sandwich Ordinance, but it is worthwhile to point out some of the differences. First of all, the Centre Harbor Ordinance does not have a limit of one acre or more for the overlay zone, as the Sandwich Ordinance does. Second, though both permit essentially the same uses, the Centre Harbor Ordinance is less specific as to the need for best management practices when utilizing wetlands for forestry and agricultural purposes. Third, the Centre Harbor Ordinance, in the section entitled "Purpose and Intent", mentions encouraging low intensity uses that can harmoniously, appropriately and safely be located in wetlands. In the Sandwich Ordinance, these low intensity uses are permitted but not encouraged. Finally, specific dimensional provisions of the two ordinances are somewhat different. Centre Harbor requires a less stringent 100 foot setback for both septic systems and structures.

Four of the watershed towns, Holderness, Ashland, New Hampton, and Moultonborough have not adopted specific wetland conservation ordinances. Holderness has 106 acres of wetlands within the watershed, as well as additional wetland acreage north of it. While the town doesn't have a Wetlands Conservation Ordinance, the Holderness Zoning Ordinance says that conservation commission approval is required before any building or structure is allowed to be built in a wetland, or in an area that will affect any wetland that is on the town's Wetlands Inventory.

Within the watershed, the acreage of wetlands in Moultonborough is minimal. However, there is a significant amount of wetland acreage in the town to the east of the watershed boundary, within the Winnepesaukee drainage basin. The Moultonborough Zoning Ordinance makes no mention of wetlands, although the town's 1982 master plan generally recommends protection of all wetlands, and especially those identified in the conservation commission's inventory as most significant. No mention is made of establishing a wetlands district.

Ashland contains relatively little wetland acreage either within the watershed or outside of it. The town's 1986 master plan set the goal of restricting development on critical resource areas, but did not give any more specific information than that.

**Table 8-3. Overlay Zoning Techniques: Key Characteristics**

Wetlands	Floodplains	Watershed
- Permitted and prohibited uses*	- Permitted and prohibited uses*	- Permitted and prohibited uses*
- Setbacks for septic tanks and leachfields*	- Setbacks for septic tanks and leachfields*	- Performance standards more stringent than generally required by zoning*
- Setbacks for roads and structures*	- Setbacks for wells, structures, roads*	- Site specific data requirement option
- Buffers*	- Zero increase in peak flood elevation	
- Definition of wetlands and methodology for their delineation*	- Site specific data requirement option	
- Site specific data requirement option		
Aquifer	Steep Slopes	Shoreline
- Permitted and prohibited uses*	- Requirements for location or prohibition of septic systems vs. roads and structures*	- Buffers, setbacks and rationale*
- Definition and methodology for delineation of district*	- Site specific data requirement option	- BMP's for lawn management, natural vegetative buffers, etc.*
- More stringent performance standards than required by site review*		- Requirements for shoreline structures*
- More stringent performance standards than watershed*		- Site specific data requirement option
- Limitations on percent coverage by impervious materials*		
- Site specific data requirement option		

Note: \* Need to examine scientific basis.

Source: NH Office of State Planning, Water Protection Assistance Program, 1990.

The portion of New Hampton which is within the watershed contains only a small amount of wetlands. The town master plan suggests that the development of a wetlands conservation district be considered in order to protect the town's wetland resources.

One of the problems inherent in the regulation and management of wetlands in New Hampshire is the confusion that is caused by the different methodologies that are currently used to delineate the boundaries of wetlands for regulatory purposes. The U.S. Army Corps of Engineers require, through the section 404 permitting process, that wetlands be delineated in accordance with a detailed methodology specified in the federal manual for the delineation of jurisdictional wetlands. This method requires that detailed field investigations be performed by qualified professionals to document evidence of hydric soils, hydrophytic vegetation and hydrology.

At the State level, the Wetlands Board's rules define wetlands as areas which support a prevalence of vegetation adapted for life in saturated soil conditions. Two appendices to the rules include specific lists of vegetative species that are likely to be dominant in bogs, marshes, swamps and saltwater wetlands. These provide guidance to applicants for State fill and dredge permits.

Local wetlands ordinances are unique to the needs of the municipalities which adopt them. Therefore, the methodologies for wetland delineation specified in local ordinances are subject to variation. Many municipalities define their wetlands overlay district as those areas that are mapped as poorly and very poorly drained soils in the current SCS County Soil Surveys, because the information adheres to federal standards and is readily available. Although in some instances it may be desirable, site specific investigations are not generally required to implement such an ordinance. Other municipalities have chosen to define their wetlands districts based on a prevalence of hydrophytic vegetation, to be more consistent with the State requirements. This would require site specific investigation, because there is not an existing, reliable, readily available source of vegetative information at a scale that is appropriate for site specific use. Still other communities allow the applicant the option to delineate the boundary using either soils or vegetation, or a combination of the two methods. Some ordinances now require high intensity soil (HIS) mapping, while others have added the third criteria of hydrology, in order to be more consistent with the federal criteria.

In short, it is not uncommon for an applicant to have to delineate the wetlands on a particular site by three different methods, in order to satisfy the requirements of local, State, and federal permit processes. There is a need for regulators at all three levels of government to reach a consensus relative to one consistent methodology for wetland delineation for regulatory purposes.

However, the process of moving toward a more uniform and precise method of delineating wetlands could present unique potential problems for local officials. The traditional soil-based wetlands ordinances are consistent with the well established concept of soil-based zoning, which is limited to the level of accuracy of the SCS methodology. The increased accuracy that would result from the level of technical information required by the federal manual could result in a larger area of a community being included in the wetlands zoning district defined by that methodology. Applicants for local approvals may also argue that the cost of providing that level

of detail for all wetlands is excessive. The federal manual is relatively new, and its methods are still being tested by both the Corps and environmental consultants through the Corps permitting process. Questions are being asked about some of the requirements in the current manual.

It is important to strive for consistency between regulatory processes, and planning boards should strive to use the best available information in their decision-making. However, it may be appropriate for communities to continue to require an intermediate level of detail for wetland delineations in their local ordinances. They should reconsider the more detailed federal definition once the technical and procedural issues have been resolved at both the State and the federal level. This would allow for ongoing local protection requiring an established, acceptable level of detail, while the more detailed federal requirements are made and any subsequent legal challenges defended, at the federal level.

**Towns in the watershed should enact wetlands overlay zoning ordinances to increase protection of these important areas.**

**Planning boards in the watershed should be aware of the changes that are occurring in defining the methodologies for wetland delineation at the State and federal levels. Based on these changes, they should reevaluate the effectiveness of the provisions in their existing wetlands ordinances which outline the methodology for delineating the district boundary. Revisions should be proposed where they are determined to be appropriate.**

**Planning boards in the watershed should require that local approval of proposed projects in wetlands be conditioned upon approval of State and federal wetlands permits.**

Floodplain Zoning - Floodplains are sensitive resources that are often protected by local zoning. Their values include their ability to protect adjacent properties from damage by assimilating flood waters during storm events. Many also serve as critical wildlife areas, and either are wetlands or are associated with wetland habitats. Communities are required by the Federal Emergency Management Agency (FEMA) to pass certain minimal zoning restrictions for floodplain development, in order to be eligible for the federal flood insurance program. Many communities choose to adopt floodplain requirements in their zoning ordinances which are more stringent than the minimum required by the FEMA program. The FEMA program allows construction within sensitive floodplain areas if the structures are "floodproofed." Filling in or paving over floodplains decreases the peak flow capacity of the riverine system. The cumulative impacts of filling or paving, over time, can have a significant impact on downstream properties. Municipalities can adopt more stringent overlay zoning requirements than FEMA's, to provide protection measures for floodplain areas. Floodplain ordinances can include setbacks and site specific data requirements that are similar to those found in wetlands ordinances. Requirements for maximum or no increases in peak flood levels are often considered in floodplain zoning ordinances.

Three of the towns in the Squam watershed have adopted floodplain zoning districts, and they are structured somewhat differently. The Sandwich Floodplain Management Ordinance regulates areas along Burrows Brook and Eastman Brook. The ordinance does not prohibit development in these floodplain areas.

However, any development requires special permits and must meet a number of requirements which are spelled out in detail in the ordinance. Requirements include special provisions for sewer and water facilities, floodproofing of buildings and the alteration or relocation of portions of a watercourse. These requirements apply to all lands designated as special flood hazard areas (Zone A) by the Federal Emergency Management Agency in its Flood Insurance Study for Sandwich, along with Flood Insurance Rate Maps for the town. Such lands occur where the elevation is at or below the 100 year flood level.

The Sandwich Floodplain Ordinance also includes a separate "regulatory floodway", as determined by FEMA. The requirements relating to development within this floodway are more stringent than in Zone A. The criteria for establishing them include a review by the town Building Inspector of floodway data available from Federal, State or other sources. This regulatory floodway is defined as the "the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot at any point". Along watercourses that have been designated regulatory floodways, no development is allowed unless it meets the floodway requirements.

The Town of New Hampton's Flood Hazard District is listed in the zoning ordinance as one of the official zoning districts for the town. It is designed to regulate areas along Ames Brook and the area where the Squam River meets the Pemigewasset River. The permitted uses, which are spelled out in the ordinance, are forestry, agriculture, certain recreational uses and "residential accessory" use. These uses are only permitted if they do not require structures, fill or storage of materials or equipment. Other uses are allowed by special exception, to include certain structures, fairgrounds, marinas, etc. They are required to meet all other requirements of the ordinance.

The New Hampton Ordinance defines flood hazard areas as those that are subject to frequent periodic flooding, and are delineated as alluvial soils by SCS County Soil Survey. Also included are all of the areas delineated as flood hazard on the revised Flood Hazard Boundary Map for the Town of New Hampton, 1976. Where the flood hazard district is superimposed over another zoning district, the more restrictive regulations shall apply.

In Holderness, floodplains are found along various portions of Owl Brook, as well as along Bennett Brook and on the area of Livermore Cove. The town has a floodplain damage ordinance which governs any new building or structure development within a flood hazard area as delineated on the Flood Insurance Rate Map.

The Town of Ashland is the only other town in the watershed that has a considerable floodplain acreage within the Squam watershed, and at present has no floodplain overlay zoning ordinance. Floodplain areas are found within the town along The Pemigewasset River, the Squam River and Owl Brook. The town's 1984 master plan recommended that the Pemigewasset as well as the Owl Brook floodplain areas be conserved as open space, where primarily forestry and occasionally low intensity residential use would be allowed.



**Towns in the watershed should adopt local floodplain zoning ordinances which are more stringent than the minimum FEMA requirements. The purpose of these ordinances would be to take a resource protection oriented approach to regulating development in floodplains and to decrease the cumulative impacts of the disturbance of these sensitive areas on downstream property owners.**

Watershed Zoning - Some communities have recognized the importance of particular watersheds by adopting watershed protection overlay districts. This is common where there is either a public surface water supply or a particular watershed contributing recharge to a groundwater supply. It is also common for watershed zoning to be used to protect a surface waterbody that is considered a critical resource for reasons other than drinking water supply. Such ordinances usually specify land uses which are permitted or prohibited within the watershed. With outright prohibition of land uses within an entire watershed, the potential for a "taking" issue may come into play. The emphasis, therefore, is usually on performance standards that are somewhat more specific or stringent than those required for the rest of the community. Such standards should be designed to address protection of the specific resource values for which the watershed is considered locally important. In many instances the land of a significant watershed may lie within a number of municipalities. In these cases it may be appropriate for each community to adopt the same performance standards for the portion of the watershed that is within their town. This is one way to assure consistent protection throughout the entire hydrologic system.

The watershed zoning approach has not yet been taken by any of the municipalities in the Squam Lakes watershed.

Jackson Pond and Sky Pond, located in the southwest portion of the watershed in New Hampton, serve as the surface water supply for the town of Ashland. Jackson Pond is the major impounding reservoir, with Sky Pond feeding into it. The total drainage area for these two ponds is 666 acres. Two residential parcels exist in the watershed, and a narrow strip of land in the area is owned by the town of Ashland. Also, Sky Pond State Forest occupies 119 acres within the watershed. It is important to regulate land uses within this small drainage area to protect the quality of the water supply. Especially critical are uses in the immediate vicinity of the ponds or direct tributaries to them. At present, this area is zoned as general residential, agricultural and rural on the New Hampton Official Zoning Map.

**New Hampton should adopt a watershed protection district as an overlay zone for the Sky Pond and Jackson Pond drainage area.**

Aquifer Zoning - There has been an increased interest in local groundwater protection, stemming from a growing public awareness about groundwater contamination occurrences. The State-USGS cooperative aquifer mapping program is making available improved information about stratified sand and gravel aquifers on a statewide basis. In order to protect these areas for future use as potential water supplies, many municipalities have adopted aquifer zoning districts. These ordinances generally list permitted and prohibited uses. To a large extent, they also rely on performance standards for future land uses to minimize the chances of aquifer contamination resulting from new development. Such standards often include provisions that require containment structures for uses involving the presence of dangerous materials. Treatment swales to control

stormwater flows and assure infiltration for groundwater recharge are also common. Due to their high rates of transmissivity and permeability, aquifer areas that may serve as existing or future water supplies are sensitive to potential pollutants. This is generally considered to be justification for more stringent performance standards than are imposed throughout the municipality.

In addition to more stringent performance standards, many aquifer ordinances limit the percentage of land coverage allowed by impervious materials. A combination of the coverage limitation plus allowing well sited and maintained sub-surface disposal systems, can allow for continued recharge to the groundwater to occur. When regulating the use of private property, it is important to consider the accuracy of resource delineation boundaries. Most local ordinances, based on the older USGS reconnaissance level studies, include a clause which allows for a challenge to the mapped district boundary. The party in dispute is responsible for the cost of a site specific technical study to define the boundary more accurately. The detailed USGS mapping for the Pemigewasset River Basin is still in the investigatory phases. Some drilling has been done on property owned by the Pemigewasset Fish and Game Club. Additional field explorations will be done in the Squam Lakes watershed in the area northwest of the lake near the Science Center property and in a small area east of the lake. The potentially water bearing materials located within the watershed are generally thin sands. The interpretive mapping report for the Pemi Basin is scheduled for release by late 1990. This will be followed by approximately a year review period before the project will be final.

Wellhead protection is another more specific aspect of protection of a portion of an aquifer that is currently used as a public water supply. A wellhead protection area is the area of contribution to a pumping drinking water supply well. The regulatory purpose of protection of public health and safety is clear with an existing supply source. Zoning can be used as a local protection technique for wellhead protection. The most stringent performance standards may be justifiable in such cases.

None of the towns in the Squam Lakes watershed have adopted aquifer protection zoning or zoning to protect wellhead areas. There are, however, approximately fifty-eight wells that meet the State's definition for public drinking water supplies within the watershed.

**Towns are encouraged to adopt aquifer protection overlay districts as part of their zoning ordinances.**

**Towns should consider participation in the emerging State wellhead protection program by undertaking local inventories of potential threats to existing wells and adopting local protection measures to manage activities in wellhead areas.**

**Steep Slopes Zoning** - Steep slopes are quite vulnerable to erosion and consequent sedimentation of water-courses, when exposed by disturbance of land and vegetation. For this reason, many communities prohibit the location of roads, structures and septic systems in areas with excessive slopes. Some communities have mapped areas with a slope of greater than a certain percentage, and consider these areas as an overlay district. Some simply specify, in the text of the ordinance, that land with greater than a certain percent slope cannot be built

upon or used in calculations to fulfill minimum lot size requirements. Within the Squam Lakes watershed, the Town of Sandwich has a specific steep slope protection provision in its zoning ordinance.

**Towns should consider adoption of steep slope ordinances as a means of providing more explicit guidance to land owners as to the kinds of uses and minimum space standards which can be permitted in these areas.**

Shoreland Zoning - A concern about disturbance of natural shorelands has arisen from the increase in demand for and the value of waterfront property. Devegetated, exposed shorelands are subject to erosion from increased wave action due to storm and boating pressures. Further removal of natural shore vegetation leaves the land vulnerable to storm event related erosion. The installation of lawns along the shore often leads to the introduction of fertilizers and pesticides. Many municipalities with lake and river shorelands are responding to this concern by developing overlay zoning ordinances that address specific lacustrine and riverine habitat problems. Consideration is being given to minimum frontage requirements and setbacks from surface waters for septic systems, structures and other alterations of terrain. All six of the watershed towns impose some form of restrictions on lots fronting on surface waters. There can also be performance standards designed to address placement of shoreline structures, maintenance of natural vegetative buffers and lawn maintenance within a certain distance of surface waters.

An example of a shoreland protection effort in the Squam Lakes watershed is the Pemigewasset River Corridor Protection Ordinance. Variations of the same protection ordinance have been approved by the voters in the Towns of Ashland, Holderness and New Hampton. This is an example of cooperative local efforts to protect a common resource.

Some municipalities in the Squam Lakes watershed have used zoning as a tool to address impacts associated with concentrated use of shore lots by back land property owners for recreational access. Included in these ordinances are provisions for off-street parking areas, toilet facilities and minimum frontage requirements per number of back lots or units. A general summary of these existing requirements are provided in Figure 4-1, in Chapter 4.

**Towns should consider adopting shoreland protection districts adjacent to all waterbodies consistent with recommendations in Chapter 4. Where waterbodies traverse municipal boundaries, the towns sharing these resources should cooperate to adopt similar shoreland standards.**

### **Building Lot Size and Spatial Requirements**

One of the most important functions of zoning is to provide a regulatory structure within which land uses and densities are allowed so as to be compatible with the natural capability of the land. As was discussed in Chapter 4, land capability is related to the ability of soils to support various uses of land. The Soil Conservation Service of the United States Department of Agriculture has prepared soil surveys for each county

in New Hampshire. These surveys vary in level of detail and focus, depending upon the time frame during which they were developed. In general, they include a series of soil maps prepared on aerial photographic bases.

The surveys describe the mapped soil units and provide a general discussion of soil properties, classification and morphology. There is also discussion of the potential that soils have to support various land uses and management practices. This includes an evaluation of the natural capability of soils to support crop and pasture land, woodland, recreational land uses, wildlife habitat, engineering, building site development and the location of sanitary facilities. Many municipalities in New Hampshire have used this information in their municipal master plans to give an indication of where future land uses may be most appropriately located within the community. It is common for local zoning ordinances to use the soils data as the basis for land uses that are either permitted or prohibited within a given district. An example of this would be a wetlands overlay zoning district which restricts the use of land in areas with poorly and very poorly drained soils. Another common example is a municipality which uses soil limitations for sanitary facilities as the basis for lot sizes prescribed in the zoning ordinance. The rationale behind this type of zoning is to require that lots be of sufficient size to attenuate nutrient loading from septic systems. This is of particular importance in areas that rely on individual on-site wells and sub-surface disposal systems for water supply and wastewater management.

The DES-WSPCD has traditionally used a combination of soil types and number of bedrooms to determine the minimum lot sizes required by their rules for sub-surface disposal system design. The original lot size by soil type approach to local zoning was developed cooperatively by the planning commission, conservation district and the Soil Conservation Service in Rockingham County. The effort was undertaken in response to the increased development pressures that occurred in the late nineteen seventies. Since that time, a number of municipalities have adopted soil-based, lot size zoning ordinances, including towns in the Squam Lakes watershed. Over time, municipalities have made modifications to the original model ordinance. These changes may have been designed to accommodate administration of the ordinances, or to address individual circumstances or concerns that arise within municipalities. The fact that the requirements, based on the same data, differ from municipality to municipality has caused some confusion.

An ad hoc committee of State, regional and private technical professionals was formed in 1988 to examine and update the scientific basis for lot sizes by soil type. This work is currently being performed with EPA funding through DES-WSPCD's Nonpoint Source Program. The end products of the project will include a number of recommendations, accompanied by the scientific and technical basis for the recommendations. They will include an updated soil-based lot sizing regulatory scheme, with consideration given to groundwater quality protection in the development of lot sizes and density requirements. There will be an effort to design the recommendations to relate to both SCS and HIS soil types. The significance of these recommendations is that they are supported by a technical report that links the requirements of the model ordinance which they committee recommends to the science upon which the recommendations are based.

The specific soil-based lot size requirements differ somewhat from community to community in the Squam Lakes watershed. It is important for planning boards in the Squam watershed to carefully evaluate these requirements to determine if they are consistent with the new soil-based density requirements, if they decide

to revise their existing lot size ordinances. A technical bulletin explaining the new soil-based density requirements will be developed by OSP once they are finalized.

**Planning boards in the watershed should reevaluate the lot size, density and setback requirements of their existing ordinances and regulations once the science based recommendations of the ad hoc committee examining the basis for lot size and density requirements are completed.**

### **Lot Coverage Standards**

Spatial requirements, such as the percentage of a lot that may be covered by impervious materials and minimum requirements for yards, courts and other open spaces are commonly included in zoning ordinances. Such provisions are particularly important to water resource management. Significant increases in impervious land cover can reduce the potential for infiltration of precipitation to recharge groundwater. At the same time, the increase in runoff has the potential to increase erosion and sedimentation to surface waters. Local zoning can help to maintain groundwater recharge as land develops, by limiting the percentage of the land that can be rendered impervious. The use of porous pavement for roads and parking lots can also be helpful. Each of the municipalities within the Squam Lakes watershed have provisions within their zoning ordinances to limit the area of land that can be covered by either structures or a combination of structures, roads and driveways as indicated in Figure 8-1. More detail is included in Figure 8-2.

**Planning boards within the watershed should reevaluate the maximum coverage requirements in their zoning ordinances, and consider revisions to these requirements to provide for consistency between the towns.**

### **Innovative Land Use Controls**

Municipalities in New Hampshire are authorized to adopt innovative land use controls through zoning. The statute, RSA 674:21, lists twelve types of such controls that can be adopted by municipalities:

- timing incentives
- phased development
- intensity and use incentive
- transfer of development rights
- planned unit development
- cluster development
- impact zoning
- performance standards
- flexible and discretionary zoning
- environmental characteristics zoning
- inclusionary zoning
- accessory dwelling unit standards

Many of these innovative land use controls can be used directly or indirectly to protect water resources. Timing incentives or phased development may be used to slow growth such that the impact of land disturbance can be minimized over a longer period of time. Transfer of development rights and cluster development could be used to allow a higher density in specified areas in exchange for deeding critical resource areas as open space in perpetuity. Impact zoning could be used to require developers to contribute toward certain community improvements in order to mitigate the impacts of a proposed project. Performance standards can be adopted to assure that development occurs with minimal impact to water quality. Any of the water resource related overlay zoning districts discussed earlier in this section could be adopted as environmental characteristics zoning.

Large lot zoning, established to preserve "rural character" or as a means to minimize population density has absorbed land at an accelerated rate. Such development has occurred without the desired benefits, such as economy of layout, convenience of access to town roads, improved visual quality, or permanent preservation of rapidly diminishing open space.

With expectations of higher development quality and more demanding responsibility placed on land use decision makers, the need to utilize more efficient methods of developing land is being increasingly recognized. Clusters of residential development, where appropriate, provide a way to creatively preserve open space, accommodate growth and at the same time preserve the open rural appearance of a community. This process encourages the concentration of groupings of buildings on those areas of a site which are best suited for development, while requiring that the remaining land be retained as common open space to maintain the natural character of the site.

Cluster development allows lots that are smaller than those specified within the zoning ordinance, provided that the land saved is devoted to permanent open space. The number of lots or density of units permitted throughout the subdivision remains essentially the same as in a conventional development. An increase in overall density when clustering may be appropriate in some municipalities, particularly in an urban setting where public sewer and water are present. However, an increase in density is not required under this concept. The use of clustering might be limited to a particular zoning district, to areas served by public sewer, or to areas where the presence of certain soils and slope conditions will allow a more intensive land use.

Where the use of this technique permits the clustering of buildings, the planning board should ask the developer to submit two different design review plans for general discussion before approving the cluster subdivision concept. One plan should show a conventional subdivision plat based on existing regulations, without cluster design, to establish the number of developable lots possible. The second plan should include a cluster subdivision which would be reviewed to determine whether a cluster design would be appropriate for the specific site.

Cluster development is authorized by the zoning ordinance and may be implemented through the subdivision regulations. A cluster development provision should be adopted as an amendment to the municipality's zoning ordinance since such a provision will place controls upon lot size, frontage, density and other characteristics. The zoning ordinance should reference the subdivision regulations and should state that

proposals submitted to the planning board should comply with the applicable provisions of the subdivision regulations. Where there is a conflict, the more stringent provisions of the cluster development ordinance take precedence.

A cluster ordinance should clearly articulate the purpose of the cluster provision and establish the minimum standards required. These standards may relate to basic requirements such as density, setbacks, perimeter buffers, road requirements and the amount of open space to be left in common ownership. The ordinance should also address the legal mechanism by which the open space will be permanently protected.

It also should be noted that the municipality's master plan should present the community's goal for open space preservation and should delineate areas of unique ecological or scenic value. This provides the basis for the zoning ordinance requirements for open space and conservation of significant natural features.<sup>3</sup>

The town of Holderness provides for cluster residential development to allow for more efficient provision of infrastructure and utility networks. The ordinance also encourages the preservation and recreational use of open space in harmony with the natural terrain, scenic qualities and outstanding land features. Moultonborough also permits multi-family and cluster development to preserve the natural beauty of existing undeveloped land, to allow diversity of housing opportunities with open space areas, and to promote other purposes. New Hampton also provides for cluster development to reserve land as permanently protected open space. Ashland allows for cluster development as a permitted use, in its rural residential zoning district only, in order to preserve open space, to promote more efficient use of land and to provide flexibility in subdivision design. Sandwich defines cluster in its zoning ordinance and provides for more detail in the subdivision regulations. Centre Harbor does not permit cluster development at present.

**Watershed communities should adopt cluster and/or other innovative land use controls as alternatives to traditional tract development in order to preserve resources such as prime forest and agricultural lands as open space, thus serving to enhance and protect the rural and aesthetic character of the landscape in the watershed.**

### **Subdivision Regulations**

Municipalities in New Hampshire are authorized by RSA 674:36 to adopt subdivision regulations which provide protection from scattered or premature subdivision that would involve danger to health, safety or prosperity by reason of lack of water supply, drainage or other public services. The regulations may provide for adequate open spaces and require that land proposed for subdivision be of a character that can be used for building purposes without danger to health. The statutes specifically allow for subdivision regulations to

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<sup>3</sup> Source: Excerpted from: Technical Bulletin 4, *Cluster Residential Development* NH Office of State Planning, 1989.

prescribe minimum lot sizes that conform to the zoning ordinance, and to assure additional areas which may be needed for each lot for on-site sanitary facilities. Table 8-3 provides a general comparison of subdivision regulations for towns within the Squam Lakes watershed with more detail provided in Table 8-4. See Appendix A for specific details of subdivision regulations for each town.

The Soil Conservation Service has developed performance standards and best management practices for erosion and sediment control and on-site stormwater management. Municipalities can require, in their subdivision regulations, that applicants for subdivision approval submit detailed plans which meet these SCS established standards. Provisions can be included for an independent review of these plans, by a qualified professional consultant selected by the planning board, to verify that the plans meet SCS standards and best management practices. This can be performed at the expense of the applicant. The regulations can also specify that the planning board's review will include an on-site inspection by their consultant to assure that the design standards are reflected in the actual construction. Implementation of the regulations can be enhanced by requiring successful completion of the on-site "as-built" inspection as a condition of final subdivision approval.

The subdivision regulations can assist the planning board in making informed land use decisions by requiring that critical water resources be identified by the applicant and located directly upon the subdivision plat. This should include the location of all perennial and intermittent watercourses and waterbodies, with the 100 year flood level identified for consideration by the board. This should also include the location of wetlands according to the methodology specified either in the zoning ordinance or the subdivision regulations. This will give the board sufficient information to make a determination as to whether or not special investigative studies should be required. The nature of these studies should be defined within the regulations to provide adequate guidance to both planning board members and subdivision applicants.

The subdivision regulations can further protect significant water resources by requiring that provision of adequate access to water for fire protection not have a significant impact on wetlands. This should include such activities as the alteration of wetlands to build fire ponds.

**Planning boards within the watershed should evaluate the effectiveness of existing erosion and sediment control requirements in their subdivision regulations, and consider revisions to these requirements based on standards contained in the 1987 publication prepared by the USDA Soil Conservation Service, in cooperation with the NH State Conservation Committee, the NH Association of Conservation Districts and the North Country Resource Conservation and Development Area entitled *Erosion and Sediment Control Design Handbook for Developing Areas of New Hampshire*. In the process of incorporating these requirements, planning boards should include provisions for bonding the construction of these control measures, and also for their inspection and maintenance following construction.**



Planning boards within the watershed should adopt stormwater management control requirements to address water quality, as part of their subdivision regulations. These requirements should include provisions for bonding the construction of these management controls, and also for their inspection and maintenance following construction.

Planning boards should adopt provisions within their subdivision regulations that allow the planning board to require site specific and technical studies to be prepared by qualified consultants, at the expense of the applicant. These provisions should include the option for the planning board to require an independent review of those studies by a qualified consultant, hired by the planning board at the owner's expense.

Town planning boards in the watershed should amend their existing subdivision regulations to reflect changes that have been made to State statutes since their original adoption. RSA 676:4, entitled "Board's Procedures on Plats", details the following subdivision review procedures:

- (1) conceptual consultation is allowed as an option of the applicant, without notification to abutters;
- (2) design review is allowed before submission of a completed application, as an option of the applicant, with notification to abutters; and
- (3) the option is allowed for the applicant to initiate review by submission of a completed application.

Some planning boards in the watershed have amended their regulations to partially address the statutory changes. Others should amend their regulations to remove more of the outdated language. Included should be the provisions for "Abandonment of Preliminary Layouts".

### **Site Plan Review Regulations**

In municipalities that have adopted a zoning ordinance, and where the planning board has adopted subdivision regulations, the local legislative body can authorize the planning board to adopt site plan review regulations. Site plan review regulations detail requirements for nonresidential and multi-family land uses. Appendix A summarizes these regulations for each town in the watershed. Since these types of land uses are more likely to exhibit qualities that may pose potential threats, site plan review regulations can be very effective in water resources protection. Performance standards for facilities siting can be built directly into the site plan review regulations. This can include requirements for structural containment to guard against potential hazards due to spilling of any petroleum products and/or chemicals that may be stored on-site. See Table 5-4 in Chapter 5 for a list of activities and land uses which may represent water quality contamination sources. Stormwater

management plans can require the placement of oil and grease traps in storm drains to handle parking lot and other site runoff. The potential for runoff to have adverse impacts on adjacent properties can be reduced by requiring that, through proper stormwater management practices, all runoff is handled on-site with no net increase in off-site flow.

The performance standards developed by SCS for erosion and sediment control and stormwater management can be incorporated into the site plan review regulations and applied to nonresidential and multi-family land uses. There are plans to update these standards through the NH Nonpoint Source Program. Again, implementation can be enhanced by requiring an independent review of the specifications of proposed projects and a site inspection to verify that site plan requirements have been met as a condition of final approval.

There is also a need for facility specific performance standards to address the many different types of nonresidential facilities that may be subject to site plan review. The types of facilities which may be of concern are identified in the NH Wellhead Protection Program, which is currently being developed by DES. One of the goals of that program is to develop performance standards and best management practices for land uses that pose a potential threat to groundwater quality. Although the focus of that program is on the inventory and management of potential threats to existing wellhead areas, the recommended management strategies should be valid on either a townwide or a watershed basis. Once developed, these standards can be adopted as requirements in local site plan review regulations.

**Planning boards within the watershed should adopt erosion and sediment control requirements, to address water quality, as part of their site plan review regulations, based on standards contained in the 1987 publication prepared by the USDA Soil Conservation Service, in cooperation with the NH State Conservation Committee, the NH Association of Conservation Districts, and the North Country Resource Conservation and Development Area entitled *Erosion and Sedimentation Control Design Handbook for Developing Areas of New Hampshire*. In the process of incorporating these requirements, planning boards should include provisions for bonding the construction of these control measures, and also for their inspection and maintenance following construction.**

**Planning boards within the watershed should adopt stormwater management requirements, to address water quality, as part of their site plan review regulations. These requirements should include provisions for bonding the construction of these measures and also for their inspection and maintenance following construction.**

**Planning boards within the watershed should adopt performance standards as part of their site plan review regulations for land uses which have the potential to impact water quality. Updated performance standards for potential contaminant sources are proposed to be developed through the NH Wellhead Protection Program.**

**Planning boards should adopt provisions within their site plan regulations that allow the planning board to require technical studies to be prepared by qualified consultants at the expense of the applicant, as part of the local review process. These provisions should include the option for the planning board to require an independent review of those studies by a qualified consultant, hired by the planning board at the owner's expense.**

### **Building Codes**

Many municipalities have adopted the BOCA Code as their local building code. Section 112.1 of the BOCA Code requires that the code enforcement official deny any building permit application or plan that does not comply with the requirements of all applicable laws and local ordinances. Municipalities that have adopted the requirements of BOCA and have either a building inspector or code enforcement officer can use the building inspection process to perform an inspection to determine if all local regulatory requirements have been met. BOCA requires that the application be rejected in writing if it does not comply. Payment of the cost of the inspection can be required of the applicant. Municipalities that have adopted a building code other than BOCA can amend their Code, in accordance with the procedures of RSA 674:51, to include such requirements for issuance of a building permit.

Of the towns in the watershed, Ashland and Moultonborough have adopted the BOCA code. Centre Harbor and Sandwich have building codes which are not BOCA. New Hampton and Holderness do not have building codes.

**Towns in the watershed which have not adopted a building code should either adopt the BOCA code or one that has similar requirements to section 112.1 of the BOCA code, which includes a requirement that the building inspector or code official reject any application that does not conform to the requirement of all pertinent laws. All towns in the watershed should enforce such a requirement.**

### **Health Ordinances**

The powers of the health officer to make regulations are very broad in New Hampshire. Municipal health officers are appointed by the Director of the Division of Public Health Services, upon recommendation by the local board of selectmen. In accordance with RSA 147:1, I, the health officers "may make regulations for the prevention and removal of nuisances, and such other regulations relating to the public health as in their judgement the health and safety of the people require. . ." Such regulations are relatively easy to adopt in comparison to zoning ordinances, which require a public hearing process and an official ballot vote at town meeting. A health ordinance takes effect upon approval by the selectmen, recording with the Town Clerk and either publishing the ordinance in a local paper or posting it in at least two public places in town. The health ordinance can be a very powerful and effective tool in water resources protection. The statute (RSA 128:5, III) specifically authorizes the health officer to "upon reasonable information, personal knowledge or belief, in order

to safeguard public health or to prevent pollution of any aquifer or body of water, enter upon private property . . . to investigate and, if necessary, take appropriate action to prevent further pollution." This type of statutory backing does not exist for the other regulatory techniques described in this chapter.

Health ordinances have been used by municipalities within New Hampshire to protect water quality on a somewhat limited basis. It is common for local health ordinances to spell out requirements for septic system design and siting criteria, some of which are more stringent than the State requirements. However, with such a broad authority, many possibilities exist for increased and more effective use of these ordinances. The concept of septic system requirements could be expanded to include quality criteria for discharge and/or pretreatment of nonsanitary wastes to septic systems. The planning board could enhance the effectiveness of these requirements by referencing them in the subdivision and site plan review regulations. Minimum distances between septic systems and existing private wells could be included in a health ordinance. Specific requirements for conversion of seasonal septic systems to year-round use and requirements for periodic inspection and maintenance of existing septic systems could also be included.

Another water quality issue that has not been widely addressed by health ordinances is the siting, testing, and abandonment of private wells. The health ordinance could include requirements for minimum new well siting setbacks from existing septic systems. Water quality testing of private wells could be required for conversion of seasonal homes to year-round use or prior to rental of property serviced by an on-site well. The results of these tests could be required to be passed on to the prospective owner or tenant. Another often overlooked issue could be addressed by including standards for proper closure of abandoned wells. It is important to assure that abandoned wells do not become a potential conduit for contaminants to enter groundwater.

Storage of petroleum products and chemicals can also present water quality related public health problems. Reporting of the size, location, nature, and an inventory of contents for above ground and underground storage tanks could be required to be reported to the local health officer on a regular basis. A health ordinance could also require containment structures to guard against possible spillage of chemicals or petroleum products stored above ground.

**Municipalities in the Squam Lakes watershed should maximize use of local health ordinances as effective water resources management and protection tools. Health ordinances should be designed to address the following:**

- (1) Private well design and siting requirements, and setbacks;**
- (2) Septic system design and siting requirements and setbacks;**
- (3) Private well testing prior to transfer or rental of property or conversions of seasonal homes to year-round use;**
- (4) Septic system requirements for conversion of seasonal homes to year-round use;**
- (5) Mandatory periodic inspection and maintenance of septic systems, with a report filed with the local health officer on a regularly basis;**

- (6) **Design and siting requirements for containment structures for above ground storage of chemicals or petroleum products; and**
- (7) **Design and siting requirements for underground storage tanks <1,100 gallons.**

#### **Excavation Regulations, RSA 155-E**

RSA 155-E: 11 authorizes planning boards to adopt local excavation ordinances to regulate commercial excavation of sand, gravel, rock, soil or construction aggregate. Planning boards can require measures to minimize water quality impacts during operation and specify reclamation requirements. Performance standards can be included to control erosion and sedimentation and manage stormwater while the earth's surface is exposed. Monitoring wells are often required to be installed. Storage of potentially threatening materials, the changing of oil and other lubricants and maintenance of equipment can be required to take place off-site in properly managed areas. Such regulations often include provisions for periodic review and inspection of the operation by the planning board to determine if all permit requirements are being met. The regulations can also specify a finite time limit on a permit, after which the operator must come back to the planning board to apply for a permit renewal. The local regulations should specify closure requirements, to include grading, revegetating and providing for proper drainage on and off-site.

**Planning boards within the watershed should adopt performance standards for land use activities which have the potential to impact water quality as part of their local excavation ordinances. It is recommended that those municipalities that do not have such ordinances, adopt one.**

**Planning boards within the watershed should adopt erosion and sediment control and stormwater management requirements, to address water quality, as part of their local excavation ordinances. These requirements should include provisions for bonding the construction of these control measures and also for their inspection and maintenance following construction.**

**Local excavation ordinances should incorporate provisions to include record of lawfully existing excavations, and requirements for reclamation (RSA 155 E:2, I (c) and (d)).**

**Planning boards within the watershed should include requirements for periodic review and inspection of excavations and for finite time limitations for excavation permits, after which the operator must apply for a renewal.**

#### **Police Power Bylaws, RSA 31:39**

In accordance with RSA 31:39, towns may make bylaws for a number of specific reasons. One of these that relates to surface waters includes regulations of the use of mufflers upon boats and vessels propelled by gasoline, oil or naphtha and operating upon the waters within the town limits. Another which relates to water

quality is to regulate the collection, removal and destruction of garbage, snow and other waste materials. A broader authority is also outlined in the statute to allow towns to make bylaws for "making and ordering their prudential affairs." This authority could be used to regulate many potential threats to water resources. Underground storage tanks of less than 1,100 gallons, which are not regulated by the State could be locally controlled under this authority.

**Municipalities within the Squam Lakes watershed should consider adoption of local police power bylaws in accordance with RSA 31:39 to protect water quality for the public health and safety.**

### **Junkyard Regulations, RSA 236:111-229**

As was previously mentioned in Chapter 5, junkyards are one of the few land based disposal practices not currently regulated by DES. However, both motor vehicle junk yards and other junkyards are licensed at the local level, by the selectmen, in accordance with RSA 111-229. The statute requires a public hearing and that the selectmen "take into account the suitability of the applicant with reference to his ability to comply with ... other reasonable regulations concerning the proposed junkyard ..." This authorizes the local governing body of a municipality to make "reasonable regulations" relative to junkyards. This authority has not commonly been exercised at the local level to enact a junkyard ordinance to address water quality concerns. There are three local options for an ordinance to address water quality concerns relative to junkyards. They are as follows:

1. The selectmen may make "reasonable regulations" relative to junkyards as authorized by RSA 236:117.
2. Municipalities with a zoning ordinance may regulate junkyards through amendments to that ordinance, adopted in accordance with RSA 675:2-5.
3. Municipalities may also enact a local ordinance in accordance with RSA 31:39, to address water quality concerns of junkyards. Adoption requires a warrant article at Town Meeting either to adopt the bylaw or to authorize the selectmen to prepare and adopt such a regulation.

The local licensing regulations should consider the handling, storage and ultimate disposal of the following wastes:

- 1) oil
- 2) diesel fuel
- 3) solvents (thinners and/or degreasers)
- 4) batteries
- 5) contaminated soil
- 6) antifreeze

Selectmen within the Squam Lakes watershed should develop local junkyard regulations for adoption in accordance with one of the options listed above. The purpose of such regulations would be to provide Squam Lakes watershed selectmen with water quality related criteria and performance standards for issuance of junkyard licenses.

## **Preservation of Scenic Areas**

### **View Protection**

The natural landscape and visual quality of a place provide a community and region with a sense of pride and individuality, setting it apart from other places. Special vistas, views and scenic areas contribute significantly to the overall quality of life in an area. They add to the value of property, and to the overall desirability and livability of a community. Such is the case with the Squam Lakes area, where visitors are attracted to its scenic beauty, and this in turn contributes to the region's overall economic well being.

Many of the Squam Lakes area views and scenic vistas are found along public highways, or from turnoffs adjacent to these roadways. (See description of scenic vistas in Chapter 7.) Since driving is a leading form of passive outdoor recreation, these views should not be obstructed. For many individuals, the view of the lake, river, hillside or mountaintop, as observed from an automobile window, or from a highway turnoff which provides an opportunity to leave the automobile for a short period of relaxation or a picnic, may be the closest experience they will have of the Squam Lakes, or mountains. However, even this brief visual access can provide a most adequate and satisfying experience.

For these reasons, it is important to identify and protect those vistas, views and scenic areas which are considered significant to the people of the Squam Lakes region. Protecting well identified views is a legitimate public good, particularly when aesthetics are so closely related to the overall economic well being of the community. As such, they may be viewed as an extension of the concept of promoting the general welfare of the community and region.

The primary threat to roadside views enjoyed by many, but often taken for granted, is the indiscriminate placement of buildings or other structures, and the lack of selective brush cutting or tree trimming where such vegetation becomes overgrown. A municipality may wish to take action to assure that selected views beyond the road right-of-way are protected and maintained for the continued enjoyment of the public.

## **Visual Survey and Master Plan Element**

The planning board should enlist citizen participation and public opinion to help conduct a visual survey to identify views, vista areas and open space that are considered by the community to be worthy of protection. This will help to establish the public support for view protection as a legitimate community goal. The inventory will provide the planning board with information that can be used when the board is reviewing an application for approval.

A brief description of each view area to be considered for protection should be prepared as part of the inventory. This description should explain why each is unique, what its distinguishing aesthetic characteristics are which contribute to the visual quality or experience of the viewer or traveler, the area's general size, ownership, access, and appropriate land use considerations. This information then can be keyed to a map and incorporated into the municipality's master plan, along with stated goals and objectives relative to visual and aesthetic protection. It will also help in developing the standards and regulations for protecting the identified views.

## **View Protection Regulations**

Where there is a clear public purpose, reasonable controls over the placement of buildings and other structures may be applied for the purpose of preserving and enhancing unobstructed views from public roadways, particularly where a property owner is left with a reasonable economic use of his property and where the regulations are no more restrictive than required to further the public purpose. Under its police power authority through zoning and site plan review regulations, a municipality may impose restrictions to protect open space, provide access to adequate light and air and assure proper use of natural resources. However, like other land use controls, view protection regulations should be developed and implemented carefully and cautiously.

A primary objective of a regulation to protect views and scenic areas is to provide the ability to see something such as a panorama of the lake or mountains without visual interference. Such regulations should focus on the special or distinctive views that contribute to the visual quality of the community and area, but should not be so exacting that they prohibit any development from occurring on a property or deny other reasonable use of the property.

Protection of views can be accomplished by adapting and amending present zoning and site plan review regulations. Aesthetics based land use regulations might encourage cluster development which permits the concentration of buildings in specific areas on a site to preserve open space and special areas and features, while essentially maintaining the overall development density allowable in the zoning district. Cluster development is an excellent design technique to protect views and the visual quality of a site.

A planning board may encourage the permanent maintenance of vistas and open space by allowing a density bonus. It may also permit a reduction in side yard and setback requirements, when the reduction would



result in maintaining or providing a better view from the roadway or adjoining property, without impairing the view from existing buildings nearby. Some discretion in siting of a building should also be considered in such regulations.

A planning board can use structure placement and lot coverage requirements of its existing zoning ordinance to achieve certain view protection objectives. For example, setback requirements may preserve views along a street or roadway. Side yard requirements, minimum distance between buildings, and lot coverage requirements may prevent the effect of solid walls of buildings which block views. Height restrictions and sign regulations may prevent view obstruction as well. Where view protection is a specific public goal, it should be stated in the zoning ordinance section describing the purpose of the ordinance, and the ordinance should clearly spell out the procedures to accomplish this purpose.

### **Overlay View Protection District**

One approach to accomplish the above objectives is to establish an overlay view protection district with special restrictions and standards tailored to the specified area or areas identified for view protection. The overlay district would be superimposed upon existing zoning districts without changing the applicability of the underlying district regulations. The regulations for an overlay district are usually described separately from the basic district designation, both in the text of the zoning ordinance and on a map where the boundaries of the overlay district are shown.

Standards which must be met by a development proposal or builder within the view protection district should address the effects of a land use on the view being protected. These standards would apply only within the view protection district. The standards would relate to the size, bulk, location and height of a structure, and the location of fences and signs. Size and location of on-site landscaping would also be considered. While the overlay district site design standards are more restrictive than those specified for the land use district, they must provide for flexibility of design and use in a particular project. Standards which are too specific will limit the freedom of architects and designers, yet standards should not be so overly general that planning board members vote their personal preference.

All development in the overlay view protection district would be subject to review as set forth in district regulations. The planning board would determine if the proposed development structure(s)' location and height meet the objectives of the zoning ordinance.

The sight line is established from a viewpoint or highway right-of-way to a reference point or elevation on the view or hillside to be protected (see Figure 3). This approach might present some technical difficulties in its administration. The precise location of a sight line is open to dispute, particularly where the topographic slopes run in various directions.

#### **Buffer or Screen Area**

Building sites on hillsides should retain sufficient tree cover to screen structures from view. Natural vegetation (trees and shrubs) or a landscaped buffer should be maintained or established on the downhill side of the mountain slope between the viewpoint area and the building. This screening is intended to block visual contact with the structure from a view area and to create a strong impression of uninterrupted open space.

#### **Administration of View Protection Regulations**

While a view protection regulation may control the height and location of structures, the only way to assure that a view is properly protected is through good site planning and administrative review of an individual site. The planning board must work closely with applicants for local approval, encouraging them to design their proposal in a manner which has a minimum impact upon views identified in the master plan and zoning ordinance. Through the site plan review authority, adequate attention can be given to the spacing of structures to assure that the identified view will not be impaired.

The responsibility for developing a view protection district is in the hands of the planning board. Once enacted, the board will have some control in its implementation through site plan review and a special permit approval. However, the administration of the regulation and its standards are the responsibility of the building official, code enforcement officer or other individuals or groups as may be designated by the town.

#### **View Protection Through Acquisition or Easements**

While preservation and protection of scenic areas through regulation is a more realistic approach than outright purchase of land, particularly in a time of limited public funds, acquisition of a land parcel for public use and permanent open space may be the most positive method, and the only option that is acceptable to the community in certain cases.

The purchase or donation of development rights through a scenic easement is another technique that may be used for preserving scenic areas and views. Here a landowner continues to own the property but gives

### **Siting of Buildings**

As can be seen from the above discussion, the most direct way of achieving view protection objectives is through the control of building location, spacing (see Figure 8-1), bulk and height. When protecting views straight on such as a lake view, or on the downhill side from a viewpoint area such as an overlook, it is important to control building bulk and spacing, as well as the placement of fences, shrubs, and trees. In this setting, even one story buildings erected within the view area or in a long solid mass can block a view.

In such settings, buildings should be placed in such a manner that they do not obstruct the view to be preserved. Buildings along a shoreline, placed so as to create this solid wall effect, not only obstruct views of the lake but also adversely affect the shoreline's visual quality from the lake (See Figure 8-2). To assure that this will not happen, the planning board should require the designer, developer or builder to lay out and stake out the outline of all proposed buildings and landscaping for site inspection, so that the view blockage will be made clear before the plan is approved or a building permit issued.

Where construction is to be located on a hillside within the view area, all hillside grading should be kept to a minimum. Siting and location of roads, buildings and other structures should be engineered to minimize grading and to retain existing landforms and characteristics in a natural state. Any building project should be designed to utilize the natural grade rather than graded building pads. Terrace or step-type building pads which substantially alter the natural contours should not be permitted.

### **Maximum Building Height**

To protect the aesthetic quality of a hillside or the upper portion of a mountain view within a designated view protection area from unsightly development protruding above the treetops, there is considerable advantage in placing a height limitation on structures.

Buildings might be limited to a height of no more than 20 feet (measured from the average ground elevation at the building walls), where they would obstruct views or project above the tree cover. Heights exceeding this limit might be permitted where it could be shown that such construction would not interfere with the scenic attractiveness of the view to be protected.

While maximum building height might be restricted in absolute terms, buildings might be restricted to a height determined relative to the object or view to be protected. An example might be to protect the uphill view of a mountain top or mountain ridge from a given viewpoint or from a designated scenic section along a highway. This technique involves establishing a sight line where the maximum height of any building constructed within the designated view area would not intrude above the sight line. In no case, could buildings be restricted to less than 20 feet in height.

The following explains the headings in Tables 8-4 and 8-5 in more detail, in terms of the review of local ordinances and regulations.

**Subdivision Regulations and Site Plan Review Regulations:**

<b>Erosion</b>	Erosion and sediment control requirements with a focus on technical standards and bonding requirements
<b>Stormwater</b>	Stormwater management requirements with a focus on technical standards and bonding requirements
<b>Wetlands &amp; Floodplains</b>	Wetland and floodplain delineations, derived from acceptable methodologies, required to be shown on plats
<b>Inspection</b>	On-site inspection to assure compliance with local ordinances and regulations required after construction
<b>Studies</b>	Authorization to require special investigative studies with an independent review required by a consultant retained by the planning board

**Overlay Zoning:**

<b>Wetlands</b>	Formally adopted wetland overlay zoning district
<b>Floodplain</b>	Formally adopted floodplain overlay zoning district
<b>Watershed</b>	Formally adopted watershed overlay zoning district
<b>Aquifer</b>	Formally adopted aquifer overlay zoning district
<b>Steep Slope</b>	Formally adopted steep slope overlay zoning district
<b>Shoreline</b>	Formally adopted shoreline overlay zoning

**General Zoning:**

<b>% Coverage</b>	Minimum standards for lot coverage by impervious material
<b>Cluster</b>	Provisions for cluster zoning
<b>Soil/Lot Size</b>	Determined by soil type

**Excavation Ordinance:**

<b>Erosion</b>	Erosion and sediment control requirements with a focus on technical standards and bonding requirements
<b>Stormwater</b>	Stormwater management requirements with a focus on technical standards and bonding requirements

up the right to develop it. In such cases, the property owner agrees not to build structures within the viewshed easement area, and to limit use of the land to gardening, fields or other agricultural or similar natural uses, or to whatever use the agreement says, in order to achieve the long term protection and goals of the community and land owner.

### **Analysis of Local Ordinances and Regulations - Squam Lakes Watershed**

The following review of local ordinances and regulations evaluates whether or not they are consistent with the local government recommendations of this chapter. The subdivision regulations, site plan review regulations, zoning ordinance, excavation ordinance, health ordinance and junkyard regulations that have been adopted by each municipality in the Squam Lakes watershed were targeted for review and analysis. The results of that review and analysis are shown in Tables 8-4 and 8-5.

In general, where the review revealed that the requirements or standards recommended in this chapter were not included in the municipality's existing regulations, a number 1 was assigned to that ordinance or regulation. This may indicate a priority item to be addressed locally, if the municipality views the benefit of the recommended land use control as important to its local regulatory goals.

Where some language was found in the existing regulations, but that language does not provide the level of detail that was intended by the recommendations in the local government action section, a number 2 was assigned to the ordinance or regulation. This indicates that although some level of regulatory control is in place, the municipality may wish to consider revisions to their regulations, based on the general recommendations of this plan.

A number 3 was assigned where the review revealed that requirements and standards were included in the existing ordinance or regulation, and they addressed the general regulatory concept of the implementation technique that was recommended in this plan. The review did not involve a detailed qualitative analysis of the existing regulatory requirement. Therefore, a rating of 3 does not imply that improvements could not be made by revising the existing regulatory controls. This rating system simply provides perspective concerning the relative urgency of taking local action to revise each ordinance and regulation to meet the recommended level of efficiency.

Table 8-4 provides additional details relative to the focus of any revisions recommended to be considered by local officials who wish to take the initiative to upgrade their existing regulations. The Lakes Region Planning Commission is available to provide technical assistance in that area.

**Planning boards in the Squam Lakes watershed should evaluate the results of the analysis of their local ordinances and regulations and consider adopting the requirements and standards recommended in the Local Government - Land Management section of this chapter.**

**Table 8-4: REVIEW OF LOCAL ORDINANCES AND REGULATIONS  
SQUAM LAKES WATERSHED**

	SUBDIVISION REGULATIONS					SITE PLAN REVIEW					OVERLAY ZONING					GENERAL ZONING			EXCAVATION ORDINANCE				HEALTH ORDINANCE				
	Erosion	Stormwater	Wetlands & Floodplains	Inspection	Studies	Erosion	Stormwater	Wetlands & Floodplains	Inspection	Studies	Wetland	Floodplain	Watershed	Aquifer	Steep Slope	Shoreline	% Coverage	Cluster	Soil/Lot Size	Erosion	Stormwater	Reclamation	Phasing	Septic	Well	UST	Junkyard
<b>Ashland</b>	2	2	2	3	3	2	2	2	3	3	1	1	1	1	1	3	2	2	2	2	2	3	3	1	1	1	1
<b>Centre Harbor</b>	2	2	2	3	2	2	2	2	1	1	2	1	1	1	1	3	2	1	1	1	1	1	1	3	1	1	1
<b>Holderness</b>	2	2	3	1	3	1	1	1	1	1	1	?	1	1	1	3	3	2	3	1	1	1	1	1	1	1	1
<b>Moultonborough</b>	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	3	2	2	2	1	1	1	1	3	1	1	1
<b>New Hampton</b>	2	2	2	2	2	1	1	1	1	1	1	2	1	1	1	3	2	2	2	2	2	2	2	1	1	1	1
<b>Sandwich</b>	2	2	3	2	3	2	2	2	1	1	2	2	1	1	3	3	1	2	3	1	1	1	1	1	1	1	1

Source: Office of State Planning – Municipal and Regional Technical Assistance and Water Protection Assistance Program Review – March, 1990

- Note:
- 1 = Not included in Local Regulation
  - 2 = Included in Local Regulation – Revisions may be advisable
  - 3 = Included in Local Regulation – Revisions not specifically recommended in this plan

For more detailed information see Figure 8-2

**Reclamation** Reclamation plans with specific technical standards and bonding required for excavations

**Phasing** Phased permits for excavations with periodic review requirements

**Health Ordinance:**

**Septic** Septic system regulations which require technical design standards and periodic inspection and maintenance

**Well** Private well regulations which require technical standards and water quality standards for rental properties

**UST** Underground storage tank regulations which require technical design standards and periodic inspection and maintenance

**Junkyard** Junkyard regulations which require technical standards that are water quality oriented

**SUBDIVISION REGULATIONS (CONT)**

	ON-SITE COMPLIANCE INSPECTION AFTER CONSTRUCTION	SPECIAL INVESTIGATIVE STUDIES WITH INDEPENDENT REVIEW BY PLANNING BOARD'S CONSULTANT
Ashland	3	3
Centre Harbor	3	2 more detail
Holderness	1	3
Moultonborough	2 inspection after const.	2 more detail
New Hampton	2 inspection after const.	2 independent review
Sandwich	2 inspection after const.	3

1 = Not Included in Regulations

2 = Included in Regulations - Revisions Which May be Advisable are Noted

3 = Included in Regulations - Revisions Not Specifically Recommended by This Plan



**Table 8-5**

**REVIEW OF LOCAL ORDINANCES AND REGULATIONS - SQUAM LAKES WATERSHED**

**SUBDIVISION REGULATIONS**

	<b>EROSION AND SEDIMENT CONTROL WITH BONDING REQUIREMENTS</b>	<b>STORMWATER MANAGEMENT WITH BONDING REQUIREMENTS</b>	<b>WETLANDS AND FLOODPLAINS TO BE SHOWN ON PLAT</b>
Ashland	2 tech. stds. bonding	2 tech. stds. bonding	2 requires soils, should specify poorly, very poorly drained and alluvial soils
Centre Harbor	2 tech. stds. bonding	2 tech. stds. bonding	2 wetlands and floodplains (wetlands addressed through over- lay zone)
Holderness	2 tech. stds. bonding	2 tech. stds.	3
Moultonborough	2 tech. stds.	2 tech. stds.	2 more detail than USGS symbols for wetlands
New Hampton	2 tech. stds.	2 tech. stds. bonding	2 wetlands and floodplains for < 50 lots or 5 acres
Sandwich	2 tech. stds.	2 tech. stds.	3

1 = Not Included in Regulations

2 = Included in Regulations - Revisions Which May be Advisable are Noted

3 = Included in Regulations - Revisions Not Specifically Recommended by This Plan

**SITE PLAN REVIEW (CONT)**

	ON-SITE COMPLIANCE INSPECTION AFTER CONSTRUCTION	SPECIAL INVESTIGATIVE STUDIES WITH INDEPENDENT REVIEW BY PLANNING BOARD'S CONSULTANT
Ashland	3	3
Centre Harbor	1 (look at requirements in existing town subd. regs.)	1
Holderness	1	1
Moultonborough	2 inspection after const.	2 (look at requirements in existing town subd. regs.)
New Hampton	1	1
Sandwich	1	1

1 = Not Included in Regulations

2 = Included in Regulations - Revisions Which May be Advisable are Noted

3 = Included in Regulations - Revisions Not Specifically Recommended by This Plan

**SITE PLAN REVIEW**

	EROSION AND SEDIMENT CONTROL WITH BONDING REQUIREMENTS	STORMWATER MANAGEMENT WITH BONDING REQUIREMENTS	WETLANDS AND FLOODPLAINS TO BE SHOWN ON PLAT
Ashland	2 tech. stds bonding	2 tech. stds. bonding	2 more detail
Centre Harbor	2 tech. stds. bonding	2 tech. stds. bonding	2 more detail
Holderness	1	1	1
Moultonborough	2 tech. stds.	2 bonding for more than sewer and water	2 more detail
New Hampton	1	1	1
Sandwich	2 tech. stds. specific bonding	2 tech. stds. specific bonding	2 wetlands

1 = Not Included in Regulations

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3 = Included in Regulations - Revisions Not Specifically Recommended by This Plan

**OVERLAY ZONING (CONT)**

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	AQUIFER	STEEP SLOPES	SHORELINE
Ashland	1	1	3
Centre Harbor	1	1	3
Holderness	1	1	3
Moultonborough	1	1	3
New Hampton	1	1	3
Sandwich	1	3	3

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**OVERLAY ZONING**

	WETLANDS	FLOODPLAINS	WATERSHED
Ashland	1	1	1
Centre Harbor	2 clarify wetland definition/delineation methodology	1	1
Holderness	1	(addressed by a flood damage prevention ordinance, not received or reviewed)	1
Moultonborough	1	1	1
New Hampton	1	2 (protective requirements vs. FEMA driven)	1
Sandwich	2 clarify wetland definition/delineation methodology	2 (protective requirements vs. FEMA driven)	1

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2 = Included in Regulations - Revisions Which May be Advisable are Noted

3 = Included in Regulations - Revisions Not Specifically Recommended by This Plan

**EXCAVATION ORDINANCES**

	<b>EROSION &amp; SEDIMENT CONTROL WITH BONDING</b>	<b>STORMWATER MANAGEMENT WITH BONDING</b>	<b>CLOSURE PLAN WITH BONDING</b>	<b>PHASED PERMITS WITH PERIODIC REVIEW REQUIREMENTS</b>
Ashland	2 tech. stds.	2 tech. stds.	3	3
Centre Harbor	1	1	1	1
Holderness	1	1	1	
Moultonborough	1	1	1	1
New Hampton	2 tech. stds. bonding	2 tech. stds. specific bonding	2 tech. stds.	2 more than just restoration
Sandwich	1	1	1	1

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3 = Included in Regulations - Revisions Not Specifically Recommended by This Plan

**GENERAL ZONING**

	<b>LOT COVERAGE BY IMPERVIOUS MATERIAL</b>	<b>CLUSTER</b>
Ashland	2 include more than buildings	2 more than in rural residential (addressed in subdiv. regs.)
Centre Harbor	2 include com. dist.	1
Holderness	3	2 permit in other zones
Moultonborough	2 include more than com. dist.	2 more detail
New Hampton	2 include more than buildings in zones other than com. dist.	2 stds. for special exceptions
Sandwich	1	2 more than a definition (addressed in subd. regs.)

1 = Not Included in Regulations

2 = Included in Regulations - Revisions Which May be Advisable are Noted

3 = Included in Regulations - Revisions Not Specifically Recommended by This Plan

## Nonregulatory Techniques

### Best Management Practices and Performance Standards

There are land uses which may pose potential threats to water quality, for which local regulatory techniques are either inappropriate or not authorized by State statute. Agriculture and silviculture are two such land uses. Voluntary land owner application of best management practices (BMP's) can be quite effective in minimizing their potential impacts to water quality. BMP's have been developed by the SCS, Cooperative Extension Service and DRED. Many of these will be refined and included as recommendations in New Hampshire's Nonpoint Pollutant Source Program. Educational efforts available to pass these techniques on to landowners are described in more detail in a later section. They include direct technical assistance on the land, training workshops and technical guidance documents.

There is a need to develop best management practices for road salt management. Road salt is one of the only practices identified in the DES Nonpoint Source Assessment that is not regulated by State law.

Table 8-6 summarizes the types of best management practices that are available through training and technical guidance.

### Road Salt Management

As was discussed in Chapter 5, there is a potential for contamination of both groundwater and surface water from the road salt that is used in common winter road deicing practices. The Department of Transportation (DOT) has control over deicing practices used on all State maintained roads. Their road salt policy is a "bare road" policy that involves direct application of straight salt. Local selectmen, however, have control over the deicing practices used on town approved and maintained roads through their local road agents. It is possible to develop and implement a local road salt policy without local legislative action. Such a policy should consider the following:

- a. existing policies, where applicable
- b. existing high levels of sodium and chloride in private, community and non-community wells, where known
- c. inadequacies in existing salt storage areas, to include cover, impervious base below the salt, drainage control, etc.
- d. location of existing snow dumps with respect to surface waters, wetlands, floodplains and potential aquifers



**Table 8-6. Local Nonregulatory Techniques -  
Best Management Practices and Performance Standards**

BMP'S/Performance Standards	Nonregulatory Techniques	Implementation Voluntary Responsibility
Agricultural Practices	Technical Assistance and Guidance Documents - SCS, Conservation Districts, Cooperative Extension	Land Owners and Managers
Silvicultural Practices	Technical Assistance and Guidance Documents - SCS, Conservation Districts, Cooperative Extension, DRED	Land Owners and Managers
Road Salt Management	Technical Assistance and Guidance Documents	Selectmen and Road Agents

- e. determination of appropriate deicing service levels for Town approved and maintained roads
- f. determination of "environmentally sensitive" areas served by town approved and maintained roads, where low/no salt practices may be appropriate
- g. recommended best management practices for all road salt application areas
- h. designation of low/no salt application areas
- i. mechanism for public education about low/no salt application areas
- j. model language for a road salt management policy for adoption by watershed area selectmen or the administrative body of the agreement.

**DES should develop best management practices for road salt management for use by DOT and local officials in the development of road salt management policies.**

**Municipalities within the Squam Lakes watershed should cooperate to develop and adopt a consistent road salt management policy for locally maintained roads within the watershed. Input from the selectmen, road agent, health officer, planning board and conservation commission in each town is advised.**

## **Wetlands Inventory**

Very little technical information is available to local officials to document the extent and nature of the wetlands in their municipalities on a site specific basis. For this reason, many municipalities rely on the available SCS County Soil Surveys to indicate soil series units that have poorly drained and very poorly drained soils in order to indicate wetlands for planning and zoning purposes. As was discussed in Chapter 5, more detailed information is often desirable and required for informed decision making through the local, State and federal regulatory processes. Wetlands are commonly delineated by consultants hired by landowners who wish to subdivide or develop their property for nonresidential use. This often results in the careful documentation of resources that are later filled without full consideration of the relative importance of those wetlands within a particular watershed or municipality. Local officials can undertake a more proactive approach to evaluating and planning for management of their wetlands by performing a wetlands inventory. Such an inventory should result in a collection of technical reports and maps that can be adopted as part of the municipal master plan, and can serve as the basis for a local wetlands zoning ordinance. This information can be used by the planning board as a tool in evaluating subdivision and site plan review applications and by the conservation commission in evaluating and commenting on permit applications before the wetlands board. If prepared to the specifications of the NH Code of Administrative Rules Wt. 700, the inventory can be used to document and propose the designation of Prime Wetlands for approval by the municipality.

Field investigations by individuals with a background in wetland vegetation and soils are required to prepare a wetlands inventory that is of optimal use to local officials. However, successful inventories have been performed by individuals with a technical background working with volunteers such as conservation commissioners. There are existing data sources available, which can be used as a starting point for those going out in the field. The County Soil Surveys provide an indication of the general location of poorly and very poorly drained soils. The US Fish and Wildlife Service is currently mapping the State of New Hampshire as part of its National Wetlands Inventory (NWI). This mapping, being done at a scale of 1:24,000, is carried out largely through aerial photo interpretation. The emphasis is on interpretation of the presence of vegetation that is likely to be found in wetlands. This is verified by limited field checks. The information can be used to direct those conducting a wetlands inventory to appropriate sites for data collection and field verification. The NWI maps will become available for use by local officials in 1991 or 1992. Although considerable effort is required to perform a local wetlands inventory, the value of such an inventory to municipal officials is also a considerable benefit.

**Local conservation commissions should undertake wetlands inventories in their respective towns and monitor the status of those wetlands identified as part of the inventory.**

## **Prime Wetlands**

The designation of Prime Wetlands involves the local adoption of maps and information that are similar to those which might serve as the basis for a zoning overlay district. However, with local designation of Prime Wetlands, the authority to regulate certain activities within those wetlands remains in the hands of a State body, the New Hampshire Wetlands Board. By statute, a municipality choosing to designate Prime Wetlands is required to base its designation and mapping upon the criteria established by the Wetlands Board under Chapter Wt. 700, of the NH Code of Administration Rules. The process used to select Prime Wetlands involves an inventory and evaluation of the town's wetlands. Based on that evaluation, the conservation commission selects those wetlands worthy of prime wetland designation. Following a public hearing held by the planning board, Prime Wetlands are adopted by an official ballot vote at town meeting. The designation proposal, which is then submitted to the Wetlands Board for acceptance, must carefully follow the criteria, report, and map format established by the board.

The effects of local designation of Prime Wetlands include:

- . The identification of those wetlands of greatest importance to the municipality which are deemed worthy of extra protection due to their size, unspoiled character, uniqueness, fragility and/or other special characteristics.
- . The notification to owners, potential developers, and the New Hampshire Wetlands Board that the municipality feels strongly that those wetlands designated as "Prime Wetlands" should remain in their natural state.
- . The assurance that applications for dredge and fill permits in Prime Wetlands will receive special consideration from the Wetlands Board, provided that the conservation commission notifies the board that the permit application is for a proposed project in a prime wetland.

In the Squam Lakes watershed, Sandwich and Holderness have exercised the local option to inventory, map and adopt Prime Wetlands, in accordance with RSA 482-A:15 (formerly RSA 483-A:7). Sandwich has designated 8 wetlands (861 acres) and Holderness has designated 18 wetlands (272 acres).

As a result of the Prime Wetlands designation process, maps which accurately delineate the extent of wetlands become available for use in the local decision making process. This information makes it easier for a planning board to implement specified setbacks, and to enforce its wetlands ordinance. These maps also provide the conservation commission with information relative to the Prime Wetlands, which can assist them in advising the Wetlands Board relative to applications for dredge and fill permits.

**Towns should consider the designation of special wetlands which can be classified as Prime Wetlands under RSA 482-A:15 (formerly RSA 483-A:7).**

## **Summary of Recommendations**

### **Regulatory**

#### **Master Plans**

Watershed communities should review and update their master plans on a periodic basis. Every five years is recommended by RSA 674:2 VIII for local water resources management and protection plans.

#### **Local Water Resources Management and Protection Plans**

Municipalities within the watershed should enter into a formal cooperative effort to prepare a regional water resource management and protection plan that is consistent between municipalities. Planning boards should adopt the portion of that plan that pertains to their municipality as part of the conservation and preservation section of their master plans (RSA 674:2,VIII).

#### **Consistency of Zoning Ordinances**

The zoning ordinances of the towns in the Squam Lakes watershed should be consistent with one another, particularly with regard to permitted uses in zoning districts along common town boundaries. Also, distance requirements such as building setbacks and minimum frontage on waterbodies should adhere to commonly accepted standards among the towns in the watershed.

#### **Environmental Characteristics Zoning**

Municipalities should adopt requirements in their zoning ordinances to allow applicants to provide, and planning boards to require site specific information, as part of the local review process for environmental overlay zones.

#### **Wetlands Zoning**

Towns in the watershed should enact wetlands overlay zoning ordinances to increase protection of these important areas.

Planning boards in the watershed should be aware of the changes that are occurring in defining the methodologies for wetland delineation at the State and federal levels. Based on these changes, they should reevaluate the effectiveness of the provisions in their existing wetlands ordinances which outline the methodology for delineating the district boundary. Revisions should be proposed where they are determined to be appropriate.

Planning boards in the watershed should require that local approval of proposed projects in wetlands be conditioned upon approval of State and federal wetlands permits.

#### **Floodplain Zoning**

Towns in the watershed should adopt local floodplain zoning ordinances which are more stringent than the minimum FEMA requirements. The purpose of these ordinances would be to take a resource protection oriented approach to regulating development in floodplains and to decrease the cumulative impacts of the disturbance of these sensitive areas on downstream property owners.

#### **Watershed Zoning**

New Hampton should adopt a watershed protection district as an overlay zone for the Sky Pond and Jackson Pond drainage area.

#### **Aquifer Zoning**

Towns are encouraged to adopt aquifer protection overlay districts as part of their zoning ordinances.

Towns should consider participation in the emerging State wellhead protection program by undertaking local inventories of potential threats to existing wells and adopting local protection measures to manage activities in wellhead areas.

#### **Steep Slopes Zoning**

Towns should consider adoption of steep slope ordinances as a means of providing more explicit guidance to land owners as to the kinds of uses and minimum space standards which can be permitted in these areas.

#### **Shoreland Zoning**

Towns should consider adopting shoreland protection districts adjacent to all waterbodies consistent with recommendations in Chapter 4. Where waterbodies traverse municipal boundaries, the towns sharing these resources should cooperate to adopt similar shoreland standards.

#### **Building Lot Size and Spatial Requirements**

Planning boards in the watershed should reevaluate the lot size, density and setback requirements of their existing ordinances and regulations once the science based recommendations of the ad hoc committee examining the basis for lot size and density requirements are completed.

### Lot Coverage Standards

Planning boards within the watershed should reevaluate the maximum coverage requirements in their zoning ordinances, and consider revisions to these requirements to provide for consistency between the towns.

### Innovative Land Use Controls

Watershed communities should adopt cluster and/or other innovative land use controls as alternatives to traditional tract development in order to preserve resources such as prime forest and agricultural lands as open space, thus serving to enhance and protect the rural and aesthetic character of the landscape in the watershed.

### Subdivision Regulations

Planning boards within the watershed should evaluate the effectiveness of existing erosion and sediment control requirements in their subdivision regulations, and consider revisions to these requirements based on standards contained in the 1987 publication prepared by the USDA Soil Conservation Service, in cooperation with the NH State Conservation Committee, the NH Association of Conservation Districts and the North Country Resource Conservation and Development Area entitled *Erosion and Sediment Control Design Handbook for Developing Areas of New Hampshire*. In the process of incorporating these requirements, planning boards should include provisions for bonding the construction of these control measures, and also for their inspection and maintenance following construction.

Planning boards within the watershed should adopt stormwater management control requirements to address water quality, as part of their subdivision regulations. These requirements should include provisions for bonding the construction of these management controls, and also for their inspection and maintenance following construction.

Planning boards should adopt provisions within their subdivision regulations that allow the planning board to require site specific and technical studies to be prepared by qualified consultants, at the expense of the applicant. These provisions should include the option for the planning board to require an independent review of those studies by a qualified consultant, hired by the planning board at the owner's expense.

Town planning boards in the watershed should amend their existing subdivision regulations to reflect changes that have been made to State statutes since their original adoption. RSA 676:4, entitled "Board's Procedures on Plats", details the following subdivision review procedures:

- (1) conceptual consultation is allowed as an option of the applicant, without notification to abutters;
- (2) design review is allowed before submission of a completed application, as an option of the applicant, with notification to abutters; and

- (3) the option is allowed for the applicant to initiate review by submission of a completed application.

Some planning boards in the watershed have amended their regulations to partially address the statutory changes. Others should amend their regulations to remove more of the outdated language. Included should be the provisions for "Abandonment of Preliminary Layouts".

#### Site Plan Review Regulations

Planning boards within the watershed should adopt erosion and sediment control requirements, to address water quality, as part of their site plan review regulations, based on standards contained in the 1987 publication prepared by the USDA Soil Conservation Service, in cooperation with the NH State Conservation Committee, the NH Association of Conservation Districts, and the North Country Resource Conservation and Development Area entitled *Erosion and Sedimentation Control Design Handbook for Developing Areas of New Hampshire*. In the process of incorporating these requirements, planning boards should include provisions for bonding the construction of these control measures, and also for their inspection and maintenance following construction.

Planning boards within the watershed should adopt stormwater management requirements, to address water quality, as part of their site plan review regulations. These requirements should include provisions for bonding the construction of these measures and also for their inspection and maintenance following construction.

Planning boards within the watershed should adopt performance standards as part of their site plan review regulations for land uses which have the potential to impact water quality. Updated performance standards for potential contaminant sources are proposed to be developed through the NH Wellhead Protection Program.

Planning boards should adopt provisions within their site plan regulations that allow the planning board to require technical studies to be prepared by qualified consultants at the expense of the applicant, as part of the local review process. These provisions should include the option for the planning board to require an independent review of those studies by a qualified consultant, hired by the planning board at the owner's expense.

#### Building Codes

Towns in the watershed which have not adopted a building code should either adopt the BOCA code or one that has similar requirements to section 112.1 of the BOCA code, which includes a requirement that the building inspector or code official reject any application that does not conform to the requirement of all pertinent laws. All towns in the watershed should enforce such a requirement.

### **Health Ordinances**

Municipalities in the Squam Lakes watershed should maximize use of local health ordinances as effective water resources management and protection tools. Health ordinances should be designed to address the following:

- (1) Private well design and siting requirements, and setbacks;
- (2) Septic system design and siting requirements and setbacks;
- (3) Private well testing prior to transfer or rental of property or conversions of seasonal homes to year-round use;
- (4) Septic system requirements for conversion of seasonal homes to year-round use;
- (5) Mandatory periodic inspection and maintenance of septic systems, with a report filed with the local health officer on a regularly basis;
- (6) Design and siting requirements for containment structures for above ground storage of chemicals or petroleum products; and
- (7) Design and siting requirements for underground storage tanks <1,100 gallons.

### **Excavation Regulations, RSA 155-E**

Planning boards within the watershed should adopt performance standards for land use activities which have the potential to impact water quality as part of their local excavation ordinances. It is recommended that those municipalities that do not have such ordinances, adopt one.

Planning boards within the watershed should adopt erosion and sediment control and stormwater management requirements, to address water quality, as part of their local excavation ordinances. These requirements should include provisions for bonding the construction of these control measures and also for their inspection and maintenance following construction.

Local excavation ordinances should incorporate provisions to include record of lawfully existing excavations, and requirements for reclamation (RSA 155 E:2, I (c) and (d)).

Planning boards within the watershed should include requirements for periodic review and inspection of excavations and for finite time limitations for excavation permits, after which the operator must apply for a renewal.

### **Police Power Bylaws, RSA 31:39**

Municipalities within the Squam Lakes watershed should consider adoption of local police power bylaws in accordance with RSA 31:39 to protect water quality for the public health and safety.



### **Junkyard Regulations, RSA 236:111-229**

Selectmen within the Squam Lakes watershed should develop local junkyard regulations for adoption in accordance with one of the options listed above. The purpose of such regulations would be to provide Squam Lakes watershed selectmen with water quality related criteria and performance standards for issuance of junkyard licenses.

### **Analysis of Local Ordinances and Regulations - Squam Lakes Watershed**

Planning boards in the Squam Lakes watershed should evaluate the results of the analysis of their local ordinances and regulations and consider adopting the requirements and standards recommended in the Local Government - Land Management section of this chapter.

### **Nonregulatory**

#### **Road Salt Management**

DES should develop best management practices for road salt management for use by DOT and local officials in the development of road salt management policies.

Municipalities within the Squam Lakes watershed should cooperate to develop and adopt a consistent road salt management policy for locally maintained roads within the watershed. Input from the selectmen, road agent, health officer, planning board and conservation commission in each town is advised.

#### **Wetlands Inventory**

Local conservation commissions should undertake wetlands inventories in their respective towns and monitor the status of those wetlands identified as part of the inventory.

#### **Prime Wetlands**

Towns should consider the designation of special wetlands which can be classified as Prime Wetlands under RSA 482-A:15 (formerly RSA 483-A:7).

#### **Recommendation Concerning Information and Technical Assistance**

Towns should utilize the services of the Lakes Region Planning Commission, which has an extensive database and professional resources to assist municipalities with the local planning and regulatory measures suggested in this chapter. In addition, the LRPC has acquired capability in the use of geographic information systems technology, and can provide access to NH GRANIT, the State's geographic information system, for natural resources and land use planning.



## **Chapter 9. Intermunicipal Cooperation for Water Resources Planning**

### **State/Regional/Local Mechanisms For Shared Enforcement Capabilities**

#### **Rationale for Intermunicipal Cooperation for Regional Enforcement of State Laws and Local Ordinances and Regulations**

As is described in the Introductory chapter of this watershed plan, the Office of State Planning (OSP) was directed to investigate several growth related problems which were affecting the future of New Hampshire lakes, in response to a request from former Governor John Sununu to the New Hampshire Council on Resources and Development (CORD). As staff for the Council, OSP held a series of public meetings in the Lakes Region and identified a series of major issues facing lakes. Included were leasing of State land, docks and moorings, boating, water milfoil and aquatic weeds, old septic systems, growth management and lake management planning. The issues were presented in a series of three Lakes and Great Ponds Reports that were released in May of 1985. Recommendations outlined in those reports were designed to improve lake monitoring and enforcement and provide funds which would at least partially offset costs and initiate a long range lake management process. A strong emphasis was placed on the importance of lake management planning on a watershed basis. The purpose of a watershed and lake management plan is to assure that activities on and around a particular lake or pond will not exceed the capacity of that body of water to accommodate such activities. Some of these activities, such as boating and the alteration of lake shorelines by fill, dredge or structures, are regulated at the State level in accordance with State statutes and administrative rules. Other activities, such as the subdivision of land, inland construction and some water quality/public health related activities are regulated at the local level in accordance with local ordinances and regulations. There is always a need, at both the State and local levels, to review and revise regulations to reflect the results of new research and technological advances. The effectiveness of such regulations, however, is largely a function of the responsible party's ability to provide for monitoring, inspection and enforcement activities. It was suggested at the public meetings that the possibility of some form of creative State-regional-local partnership be explored, as a mechanism to increase the effectiveness of existing, limited, enforcement capabilities. This is consistent with the findings of the Lakes and Great Ponds Report - Volume I, "That a cooperative effort be undertaken to develop a strategy for sharing local and State inspection and enforcement authorities and responsibilities."

Three of the draft final goals for the Squam project address the limitations of existing local and State enforcement actions. They are as follows:

"IA5. Develop recommendations for different options to improve enforcement of local ordinances and regulations, to include consideration of circuit rider code enforcement officers;"

"IB2. Develop recommendations for changes in authorities to regulate land use and surface water use within the watershed, to include consideration of new authorities and modifications to existing authorities to improve effectiveness and shared authorities;" and

"IB5. Develop recommendations for different options to improve enforcement of federal, State and local regulations relative to land use in the watershed and surface use of the lakes, to include dedication of funds."

In order to address these goals, the Squam Lakes Watershed Advisory Committee (SLWAC) directed the Office of State Planning to develop recommendations relative to some form of a "regional authority," with enforcement capabilities. The Committee recognized two reasons for the establishment of such a regional entity. The first is to establish a regional mechanism to allow municipalities to pool their limited resources for cooperative planning, administration and enforcement of local ordinances and regulations. More efficient, consistent and professional enforcement activities would result if the municipalities were to act cooperatively to hire staff to perform local enforcement activities on an intermunicipal basis. The second is to establish a mechanism to allow for enforcement of State statutes at the regional level. If authorized to do so, regional personnel located within a watershed may be able to provide for more efficient enforcement than is currently provided by the State. This would also help to alleviate some of the existing burden on limited State personnel.

In order to begin to discuss options for regional enforcement of either local or State regulations, a number of issues need to be considered. These include, but are not limited to:

1. Specific land and water use activities for which it is desirable to have regional enforcement capabilities;
2. The level of government at which those activities are currently authorized by State statute to be regulated and enforced. Depending upon the level of government at which an activity is regulated, enforcement may either be at the State level, the local level or a shared level of responsibility;
3. The methods currently authorized by State statute to allow for shared State/local enforcement activities;
4. Proposed methods to allow for shared State/local enforcement activities that are not currently allowed by State statute;
5. The methods currently authorized by State statute for municipalities, or portions of municipalities, to cooperate jointly, on a regional basis, for mutual benefit. This benefit could include regional enforcement activities;
6. Potential methods available to fund a multi-town regional enforcement effort.

The following section of this report will discuss these issues in more detail and present a number of options for consideration by the communities in the Squam Lakes watershed. Some of the options are currently authorized by State statute. Others will require either State legislative changes or local actions in order to implement them.

**Specific Land and Water Use Activities and Level of Government at Which These Activities are Currently Regulated**

Table 9-1 presents a summary of the level of government at which land and water use activities are regulated and enforced, along with options for shared enforcement activities.

State regulated activities for which a regional enforcement capability may be beneficial to both State and local interests were identified in the Lakes and Great Ponds Report. Some specific State regulated land and water use activities that were further discussed by the SLWAC relative to regional enforcement include:

- the Wetlands Board's regulation of fill and dredge and shoreline structures in accordance with RSA 482-A (formerly RSA 483-A); and
- the Department of Safety Services' regulation of boating activities in accordance with RSA 270.

Enforcement of these laws at a regional or local level would require State legislative action. Given the concerns expressed by the SLWAC about potential contamination of water resources from either septic systems or erosion and sedimentation as the result of land disturbance, the SLWAC may also wish to consider the desirability of regional enforcement of:

The Water Supply and Pollution Control Division's regulation of septic systems in accordance with RSA 485-A:37-39 (formerly RSA 149-E:3-[b-d]); and

The Water Supply and Pollution Control Division's regulation of alteration of greater than 100,000 square feet of terrain in accordance with RSA 485-A:17 (formerly RSA 149-8:a).

**Methods Currently Authorized for State/Local Shared Responsibility** - Current State law authorizes a form of shared State/local responsibility called "concurrent jurisdiction" between the Water Supply and Pollution Control Division and local health officers, for enforcement of the statutes that regulate septic systems. In accordance with RSA 485-A:42, the WSPCD-DES is authorized to certify local officials, as follows:

"Upon certification by the division, local officials are hereby authorized and fully empowered to exercise concurrent jurisdiction in the enforcement of this chapter."

Although the statute allows for this type of shared State/local enforcement responsibility, very few municipalities have actually been certified by the Division to exercise concurrent jurisdiction. This may be, in part, because there doesn't appear to be any incentive for local officials to take on the additional responsibility of enforcing State laws, without any form of financial compensation. From the State's perspective, there also may be a reluctance to certify local officials to perform enforcement activities where there is no demonstrated source of funds at the local level to support those activities. However, the concept of concurrent jurisdiction could be effective on a watershed basis if the local officials in a number of adjacent municipalities were to:

1. Make a priority the local enforcement of State septic system laws; and
2. Enter into a formal cooperative effort, on an intermunicipal basis, to support staff to perform local enforcement activities.

Since the SLWAC has expressed concern about the potential water quality problems that could be caused by faulty septic systems, and concurrent jurisdiction for shared enforcement of the State septic system laws is currently allowed by existing statutes, it may be appropriate for each of the municipalities in the watershed to request certification for concurrent jurisdiction with the WSPCD. The selectmen of each municipality could do this independently and enforce the statutes through their local health officers. However, if consistent and improved regional enforcement is the goal, then the municipalities should enter into an agreement to cooperatively request concurrent jurisdiction for each municipality from the WSPCD. Two options for formal agreements will be discussed later in this chapter. It is important that the agreement between the municipalities be formal in nature and include a viable mechanism for funding enforcement staff. This will give WSPCD sufficient assurance that the enforcement activities will be adequately performed if the local communities are certified.

If the Squam watershed towns decide to cooperate on an intermunicipal basis to provide more efficient and effective local enforcement of State laws, their efforts will serve as an example for other municipalities that wish to undertake similar efforts. Successful implementation of a regional enforcement effort by Squam watershed towns will also serve as an example to provide justification for why the legislature should take action to allow for enforcement of other State statutes. For example, the SLWAC has suggested that shared State/regional/local enforcement responsibilities would be desirable for the statutes which regulate fill and dredge, shoreline structures and boating activities.

Locally Regulated Activities - The need for consistent municipal planning and regulatory efforts between the municipalities within a watershed was identified as critical to lake management in the Lakes and Great Ponds report. This need was also identified as important within the Squam Lakes watershed. Locally regulated activities for which a regional enforcement capability may be beneficial to both regional and local interests that were discussed by the SLWAC include:

- zoning ordinances in accordance with 674:10;
- subdivision regulations in accordance with 674:35;

- site plan review regulations in accordance with 674:43;
- police power ordinances in accordance with 31:39;
- excavation ordinances in accordance with 155-E;
- innovative land use controls in accordance with 674:21; and
- health ordinances in accordance with RSA 147:1 to address:
  - \* septic system design, inspection, maintenance and permitting;
  - \* private well siting requirements;
  - \* private well testing requirements for rental properties; and
  - \* septic system and well requirements for conversion from seasonal to year-round or expanded use.

**Methods Currently Authorized for Regional/Local Shared Responsibility** - Current State laws authorize two methods for municipalities to cooperate for mutual benefit. Municipalities may either enter into an intermunicipal agreement in accordance with RSA 53-A, or the selectmen of the municipalities may fix the boundaries of a village precinct and the voters of that precinct can vote to establish a district in accordance with RSA 52:1. There are relatively few examples of such cooperative efforts in New Hampshire. Those that exist have most commonly been formed for purposes of provision of municipal services, such as solid waste management, public water supply, fire protection, street lights and snow plowing. However, either of these methods could be employed as a formal mechanism for communities to agree to pool their resources in order to hire regional staff so as to provide more efficient and consistent enforcement of local regulations. The differences between the two types of cooperative efforts allow for municipalities to select the option that is best suited to their individual and regional needs. The strengths and weaknesses of each method are discussed in more detail in the following section.

**Existing Methods for Establishing Intermunicipal Cooperation for Regional Enforcement of State Laws and/or Local Ordinances and Regulations**

**Intermunicipal Agreement in Accordance with RSA 53-A** - Municipalities are authorized by RSA 53-A to enter into formal agreements to cooperate with other municipalities on a basis of mutual advantage in order to provide services and facilities to their residents. In order to enact an intermunicipal agreement, in accordance with the statute, the local governing body of each municipality must adopt either an ordinance or resolution at town meeting. That town meeting action could authorize the selectmen to work with the selectmen of the other communities to develop an agreement for consideration and approval of the voters at the next annual or a special town meeting. The actual agreement itself must specify, at a minimum, the following:

- a. Its duration;
- b. The precise organization, composition and nature of any separate legal or administrative entity created thereby, together with the powers delegated thereto, provided such entity may be legally created;
- c. Its purposes;

**Table 9-1. Regulation and Enforcement of Land and Water Use Activities**

Level of Government at which Activity is Regulated	Options for Intergovernmental Cooperation for Enforcement Activities
<u>STATE LEVEL</u>	<u>BETWEEN STATE AND LOCAL GOVERNMENTS</u>
<ul style="list-style-type: none"> <li>- approval of sewage and waste disposal systems</li> <li>- maintenance &amp; operation of subsurface septic systems</li> <li>- approval to increase the load of existing sewage disposal systems</li> <li>- site assessment study for sale of waterfront property</li>   <li>- Fill and Dredge &amp; Shoreline Structures</li> <li>- Boating Activities</li> <li>- Alternation of Terrain &gt; 100,000 ft<sup>2</sup></li> </ul>	<ul style="list-style-type: none"> <li>- Local Certification for Concurrent Jurisdiction with WSPCD for septic system laws, is currently authorized by statute, but not practiced extensively.</li>   <li>- Local Certification for Concurrent Jurisdiction with WRD, Safety Services and WSPCD is <u>not</u> currently authorized by statute for these regulated activities.</li>   <li>- State Legislative Action would be required to establish such authorization.</li> </ul>
<u>LOCAL LEVEL</u>	<u>BETWEEN LOCAL GOVERNMENTAL UNITS</u>
<ul style="list-style-type: none"> <li>- Zoning Ordinances</li> <li>- Subdivision Regulations</li> <li>- Site Plan Review Regulations</li> <li>- Police Power Ordinances</li> <li>- Excavation Ordinances</li> <li>- Innovative Land Use Controls (RSA 674:21)</li> <li>- Health Ordinances               <ul style="list-style-type: none"> <li>-- septic systems</li> <li>-- private wells</li> <li>-- requirements for year-round conversion, expanded use or rental</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>- Intermunicipal Coordination for Regional Enforcement is currently authorized by State statute, in the form of either an Intermunicipal Agreement or Watershed Precinct, but not practiced.</li>   <li>- Local Legislative action would be required to establish an Intermunicipal Agreement or Precinct.</li> </ul>



- d. The manner of financing the joint or cooperative undertaking and of establishing and maintaining a budget therefor;
- e. The method to be employed in accomplishing the partial or complete termination of the agreement and for disposing of property upon such termination;
- f. Any other necessary and proper matter.

Once adopted the agreement must be submitted to the Attorney General's Office for legal review and filed with the Secretary of State's Office.

Advantages to this type of agreement include the establishment of a formal mechanism to develop a budget to cooperatively finance a regional staff person. The regional staff could perform enforcement activities for either State laws for which regional or local enforcement is authorized, or local regulations and ordinances. An intermunicipal agreement would be appropriate for enforcement of State laws which local officials see as a priority for enforcement on a town wide basis, such as inland fill and dredge activities and significant alterations of terrain. The geographic focus for regional enforcement of State laws regulating specific lake related land and water uses would most likely be the extent of the watershed and the lake itself, as opposed to the extent of each municipality's boundaries. Therefore, an agreement which requires local legislative approval by a portion of the population that is within the municipality but not within the watershed may not be as appropriate for enforcement of State laws relating to some activities. This would include such lake specific activities as shoreline fill and dredge, structures, and boating activities. An intermunicipal agreement is probably best suited for regional enforcement of consistent local ordinances on a townwide basis. Regional staff hired under an intermunicipal agreement would be able to assure uniform enforcement to extent of the municipal boundaries for all of the participating communities.

One disadvantage to forming an intermunicipal agreement in accordance with RSA 53-A is that its enactment is dependent on formal town meeting approval from all of the cooperating municipalities. This requires a strong townwide commitment to the process by the voters of a number of potentially different communities. Since the statute does not grant the executors of the agreement the power to tax, there is also the matter of financing. This would need to be approved through the municipal budget processes of each cooperating community. It may be difficult for the municipalities to agree upon the methods of apportioning the costs of administering the agreement and paying regional staff.

Watershed Precincts in Accordance with RSA 52 - The second method for intermunicipal cooperation authorized by the statutes is a "village" or watershed precinct in accordance with RSA 52. Precincts may be formed for any of fourteen specified purposes, to include:

"...The supply of water for domestic and fire purposes, which may include the protection of sources of supply;...

The maintenance of activities for recreational promotions;... and

The impoundment of water."

Upon the petition of ten or more legal voters, who are inhabitants of any "village" situated in one or more towns, the selectmen may "fix" the boundaries of a district. A meeting is then called by the selectmen for the legal voters to vote to establish the district, give it a name and choose officers. The district then exists as a body corporate and politic, and must file with the Secretary of State.

There are some distinct advantages to forming a precinct. The selectmen may "fix" the district boundaries as the area which delineates a lake watershed. In that way, enforcement activities performed by regional staff to the precinct would be able to concentrate on the lake's watershed and the lake itself. This would be particularly appropriate for regional enforcement of State laws that regulate lake specific activities. A precinct is also authorized by RSA 52:16 to vote to raise money by taxation. This provides a mechanism to assure payment of costs by those who live directly in the watershed without requiring budget approval from the entire municipality.

There is the limitation that the selectmen and voters within the portion of the district in each municipality must vote to establish the district and "fix" its boundaries. However, an affirmative legislative action is more likely to be taken by those who live within the watershed precinct than by those at town meeting who live outside of the watershed. Because the watershed precinct could be limited to the watershed boundaries, this type of intermunicipal cooperation is likely to be less effective in the enforcement of local ordinances and regulations on a townwide basis.

## **Apportioning the Costs of Regional Enforcement Activities**

### **Proposed Methodologies for Assessing Costs of Enforcement Activities**

Table 9-2 summarizes possible methods for funding regional enforcement efforts. Many of these methods would require legislative changes, but would result in a net benefit in efficient and consistent enforcement activities.

#### Local Options

Cost Assessment Through an Intermunicipal Agreement - Under existing authorities, an intermunicipal agreement could specify that each municipality would be assessed for a portion of the cost, based on some agreed upon methodology. The funds to cover the cost would most likely be included in each community's municipal budget. There are many options that could be considered to determine a municipality's proportionate share of these costs to include, but not be limited to the following or any combination thereof:

- (1) a set fee per community;
- (2) acreage of the municipality within the watershed area;
- (3) length of shoreline within the municipality;
- (4) acreage plus length of shoreline divided by two;

- (5) number of existing shoreline structures;
- (6) number of existing shoreline lots;
- (7) total population;
- (8) population within the watershed; and
- (9) number of inspections and/or violations occurring on an annual basis.

The financial matters of the intermunicipal agreement could be administered by one of the towns. The agreement could include language authorizing that municipality to assess the other communities for their share of the costs based on an agreed upon methodology.

Cost Assessment Through the Taxation Procedure of a Watershed Precinct - In accordance with RSA 52:16, a watershed precinct may vote to raise money by taxation. The selectmen of each town assess the tax on the part of the district lying within their town, and commit it to the collector of taxes from their town. The options for determining each municipality's proportionate share of enforcement costs could be the same as those previously listed for assessment of costs through an intermunicipal agreement.

The financial matters of a watershed precinct could also be administered by one of the municipalities. The officers of the body corporate and politic of the precinct could authorize that municipality to assess the other communities for their share of the enforcement costs based on an agreed upon methodology.

#### State Options

Permit Fees - Legislation would need to be proposed to authorize State agencies to certify a formal regional watershed cooperative effort for concurrent jurisdiction for enforcement of State statutes and administrative rules. Existing statutes specify the dollar amount of application fees for fill and dredge and shoreline structure permits (RSA 482-A:3), alteration of terrain RSA 485-A:17,II, septic system permits (RSA 485-A:30-a) and boat registration fees (RSA 270:5). New legislation could be proposed to:

authorize expenditure of a portion of those existing fees to cover the costs of inspection and enforcement of the statute by a formal regional watershed cooperative effort; and/or

increase those fees to include the cost of regional inspection and enforcement.

This type of financial support would provide an incentive to local officials for the establishment of formal regional watershed cooperative efforts. Such regional efforts would provide for more efficient and consistent enforcement, while alleviating some of the work load pressure that is currently experienced by limited State agency staff.

## Administrative Fines

Existing Fines: Legislation would need to be proposed to authorize State agencies to certify a formal regional watershed cooperative effort for concurrent jurisdiction for enforcement of State statutes and administrative rules. Existing statutes specify the dollar amount of administrative fines for fill and dredge and shoreline structure violations (RSA 482-A:13), site assessments for waterfront property sale (RSA 485-A:39,IV) and administrative penalties for boating violations (RSA 270:46-a). New legislation could be proposed to:

- Authorize expenditure of a portion of those existing funds to cover the costs of enforcement of the statute by a formal regional watershed cooperative efforts; and/or
- Increase those fees to include the cost of regional inspection and enforcement. This would, again, provide financial incentive for the establishment of formal regional watershed cooperative efforts at the direct expense of the actual violators who make inspection and enforcement necessary.

Proposed Fines: Legislation would need to be proposed to amend RSA 485-A:17 (formerly RSA 149-8:a) to include provisions for administrative fines to be levied for violations of that chapter. The language could also:

- Authorize expenditure of a portion of those funds to cover the costs of enforcement of the statute by a formal regional watershed cooperative effort; and/or
- Increase those fees to include the cost of regional inspection and enforcement.

**Table 9-2. Potential Methods of Financing Regional Enforcement Activities**

Local Options	State Options	Shared Local/State Options
<p>1. An agreed upon methodology could be detailed in an intermunicipal agreement, to apportion a cost share to each cooperating municipality. This would be funded through each town's municipal budget.</p>	<p>1. The statutes could be amended to authorize use of State permit fees for regional enforcement activities.</p> <p>This would require State legislative action.</p>	<p>1. <u>State</u> The statutes could be amended to authorize concurrent jurisdiction and also the pass through of funds from State permit fees and administrative fines for regional enforcement activities.</p>
<p>Establishment of the agreement would require local legislative action.</p>	<p>2. The statutes could be amended to authorize use of administrative fines for regional enforcement activities.</p>	<p>- The State would benefit by more efficient and consistent enforcement of State statutes at the regional level.</p>
<p>2. A watershed precinct has the authority to vote to tax its residents.</p>	<p>This would require State legislative action.</p>	<p>The amendment could include a requirement that certification for concurrent jurisdiction and the pass through of State funds be made conditional upon demonstrated local commitment to a regional cooperative effort.</p>
<p>Establishment of a precinct would require local selectmen action.</p>		<p>- This would require State legislative action.</p>
<p>3. Amendments could be made to local regulations to include permit and inspection fees to be paid directly to a regional enforcement staff. This would require that similar amendments be made by <u>each</u> local planning board.</p>		<p>2. <u>Local</u> The statutes could be amended to authorize municipalities which have taken the initiative to do the following to be certified for concurrent jurisdiction for enforcement of State laws and the pass through of State funds:</p>
		<p>a. Enter into an intermunicipal agreement or form a watershed precinct for enforcement purposes; and</p> <p>b. Demonstrate the ability to use the agreement or precinct to provide for efficient and consistent enforcement of local ordinances for a period of at least one year.</p>
		<p>- The municipalities would benefit by receiving funds to provide more efficient and consistent enforcement of State statutes at the regional level.</p>
		<p>- This would require both State and local legislative action.</p>

## Recommendations

### Intermunicipal Cooperation for Enforcement of State Regulatory Requirements in Accordance with Existing State Statutes

Municipalities in the Squam Lakes watershed should take local action to either enter into an intermunicipal agreement in accordance with RSA 53-A, form a watershed precinct in accordance with RSA 52, or develop a program with the Lakes Region Planning Commission for the coordination and enforcement of zoning and subdivision regulations in accordance with RSA 36:47. This regional cooperative effort should be used as a mechanism to request that WSPCD certify each of the municipalities for concurrent jurisdiction for enforcement of the septic system laws. The cooperative effort should be used to hire regional staff to perform consistent, more efficient enforcement activities.

Municipalities within the Squam Lakes watershed should demonstrate that a regional cooperative effort can, in fact, provide for consistent, more efficient enforcement activities through regional staff for a period of at least one year.

### Proposed Legislation to Authorize Shared Government Enforcement Capabilities

Use the example of successful implementation of intermunicipal cooperation for enforcement of State regulatory requirements, as the basis for recommending legislative changes to:

Authorize concurrent jurisdiction for enforcement of other State statutes; and/or

Authorize pass through to local officials of funds for enforcement activities from existing and proposed permit fees, administrative fines and administrative penalties.

Legislation proposed to authorize certification of regional concurrent jurisdiction and the pass through of State funds should include language to condition that certification upon:

The municipalities establishing either an intermunicipal agreement, watershed precinct or regional planning commission program, and the municipalities demonstrating successful cooperation for enforcement of the State septic system laws through that agreement, precinct or program for a period of at least one year.

## Chapter 10. Land Protection

### Overview

Since the early 1900's, the abundant natural resources contained in the Squam Lakes watershed have been relatively unthreatened. A fairly small number of landowners have held large shore, island and hillside expanses, over several generations. But as development pressures have mounted in recent years, the future of these special areas has been brought into question. Less than 9 percent of the Squam watershed was developed as of 1955, but by 1988, this figure had climbed to 21 percent. A significant part of this development pressure has been expressed as a demand for shoreland and other scenic building sites, reflecting a trend for New Hampshire as a whole. Market values have soared, leading to increases in local property taxes, which has made it more likely that these special areas will be sold. The high demand for such areas has also meant increased costs for land conservation. Despite a current economic slowdown in New Hampshire and the Northeast in general, these and other sensitive land areas remain vulnerable.

The Squam Lakes Watershed Plan recognizes that in order to preserve and protect the special and sensitive resources that are found in the watershed, it will be important for municipalities and conservation organizations to join together and continue to develop a workable and comprehensive land conservation strategy for this region. A variety of important goals can be addressed simultaneously, with such a strategy: the protection and preservation of wildlife habitat; the protection of water quality; the preservation of views and trails; the provision of possible public access areas for passive and active recreation; and the preservation of areas that should remain available as productive resources for watershed residents now and in the future.

The protection of these resource values can be accomplished through a range of methods, some of which are already being used in the Squam watershed, and others which are recommended in this plan. Existing regulatory controls for watershed towns already provide a degree of protection for environmentally sensitive areas such as wetlands and steep slopes. Recommendations in Chapters 4, 5 and 8 provide guidance as to how to improve local regulatory techniques in order to minimize negative impacts on these and other sensitive areas. Innovative land regulations such as cluster zoning are described in Chapter 8 as an especially useful way to protect important resources, without unfairly infringing upon property owners' rights. Chapter 8 also addresses best management practices and performance standards governing land clearing, construction, and use, which are aimed primarily at protecting water quality. Chapter 11 addresses the fundamental role education can play in informing landowners, other residents of the watershed, and visitors about Squam's splendid natural resources, and ways in which they can be protected and preserved.

This chapter focuses primarily on land protection through outright acquisition, or through the acquisition of less than fee simple rights to parcels of land. "Land protection techniques", as referred to in the chapter,

mean the transfer, through gift or purchase, of some or all of the interest in a parcel of land to a governmental unit or conservation organization, in order to protect, manage and/or improve the natural character and resources of the parcel. A number of innovative methods have been developed to acquire some or all of the interest in a piece of land. Since fee simple land acquisition is costly, strategies should encompass a range of methods, and should especially focus on conservation easements, (with or without public access conditions), that are either donated or bargain-purchased, as the most cost-effective means of meeting protection objectives.<sup>1</sup>

Easements are an effective way to provide permanent protection, while not taking the land entirely off the tax rolls. They also do not place the burden on local communities to manage additional public land. Conservation easements can be an important option when negotiating with a developer, especially when the developer is working in environmentally sensitive areas that have been identified as locally significant in municipal master plans or other documents. Outright acquisition of land may be necessary for those few locations in the Squam watershed where more intensive public use is anticipated.

The last section of this chapter describes various land protection methods, with their advantages and disadvantages. This information is not an exhaustive treatment of techniques, but is rather intended to highlight their most important aspects. Several guides have been written which describe protection methods more completely and authoritatively than is possible in this document. The following publications are recommended to local communities and conservation organizations in the watershed, for their own use or as information sources for landowners in local towns: *Land Protection and the Tax Advantages for New Hampshire Landowners*; *Land Protection for New Hampshire Communities and Organizations*.<sup>2</sup>

### **Land Protection Efforts in the Squam Lakes Watershed**

Because of vision and action on the part of local conservation organizations and communities in the Squam watershed, several important natural areas have already been protected through acquisition or purchase of conservation easements. These areas contribute numerous benefits for watershed residents and visitors alike, and also provide a significant foundation, both in terms of land acreage and commitment, for a long term conservation strategy for the Squam watershed.

Table 10-1 lists these protected land areas, though it is recognized that this list may not be complete. The Conservation Subcommittee of the Squam Lakes Association has an effort underway to provide a more comprehensive and detailed listing and mapping of protected areas in the watershed, and this will continue past the completion date of the Squam Lakes Watershed Plan. With this information in place, ideally in computerized form, the various private/public organizations will be better able to coordinate land protection efforts for the watershed.

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<sup>1</sup> Tom Howe, Lakes Region Conservation Trust, 1990.

<sup>2</sup> Cooperative effort between NH Office of State Planning and the Society for the Protection of NH Forests, 1987.



Table 10-1. Protected Land Areas - Squam Lakes Watershed

Town	Easement - E Ownership - O Reverter Interest - R	Acreage	Water Access	Type of Property
<b>ASHLAND</b>				
Stevens Forest (L.Squam)	NE Forestry Foundation - O	155	1,234 ft.	lakefront
Ashland Town Beach	Town of Ashland - O	1.5	650 ft.	lakefront
Scribner Fellows State Forest	State of New Hampshire - O	47		backland
John & Barbara Newsom Forest	NE Forestry Foundation - O	55		backland
<b>CENTRE HARBOR</b>				
Proctor Sanctuary	NH Audubon Society - O	47		backland
Dog Cove Reservation	Squam Lakes Assoc. - O	90	600 ft.	lakefront
Chamberlain-Reynolds Forest	NE Forestry Foundation - O	151	8,000 ft.	lakefront
Kimball Island	Ctr. Harbor Cons. Comm. - E	31.5		island
Sturtevant Cove	Squam Lakes Cons. Soc. - E	5	1,000 ft.	lakefront
Gray-Twombly	Soc./Prot./NH Forests - E	25	1,000 ft.	lakefront
Town Beach	Ctr. Harbor - O	0.5		lakefront
Part of Great Island	Squam Lakes Cons. Soc. - E	113		island
Duck Island-Cheever	Squam Lakes Cons. Soc. - E	1.5		island
<b>HOLDERNESS</b>				
Science Center of NH	Science Ctr. of NH - O	285		backland
West Rattlesnakes	Univ. of New Hampshire - O	150		hillside
	Squam Lakes Cons. Soc. - R			
Moon Island	Squam Lakes Assoc. - O	30	6,000 ft.	island
Curry Property	Squam Lakes Assoc. - O		1,054 ft.	riverfront (Squam River)
Stevens Forest	NE Forestry Foundation - O	22	600 ft.	
White Oak Pond	Lakes Reg. Cons. Trust - O	6		island/marsh
Town Beach	Squam Lakes Cons. Soc. - O	7.8		
Part of Great Island	Squam Lakes Cons. Soc. - E	59		island
Ellen Barry Property	Soc./Prot./NH Forests - E	15		lakefront
Basin Island	Squam Lakes Cons. Soc. - E	1		island
Kate Island	Squam Lakes Cons. Soc. - E	2		island
<b>MOULTONBOROUGH</b>				
Unsworth Preserve	Squam Lakes Cons. Soc. - O	159		backland
Harvard Pond	Squam Lakes Cons. Soc. - O	15.4		lakeshore
Yard Islands	Squam Lakes Cons. Soc. - E			island
<b>NEW HAMPTON</b>				
Sky Pond State Forest	State of New Hampshire - O	119		backland
Scribner Fellows State Forest	State of New Hampshire - O	93		
<b>SANDWICH</b>				
Lily Cove	Squam Lakes Cons. Soc. - E	19.9		marsh
Five Finger Point	Univ. of New Hampshire - O	55	10,000 ft.	lakefront
	Squam Lakes Cons. Soc. - R			
Town Beach	Sandwich - O	0.4		lakefront (Squam)
Coolidge Property	Sandwich - E	65		hillside/lakefront
Coolidge Property	Sandwich - E	19.7		hillside
Pinehurst - South of E. Rattlesnakes	Lakes Reg. Cons. Trust - E	200		hillside
E. Rattlesnakes	Univ. of New Hampshire - E	296		hillside
Squaw Cove	Lakes Reg. Cons. Trust - E	9.1		lakeshore
Eagle Cliff Trust	Lakes Reg. Cons. Trust - E	101		hillside

This coordination of land protection efforts can be furthered by organizing the protected lands under the concept of a Squam Lakes Reserve. Reserve properties should include private lands under easement (with the owner's consent), and various properties in non-profit and public ownership. Such properties could be designated and marked with signs, and coordinated management strategies and plans could be developed for their long term protection.

### **Establishment of Priorities for Land Protection**

In order to be effective, the land protection strategy for the Squam Lakes watershed should allow non-profit groups, government entities, and private landowners adequate opportunity to share in the establishment of priorities for land protection. One example of such an opportunity provided locally is a survey conducted by the Holderness Task Force on the Trust for New Hampshire Lands in March of 1989. The purpose of the survey was to gather community ideas and preferences for land conservation. The "most common and urgent appeal" expressed in the survey was concerned with the protection of scenic hillsides from development. Information such as this is valuable, and it would be worthwhile for other towns in the watershed to survey their residents in order to get a better sense of which lands should be the focus of land protection efforts.

The Squam Lakes Watershed Advisory Committee and OSP have given serious consideration throughout the planning process to the kinds of areas which should be targeted for protection through easements and/or other means. The list which follows has been compiled based in large part on the Committee's recommendations concerning the kinds of areas most in need of protection at the present time. This list places special emphasis on the protection of areas possessing important natural values: wildlife habitats, scenic, recreational and productive resources such as groundwater supplies and prime forest and/or agricultural areas.

- a. \* undeveloped islands
- b. \* extensive undeveloped shoreline
- c. \* habitat for rare, threatened or endangered species of flora or fauna
- d. scenic viewpoints of the lakes
- e. shorefront areas with potential for controlled public use
- f. established trail corridors for continued public use
- g. \* wetlands (specifically, buffers surrounding wetlands)
- h. \* deer wintering areas
- i. wildlife travel corridors
- j. productive natural resources

Note: \* critical wildlife habitat identified in Chapter 6

In order to prioritize land areas among and within the categories listed above, local conservation organizations and communities can use the following list of questions and issues (or a comparable list that they might wish to develop), in conjunction with mapping information provided in the Squam Lakes Watershed Plan.

- . How likely is an area to be developed? Is there a threat of conversion? Things to be considered include: existing zoning, existing ownership, future land use set out in town master plan, economic trends, surrounding land uses and local development trends.
- . How important is a land area to the community? Does it have recreational or historical values, or is it unique in some other way? Does it have significant productive resources, such as potential aquifers, surface water supplies, agricultural and/or forest soils? What is its relationship to other community properties? Is it identified as significant in local master plans?
- . Is a land area so unique as to be of statewide significance?
- . What is the relationship of an area's resources to larger resource systems extending beyond its boundaries, for example, riverine habitat, aquifers, wetlands, wildlife travel corridors? Is the area adjacent to land already dedicated to open space, so that a larger amount of contiguous area can be protected as a result if this land is protected? Is the area adjacent to an undeveloped area which has important resources but is not already protected?
- . What are the possible entities for management/monitoring of an area, once it is protected? What are the implications of protection - in terms of an organization or municipality's ability to monitor the parcel?
- . When choosing alternative measures to protect a land area, which one has the least cost/impact, while still doing the job?
- . How willing would landowners owning property within a significant area be to sell or grant rights to the land?

## Land Protection Candidate Areas

The following sections identify specific locations within the Squam Lakes watershed which are potential candidates for land protection efforts, based upon mapped information that has been provided in Chapters 3 through 7 of the watershed plan. This information includes 1988 land use/land cover, wildlife habitat, water quality, access, and productive natural resources data.

### A. Islands

Islands probably contribute more to the scenic experience on Squam Lake than any other land feature, and several are known to harbor important wildlife habitat, especially for bird species. Some Squam islands also have potential value for limited recreational activities such as picnicking, nature study and camping, and because of these many values, they are recognized as important candidates for land protection efforts. As the list below indicates, several entire islands, as well as portions of islands, are presently undeveloped, but are in fact developable, under current zoning. Outright acquisition may be appropriate in order to protect some of these islands, especially those that are home to threatened and endangered species.

- \* Long Island - 105 acres. This island, which spans portions of Holderness, Centre Harbor, and Moultonborough, provides nesting area for the great blue heron; the western and northeast section of the island is also known habitat for rare elements of natural diversity, as well as for the common tern, an endangered species in NH; salmon and whitefish areas are within close proximity to the island. Most of Long Island is presently undeveloped, and is developable under current zoning, which allows from 1.0-2.5 acres/lot. The island is presently unprotected, other than the northeastern portion, which has a degree of protection under current use.
- \* Bowman Island - 23 acres. This island, located in Holderness, provides loon nesting habitat; there is also a bass reef located off of the island's northern shore. Bowman Island is currently developable, at 2.0 acres or greater/unit, but much of the island is presently undeveloped, and none of it is protected.
- \* Kent Island - 13.6 acres. The eastern portion of this island, found in Moultonborough, provides loon nesting habitat, and is developable under current zoning at greater than 2.5 acres per development unit. Only its northern portion is not yet developed, and this area is not protected.
- \* Sheep Island, Holderness - 14 acres. The entire island, found in Holderness, is developable at 1.0-1.5 acres/unit, but none is currently developed, and the island has no protection at present.
- \* Groton Island, Holderness - 11.5 acres. The entire island, located in Holderness, is undeveloped at present, but is developable under current zoning. No protection for Groton Island is currently provided.

- \* Merrill Island, Holderness - 22 acres. The entire island, also located in Holderness, is currently developable at 1.0-1.5 acres/unit; it is not currently developed, and is in current use.
- \* Mink Island, Holderness - 1.2 acres.

#### **B. Undeveloped Shoreline**

Undeveloped shoreline areas in the Squam Lakes watershed should also be considered as an important focus for land protection efforts because of the variety of scenic and resource values these areas contain, and also because of their relative scarcity. Land use data compiled for the watershed as of 1988 indicates that there has been a noticeable decrease in undeveloped shoreline areas around Squam Lake since the previous land use data was analyzed in 1982.

It is recognized that even with improved local ordinances and regulations for watershed towns, shoreline areas may not receive the degree of protection they need. Zoning ordinances for local towns presently require setbacks for septic systems and houses. The proposed shoreland overlay district of 250 feet inland from shore is presented in Chapter 4 of this plan. Such a district, if incorporated into local zoning ordinances, would require, among other things, a 50 feet vegetative buffer around the Squam Lakes. In order to provide additional protection in those shoreline areas harboring critical loon and other wildlife habitat, the chapter recommended that local conservation commissions seek additional setback distances of natural cover around the lakes through conservation easements.

Listed below are the extensive lakeshore areas surrounding Squam Lake which are undeveloped at the present time, according to the 1988 land use data, and are developable under current zoning. These undeveloped shoreline areas are found on Maps 6-1 and 6-6 in the Wildlife Habitat chapter. They have no permanent protection (see Map 4-5), though some are in current use (see Map 4-14).

- \* Extensive area of Squaw Cove, Sandwich - Much of cove is shallow, and is therefore especially vulnerable to development. Present zoning requires 2.0 -2.5 acres per unit for development in this area. There is an extensive stream network - travel corridor area (Eastman Brook), which feeds the cove. Wildlife - loons, pied billed grebe and other water fowl are found here. Much of area is in current use but has no permanent protection.
- \* Portions of the area between Squaw Cove and Bear Cove, in Sandwich - Loon habitat. Some of the area is under conservation easement, but some is not. This area is also developable at 2.0 - 2.5 acres per unit.
- \* Long Point, Sandwich - Deer wintering area just north of the area; common tern, a threatened/ endangered species, spotted here. None of the area is presently protected, and much of it is developable, with zoning allowing a range of 2.0 acres to greater than 2.5 acres per unit, depending on the location on Long Point.

- \* Eastern section of High Haith, most of which is only in current use, and is developable at 1.0 to 1.5 acres per unit. There is a deer wintering area on High Haith, including this eastern section. There is also a shoreline area providing loon habitat, inland from High Haith along the southern shore of Bean Cove, down slope from Pine Hill in Moultonborough which has no protection, and is developable at 2.0 -2.5 acres per unit. The last time the bald eagle was sited in the Squam Lakes watershed was here, in 1977.
- \* Much of the outer portion of Centre Harbor Neck, as well as an inner portion of Neck which faces inner portion of Sturtevant Bay, in Centre Harbor. Most is in current use. Present zoning allows within a range of 1.0 -2.0 acres per unit for development. The area contains loon habitat, and there is a deer wintering area nearby.
- \* Area along northeastern portion of Dog Cove, which has no protection, and is developable at 1.0 - 1.5 acres per unit.
- \* Part of shoreline of Willoughby Point, directly north of Groton Island, which is in current use, and is developable under current zoning in Holderness at between 1.0 - 2.0 acres per unit.

#### **C. Habitat for Rare Threatened or Endangered Species of Flora or Fauna**

The chapter on Wildlife Habitat, provided a map of loon habitat areas within the Squam watershed. In addition, the Natural Heritage Inventory has indicated several areas which support habitats for significant plants and animals. These areas were shown on Map 6-5. In order to provide protection for these sensitive species, their specific names are not identified on the map. Seven of the areas are clustered together between Route 113 and Squam Lake in the area of the Rattlesnake Mountain peaks, indicating the particular significance of this area in the watershed. Those areas that are undeveloped should be a focus of attention for land protection efforts, as more is learned about them. The areas of known ecological significance are as follows:

- \* the southern bank of the Squam River in Ashland where it flows into the Pemigewasset River
- \* the northern-most point of Long Island in the Moultonborough section of Squam Lake
- \* the western-most point of Long Island in the Holderness section of Squam Lake
- \* Five Finger Point in Sandwich
- \* the eastern peak of Rattlesnake Mountain in Sandwich, including all elevations above 1000 feet on the mountain
- \* the western peak of Rattlesnake Mountain in Holderness, including the southwestern face of the peak above 600 feet

- \* an area in the center of Willoughby Point peninsula in Holderness, in between Route 113 and Algonquin Point
- \* a shoreline area on Willoughby Point peninsula in Holderness which is adjacent to Route 113 and the Carns Cove shoreline

#### **D. Scenic Viewpoints**

As noted in Chapter 7 - Access, views of the Squam Lakes and other scenic areas in the watershed allow a person the opportunity to feel a part of this wonderful area. Not all residents or visitors have the opportunity to get out onto the lakes themselves, so that a view of the lake may be all that they have in order to get an appreciation of the area, and a sense of perspective about the watershed. At present, however, there are a relatively limited number of scenic viewpoints of the lakes themselves, either from vantage points adjacent to the lakes or areas up-slope from them, where people are encouraged to stop and stay for awhile. A listing of existing sites is contained in Chapter 7 (see Map 7-1). This description lists 17 sites that provide scenic view points. Because of the probable high cost of outright acquisition of land which would provide panoramic views of the Squam Lakes, the use of conservation easements to protect existing and develop additional scenic viewpoints should be explored. In addition, local zoning and other regulatory measures which can be used to protect scenic views are described in Chapter 8.

#### **E. Lakeshore Areas With Potential For Controlled Public Use**

Chapter 7 indicated that despite existing access to the Squam Lakes, there is a need for additional access to the lakes. Because of the location of marinas at the western end of Squam Lake, this area presently witnesses the bulk of boating activity. Chapter 7 therefore recommends that 2 or 3 new public access points be developed within the easterly portion of Squam Lake, with consideration being given to both the northeasterly and southeasterly sections of the watershed. Lakeshore areas within these portions of the watershed that have potential for controlled public use should be carefully examined.

#### **F. Established Trail Corridors for Continued Public Use**

Trails play an important role within the Squam Lakes watershed in providing hiking, hunting, camping, access to waters and outdoor education for residents and visitors to the area. Map 7-1 indicates the location of trails within the watershed. The Squam Lakes Association has recently focused on the following issues which relate to these trails: relative importance and use of principal trails; problems and costs of trail management and maintenance; ownership; access (parking); and environmental impact and legal issues concerning public usage. It is recognized by the SLA and others that trail traffic in the watershed is increasing, and that there needs to be a clearer definition of the proper use of those trails, so that those uses can be protected, and others not permitted.

Local conservation organizations and communities have recognized that permanent public rights to the use of all principal trails in the watershed need to be obtained, if these areas are to be adequately protected on a long-term basis. It is hoped that owners of trail lands will give serious consideration to donation or sale of permanent trail-corridor easements to public or non-profit agencies.

#### **G. Wetlands Buffers**

There has been discussion throughout the Squam Lakes Watershed Plan concerning the importance of wetlands, and as previously indicated, these areas already receive a certain amount of protection through State and local regulations. All towns in the watershed prohibit development in wetlands based on soils considerations, thus discouraging development from being located in and around these areas. Through wetlands protection ordinances, two watershed towns, Centre Harbor and Sandwich, have additional protective requirements or higher standards within wetland areas. Chapter 8 of the Squam plan recommends adoption of similar ordinances by other watershed towns. In comparison, protection of important riparian buffer areas surrounding wetlands is not addressed in these local regulations, though the importance of these areas in protecting water quality and providing wildlife habitat is well understood. Wildlife biologists recommend a 300 foot buffer based on habitat considerations.

It is appropriate for municipalities in the Squam watershed to consider conservation easements as a way to provide specific protection for these buffer areas around wetlands. Local wetlands inventories and/or Prime Wetlands designation have already been completed by some watershed towns, and should be undertaken by others. The most important wetland systems should be identified, and conservation commissions and/or local conservation organizations should consider purchase of easements for riparian buffers of these areas.

#### **H. Deer Wintering Areas**

The importance of deer wintering areas in helping the species to survive the harshness of New Hampshire winters was previously described in Chapter 6. An important element in protecting these areas would be to prioritize the most important deer wintering areas in the Squam watershed, with a major consideration being their proximity to other important habitat areas, such as stream corridors, wetland buffers, and especially those habitat areas that already receive permanent protection. Conservation easements could then be used by either local conservation commissions or conservation organizations to provide permanent protection for wintering areas. Deer wintering areas are also occasionally acquired by the Fish and Game Department.

A key recommendation in the Wildlife Habitat chapter described regulatory methods by which planning boards in watershed towns could indirectly benefit wildlife habitat such as deer wintering areas. It was recommended that towns adopt the mapped information on these and other areas as amendments to their master plans, and refer to it when working with applicants through local subdivision and site plan review processes. The information would thus serve to educate both town officials and developers about the importance of deer wintering areas. Another important recommendation of the chapter was that planning boards should consult



with the Fish and Game Department and other wildlife professionals concerning wildlife habitat such as deer wintering areas. The use of open space provisions of cluster zoning as a vehicle for protecting these areas was also addressed in the Wildlife Habitat chapter, and is important to restate here.

#### **I. Wildlife Travel Corridors**

As indicated in Chapter 6, there is little information available concerning known wildlife travel corridors within the Squam Lakes watershed. The chapter therefore recommended the development of a strategy to conserve travel corridors which focuses on the habitat types already identified as critical and significant earlier in the chapter: stream corridors; wetlands and their buffers; deer wintering areas and adjacent blocks of contiguous forest; lakeshores and islands; and abandoned pasture/cropland and woodland edges. As noted in the Wildlife Habitat chapter, an important consideration in identifying and protecting travel corridors is determining their proximity to areas of critical and significant habitat that are already protected. In this way, land protection strategies can work to connect and add to large protected blocks of habitat.

It is therefore important that local watershed towns incorporate the wildlife habitat maps in Chapter 6 into town master plans, and carefully analyze and field check these maps with Fish and Game Department personnel in order to determine likely corridors for wildlife in the watershed. The mapping of protected lands in the watershed that is being developed by the Squam Lakes Association can then be used to determine the proximity of these corridors to areas that have already been protected. As with information on deer wintering and other habitat areas, this information could be used in various ways by local towns. It could be used in developing provisions for open space as part of a cluster development, and could also be used by planning boards in working with applicants through local subdivision and site plan review processes.

The way in which a particular corridor is protected will depend on the kind of land area that comprises the corridor. The regulatory techniques described above could indirectly protect a variety of habitats that provide corridors. Examples of non-regulatory techniques include protection of stream corridor and wetland buffers by conservation easements, and protection of edges of woodland/agricultural edges through the use of current use taxation.

#### **J. Productive Natural Resources**

Chapter 4 identified areas within the watershed which because of their productive natural resources, - forests, agricultural areas, and potential surface water or groundwater supplies, should be conserved. Watershed towns and others interested in the long term availability of these resources can make use of the information developed as part of the Squam Lakes Watershed Plan to determine the degree of protection they presently have, and what might be required.

Chapter 4 indicated that there are relatively few potential water supply areas in the Squam watershed. The Jackson Pond subwatershed serves Ashland as a surface water supply, and the Cotton Cove Brook and Owl

Brook subwatersheds, along with a few other areas, were identified as containing potential groundwater supplies. Protection of these areas was recommended through the use of overlay zoning, as well as through cluster zoning and other innovative land use controls. Acquisition of the Jackson Pond subwatershed may be an appropriate action to protect Ashland's surface water supply.

The relative scarcity and importance of agricultural lands is generally noted in master plans of the watershed towns. Their importance is recognized not only as potential food sources, but also in maintaining rural character, scenic views, and wildlife habitat. Agricultural areas that are presently unprotected could also be protected through open space provisions of cluster zoning, and of course, obtain a degree of protection through current use taxation.

Municipalities as well as non-profit conservation organizations should use Map 4-9 in Chapter 4 - (Agricultural Soils/Land Use), as well as the Upland Habitat map in Chapter 6 which denotes abandoned pasture/open fields, to: identify land that is presently used for agricultural purposes; identify abandoned pasture and agricultural land that has not yet returned to forest; and identify prime agricultural soils and their location, especially relative to areas that are already cleared. The immediate focus should be on protecting those areas with good soils that are presently idle, and are therefore especially vulnerable to development.

Protection of productive forest areas in the watershed might best be accomplished by first focusing on those areas classified as IA and IC by the Soil Conservation Service. Class IA soils are the most productive soils in the watershed, and have the fewest management limitations for hardwood production. Class IC soils are best suited to softwoods because they have less competition from hardwood species, and also have few other management limitations. A particular forested area would need to be field checked if it were being considered for protection, because the SCS acknowledges that the mapping classifications are fairly generalized. Watershed communities could use this kind of information in determining where to locate Town Forests. The information could also be used by the Society for the Protection of New Hampshire Forests, and/or the New England Forestry Foundation, if they were seeking to obtain land or easements in these especially important forest areas.

Special forest management practices should be used on the large forest tracts in the watershed. In this way, sensitive wildlife species such as black bear and forest interior birds, which require a fairly large amount of undisturbed habitat, will receive a degree of protection. If forests in these areas are managed, an uncut buffer along streams, shorelines and roadsides should be retained. As the Wildlife Habitat chapter indicated, the wider the buffer for these areas, the more protection it provides, especially for forest interior birds.

#### **Appropriate Entities to Negotiate Future Agreements, Acquire and Manage Sites**

The various public and private entities that are concerned with protecting important land areas within the Squam Lakes watershed most likely have somewhat different priorities. Past efforts by these organizations perhaps reflect what these priorities have been. But as these entities have probably experienced, they can benefit from working cooperatively. Such cooperation can result in better use of limited financial resources, sharing of varying levels of expertise on land protection techniques, and sharing of responsibilities, in terms of both

acquisition as well as management of important areas. A cohesive, cooperative effort would also increase the likelihood of managing an area to achieve a number of goals at the same time. For example, through collaborative efforts, an acquired forested area in the watershed could be managed for multiple uses, including wildlife habitat protection, hiking trails, educational opportunities, access to views, etc.

### **Local Conservation Organizations**

As was clearly indicated by Table 10-1, local conservation organizations in the Squam Lakes watershed have already played a major role in negotiating land protection agreements, and as a result, a sizeable amount of acreage has been protected through acquisition and/or conservation easements. The active involvement of these local organizations in the present planning process for the Squam Lakes watershed reflects their commitment to continue such efforts. As compared to public entities, these organizations have the advantage that they can act more quickly to acquire land/easements, and can be more flexible as to the kinds of agreements that can be negotiated. They also may be better able than government entities to focus their efforts on particular geographic areas, or types of land areas, if that is desired.

What follows is a brief description of local conservation organizations that have an important role to play in future land protection efforts in the Squam Lakes watershed.

Squam Lakes Association - SLA created a trust fund about 20 years ago to help protect land threatened by development that could prove harmful to the Squam Lakes. SLA had earlier provided financial assistance to local town boards in order to protect Squam wetlands and shoreline areas from development that would have harmed them. SLA purchased Moon Island in 1986, in order to preserve its natural conditions, protect loon nesting sites, and provide the boating public with continued use of a recreational resource.

Squam Lakes Conservation Society - The emphasis of this organization, which came into existence in 1968, has been to preserve those wildlife areas on Squam Lake and in the watershed that "allow nature to maintain its pristine condition and beauty." As indicated in Table 10-1, the Society has donated a number of areas, such as the Unsworth Preserve in Moultonborough, and has also obtained several conservation easements, for example, a recently acquired conservation easement for the bulk of acreage of Great Island. SCLS also has reverter interest on two much-loved areas in the Squam Lakes watershed, the West Rattlesnakes Area and Five Finger Point, in order to insure that they are forever protected against development. The official owner of the two areas is the University of New Hampshire, which donated them for educational purposes.

Lakes Region Conservation Trust - Organized in 1979, this local organization has two important goals: to protect lands in the Lakes Region that have significant wildlife, scenery and other conservation values; and to educate people about the natural heritage of the region, as a complement to land conservation work. LRCT's focus in the Squam watershed has been on obtaining conservation easements, as exemplified by a recently negotiated agreement for a 200 acre parcel located south of the East Rattlesnakes.

Loon Preservation Committee - As part of its work in protecting loons and loon habitat in the Squam watershed, the LPC provides information and management expertise about loons to organizations and individuals interested in obtaining conservation easements for loon habitat areas. According to the Committee, which on occasion will purchase an easement themselves, "the conservation easement is the most valuable tool we now have at our disposal to protect loon habitat. Individuals need only recognize that their land is valuable as loon habitat, and give over management for the land to a suitable organization, such as a town conservation commission."

### **Non-local Conservation Organizations**

New England Forestry Foundation - As part of its Memorial Forest Program, the New England Forestry Foundation is actively involved in the preservation of woodlands. The program is set up to enable forest landowners to donate property as memorial forests, so that the land will be preserved for future generations, and will be managed for multiple-use purposes, including timber, wildlife, and recreation. Within the Squam Lakes watershed, the foundation owns the Chamberlin-Reynolds Forest in Centre Harbor, and the Stevens Memorial Forest in Ashland and Holderness, maintaining them both to serve as examples of good forest management. The Foundation also provides technical assistance to landowners as well as public education in forestry.

Society for the Protection of NH Forests - The goal of the Society is to protect productive forest land, agricultural land and other land with significant ecological, scenic or recreational value. It owns and manages lands that are received by gift or purchase, and monitors numerous easements throughout the State. One such easement, the Gray-Twombly easement, is located in Centre Harbor, in the vicinity of Dog Cove. The Forest Society has a well established land protection program, and its staff can provide expertise to local groups and landowners who wish to develop as well as implement land conservation plans.

New Hampshire Audubon Society - Priorities of Audubon in terms of land protection are: 1) land providing extremely valuable wildlife habitat, especially for threatened and endangered species, migratory water birds and non-game species; 2) land with a high degree of habitat diversity, and which has had a minimal amount of disturbance or development; 3) land of substantial acreage which has a high potential for educational use. The Society acquires land and easements through gift, trust and purchase. Land owned by the NH Audubon Society within the Squam watershed includes the Proctor Sanctuary, located in Centre Harbor.

The Nature Conservancy - The Nature Conservancy is a national organization which is exclusively committed to the identification and protection of ecologically unique natural areas, and areas of biological diversity. The organization is based in Washington, D.C., and opened a regional office in Concord, NH in 1984. TNC targets its protection efforts through a ranking system which determines an element's relative rarity throughout its range. Recommendations for a State heritage program were developed by the Conservancy in 1981, and the Natural Heritage Program was subsequently established within the Department of Resources and Economic Development in 1986. The Heritage Program's focus is on protecting the prime examples of the State's natural diversity, using the inventory system the Nature Conservancy has developed.

## Local Government

Previous chapters of this plan have described the various reasons why local towns in the Squam Lakes watershed may wish to act to protect important land areas, and the plan goes into detail as to the kinds of regulatory methods that can be used either directly or indirectly to accomplish this. Local towns can also provide protection for important areas in the watershed through acquisition or easements, and can achieve a number of goals, for example: provision of recreational access to public waters for town residents and visitors; multiple-use management of a Town Forest; protection of prime wetland areas that have been identified. The conservation commission is the branch of local government which takes the lead in land protection at the local level. Under RSA 36-A:4, it is authorized to acquire land or an interest in land in the name of the municipality for conservation purposes. The Current Use Program can and is being used within the Squam watershed to protect important agricultural and forest land, and possible funding which would allow the towns to purchase some of these areas might be provided by fees collected when lands are taken out of the current use program. Other methods by which local towns can obtain funding for land protection efforts are described on page 10-17.

## State Agencies

Land Conservation Investment Program (and private partner, The Trust for NH Lands) - LCIP is the public partner of the Trust for NH Lands, a private organization made up of conservationists, business people, government officials and private citizens. The partnership between the two organizations was created as a five year, \$50 million program, with a goal to protect 100,000 acres of New Hampshire's best natural areas for conservation and recreation, and also to help local communities identify and preserve lands that are integral to their character. Most of the LCIP/Trust projects have been accomplished through the use of conservation easements, though land acquisition has also been used. A priority of the program has been to allow farms and forest to remain productive by assuring that they will never be developed or subdivided to the point where farming or forestry will no longer be economically viable. To date, the LCIP/Trust for New Hampshire has been able to protect more than 90,000 acres of land in New Hampshire.<sup>3</sup> The last round of grants is presently scheduled to end in December, 1990, and the program will shut down in early 1992.

Department of Resources and Economic Development - Parks and Recreation Division and Forests and Lands Division - These two divisions are primarily concerned with acquiring the following kinds of land: 1) land with water frontage on a public access to great ponds and rivers; 2) inholdings in existing State parks and forests; and 3) land with unusual features such as archeological or geological features. The Department is eligible to receive federal Land and Water Conservation Funds for some acquisition projects.

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<sup>3</sup> Land Conservation Investment Program Bulletin, 1990.

NH Fish and Game Department - This State agency acquires land and conservation easements on land that is of special value to fish and wildlife. Such areas include those that provide access to public waters, potential or existing waterfowl marsh areas, large upland tracts, particularly upland tracts which contain deer wintering areas and critical habitat for threatened or endangered wildlife species.

NH Department of Agriculture - The Agriculture Department has overseen the acquisition of agricultural land development rights in the State under a program initiated in 1979 by the Legislature by two appropriations totalling five million dollars. Thus far, 2500 acres of prime farmland have been protected through the purchase of development rights by the State. Further protection of farmland will require new legislative funding.

Water Resources Division, the Department of Environmental Services - The Water Resources Division is authorized to acquire land, flowage rights, water rights, and mill privileges under NH RSA 484:36. NH RSA 484:4 authorizes the Division to "recommend acceptance to the Governor and council of gifts or grants of real estate, or any interest therein, contiguous to inland public waters, rivers or streams, when it is determined to be in the public interest."<sup>4</sup>

### Funding

Towns in the Squam Lakes watershed can obtain funding for land protection through federal, State or local means. Federal funding flows most directly to communities through the Land and Water Conservation Fund, which is administered in New Hampshire by the Division of Parks and Recreation in the Department of Resources and Economic Development. This fund pays for up to 50 percent of the appraised fair market value of lands acquired by municipalities, school districts or the State for conservation and recreation. In recent years the available LWCF funds have been reduced to approximately \$100,000 per year.

Federal funding for land protection also flows through the New Hampshire Fish and Game Department, under the Pittman-Robertson, Dingell-Johnson, and Wallop-Breaux Acts. Together these are able to pay 75 percent of the appraised fair market value of land purchased by the Department. If a town is unable to purchase a piece of land that needs protection because it is valuable wildlife habitat or provides access to public waters, it may be worthwhile to encourage the Fish and Game Department to purchase the property. Money may also be available through the State Waterfowl Conservation Fund for the State to purchase wetland and waterfowl areas.

State funding for public land protection is funnelled primarily through the Land Conservation Investment Program, under RSA 221-A, in conjunction with the private Trust for New Hampshire Lands. Under RSA 36-A:4, local conservation commissions are authorized to acquire land by using local conservation funds. The commission is required, under RSA 36-A:5 to hold a public hearing before using the conservation fund to acquire land or easements. Private funds available for communities to acquire various kinds of conservation

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<sup>4</sup> NH Office of State Planning and Society for the Protection of NH Forests, *Land Protection and Tax Advantages for NH Landowners*, April 1987.

lands include the Environmental Loan Fund, managed by the Society for the Protection of New Hampshire Forests. Other funding is available through the New Hampshire Charitable Fund, which administers a similar environmental loan fund as well as other land protection funds such as the Natural Areas Conservation Fund. This fund provides small grants for land protection projects. Money may also be available through the Charitable fund for specific conservation commission projects.

### **Land Protection Techniques**

Educational efforts can be and need to be devoted to informing landowners about the acquisition methods that are available. Landowners in the watershed should also be kept informed as to whether there are special elements occurring on their property that are important to consider protecting, and they should also be informed of economic and other advantages of protecting their land on a permanent basis.

#### **Donation, Bequest, or Purchase**

**Donation** - This method involves giving land or partial interest in land, such as conservation easements, to a non-profit conservation organization or government agency which is a qualified recipient of tax deductible contributions. The IRS has very specific requirements of an organization that is able to accept tax-deductible land donations. Under the IRS code 501 (c) (3), a tax deductible contribution can only be given to an organization that has achieved 501 (c) (3) status. The choice of recipient is a function of the landowner's preference and the interests of the recipient organization. The entity receiving the land is responsible for managing and maintaining it in a manner which is consistent with the terms of the agreement between the donor and recipient organization. Such terms generally provide for conservation of the property's natural resources and often provide for public use and enjoyment. Donating land to a government agency or conservation organization insures its long-term protection, and may provide the donor with a number of tax benefits. Such benefits include federal income tax deductions, estate tax reductions, and relief from property taxes. A donation takes immediate effect because full title and ownership are immediately transferred. This method allows maximum tax advantages for the landowner, because the charitable gift deduction is generally based on the full market value of the property.

A landowner may also choose to transfer ownership of a property now, but retain the right to occupy and use the land until his/her death or the death of a specified successor. The owner's interest is known as a life interest. The use of the land while the landowner is alive depends on the agreement made between the landowner and the recipient of the land. The recipient gets clear title upon the death of the holder or successor of the life interest. This land acquisition method is more secure than a bequest because the gift occurs immediately. Details of the agreement can be worked out by the parties involved in the land transaction, rather than the estate's executors. One shortcoming of this method is that the tax advantages for the donor are not as great as those involved with an outright donation.

Bequest - Land can also be donated by a bequest. In this situation, the gift takes effect after the donor's death. Although there is no income tax deduction with this method of land protection, estate taxes are reduced because the land is removed from the donor's taxable estate when that person dies. A bequest also allows the land donor to assist in the development of a plan for its ultimate care, while retaining full control over the land for life.

Purchase - Purchase of a piece of land may be appropriate when the landowner is willing to sell, but is unable to provide the land as a gift. Many landowners sell property at a "bargain" price, which gives them sufficient cash for their needs and a tax deduction for the balance of the land's full market value. Funding to allow communities to purchase important land may be available through federal, State or local governments, or a combination of these three sources. Public funds are generally not available to private non-profit organizations, but the latter can be helpful in providing matching dollars. Some foundations also have money for conservation land acquisitions.

Fee simple acquisition of a piece of land, whether by donation, bequest, or purchase, insures that all possible uses and rights associated with the land are acquired. Less than fee simple acquisition, such as conservation easements (described below), involves the transfer of the development rights, mineral or other rights, only, leaving the remaining property rights with the landowner.

#### Easements, Deed Restrictions, and Covenants

Conservation Easements - Conservation easements involve the transfer of some, but not all of the possible uses and rights associated with a piece of land. They may be received by donation or purchase. They can be used to protect outstanding conservation lands whose preservation will provide a significant benefit to the general public. Such easements allow long-term protection of a piece of land, while allowing a landowner to retain ownership and control. They place perpetual restrictions on the use of a piece of land. Easements are frequently written to prohibit development or commercial use of the land, but can also be used to encourage certain kinds of land use, for example, good forestry and agricultural practices. Though best management practices are not required, they may be included in an easement if the landowner desires, along with specific obligations of the recipient for monitoring and enforcement of such practices. A vital component of a conservation easement is that it provides for long term enforcement of the easement by the recipient, conservation group or government agency. This entity must establish a regular monitoring program and provide for potential legal enforcement.

The terms of an easement can be designed to suit a landowner's particular property and situation. They must satisfy certain purposes defined by the IRS if a landowner plans to make a donation and take a charitable deduction based on the value of the easement for income tax purposes. The restrictions in the easement are permanent. They run with the land and are binding on all future owners. The grantor may ask for a cash donation to offset the future costs of enforcing the restrictions in the easement.



The Internal Revenue Service has established criteria for the kinds of easements which qualify as charitable deductions.<sup>5</sup> They include those which do the following:

- 1) preserve land areas for outdoor recreation by, or education of, the general public (e.g. forest land parcel used for cross country skiing);
- 2) protect a relatively natural habitat of fish, wildlife, or plants, or similar ecosystem (e.g., wetland, site harboring rare plant);
- 3) preserve open space where such preservation is for the public's scenic enjoyment or pursuant to a clearly delineated public policy and yields a significant public benefit (e.g. locally or regionally identified important productive farmland or forest land, ridgeline viewable from public places, parcel in area of town designated by the master plan as worthy of conservation);  
or
- 4) preserve an historically important land area or certified historic structure.

The easement must also convey a public benefit. Some of the factors which determine its public benefit include:

- (1) uniqueness of the property
- (2) intensity of development in the area
- (3) consistency of easement with public programs for conservation; or
- (4) opportunity for public to enjoy the use of the property or appreciate its scenic values.

Covenants - Unlike easements which are permanent and benefit the general public, covenants benefit adjacent property owners and are not necessarily permanent. Covenants may be appropriate where the protected conservation values are locally important but not significant enough to warrant a conservation easement. Mutual covenants can be developed when a group of landowners is concerned about protecting a common open space area. This could either be an area that is collectively owned, a scenic view that is shared, or lake frontage which is collectively owned. For example, lakefront residents can sign mutual covenants which prohibit construction within a setback or common open area around the lake. Each landowner's covenant is enforceable by the other landowners, as well as their heirs and

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<sup>5</sup> NH Office of State Planning and Society for the Protection of NH Forests, Land Protection and Tax Advantages for NH Landowners, April 1987, p. 7-8.

successors. There is, however, no agency which enforces the covenants, as there is in the case of conservation easements. There are also no tax deductions allowed for mutual covenants. Finally, covenants may not be permanent since they can be nullified by civil action if a court in the future finds that the conditions of the original covenant are no longer applicable.<sup>6</sup>

Deed Restrictions - The selling of land subject to deed restrictions, otherwise called a restricted sale, is a land protection technique which is also less secure than a conservation easement. The longevity of a deed restriction is up to the landowner, and is dependent on the landowner's presence in the area and diligence. As with the mutual covenants, if the restrictions are no longer applicable, a court may nullify them.

Leases - This land protection method is especially appropriate for productive land. A landowner in this situation can lease part of his land to a farmer. The land will therefore be kept in production, and will provide income to defray property taxes. Development will not take place for the term of the lease. A lease protects land against development only if its term is very long and lasts for years after the lessor's death. Still, it is only a temporary obstacle to development. The approach has limited applicability in New Hampshire.

Right of First Refusal - With this kind of agreement, a landowner wishing to sell his land agrees to provide a conservation commission, private environmental organization, etc. with the first opportunity to buy the parcel. This provides no protection until the owner intends to sell. Upon exercise, it usually results in the conservation group having to pay top dollar to buy the land.

### Current Use Assessment

The Current Use Assessment Program, authorized by NH RSA 79-A, provides for reduced local property taxes for land that remains as open space. The amount of the property tax reduction is determined by the category in which the land is placed in current use. The categories include: parcels of field, farm, forest, wetland, and recreation lands which are 10 acres or more; "natural preserves" of any size; and farmland generating revenues of more than \$2,500 dollars annually. The land's status in current use remains with the land, even if sold, until the use of the land changes. If the use of the land is changed to any use not eligible under RSA 79-A, the then current owner is assessed a land use change tax equal to 10 percent of the fair market value of the property at the time the change occurs.

Also under RSA 79-Aa, "discretionary easement" can be applied to a property which is less than 10 acres in size and does not fit the criteria for current use assessment. Such an easement lasts for a set number of years. It must receive approval from the local planning board, the selectmen, or, if in a city, by the mayor and council.

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<sup>6</sup> Ibid, p. 10.

## Recommendations

### Priority Areas for Land Protection

Both private, non-profit conservation groups and local conservation commissions within the Squam Lakes watershed should consider islands, shorelines, wetlands and wetland buffers, unique natural areas, habitat for threatened or endangered species, and wildlife travel corridors as priority areas for their land acquisition programs.

Conservation commissions and conservation organizations in the watershed municipalities should utilize the maps contained in this plan which show important wildlife areas, unique natural areas and other features not currently protected, as one source of information in developing priorities for their land acquisition programs.

Communities in the watershed should consider dedication for open space acquisition of penalty fees that are returned as a result of land being removed from the Current Use program.

The Squam Lakes Association, town conservation commissions, the Appalachian Mountain Club, and appropriate State agencies should join together to provide information and encouragement to trail landowners to donate or sell permanent trail corridor easements to public or non-profit agencies.

Each preserved open space area (including public use areas) should be designated and marked with signs, identifying them as components of a Squam Lakes Reserve. Reserve properties could include private lands under easement (with the owner's consent), and various nonprofit and public ownerships. Public information should be developed about use areas in the Reserve in order to promote broad public recognition of and respect for preserved lands.

## **Chapter 11. Education**

### **Environmental Education for Young People**

The Squam Lakes watershed provides a magnificent opportunity to learn about the natural environment. The watershed is located in a way that makes it fairly easy to visualize and focus upon, which can help young people to understand what the watershed is, and what needs to be done to take care of it. A major strength of environmental education opportunities in the watershed is the presence of numerous natural areas within reach of local schools which can provide outdoor learning situations, for example, the Science Center of New Hampshire, the Unsworth Preserve, Five Finger Point, The Rattlesnakes Natural Area, New England Forestry Foundation properties and Moon Island.

Weaknesses in present environmental education have more to do with formal education opportunities in the watershed. This was indicated in a survey which the Science Center did early in 1989, in cooperation with the Office of State Planning. Surveyed were schools which provide education for young people, including 5 area high schools and 7 elementary schools. One hundred and twenty survey forms were distributed to elementary and high school science teachers, and a total of 45 elementary teachers and 16 high school teachers responded. The schools surveyed included: Ashland Elementary School and High School; Holderness Center School; Interlakes Elementary School; Lang Street School; Sandwich Elementary and High School; Moultonborough Central School and Academy; New Hampton Elementary School; Newfound High School; and Plymouth Area High School. Half of the survey questions were directed at investigating what environmental and water related issues are currently included in the schools' curricula. Other questions dealt with concerns regarding science field trips.

The survey indicated that in general, elementary and high school curricula dealing with environmental issues which relate to the Squam Lakes and their watershed are implemented on a more or less "hit or miss" basis, with no consensus as to what is being taught or at what level. Environmental education is not an important priority in any but a few classes, where an individual teacher makes an effort on his/her own. Seventy percent of teachers said they taught environmental education subjects at least once per season. Of those 70 percent, 4 percent of teachers said they did this on a daily basis, while 10 percent did it on a weekly basis, and 20 percent said they taught these subjects on a monthly basis. Four percent of the teachers surveyed said they never taught environmental subjects in their classes.

When asked if they taught students about water quality issues, only 15 percent of teachers responded that they did. Subjects taught which were mentioned by two or more of the teachers were water pollution, water use, acid rain, and the water cycle. Twelve percent of elementary teachers said that they presented the watershed concept to their students, while 69 percent of high school teachers said they presented the concept.

Though the survey indicated little consensus as to what was being taught, in terms of water quality issues, it did indicate a healthy interest among teachers on the subject of water quality. When asked what kind of background environmental information they would be interested in getting, teachers listed this information in the following order: curricula dealing with water; information on water use; water quality information; water laws; water testing information. An important finding was that 68 percent of elementary teachers and 92 percent of high school teachers said they would be interested in taking part in a program dealing with watershed and water issues if a curriculum was developed, and money and time were available to implement it.

In fact, there are a number of environmental education programs that have been developed in New Hampshire which could provide supplementary curricula concerning water quality and other important environmental issues for teachers, but they are not used nearly to the extent that they could be. The survey strongly indicated that the gap between what educational material is available and what is used is due for the most part to a lack of money and time available to local schools and teachers to implement such programs. According to the Science Center of New Hampshire, "budgetary constraints prevent most classes from bringing in outside resource people or participating in regular field trips, even though practically all of the schools in the Squam watershed have access to natural resources which should be close enough for class use."

Formal published curricula were by far the most important educational materials utilized in the science teaching of those teachers who responded to the survey. Unfortunately, it is this kind of curriculum which is likely to be least open to modifications such as those which would be able to integrate watershed issues. One reason for this inflexibility is that textbook editors must be persuaded that there is a large enough demand to warrant the development of this kind of material. Because New Hampshire is a small state, and has no official statewide science curricula, requests for such educational materials are likely to be overlooked. But on the other hand, because there is no State mandated science education curriculum, individual school districts and teachers have more flexibility as to what and how they can teach their students. There is therefore more opportunity for supplementary environmental curricula, including those that deal with watershed issues, to be introduced into schools within the Squam Lakes watershed.

The following is a list of formal and informal environmental educational programs available within the watershed at present, at either the local, regional or State level.

## **Local Programs**

### **Science Center of New Hampshire**

Schools in the Squam Lakes watershed are very fortunate to have the Science Center within close proximity to them. For the last 20 years it has provided an excellent opportunity for young people to learn about their natural environment. The Center is open to the general public and to more than 25,000 school-age students from across the State who visit every year. It sees it's role as providing a catalyst for further learning which should take place in school.

The Science Center has been involved in teaching watershed related issues as part of its mission. Field trips which it organizes at the Center itself, and for local natural areas provide environmental education opportunities for a number of schools in the watershed. The Center itself has a trail which has exhibits on pond life, wetlands and the common loon. There are also several education programs which deal directly with water ecology. A class which explores pond populations and the relationship of species diversity to water quality is available to students in grades 3-6, and there is also a popular lake ecology program which focuses directly on the Squam Lakes and their watershed. As part of this program, middle and high school students get out on to the lakes on the Science Center's 28 foot "floating lab". While there, they collect and analyze plankton and other kinds of water samples. Science Center personnel feel that if through experiences like this, young people can become interested and excited about what they learn about, they will be more likely to care about what happens to their environment. At some later point, they will then be more likely to go on to learn more of the technical information that will be necessary in order to understand and ultimately manage and protect their watershed.

Though outreach to local schools is not a major part of the Science Center's program, and though the majority of educational opportunities are provided at the Center itself, there are also off-site educational activities available. For example, in addition to the Limnology program, the Science Center has put on some presentations at local schools, for example, one that was done in New Hampton for 4th graders.

### **Loon Preservation Committee**

New Hampshire Audubon Society has developed, through the Loon Preservation Committee, a two month educational unit. There is one session per week, including general loon ecology and the philosophy of loon management existing in New Hampshire. This unit is specifically designed for sixth and eight graders, but flexible enough to be used by other age groups, within a variety of school curricula.

## **Lakes Region Conservation Trust**

This organization runs various summer education programs, within the Lakes Region, though not presently on Squam Lake. The organization receives national sponsorship for much of their work, from the National Science Center for Youth Foundation.

## **Regional Programs**

### **Merrimack River Watershed Education Project**

This program is coordinated by the NH Fish and Game Department, through its Aquatic Resources Education Program. Designed to teach high school students about watersheds as well as the monitoring of water quality, a fundamental goal of the program is to make this kind of education available to every high school in the Merrimack River watershed. Eleven high schools in the watershed are presently involved with the project, and five additional schools are soon to join. Its curriculum is based on a watershed program designed at the University of Michigan. Teachers from the eleven schools have also provided additional input as to the specific design of the curriculum. Training for these teachers has been provided by Fish and Game, in conjunction with DES's Water Supply and Pollution Control Division and Cooperative Extension's Water Quality Program.

The curriculum implemented last year had students in each of the schools first learn about the concept of a watershed in the classroom, as well as the particular history of the Merrimack watershed. This was followed by instruction in water quality testing, and then by actual monitoring of sites on the Merrimack River and its tributaries. Student representatives from each school then met three weeks later to share the data they had collected, and to discuss issues that are facing the watershed.

## **Programs Available Statewide**

### **New Hampshire Waters**

This is a supplementary environmental education curriculum about water resources which was developed by Cooperative Extension, and is geared toward schools and youth organizations in New Hampshire. The program parallels a water quality education program which Cooperative Extension has developed for adults. The curriculum has six parts, which include: Basic Principles of Water; the Hydrologic Cycle; Groundwater; Surface Water; Water Supply and Conservation; and Household Products. Printed material is provided as part of the basic curriculum. Cooperative Extension also loans schools additional materials to help students visualize and understand water resource concepts discussed in the curriculum. These materials include such things as videotapes and a 3 dimensional groundwater flow model.

The following programs have also developed broad based supplementary curricula concerning a variety of environmental subjects. Watershed schools can obtain support for sending their teachers to these workshops through the Department of Education, if the schools have submitted a staff development Title II plan.

**Project WILD**

Administered by the NH Fish and Game Department, this program provides teacher training with an interdisciplinary curriculum which focuses on wildlife and their habitat.

**Project WILD Aquatic**

Also administered by the NH Fish and Game Department, the program provides teacher training with an interdisciplinary curriculum which focuses on wetlands.

**Project Learning Tree**

This program is administered by the Society for the Protection of New Hampshire Forests, and is coordinated by the Science Center of New Hampshire. Its curriculum focuses on forests - their management and protection.

**New Hampshire Audubon Society**

Audubon has several educational programs - on wetlands, wildlife habitat and other related fields. It has recently developed a pilot program in 4 districts, entitled "Awareness to Action".

**Project Conserve**

This is the Forest Society's primary education program in the public schools, and is geared to 4th and 5th grade classes. It is a multi-part program taught by SPNHF docents, that looks at resource conservation issues.

**Growing, Going, Gone: Land Use Planning for the Future**

This is a multi-part program for high school students taught by SPNHF docents, which includes a community based project.



## **Environmental Education and Public Information for Adults**

As is the case for young people, there are strengths but also weaknesses in present environmental educational programs for adults in the Squam Lakes watershed. The strengths again include the availability of the Science Center, along with other natural areas within the watershed, such as the Unsworth Preserve, Five Finger Point, The Rattlesnakes Natural Area, the New England Forestry Foundation property and Moon Island. Educational and interpretive programs at some of these areas have been very beneficial in teaching adults, both residents and visitors an appreciation of the watershed's resources. Hopefully the influence of these programs will continue and possibly increase in the future. Over time, it is becoming increasingly important to develop a broad constituency, both local and non-local, which is aware of the natural heritage present in the Squam Lakes watershed, and which has specific knowledge about elements of this heritage and the need to protect them. Educational and interpretive programs available at natural areas in the Squam watershed can help to develop this constituency. In effect, the programs can become an important part of watershed management, because the positive attitudes they inspire motivate people to learn about, and then to protect what it is that they have come to appreciate. The only present weakness in this kind of adult education is that most likely, those people who have already taken advantage of existing educational opportunities "already believe in the message."<sup>1</sup> Such people are likely to represent a relatively small percentage of the Squam Lakes watershed population, but this is also generally the case for other watershed populations throughout New Hampshire.

An area where more information needs to be provided to the public, whether they be year round residents, seasonal residents or visitors, concerns recreational access opportunities in the area. Equally important, this public information needs to help those who use and enjoy the watershed to understand the consequences of their recreational activities, including possible negative impacts on the environment. Information such as this should describe: what recreational areas are available to the public; how to get to "public" access and other access areas along lake shorelines and other parts of the watershed; what uses and activities are allowed once one gets to these places; how to minimize negative impacts on the environment while using them; and the importance of respecting the needs of fellow recreationalists as well as the interests of nearby property owners. If, as suggested by the chapter on Land Protection, a Squam Lakes Reserve were to be established, this information could be organized and presented as part of a coordinated public information program. Such a program could do much to insure that the Reserve concept was successful.

Residents and visitors to the Squam Lakes also need to be kept adequately informed about various boating regulations and other related issues. An effective public information program should focus on the following: providing practical and readily available information on boating safety and boating laws, geared to both State residents and out-of-staters, of all ages; distributing information on other aspects of boating management to local marinas and to the public, concerning such things as washing boats, prevention and/or control of the growth of milfoil on the lakes, prevention of contamination of the lakes from fuel from watercraft combustion engines and from litter and sanitary wastes from boating and fishing activities. It should also give the public specific information on the location and extent of the lake zones proposed in the chapter on Access, if they are established on Squam Lake, as well as information about time zoning, if it is put into effect.

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<sup>1</sup> Judy Silverberg, Project WILD, NH Fish and Game Department, 1990.

The Squam Lakes Association presently provides some information to the public concerning boating regulations and other related issues, for example in pamphlets such as "Squam Boating Rules", which are available at local marinas and other places throughout the watershed. SLA members who were on the Squam Lakes Watershed Advisory Committee recognized that despite efforts such as these to inform the public, there was a need to provide more of this kind of information, and in a more effective way.

The Department of Safety Service's Watercraft Safety Bureau has a state-wide education program concerning boating activity, but because of limited personnel, the program has had a limited effect on boating practices on New Hampshire lakes, including the Squam Lakes. Because of a significant increase in the number of boats on the State's lakes in the past ten years, the program is currently in need of expansion. The draft *Public Access Plan for New Hampshire's Lakes, Ponds and Rivers* has proposed an increase in registration fees to help increase the scope and effectiveness of the Department of Safety Services' public information program.

Other present weaknesses in adult education in the Squam watershed have more to do with the reality that important environmental issues often require a level of knowledge and understanding which is greater than the average person has the opportunity to develop. Town officials, landowners, and land managers are faced with resource issues of increasing number and complexity, and there continues to be an increase in the amount of information that is theoretically available concerning these issues. The ability to digest and make appropriate use of this ever larger amount of information can prove difficult. Positive attitudes and the best of intentions don't necessarily translate into an ability to sort through and synthesize large amounts of technical information. At the same time, as environmental issues become more complex, there always seems to be a need for more new information. For example, scientific research concerning lakes and their carrying capacities has not been thoroughly developed at the present time, yet town officials within the Squam Lakes watershed are being asked to make decisions which require information which can only come from this kind of research.

Generally speaking, there is a need for two important and distinct kinds of environment education opportunities for adults within the watershed, concerning specialized technical information. The first type of opportunity is somewhat hard to define, but it is nonetheless important that it be provided to the various adult audiences in a way that is suited to each of them. This concerns how a town official, landowner, or land manager can determine what information is needed in order to achieve a management or planning goal. Such educational opportunities are needed to provide insights as to how to narrow down the choice from the wide array of information that is available, and to explain how to determine whether "new" information is needed. They would help a town official, for example, to select information that was accurate, up-to-date, and useful in achieving a particular objective. Such organizations as the Lakes Region Planning Commission, Office of State Planning and the NH Municipal Association would be most likely to be able to provide this kind of perspective to town officials. With the development of Geographic Information System capability, the Lakes Region Planning Commission and OSP will be in a better and better position to assist towns in their management of information. UNH Cooperative Extension educators in agriculture and forestry could provide this kind of perspective on technical information to landowners and land managers.

The second kind of education involves the actual presentation of this information by various entities, public and private, using a number of different techniques. What follows is a summary of some of the key environmental issues addressed in the Squam Lakes Watershed Plan, with a list of the parties which could realistically be expected to provide technical information about them to adults.

### **Land Capability/Water Quality**

The Soil Conservation Service, in cooperation with the New Hampshire Association of Conservation Districts, has developed various kinds of soils information that are important in determining land capability. County SCS offices and conservation districts provide this information to landowners, town officials and resource managers through workshops, printed materials, individual training sessions and audio-visual materials. These educational techniques also serve to increase the awareness of the need for such information.

Cooperative Extension is responsible for the general education programs of the US Department of Agriculture. Part of its mission is to make available to various audiences the results of research on the management and utilization of natural resources. Extension has recently been especially active in the area of water quality, having developed a comprehensive program to deliver water quality education to the State's citizens. Education concerning septic systems is a key part of the program, which focuses on homeowners, realtors and septic system designers and installers. The program's goal is to insure that these audiences are able to identify methods of monitoring septic systems, and know what to do if problems occur. Reflecting the fact that 60 percent of New Hampshire's population is served by groundwater wells, a second component of Extension's program concerns water testing, treatment, conservation and health effects for rural New Hampshire.

The water quality program also provides instruction concerning a third resource issue, good management practices for agriculture. Examples of this are manure and fertilizer management to minimize impacts of nitrogen to groundwater. A fourth component of the program addresses the issue of the relationship between pesticides, soils and water quality. Cooperative Extension's manual notes that "to control pests with minimal water quality impact requires access to a large amount of information from three domains: 1) soil properties and site conditions; 2) pesticide properties; and 3) management practices. Pesticide applicators (landowners or professionals) generally lack access to much of the information needed, and lack ways to integrate information from these three domains to make appropriate decisions." The situation described is quoted here because it is a common one for those who are involved with natural resources management and planning.

A sixth component of the water quality program involves workshops for foresters and loggers concerning wetland regulations and their effects on forestry operations. An emphasis is placed on good management practices to satisfy these regulations. A seventh component involves organizing a coordinated effort to provide community assistance in the area of natural resources protection.

Cooperative Extension also now oversees the UNH Lakes Lay Monitoring Program, and through it, is able to educate local landowners about lake water quality. The Lay Monitoring Program has been, and continues to be instrumental in increasing Squam lakes residents' awareness and knowledge of lake ecology and water quality issues. The Department of Environmental Services' Biology Bureau (within Water Supply and Pollution Control Division) also provides educational material on lake water quality.

The Fish and Game Department's Aquatic Resource Education Program also has developed plans to reach adult audiences concerning water resources. They recognize that contact with adults "must be made in a variety of ways, and through a variety of messages, to make them aware, build their knowledge, change an attitude, and to finally move them to action."<sup>2</sup> The agency feels that with the programs currently available in the Merrimack watershed, about a tenth of the population, those that already believe in the message, have already been reached. Being realistic, they feel that "reaching the other 90 percent will take a lot of time, money and energy." Over the next five years the Aquatic Resources Education Program will conduct programs for adults in order to increase their awareness and knowledge of water resources and water issues.

### **Wildlife Habitat/Natural Areas and Land Acquisition**

There is sometimes a need for a town official or landowner to have a more in depth understanding of particular plants and animals, of habitat areas such as wetlands or deer wintering areas, or of lake dynamics as they affect specific species of fish and wildlife. Much of this kind of information is provided informally within the Squam watershed. Locally, the Science Center is available to provide details about specific wildlife species and their general habitat needs. The Loon Preservation Committee and its parent organization, NH Audubon Society, have been especially effective at helping local officials to understand the specific needs and requirements of a particular species, thus making successful management and protection of the loon more likely. At the State and regional level, the NH Fish and Game Department is continuing to expand its adult education programs, and to make them more user oriented. The Aquatic Resources program developed in 1986 by the Division of Information and Education at Fish and Game has undertaken an ambitious plan to reach as large an audience as possible. A variety of programs have been developed, many of them for adults. Some of these include: a speaker's bureau made up of knowledge individuals who speak to the general public about water resource issues; a six part video series for general audiences on aquatic systems; and the development and distribution of information sheets. Special training concerning aquatic systems is also available for conservation commissions and zoning boards.

Under the Nongame Species Management Act of 1988, Fish and Game was authorized to set up a program to study and manage nongame animals. As part of this program, the agency is developing public information and educational outreach programs for adults and young people. UNH Cooperative Extension also has a wildlife program to work with private consulting foresters. As part of this program, Extension shares a wildlife biologist with the Fish and Game Department.

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<sup>2</sup> Judy Silverberg, Project WILD, NH Fish and Game Department.

In order to be able to protect land with wildlife and other important resource values, town officials, landowners, and the general public also need a good awareness and understanding of non-regulatory land protection techniques. These techniques may be essential to long term protection when regulatory protection methods are not available or not applicable. Local conservation commissions, and local conservation organizations, such as the Squam Lakes Conservation Society, the Lakes Region Conservation Trust, and the Squam Lakes Association should be available to provide information and assistance concerning land protection. (See more discussion of this in Chapter 10 - Land Protection.)

## **Recommendations**

### **Young People**

**Upper elementary and middle school teachers in the Squam Lakes watershed should be encouraged to use the curriculum developed by the New Hampshire Waters program, which parallels Cooperative Extension's adult-oriented Water Quality Program. The program provides young people with a strong background in watershed dynamics and water quality issues facing New Hampshire. This background can be reinforced and enlarged upon by Extension's adult Water Quality program.**

**Lower and upper elementary schools in the Squam watershed should encourage local teachers to attend workshops put on by such programs as Project WILD, Project WILD Aquatic, Project Learning Tree, Project Conserve and NH Audubon Society's Awareness to Action Program. If for some reason local teachers are unable to implement supplementary environmental curricula, local schools should provide the opportunity for DOCENTS to come to local schools to present this information to young people.**

**High school teachers in the Squam Lakes watershed should be encouraged by their local school districts to become involved in the Merrimack River Watershed Education Project. This program provides specific, technical instruction to young people concerning water resources and water quality issues facing New Hampshire, and more specifically, the Merrimack River watershed.**

**Local schools should seek input from local science teachers in biology, chemistry and other areas to refine the basic curricula that have been developed by the above programs. This input is essential to the success of implementing these curriculums, because teachers in the watershed need to feel that they have a personal stake in them, and are able to maximize their own strengths and local resources in helping to make the programs a reality.**

**Local organizations such as the Science Center of NH, the Squam Lakes Association, the Lakes Region Conservation Trust, and the Loon Preservation Committee should develop background information about the watershed to be included in the above supplementary curriculums. For example, the Science Center is especially helpful in providing information on local animal and plant species and their habitats. The SLA could provide useful historical information and perspective about the watershed, as well as up-to-date water quality information derived from the lay monitoring program. Knowledgeable, concerned local citizens can also provide schools with background information about the watershed.**

**Local conservation commissions should promote a "Conservation Teacher of the Year" award in their towns.**

A greater number of recreational activities should be available on the Squam Lakes for young people living in the watershed, who may or may not have regular access to the lakes. Activities such as sailing, rowing, and fishing competitions can be an effective way to motivate young people to learn about their watershed, and to care enough about it to want to help protect it. As part of this activity, young people should be taught about boating laws, boating safety, and water safety in general.

## **Adults**

### **Public Information**

Information should be provided to the public, including year round residents, seasonal residents and visitors, concerning recreational access opportunities in the Squam Lakes watershed, and the possible consequences of their recreational activities, possible negative impacts on the environment. If a Squam Lakes Reserve is established, one of its functions should be to organize and conduct as a coordinated public information program.

Residents and visitors to the Squam Lakes of all ages also should be kept informed about various boating regulations and other related issues: providing practical and readily available information on boating safety and boating laws, geared to both State residents and out-of-staters. It should also give the public specific information on the location and extent of the lake zones proposed in the chapter on Access, if they are established on Squam Lake, as well as information about time zoning, if it is put into effect.

### **Technical Information**

Coordinated efforts among natural resource agencies, and between these agencies and private organizations should be continued in order to promote information transfer and awareness of important local as well as non-local environmental issues. This will assure that educational resources are used efficiently and effectively, and will avoid duplication of effort.

### **Land Capability**

Local conservation districts, SCS and the Lakes Region Planning Commission should be called upon by town officials, landowners and land managers to provide technical information needed to make land use planning and management decisions affecting the Squam Lakes watershed.

### Water Quality

SLA and local municipalities should promote landowner awareness and understanding, particularly in those areas bordering surface waters, concerning land management practices which protect water quality. Septic system maintenance and proper use of pesticides and fertilizers are some of the practices that can be promoted in this way.

Town officials, landowners and land managers should utilize Cooperative Extension's Water Quality Program.

Awareness and understanding of Extension's Lakes Lay Monitoring Program should be expanded to include a greater number of the watershed's population.

The Fish and Game Department's new Aquatic Resources Program should also be utilized by local towns.

### Wildlife

The educational effort that the Loon Preservation Committee has put forth, both in terms of collection and transfer of information should serve as a model for local education concerning other wildlife species. The Squam Lakes Association can be effective in making lake users aware of wildlife habitat areas and the need for their protection. Organizations such as the NH Municipal Association, the Office of State Planning and the Lakes Region Planning Commission should provide general guidance for town officials, landowners, and land managers concerning the kinds of information they need in order to make specific planning and management decisions.

### General

The Science Center of New Hampshire, the local Chambers of Commerce, and the local towns should provide easily accessible materials which interpret the natural resources, cultural aspects, and economic factors within the watershed. For example, if a visitor did not have time to follow a trail to a specific location, he/she should have the opportunity to short-cut the process by driving to various locations on existing road and observing specific sites and reading interpretive information. In this way, a visitor could obtain a limited but accurate understanding and appreciation of the watershed.



**APPENDIX A**

**TOWN OF ASHLAND**

**ZONING ORDINANCE**

Districts: Commercial; Industrial; Village Residential; Rural Residential; Pemigewasset Overlay.

Water Setback: Building - 50 feet from Little Squam Lake; 200 feet from Pemigewasset River; within Industrial district, structure setback from Pemigewasset River may be reduced to 50 feet through special exception; leachfield - 125 feet between septic system and any year-round surface water.

Minimum Shore Frontage: 200 feet for building lot located along Little Squam Lake or along the Squam and Pemigewasset Rivers; 200 feet for waterfront access lots with 1-10 units, plus 20 feet for each additional unit.

Minimum Lot Size/Lot Size by Soil/Slope: 40,000 square feet, (variation from this depends on Soil/Slope table); no minimum for commercial use with sewer and water; **Village Residential, with sewer and water** - 15,000 square feet ; **Pemigewasset Overlay district** - 2 acre minimum; wetlands and areas with slopes greater than 25% can't be included in minimum lot size.

Residential buildings of 5 to 10 bedrooms: # of bedrooms X (minimum lot size from Soil/Slope Table.

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Residential buildings with more than 10 rooms, and commercial and industrial uses - refer to regulations of Department of Environmental Services; subdivisions with community or municipal water - minimum lot size may be decreased by 1/3 from minimum lot size as determined by Soil/Slope Table. Cannot be less than 40,000 square feet.

Lot line Setbacks: Buildings - front setbacks - 35 feet for all districts; rear setbacks - 15 feet for Commercial with sewer and water; 25 feet for Industrial; 15 feet for Village/Residential with sewer and water; 25 feet for Rural Residential; leachfield - 15 feet between it and any boundary.

Minimum Lot Frontage: 100 feet for Commercial district with and without sewer and water, and for Village Residential district with and without sewer and water; 150 feet for Industrial district, Rural Residential district and Pemigewasset Overlay district; 50 feet for back lots, under specific conditions. Minimum lot frontage may be reduced where lot sizes of less than 40,000 square feet are permitted. A lot owned in common as a recreation area serving nearby dwelling units is exempt from the minimum lot frontage required.

Unit Density: Commercial - 7500 square feet/unit; Village Residential - 7500 square feet/unit; Rural Residential - 40,000 square feet/unit; Industrial - sewer system; Pemigewasset Overlay district - 60,000 square feet/unit.

Minimum % of Lot for Green Space: Minimum of 10%; also, lots with 3 or more residential units shall provide 500 square feet for recreational playground, plus 100 square feet for each additional residential unit over 3.

Percent of Lot Covered by Building: 35% - Village Residential; 30% - Rural Residential.

Height Restrictions: Maximum of 3 stories, or 40 feet above ground level; 35 feet in Pemigewasset Overlay district.

Overlay District: Pemi Overlay district - prohibited uses - structures on slopes which exceed 15%; mobile home parks; any excavation for which an Earth Excavation Permit issued under RSA 155-E is required. Floodplains shall be considered those floodplain soil areas shown on SCS Soil Survey for Ashland.

Waterfront Access: Waterfront access provision of zoning ordinance provides guidelines for development of back land with access to Little Squam Lake, and the Squam and Pemigewasset Rivers, to prevent overcrowding and to protect water quality. Minimum area of any waterfront access lot shall be the greater of 1 acre or 800 square feet per residential unit, campsite or lodging unit; one toilet facility to be provided for each 10 residential units; access lot shall have minimum of 200 feet of shore frontage; parking area of 300 square feet adjacent to access lot provided for each dwelling unit, campsite or lodging unit.

Waterfront Parking/Toilet: 300 square feet for each unit or campsite located more than 1,000 feet from water; 1 toilet for each 10 units.

Recreational Camping Parks: Pemi Overlay District - minimum area of 5 acres, with a 35 feet landscaped park buffer, with 75 feet buffer along riverfront.

Removal of Natural Materials: Most activities need planning board permit, bond and public hearing. Site requirements - topsoil stripped and stored before excavation, phased to minimize erosion; visual barrier between surrounding land uses and site. Excavation plan to include site boundaries, distances, aquifer areas, surface water adjacent to proposed excavation, elevation of highest annual average groundwater table within or next to proposed excavation. Restoration plan - must restore area to blend with surrounding landscape; must eliminate standing water; must have soil fertilization and plant material.

Off-Street Parking: Adequate space for parking, loading, maneuvering; 200 square feet/parking space. residential - 2 spaces/unit; public assembly - 1 space for every 4 seats; hotel/tourist - 1 space per unit; commercial and industrial - 1 space for every 3 employees/patrons.

Obnoxious Use/Junkyards: Both are prohibited.

Non-Conforming Uses: Pre-existing use may continue, but if abandoned for 1 year, must then conform to current Regulations. May expand as long as it does not become more non-conforming. Non-conforming buildings which are destroyed may be replaced/rebuilt if non-conforming use is not increased.

## **SUBDIVISION REGULATIONS - ASHLAND**

Investigative Studies: For drainage, erosion control, sewage disposal system, water facilities, road construction; all costs paid by subdivider.

Preliminary Subdivision Layouts: At public hearing - general site location/boundaries; abutters; existing and proposed easements; water courses; ponds; standing water; other essential features; location/size of bridges and culverts; topography soil/slope; zoning districts identified, lot size/frontage/lines; easements; deed restrictions; public use areas, sewer and water statement; proof of water sufficiency for private lines; private roads.

**Final Plat Requirements:** Same as preliminary layout.

**Performance Bond:** Streets/bridges, public sewer and water line extensions, storm drains, under-drains, erosion control.

**Preservation and Protection of Features:** Scenic points, trees, brooks, streams, waterbodies, natural areas, historic landmarks.

**Areas Not to be Platted:** Land with 15% or greater slope over most of lot; high water table areas (within 2 feet of surface); floodplains, areas with less than 3 feet of natural soil over impermeable material; other unsafe land.

**Easements:** Any controlled access reserve strips are prohibited; for proposed water courses for public control, must be a minimum 20 feet permanent easement; reasonable size/character for park or playground area.

**Flood Hazard Areas Within a Subdivision:** Include 100 year flood elevation data for proposals of 50 lots/5 acres (lesser of); all construction and public utilities will be located and built so as to minimize/eliminate flood damage; must be adequate drainage to reduce hazard exposure; consistent in minimizing flood damage; new sewer and water system shall minimize/eliminate infiltration into system.

**Minimum Lot Frontage:** Conforms to Article 2 in zoning ordinance and depends on subdivision layout/location.

**Minimum Lot Size:** Conforms to Article 2 in zoning ordinance and depends on subdivision layout/location. Also conforms to zoning ordinance Soil/Slope Table.

**Lot line Setbacks:** Conform to Article 2 in zoning ordinance and depends on subdivision layout/location.

**Cluster Development:** Minimum lot size is determined by planning board/conditions; total area must conform with zoning ordinance; must have common open space, with deed restriction; adequacy statement required for utility systems; height, parking, setback dimensions must comply with zoning ordinance; may have private roads.

**Road Design:** Minimum 50 feet wide road design, with a maximum grade of 10%; installation of drainage facilities and culverts required (minimum diameter of 18 inches); drainage ditches - 3 feet wide by 16 inches deep required on both sides of road at right-of-way.

**Sewer and Water Systems:** Developer shall be responsible for installation/extension of public sewer and water lines, including improvements to meet increased demand; if private water supply is used, must be adequate to meet all needs; private sewer and water systems - must meet NH WSPCD requirements; private sewage disposal system must be 125 feet from all year-round surface water.

**Erosion Control:** Maintenance of vegetative cover on steep slopes; seeding of road shoulders and embankments; construction of settlement basins and temporary dams; other measures during lot clearing, road construction.

**Recreation Land/Open Space:** For subdivision with 15 or more lots - must be 1 or more recreation areas with combined size of 2,000 square feet for each building lot under 50,000 feet; does not apply to cluster development.

Waterfront Subdivision: Development with frontage on Little Squam Lake, Squam Lake, or Pemigewasset River must conform to zoning ordinance; minimum area must be the greater of 1 acre or 800 square feet/unit; 200 linear feet of frontage required for 1-10 units, plus 20 feet for each additional unit; parking/toilet; minimum shore frontage - 200 feet.

Watercourses within a Subdivision: If water is relocated/alterd, subdivider must: notify NH Civil Defense Agency and requested adjacent communities; apply for Dredge and Fill permit from NH Wetlands Board; water courses shall be cleaned/increased to take care of storm runoff (if necessary).

Bridges: Designs to be approved by Ashland highway agent; concerning traffic conditions - 250 vehicles/day require a 20 foot road; more than 250 vehicles/day require a 22 foot road; more than 400 vehicles/day require a 24 foot road; minimum carrying load capacity is 30 tons; must be certified by engineer, state permit.

Waiver: If conformity causes undue hardship or injustice to land owners.

Unsuitable Conditions for Subdivision Development: Rock formations; areas with periodic flooding; areas with poor drainage, unsuitable soil(s), inadequate capacity for sanitary sewer disposal; location with lack of water supply, drainage, transportation, schools, fire protection and other services.

Other: Subdivision applicants need approval of NH WSPCD and must provide all data/stipulations, driveway permits from NH DOT, and any other required state permits.

### **SITE PLAN REVIEW REGULATIONS - ASHLAND**

Pollution Control: Provisions to prevent ground and surface water contamination due to on-site storage, use of petroleum products and hazardous substances.

Buffer Strips: Must be landscaped of sufficient width for privacy and noise protection; visual screen shall hide storage; litter or garbage collection from adjoining parking areas, lots and public highways.

Drainage Provision: Grading/filling must minimize the alteration of surface, and sub-surface drainage towards abutting properties.

Erosion and Sedimentation: Provisions shall be made to prevent erosion and sedimentation caused by changed topography, soil, surface conditions during/after construction; where sediment is in runoff water, must have sediment basins until area is stabilized.

Special Investigations: Yes; costs are paid by applicant.

Site Plan Requirements: Zoning district boundaries, abutters, easements, waterbodies and courses; location of parking, loading space, location of solid waste disposal facilities, septic systems, wells, catch basins, and other surface drainage facilities; proposed grading and filling, topography.

Relaxation of Standards: Planning board may waive/modify if they cause unnecessary hardship to applicant.

Performance Bond: Construction of site plan improvements.

Site Inspection: Planning board may conduct.

## **TOWN OF CENTRE HARBOR**

### **ZONING ORDINANCE**

**Districts:** Residential, Commercial-Village, Commercial-Light Industry, Agricultural and Rural, Wetlands Conservation.

**Note:** For Sewer and Water types:

- Class 1 - off lot sewer and water
- Class 2 - off lot sewer and water
- Class 3 - on lot sewer and water

**Water Setbacks:** **Building:** 40 feet from lake or pond shoreline, 100 feet from wetland within Wetlands district; **septic:** 100 feet within Wetlands district.

**Minimum Shore Frontage:** On Squam Lake - for 1-2 units/150 feet; 50 additional feet for each additional unit.

**Minimum Lot Size/Lot Size by Soil/Slope:** Lot sizes depend on district and utility class, with soil conditions permitting; no slope/soil table in the zoning ordinance. **Residential and Commercial-Light Industry** - Class 1 - 10,000 square feet; Class 2 - 20,000 square feet, soil conditions permitting; Class 3 - 40,000 square feet, soil conditions permitting; **Agricultural and Rural** - Class 1, 2 - 20,000 square feet, soil conditions permitting; Class 3 - 40,000 square feet soil conditions permitting; **Commercial-Village** - Class 1 - 10,000 square feet; Class 2 - 20,000 square feet, soil conditions permitting.

**Lot Line Setbacks** - **Building** - 50 feet between it and any public right-of-way.

**Minimum Lot Frontage:** **Residential, Commercial-Light Industry** - Class 1, 2 - 100 feet; Class 3 - 150 feet.  
**Agricultural-Rural** - Class 1, 2 - 125 feet; Class 3, - 150 feet; **Commercial-Village** - Class 1, 2 - 100 feet.

**Unit Density:** Under certain conditions, more than 1 unit may be built on a lot without subdivision approval; units must be more than 30 feet away from each other on any one lot.

**Maximum % of Lot Covered by Building:** All districts - 30% (except Commercial).

**Height Restrictions:** 3 stories, or 35 feet.

**Waterfront Access:** 800 square feet of waterfront area per dwelling unit to be granted rights of use or access, or 200 square feet of waterfront area per person to be granted rights of use or access, in the case of group development.

**Wetland Protection:** Wetlands Conservation Ordinance

**Purpose:** To prevent development destruction and to protect natural areas and aquifers

**District Boundary:** Defines and establishes wetlands

**Permitted Uses:** Forestry, crops, wildlife refuges, parks, conservation areas, open space

**Special Exceptions:** Access ways, utility easements, water impoundments, other harmonious uses

**Special Requirements:** No structure or septic system shall be within 100 feet of wetland area

Steep Slope Protection: Restrictions - no dwellings on designated recreation land or shorefront lots; no unit, parking or toilet located on waterfront area.

Docks: If constructed, shall conform with applicable State and local regulations.

Waterfront Parking/Toilet: 300 square feet parking area for each unit with granted access; area shall be between 100-800 feet of high water line; toilets for 5-10 units/1 facility, for 11-50 units/1 facility each for male and female; for the next 50 units/1 additional facility for each sex; other conditions exist for group developments.

Recreational Camping Parks: Organized camping only, except on private land; camps must not be visible from roads, dwellings; permit, caretaker required; sewer and water details on application; minimum of 10 acres; minimum of 15 prepared campsites of 750 square feet each; 150 foot space to be landscaped for each site; minimum of 200 square feet of parking, plus picnic table, trash can and fireplace for each site.

Removal of Natural Material: Permitted by exception in certain districts, under selectmen supervision, after a public hearing (for excavation, removal and filling of land).

Off-Street Parking: 200 feet parking space; must be on same lot as principle use; residential - 2 spaces/dwelling; hotel - 1.5 spaces/unit + 2 spaces; business - 1 space/employee + 1 space/600 square feet floor area; public assembly - 1 space/4 seats.

Obnoxious Use/Junkyard: Obnoxious use prohibited.

Damaged or Hazardous Buildings: Must be repaired or removed within one year of damage.

Non-Conforming Uses: Pre-existing may continue, except if abandoned for 1 year, in which case it must conform to current regulations; may expand as long as it does not become more non-conforming; non-conforming buildings which are destroyed may be replaced/rebuilt if non-conforming is not increased; non-conforming uses/structures may be altered, enlarged if area is less than 20%; can also be superseded by a permitted use or by another non-conforming use with conditions.

## **SUBDIVISION REGULATIONS - CENTRE HARBOR**

Preliminary Subdivision Layouts: Site location; boundaries; existing easements; water courses, ponds, standing water; water mains, sewers, culverts, drains, connections, alternate water supply; sewage disposal and surface drainage, perc. test results, soils and support data for sewer and water that insures non-contamination; public use land with deed restrictions; location and size of bridges, culverts.

Final Plat Requirements: Preliminary layout details, plus design/location of proposed on-lot sewer and water systems.

Performance Bond: Streets, extension of public sewer and water lines.

Easements: Proposed permanent easements - 15 feet minimum width; water courses for public control - minimum 20 feet easement; controlled access reserve strips are prohibited.

Water Setback: 75 feet between water system and septic tank, drainage field.

Lot line Setback: 15 feet between building and any lot line.

Road Design: Lots to be graded to eliminate floods/stagnant water; catch basins and ditches required; underground pipes to be 12 inches in diameter.

Sewer and Water Systems: 75 feet between sewage disposal system and water. 75 feet between private septic tank or leachfield and on-site water supply, or adjoining water supply or any water shoreline; developer shall be responsible for installation/extension of public sewer and water lines, including improvements to meet increased demand; if private water supply, it must be adequate to meet all needs; private sewer and water systems need NH WSPCD approval.

Recreation Land/Open Space: For subdivision with 10 acres or more - 5% of area must be reserved for recreation.

Watercourses Within a Subdivision: Natural drainage not to be altered unless runoff provisions exist. Natural water courses must be cleared and if necessary, increased, to prevent possible washout.

Waiver: Platting requirements may be modified if no streets are created or extended, no public utilities or public facilities are installed, and adequate provision has been made for logical extension of street system to all interior parcels.

Unsuitable Conditions for Subdivision Development: Scattered or premature use of land; development which poses threat to prosperity of town because of lack of water, drainage, transportation, schools, fire protection, or other public services; development which conflicts with harmonious development of town.

Other: Planning board may give recommendations for earth movement and retention of natural cover; waiver for hardship conditions.

## **SITE PLAN REVIEW REGULATIONS - CENTRE HARBOR**

Pollution Control Standards: Protection of adjoining premises against any possible detrimental or obnoxious use on-site; planning board gives consideration to site's impact on environment.

Drainage Provisions: Adequate drainage methods for surface water.

Site Plan Requirements: Mentions but does not specify requirements.

Relaxation of Standards: Board of selectmen grants exceptions for site plan review if - use does not adversely affect community; no increase in traffic, noise, air or water pollution; no major change in site design; additional buildings are not more than 1,000 square feet; and use does not violate the purpose/intent of town's site plan review.

Performance Bond: Required.

Sewer and Water Inspection: Adequate sewer and water disposal systems for permitted land uses.

Parking: Adequate for off-street parking/loading.

Other: Planning board may use its broadest discretion to assure compatibility with town objectives and adjacent land uses.



**TOWN OF HOLDERNESS**

**ZONING ORDINANCE**

**Districts:** General Residential, Rural Residential, Commercial, Pemigewasset River Corridor Overlay.

**Water Setback:** (from domestic water supply, lake or pond high water mark, stream, wetland): **leachfield** - 125 feet; **septic tank** - 75 feet; **buildings** - 50 feet from any shoreline; 200 feet from Pemigewasset River for any and all buildings or structures.

**Minimum Shore Frontage:** For first three districts - 200 feet of shore frontage for up to ten residential dwelling units, individual campsites or individual lodging units granted rights of use or access; additional 20 linear feet of shore frontage for each additional unit. **Pemigewasset Overlay District** - 200 feet for the first dwelling unit, with 20 additional feet needed for each additional dwelling unit.

**Minimum Lot Size/Lot Size by Soil/Slope:** Based on High Intensity Soil Survey Information (Table 1).

**Waterfront Area** - minimum lot sizes for each soil type shall be increased by 1/3 of the requirements as stated in Table 1. Minimum depth shall be one half of the frontage.

**Non-Waterfront Area** - Minimum of one acre; subject to lot size requirements of Table 1.

**Pemigewasset Overlay District** - two acre minimum lot size

In subdivision, where community water supply or community wastewater system is to be provided, minimum lot size requirements may be reduced by 1/3 of minimum required as stated in Table 1, but in no case less than one acre.

For residential developments with 5-10 bedrooms per unit, minimum lot size is determined by the following formula:

$$\text{lot size (square feet)} = \frac{\text{No. of bedrooms}}{4} \times (\text{lot size from Table 1})$$

For commercial, industrial and 10 plus bedroom residential use, minimum lot size is determined by the following formula:

$$\text{lot size (square feet)} = \frac{\text{Gal. of wastewater/day}}{4} \times (\text{lot size from Table 1}) + \text{land required (for well radius)}$$

The required area of a lot is exclusive of the land inside the protective radius of the well, being a 75 feet radius for under 2000 gallons per day and a 200 feet radius for over 2000 gallons per day.

Septic systems are not permitted on poorly drained or very poorly drained soils.

**Lot Line Setbacks:** **Septic, leachfield** - 35 feet; **buildings** - back, front and side - 35 feet; **dock** - 10 feet from property line or its imaginary extension into the water.

Minimum Lot Frontage: Each district has separate conditions, but generally - General Residential - 150 feet; Rural Residential - 300 feet; Commercial - 100 feet; multi-dwelling unit - 150 feet.

Unit Density: One dwelling/lot unless subdivision or site plan; condominium conversion - 1 year-round unit per acre; 4 seasonal units per acre.

Minimum % of Lot for Green Space: Condominium conversion - common area of 30% of total is required.

Percent of Lot Covered by Building: Commercial - 50%; Rural Residential - 15%; General Residential -15%.

Height Restrictions: No building or structure to exceed 35 feet above average ground level at foundation.

Overlay District: Pemigewasset River Corridor - permitted uses - farming and agriculture; wildlife refuges; parks; permitted uses in underlying districts which can comply with more restrictive regulations.

Waterfront Access: Waterfront lots shall have not less than 200 linear feet of shore frontage for up to 10 residential units, individual campsites or lodging units granted rights of use or access; an additional 20 feet of shorefront for each additional residential dwelling unit, individual recreational campsite or individual lodging unit. 30 square feet of parking area provided for each dwelling unit, campsite or lodging unit granted use of access. Parking area not to be closer than 100 feet from high water line.

Wetlands Protection: Any new building/structure or improvement in wetlands requires Conservation Commission approval.

Flood Area: Any new building, structure development or substantial improvement of structure within flood area (as delineated on Holderness Flood Insurance Rate Map) to be governed in accordance with Holderness Flood Prevention Ordinance, as well as other State and federal regulations.

Marinas: Docks - 1 slip per 25 feet of shoreline. Parking - 3 spaces for every 2 wet slips; 1 space of dry docking storage provided unless storage space is used only for winter or sales storage.

Waterfront Parking/Toilet: 300 square feet of parking provided for each dwelling unit, recreational campsite or lodging unit granted access to waterfront. Parking area to be no closer than 100 feet from high water line; parking to occur only in designated parking area. 1 toilet facility each for males and females provided for 2-25 residential dwelling units, campsites or lodging units.

Recreational Camping Parks: Camping park shall have minimum area of five acres; camping space to be 2,500 square feet and at least 30 feet in width; suitable parking area of at least 10 feet wide and 20 feet deep; buffer of 25 feet to be maintained as a landscaped area abutting all recreational camp property, and 100 feet from any public street or highway. Permitted dumping facility must be on-site; 1 or more bathrooms to be provided for each camping park; interior roads to be at least 30 feet wide with compact gravel surface at least 20 feet wide.

Removal of Natural Material: If material is removed within 100 feet of public highway, stream, roadway or waterway, area must be regraded, redressed within 90 days to assure protection against erosion and washouts, unsightly conditions.

Off-Street Parking: Adequate parking to be provided for new or enlarged existing uses: residential use - 2 spaces for each dwelling unit; hotels, lodging units - 1 space per unit; commercial, industrial use - 1 space for each three anticipated patrons/employees on premises at same time.

**Obnoxious Use/Junkyard:** No person within the town shall keep any hazardous materials, dump, refuse, junkyard without town permit, or keep any other material that might leach into a waterway or in any other way be offensive or a menace to the public.

**Fire Damaged or Hazardous Buildings:** Must be repaired/removed within 1 year.

**Non-Conforming Uses:** Non-conforming use properties in active use when zoning ordinance was passed and adopted may continue in present use. If use is discontinued or abandoned for one year, shall then conform to regulations for the district, and the non-conforming use may not be resumed without approval of board of adjustment.

## **SUBDIVISION REGULATIONS - HOLDERNESS**

**Investigative Studies:** Drainage, erosion control, sewage disposal system, water facilities, road construction; also possibly economic and traffic impacts; all costs paid by subdivider.

**Preliminary Subdivision Layouts:** General site location/boundaries, abutments, existing/proposed easements, buildings, all water courses, other essential features, water mains, sewers, culverts, drains, bridges, alternate means of water supply, sewage disposal, surface drainage, perc. test holes, public use land, deed restrictions, erosion and sediment control provisions.

**Final Plat Requirements:** General site location/boundaries as in preliminary layout; design and location of any proposed on-lot sewer and water system; location/size of any proposed storm pipes/catch basins; layout for all required improvements.

**Performance Bond:** Streets, improvements, utilities, essential drainage. Upon release of these bonds, a maintenance bond may be required; may be released after one year.

**Preservation and Protection of Features:** If feasible, natural vegetation.

**Areas Not to be Platted:** Lands considered unsafe because of danger from fire, flood, erosive action, unstable slope, fill or other menace, including no natural floodway.

**Easements:** Proposed permanent easements over or under private property shall be minimum of 20 feet wide, and shall have satisfactory access to existing or proposed public ways. Watercourses proposed for public control shall have permanent easement of at least 20 feet; controlled access reserve strips prohibited.

**Flood Hazard Areas Within a Subdivision:** Include 100 year flood elevation data for any proposal when in a flood hazard area, as defined in ordinance; all construction and public utilities will be located and built so as to minimize/eliminate flood damage; adequate drainage to reduce hazard exposure; consistent in minimizing flood damage; new sewer and water system shall minimize/eliminate infiltration into system.

**Minimum Lot Frontage:** 200 feet on water, and 150 feet on street; back lot water access for 1-10 units, must be a minimum of 200 feet, plus 20 feet for each additional unit; 200 feet for commercial or industrial lots.

**Minimum Lot Size:** 1 acre within any subdivision; variation from this depends on slope and soil considerations (High Intensity Soil Survey table used); 25% slopes and wetlands are not included in minimum size. For 1-4 bedrooms - refer to chart; for 5-10 bedrooms, lot size = N/4 X table soil lot size; in subdivision with community sewer and water system, lot size from table may be decreased by 33%; for lakeshore areas - lot size must be increased by 33%.

**Lot Line Setback:** 35 feet from side or back lines.

**Cluster Development:** Minimum lot size - soil lot size X number of units; surrounding land shall be left open.

**Road Design:** Must be graded for drainage, to eliminate flood or stagnant water pools; minimum for catch basins, drainage swales is 3 feet X 16 inches depth, except where well drained soils permit underground pipes/culverts, where minimum is 18 inches; provisions are included for increased runoff during/after development; maximum road grade can be 12%.

**Sewer and Water Systems:** All parts of septic system shall not be less than 125 feet from on-site water supply, water supply of adjoining property or high water line of any lake, pond, stream, wetland, or any body of water, natural or artificial; developer responsible for installation/extension of public sewer and water lines, including improvements to meet increased demand; if private water supply, must be adequate to meet all needs; private sewer and water systems - NH WSPCD requirements.

**Erosion Control:** Provisions must be in preliminary layout for erosion and sediment control unless planning board deems unnecessary; erosion to be controlled by putting mulch or matting on all surfaces disturbed by construction of roadways.

**Recreation Land/Open Space:** Must be of reasonable size/character relative to neighborhood; for subdivisions with more than 25 acres, at least 5% shall be reserved for recreation.

**Waterfront Subdivision:** Minimum lot size determined by slope/soil table; for lakeshore areas - increase table size by 33%; shall provide minimum of 20 feet of access or permanent easement on waterfront at suitable intervals for fire fighting equipment.

**Watercourses Within a Subdivision:** Natural water courses must be cleaned and if necessary, increased, to take care of storm runoff.

**Bridges:** Any bridge or culvert needs planning board approval.

**Parking:** 2 cars for each family unit (cluster too); back lot water access - 200 square feet/unit, with granted access; not to be located closer than 100 feet from high water line.

**Waiver:** Size frontage waiver on some lands deeded prior to December 21, 1970 with Grafton County, but sewer and water must conform to current regulations; waiver of certain requirements for land to be subdivided into not more than 3 lots; road construction in 2 lot subdivision - bonds may be eliminated.

**Recreation Camping Parks:** Graded location for drainage of surface/groundwater, sewage and stagnant pools; 25 feet landscaped buffer around property with 100 feet from any road; 2,500 square feet is minimum size for lots with no on-site sewage disposal system.

**Impact Documentation:** High water table, bedrock or other impervious strata, excessive slope.

## TOWN OF MOULTONBOROUGH

### ZONING ORDINANCE

Districts: Not formally defined, but Commercial and Waterfront property are mentioned in ordinance.

Water Setbacks: Septic system - 75 feet; buildings - 50 feet.

Minimum Shore Frontage: 100 feet for first unit granted access; 50 feet additional for each dwelling; no frontage may be allocated twice.

Minimum Lot Size/Lot Size by Soil/Slope: Waterfront - 40,000 square feet with soil/slope considerations, plus 3,000 square feet for each additional unit; non-waterfront - 40,000 square feet. Soil/slope table sets standards for all lot sizes; refer to table.

Lot Line Setbacks: Septic/leachfield - None; buildings - 20 feet; docks - 20 feet.

Unit Density: One dwelling per lot unless subdivision or site plan.

Minimum % of Lot for Green Space: 25 feet minimum for commercial property.

Percent of Lot Covered by Building: 50% for commercial.

Height Restrictions: 2 stories, or 32 feet.

Waterfront Access: The area required for beachfront water access lot shall not be occupied by any dwelling unit. No portion of the waterfront lot may be counted to satisfy minimum lot size for construction of subdivision.

Off-Street Parking: 200 square feet per parking space; residential - 2 spaces per unit; hotels - 1 space per unit, plus 1 space per employee; commercial property - 1 space per employee plus 1 space per patron, with a minimum of 3 parking spaces for commercial. Also, commercial parking must be a minimum of 10 feet from other commercial property lines, and 25 feet from residential lot lines.

Obnoxious Use/Junkyards: Obnoxious use prohibited; junkyards may not be offensive.

Fire Damaged or Hazardous Buildings: Need to be repaired/removed within 1 year.

Non-Conforming Uses: Pre-existing use may continue; if/when abandoned for one year, use must conform to current regulations. May expand as long as it does not become more non-conforming; non-conforming buildings which are destroyed may be replaced/rebuilt if non-conforming use is not increased.

## **SUBDIVISION REGULATIONS - MOULTONBOROUGH**

**Investigative Studies:** Planning board may conduct a site inspection of proposed subdivision to check natural site conditions and road layout; developer responsible for costs of special investigations.

**Preliminary Subdivision Layout:** Easements; parks; public open space; abutters; water courses; ponds; standing water; wetlands; existing water mains, sewers, culverts, drains; electric utilities; water supply and hookups; sewage disposal and surface drainage - connections, perc. test results, soil conditions, protective well radius locations; location/size of bridges, culverts; setbacks; off-site geographic factors within 200 feet of proposal, including, wetlands, shorelines, water sources, utility construction.

**Final Plat Requirements:** Preliminary layout, plus topography, wetland areas, lot adequacy for sewer and water installation/operation; public sewer and water service statements; hydrologic study of land area.

**Performance Bond:** Streets/bridges, public sewer and water line extensions, storm-drains, under-drains, erosion control, fire protection facilities, monuments.

**Preservation and Protection of Features:** Scenic points, trees, brooks, streams, waterbodies, natural areas, historic landmarks.

**Areas Not to be Platted:** Areas that can be platted but are not to be included in minimum lot size are areas with flood/fire hazards, poor drainage, poor soil conditions, high water tables, areas with less than 3 feet of natural soil cover.

**Easements:** Proposed permanent easements and water courses for public control must have minimum of 20 foot easement; for fire fighting - 30 foot easements are required at intervals (these areas shall have no other purpose). In dry areas, subdivision shall furnish fire ponds, dry hydrants and other fire protection; recreation easement.

**Flood Hazard Areas Within a Subdivision:** All construction and public utilities will be located and built so as to minimize/eliminate flood damage; adequate drainage required to reduce hazard exposure; must be consistent in minimizing flood damage. New sewer and water system must minimize/eliminate infiltration into system; no 100 year flood area.

**Minimum Lot Frontage:** On water - 100 feet for first unit, and 50 feet for each additional unit.

**Minimum Lot Size:** 40,000 square feet; variation from this depends on soil/slope table; minimum width must be 300 feet; maximum length is to be 1,200 feet. For 1-4 bedrooms, use soil/slope table; for 5-10 bedrooms, calculate =  $N/4 \times$  soil/slope table size; residential developments over 10 bedrooms, as well as commercial, institutional, and industrial development must conform to NH WSPCD regulations.

**Lot Line Setback:** 20 feet between dock, breakwater, dug-in boat slip/basin and any lot line.

**Cluster Development:** Minimum lot size determined by planning board, land character, and layout; lot size must equal soil table size  $\times$  number of units; allowance for open space, which is deeded against other uses; adequacy statement required for utility systems - water service, fire protection, sewer service and storm drainage.

**Road Design:** Must consider natural features and community assets; need adequate drainage for stormwater, and to prevent pavement flooding (50 year storm) and erosion; road construction must conform with laws of NH WSPCD and NH Fish and Game, and show no interference with watershed drainage; must have minimum number of access points.

**Sewer and Water Systems:** 75 feet between private septic tank or leachfield and on-site water supply, or adjoining water supply or any water shoreline; developer shall be responsible for installation/extension of public sewer and water lines, including improvements to meet increased demand; if there is a private water supply, it must be adequate to meet all needs; private sewer and water systems must meet NH WSPCD requirements.

**Erosion Control:** Control facilities must be consistent with Carroll County Soil Conservation District and US Soil Conservation Service guidelines.

**Recreation Land/Open Space:** Planning board may require open space/parks; can be maximum of 15% of subdivision.

**Waterfront Subdivision:** For subdivision with access or granting rights - minimum area of 40,000 square feet, plus 3,000 square feet for each additional unit (also by soil/slope table); no dwellings on beachfront; 100 feet minimum shore frontage for first unit plus 50 feet for each additional unit; same frontage may not be allocated more than once; for each unit with access and located 1/2 mile away - 1 parking space at beach area; 1 toilet facility each for male/female for every 25 units/lots; boating and swimming areas to be divided and separate.

**Watercourses Within a Subdivision:** Natural drainage is not to be obstructed unless runoff provisions exist.

**Impact Documentation:** Developer shall provide environmental and economic impact statement; documentation to include drainage, erosion, forest productivity, ground and surface water quality, traffic safety, public services, and any other long/short-term factors for public well being.

**Unsuitable Conditions for Subdivision Development:** Scattered or premature use of land; development that shows threat to prosperity of town because of lack of water, drainage, transportation, schools, fire protection, or other public services; development that would conflict with harmonious development of town; unsuitable natural conditions - rock formation, steep slopes, unusual surface configuration, periodic flooding tendencies, unsuitable soils, inadequate capacity for sanitary sewer disposal.

**Other:** Subdivision needs approval of NH WSPCD. **Conversion to condo or timesharing unit:** Sub-surface sewage disposal shall conform to NH WSPCD; Drinking water supplies from groundwater to be protected by restricting land use/conserving water quality and quantity within the protective radius (radius is based on average daily demand on the system); no sewer, sewage or waste disposal system shall be permitted within the protective radius; Responsibility of sewer and water to be clearly established in agreement.

**Protective Well Radius for Community Water Systems:** If subdivision has 4 lots or more, must have protective radius; No building allowed in radius (except a pumping facility); no risks allowed that might cause contamination.

## **SITE PLAN REVIEW REGULATIONS - MOULTONBOROUGH**

**Buffer Strips:** Must have landscaped buffers, except when residential abuts another residential lot.

**Drainage Provisions:** Parking/loading area shall be properly drained.

**Special Investigation:** Developer is responsible for all costs.

**Site Plan Requirements:** Same as Sandwich, except that zoning district identification is not required.

**Relaxation of Standards:** Waiver for undue hardship or injustice to owner.

**Performance Bond:** Access improvements, streets, roads, sewer and water disposal, drainage and any other planning board requirements.

**Site Inspections:** May conduct to determine natural/built-up conditions or layout of the site.

**Parking:** Off-street parking/loading provision; minimize impact of intrusive elements; if existing use changes, parking must accommodate new use; proper drainage required; parking must be on primary use land except when off-street public parking is available; shall have adequate space for handicapped parking.

**Other:** Documentation - land use in development; stages of development, deeds of easements and right-of-ways; condominium declaration; any restrictions.



## **TOWN OF NEW HAMPTON**

### **ZONING REGULATIONS**

**Districts:** General Residential, Agricultural and Rural; General Business; Village; Flood Hazard District; Pemigewasset Overlay District.

**Water Setbacks:** Septic tanks - 125 feet for Pemi Overlay district; 75 feet generally.

**Minimum Shore Frontage:** Generally, 150 feet (includes stream or pond frontage also); 200 feet in Pemigewasset Overlay District.

**Minimum Lot Size/Lot Size by Soil/Slope:** 1 acre/dwelling unit, unless community sewer and water systems are provided; then board of adjustment modifies lot size; variation depends on soil/slope. Pemigewasset Overlay district - 2 acres/unit in

**Lot Line Setback:** Buildings - 35 feet from front; 20 feet from side and rear; 100 feet from front, side, rear for industrial parks in Business district. Septic system - 20 feet between system and any property line.

**Minimum Lot Frontage** - 150 feet unless lot has deeded private right-of-way or lot is located on a curve.

**Unit Density** - 1 acre/unit.

**Maximum % of Lot Covered by Building:** Commercial - 50% coverage; 20% in all other districts.

**Height Restrictions:** 35 feet.

**Overlay District:** Pemigewasset Overlay District. Specific dimensional requirements; prohibited uses - mobile home parks; junkyards; earth excavation when permit under RSA 155-A is required; diversion of the river.

**Flood Area:** Flood Hazard District established for those areas subject to periodic flooding and delineated as alluvial soils by the Soil Conservation Service, Belknap Company, 1968; where flood hazard district is superimposed over another zoning district, the more restrictive regulations apply. **Permitted uses** - agriculture, private and public recreation, residential accessories. **Special exceptions** - Other accessory uses, fairgrounds, extraction of natural materials, marinas, boat rentals, docks, railroads, streets, bridges, pipelines. **Structures** - No structures for human habitation; other structures shall have low flood damage potential and minimum obstruction to floodwater flow; need a permit to deposit fill in district.

**Removal of Natural Material:** Permitted for private use, provided that all land shall be regraded and seeded to protect against erosion and washouts; must conform to town's Earth Excavation regulations.

**Off-Street Parking:** Off street space for delivery vehicles; parking space - 200 square feet of all weather, dustless surface plus maneuvering area; **residential** - 2 spaces/unit; **public assembly** - 1 space/6 seats; **hotel** - 1 space/unit and 1 space/employee; **commercial/industrial** - minimum of 3 spaces, with 1 space/employee, 1 space/patron.

Obnoxious Use/Junkyard: Obnoxious use prohibited; junkyards are permitted by special exception in Rural-Agricultural-Residential district; must comply with State regulations.

Non-Conforming Uses: Pre-existing use may continue, except when abandoned for 1 year, in which case it must conform to current regulations; may expand as long as it does not become more non-conforming; non-conforming buildings which are destroyed may be replaced/rebuilt if non-conforming is not increased.

## **SUBDIVISION REGULATIONS - NEW HAMPTON**

Investigative Studies: Concerning drainage; erosion control; sewage disposal system.

Preliminary Subdivision Layouts: Consideration of topography, other essential site features -water courses, ponds, standing water, rock ledges. Site location; boundaries; existing easements; water mains, sewers, culverts, drains, connections, alternate water supply; sewage disposal and surface drainage, perc. test results, soils and support data for sewer and water that insures non-contamination; public use land with deed restrictions; location and size of bridges, culverts.

Final Plat Requirements: Lot lines/size; easements; public use area; reservations; general site location; road plan, including bridges, culverts, under-drains; abutters; topography.

Performance Bond (except for in a minor subdivision): Streets; extension of public sewer and water lines; storm drains; under-drains; erosion control.

Areas Not to be Platted: Areas that show potential danger from fire, flood, poor drainage, excessive slope or other hazardous conditions; areas that would have inadequate sanitary sewage disposal (unless connected to municipal system).

Easements: Water courses for public control - 25 feet minimum; proposed permanent easements - 15 feet minimum width; any controlled access reserve strip prohibited; reasonable size and character for park/playground area.

Flood Hazard Areas Within a Subdivision: No 100 year flood area data; all construction and public utilities will be located and built so as to minimize/ eliminate flood damage; adequate drainage to reduce hazard exposure; consistent in minimizing flood damage; new sewer and water system shall minimize/eliminate infiltration into system.

Minimum Lot Frontage: 150 feet on water or road.

Minimum Lot Size: 1 acre/unit - variation depends on soil/slope; soils table included in subdivision regulations to determine lot size.

Lot Line Setback: 20 feet between building and lot line.

Cluster Development: Number of units depends on planning board, land character, housing type etc; open space with deeded restrictions; total land area is to be minimum of 10 acres; maximum of 6 units may be grouped, and each unit must have minimum land area of 10,000 square feet; minimum distance between buildings in different clusters is to be 50 feet; 30 feet minimum between detached units in a cluster; 2 parking spaces/dwellings; need adequacy statement for public utilities.

**Road Design:** Must include drainage facilities, including catch basins, ditches, underground pipes 15 inches in diameter; all culverts shall have 2 headers.

**Sewer and Water Systems:** Subdivider is responsible for extending town lines; septic tank and leach field must be minimum of 75 feet from any water supply or shoreline.

**Erosion Control:** All embankments shall be graded, raked, loamed, hayed, and seeded.

**Waterfront Subdivision:** Subdivisions with frontage on Little Squam and Pemigewasset Rivers must comply with Article 5 of the zoning ordinance.

**Watercourses within a Subdivision:** No natural drainage way shall be obstructed unless there are runoff provisions, including cleaning and increase in size of drainage swales (3 feet by 16 inches deep at row on both sides); must notify NH Civil Defense Agency and Wetlands Board; must give evidence of notification to building inspector, Federal Emergency Management agency and adjacent communities; need engineer's certification of flood carrying capacity of the water course.

**Parking:** 2 off street parking spaces per dwelling.

**Unsuitable Conditions for Subdivision Development:** Scattered or premature use of land; development that poses threat to prosperity of town because of lack of water, drainage, transportation, schools, fire protection, or other public services; development that would conflict with harmonious development of town.

## TOWN OF SANDWICH

### ZONING ORDINANCE

Districts: Rural Residential; Historic; Commercial; Waterfront.

Water Setback: Buildings - 100 feet between waste generating structure and high water line of water/wetlands; no detached structure (ex. garage) to be placed closer than 50 feet from high water line of waterbody or wetland. Septic, leachfield - 125 feet between septic tank/leachfield and high water line of waterbody or wetland.

Minimum Shore Frontage: Waterfront district - 320 feet/unit. For lakefront used for purpose of granting deeded rights of access, 320 feet/unit, plus extra 50 feet additional frontage for each additional unit having access.

Minimum Lot Size/Lot Size by Soil/Slope: Single family or business - 100,000 square feet minimum (variation based on lot size requirements of soils table); multiple unit development - 175,000 square feet minimum, and number of units shall not exceed 1 unit for each acre of developable land; mobile homes - 175,000 square feet for first 4 home sites; 1 acre for each additional site. On steep slopes (15-25%) - single family, 260,000 square feet minimum lot size; multiple units - 455,000 square feet minimum.

Lot Line Setbacks: Buildings (includes septic) - no dwelling, or structure of a waste generating nature within 50 feet of side or back lot lines; no detached structure within 25 feet of side or back lot lines; 75 feet between center road and dwelling; 40 feet between center of road and detached structure; 15 feet between edge of right-of-way and detached structure.

Minimum Lot Frontage: 160 feet road frontage; multiple-unit property may be required by planning board to exceed this, depending on number of units and layouts.

Unit Density: Single family - 1 unit/lot; multiple-unit development - 1 unit/43,750 square feet; on steep slopes - 1 unit/113,750 square feet.

Percent of Lot Covered by Building: Commercial - 50% maximum, including 200 feet wooded buffer zone.

Waterfront Access: Lakefront lots within the Waterfront district shall not be used for purpose of granting deeding rights or access to the lake to residents of multiple-unit nonwaterfront properties. Lakefront lots within district that are used to grant deeded rights of access to lake for residential single family dwelling units (regardless of location of units) shall not have less than 320 feet of shore frontage; 50 feet of additional shore frontage granted for each additional unit.

Wetlands Protection: Limits of wetlands - all areas subject to high water tables for extended periods of time, to include, but not necessarily be limited to, all such areas delineated as wetlands on current Sandwich Wetlands Maps on file in the town office. Isolated wetlands less than 15,000 square feet not contiguous to surface waters may be disregarded in computing minimum lot size if planning board determines these areas don't interfere with health and safety of community; however they must be platted. Purpose of Wetlands Conservation District - to prevent development in wetlands which would contribute to pollution; prevent destruction or significant change of wetlands; protect unique and unusual natural areas and wildlife habitat; ensure potential water supplies by protecting aquifers and their recharge areas; forestall expenditure of municipal funds that might be needed because of misuse or abuse of wetlands. Permitted uses - forestry; agriculture, with suitable soil practices; wildlife refuges; parks; open space; conservation areas. Special provisions - 125 feet between septic

system and wetland; 100 feet between any dwelling/structure and wetland; wetlands not included in minimum lot size.

**Steep Slope Protection:** Permitted uses - Single family and multiple family residence allowed if sewer and water and roads have no adverse impact; agriculture and silviculture, if soil conservation practices are used; recreation that does not alter the terrain, (not to include off-the-road vehicles unless special study is done); mining and excavation, if environmental impact study is done. Special provisions - minimum lot size for residential use - 260,000 square feet on slopes 15-25%; multiple-unit dwellings - 455,000 square feet, excluding wetlands and slopes in excess of 25%. No dwelling or structure of waste generating nature allowed on slope greater than 25%. Where area is composite of developable soils and steep slopes (15-25%), adjusted minimum lot size is determined by interpolation with Table 1. Isolated occurrences of steep slopes totalling less than 15,000 square feet may be disregarded when computing minimum lot size area, if planning board determines.

**Prime Wetlands:** Must have very poorly drained soils, unique or outstanding flora and fauna, and a significant role hydrologically in the watershed. May also have other characteristics which make them important.

**Flood Area:** See floodplain management section of zoning ordinance. All proposed development in any special flood hazard areas shall require a permit. Building inspector's 100-year flood elevation determination will be used as criteria for various requirements in area designated as zone A on Sandwich Flood Insurance Rate Map.

**Waterfront Parking/Toilet:** For units with access rights, but more than 1/2 mile away - 1 parking space.

**Recreational Camping Parks:** Designated to organized areas only (and private as well); minimum of 15 campsites with management; can't be visible from adjacent dwelling or from water surface; 200 feet from any public road or lot line; provision for safe drinking water, sewage, fire control, and solid waste disposal.

**Removal of Natural Material:** Gravel pits permitted in Rural/Residential district, if they comply with town's excavation regulations. Excavation not allowed in Historic district.

**Height Restrictions:** Maximum of 32 feet.

**Off-Street Parking:** Single family unit - 2 spaces of at least 200 square feet each; commercial - 3 square feet of parking area for every square feet of floor area to be used for business; restaurants - 1 space for every 3 seats; manufacturing - 200 square feet for each 2 employees.

**Obnoxious Use/Junkyards:** No use of vehicles as dwellings; no more than 2 unlicensed vehicles to be parked or stored unless in authorized sales areas, enclosed buildings or approved junkyards, unless unlicensed vehicles are special or are farm vehicles.

**Fire Damaged or Hazardous Buildings:** Building suffering structural damage shall be repaired or completely removed within one year of notice.

**Non-Conforming Uses:** May continue if non-conforming use existed before 3/12/85; cannot be enlarged or changed to another non-conforming use; when use has been discontinued for 1 year, land use must then conform to current regulations.

## **SUBDIVISION REGULATIONS - SANDWICH**

**Investigative Studies:** Whatever planning board deems necessary; developer responsible for cost; determination of impact on environment; impact on public facilities and services for short and long term.

**Final Plat Requirements:** Square footage of lots; wetlands; stream beds; soil types, using Carroll County Soil Survey or High Intensity Soil Survey; floodplain areas; setbacks; easements; areas to be dedicated to public use; right-of-ways; street cross-sections; grades; surface elevations, including steep slopes; information on on-lot sewage, water, drainage; off-site geographical features within 200 feet of proposed subdivision.

**Performance Bond:** Streets, extension of public sewer and water lines, storm drains; erosion control. Not needed if subdividing into less than 4 lots, or if planning board waives.

**Preservation and Protection of Features** Trees, scenic points, brooks, streams, waterbodies, other natural areas; historic landmarks.

**Areas Not to be Platted:** Areas that can be platted but are not to be included in minimum lot size - flood/fire hazards; poor drainage areas; poor soil conditions; excessive slope; high water tables; floodplains; areas with less than 3 feet natural soil cover impermeable material.

**Easements:** Where topography makes difficult the inclusion of utilities, etc. within a public area; proposed permanent easements and water courses for public control are to be a minimum of 20 feet; for fire fighting - 30 feet easements, at intervals (these areas shall have no other purpose); in dry areas, subdivision shall furnish fire ponds, dry hydrants and other fire protection; recreation easement.

**Flood Hazard Areas Within a Subdivision:** Proposals which include land designated as "Areas of Special Flood Hazard" by Federal Emergency Management Agency, and shown on Flood Insurance Rate Maps, must provide sufficient evidence to show that requirements of Section XI of Sandwich Zoning Ordinance have been satisfied.

**Minimum Lot Frontage:** 160 feet minimum road frontage for single lots; minimum frontage for multiple unit development may be required to exceed 160 feet; 160 feet, depending on number of units, layout and configurations.

**Minimum Lot Size:** Based on soil, wetlands, floodplains and slopes (Table 1), the following minimum lot sizes are allowed: single family unit - 100,000 square feet; single family unit on steep slope area - 260,000 square feet; multiple-unit development - 175,000 square feet, with number of units not to exceed 1 per 43,750 square feet; multiple-unit development on steep slope area - 455,000 square feet, with number of units not to exceed 1 per 113,750 square feet. For areas consisting of both developable land and steep slopes, minimum lot size is determined by interpolation of Table 1.

**Building Location:** Water and wetlands setback - 100 feet for waste generating structure, unless wetland area is less than 1 acre, and is not contiguous to surface waters; 125 feet for septic system; 50 feet for detached structure. Lot line setback - 50-75 feet.

**Cluster Development:** Planning board approval required; minimum lot size - 4 acres, with 1 unit/acre; plat to include - waste disposal, surface water, flood-prone boundaries and site plan.

**Road Design:** Specifications regarding road foundation material and construction; streets to be logically related to topography; provisions for drainage by a stormwater system; drainage ditches are to be 3 feet by 16 inches at right-of-way on both sides; all utilities shall be placed underground if possible; minimize number of road access points.

**Sewer and Water Systems:** Each lot shall satisfy requirements of State of New Hampshire and Town of Sandwich for sewage disposal systems near shorelines, wetlands, floodplains. Each lot also will be adequate for on-site water supply, located no closer than 75 feet from septic tank or leachfield on its own or adjoining lots; if sewage and water connections are required, is responsibility of developer to connect to existing public lines.

**Erosion Control:** All erosion control facilities to be consistent with Carroll County Conservation District or SCS procedures and guidelines; paving, stone, or sod waterways in ditches; maintenance of vegetative cover on steep slopes, seeding of road shoulders and embankments; construction of settlement basins and temporary dams; other measures during lot clearing, road construction.

**Recreation Land/Open Space:** Planning board may require open space/parks; maximum of 15% of subdivision.

**Waterfront Subdivision:** A minimum of 320 feet is required for lakefront lots; for lakefront lots used for purpose of granting rights of access for single family units, 320 feet is required for first unit, and 50 additional feet is required for each additional unit having access.

**Watercourses Within a Subdivision:** Natural drainage not to be altered unless adequate means taken to provide for runoff. Natural water courses must be cleaned and if necessary, increased, to take care of storm run-off.

**Bridges:** Location/size in plat.

**Waiver:** If undue hardship/injustice to owner because of property limitations.

**Impact Documentation:** For multiple-unit development in steep slope areas, EIS must be done; planning board may require that one be done for multiple-unit developments in other areas; planning board may require EIS for single lot development. Impact statement may require evaluation of drainage, erosion, forest productivity, ground and surface water quality, traffic safety, public services, etc.

**Unsuitable Conditions for Subdivision Development:** Scattered or premature use of land; development that threatens prosperity of town because of lack of water, drainage, transportation, schools, fire protection, or other public services; development that conflicts with harmonious development of town.

**Other:** Unit density: 1 dwelling per lot except in multiple-unit development or steep slope areas; steep slope areas (areas in excess of 15%): There are special plat requirements - delineation of topography at intervals of 5 feet, as determined by field survey or aerial photos; separate delineation of slope areas that are over 15% and areas that are over 25%.

## **SITE PLAN REVIEW REGULATIONS - SANDWICH**

**Pollution Control:** Provisions for safe storage of hazardous materials and/or waste to protect against environmental pollution.

**Buffer Strips:** Buffers/landscaping/screening to protect adjoining properties from offensive site uses, unsightly appearance, smoke, noise, visual pollution; adequate buffer between site and other properties, roads, litter collection.

**Drainage Provision:** Adequate provisions must be made if site is in flood hazard area, in order to minimize flood damage to structures, public facilities, and septic systems.

**Erosion and Sedimentation:** Access, parking and loading areas are to be constructed to minimize dust, erosion, and runoff conditions that would be detrimental to neighboring properties.

**Site Plan Requirements:** Base survey, including boundaries of existing natural features, vegetative cover of area; existing features on-site border; site plan map; plan detail including roads, parking, structures, special facilities, topography; existing and proposed water lines, wells, sewage systems and lines, surface drainage, utility lines, sewage disposal fields, service areas; additional material including NH WSPCD approval for on-lot sewage systems.

**Performance Bond:** Conditions of site plan and any other pertinent zoning ordinance, subdivision regulations, and building regulations.

**Sewer and Water Systems:** Adequate sizes for demand; and conforming to NH WSPCD regulations.



## APPENDIX B

### Soil Unit Codes and Development Capability

This appendix identifies the development capability classification to which each soil unit was assigned, according to the latest local zoning ordinance in the Squam Lakes watershed.

The development capability categories employed were the following:

1. Less than .5 acres per dwelling unit
2. .5 to 1 acre per dwelling unit
3. 1 to 1.5 acres per dwelling unit
4. 1.5 to 2 acres per dwelling unit
5. 2 to 2.5 acres per dwelling unit
6. 2.5 acres or more per dwelling unit
7. Wetland and alluvial soils - not developable
8. Soils on slopes greater than 25 percent - not developable
9. Gravel pits, disturbed land and other soils which had not been rated for development capability at the time of this analysis.

The following soil units are listed by development capability category:

#### Belknap County Soil Codes for Centre Harbor, Meredith and New Hampton

All three towns have adopted the same lot size/soil type table in their zoning ordinances.

Develop Category	Soil Unit Symbol	Soil Unit Name
4	AaB	Acton and Acton Firm Substratum- Fine Sandy Loams- 0-8% Slopes
4	AtB	Acton and Acton Firm Substratum- Very Stony Fine Sandy Loams- 0-8% Slopes
4	AtC	Acton and Acton Firm Substratum- Very Stony Fine Sandy Loams- 8-15 % Slopes
7	AuB	Au Gres Loamy Sand- 0-8% Slopes
3	CaB	Charlton Loam- 3-8% Slopes
3	CaC	Charlton Loam- 8-15% Slopes
4	CaD	Charlton Loam- 15-25% Slopes
3	ChB	Charlton Very Stony Loam- 3-8% Slopes
3	ChC	Charlton Very Stony Loam- 8-15% Slopes
4	ChD	Charlton Very Stony Loam- 15-25% Slopes
8	ChE	Charlton Very Stony Loam- 25-60% Slopes
4	CrD	Charlton Extremely Stony Loam- 8-25% Slopes
8	CrE	Charlton Extremely Stony Loam- 25-60% Slopes
4	DeA	Deerfield Loamy Sand- 0-3% Slopes
4	DeB	Deerfield Loamy Sand- 3-8% Slopes
3	GcB	Gloucester Sandy Loam- 3-8% Slopes
3	GcC	Gloucester Sandy Loam- 8-15% Slopes
3	GcD	Gloucester Sandy Loam- 15-25% Slopes
3	GrB	Gloucester Very Stony Sandy Loam- 3-8% Slopes
3	GrC	Gloucester Very Stony Sandy Loam- 8-15% Slopes
3	GrD	Gloucester Very Stony Sandy Loam- 15-25% Slopes
8	GrE	Gloucester Very Stony Sandy Loam- 25-60% Slopes

3	GsD	Gloucester Extremely Stony Sandy Loam- 8-25% Slopes
8	GsE	Gloucester Extremely Stony Sandy Loam- 25-60% Slopes
9	Gv	Gravel and Borrow Pits
8	HrE	Hinckley Gravelly Loamy Sand- 15-60% Slopes
3	HsB	Hinckley Loamy Sand- 3-8% Slopes
7	Mh	Marsh
7	Mp	Muck and Peat
7	Oh	Ondawa Fine Sandy Loam- High Bottom
4	PaB	Paxton Loam- 0-8% Slopes
4	PaC	Paxton Loam- 8-15% Slopes
4	PnB	Paxton Very Stony Loam- 3-8% Slopes
4	PnC	Paxton Very Stony Loam- 8-15% Slopes
5	PnD	Paxton Very Stony Loam- 15-25% Slopes
8	PnE	Paxton Very Stony Loam- 25-60% Slopes
7	RbA	Ridgebury Loam- 0-3% Slopes
7	RdA	Ridgebury Very Stony Loam- 0-3% Slopes
7	RdB	Ridgebury Very Stony Loam- 3-8% Slopes
7	RhA	Ridgebury and Whitman Very Stony Loams- 0-3% Slopes
7	RhB	Ridgebury and Whitman Very Stony Loams- 3-8% Slopes
8	Ro	Rock Outcrop
7	Ru	Rumney Fine Sandy Loam
4	SgB	Shapleigh-Gloucester Sandy Loams- 3-8% Slopes
5	SgC	Shapleigh-Gloucester Sandy Loams- 8-15% Slopes
5	ShC	Shapleigh-Gloucester Very Rocky Sandy Loams- 3-15% Slopes
6	ShD	Shapleigh-Gloucester Very Rocky Sandy Loams- 15-25% Slopes
8	ShE	Shapleigh-Gloucester Very Rocky Sandy Loams- 25-60% Slopes
6	SoD	Shapleigh-Gloucester Extremely Rocky Sandy Loams- 8-25% Slopes
8	SoE	Shapleigh-Gloucester Extremely Rocky Sandy Loams- 25-60% Slopes
3	WdA	Windsor Loamy Sand- 0-3% Slopes
3	WdB	Windsor Loamy Sand- 3-8% Slopes
3	WdC	Windsor Loamy Sand- 8-15% Slopes
8	WdE	Windsor Loamy Sand- 15-60% Slopes
4	WoB	Woodbridge Loam- 0-8% Slopes
4	WoC	Woodbridge Loam- 8-15% Slopes
4	WvB	Woodbridge Very Stony Loam- 0-8% Slopes
4	WvC	Woodbridge Very Stony Loam- 8-15% Slopes

**Carroll County Soil Codes for Moultonborough and Sandwich**

**Moultonborough and Sandwich have different lot size/soil type tables in their zoning ordinances.**

Develop Category	Soil Unit Symbol	Soil Unit Name
7-7	AW	Alluvial Land- Wet
4-5	BcC	Becket Very Stony Fine Sandy Loam- 8-15% Slopes
3-5	BsB	Berkshire Very Stony Fine Sandy Loam- 3-8% Slopes
3-5	BsC	Berkshire Very Stony Fine Sandy Loam- 8-15% Slopes
3-6	BsD	Berkshire Very Stony Fine Sandy Loam- 15-25% Slopes
8-8	BsE	Berkshire Very Stony Fine Sandy Loam- 25-35% Slopes
3-6	BtD	Berkshire Extremely Stony Fine Sandy Loam- 8-25% Slopes
3-5	BVC	Berkshire Very Stony Fine Sandy Loam Association- Sloping

8-8	BVE	Berkshire Very Stony Fine Sandy Loam Association- Steep
8-8	BVF	Berkshire Very Stony Fine Sandy Loam Association- Very Steep
8-8	CEF	Canaan-Redstone-Rock Outcrop Association- Very Steep
3-5	CnB	Colton Gravelly Loamy Fine Sand- 3-8% Slopes
3-5	CnC	Colton Gravelly Loamy Fine Sand- 8-15% Slopes
3-5	CyA	Croghan Loamy Fine Sand- 0-3% Slopes
7-7	FA	Fresh Water Marsh
3-5	GsC	Gloucester Very Stony Fine Sandy Loam- 8-15% Slopes
3-6	GsD	Gloucester Very Stony Fine Sandy Loam- 15-25% Slopes
3-6	GtD	Gloucester Extremely Stony Fine Sandy Loam- 8-25% Slopes
8-8	GtE	Gloucester Extremely Stony Fine Sandy Loam- 25-60% Slopes
7-7	GW	Greenwood Mucky Peat
3-5	HfB	Hermon Fine Sandy Loam- 3-8% Slopes
3-5	HfC	Hermon Fine Sandy Loam- 8-15% Slopes
3-5	HmB	Hermon Very Stony Fine Sandy Loam- 3-8% Slopes
3-5	HmC	Hermon Very Stony Fine Sandy Loam- 8-15% Slopes
3-6	HmD	Hermon Very Stony Fine Sandy Loam- 15-25% Slopes
3-6	HnD	Hermon Extremely Stony Fine Sandy Loam- 8-25% Slopes
8-8	HnE	Hermon Extremely Stony Fine Sandy Loam- 25-60% Slopes
8-8	HOE	Hermon Very Stony Fine Sandy Loam Association- Steep
3-5	HsC	Hinckley Gravelly Loamy Sand- 8-15% Slopes
4-5	HtC	Hollis-Charlton Fine Sandy Loams- 8-15% Slopes
5-5	HvC	Hollis-Charlton Very Rocky Fine Sandy Loams- 8-15% Slopes
6-6	HxD	Hollis-Charlton-Rock Outcrop Complex- 8-25% Slopes
8-8	HxE	Hollis-Charlton-Rock Outcrop Complex- 25-60% Slopes
7-7	LfA	Leicester-Walpole Very Stony Fine Sandy Loams- 0-3% Slopes
7-7	LfB	Leicester-Walpole Very Stony Fine Sandy Loams- 3-8% Slopes
7-7	Lk	Limerick Silt Loam
3-5	LnB	Lyman-Berkshire Very Rocky Fine Sandy Loams- 3-8% Slopes
4-5	LnC	Lyman-Berkshire Very Rocky Fine Sandy Loams- 8-15% Slopes
6-6	LnD	Lyman-Berkshire Very Rocky Fine Sandy Loams- 15-25% Slopes
8-8	LnE	Lyman-Berkshire Very Rocky Fine Sandy Loams- 25-35% Slopes
6-6	LsD	Lyman-Berkshire-Rock Outcrop Complex- 8-25% Slopes
8-8	LsE	Lyman-Berkshire-Rock Outcrop Complex- 25-60% Slopes
5-5	LVC	Lyman-Berkshire Very Rocky Fine Sandy Loams Association- Slopes
8-8	LVE	Lyman-Berkshire Very Rocky Fine Sandy Loams Association- Steep
8-8	LVF	Lyman-Berkshire Very Rocky Fine Sandy Loams Association- Very Steep
8-8	LYE	Lyman-Rock Outcrop-Berkshire Association- Steep
8-8	LYF	Lyman-Rock Outcrop-Berkshire Association- Very Steep
3-5	MaB	Marlow Fine Sandy Loam- 3-8% Slopes
3-5	MdB	Marlow Very Stony Fine Sandy Loam- 3-8% Slopes
4-5	MdC	Marlow Very Stony Fine Sandy Loam- 8-15% Slopes
5-6	MdD	Marlow Very Stony Fine Sandy Loam- 15-25% Slopes
8-8	MdE	Marlow Very Stony Fine Sandy Loam- 25-60% Slopes
4-5	MFC	Marlow-Peru Very Stony Fine Sandy Loams Association- Sloping
3-5	MIB	Millis Fine Sandy Loam- 3-8% Slopes
4-5	MIC	Millis Fine Sandy Loam- 8-15% Slopes
3-5	MsB	Millis Very Stony Fine Sandy Loam- 3-8% Slopes
4-5	MsC	Millis Very Stony Fine Sandy Loam- 8-15% Slopes
5-6	MsD	Millis Very Stony Fine Sandy Loam- 15-25% Slopes
7-7	MU	Muck and Peat
7-7	NaB	Naumburg Loamy Sand- 0-8% Slopes
3-5	PeB	Peru Very Stony Fine Sandy Loam- 3-8% Slopes
5-5	PeC	Peru Very Stony Fine Sandy Loam- 8-15% Slopes

5-5	PLC	Peru Very Stony Fine Sandy Loam Association- Sloping
7-7	Ps	Podunk Fine Sandy Loam- Sandy Subsoil Variant
7-7	RgB	Ridgebury Fine Sandy Loam- 0-8% Slopes
7-7	RIA	Ridgebury Very Stony Fine Sandy Loam- 0-3% Slopes
7-7	RIB	Ridgebury Very Stony Fine Sandy Loam- 3-8% Slopes
3-5	SdB	Scituate Very Stony Fine Sandy Loam- 3-8% Slopes
3-5	WaB	Waumbek Very Stony Fine Sandy Loam- 3-8% Slopes
4-5	WaC	Waumbek Very Stony Fine Sandy Loam- 8-15% Slopes

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**Grafton County Soil Codes for Ashland, Holderness and Campton**

All three towns have adopted the same lot size/soil type table in their zoning ordinances.

Develop Category	Soil Unit Symbol	Soil Unit Name
7	102	Sunday Loamy Sand
7	104	Podunk Fine Sandy Loam
7	105	Rumney Fine Sandy Loam
7	109	Limerick Silt Loam
7	114A	Walpole-Binghamville Complex- 0-5% Slopes
7	15	Searsport Mucky Peat
3	173C	Berkshire Loam- 8-15% Slopes- Extremely Stony
3	173D	Berkshire Loam- 15-25% Slopes- Extremely Stony
8	173E	Berkshire Loam- 25-35% Slopes- Extremely Stony
3	22A	Colton Loamy Sand- 0-3% Slopes
3	22B	Colton Loamy Sand- 3-8% Slopes
3	22C	Colton Loamy Sand- 8-15% Slopes
8	22E	Colton Loamy Sand- 15-60% Slopes
3	254B	Monadnock and Hermon Soils- 3-8% Slopes
3	254C	Monadnock and Hermon Soils- 8-15% Slopes
3	254D	Monadnock and Hermon Soils- 15-25% Slopes
3	255B	Monadnock and Hermon Soils- 3-8%- Very Stony
3	255C	Monadnock and Hermon Soils- 8-15%- Very Stony
4	255D	Monadnock and Hermon Soils- 15-25% Slopes- Very Stony
8	255E	Monadnock and Hermon Soils- 25-35% Slopes- Very Stony
3	28B	Madawaska Fine Sandy Loam- 3-8% Slopes
7	295	Greenwood Mucky Peat
9	298	Pits- Gravel
9	299	Udorthents- Smoothed
3	313A	Deerfield Loamy Find Sand- 0-5% Slopes
7	347A	Lyme and Moosilauke Soils- 0-3% Slopes- Very Stony
7	347B	Lyme and Moosilauke Soils- 3-8% Slopes- Very Stony
3	355C	Hermon Fine Sandy Loam- 8-15% Slopes- Extremely Bouldery
3	355D	Hermon Fine Sandy Loam- 15-25% Slopes- Extremely Bouldery
8	355E	Hermon Fine Sandy Loam- 25-35% Slopes- Extremely Bouldery
3	36A	Adams Loamy Sand- 0-3% Slopes
3	36B	Adams Loamy Sand- 3-8% Slopes
3	36C	Adams Loamy Sand- 8-15% Slopes
5	559B	Skerry Fine Sandy Loam- 3-8%- Very Stony
4	559C	Skerry Fine Sandy Loam- 8-15% Slopes- Very Stony
6	559D	Skerry Fine Sandy Loam- 15-25% Slopes- Very Stony

3	56B	Becket Fine Sandy Loam- 3-8% Slopes
4	56C	Becket Fine Sandy Loam- 8-15% Slopes
5	56D	Becket Fine Sandy Loam- 15-25% Slopes
3	57B	Becket Fine Sandy Loam- 3-8% Slopes- Very Stony
4	57C	Becket Fine Sandy Loam- 8-15% Slopes- Very Stony
5	57D	Becket Fine Sandy Loam- 15-25% Slopes- Very Stony
8	57E	Becket Fine Sandy Loam- 25-35% Slopes- Very Stony
4	59B	Waumbek Loamy Sand- 3-8% Slopes- Very Stony
4	59C	Waumbek Loamy Sand- 8-15% Slopes- Very Stony
7	613A	Croghan Loamy Fine Sand- 0-5% Slopes
7	614A	Kinsman Sand- 0-5%
4	61B	Tunbridge-Lyman-Rock Outcrop Complex- 3-8% Slopes
5	61C	Tunbridge-Lyman-Rock Outcrop Complex- 8-15% Slopes
6	61D	Tunbridge-Lyman-Rock Outcrop Complex- 15-25% Slopes
8	61E	Tunbridge-Lyman-Rock Outcrop Complex- 25-60% Slopes
7	647A	Pillsbury Fine Sandy Loam- 0-3% Slopes- Very Stony
7	647B	Pillsbury Fine Sandy Loam- 3-8% Slopes- Very Stony
(9)	709D	Becket-Tunbridge Association- Hilly- Very Stony
(9)	719D	Marlow-Tunbridge Association- Moderately Steep- Very Stony
8	719E	Marlow-Tunbridge Association- Steep- Very Stony
8	720E	Marlow-Lyman-Rock Outcrop Complex- Steep
(9)	723B	Peru-Pillsbury Association- Gently Sloping- Very Stony
8	726E	Rock Outcrop-Lyman Complex- Steep
(9)	731	Peacham and Ossipee Soils- Very Stony
3	73C	Berkshire Loam- 8-15% Slopes- Very Stony
3	73D	Berkshire Loam- 15-25% Slopes- Very Stony
4	76C	Marlow Fine Sandy Loam- 8-15% Slopes
5	76D	Marlow Fine Sandy Loam- 15-25% Slopes
4	77C	Marlow Fine Sandy Loam- 8-15% Slopes- Very Stony
5	77D	Marlow Fine Sandy Loam- 15-25% Slopes- Very Stony
8	77E	Marlow Fine Sandy Loam- 25-35% Slopes- Very Stony
5	78C	Peru Fine Sandy Loam- 8-15% Slopes
3	79B	Peru Fine Sandy Loam- 3-8% Slopes- Very Stony
5	79C	Peru Fine Sandy Loam- 8-15% Slopes- Very Stony
3	90B	Tunbridge-Lyman Complex- 3-8% Slopes
4	90C	Tunbridge-Lyman Complex- 8-15% Slopes
6	90D	Tunbridge-Lyman Complex- 15-25% Slopes
8	36E	Adams Loamy Sand- 15-60% Slopes (36E)
7	395	Chocorua Mucky Peat (395)
7	406	Medomak Silt Loam
3	558B	Skerry Fine Sandy Loam- 3-8% Slopes

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## APPENDIX C

### Prime Farmland Soils

Farmland Code*	Soil Symbol	Soil Name
1	104	Podunk Fine Sandy Loam
1	28B	Madawaska Fine Sandy Loam- 3-8% Slopes
1	558B	Skerry Fine Sandy Loam- 3-8% Slopes
1	56B	Becket Fine Sandy Loam- 3-8% Slopes
1	CaB	Charlton Loam- 3-8% Slopes
1	MaB	Marlow Fine Sandy Loam- 3-8% Slopes
1	MIb	Millis Fine Sandy Loam- 3-8% Slopes
1	Oh	Ondawa Fine Sandy Loam- High Bottom
1	PaB	Paxton Loam- 0-8% Slopes
1	WoB	Woodbridge Loam- 0-8% Slopes
5	Ps	Podunk Fine Sandy Loam- Sandy Subsoil Variant

\* 1 = Unrestricted farmland soils

5 = Farmland soils with management restrictions

### Production Forest Soils

Forest Code	Soil Symbol	Soil Name
IA	173C	Berkshire Loam- 8-15% - Extremely Stony
IA	173E	Berkshire Loam- 25-35% - Extremely Stony
IA	254B	Monadnock and Hermon Soils- 3-8%
IA	254C	Monadnock and Hermon Soils- 8-15%
IA	254D	Monadnock and Hermon Soils- 15-25%
IA	255B	Monadnock and Hermon Soils- 3-8% - Very Stony
IA	255C	Monadnock and Hermon Soils- 8-15% - Very Stony
IA	255D	Monadnock and Hermon Soils- 15-25% - Very Stony
IA	255E	Monadnock and Hermon Soils- 25-35% - Very Stony
IA	28B	Madawaska Fine Sandy Loam- 3-8%
IA	558B	Skerry Fine Sandy Loam- 3-8%
IA	559B	Skerry Fine Sandy Loam- 3-8% - Very Stony
IA	559C	Skerry Fine Sandy Loam- 8-15% Slope - Very Stony
IA	559D	Skerry Fine Sandy Loam- 15-25% - Very Stony
IA	56B	Becket Fine Sandy Loam- 3-8%
IA	56C	Becket Fine Sandy Loam- 8-15%
IA	56D	Becket Fine Sandy Loam- 15-25%
IA	57B	Becket Fine Sandy Loam- 3-8% - Very Stony
IA	57C	Becket Fine Sandy Loam- 8-15% - Very Stony
IA	57D	Becket Fine Sandy Loam- 15-25% - Very Stony
IA	57E	Becket Fine Sandy Loam- 25-35% - Very Stony
IA	73C	Berkshire Loam- 8-15% - Very Stony

IA	73D	Berkshire Loam- 15-25% - Very Stony
IA	76C	Marlow Fine Sandy Loam- 8-15%
IA	76D	Marlow Fine Sandy Loam- 15-25%
IA	77C	Marlow Fine Sandy Loam- 8-15% - Very Stony
IA	77D	Marlow Fine Sandy Loam- 15-25% - Very Stony
IA	77E	Marlow Fine Sandy Loam- 25-35% - Very Stony
IA	78C	Peru Fine Sandy Loam- 8-15%
IA	79B	Peru Fine Sandy Loam- 3-8% - Very Stony
IA	79C	Peru Fine Sandy Loam- 8-15% - Very Stony
IA	AaB	Acton & Acton Firm Substra.- Fine Sdy Loams- 0-8%
IA	AtB	Acton & Acton Firm Substra.- Very Stony Fine Sdy Loams
IA	AtC	Acton & Acton Firm Substra.- Very Stony Fine Sdy Loams
IA	BVC	Berkshire Very Stony Fine Sandy Loam Ass.- Sloping
IA	BVE	Berkshire Very Stony Fine Sandy Loam Ass.- Steep
IA	BcC	Becket Very Stony Fine Sandy Loam- 8-15%
IA	BsB	Berkshire Very Stony Fine Sandy Loam- 3-8%
IA	BsC	Berkshire Very Stony Fine Sandy Loam- 8-15%
IA	BsD	Berkshire Very Stony Fine Sandy Loam- 15-25%
IA	BsE	Berkshire Very Stony Fine Sandy Loam- 25-35%
IA	CaB	Charlton Loam- 3-8%
IA	CaC	Charlton Loam- 8-15%
IA	CaD	Charlton Loam- 15-25%
IA	ChB	Charlton Very Stony Loam- 3-8%
IA	ChC	Charlton Very Stony Loam- 8-15%
IA	ChD	Charlton Very Stony Loam- 15-25%
IA	ChE	Charlton Very Stony Loam- 25-60%
IA	CrD	Charlton Extremely Stony Loam- 8-25%
IA	MFC	Marlow-Peru Very Stony Fine Sandy Loams Ass.- Sloping
IA	MaB	Marlow Fine Sandy Loam- 3-8%
IA	MdB	Marlow Very Stony Fine Sandy Loam- 3-8%
IA	MdC	Marlow Very Stony Fine Sandy Loam- 8-15%
IA	MdD	Marlow Very Stony Fine Sandy Loam- 15-25%
IA	MIB	Millis Fine Sandy Loam- 3-8%
IA	MIC	Millis Fine Sandy Loam- 8-15%
IA	MsB	Millis Very Stony Fine Sandy Loam- 3-8%
IA	MsC	Millis Very Stony Fine Sandy Loam- 8-15%
IA	MsD	Millis Very Stony Fine Sandy Loam- 15-25%
IA	Oh	Ondawa Fine Sandy Loam- High Bottom
IA	PLC	Peru Very Stony Fine Sandy Loam Association- Sloping
IA	PaB	Paxton Loam- 0-8%
IA	PaC	Paxton Loam- 8-15%
IA	PeB	Peru Very Stony Fine Sandy Loam- 3-8%
IA	PeC	Peru Very Stony Fine Sandy Loam- 8-15%
IA	PnB	Paxton Very Stony Loam- 3-8%
IA	PnC	Paxton Very Stony Loam- 8-15%
IA	PnD	Paxton Very Stony Loam- 15-25%
IA	Ps	Podunk Fine Sandy Loam- Sandy Subsoil Variant
IA	SdB	Scituate Very Stony Fine Sandy Loam- 3-8%
IA	WoB	Woodbridge Loam- 0-8%
IA	WoC	Woodbridge Loam- 8-15%
IA	WvB	Woodbridge Very Stony Loam- 0-8%
IA	WvC	Woodbridge Very Stony Loam- 8-15%
IB	102	Sunday Loamy Sand
IB	59B	Waumbek Loamy Sand- 3-8% - Very Stony



IB	59C	Waumbek Loamy Sand- 8-15% - Very Stony
IB	709D	Becket-Tunbridge Association- Hilly- Very Stony
IB	719D	Marlow-Tunbridge Ass.- Moderately Steep- Very Stony
IB	719E	Marlow-Tunbridge Ass.- Steep- Very Stony
IB	90B	Tunbridge-Lyman Complex- 3-8%
IB	90C	Tunbridge-Lyman Complex- 8-15%
IB	90D	Tunbridge-Lyman Complex- 15-25%
IB	GcB	Gloucester Sandy Loam- 3-8%
IB	GcC	Gloucester Sandy Loam- 8-15%
IB	GcD	Gloucester Sandy Loam- 15-25%
IB	GrB	Gloucester Very Stony Sandy Loam- 3-8%
IB	GrC	Gloucester Very Stony Sandy Loam- 8-15%
IB	GrD	Gloucester Very Stony Sandy Loam- 15-25%
IB	GsC	Gloucester Very Stony Fine Sandy Loam- 8-15%
IB	GsD	Gloucester Extremely Stony Sandy Loam- 8-25%
IB	HOE	Hermon Very Stony Fine Sandy Loam Association- Steep
IB	HfB	Hermon Fine Sandy Loam- 3-8%
IB	HfC	Hermon Fine Sandy Loam- 8-15%
IB	HmB	Hermon Very Stony Fine Sandy Loam- 3-8%
IB	HmC	Hermon Very Stony Fine Sandy Loam- 8-15%
IB	HmD	Hermon Very Stony Fine Sandy Loam- 15-25%
IB	HtC	Hollis-Charlton Fine Sandy Loams- 8-15%
IB	HvC	Hollis-Charlton Very Rocky Fine Sdy Loams- 8-15%
IB	LVC	Lyman-Berkshire Very Rocky Fine Sdy Loams Ass.- Slo
IB	LVE	Lyman-Berkshire Very Rocky Fine Sdy Loams Ass.- Steep
IB	LnB	Lyman-Berkshire Very Rocky Fine Sandy Loams- 3-8%
IB	LnC	Lyman-Berkshire Very Rocky Fine Sdy Loams- 8-15%
IB	LnD	Lyman-Berkshire Very Rocky Fine Sdy Loams- 15-25%
IB	LnE	Lyman-Berkshire Very Rocky Fine Sdy Loams- 25-35%
IB	SgB	Shapleigh-Gloucester Sandy Loams- 3-8%
IB	SgC	Shapleigh-Gloucester Sandy Loams- 8-15%
IB	ShC	Shapleigh-Gloucester Very Rocky Sdy Loams- 3-15%
IB	ShD	Shapleigh-Gloucester Very Rocky Sdy Loams- 15-25%
IB	WaB	Waumbek Very Stony Fine Sandy Loam- 3-8%
IB	WaC	Waumbek Very Stony Fine Sandy Loam- 8-15%
IC	22A	Colton Loamy Sand- 0-3%
IC	22B	Colton Loamy Sand- 3-8%
IC	22C	Colton Loamy Sand- 8-15%
IC	313A	Deerfield Loamy Fine Sand- 0-5%
IC	36A	Adams Loamy Sand- 0-3%
IC	36B	Adams Loamy Sand- 3-8%
IC	36C	Adams Loamy Sand- 8-15%
IC	613A	Croghan Loamy Fine Sand- 0-5%
IC	CnB	Colton Gravelly Loamy Fine Sand- 3-8%
IC	CnC	Colton Gravelly Loamy Fine Sand- 8-15%
IC	CyA	Croghan Loamy Fine Sand- 0-3%
IC	DeA	Deerfield Loamy Sand- 0-3%
IC	DeB	Deerfield Loamy Sand- 3-8%
IC	HsB	Hinckley Loamy Sand- 3-8%
IC	HsC	Hinckley Gravelly Loamy Sand- 8-15%
IC	WdA	Windsor Loamy Sand- 0-3%
IC	WdB	Windsor Loamy Sand- 3-8%
IC	WdC	Windsor Loamy Sand- 8-15%



## APPENDIX D

### Historical Water Quality Data for the Squam Lakes

There have been numerous short-term studies done of the Squam Lakes since the 1950's, but it is only within the last 10 years or so that consistent, readily comparable data have been compiled. Comparison of data from earlier studies with this more recent data is difficult, for a number of reasons. First is the fact that different sites may have been sampled, and at different times of the year and different times of day. Such data is subject to a large amount of variation. Also, different sampling methods may have been used to obtain the data, and different techniques may have been used to analyze these samples. Techniques used in the analyses have been improved over the years and are much more sensitive than they once were. A good example of this is the measurement of total phosphorus, which at one time was measured in parts per million, but is now measured in parts per billion. It is important to keep changes such as this in mind when looking at the older data, in order to get a realistic perspective of how it relates to the more recent data.

The earliest water quality studies of the Squam Lakes were done by the New Hampshire Fish and Game Department in 1938 and in the 1950's. The data provided a single depth profile of temperature and dissolved oxygen, pH, carbon dioxide, and alkalinity. Methyl orange alkalinity readings found for Squam Lake in 1938 averaged 6.8. Little Squam Lake alkalinity averaged 7.0  $\text{CaCO}_3\text{L}^{-1}$  at this time. These numbers can be directly compared to UNH fixed end point alkalinity measurements taken for the last nine years.<sup>1</sup> Average Squam fixed end point alkalinity has been 5.1  $\text{CaCO}_3\text{L}^{-1}$ , while Little Squam  $\text{CaCO}_3\text{L}^{-1}$  alkalinity has averaged 5.8.

A group of researchers from the University of New Hampshire sampled a number of lakes in the Lakes Region, including the Squam Lakes, in 1967 and 1968. They obtained secchi disk readings for 3 points on the lake. These readings ranged from 6.7 to 7.8 meters in depth. Chlorophyll *a* was measured at three sites and 6-7 different depths, and was found to have a range of 1 to 6  $\text{mg/m}^3$ . In comparison to the other lakes which the research team was also studying, a later study described Squam Lake as mesotrophic.<sup>2</sup> These numbers indicate that the lake may have "tended toward" mesotrophic conditions. However, because no average values over time were given, the mesotrophic label appears to be unjustified.

The first in depth water quality study of Squam Lake was done by Jason Cortell and Associates, in the summer and fall of 1969. Stations were established throughout the lake to provide data on water transparency, phosphorus and nitrogen levels, and plankton species. Unfortunately, later studies raised serious questions about the phosphorus data that was obtained in this particular study.<sup>3</sup> The 1974 Squam Lakes Water Quality Study said that the phosphorus levels found in the Cortell Study, which would indicate extremely eutrophic conditions, did not correspond with relatively high dissolved oxygen and transparency levels that were obtained in the study at the same sites. The phosphorus data also appears to conflict dramatically with other phosphorus data that has been collected since the Cortell Study was done.

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<sup>1</sup> LLMP, 1989, Loc. cit.

<sup>2</sup> Lakes Region Planning Commission, *Squam Lakes Water Quality 1974, 1975*.

<sup>3</sup> Ibid.

Studies done by Frey and Fabian in 1972<sup>4</sup> and 1973<sup>5</sup> focused primarily on bacteriological work, though some useful data on secchi disk readings, total phosphorus concentrations, nitrate concentrations and phytoplankton were also provided. Secchi disk readings were high, 6.1 to 8.2 meters, in most of the sites that were that deep. Total phosphorus levels in 1972 were found to increase by an order of magnitude, from June to July. It is hard to reach any conclusions from the data, because it was sparse, and there is no indication of where the sampling was done. The 1973 study indicated that phosphorus levels remained low.

The previously mentioned 1974 Lakes Regional Planning Commission Study conducted an in-depth water quality study of Squam Lake. Samples were taken every two to three weeks (a total of 5 times) at 12 lake stations, throughout the summer. Sites sampled included: Dog Cove; Sturtevant Bay; Bean Cove; Birch Island - Utopia; Cotton Cove; Hubble Island; Perch Island - Diamond Ledge; Hoag Island- Brown Point; Sandwich Bay; Squaw Cove and Rattlesnake Cove. The study reported that "evidence of increased biological activity was found in both lakes in comparison to earlier studies".<sup>6</sup> This activity was indicated by generally lower secchi disk readings, a late summer oxygen deficit in the hypolimnion (lower depths) of both lakes and a late summer algae bloom of *Gloetrichia* sp. (a blue-green algae) throughout the lakes. Phosphorus levels on the lakes were generally low, and decreased at most sites during the summer.

Also done in 1974 was a limnological survey of Squam Lake and Lake Winnepesaukee. The study was prepared by Biospheric Consultants International, for the Lakes Region Planning Commission. Vertical profiles for dissolved oxygen, turbidity, pH, conductivity and water temperature were found to be "typical for low productive northern temperate lakes."<sup>7</sup>

Harvard researchers undertook a study on the Squam Lakes from March 1975 through March 1976. The study was done because of preliminary investigations which indicated that though the lakes could still be classified as oligotrophic, they were beginning to show signs of increased human activity. Five open water sampling stations were established, which were considered to be representative of both of the Squam Lakes. Secchi disk transparency ranged from 4.4 to 8.1 meters over the course of the study. Chlorophyll *a* values for surface waters, from July through September, 1975, varied from 0.6 mg/m<sup>3</sup> in late July to 2.3 mg/m<sup>3</sup> in late September. Phytoplankton studies indicated mostly diatom species, with some dinoflagellates, green algae and blue-green species. No increase in numbers for a single species was observed which was comparable to the bloom of the blue-green algae *Gloetrichia* sp. in August of 1974. The study indicated that there was an increase in total phosphorus in the water column from September to October, most likely a result of fall turn-over/mixing.<sup>8</sup>

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<sup>4</sup> Frey and Fabian, UNH Water Resources Research Center, *Determining the Tolerance of a Recreational Lake for Development and Usage, I: Water Quality Data and the Current Status of Squam Lake*, 1972.

<sup>5</sup> Frey and Fabian, UNH Water Resources Research Center, *Determining the Tolerance of Recreational Lake for Development and Usage, II: Developing a Method to Determine Sources of Pollution and Contamination through Water Analysis*, 1973.

<sup>6</sup> LRPC, Loc. cit.

<sup>7</sup> Biospheric Consultant International, for Lakes Region Planning Commission, *A Limnological Survey of Squam Lake and Lake Winnepesaukee*, 1974.

<sup>8</sup> Harvard Study on Squam Lakes, 1976.

## APPENDIX E

### A Partial List of Wildlife Species Potentially Occurring in the Squam Lakes Watershed by Habitats Utilized

#### Types of Habitats

Wetlands (Marshes, Swamps, Bogs)  
Water (Ponds, Lakes, Streams, Rivers)  
Riparian (shores of rivers, streams and lakes)  
Forested (sapling to mature stages)  
    Hardwood (Aspen, Birch, Maple, Oak)  
    White Pine  
    Other Softwood (Balsam Fir, Red Spruce, Hemlock)  
    Mixed Hardwood/Softwood  
Agricultural Land (Cultivated, Grass, Pasture, Orchards)  
Reverting Farmland (Forb, Old Fields, Savanna)  
Structures (Structure, Derelict Buildings, Debris)  
Miscellaneous Habitats

#### Symbols Prior to Species Name Indicate:

- # Species not currently known to be present but has potential to re-establish
- @ Species not expected to breed in watershed but occurs as migrant, winter resident or transient

References: DeGraaf, RM and Rudis, DD: New England Wildlife: Habitat, Natural History, and Distribution Northeastern Forest Experiment Station, General Technical Report NE-108, Revised June 1987.

Ridgely, B: Guide to the Birds of Squam Lakes Region, New Hampshire. Squam Lakes Association. Holderness, NH 1988.

Species	Wetlands	Water	Riparian	Hardwood	White Pine	Other Softwood	Mixed Hdwd/Stwd	Agricultural Land	Reverting Farmland	Structure	Misc Habits
Class: Mammal											
Beaver	*	*	*	*		*	*				
Big Brown Bat	*	*	*	*	*	*	*	*	*	*	*
Black Bear	*	*	*	*	*	*	*	*	*	*	*
Bobcat	*	*	*	*	*	*	*	*	*	*	*
Coyote	*	*	*	*	*	*	*	*	*	*	*
Deer Mouse		*	*	*	*	*	*	*	*	*	*
Eastern Chipmunk		*	*	*	*	*	*	*	*	*	*
Eastern Pipistrelle	*	*	*	*	*	*	*	*	*	*	*
Ermine	*	*	*	*	*	*	*	*	*	*	*
Fisher	*	*	*	*	*	*	*	*	*	*	*
Gray Fox	*	*	*	*	*	*	*	*	*	*	*
Gray Squirrel		*	*	*	*	*	*	*	*	*	*
Hairy-tailed Mole		*	*	*	*	*	*	*	*	*	*
Hoary Bat	*	*	*	*	*	*	*	*	*	*	*
House Mouse		*	*	*	*	*	*	*	*	*	*
Keen's Myotis	*	*	*	*	*	*	*	*	*	*	*
Little Brown Myotis	*	*	*	*	*	*	*	*	*	*	*
Long-tailed Shrew		*	*	*	*	*	*	*	*	*	*
Long-tailed Weasel	*	*	*	*	*	*	*	*	*	*	*
Marten		*	*	*	*	*	*	*	*	*	*
Masked Shrew	*	*	*	*	*	*	*	*	*	*	*
Meadow Jumping Mouse	*	*	*	*	*	*	*	*	*	*	*
Meadow Vole	*	*	*	*	*	*	*	*	*	*	*
Mink	*	*	*	*	*	*	*	*	*	*	*
Moose	*	*	*	*	*	*	*	*	*	*	*
Muskrat	*	*	*	*	*	*	*	*	*	*	*
New England Cottontail	*	*	*	*	*	*	*	*	*	*	*
Northern Flying Squirrel		*	*	*	*	*	*	*	*	*	*
Northern Short-tailed Shrew	*	*	*	*	*	*	*	*	*	*	*
Norway Rat		*	*	*	*	*	*	*	*	*	*
Porcupine	*	*	*	*	*	*	*	*	*	*	*
Pygmy Shrew	*	*	*	*	*	*	*	*	*	*	*
Raccoon	*	*	*	*	*	*	*	*	*	*	*
Red Bat	*	*	*	*	*	*	*	*	*	*	*
Red Fox	*	*	*	*	*	*	*	*	*	*	*
Red Squirrel		*	*	*	*	*	*	*	*	*	*
River Otter	*	*	*	*	*	*	*	*	*	*	*
Rock Vole		*	*	*	*	*	*	*	*	*	*
Silver-haired Bat	*	*	*	*	*	*	*	*	*	*	*
Small-footed Myotis	*	*	*	*	*	*	*	*	*	*	*
Smoky Shrew	*	*	*	*	*	*	*	*	*	*	*
Snowshoe Hare	*	*	*	*	*	*	*	*	*	*	*
Southern Bog Lemming	*	*	*	*	*	*	*	*	*	*	*
Southern Flying Squirrel		*	*	*	*	*	*	*	*	*	*
Southern Red-backed Vole	*	*	*	*	*	*	*	*	*	*	*
Star-nosed Mole	*	*	*	*	*	*	*	*	*	*	*
Striped Skunk	*	*	*	*	*	*	*	*	*	*	*
Virginia Opossum	*	*	*	*	*	*	*	*	*	*	*
Water Shrew	*	*	*	*	*	*	*	*	*	*	*
White-footed Mouse	*	*	*	*	*	*	*	*	*	*	*
White-tailed Deer	*	*	*	*	*	*	*	*	*	*	*
Woodchuck	*	*	*	*	*	*	*	*	*	*	*
Woodland Jumping Mouse	*	*	*	*	*	*	*	*	*	*	*
Woodland Vole		*	*	*	*	*	*	*	*	*	*
Class: Reptile											
Common Snapping Turtle	*	*	*	*	*	*	*	*	*	*	*
Eastern Garter Snake	*	*	*	*	*	*	*	*	*	*	*
Eastern Milk Snake	*	*	*	*	*	*	*	*	*	*	*
Eastern Ribbon Snake	*	*	*	*	*	*	*	*	*	*	*
Eastern Smooth Green Snake	*	*	*	*	*	*	*	*	*	*	*
Midland Painted Turtle	*	*	*	*	*	*	*	*	*	*	*
Northern Black Racer	*	*	*	*	*	*	*	*	*	*	*
Northern Brown Snake	*	*	*	*	*	*	*	*	*	*	*
Northern Redbelly Snake	*	*	*	*	*	*	*	*	*	*	*
Northern Ribbon Snake	*	*	*	*	*	*	*	*	*	*	*
Northern Ringneck Snake	*	*	*	*	*	*	*	*	*	*	*
Northern Water Snake	*	*	*	*	*	*	*	*	*	*	*
Spotted Turtle	*	*	*	*	*	*	*	*	*	*	*
Stinkpot	*	*	*	*	*	*	*	*	*	*	*
Wood Turtle	*	*	*	*	*	*	*	*	*	*	*

Species	Wetlands	Water	Riparian	Hardwood	White Pine	Other Softwood	Mixed Hdwd/Stwd	Agricultural Land	Reverting Farmland	Structure	Misc Habitat
Class: Amphibian											
Blue-spotted Salamander	*	*	*	*							
Bullfrog	*	*		*			*				
Eastern American Toad	*	*	*	*	*	*	*	*	*		*
Four-toed Salamander	*	*	*	*			*				
Gray Treefrog	*	*	*	*			*				
Green Frog	*	*	*	*							
Jefferson Salamander	*	*	*	*							
Northern Dusky Salamander	*	*	*	*	*	*	*	*			
Northern Leopard Frog	*	*	*	*				*			*
Northern Spring Peeper	*	*	*	*		*	*				*
Northern Spring Salamander	*	*	*	*		*					*
Northern Two-lined Salamander	*	*	*	*	*	*	*	*	*		
Pickereel Frog	*	*	*	*	*	*	*				*
Red-spotted Newt	*	*	*	*	*	*	*				
Redback Salamander	*	*		*	*	*	*			*	
Silvery Salamander	*	*	*	*							
Spotted Salamander	*	*	*	*	*	*	*				
Wood Frog	*	*	*	*	*	*	*	*			
Class: Bird											
Alder Flycatcher	*	*	*		*				*		
American Bittern	*	*	*								
American Black Duck	*	*	*	*				*			
@ American Coot	*	*									
American Crow	*	*		*	*	*	*	*	*		
American Goldfinch	*	*	*	*	*	*	*	*	*		
American Kestrel	*	*						*	*	*	
American Redstart	*	*	*	*	*	*	*	*	*		
American Robin	*	*	*	*	*	*	*	*	*	*	
@ American Tree Sparrow	*	*	*					*	*		
@ American Widgeon	*	*									
American Woodcock	*	*	*	*				*	*		
@# Bald Eagle	*	*	*	*	*	*	*	*	*		
Bank Swallow	*	*	*					*	*		*
Barn Swallow	*	*	*					*	*	*	
Barred Owl	*	*	*	*	*	*	*	*	*		
@ Bay-breasted Warbler		*	*			*			*		
Belted Kingfisher		*	*								*
@ Black Scoter		*									
@ Black Tern	*	*									
Black-and-White Warbler	*	*	*	*	*	*	*	*	*		
@ Black-backed Woodpecker	*	*			*	*					
Black-billed Cuckoo	*	*		*	*	*	*		*		
Black-capped Chickadee		*	*	*	*	*	*	*	*		
@ Black-crowned Night-Heron	*	*	*								
Black-throated Blue Warbler		*	*	*	*	*	*				
Black-throated Green Warbler		*	*	*	*	*	*				
Blackburnian Warbler		*	*	*	*	*					
@ Blackpoll Warbler		*	*	*	*	*					
Blue Jay		*	*	*	*	*	*	*	*	*	
Blue-gray Gnatcatcher	*	*		*			*	*	*		
@ Blue-winged Teal	*	*						*	*		
Bobolink	*	*						*	*		
@ Bohemian Waxwing		*	*					*	*		
@ Bonaparte's Gull		*									
@ Boreal Chickadee	*	*		*		*					
Broad-winged Hawk		*		*	*	*	*	*	*		
Brown Creeper	*	*	*	*	*	*	*	*	*		
Brown Thrasher		*	*	*	*	*	*	*	*		
Brown-headed Cowbird	*	*	*	*	*	*	*	*	*		
@ Bufflehead		*		*							
@ Canada Goose	*	*	*					*			
Canada Warbler	*	*	*	*	*	*	*				
@ Cape May Warbler		*	*	*	*	*					
Cedar Waxwing	*	*	*	*	*	*	*	*	*		
Chestnut-sided Warbler	*	*	*	*	*	*	*	*	*		
Chimney Swift	*	*						*	*	*	
Chipping Sparrow		*	*	*	*	*	*	*	*	*	
Cliff Swallow	*	*						*	*	*	*
@ Common Redpoll		*						*	*		
@ Common Goldeneye		*		*	*	*					

Species	Wetlands	Water	Riparian	Hardwood	White Pine	Other Softwood	Mixed Hdwd/Stwd	Agricultural Land	Reverting Farmland	Structure	Misc Habit
Common Grackle	*	*	*	*	*			*	*		
Common Loon		*									
Common Merganser		*		*	*	*	*				
@ Common Nighthawk	*	*	*	*	*	*	*	*	*	*	*
Common Raven	*	*	*	*	*	*	*				*
Common Snipe	*	*	*					*			
@ Common Tern		*									
Common Yellowthroat	*	*	*	*	*	*	*	*	*		
@ Cooper's Hawk		*		*	*	*	*	*	*		
Dark-eyed Junco		*		*	*	*	*	*	*		
@ Double-crested Cormorant		*	*								
Downy Woodpecker		*		*	*	*	*	*			
Eastern Bluebird	*	*			*			*	*		
Eastern Kingbird	*	*	*					*	*		
Eastern Meadowlark		*		*	*	*	*	*	*	*	*
Eastern Phoebe		*	*	*	*	*	*	*	*	*	*
Eastern Screech-Owl	*	*	*	*	*	*	*	*	*		
Eastern Wood-Pewee		*	*	*	*	*	*	*	*		
European Starling	*	*	*	*	*	*	*	*	*	*	
@ Evening Grosbeak		*		*		*	*	*	*		
Field Sparrow		*						*	*		
@ Fox Sparrow		*							*		
Golden-crowned Kinglet		*		*	*	*	*		*		
@ Grasshopper Sparrow		*						*	*		
Gray Catbird	*	*	*	*	*		*	*	*		
@ Gray Jay		*				*					
@ Gray-cheeked Thrush		*				*					
@ Great Black-backed Gull		*									
Great Blue Heron	*	*	*	*				*	*		
Great Crested Flycatcher	*	*	*	*	*	*	*	*	*		
Great Horned Owl	*	*	*	*	*	*	*	*	*		
@ Greater Yellowlegs	*	*	*	*				*	*		
Green-backed Heron	*	*	*	*				*	*		
@ Green-winged Teal	*	*	*	*	*	*	*	*	*		
Hairy Woodpecker	*	*	*	*	*	*	*	*	*		
@ Henslow's Sparrow	*	*						*	*		
Hermit Thrush	*	*	*	*	*	*	*	*	*		
Herring Gull		*									
Hooded Merganser	*	*	*	*	*	*	*	*	*		
@ Horned Grebe		*							*		
@ Horned Lark		*						*	*	*	*
House Finch		*	*	*	*	*	*	*	*	*	*
House Sparrow		*	*	*	*	*	*	*	*	*	*
House Wren		*	*	*	*	*	*	*	*	*	*
Indigo Bunting		*	*	*	*	*	*	*	*	*	*
Killdeer	*	*	*	*				*	*	*	*
Least Flycatcher		*	*	*		*	*	*	*	*	*
@ Least Sandpiper	*	*	*	*				*	*	*	*
@ Lincoln's Sparrow	*	*							*		
Louisiana Waterthrush	*	*	*	*							
Magnolia Warbler		*				*					
Mallard	*	*	*					*	*		
Marsh Wren	*	*	*								
@ Merlin	*	*				*		*	*	*	*
Mourning Dove		*		*	*	*	*	*	*	*	*
Mourning Warbler	*	*		*	*	*	*	*	*	*	*
Nashville Warbler	*	*		*	*	*	*	*	*	*	*
Northern Cardinal	*	*	*	*	*	*	*	*	*	*	*
Northern Flicker		*		*	*	*	*	*	*	*	*
Northern Goshawk		*		*	*	*	*	*	*	*	*
@ Northern Harrier	*	*						*	*	*	*
Northern Mockingbird		*	*	*	*	*	*	*	*	*	*
Northern Oriole		*	*	*	*	*	*	*	*	*	*
Northern Parula	*	*		*	*	*	*	*	*	*	*
Northern Rough-winged Swallow	*	*	*	*	*	*	*	*	*	*	*
Northern Saw-whet Owl	*	*		*	*	*	*	*	*	*	*
@ Northern Shrike	*	*		*	*	*	*	*	*	*	*
Northern Waterthrush	*	*	*	*	*	*	*	*	*	*	*
Olive-sided Flycatcher	*	*	*	*	*	*	*	*	*	*	*
@ Osprey	*	*	*	*	*	*	*	*	*	*	*
Ovenbird		*		*	*	*	*	*	*	*	*
@ Palm Warbler	*	*	*	*	*	*	*	*	*	*	*



Species	Wetlands	Water	Riparian	Hardwood	White Pine	Other Softwood	Mixed Hwd/Stwd	Agricultural Land	Reverting Farmland	Structure	Misc Habitat
@# Peregrine Falcon	*	*	*	*	*	*	*	*	*		*
Philadelphia Vireo		*	*	*			*		*		
Pied-billed Grebe	*	*	*								
Pileated Woodpecker		*	*	*	*	*	*				
@ Pine Grosbeak		*	*	*	*	*	*	*			
@ Pine Siskin	*	*	*	*	*	*	*	*		*	
Pine Warbler		*	*	*	*	*	*				
Purple Finch		*	*	*	*	*	*	*		*	
@ Purple Martin	*	*	*					*	*	*	
@ Red Crossbill		*	*	*	*	*		*			
@ Red-bellied Woodpecker		*	*	*	*	*	*	*			
Red-breasted Nuthatch	*	*	*	*	*	*	*	*			
Red-eyed Vireo		*	*	*	*	*	*	*			
@ Red-headed Woodpecker		*	*	*			*	*	*		
@ Red-necked Grebe		*	*	*							
@ Red-necked Phalarope		*	*	*							
Red-shouldered Hawk	*	*	*	*	*	*	*				
Red-tailed Hawk		*	*	*	*	*	*	*		*	
@ Red-Throated Loon		*	*	*							
Red-winged Blackbird	*	*	*	*				*	*		
@ Ring-billed Gull	*	*	*	*				*			
@ Ring-necked Duck	*	*	*	*							
Rock Dove		*	*	*				*	*	*	
Rose-breasted Grosbeak		*	*	*	*	*	*	*	*		
@ Rough-legged Hawk	*	*	*	*	*	*	*	*	*		
Ruby-crowned Kinglet		*	*	*	*	*	*	*	*		
Ruby-throated Hummingbird	*	*	*	*	*	*	*	*	*		
Ruffed Grouse		*	*	*	*	*	*	*	*		
Rufous-sided Towhee		*	*	*	*	*	*	*	*		
@ Rusty Blackbird	*	*	*	*	*	*	*	*	*		
Savannah Sparrow	*	*	*	*	*	*	*	*	*		
Scarlet Tanager		*	*	*	*	*	*	*	*		
@ Sedge Wren	*	*	*	*	*	*	*	*	*		
@ Sharp-shinned Hawk		*	*	*	*	*	*	*	*		
@ Short-billed Dowitcher		*	*	*	*	*	*	*	*		
@ Snow Bunting	*	*	*	*	*	*	*	*	*		
@ Snow Goose		*	*	*	*	*	*	*	*		
@ Solitary Sandpiper	*	*	*	*	*	*	*	*	*		
Solitary Vireo		*	*	*	*	*	*	*	*		
Song Sparrow	*	*	*	*	*	*	*	*	*		
Sora	*	*	*	*	*	*	*	*	*		
Spotted Sandpiper	*	*	*	*	*	*	*	*	*		
@ Surf Scoter		*	*	*	*	*	*	*	*		
Swainson's Thrush		*	*	*	*	*	*	*	*		
Swamp Sparrow	*	*	*	*	*	*	*	*	*		
@ Tennessee Warbler	*	*	*	*	*	*	*	*	*		
Tree Swallow	*	*	*	*	*	*	*	*	*		
Tufted Titmouse		*	*	*	*	*	*	*	*		
Turkey Vulture	*	*	*	*	*	*	*	*	*		
Veery		*	*	*	*	*	*	*	*		
Vesper Sparrow	*	*	*	*	*	*	*	*	*		
Virginia Rail	*	*	*	*	*	*	*	*	*		
Warbling Vireo		*	*	*	*	*	*	*	*		
@ Water Pipit		*	*	*	*	*	*	*	*		
Whip-poor-will		*	*	*	*	*	*	*	*		*
White-breasted Nuthatch		*	*	*	*	*	*	*	*		
@ White-crowned Sparrow		*	*	*	*	*	*	*	*		
White-throated Sparrow		*	*	*	*	*	*	*	*		
@ White-winged Scoter		*	*	*	*	*	*	*	*		
@ White-winged Crossbill		*	*	*	*	*	*	*	*		
# Wild Turkey		*	*	*	*	*	*	*	*		
Willow Flycatcher		*	*	*	*	*	*	*	*		
@ Wilson's Warbler	*	*	*	*	*	*	*	*	*		
Winter Wren	*	*	*	*	*	*	*	*	*		
Wood Duck	*	*	*	*	*	*	*	*	*		
Wood Thrush		*	*	*	*	*	*	*	*		
Yellow Warbler	*	*	*	*	*	*	*	*	*		
Yellow-bellied Flycatcher	*	*	*	*	*	*	*	*	*		
Yellow-bellied Sapsucker		*	*	*	*	*	*	*	*		
@ Yellow-billed Cuckoo		*	*	*	*	*	*	*	*		
Yellow-rumped Warbler	*	*	*	*	*	*	*	*	*		
Yellow-throated Vireo		*	*	*	*	*	*	*	*		



## APPENDIX F

### Previous Lake Capacity Studies

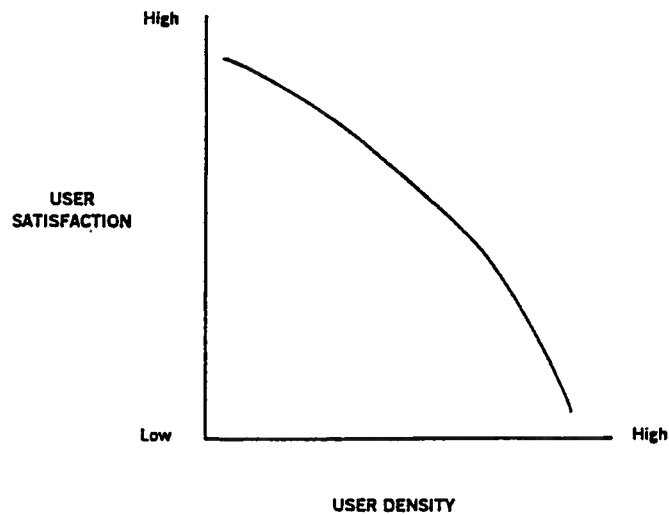
A recent literature search by the Army Corps of Engineers<sup>1</sup> determined that a number of studies have been undertaken which investigate lake capacity for a variety of uses. These include recreational; physical; economic; and social.

The Corps report was prepared to provide New Hampshire water resources planners with a general understanding of the concept of recreational carrying capacity and related issues involving the management of lake resources for recreation. The principal conclusions of the study are as follows:

"These studies discuss a number of problems with attempting to define carrying capacity particularly with regards to obtaining valid data. Several efforts have utilized "spatial standards"; others have sought to establish a social capacity by attempting to relate use levels to user satisfaction; while others have attempted to establish ecological carrying capacities. Generally speaking these studies have provided some interesting approaches and have added to the field of knowledge regarding lake carrying capacity. In each case, however, the studies have been relatively limited and have not provided a firm basis for determining the carrying capacity of an existing watershed."

From these studies, several ideas will be utilized as a basis for the Squam Lake Watershed Plan. These include acceptance of the basic relationship that as users density increases user satisfaction decreases, (Figure F-1), and that the compatibility of different lake uses varies from no conflict to incompatible (Figure F-2).

Figure F-1



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<sup>1</sup> State of New Hampshire, U.S. Army Corps of Engineers, New England Division, Waltham, Mass., *Recreational Carrying Capacity and Application to Lake Management*, May 1989.

**Figure F-2: Compatibility of Uses on NH Great Ponds**

**KEY:**

- . No Conflict
- Minor Conflict
- ⊙ Major Conflict
- Incompatible Uses

	Swimming	Scuba Diving	Snorkeling	Sailboarding	Boating, Nonpower	Boating, Sailing	Boating, Limited Power	Boating, Electric	Boating, Unlimited Power	Hovercraft	Water Skiing	Jet Boating/Skiing	Fishing, Boat	Fishing, Shoreline	Hunting	Species Protection	Natural Areas	Solitude, Nature	Snowmobiling	Ice Boating	Fishing, Ice	Drinking Water	Flood Control	Hydroelectric
Swimming	.	.	.	.	.	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Scuba Diving	.	.	○	.	○	●	○	●	●	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○
Snorkeling	.	.	○	.	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Sailboarding	.	○	○	.	.	○	.	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Boating, nonpower, canoe	.	.	.	.	.	○	.	○	○	○	○	.	.	.	.	.	.	.	.	.	.	○	.	.
Boating, sail	.	○	○	.	.	○	.	○	○	○	○	○	.	.	.	.	.	.	.	.	.	○	.	.
Boating, limited power	○	●	○	○	○	.	.	.	.	.	.	○	.	.	.	○	○	○	.	.	.	○	.	.
Boating, electric	○	○	○	.	.	.	.	○	.	○	○	○	○	○	○	○	○	○	.	.	.	○	.	.
Boating, unlimited power	○	●	○	○	○	.	○	.	.	.	.	○	○	○	○	○	○	○	.	.	.	○	.	.
Boating, excursion	.	●	○	.	.	.	.	.	○	.	○	○	○	○	○	○	○	○	.	.	.	○	○	.
Hovercraft	●	●	○	○	○	.	○	.	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Water skiing	○	●	○	○	○	.	.	.	○	○	○	○	○	○	○	○	○	○	.	.	.	○	○	.
Jet boating/skiing	●	●	○	○	○	.	○	○	○	○	○	○	○	○	○	○	○	○	.	.	.	○	○	.
Fishing, boat	○	○	○	.	○	○	○	○	○	○	○	○	.	.	.	.	.	.	.	.	.	○	.	.
Fishing, shoreline	○	○	○	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hunting, waterfowl	○	○	○	.	.	.	.	○	.	○	.	.	.	.	.	○	○	.	.	.	.	.	.	.
Species protection	○	.	○	.	.	○	○	○	○	○	○	.	.	.	.	.	○	.	.	.	.	○	○	.
Natural areas	○	○	○	.	.	○	○	○	○	○	○	.	.	.	.	.	.	○	.	.	.	○	○	.
Solitude, nature enjoyment	○	○	○	.	.	○	○	○	○	○	○	.	.	.	.	.	.	○	.	.	.	.	○	○
Snowmobiling	.	.	.	.	.	.	.	.	○	.	.	.	.	.	.	○	○	.	.	.	.	○	○	.
Ice boating	.	.	.	.	.	.	.	.	○	.	.	.	.	.	.	.	.	○	.	.	.	.	○	.
Fishing, ice	.	.	.	.	.	.	.	.	○	.	.	.	.	.	.	.	.	○	.	.	.	.	○	.
Drinking water supply	○	○	○	○	○	○	○	○	○	○	○	○	.	.	.	.	.	○	.	.	.	○	○	.
Flood control	.	.	.	.	.	.	.	.	○	.	.	.	.	.	.	○	○	.	.	.	.	○	○	.
Hydroelectric	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	○	○	.	.	.	.	○	○	.

Ecological Carrying Capacity - Ecological carrying capacity was defined in the Corps study as "... the maximum level of recreational use in terms of numbers and activities that can be accommodated by an area or an ecosystem before an unacceptable or irreversible decline in ecosystem value occurs." (Pilgram 1983)

Space Standards - The Corps Study evaluated a number of early studies relative to "space standards" for boating (Table F-1). "Estimates are largely based on safety concerns, though in some cases user satisfaction, and other management objectives are also taken into account. Estimates for any particular type of boating vary widely, and should be viewed only as general guidelines. There is general agreement, however, that water skiing and power boating require more water surface area than other types of boating."

"Several factors preclude the development of uniform space standards for boating. Most importantly is the wide variation between lakes in term of size, depth, shoreline development, and other morphological parameters. For example, a lake with many inlets and bays is likely to have greater carrying capacity than a circular lake with the same surface area. Space standards also fail to take into account potential conflicts between different types of boating and other recreational activities. Regulations may also impact space standards. For example, speed limits could substantially lower the space requirements of high speed power boating."

"Space standards are also available for swimming beaches (Fogg, 1981; U.S. Bureau of Outdoor Recreation, 1970). Standards vary widely. Those presented by Fogg (1981) propose 8 - 20 persons per foot of shoreline for "low" and "high" density beaches, respectively. Space standards, including water and beach area, range from 75 (high density) to 150 (low density) square feet per persons."

Clearly the carrying capacity of a lake is a function of the specific characteristics of each body of water. These include in addition to the use and user mix, the depth, size, area and quality of the lake itself as well as the characteristics of the watershed and the land uses within the watershed.

Management/Regulations - The Corps study identifies several factors which affect management. These include the provision of support facilities; careful site analysis which locates campsites, picnic areas, hiking trails and other shore based facilities based on natural characteristics including soils, topography, flushing characteristics and erosion potential.

A 1971 study by Jakkson which includes a discussion of the use of zoning to regulate recreation in lakes is summarized. His study defines three primary types of zones in lakes; shoreland; open water and "activity zones."

"The shoreline activity zone was defined to extend about 200 - 300 feet from shore, or to the five foot depth contour. Jakkson suggested limiting boating in the shoreline zone to avoid conflicts with activities such as swimming, and to minimize adverse environmental impacts. A speed limit of 5 miles per hour for boating traffic and the prohibition of power boat movement parallel to shore was proposed."

Table F-1. Boating Space Standards (Acres per boat)

Authority <sup>a</sup>	General Standard	Non-Power	Power (unspec.)	Power (<10hp)	Power (unlimited)	Sailing	Water Skiing	Fishing
Allegheny Nat. For. (3)		1		5		1	20	1
Bur. Out. Recr. (1977)				2-10	3-18		7-20	
Calif. Recr. Comm. (2)	1							
Corps of Engineers (1)	1	0.5		0.5	3	0.25	3	0.2 <sup>b</sup> 0.5 <sup>c</sup>
Fog (1981)			10					2
Gr. Lks. Basn. Comm. (1975)		0.33	20			1.25	40	8
Jaakson (1984)	50							
Louis. Park Recr. Comm. (1)								
Manitoba (3)	10							
Mn. Dept. Nat. Res. (3)		1	6-8			6-8	15-20	
New York State (1978)		1.5			8.8			
New Hampshire (1985)				5.5	7.5			
Ohio Dept. Nat. Res. (2)	10							
Ontario Min. Hsg. (3)	0.8-1.8							
Sirles (3)								
Soil Conserv. Ser. (1)			3			3	5	0.2 <sup>b</sup> 0.35 <sup>c</sup>
Sowman and Fuggle (1987)			5				20-40	1.2-10
Tychoek (3)				10-20		2	40	8
Wisc. Out. Rec. Plan. (1)		1	20				20-40	8
Wisc. Dept. Nat. Res. (2)	20							

<sup>a</sup> See the following for complete citations

- (1) US Bureau of Outdoor Recreation, 1970. *Outdoor Recreation Space Standards*. Dept. of Interior, Washington, DC
- (2) Eberwein, A. 1984. *Moraine State Park Lake Arthur Boat Carrying Capacity*. PA Dept. Environ. Res., Bureau of State Parks, Harrisburg
- (3) Barstad, W. and Karasov, D. 1987. *Lake Development: How Much Is Too Much*. Minnesota Dept. Nat. Res. Div. of Waters, St. Paul

<sup>b</sup> anchored fishing  
<sup>c</sup> trolling fishing

"The open water activity zone consists of the remainder of a lake beyond the shoreline zone (in small shallow lakes or embayments this zone would be absent). In large lakes with complex morphology, this zone could be further subdivided to reduce conflicts between various sorts of open water activities (i.e. water skiing; power boating; sail boating)."

The wildlife activity zone was proposed to protect a portion of the lake ecosystem from adverse recreational impacts. This zone would include a portion of the littoral zone and adjacent shoreline habitat. Jakkson proposed limiting recreation activities in this zone to sedentary or slow moving pursuits such as canoeing, fishing, and nature observation."

Brown et al. (1979) summarized the types of water surface zoning techniques employed in the United States in the late 1970's. Regulations were classed into five broad categories:

- . Restrictions on boat speed and horsepower
- . Special Use Zones (e.g. no more zones, no boat zones, slow/no wakes zones).
- . Time Zoning (e.g. limiting water skiing or power boating to only certain times during the day, seasonal use restrictions).
- . Protective Space Zoning (e.g. a protective zone around slow moving boats).
- . Limited Density Zones (e.g. restricting the number of water skiers using a lake at any one time).

Regulations were typically tailored for individual lakes on a case by case basis, within the framework of State boating regulations.

State Policies - "For this study several states were contacted to survey current water zoning policies. Wisconsin has restricted power boats to slow-no wake speeds on lakes smaller than 50 acres since 1983. No regulations limiting the size (horsepower) of motors are in place because of a recent court case which found such restrictions to be unconstitutional (Dale Morrey, pers. commun.)."

"Regulations in Minnesota lakes frequently involve the establishment of speed limits and slow-minimum wake zones (Minnesota Department of Natural Resources, n.d.). Shore protection zones range in width from 100 to 300 feet. Motorboats are banned in some lakes, and in others only those powered by electric motors are allowed. A survey of Minnesota boaters indicated that those who perceive conditions to be crowded are strongly in favor of zoning restrictions (Barstad and Karasov, 1987). Speed-no wake zoning and, to a lesser extent, limitations on horsepower and boat type/size were the most frequently requested restrictions."

"Regulations established by the Vermont State Water Resources Board frequently prohibit the use of motorboats with internal combustion engines or place strict (5 mile per hour) speed limits (Vermont Department of Motor Vehicles, 1987). Shore protection zones are established for several lakes. Houseboats and water skiing

are also frequently prohibited. Surveys of Vermont recreationists indicate that a majority support various zoning restrictions (Lindsay and Rupe, 1979). Among user groups, fishermen were most supportive of regulations while water skiers were the least supportive group."

"In New Hampshire lakes, regulations in place most frequently limit boat speeds to less than 10 miles per hour or prohibit motorboat (or outboard motor) use entirely (New Hampshire Department of Safety, 1987). In some restricted use lakes only those boats powered by internal combustion engines are prohibited. Shore protection zones are established for only a few lakes."

Implementation Measures - "In order to be effective, zoning regulations should be well publicized and enforceable. Adequate resources must be allocated for public education (signs, leaflets, buoys, etc.) and enforcement. Efforts to explain the rationale and benefit associated with use restrictions are likely to increase public acceptance and compliance (Frost and McCool, 1988)."

"User numbers in recreational settings can be controlled by various sorts of rationing techniques. These include systems which limit entry based on reservations, lotteries (chance), queuing (first-come, first serve), and user fees. Rationing can be employed to limit lake use on both a daily and seasonal basis. Queuing is used, for example, on Walden Pond (Massachusetts) where parking lot gates are closed once carrying capacity is exceeded. In some lakes rationing might be useful in allocating, on a seasonal basis, a limited number of boat moorings. Hendee *et al.* (1978) provide discussions of the relative merit, and problems associated with various rationing techniques in wilderness situations. Much of their discussion, however, is applicable to other recreational settings."

"Environmental impacts of recreation in lakes can be placed in several categories. The significance of microbial contamination is generally felt to be minimal, except at specific, localized areas such as campsites, beaches and marinas."

"Increases in lake nutrient concentrations have been demonstrated as a result of recreational activities. The sources of these increases include toilet facilities, detergents and outboard motor fuel. Field studies in Florida found that mixing by motorboats significantly increased turbidity and phosphorus levels in the water column."

Additional problems include increases in suspended sediments as a result of erosion, or boating activities; the release of a variety of contaminants largely from older type engines, poorly located launching facilities, or fuel spillage; litter from anglers, and impacts on fish, aquatic invertebrates, waterfowl and aquatic vegetation.



## APPENDIX G

### LIST OF WATER AND RELATED LAND RESOURCE AUTHORITIES ESTABLISHED BY STATE STATUTE

#### STATE

##### Boating and Recreational Uses

##### **RSA 206 Fish and Game Commission**

206:15-a Director of Fish and Game has authority to close any area to hunting and fishing when there is danger to people and property. The Director also has the authority to close any area to fishing for stocking or conservation purposes.

206:16 The Director may close waters to the taking of crayfish, for their protection.

206:27-a The Director of Fish and Game is authorized to recruit, train and organize deputy conservation officers for the purpose of assisting conservation officers in the enforcement of Fish and Game laws and regulations.

##### **RSA 207 Fish and Game Generally**

207:7 Prohibits hunting of birds or animals from, or carrying of loaded weapons on, moving motor vehicles of any type.

207:40 The Director of Fish and Game may close waters to ice fishing, for the benefit of ice harvesting.

##### **RSA 210 Fur-Bearing Animals**

210:9 No person shall destroy, disturb or interfere in any manner with the dams and houses of beaver without a permit from the Director of Fish and Game.

210:10 No persons shall tend traps from shores which they do not own or occupy, unless they are trapping on a water of ten acres or more, have written permission of the shore owner, and have filed with the local conservation officer.

##### **RSA 211 Fish, Shellfish, Lobsters and Crabs**

211:4 In lakes and ponds divided by state borders, where agreed upon by both states, persons licensed in either state will be allowed to fish on the entire body of water, under rules agreed upon by the two Fish and Game Departments.

## **RSA 212-A Endangered Species Conservation Act**

212-A:5,IV The Executive Director of the Department of Fish and Game and the Director of Safety Services may independently, or in concert, adopt and enforce rules temporarily restricting boat traffic on any waters of this state as either director deems necessary to protect any threatened or endangered species of wildlife in the earliest stages of life.

212-A:6,II(a) The Director of Fish and Game and his staff may classify any species of wildlife normally occurring within the state an endangered or threatened species due to present or threatened destruction, modification or curtailment of its habitat or range, over utilization, disease or predation, or other natural or man made factors.

## **RSA 214 Penalty for Throwing Refuse into Public Waters or on Neighboring Lands**

214:19 The Director of Fish and Game shall revoke the license of any person who has been found guilty in court of a violation of RSA's 163-B, 236:26, 265:102, 635:2, 208:8, 208:1-a, or any rule or regulation of the Director.

## **RSA 270 Supervision of Navigation; Registration of Boats and Motors; Common Carriers by Waters**

270:1,I Charges Safety Services, of the Department of Safety, with responsibility for:

1. Inspections of boats and machinery, appliances, and equipment thereon;
2. Safety of navigation;
3. Establishment of aids to navigation;
4. Removal of obstructions to navigation; and
5. Lights and buoys.

270:1,II New Hampshire's Public Waters shall be regulated so as to provide safe and mutual enjoyment of a variety of uses from shore and water-borne conveyances. Considerations are 1) the propriety of various uses to lakes, 2) public safety, 3) environmental protection and water quality, and 4) nurture of threatened and endangered species.

270:1,III Recognizes that rafting requires appropriate regulation.

270:1-a Safety Services is responsible for investigating drownings and accidents resulting in damages over \$100.

270-A:2 Overnight berthing of houseboats must be at, or reasonably adjacent to, a location owned, leased or controlled by the owner or operator of the houseboat, or by permission of the owner, lessee, or person in control.

Note: Houseboats are prohibited on Squam Lake

270-A:3 Exceptions to 270-A:2 may be allowed in emergencies.

270:3 Requires registration of boats operated in state inland waters, unless participating in a permitted race, and in the state less than ten days.

270:4-b Inboard and inboard/outboard motor rental boats shall be inspected by Safety Services before rental plates can be issued. All rented boats must have rental plates.

**270:7** Common carriers of passengers or freight must be authorized, and meet certain requirements made by the Public Utilities Commission.

**270:11** Empowers the Department of Safety to make rules and regulations relative to: 1) equipment of boats; 2) operation of boats, meaning rafts and boats of any kind - authorized employees of Safety Services have the powers of county deputy sheriffs; 3) classification exam and certification required of captains and pilots; and 4) a recommended uniform fine schedule is established for any boating violation.

**270:12** Department of Safety may regulate maximum horsepowers of boat motors on public waters of thirty-five acres or less.

**270:12-a** The Commissioner of the Department of Safety and his authorized employees have all the powers of peace officers in all the counties of the state in the enforcement of: a) this law and rules made under it, b) RSA 631:5, unlawful operation of boats and all other crimes committed on public fresh waterbodies, c) RSA 637:9, unauthorized use of vessels, d) RSA 642:1, interfering with a public servant, e) RSA 642:6 escape from official custody, and f) provisions of Title LXII when: 1) violations occur on an island accessible only by boat when no other law officer is available and immediate action is necessary, 2) trespass on shoreland when a boat is used to gain access, and 3) may assist peace officers when requested, or request assistance of peace officers.

**270:16-a-b** Boat registrations may be suspended or revoked by the Director of the Department of Safety for violations of RSA 270, the rules and regulations of Safety Services, after being judged by the directors to be physically or mentally incompetent or improper for handling a vessel, or after complaint by a tax collector or selectman that the owner has failed to pay property taxes on vessel.

**270:25** All boats operated in New Hampshire waters must have underwater exhaust and propulsion devices, unless they are participating in a permitted boat race. The Director of Safety may exempt licensed air boats and hover craft in specific areas at specific times for safe and necessary purposes.

**270:25-a** No air boat is to be operated within 150 feet of shore. Use is prohibited where it adversely affects fish and wildlife habitat, public safety, or the natural environment.

**270:26** Tampering with navigational lights or buoys, and obstruction of navigation are violations (misdemeanor).

**270:26-a** It is a violation to let or cut loose vessels without owner's permission.

**270:27** Boat races must be permitted by safety services.

**270:29** Prohibits and restricts power boats in certain waters of the state.

**270:30** No person under sixteen is allowed to use motors of twenty-five or more horsepower unless accompanied by an adult.

**270:30-b** No owner of a float, dock, etc. shall use as a floatation device any container formerly containing any hazardous or toxic substances, unless the container has been rendered harmless.

**270:31** Scuba divers and snorkelers must use flags which extend at least three feet above the surface. Safety Services may restrict night diving.

270:32-a Watercraft must stay seventy five feet away from diving flags.

270:37 Decibel limits on noise are as follows: 86 decibels on "A" scale, measured at a distance of 50 feet from boat.

270:40 Outlaws alterations of boat motors that increase noise levels.

270:41 The Director of Safety Services may permit certain exceptions to 270:40.

270:42 Rafting rules are established, along with areas, enforcement and exceptions.

270:59-72 Regulates the use of moorings on public waters. Transfer of moorings is prohibited; certain moorings are prohibited; regulations are provided concerning removal of moorings; congregate mooring fields permit is required; describes designation of mooring area; describes penalties.

270:73-v Operation of ski craft is prohibited on several lakes, including Big Squam Lake (in towns of Sandwich, Moultonborough, Holderness and Centre Harbor) and Little Squam Lake (in towns of Holderness and Ashland).

270:74-I,x Operation of ski craft is not allowed on a lake, pond, or river on which ski craft operation is prohibited by: RSA 486 and other legislative acts, and by the Department of Safety pursuant to RSA 270:74. The law also requires the commissioner of Safety to establish procedures for and hold public hearings to decide on petitions to prohibit or restrict ski craft use. Also contains a listing of lakes, rivers, and ponds that will be given priority with respect to the hearing process.

#### **RSA 270-B Abandoned Boats**

270-B:2 Any boat found unattended in a sunken, beached, or drifting condition shall be considered abandoned.

270-B:3 Safety Services may remove, impound, and store abandoned vessels. Cost to the State for these actions shall constitute a lien against the boat.

270-C:1-14 Adoption of Federal Numbering System for Certain Watercraft

#### **RSA 486 Restrictions on Boating**

Puts restrictions and prohibitions on the use of houseboats, motor boats, and outboard motors in certain waters of the state.

486:327-34 Provides restrictions on power boats for various individual lakes and ponds in New Hampshire.

486:33 Waterskiing is prohibited in certain coves of Squam Lake - Rattlesnake Cove and Inner and Outer Squaw Coves.

486:35 Regarding Little Diamond Pond - Based on oil pollution tests to be done by DES during the summer of 1988, petroleum boats might be banned from the pond as of January 1, 1989. At that pond, only electric motors would be allowed.

**RSA 488 Water Pollution Control Compact**

Allows the state to enter into the New England Interstate Water Pollution Control Compact to provide for a water pollution abatement strategy on a regional basis.

**RSA 631 Assault and Related Offenses**

631:5 Makes it a misdemeanor to operate a boat while under the influence of liquor or drugs, punishable by suspension of the right to operate a boat on the waters of this state for one year.

**Structures, Filling, and Dredging in Lakes**

**RSA 4 Powers of the Governor and Council**

4:40 Gives Governor and Council power to convey sand, gravel, and other mining rights to the bed of any navigable water or great pond, after the recommendation of the Wetlands Board. Defines great ponds as any " . . . public water of more than ten acres."

**RSA 482 Dams and Flowage**

482:47 No fill may be put below mean high water level of public waters, or below artificially created high water level of public water with the intent to create or form filled land adjacent to such body of water (10 acres).

**RSA 483 Fill and Dredge in Wetlands**

482-A:6 Enable the Wetlands Board to regulate structures, projects, or land altering activities in and on the banks of, any wetland or waters in the state.

482-A:5 Wetlands Board is to carry out the provisions of Chapter 202, which confers on Division of Water Resources the authority to decide matters relative to resources of the state, including but not limited to excavating dredge and filling of waters of the state.

482-A:2 Wetlands projects classified as minor or of minimum impact do not require a hearing.

482-A:8 Provides for comment and input into the review process by local conservation commissions in regards to projects.

483-A:13 Authorizes the Wetlands Board to impose administrative fines of up to \$2,000.

**RSA 488-A Excavating and Dredging in Public Waters**

482-A:21 Gives the Governor and Council and the Wetlands Board the power to regulate excavating and dredging below the mean high water level in great ponds and lakes.

**RSA 488-B Restrictions on Use of Structures Built Over the Waters of the State.**

482-A:26 Residential structures, and other structures used for dwelling, may not extend past the mean high water level and over or into the waters of the state.

Water Quality

**RSA 4 Powers of the Governor and Council**

4:12-s-v Establishment of the Water Protection Assistance Program, within the Office of State Planning. Program's purpose is to assist municipalities individually and/or collectively to evaluate their water resources and to develop local and regional measures for the protection of both ground and surface water. By providing a range of technical assistance, the program shall help municipalities to exercise powers within their jurisdiction, including but not limited to, land use regulation, to enhance water protection measures, and to ensure the continued availability of this resource. Regional planning commissions shall play a significant role in helping municipalities to develop water plans.

4-C:22.I Statute, amended in 1989, requires review of local water plans by OSP for consistency with the rules prior to adoption. The amendment does not state that the plan shall not take effect unless the written comment has been received prior to adoption, as did the previous statute.

Implementation of local water plans shall be through the adoption and enforcement of municipal ordinances that are consistent with the plan. In addition to the WPAP in OSP, the new statute states that assistance shall be available through "programs of the department of environmental services."

**RSA 7 Attorney General, etc.**

7:18-b Charges the Environmental Protection Division with responsibility to enforce statutes pertaining to environmental protection, control and preservation, and to bring actions to Superior Court upon the complaint of private citizens when there is a substantial impact upon the environment. The division shall also exercise the common law powers of the Attorney General, and counsel of state agencies and commissions with environmental concerns.

**RSA 21-O Department of Environmental Services**

Department of Environmental Services shall be responsible for the following functions: water pollution control; water supply protection; regulation of waste disposal generally and as it affects water quality; maintenance of state-owned dams; inspection of dams; flood control; and air pollution control.

21-O:4 Division of Water Resources

21-O:6 Division of Water Supply and Pollution Control

21-O:8 Division of Waste Management

21-O:10 Division of Air Resources

**RSA 124 Federal Aid**

124:12 WSPC construction grants-in-aid are authorized for large town sewage disposal facilities.

486:3.4 See RSA 145:5 above.

486:14 Authorizes participation in the state water pollution control revolving loan program established by the federal Clean Water Act amendments of 1987. The legislation also establishes a study committee to review funding mechanisms and appropriated \$2,400,000 to provide a 20 percent state matching grant for the federal funds deposited during fiscal year 1989.

**RSA 149-D Pesticide Controls**

149-D Establishes a state pesticides control board to safeguard and monitor waters of the state in regards to pesticides; and to regulate the timing, location, and conditions of pesticide application.

**RSA 149-E Sewage Disposal Systems**

Provides state funding to municipalities constructing storm drains, if such drains could be shown to be a cost-effective method for eliminating a combined sewage overflow structure. The state is required to encourage towns to form regional private cooperatives to share the costs of construction and use of regional facilities to deal with disposal of non-recyclable solid waste.

485-A:29-35 Provides for the submission of sewage disposal system plans to Water Supply and Pollution Control Commission, for lots under five acres, with certain specifications and exemptions.

485-A:39 Prior to offering for sale any developed waterfront property with a sewage disposal system, owner of the property shall at his expense have a licensed person do a site assessment study to determine if the site meets current standards for sewage disposal.

**RSA 149-F Control of Algae and Other Aquatic Nuisances**

487:15-18 Directs the Water Supply and Pollution Control Commission to prevent the introduction and further dispersal of exotic aquatic weeds, and to manage or eradicate exotic aquatic weed infestations in the surface waters of the state.

**RSA 149-G Winnepesaukee River Basin Control**

Division of Water Supply and Pollution Control is authorized to develop and operate sewage facilities to serve certain municipalities within the Winnepesaukee River Basin.

485-A:45-54 Provides for sewage treatment and pollution abatement in the Winnepesaukee River Basin.

**RSA 149-J New Hampshire/Vermont Interstate Sewage and Waste Disposal Facilities Compact**

149-J New Hampshire and Vermont may Co-operate in Sewage Disposal.

**RSA 149-K New Hampshire/Massachusetts Interstate Sewage and Waste Disposal Compact**

149-K New Hampshire and Massachusetts may Co-operate in Sewage Disposal.

**RSA 149-M**

149-M The Division of Waste Management is established within DES in 1986 under Chapter 202. The state is required to encourage towns to form regional private cooperatives to share the costs of construction and use of regional facilities with disposal of non-recyclable solid waste.

**RSA 155-E Local Regulation of Excavations**

The State shall have the power to regulate the excavation of minerals including the dimensional stone.

**RSA 162 Council on Resources and Development**

162-C:2 Requires the Council on Resources and Development (CORD) to establish a process for designating lakes and rivers deserving protection. The legislation also established an advisory committee to develop designation criteria upon consultation with the Council. The law allows any New Hampshire resident or organization to nominate a water area to be considered for designation and requires CORD to hold a hearing on such designation and subsequently make recommendations to the General Court concerning nominations and protection measures.

**RSA 163-B Litter Control Law**

Directs all law enforcement agents and agencies to enforce anti-litter laws.

**RSA 206 Fish and Game Commission**

206:26 Conservation officers have the power:

- I. To enforce all laws and regulations relating to fish, game, fur-bearing animals and marine species; to enter property in performance of duties;
- II. To execute warrants and search warrants for violation of Fish and Game Laws and regulations;
- III. To serve subpoenas for related offenses;
- IV. To carry firearms in performance of duty;
- V. To arrest without warrant for related offenses;
- VI. Of search and seizure;
- VII. To secure and execute search warrants;
- VIII. To seize illegal fish, game, fur-bearing animals or marine species without warrant;
- IX. To seize illegal fishing or hunting equipment;
- X. To enact precautions against fire hazards;



- XI. To enforce the laws relating to snowmobiles, all terrain vehicles, trespass on posted lands, motor vehicles blocking private ways, vandalism and malicious damage to property and livestock, use and transportation of firearms for hunting, bob houses, boats, dogs at large, breaking and entering and larceny in remote areas, protection of the environment, littering and dumping;
- XII. To conduct search and rescue operations in inland waters;
- XIII. To cooperate with other agencies in emergencies;
- XIV. To exercise the powers of RSA 594; "arrests in criminal cases," in matters within jurisdiction.

**RSA 211 Fish, Shellfish, Lobsters and Crabs**

211:73 The Fish and Game Director shall notify WSPCC or any other state agency authorized to seek injunctive relief against water pollution if the contamination is a continuing offense.

211:74 When damage occurs to fish, aquatic life, wildlife or their habitat, the Fish and Game Director shall request the Attorney General to institute an action at law for damages caused by contamination. Any moneys received as a result shall be credited to the Fish and Game fund.

**RSA 220 Forest Resources Planning Act**

220:1 This act recognizes that the maintenance and protection of forests is one of the factors necessary to improve conditions for water and wildlife. Further, the act creates forest advisory boards to advise and assist the Director of the Department of Resources and Economic Development for this and other goals of forest management.

**RSA 270 Supervision of Navigation; Registration of Boats and Motors; Common Carriers by Waters**

270-A:4 Landowners, lessees, or controllers of locations for berthing of houseboats must keep records of such activities, and keep the Water Supply and Pollution Control Commission notified of actions. This includes long-term berthing, unless the Division of Motor Vehicles is notified.

270:4 The mooring of houseboats requires the notification of the Water Supply and Pollution Control Commission.

**RSA 481 State Dams, Reservoirs and Other Water Conservation Projects**

481:1,III The groundwater resources of the state are declared to be an integral part of the overall resources of the state; they must be conserved, protected, allocated, and otherwise managed to insure the uses most favorable to the public good (also see Chapter 77, Laws of 1985).

462:3 Authorized the Water Resources Board to begin an investigation of the state's water resources, including the registration and reporting of water use. Authorization to begin a water allocation program was conditioned on the adoption of a state water resources management plan by the legislature. A plan was submitted, but never adopted.

482:54-57 Dam Maintenance Fund is established for the repair and reconstruction of state-owned dams.

**RSA 489-A North Eastern Water and Related Land Resources Compact**

484-13 Article II Provides for facilities and procedures for the coordination of policies, programs, and activities dealing with planning, use, and conservation of water and related land resources. This is intended for cooperation and coordination on the federal and state levels.

**RSA 482-B**

Requires licensing and regulation of water well contractors and pump installers, and for the furnishing of well and pump records to the state.

**RSA 541-A**

Rules are adopted to provide for protective well radii for private wells and for regulation of land use within the radii boundary. The intent is to require that all wells and associated radii be confined to the lot which the well serves for newly created lots, and to minimize the impact of development of pre-existing lots on abutting property. The chapter also requires that the protective radius be shown on sewage or waste disposal system plans.

**Shoreline Development Controls**

**RSA 9-A**

9-A:5-d Program established whereby the Office of State Planning coordinate state, regional and local planning efforts, and will provide technical assistance to local governments in areas related to growth management and resource protection.

**RSA 224 Cutting of Timber Near Certain Waters and Public Highways of the State**

224:44-a No more than 50 percent of basal area of trees shall be cut within 150 feet of any great pond, navigable water or standing body of water of 10 acres or more (except for immediate conversion of land for other than forestry purposes), without prior consent of the Director of the Division of Forests and Lands or his agents. Amends RSA 224:44-a by providing that timber cutting for land conversion purposes is exempt if all required local permits including but not limited to building, subdivision, zoning, excavation on site plan approvals have been secured.

**RSA 430-A Implementation of the Federal Soil Conservation and Domestic Allotment Act**

430-A:3 Directs the Department of Agriculture to Produce a State Plan each year with many goals; among them are: 1) promotion of economic and conservative use of land, 2) diminishment of exploitative, wasteful and unscientific use of soil, and 3) protect rivers and waterways against the results of soil erosion.

## Revenue Sources for Lake and Lakeshore Protection

### **RSA 206 Fish and Game Commission**

206:33 Once a month, moneys received and collected by Fish and Game from licenses, permits, fines, forfeitures, and all other sources are turned over to the state treasurer to be deposited in the Fish and Game fund, which is appropriated to the use of the Department.

206:33-a Gifts not exceeding \$500 may be received and expended by Fish and Game with the consent of the Commission.

206:35-c All revenue from sale of fish food at hatchery vending machines is credited to an account set aside for acquisition and maintenance of fish hatchery equipment.

206:35-e Appropriates \$300,000 to the Department of Fish and Game for fiscal years 1988 and 1989 to be credited with available federal matching shares for land acquisition and the construction or maintenance of boat launching sites.

206:39 Fish and Game may receive and expend any gifts and grants to complete any project authorized by Governor and Council.

206:41 Fish and Game Commission may authorize the printing and sale of wildlife stamps, decals, buttons, medallions, mementoes, etc. Revenue is to go to the wildlife protection account which may be used for issuing other stamps, etc., and wildlife habitat protection, restoration, and enhancement programs.

### **RSA 260 Motor Vehicles**

260:60 The unrefunded road tolls on boat fuel sold on inland waters of the State of New Hampshire are to be divided evenly between the Department of Safety Services and the Fish and Game Department. Safety Services shall use these funds for the promotion of safe navigation.

### **RSA 270-B Abandoned Boats**

270-B:7 Unredeemed boats may be sold or destroyed after ninety days. If sold, the money goes to the General Fund.

## Public Title to Lakeshore Lands

### **RSA 4 Powers of the Governor and Council**

4:29 Enables Governor and Council to acquire land for public parks or public improvement purposes.

## **RSA 36-D Acquisition of Agricultural Land Development Rights**

Conceives the "Agricultural Lands Preservation Committee" for the purpose of acquiring agricultural lands, and development rights for the same. Municipalities shall use the committees criteria and rules to evaluate and nominate tracts of land with potential to be useful to this program.

## **RSA 212 Propagation of Fish and Game**

212:1 The state may acquire title to or control of lands or waters, or hunting or fishing or other rights on private lands or waters, suitable for the protection and propagation of fish, game and fur-bearing animals, or for fishing or hunting or administrative purposes, by purchase, lease or gift.

212:2 When Governor and Council decide it is expedient for the state to own any land or water rights that are needed for the protection and propagation of fish and game, and it is unable to purchase same for reasonable price, it may take them.

212:18 The state may acquire by purchase lease or gift, hunting and fishing rights to lands or waters, and rights of access.

## **RSA 212-A Endangered Species Conservation Act**

212-A:9,I Director of Fish and Game shall establish such programs, including acquisition of land or aquatic habitat or interests therein, as are deemed necessary for the conservation of endangered or threatened species. Director shall utilize all authority vested in the Fish and Game Department to carry out the purposes of this section.

212-A:9,III All other state departments and agencies to the extent possible, consistent with their authorities and responsibilities, shall assist and co-operate with the director for purposes of chapter.

## **RSA 219 Public Forest Lands**

219:1 Authorizes the Department of Resources and Economic Development to obtain land for state parks with Governor and Council approval.

## **RSA 221-A Land Conservation Investment Program**

This act establishes the Land Conservation Investment Program in order to preserve the beauty, landscape, rural character, natural resources, and high quality of life in New Hampshire by acquiring voluntarily lands and interests in lands of statewide, regional, and local conservation and recreation importance.

## **RSA 230 Rights-of-Way to Recreational Waters**

230:63 Governor and Council can decide that public access to Great Ponds is necessary, and direct the construction of such.

230:73 States that public access to water with recreational potential shall not be lost if presently held by any state agency or department.

**RSA 484 Lake Levels, Investigation and Proceedings**

482:79 Allows the Water Resources Council, at the request of the public or Attorney General, to investigate conditions affecting the use and enjoyment of inland waters. Enables the WRC to manage water levels according to the best public interest after due process of public hearings and negotiations with landowners.

482:80 After this process WRC must obtain approval of Governor and Council.

**LOCAL**

**Boating and Recreational Uses**

**RSA 31 Powers and Duties of Towns**

313:39 Towns may make bylaws for regulation of the use of mufflers on boats and vessels operating upon the waters within the town limits.

**RSA 47 Powers of City Councils**

47:17,XIII City councils have the power to regulate the times and places of bathing and swimming in canals, rivers and other waters of the city.

**RSA 72-A Boat Tax**

Establishes a boat tax in the form of a permit fee, graduated to boat size and year, and motor horsepower rating, revenues going to the town where collected. If collected by motor vehicle division, one dollar goes to the general fund. Fees have been increased over time, including 1988.

**Structures, Filling, and Dredging in Lakes**

**RSA 31 Powers and Duties of Towns**

31:3,XXVII Towns may acquire, construct, control and operate dams to improve the recreational value of waterbodies.

**RSA 47 Powers of City Councils**

47:17,VII City councils have the power to make ordinances, rules, regulations, and bylaws to regulate all public way, wharves, and docks; and the use of them.

## **RSA 482 Dams and Flowage**

482:13 Owner of a dam shall not breach any dam, lower any waterbody for repair of dam, or cause significant lowering of water level of pond or lake without first notifying local governing body, at least 30 days prior to such action(s).

## Water Quality

### **RSA 4-C Regional Water Resources Management and Protection Plans**

4-C:23 The new statute authorizes and encourages municipalities to enter into intermunicipal agreements, pursuant to RSA 53-A, for the purpose of developing and implementing regional water plans and ordinances. Appropriate action of municipalities by ordinance, resolution or other action will be necessary for such agreements to enter into force. Agreements are required to be consistent with criteria for local water plans pursuant to RSA 4-C:22. Municipalities are encouraged to seek assistance from regional planning agencies in regional water plan development and to coordinate their plans with the agencies' regional water planning efforts.

### **RSA 31 Powers and Duties of Towns**

31:4, XLVI Towns may maintain funds which the municipal health officer can expend to repair faulty private sewage disposal systems.

### **RSA 48-A Housing Standards**

48-A:3(a)(b)(c) Provides for enforcement of standards by municipal employee or board.

48-A:14, II Establishes minimum standards for housing, including municipalities which have not adopted ordinances. Includes provisions against faulty septic and sewage systems.

### **RSA 52 Village Districts**

52:1 Enables the formation of "Village Districts" for many reasons, among them the construction and operation of sewage and waste treatment plants.

### **RSA 146-A Oil Spillage in Public Waters**

146-A:17-a, I Empowers municipal health officer to order restoration of sewage systems in disrepair.

146-A:17-a, II Selectmen or mayor and council may appropriate funds for repair of faulty private septic systems.

146-A:17-b Expenses to the town for repair of faulty private systems shall constitute just reason for an assessment against the owner and a lien on the property.

## **RSA 148 Protection of Sources of Water and Ice**

485:18 Municipal water commissions or boards of health may remove pollutants and charge the polluter for expenses.

485:21-22 Municipal boards of health and water commissions may make reasonable rules and regulations in regards to fishing, racing, boating, or bathing in or on public water supplies. Violations are misdemeanors.

## **RSA 149-I Sewers**

149-I:1 The mayor and aldermen may construct facilities necessary for public health.

149-I:2 The mayor and aldermen may take land for public health facilities.

149-I:3 The mayor and aldermen shall secure land when ordered to by Water Supply and Pollution Control Commission.

149-I:6 The mayor and aldermen may adopt ordinances for proper operation of treatment facilities. Ordinances are not to be more stringent than federal or state standards.

## **RSA 149-M Solid Waste Management**

Under revisions to RSA 149-M, single towns are permitted to form a district or subdistrict for the purposes of solid waste recycling or waste disposal. The division is given responsibility to regulate the closure of all solid waste facilities and authorized to establish minimum standards for such closures.

149-M:13-b The section authorizes the governing body of towns, cities, and county commissioners (including those responsible for unincorporated towns or places) to enter into cooperative agreements with other towns, cities, unincorporated places, or counties to provide a regional facility to collect, separate, or recycle solid waste.

## **RSA 155-E Local Regulation of Excavations**

Major changes were made to RSA 155-E by the legislature in 1989. The municipalities retain the power to regulate the removal of earth to be used as construction aggregate. This law exists as a grant of authority independent of zoning enabling legislation.

155-E:1 Involves a reenacting a permit process which re-instates August 24, 1979 as the date before which excavations may have existed without permits; establishing a permit process for any changes to such sites; and requiring that a report be made to the planning board by owners of existing excavation sites.

Also covers abandoned excavations; stationary manufacturing plants; and highway excavations. Also established within 155-E are sections on Exceptions; Reclamation; Prohibited Projects; Operational Standards; Reclamation Standards; Incremental Reclamation; and further defines the extent of regulations under the statute.

## **RSA 430-B Conservation Districts**

430-B:9 Conservation Districts have the following powers:

- I. To conduct surveys, investigations and research relating to the conservation and development of the soil, water, and related natural resources;
- II. To conduct demonstrational projects to illustrate means, methods, and measures to present and control soil washing and sediment damages;
- III. To carry out preventative and control measures and improvements for the conservation and development of the soil, water, and related natural resources;
- IV. To cooperate with and furnish financial aid to any agency or occupier of land in carrying out erosion control, drainage, watershed protection, and resource conservation and development projects;
- V. To obtain options on and to acquire any property and to maintain, administer, and improve it;
- VI. To make available items and materials which will assist land occupiers in carrying out these projects,
- VII. To construct, improve, operate and maintain structures for these purposes;
- VIII. To develop comprehensive plans for changes in land use and the conservation and development of natural resources;
- IX. To take over any project or improvement for the conservation and development of natural resources;

All of these limited to each districts own confines.

## **RSA 674 Local Land Use Planning and Regulatory Powers**

674:2.VIII A conservation and preservation section which may provide for preservation, conservation, and use of natural and man-made resources. The conservation and preservation section of the master plan should include a local water resource management and protection plan specified in RSA 4:12-v. This plan should be reviewed and revised necessary at intervals not to exceed 5 years.

## Shoreline Development and Controls

### **RSA 36 Planning Boards**

36:14 The master plan shall be made with the general purpose of guiding and accomplishing a coordinated, adjusted, and harmonious development of the municipality and its environs.



36:21 Planning Board subdivision regulations may provide for open spaces of adequate proportions, may require that plans include a park or parks of reasonable size, and may prescribe minimum areas of lots.

**RSA 36-A Conservation Commissions**

36-A:2 Provides that these groups should study and recommend programs for the protection and betterment of watersheds, wetlands, natural areas and open spaces.

36-A:4 These commissions have the power to acquire fee, title, or lesser interest to land in order to limit future use of or properly utilized land and water areas in the city or town.

**RSA 47 Powers of City Councils**

47:17,XIV City councils have the power to regulate the location and construction of tanneries, stables, barns privies, sewers, and other unwholesome or nauseous buildings or places; and the power to abate and remove nuisances.

47:17,XVI Warnings and Citations: Establishes a procedure for issuing warnings and citations for the violation of health, fire, planning board, building, zoning, and housing codes.

**RSA 49-A Local Option - City Charters**

49-A:21 Empowers mayor to enforce the ordinances of the city, the charter, and all general laws applicable to the city.

**RSA 53-A Agreements Between Government Units**

53-A:3 Allows and provides guidelines for agreements, joint projects, and joint exercise of powers between counties, municipalities, districts, etc.

**RSA 79-A Current Use Taxation**

Creates a means of relieving the tax burden of land resulting from property taxes based on market value. Farm land, forest land, floodplain, wetland, recreation land, or wild lands are eligible. The purpose is to encourage the preservation of open space for a healthful and attractive environment and maintain the character of the States landscape.

79:A-4 Current Use Advisory Board shall have the power to establish acreage requirements, and such new criteria and values as legislature and land use management practice may indicate.

79:A-7,IV(b) Allows owner of property classified as open space to excavate top soil and gravel for certain purposes without changing the current use status; makes the sale of excavated materials a land use change; reclamation requirements, etc.

79:A-5,I Selectmen or assessing officials shall use the soil potential index when available to determine the value of current use farmland; Open space land shall be appraised based on the current use values that have been determined in this manner.

79:A-29,II In towns that have adopted the provisions of RSA 79-A:29, a percent of current use revenues shall be placed in the conservation commission fund.

#### **RSA 155-E Local Regulation of Excavations**

Major changes were made to RSA 155-E by the legislature in 1989. The municipalities retain the power to regulate the removal of earth to be used as construction aggregate. This law exists as a grant of authority independent of zoning enabling legislation.

155-E:1 Involves a reenacting a permit process which re-instates August 24, 1979 as the date before which excavations may have existed without permits; establishing a permit process for any changes to such sites; and requiring that a report be made to the planning board by owners of existing excavation sites.

Also covers abandoned excavations; stationary manufacturing plants; and highway excavations. Also established within 155-E are sections on Exceptions; Reclamation; Prohibited Projects; Operational Standards; Reclamation Standards; Incremental Reclamation; and further defines the extent of regulations under the statute.

#### **RSA 672 General Provisions Regarding Zoning and Land Use Planning**

##### 671:1 Declaration of Purpose

672:1.I Planning, zoning and related regulations have been and should continue to be the responsibility of municipal government;

672:1.II Zoning, subdivision regulations and related regulations are a legislative tool that enables municipal governments to meet more effectively the demands of evolving and growing communities;

672:1.III Proper regulations enhance the public health, safety and general welfare and encourage the appropriate and wise use of land;

672:1.III-b Natural features, terrain and the pattern of geography of the state frequently place agricultural land in close proximity to other forms of development and commonly in small parcels. Agricultural activities are a beneficial and worthwhile feature of the New Hampshire landscape and should not be discouraged or eliminated by use of municipal planning and zoning powers or the unreasonable interpretation of such powers.

672:1.III-c Provides a broad statement of purpose regarding local regulation of forestry. The amendment states that "municipalities are discouraged from using their zoning and planning powers to restrict forestry activities, including the harvest and transport of forest products, when these activities are carried out within the constraints established by all applicable state laws."

672:2.III Requires housing section to be put in a towns master plan, which analyzes existing housing resources and addresses current and future housing needs at all levels of income of municipality and the region.

#### **RSA 674 Local Land Use Planning and Regulatory Powers**

##### 674:1-4 Master Plan

674:1-4 The master plan shall generally be comprised of a report or set of statements and land use and development proposals with accompanying maps, diagrams, charts and descriptive matter designed to show as fully as is possible and practical the planning board's recommendations for the desirable development of the territory legal and logically within its planning jurisdiction.

674:2,II A land use section will take into account natural conditions which shows the existing conditions and the proposed location, extent, intensity of future land usage should be included.

674:5-8 Capital Improvements Program

674:9-15 Official Map of the Municipality

674:16-23 Zoning

674:16,I(b) Zoning ordinances shall be designed to regulate and restrict lot sizes, the percentage of a lot that may be occupied, and the size of yards, courts and other open spaces.

674:17 Some of the purposes of zoning ordinances are: to prevent the overcrowding of land; to avoid undue concentration of population; and to assure proper use of natural resources and other public requirements.

674:21 Innovative Land use Controls may include, but are not limited to: timing incentives, phased development, intensity and use incentive, transfer of development rights, planned unit development, cluster development, impact zoning, performance standards, flexible and discretionary zoning, and environmental characteristics zoning. Amended in 1988 to include Inclusionary Zoning. Land use regulations which provide voluntary incentive or benefit to property owner in order to induce property owners to produce housing units which are affordable to people of low-moderate income.

674:22 The local legislative body may further exercise the powers granted under this subdivision to regulate and control the timing of development. Any ordinance imposing such a control may be adopted only after preparation and adoption by the planning board of a master plan and a capital improvement program and shall be based upon a growth management process intended to assess and balance community development needs and consider regional development needs.

674:24-30 Emergency Temporary Zoning and Planning Ordinances

674:31-32 Manufactured Housing

674:33-34 Zoning Board of Adjustment and Building Code Board of Appeals

674:35-42 The planning board of a municipality shall have the authority to regulate the subdivision of land under the enactment procedures of RSA 675:6.

674:43-44 A municipality, having adopted a zoning ordinance as provided in RSA 674:16, and where the planning board has adopted subdivision regulations as provided in RSA 674:36, may by ordinance or resolution further authorize the planning board to review and approve or disapprove site plans for the development or change or expansion of use of tracts for nonresidential uses or for multi-family dwelling units, which are defined as any structures containing more than 2 dwelling units, whether or not such development includes a subdivision or resubdivision of the site.

674:45-50 Historic Districts

674:51-52 Building Codes

Public Title to Lakeshore Lands

**RSA 31 Powers and Duties of Towns**

31:3 Towns may purchase and hold real and personal estate for the public uses of the inhabitants.

31:4,XV Towns may appropriate funds to establish and maintain parks and commons.

**RSA 35-B Public Recreation and Parks**

35-B:1 Municipalities, districts, and other political subdivisions may acquire land by gift, purchase, or lease for parks and public recreation and may prepare, equip and maintain it.

35-B:2 The body having control over the finances of a political subdivision may issue bonds and create or raise taxes or levies to pay for such lands and facilities. Political subdivisions may be allowed to operate such facilities on lands owned or leased by the State.

**RSA 432 Soil Conservation**

432:20, 22, 24 Acquisition of agricultural land development rights by Conservation Districts based on suitability of land as to soil classification and other criteria for agricultural use, fair market value, and especially the degree to which acquisition would serve to preserve agricultural potential of the State.