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 Bacon Keith
A SUMMARY OF THE PLAN FOR THE

Squam Lakes

Watershed

August 1991

State of New Hampshire,
Judd Gregg, Governor

New Hampshire Office of State Planning,
Jeffrey H. Taylor, Director
On July 23, 24, and 25, 1991, the Office of State Planning held public meetings in the Squam watershed towns of Holderness, Centre Harbor, and Sandwich. The purpose of the meetings was to present the findings of the Squam Watershed Plan and to receive comments from area residents and local officials.

A number of suggestions that were made during the meetings are reflected in this final plan report.

Those who attended the meetings accepted the fact that local action will be needed if the Squam watershed is to be preserved — action by town officials and residents, by lake users, developers, and visitors, among others.

Such local initiative successfully restored Squam Lake early in the twentieth century, following the formation of the Squam Lake Improvement Association, now the Squam Lakes Association (see quote, inside front cover). That spirit of concern and cooperation is alive today among Squam area property owners and watershed users.

But the discussions also brought out the strong opinion that the State of New Hampshire should do a better job of enforcing existing environmental and safety regulations affecting watershed land and water use. These regulations — on subjects such as lake boating, land development, septic management, and wildlife protection — tend, in varying degrees, to be ignored, and thus to become ineffectual.

State and local groups must accept the fact that both have roles to play, and the objective of watershed protection will be reached only if both work for it.

The Squam Lakes Watershed Plan has been printed with support from
the Squam Lakes Association,
the Northern New Hampshire Foundation (Newyl Fund),
and other friends of the Squam Lakes.
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Background of the Squam Lakes Watershed Plan

THIS SQUAM LAKES WATERSHED PLAN is the first in a series of management plans for lake watersheds throughout New Hampshire.

The idea for such a series emerged from several meetings organized and held in the Lakes Region in 1984 by the New Hampshire Council on Resources and Economic Development (CORD). The meetings were designed to analyze the effects of rapid development around the area’s lakes, and to recommend a program of action to protect the lakes and their surrounding lands.

The CORD meetings resulted in a report to the governor in 1985 that discussed the need to control development in the Lakes Region. It also covered several other topics: the public’s use of docks and moorings; boating practices on the lakes; the proliferation of water milfoil and aquatic weeds; the effects of old septic systems on lake water quality; the leasing of state land; and, perhaps most important over the long run, the need to develop plans for these and other New Hampshire watersheds.

Watershed planning is based on the idea that the protection and development of a lake and its watershed should be managed as a whole, rather than piecemeal along local town boundaries.

A watershed plan should ensure that the activities on and around a lake never exceed the capacity of the lake and its watershed to support them. In other words, the lake and the land around it can handle only so many people, so many boats, and so much development. A watershed plan calculates how much the lake and its adjacent lands can handle, and then describes the protective measures that will keep future use within those agreed-on limits.

The CORD report recommended that the Office of State Planning take on the job of developing a pilot lake management plan that could become a model for subsequent watershed studies and plans.

In September 1985, five towns around Squam and Little Squam Lakes asked the Governor for help in creating a Squam Lakes watershed management plan, and the Governor in turn asked the Office of State Planning to use the Squam Lakes watershed as a planning prototype.

Work began in 1988, and a year later the Squam Lakes Watershed Advisory Committee, comprised of local officials and organizational representatives, was formed. This committee provided policy guidance and reactions to plan drafts as the project progressed.
AS THE SUBJECT for a pilot study and management plan, the Squam Lakes watershed was a good choice.

The Squam Lakes, along with other major lake systems in New Hampshire, are at risk. Today's trends, which are visible for all to see, are not good: growing demand for watershed development and recreational lake use threaten to degrade these resources irreparably.
Extending over more than 42,000 acres, of which 7,847 are water area, the Squam Lakes constitute one of the state's major watersheds. Within its boundaries lie parts of the towns of Ashland, Centre Harbor, Holderness, Moultonborough, Sandwich, and New Hampton. The lakes attract large numbers of local and seasonal residents, boaters, campers, and tourists. "Big" Squam Lake is dotted with more than 30 islands, making it, in effect, a collection of bays and coves that present special conservation problems under conditions of modern use.

Rising land values and taxes around the Squam Lakes have encouraged some landowners to develop their large parcels. If these trends continue, the accompanying environmental effects could include increased risks of lake pollution, damage to wildlife habitats, alterations in forests and scenic views, and excessive high-intensity boating.

Efforts to restore and protect the quality of the Squam Lakes date back at least to 1904, when the Squam Lake Improvement Association (now the Squam Lakes Association) was formed. This association was responsible for early lake cleanup programs which, in many ways, were responsible for the relatively clean, scenic lakes of today.

More recently, a number of other local groups have become active, including the Squam Lakes Conservation Society, the Loon Preservation Committee of the Audubon Society, the Science Center of New Hampshire, and the Pemigewasset Valley Fish and Game Club.

Today, more than 2,330 acres of the Squam Lakes watershed and almost 30,000 feet of shoreline are in protected status through conservation forests, easements, and other special measures.

This 20th century Squam Lakes tradition of protecting the lakes has led to strong local zoning regulations and a generally high level of awareness and concern among area citizens. However, such a tradition does not guarantee agreement on how the lakes and the land around them should be used, so it was seen from the beginning that an effective Squam Lakes watershed management plan would have to accommodate a number of competing interests and points of view while laying out a program that offered adequate protection for the watershed as a whole.

The plan would require the support of local boards and officials, and of an informed and cooperative citizenry that would accept changes in watershed use patterns because such changes would appear to be fair, reasonable, and necessary.
THE SQUAM LAKES WATERSHED PLAN is the result of a collaboration between the New Hampshire Office of State Planning (OSP) and the local Squam Lakes Watershed Advisory Committee. OSP was responsible for the collection of data and for the initial drafting, and the committee served as a reviewing body—meeting regularly as a group to discuss, approve, or revise the findings and recommendations, and to make suggestions as to policies and directions.

The Squam Lakes study is based on a vast quantity of data. One of the important purposes of this pilot study, in fact, was to try out new ways of collecting and analyzing information about a watershed.

Data were gathered for soils, hydrology, land use, land cover, groundwater availability, geology, topography, wildlife habitat, lake water quality, and potential threats to water resources. Some data came from existing sources. Some had to be developed from aerial photos to show changes in land use over time. Some, such as critical wildlife habitats and potential threats to water resources, were gathered by OSP staff with help from technical experts.

Once collected, the data were compiled on maps (using U.S. Geological Survey topographic maps) and then fed into GRANIT, the state’s computerized geographic information system (GRANIT stands for Geographically Referenced Analysis and Information Transfer). The GRANIT system can manipulate and analyze information in ways that have not been available to planners in the past. It can be used to select, overlay, compare, and combine different types of information and can display information in a variety of graphic forms.
The Goal: Protection Through Managed Use

A WATERSHED is a sensitive natural setting, where interacting forces need to be kept more or less in balance if the watershed is to remain stable and not deteriorate. People, animals, plants, trees, insects, and even bacteria are all part of this system; their roles must be understood and kept under control if one element is not to become dominant at the expense of the others.

Although people are the most aggressive watershed users, it does not necessarily follow that maintaining land and water quality within a watershed requires extreme restrictions on the human use of the resources. Nor does it mean prohibiting growth and development. It does mean finding out how much human activity the watershed's land and water can support without damaging the system as a whole, and then making sure that land development and surface water use do not exceed those limits.

In planning terms, this means providing guidelines and recommendations to make sure that the use of the land and water is consistent with the natural capabilities of the watershed.

The need to limit use of Squam Lakes watershed resources

The first finding of the watershed study was that regulations now in place affecting the Squam Lakes watershed are not adequate to provide such assurances.

Although local zoning and health ordinances, building codes, and site plan review regulations are reasonably strong, they are still not adequate to insure that human use of Squam Lakes lands and waters will not exceed the "natural capabilities" of the watershed.

This underlying fact was determined early in the Squam Lakes study. By creating a computerized picture of the maximum "build-out," or development within the watershed that would be permissible under current regulations, it was possible to project the loads that would be placed on the land, wildlife, and water resources. These were excessive. The new buildings that could be constructed, the soil erosion and pollution sources that might be created, and the increased boating that might be generated would all add up to more than the watershed's resources could sustain without deterioration.

Regulating land use

With respect to land use, the Squam Lakes project was able to use recently developed technology to map and analyze a huge amount of data for the watershed area. Information on soils, land cover and land uses, wildlife habitats, water resources, and other features was collected,
translated into maps, and used in developing recommendations.

The towns in the Squam Lakes watershed already have ordinances in place to limit or prohibit development in sensitive areas such as wetlands, floodplains, steep slopes, and shorelands, or areas next to bodies of water and wetlands. The Watershed Plan contains discussions of each of these subjects, along with recommendations.

**Wetlands**—Because of their high year-round water table, wetlands are unsuitable for development. They act as natural buffers for lakes and ponds, holding floodwaters, regulating water flow, and absorbing nutrients to help prevent pollution. Wetlands also serve as home and shelter to a wide variety of wildlife. All the towns in the watershed prohibit approval of septic systems in the kinds of soils found in wetlands. In addition, Sandwich and Centre Harbor have wetlands conservation ordinances that give even more protection for these areas.

**Recommendations:**

- Wetlands should be further protected from development by the adoption of wetlands overlay districts (acreage that may overlap town boundaries or zoning districts) in the various town zoning ordinances.
• Local conservation commissions should develop inventories of wetlands in their towns and seek additional protection for those areas through land purchases, conservation easements, and Prime Wetlands designation.

**Floodplains**—These low-lying areas next to rivers and streams are flooded periodically and play an important role in stabilizing the water flow in a watershed. Floodplains also are likely to contain good agricultural land and often serve as important travel corridors for wildlife.

The floodplain is a more attractive magnet for development than wetlands, but the impact of development on the environment can be just as severe: development and filling of floodplains sends more water downstream during times of high water and increases the risk of erosion with the accompanying silting of streams and rivers.

**Recommendation:**

• Communities should move to protect their floodplains by discouraging inappropriate uses. As with wetlands, floodplain overlay districts should be included in local zoning ordinances.
Steep slopes—None of the towns in the Squam Lakes watershed allows development (septic system installation) on slopes of 25 percent or more. Soil erosion, more rapid stormwater runoff, and ground and surface water pollution from inadequate septic systems can create obvious problems.

In general, slopes between 3 and 15 percent are best for development, and slopes between 15 and 25 percent require very careful planning and management if they are built on.

Recommendation:
- Municipal zoning ordinances should prohibit development on slopes greater than 25 percent. Development on slopes between 15 and 25 percent should be limited to areas having suitable house sites and should require appropriate septic design, special measures to control erosion, and larger lot sizes.

Shoreland District—The shoreland, a ribbon of land several hundred feet wide surrounding a body of water, is extremely important to the health of the lake or pond it encircles.

The Squam Lakes Watershed Plan contains recommendations concerning activities that should be regulated in a shoreland district.

Recommendations:
- A shoreland overlay district extending 250 feet landward from the mean high water level should be incorporated in the zoning ordinances of towns within the Squam Lakes watershed. This should include a minimum buffer of 50 feet of natural vegetation from the shoreline, and greater vegetative buffer distances for those shoreland areas possessing exceptional wildlife habitats such as loon nesting or brooding areas (within this buffer strip, selected cutting of trees and understory growth may be allowed through special approval for wildlife management or the creation of water views).
- Municipal conservation commissions should seek to secure additional distance setbacks of natural cover through landowner education, purchase of conservation easements, and other means.
• Subsurface disposal systems (leaching fields) for septic wastes should not be permitted within 125 feet of mean high water.

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

• In shoreland areas where the 250 foot 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 should be required to use a cluster design and to keep development away from important natural resource areas.

• 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 distance between the sides of the lot at water's edge and the curvilinear distance between these points.

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

• 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.

• 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. Building codes should require that any erosion and sedimentation control measures should be maintained by the landowner as a condition of the certificate of occupancy.

• Local subdivision and site plan review regulations and building codes should require that the design of drainage systems use 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.
Shoreland District Diagram

- 35 foot maximum building height
- Cluster Development
- No solid/hazardous waste
- Visual buffer
- 250 foot shoreline buffer
- 125 foot septic system setback
- Building setback
- No fertilizers, herbicides, or pesticides
- 200 foot minimum lot frontage
- 50 foot vegetated buffer
• 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.

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

• The application of fertilizers, herbicides, and pesticides for noncommercial private purposes within the shoreland district should be prohibited. 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 the U.S. Soil Conservation Service. 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 properties.

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

Other land protection measures

The Squam Lakes Watershed Plan also recommends action to protect other watershed lands:

• Municipalities should encourage landowners possessing parcels with productive agricultural and forest soils to apply for current use 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 should be monitored by the town selectmen.

• Cluster development and other innovative land use control mechanisms should be encouraged 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.

• Municipalities within the watershed should consult with and seek assistance from the Lakes Region Planning Commission, county conservation districts, the Department of Environmental Services and other agencies concerned with land use planning.
Maintaining Squam water quality

Irregularly shaped lakes like the Squam Lakes include many coves, bays, and depths. All of these areas tend to work independently of each other, influenced by different types of drainage from the sub-watersheds around the lake. For this reason, the Squam Lakes are monitored at a number of different sites each summer in order to provide an accurate picture of the lake's water quality. The work is supervised by the University of New Hampshire's Lakes Lay Monitoring Program, and is carried out by Squam Lakes Association volunteers.

This program looks at three different measures to keep track of water quality in the lakes: chlorophyll a, water transparency, and phosphorus, which, taken together, can show how "productive," or diminished in quality, the lake may be:

Chlorophyll a is the green pigment found in all plants, and the more chlorophyll there is in the water, the more algae there are. Pollution in the form of nutrients, generally from man-made activities, feeds the algae.

Water transparency is a function of the amount of dissolved or suspended particles in the water and can be affected, for example, by algae blooms or the silt in the run-off from a construction site. Less productive lakes are clearer and generally healthier. Water transparency, like lake productivity, can vary considerably with the season.

High concentrations of phosphorus, such as are found in laundry detergents, encourage the growth of many types of plants in a lake, from weeds to algae. Phosphorus levels can change dramatically through a season, and sampling for phosphorus must be done frequently and consistently.

Generally speaking, the data show that the Squam Lakes have excellent water quality, and can be classified as oligotrophic lakes, of low productivity. However, the data also show subtle changes over time, which indicate that their productivity is likely to be increasing. Thus it is vital to locate pollution sources and to develop an action plan for eliminating them.

Sources of pollution

A watershed is continually washed by the water that moves through it, so any use of the land or water within the region has the potential to affect water quality in that watershed. The water moving through a watershed can carry a wide variety of pollutants, and those pollutants can come either from point or nonpoint sources. A point source of pollution, as the word suggests, comes from a single source that can be identified, such as a wastewater treatment facility. Run-off from agricultural lands is an example of a nonpoint source of pollution.

Point pollution sources are relatively easy to find and keep track of. They are also well-regulated, and the intent of that regulation is to keep groundwater from being altered in any way that would make it unsuitable for drinking.
Non-point sources of pollution, however, can be much more difficult to locate, measure, and regulate. Almost any large-scale change in the land in a watershed has the capacity to affect the lakes and ponds downstream. Run-off from farming, lumbering, road construction, and other operations carries away fertilizer, pesticides, nutrients, and silt. Pollution from leaking fuel storage tanks and bad septic and wastewater treatment systems can also find its way into a lake and can be extremely difficult to identify.

Actions to counteract pollution

The Squam Lakes Watershed Plan makes a number of suggestions on steps to reduce pollution threats to the Squam lakes.

Recommendations:

- Planning boards should also adopt stormwater management requirements as part of their subdivision regulations, site plan review regulations, and local excavation ordinances.
- Municipalities within the watershed should undertake local inventories of point and nonpoint pollution sources as potential threats to water quality, and include this information in the local water resource management and protection portions of their municipal master plans.
- Conservation commissioners and health officers in the Squam Lakes watershed should develop an inventory of septic systems within the recommended shoreland protection district, and work with the landowners to improve septic system maintenance. 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).
- Municipalities should adopt health ordinances that address the installation and maintenance of private septic systems, underground storage tanks, and other land uses that have the potential to harm water quality.
- Municipalities within the watershed should evaluate the adequacy of existing septage disposal practices and should require periodic septic system inspection and maintenance through local health ordinances.
- Municipalities within the watershed should act to protect the 58 wellhead areas in the watershed, and should develop inventories of potential threats to water quality in these wellhead areas.
• In order to detect long term water quality trends for the Squam Lakes, the Squam Lakes Association's lay monitoring program should improve the consistency of its sampling, in terms of locations sampled, timing of sampling, and techniques used.

• More frequent chlorophyll a sampling should be done in late summer for both lakes at the metalimnion, or middle depth zone, in order to monitor the algae blooms that have been occurring there.

• Alkalinity monitoring should be continued to test the buffering capacity of the Squam Lakes, and thus their vulnerability to the effects of acid rain.

• There should be more detailed monitoring of cove areas, including shoreline vegetation surveys and checks for nuisance species such as milfoil (a weed-watcher program should be established for individual cove areas of the Squam Lakes).

• Tributary sampling should be carried out in order to identify sub watershed inputs to the Squam Lakes.

• Critical areas of the lakes should be identified, based on water quality data collected over time. This information should be coordinated with other kinds of information (land use, fisheries, wildlife habitat, soils, boating and other recreational use of the lakes). It then can be used for discussion of carrying capacity; to support new or existing recreational water use regulations; to help locate appropriate public access sites; and to help identify areas that should be protected through some kind of land acquisition.

• A “water budget” should be prepared for the Squam Lakes to provide input and output flow information about the watershed. Detailed flow information can be used in conjunction with a nutrient analysis in the development of a nutrient budget for the watershed. The purpose of a nutrient budget is to gain an understanding of the nutrient contribution from septic systems and other land uses.
The Importance of Wildlife Habitats

INCREASING USE of the Squam watershed resources inevitably poses threats to Squam’s natural wildlife habitats.

Eagles, once common in the area and then decimated by the effects of pesticides, have been aided by the DDT ban and are now occasionally seen again. With fish an important part of their diet, eagles search for relatively isolated nesting sites near the water. Shoreland development makes these hard to find.

Loons, too, have been harmed by people’s activities—in this case, by boaters’ disturbance of nesting and brooding areas. Loons have been helped by the work of groups such as the Loon Preservation Committee of the Audubon Society, which has sensitized people to the need for loon protection. But special conservation measures will always be necessary.

Fish populations can be threatened by watershed development, if it results in polluting runoffs capable of contaminating spawning areas.

The Squam Lakes Watershed Plan thus requires a fish and wildlife component that mandates special treatment for particular segments of the watershed: areas where large numbers of animal species can be found; habitats threatened by development; areas where highly valued wildlife is located; and habitats that would be difficult to replace if damaged or destroyed.

Squam lakeshore areas, in particular, are important not only to eagles, but to a wide variety of creatures. Waterfowl breed and nest there, migratory birds use them as a stopover, and wide-ranging animals like deer use them as travel corridors.
Approaching the problem

Many of the strategies that apply in general to watershed management will serve to protect such wildlife habitats, but this does not mean that these zones do not need special consideration.

One way to ensure that wildlife and their habitats are considered in subdivision and site plan reviews is to establish a formal link between the local planning boards and conservation commissions.

Recommendations:

- Planning boards in the watershed should amend their municipal master plans by adopting the maps and information that identify significant wildlife habitats. Lists of those species that are likely to be found in those habitats can be included as appendices to master plans for use in carrying out site evaluations.

- Cluster development should be encouraged to provide for open space and to allow flexibility in the design of projects. Ordinances should specify that first priority for open land in cluster developments include consideration of wildlife habitats.
Recreational Use of the Lakes

WITH THEIR EXCEPTIONAL natural beauty, the Squam Lakes have attracted swimmers, boaters, fishermen, and just plain nature lovers for well over one hundred years. Today, the Squams’ clean waters and many islands, bays, and coves are particularly inviting to urban and suburban dwellers who yearn for the lakes and mountains.

In practical terms, this means that people in growing numbers want access to the Squam Lakes.

What should be done about this? What access should be created for the public that actually owns these waters — and that increasingly demands the right to use them? Then, recognizing that environmental damage can result from over-use, what restrictions should be placed on the public’s rights of access and use?

Some principles regarding lake use

With these questions in mind, the Squam planning group accepted three basic principles regarding lake use:

1. The Squam Lakes are public waters and therefore should be accessible to the public.

2. The use of the Squam Lakes’ water surface should be managed so as to insure that the level of activity resulting from increased public access does not exceed the capacity of the lakes and therefore does not pose threats to the lake environment or to public safety.

3. The roles of the public and private sectors in providing opportunities for public access to and use of the lakes must be defined and related to each other.

The question of access

The 1987 CORD report, drawing on State of New Hampshire statutes, defined access to New Hampshire waters as “Legal passage... by [land] owned or controlled by [a] state agency, assuming that all members of the public shall have access to and use of the public waters for recreational purposes.”

The Squam watershed planners thought this definition was too narrow and unrealistic, as it limits access areas to shoreland actually owned or controlled by the state. Since the state owns no land around Squam, and yet municipal and private access points are available to the public, the Squam Watershed Plan redefines access as:

"Legal passage by way of designated land owned or controlled by public or private entities, for the purpose of providing recreational opportunities and/or use of the public waters of the state—which may or may not involve the payment of a fee."
Dealing with the access problem

According to the calculations of the State Public Access Advisory Committee, the Squam Lakes should have nine public access areas to serve its 7,847 acres of water (the Committee's formula relates the number of access points to miles of shoreline and total water surface). By the state's own definition, there are technically no access points on the Squams today, although as a practical matter the Squam planning group identified eight, including privately controlled points that are open to the public.

The conclusions reached by the Squam watershed planners with respect to public access were as follows:

1. Public access to the lakes for such activities as swimming, picnicking, camping and winter recreation is as important as is access for boating.

2. Although boating access is currently restricted (points include three marinas, a privately owned ramp on Route 113, and a public launch site on the Squam River), other kinds of public access are now available at Five Finger Point, the NEFFA property on Dog Cove, and the Ashland town beach.
3. Two or three new access areas to allow swimming, boating and other recreational opportunities should be created in the next five years. This might result in an increase in boating of up to 30 percent over present levels. Lake capacity calculations suggest that this need not damage the lake environment (see boating limits discussion below).

4. The greatest need with respect to boating access is for small boats, which now must compete with larger boats at the available access sites in Little Squam, the Squam River, and the inter-lake channel.

5. Partly for this reason, new access areas should be sought in the southeastern and northeastern sections of Squam Lake. This will help to relieve the congestion in Little Squam and at the westerly end of Squam, and will also enable small boats to get to all parts of the lakes without having to travel their entire length.

6. The access point on the Squam River should be enlarged by adding publicly-owned land adjacent to the nearby dam. This will enable parking related to boat launchings.

7. Swimming, picnicking, carry-in boat launching, and trail access facilities should be created at various locations around the Squams beyond the recommendations outlined above.
Putting limits on boating use of Squam

Next, in the interest of resource protection and public enjoyment and safety, what limits should be placed on boating use of the Squam Lakes? If access is to be improved, is there a risk that boating activity will intensify and cause damage to the lake environment, and if so, what should be done to anticipate and prevent it?

Studies of lakes and boating use have given planners the ability to estimate the boat carrying capacity of any lake by taking into account such factors as type of use, lake size and configuration, and population density, along with measurements of actual boating use.

Calculations for the Squam Lakes suggest that a reasonable increase in the number of boats over a period of time will not have a negative effect on the lake resource as long as certain controls are applied. These controls should be based on a) the establishment of water use activity zones; b) tighter management of access areas; c) continued monitoring of boating use; and d) restricting the size, speed and power of boats operating on Squam—perhaps during certain hours of the day or during certain days of the week—if use levels threaten to pose dangers to the lake environment and to public safety.

a. Water use activity zones. The Squam Lakes Watershed Plan proposes the establishment of three activity zones for the lake surfaces:

- a nearshore activity zone, extending 250 feet out from and parallel to the shoreline, that would function as a “quiet zone” in which motorized craft would be required to move at headway speed;
- a wildlife protection zone, extending an additional 250 feet out from and parallel to the nearshore activity zone (making a total of 500 feet from shore), along shoreline containing known loon nesting and brooding sites or other critical habitat locations—where headway speed would also be required; and

- a general activity zone, covering the remainder of the lakes, where speed limits and types of use would be governed by existing laws and regulations.

b. Tighter management of access areas. Most desirably, anyone launching a boat onto Squam waters should come in contact with a system of boating supervision that would have several aims:

- to prevent illegal boats, such as houseboats, from being launched;
- to be sure that all boat operators are informed about the boating rules that apply, and also about the location of public use areas and toilets;
- to keep records on boat sizes and points of origin as an aid to lake-use management and rule-making;
- to prevent the introduction of aquatic weeds and milfoil into the Squam Lakes;
- to direct visitors to other launch sites when parking areas are full;
- to provide trash collection and sanitary facilities;
- to act as a reporting point on such matters as flagrant rule violations, missing buoys, and emergencies of any kind.
c. Continued monitoring of boating use. Significantly, all of the boating use recommendations in the Watershed Plan are based on data collected by the Squam Lakes Association in 1988, 1989, and 1990. These data should be continuously updated, and the Plan recommends that the Squam Lakes Association continue with an annual boat and facilities census so as to make possible a regular review of the adequacy of the watershed management plan.

d. Restrictions on boat size, speed and power. The State of New Hampshire, and towns within the watershed, should be prepared to reduce the size and power of boats, and to restrict boating speeds further if, as a result of increased public access or power-boating, or both, it can be demonstrated that unacceptable threats are being posed to the lake environment or to public safety. Some restrictions might come in the form of "time zoning," which could limit activities such as water-skiing or high-speed cruising to certain times of the day (perhaps at mid-day) or to certain days of the week (such as weekdays only).

Increasing boating safety through licensing

Due to the growing intensity of boating activity on the Squam Lakes, the Squam Lakes Watershed Plan recommends that the State of New Hampshire institute a program of licensing power boat operators. The aim of such a recommendation is to widen boat operators' familiarity with state boating laws and to promote increased boat handling proficiency, courtesy, and safety consciousness. The proceeds from licensing fees should be dedicated to the support of educational programs and boating management on the Squams and other New Hampshire lakes (obviously, such a program would have to be state-wide). The licensing program should apply to persons operating boats with motors in excess of 40 horsepower.
Conserving Watershed Lands

Establishing land protection priorities

A RELATIVELY SMALL NUMBER of landowners have held large shore, island, and hillside properties around the Squam Lakes for several generations, and thus have provided important protection for those lands. But development pressures are now threatening to change some of those patterns: where less than nine percent of the Squam watershed was developed in 1955, by 1988 this figure had grown to 21 percent.

There is growing fear that, backed by soaring market values and property taxes, this trend will continue.

Clearly, a land protection program is in order for the Squam watershed, and the Squam planning project developed a list of the kinds of areas that should be targeted for such protection. The list puts special emphasis on areas that have important natural values: wildlife habitats; scenic, recreational, and productive resources (such as groundwater supplies); and prime forest and agricultural areas. The list is as follows:

- undeveloped islands
- extensive undeveloped shoreline
- habitat for rare, threatened, or endangered flora or fauna
- land offering scenic views of the lakes
- shorefront areas with potential for controlled public use
- established hiking trail corridors
- wetlands and buffers surrounding wetlands
- deer wintering yards
- wildlife travel corridors
- land with productive natural resources

Land protection techniques

Landowners must be educated on the importance of protecting their lands and on the techniques by which they can do this—including the economic and other advantages owners can receive through land protection programs.

The simplest and most direct techniques for preserving land are through donation, bequest, or sale to conservation groups (including municipalities and the state). Any such transfer of ownership is known as “fee simple” and gives the recipient all uses and rights to the land. Alternative techniques enable landowners to transfer ownership now, but continue to use their land during their lifetimes.

An owner willing to sell land at a reduced price can take a tax deduction for the balance of the land’s full market value.
Funding to help towns buy important pieces of land may be available through federal, state, or local governments, or a combination of the three.

A conservation easement is another way of protecting land without transferring all of the rights and uses relating to it. An easement can be donated or purchased, and generally places perpetual restrictions on the use of the 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, such as good forestry and agricultural practices.

Other options for protecting land include placing it in current use; developing covenants among landowners; and employing deed restrictions, leases, and rights of first refusal. These techniques are less effective than the others in insuring complete and lasting protection for land, but they can be useful if the more permanent techniques are for some reason not applicable.

**Recommendation:**

- Private, non-profit conservation groups and local conservation commissions should consider islands, shorelines, wetlands and wetland buffers, unique natural areas, and significant wildlife habitats as priority areas for land acquisition.
Watershed Protection Through Inter-municipal Cooperation

Regional coordination now possible

By 1988 all towns in the Squam watershed had adopted master plans that now serve as the basis for local regulations — zoning ordinances, subdivision and site plan rules, building codes, and health ordinances, for example.

Starting in 1986, the towns were also encouraged to develop plans for protecting their ground and surface waters through the Water Protection Assistance Program in the Office of State Planning. Then, in 1989, an amendment to the water protection statute encouraged towns in any watershed to join together in developing regional plans and ordinances to protect the watershed as a whole.

This concept has yet to be tested in New Hampshire, but clearly could be very useful to the municipalities in the Squam Lakes watershed in applying the provisions of the Squam plan across town boundaries.

Such inter-municipal coordination could make possible a number of steps toward watershed protection:

- the development of a regional water resource management and protection plan as a guide to each municipality;
- individual planning boards' portions of the plan that apply to their towns;
- a consistent set of zoning ordinances could be developed for towns in the
watershed, particularly with regard to permitted uses in zoning districts along common town boundaries (also, distance requirements such as building setbacks and minimum frontage on water bodies could adhere to commonly-accepted standards among the towns);

- overlay districts (environmentally sensitive areas that can overlap different types of land use zones) could be created to protect wetlands, floodplains, aquifers, steep slopes, and shorelines that may run from one watershed town into another;

In addition, some activities now regulated by the state or the towns individually, including fill and dredge projects, shoreline structures, boating, and septic system design and installation might be more effectively enforced by the towns on a cooperative basis. Local responsibilities that could be shared among watershed municipalities include subdivision and site plan review regulations, zoning, police power, and excavation and health ordinances.

- aquifers and wellheads for current and future water supplies could be preserved through the joint enforcement of special protection measures;

- shorelands could be placed in overlay zoning districts to help protect water quality and wildlife habitats;

- special land use controls (such as phased development and cluster development combined with open space preservation) could be applied by all municipalities in the watershed toward the goal of watershed protection as a whole.
Paying for watershed protection

Real protection for the Squam Lakes watershed's resources will cost money – money to create inventories of pollution sources; to inspect septic systems; to manage lake access points; to patrol the lakes summer and winter to ensure that reasonable lake conservation standards are being observed; to develop educational materials for watershed users; and to acquire land or conservation easements.

The State of New Hampshire, along with many other states, faces fiscal problems that make such funds hard to come by. Similarly, and partly for this reason, the Squam Lakes watershed towns are hard pressed to balance their own budgets and to pay for schools, roads, and other municipal necessities.

This means that new money is going to be needed to pay for watershed protection measures. Where is this money to come from?

The Squam Lakes watershed study suggests that it could come, most logically, from watershed-related activities, which would be dedicated to a management fund. Some examples might include:

- conservation fees charged against new developments in the watershed;
- dock, mooring, and boathouse fees for those with such facilities on the Squam Lakes waterfront;
- boat launching fees;
- bob-house fees;
- dedication to a Squam Lakes conservation fund of a major portion of boat license fees;
- fees for waterski competitions and sailboat races.

Watershed users, in other words, should help to finance watershed conservation.
Achieving cooperative action among the watershed towns

As to the means for implementing such a cooperative plan and a funding program among the watershed towns, New Hampshire's Revised Statutes Annotated (RSA) Chapter 53-A currently gives towns the right to agree to provide services and facilities cooperatively to their residents. Under such an arrangement, the towns in the Squam Lakes watershed could hire a regional staff person to enforce either state laws for which regional or local enforcement is authorized, or local laws.

Another technique for achieving intermunicipal cooperation could be the formation of a watershed precinct, as authorized by RSA 52. Such a precinct would be defined by watershed boundaries rather than town lines, and as such could concentrate enforcement and other resource protection activities where the need is greatest.

A watershed precinct could raise money through the taxation of those actually using watershed resources (inside the watershed), thereby assuring payment of costs without requiring budget approval from entire towns, portions of which may lie outside the watershed. The precinct would, of course, include portions of all the towns within the watershed.

Because the precinct would be limited to the watershed boundaries, however, this type of inter-municipal cooperation might be less effective in the enforcement of town-wide ordinances and regulations.

A third technique would be through collaboration with the Lakes Region Planning Commission, which enables the coordination and enforcement of zoning and subdivision regulations in accordance with RSA 36:47.
A Critical Role for Education

THERE IS EVIDENCE that some people who are active in the Squam Lakes Watershed, either as residents or as visitors with recreational interests, do not consistently follow basic rules of watershed protection.

Such persons include homeowners whose septic systems are antiquated and could pollute lake water; hikers who damage and litter watershed trails; powerboaters who speed too close to shore, churning bottom sediments, eroding shoreline, and posing threats to water birds as well as public safety; commercial operators who are not careful about their handling of wastes; developers who are not thinking about the environmental consequences of their projects; and others.

This situation calls for consistent programs of information and education aimed at watershed users of all kinds—from adults who are residents or who are visitors to the watershed to children who are in local schools. Fortunately, educational resources are in place within the watershed communities that can help with this task.

Reaching the recreational user

Perhaps most urgent is the need to help the recreational watershed user to understand the issues involved in watershed protection and to modify his or her behavior to conform to resource conservation mandates.
The Squam Lakes Association is in a particularly strong position to help with this job, and has already accepted some responsibility through such publications as "Squam Boating Rules." This booklet should be more widely circulated through Squam marinas and launch sites, and should be updated as necessary. SLA might consider publishing similar booklets on other aspects of watershed use.

All prominent Squam organizations--SLA, the Squam Lakes Conservation Society, the Science Center of New Hampshire, the Loon Preservation Committee of the Audubon Society, the Pemi Fish and Game Club--should place public environmental and watershed use education at the tops of their agendas, and create and perhaps coordinate programs to help adult watershed users learn how to do their part in preserving Squam lands, waters, and wildlife.
Helping with programs in the schools

Although school surveys in the watershed have found little consistency in the way environmental issues are presented to children--particularly watershed and water quality issues--teachers have expressed a strong interest in taking part in a watershed education program.

Several environmental education resources are available in New Hampshire that teachers can use to supplement their work, and, since New Hampshire has no mandated science curriculum, individual schools have more flexibility as to what and how they teach. That means there is more opportunity for supplementary environmental curricula, including those that deal with watershed issues, to be introduced into the schools.

Of all the local sources for such supplementary materials, the Science Center of New Hampshire, in Holderness, is perhaps the most significant; schools from all over the state use the Science Center as a resource for environmental education, with the result that more than 25,000 students visit the Center every year.

The Center has several programs that deal directly with water ecology. A class designed for third-to sixth-graders explores pond populations and the relationship between species diversity and water quality. There is also a popular lake ecology program that focuses directly on the Squam Lakes and their watershed. As part of this program, middle and high school students get out on the lakes on the Science Center's 28-foot "floating lab."

Other organizations with the potential for helping with youth education programs include:

- Lakes Region Conservation Trust, which runs various summer education programs within the lakes region (though not now on Squam Lake). The Trust receives national sponsorship for much of its work from the National Science Center for Youth Foundation.
- Cooperative Extension Service, which has developed a supplementary curriculum called New Hampshire Waters that serves as a good introduction to water quality, supply, and use.
- Teacher workshops, including Project WILD at the N.H. Fish and Game Department; and Project Learning Tree at the Society for the Protection of N.H. Forests.
Putting the Plan to Work

AN ACTION PROGRAM to put the Squam Lakes Watershed Plan to work obviously will require the energies and the convictions of many people on many fronts. It is an important plan, and an ambitious one.

Action will be required from the agencies and the legislature of the State of New Hampshire; from the boards and commissions of the towns in the Squam watershed; from voluntary associations and groups interested in various aspects of Squam improvement; and, of course, from the many hundreds and perhaps thousands of individuals who, in one way or another, make use of Squam watershed resources in the course of a year.

As a beginning in implementing the watershed plan, the following steps seem, in summary, especially urgent (the complete plan contains these and many other recommendations):

The State of New Hampshire, through the legislature and the executive agencies, should:

- adopt a three-zone plan for the surface use of Squam Lakes waters that would extend the headway speed distance to 250 feet and 500 feet for nearshore and wildlife zones, respectively;
- consider the adoption of time zones that would distinguish between weekend (more restricted) and weekday (less restricted) boating use of the lakes;
- develop a long-range plan to achieve further reductions in the size, speed, and power of boats on Squam that will be construed as fair and non-discriminatory by lake users;
- establish a boater-licensing system to improve operator proficiency, increase boaters' knowledge of boating laws, and provide funds for lake safety and education programs;
- broaden the state definition of public access to include non-state-owned ar-
areas that are available to the general public for access to the Squam Lakes;

- endorse the need for up to six access sites for the Squam Lakes, including sites for small boats, car-top carry-ins, and non-boating lake users (the selectmen for the Squam watershed towns have constituted themselves as a committee to work on this problem independently, have developed some recommendations, and are an excellent resource for the state);

- develop, through the Department of Environmental Services, a long-term plan for monitoring the water quality in the Squam Lakes (more consistency is needed in the current Squam Lakes Association-University of New Hampshire program for monitoring chlorophyll a content as well as Squam cove areas);

- again through the Department of Environmental Services, use the water quality data to identify vulnerable areas in the lakes as an aid in formulating water use regulations and identifying promising public access sites;

- prepare (again through DES) a "water budget" to develop inflow and outflow information preliminary to setting a nutrient budget for the lakes;

- amend the Wetlands Board rules to prohibit dug-in boat slips;

- restructure state financing arrangements, principally through the dedication of boat licensing fees, to help provide adequate funds for lake monitoring and for supervising boating safety.

The five Squam-area municipalities should act promptly to create a Squam Lakes Watershed District, or precinct, which is now possible under State statutes and which would improve the coordination and enforcement of zoning and sub-division regulations.

Alternatively, the towns could develop a program to coordinate their zoning and subdivision regulations through the Lakes Region Planning Commission.

Ultimately, it might be possible to develop land and water use regulations locally, and to enforce them with money raised locally, supplemented by funds passed through from the State.

Meanwhile, the Squam towns should amend their zoning ordinances to:

- adopt wetlands, floodplain, and aquifer overlay districts;

- adopt shoreland overlay districts that would create vegetative buffers and building setbacks around the shore-

line and would discourage the use of fertilizers, pesticides, and herbicides;

- prevent development on slopes greater than 25 percent;

- require a minimum of 200 feet shore frontage and one acre for building lots, with building heights limited to 35 feet;

- itemize prohibited land uses that threaten surface or ground water supplies (such as junkyards, salt piles, underground tanks, and hazardous waste);

- develop inventories of wetlands, septic systems, and threats to water quality;

- amend their subdivision regulations to reflect changes in state statutes regarding subdivision review, and to protect natural resource areas and wildlife habitats;

- amend their codes so that construction within shoreland areas will create a minimum of erosion and lake sedimentation, and will provide drainage systems with open swales instead of storm drains;

- encourage applications for current use by landowners and the donation or sale of conservation easements; also encourage the development by land-
owners, working with County Foresters, of forest management plans;

- adopt health ordinances that cover the installation, maintenance, and inspection of septic systems, wells, and underground storage tanks;

- develop uniform road salt management policies;

- use Watershed Plan maps in relation to their own master plans, which should be updated every five years;

- encourage the strengthening of environmental education programs in the four Squam Lakes area school districts.

**Local organizations and groups**, especially the Squam Lakes Association, the Squam Lakes Conservation Society, the Loon Protection Committee of the Audubon Society, the Science Center of New Hampshire, and the Pemi Fish and Game Club, should familiarize themselves with the plan's details and should relate their own programs to it in ways that seem most appropriate. In particular,

- the Squam Lakes Association should continue carrying out its boating use surveys, which can help in formulating policies and regulations regarding lake use;

- SLA should also continue with its water quality monitoring program, with improvements discussed in the Watershed Plan;

- all groups should consider how their own information and education programs can be strengthened to increase awareness of the need to protect the Squam Lakes watershed resources, and what actions people must take to help with the task.

Finally, **individuals** living in the watershed or enjoying its lands and waters as visitors should act in ways that will preserve the Squam Lakes and their surrounding lands. They should familiarize themselves with the issues involved in watershed protection, from building construction to boating practices, and be sure that their own uses are consistent with the Watershed Plan's conservation objectives.
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