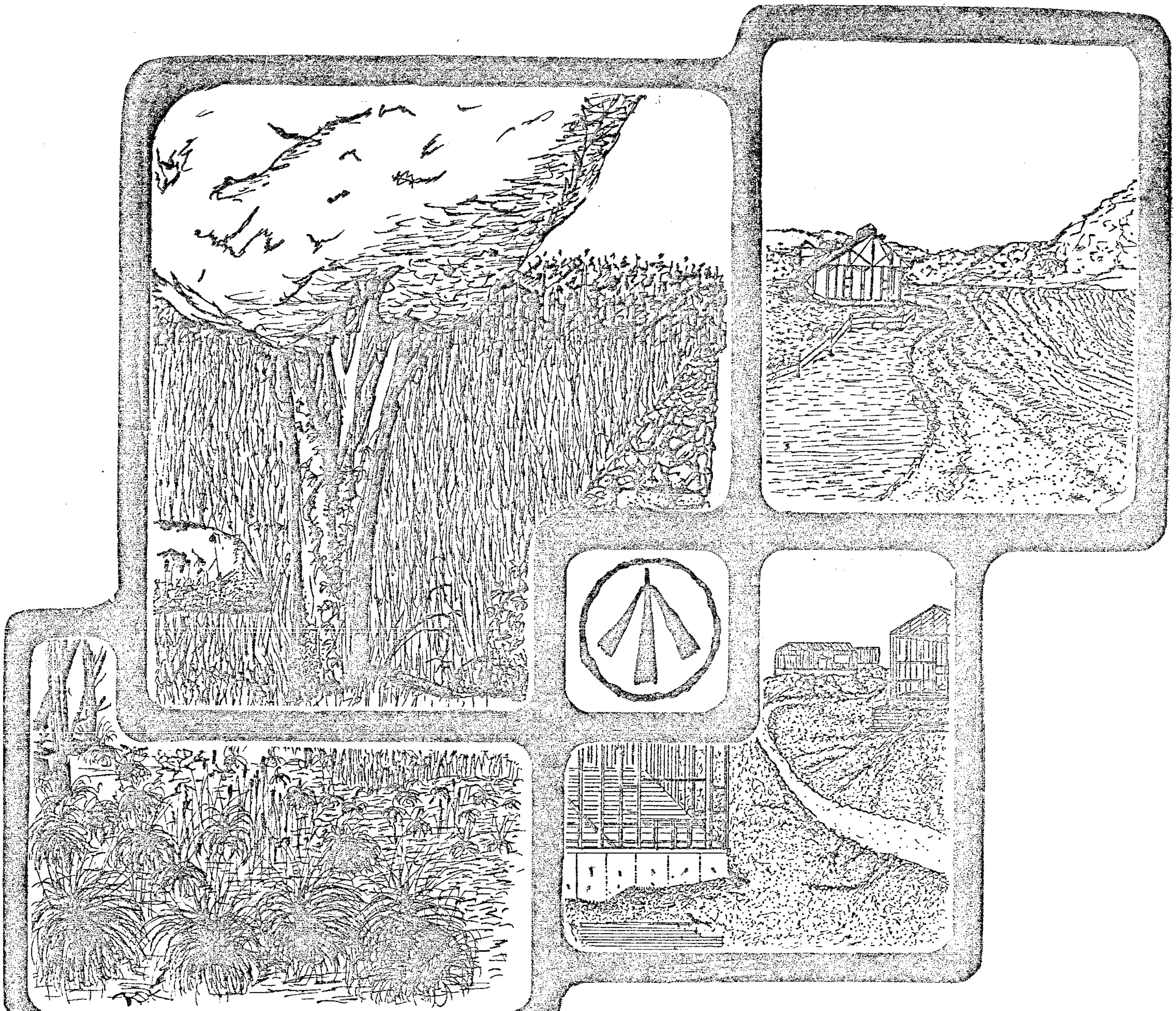
ENVIRONMENTAL REVIEW TEAM REPORT



SQUANTZ POND

NEW FAIRFIELD and SHERMAN, CONNECTICUT

KING'S MARK
RESOURCE CONSERVATION & DEVELOPMENT AREA

KING'S MARK
ENVIRONMENTAL REVIEW TEAM REPORT

SQUANTZ POND
NEW FAIRFIELD and SHERMAN, CONNECTICUT

JUNE, 1983

King's Mark Resource Conservation and Development Area
Environmental Review Team
Sackett Hill Road
Warren, Connecticut 06754

ACKNOWLEDGMENTS

The King's Mark Environmental Review Team operates through the cooperative effort of a number of agencies and organizations including:

Federal Agencies
- U.S.D.A. Soil Conservation Service

State Agencies
- Department of Environmental Protection
- Department of Health
- University of Connecticut Cooperative Extension Service

Local Groups and Agencies
- Litchfield County Soil and Water Conservation District
- New Haven County Soil and Water Conservation District
- Hartford County Soil and Water Conservation District
- Fairfield County Soil and Water Conservation District
- Northwestern Connecticut Regional Planning Agency
- Valley Regional Planning Agency
- Central Naugatuck Valley Regional Planning Agency
- Housatonic Valley Council of Elected Officials
- Southwestern Regional Planning Agency
- Greater Bridgeport Regional Planning Agency
- Regional Planning Agency of South Central Connecticut
- Central Connecticut Regional Planning Agency
- Capitol Regional Council of Governments
- American Indian Archaeological Institute
- Housatonic Valley Association

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FUNDING PROVIDED BY
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Richard Lynn, ERT Coordinator
Sandra Bausch, ERT Cartographer
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LOCATION OF STUDY SITE

SCALE: 1" = 10 miles

10 0 5 10 miles

ENVIRONMENTAL REVIEW TEAM REPORT
ON
SQUANTZ POND
NEW FAIRFIELD AND SHERMAN, CT

I. INTRODUCTION

Squantz Pond is ± 288 acres (0.45 square miles) in size and located astride the Sherman and New Fairfield town line (see Figure 1). The watershed or drainage area of Squantz Pond is approximately 3,667 acres (5.73 square miles).

Prior to 1929, Squantz Pond was about 65 acres in size and occupied the southern portion of the present day Pond.

With the creation of Candlewood Lake in 1929, the elevation of Squantz Pond was raised, creating the present day Pond. The Pond now has a maximum depth of 47 feet and a mean depth of 22.9 feet.

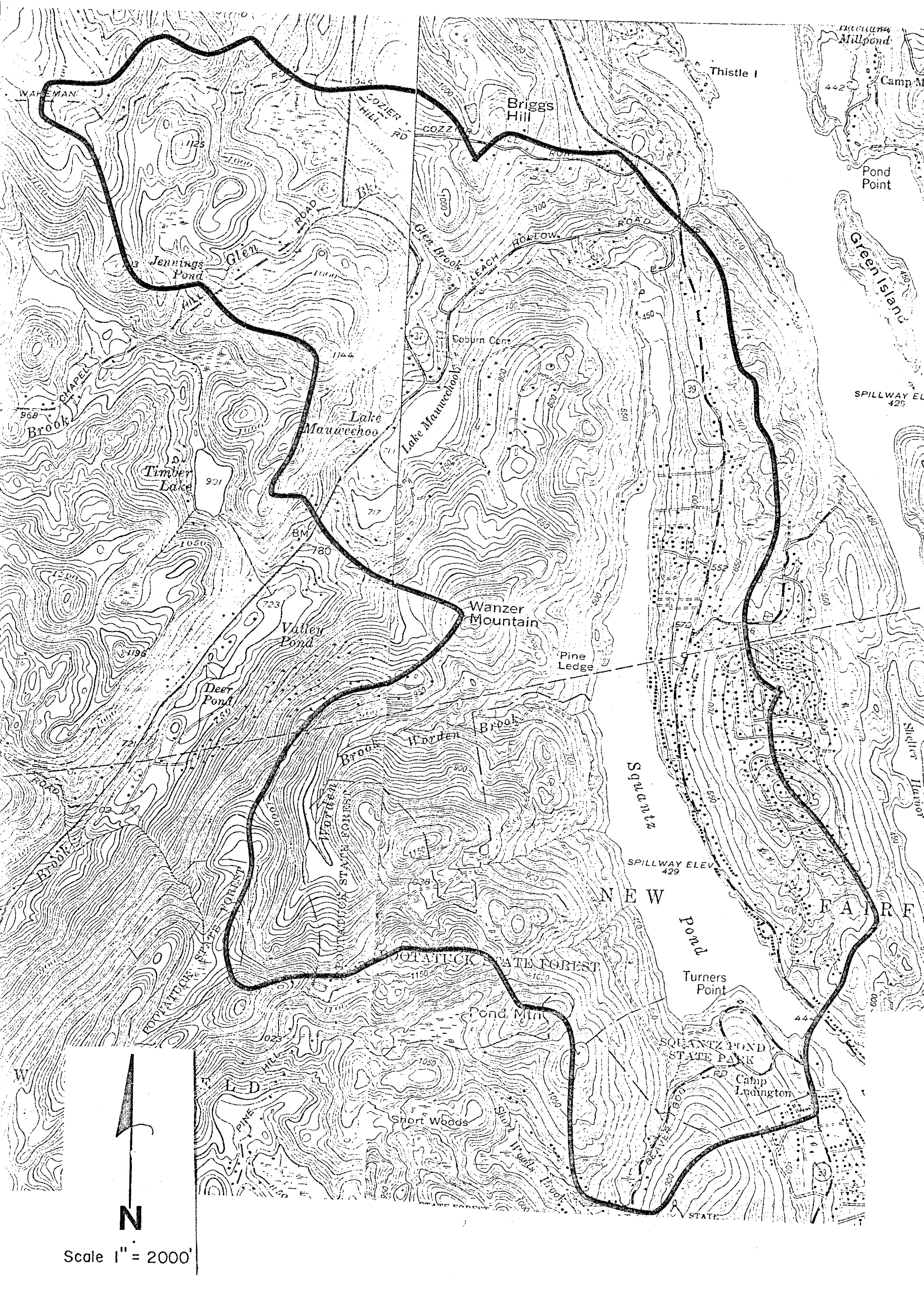
As shown in Figure 1, much of the Squantz Pond watershed is undeveloped. The western half of the watershed consists of state forest land, Squantz Pond State Park, Lake Mauweehoo, a horse farm and scattered residential structures on large lots. The eastern half of the watershed is much more heavily developed with numerous seasonal and year-round residences along the eastern shore of Squantz Pond. Major roads in the watershed include Rt. 39, Rt. 37, Leach Hollow Road, Beaver Bog Road, and Cozier Hill Road. Glen Brook is the principal stream flowing to Squantz Pond.

Concern has recently been expressed by local residents regarding the environmental deterioration of Squantz Pond. Specific problems include: 1) discoloration and loss of water clarity, 2) algae accumulation, 3) weed growth, 4) erosion, and 5) odors.

The First Selectmen from New Fairfield and Sherman requested this Environmental Review Team study to learn more about the Pond and its watershed. Specifically the Team was asked to 1) provide a natural resource inventory of the Squantz Pond watershed, 2) identify those factors which may be contributing to the above mentioned problems at the Pond, and 3) discuss alternatives available for effective Pond management. The First Selectmen requested this information to serve as a basis for decision making on how best to protect the future water quality of the Pond.

The King's Mark Executive Committee considered the town's request and approved the project for review by the Team.

Figure 1
TOPOGRAPHIC MAP



The ERT met with representatives of the two towns and field reviewed the watershed on December 8, 1982. Team members participating on this review included:

Charles Fredette	Lake Ecologist	Ct. Dept. of Environmental Protection
Joe Goyette	Environmental Planner	Ct. Dept. of Transportation
Bill Hyatt	Fishery Biologist	Ct. Dept. of Environmental Protection
Frank Schaub	Sanitary Engineer	Ct. Dept. of Health
Don Smith	Forester	Ct. Dept. of Environmental Protection
David Thompson	District Conservationist	U.S.D.A. Soil Conservation Service
Bill Warzecha	Geohydrologist	Ct. Dept. of Environmental Protection

Prior to the review day, each team member was provided with a topographic and soil map of the watershed and a checklist of concerns to address. Following the field review, individual reports were prepared by each team member and forwarded to the ERT Coordinator for compilation and editing into this final report.

This report presents the team's findings. It is important to understand that the ERT is not in competition with private consultants and hence does not perform design work or provide detailed solutions to development problems. The ERT concept provides for the presentation of natural resources information and preliminary land use analyses. All conclusions and final decisions rest at the local level. It is hoped the information contained in this report will assist the towns of New Fairfield and Sherman in making environmentally sound decisions.

If any additional information is required, please contact Richard Lynn, (868-7342), Environmental Review Team Coordinator, King's Mark RC&D Area, Sackett Hill Road, Warren, Connecticut 06754.

* * * * *

II. HIGHLIGHTS

1) *The chemical quality of streams and ponds in the Squantz Pond watershed under natural conditions is generally good. This natural water quality can be adversely impacted by various non-point sources of pollution, however, such as erosion and sedimentation, septic systems, agricultural practices, timber harvesting, road runoff and waterfowl. In the Squantz Pond watershed, it appears that septic systems and erosion are major non-point sources of pollution.*

2) *Squantz Pond is inhabited by a variety of both warm water and cold water fish species. The alewive population in Squantz Pond may be contributing to the eutrophication process. Through their predation on zooplankton, alewives may indirectly be stimulating the growth of green algae and diatoms by removing a natural predator. Interestingly, according to local residents, the first serious algal blooms on Squantz Pond were noted in 1974, corresponding closely with the appearance of the alewive. The effect of eutrophication on Squantz Pond, from a fisheries standpoint, is considered detrimental. The continuation of this process will cause the lake to become less suitable for cold water species, particularly trout.*

3) *Timber harvesting in the watershed may adversely affect water quality, largely through erosion. Adverse impacts can be minimized by good planning and responsible implementation.*

4) *Many of the soils in the watershed present severe limitations for residential development due to steep slopes, shallow to bedrock conditions, wetness, or hardpan conditions. To protect water quality in the watershed, future development should be carefully controlled.*

5) *Most of the soils along the eastern shore of Squantz Pond are considered marginally suited for subsurface sewage disposal. This area has been heavily developed with many lots less than 1/2 acre in size. Many of the existing residences were constructed for seasonal use and have since been converted to year-round use. Subdivision of this area under today's requirements for protection of water quality and public health would probably reduce the density of residential development by approximately sixty percent.*

6) *Inadequate septic systems may be contributing nutrients directly to Squantz Pond, thereby stimulating algae and weed growth. Consideration should be given to requesting the town health departments to conduct sanitary surveys to identify potential sources of pollution, particularly along the eastern shore. This may include the introduction of fluorescence dye in residential toilet systems during the wet spring months in order to determine proper system function. With the identification of any failing systems, steps can be taken for correction.*

7) *Sediment accumulation in Squantz Pond is detrimental both in terms of volume and nutrient enrichment. Future development in the watershed should include plans for the effective control of erosion and sedimentation. A recent consultants report recommends selective dredging in the north cove area and construction of a settling basin at the Glen Brook inlet to the Pond.*

8) *A considerable amount of sediment is being generated on the eastern shore of Squantz Pond. Alternatives for correcting this erosion problem are presented in the text of this report (see Page 21).*

9) *In the opinion of the Team's environmental planner, the amount of sand and salt reaching Squantz Pond as a result of winter roadway operations is negligible when looking at the total watershed ecosystem.*

10) *Squantz Pond is presently in a middle stage of eutrophication. Algae blooms and weed beds have diminished recreation opportunities to some degree for many years. It is feasible for local agencies to develop and implement watershed management practices to mitigate the effects of land use changes in the watershed.*

11) *The dense algae bloom in 1982 was apparently not caused by a gradual deterioration in water quality through the process of eutrophication but rather was the result of atypical short term nutrient loadings. It appears this nutrient loading was caused either by a reduction of nutrient utilization by macrophytes (lake weeds) or atypically large non-point nutrient loadings generated by the 100-year flood which occured the first week in June of 1982. The Connecticut DEP will be conducting additional water quality studies of Squantz Pond in 1983. The results of this additional research will be made known to town officials as it becomes available.*

12) *Consideration should be given to establishing a "Squantz Pond Property Owner's Association" to develop and implement a watershed management program for the Pond. Watershed management should be aimed at identifying and controlling existing and potential watershed characteristics which ultimately influence the Pond's trophic condition. At this point, it appears that watershed management efforts at Squantz Pond should focus on monitoring (and correcting if necessary) septic systems in the watershed and controlling erosion. If in-lake management is desired, consideration should be given to the use of herbicides to control algae, and the use of herbicides, harvesting, and/or dredging to control lake weeds.*

III. TOPOGRAPHY AND GEOLOGY

As shown in Figure 1, the watershed (i.e. drainage area) of Squantz Pond is dominated by steep slopes. The majority of the slopes are greater than 15%. These slopes drain to a number of intermittent and perennial watercourses which in turn feed Squantz Pond.

As mentioned above, the watershed of Squantz Pond comprises approximately 3,667 acres (about 5.73 square miles). The bedrock geology for this area has not been mapped in detail to date. The information presented in this report regarding the bedrock geology was compiled from a "Preliminary Bedrock Geological Map of Connecticut" by John Rogers (1982) as well as other incomplete geologic maps on file at the Natural Resources Center, Department of Environmental Protection, in Hartford.

According to preliminary information, bedrock underlying and outcropping throughout the watershed can be divided into three major bedrock formations: 1) the Manhatten Schist, 2) Augen Gneiss, and 3) the Basal Marble member of the Walloomsac Schist. The approximate distribution of these bedrock formations is shown in Figure 2.

The Augen Gneiss formation covers the largest area in the watershed and consists of a medium, gray to spotted, fine to medium grained granitic gneiss. Major minerals in the Augen Gneiss are microcline, quartz, albite or oligoclase, biotite and hornblende.

The Manhatten Schist formation which covers the eastern border and northwest corner of the watershed consists of a dark-gray to silvery, rusty weathering, generally coarse-grained, thin but poorly layered schistose gneiss. The Manhatten Schist formation is chiefly composed of the following minerals: quartz, plagioclase, biotite, muscovite, and garnet.

Finally, the basal marble number of the Wolloomsac Schist consists of a dark gray to white, massive calcite marble with some layers of schist.

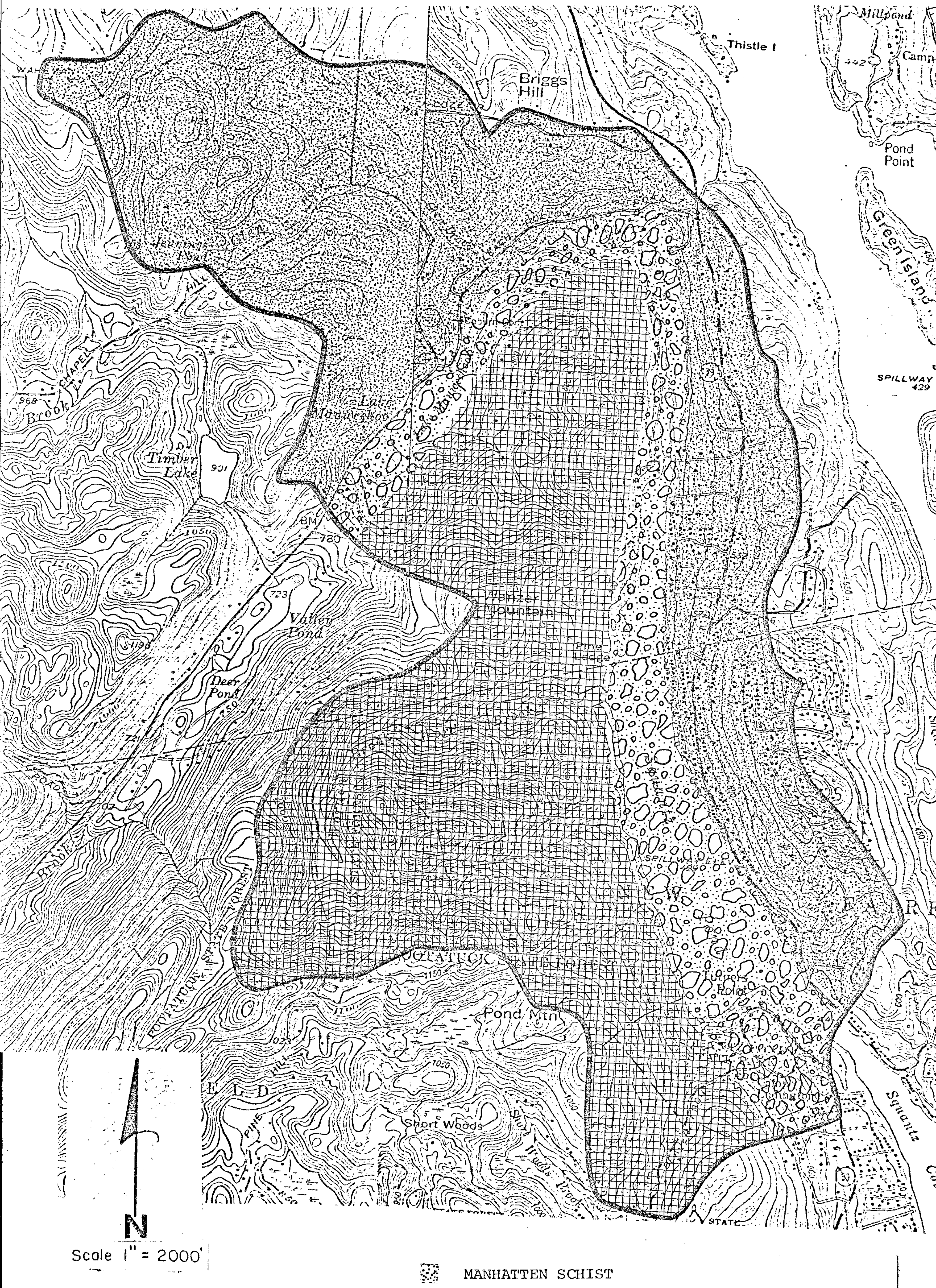
Gneisses are coarsely crystalline metamorphic rock usually characterized by thin bands of elongate, platy or flaky minerals alternating with bands or layers of more rounded mineral grains. Gneisses vary in color depending upon the colors of the dominant minerals present.

A schist like gneiss is also a crystalline, metamorphic rock; however, schists are generally finer grained than gneisses. Schists are predominantly composed of elongate, platy or flaky minerals. Both gneisses and schists are formed by regional metamorphism which is any alteration in composition, texture or structure of rock masses caused by great heat or pressure, affecting an extensive region.

The surficial geology of the Squantz Pond watershed is shown in Figure 3. This information was derived from a preliminary surficial geologic map of the New Milford quadrangle prepared by W. P. Ketterer. Surficial geologic materials consist of those unconsolidated rock particles and fragments, organic matter or any other loose debris that overlie the bedrock. The predominant surficial

Figure 2

BEDROCK GEOLOGY



MANHATTEN SCHIST

BASAL MARBLE MEMBER OF THE WOLLOOMSAC SCHIST

AUGEN GNEISS

Figure 3
SURFICIAL DEPOSITS

TILL ,greater than 10 feet thick

ALLUVIUM

ARTIFICIAL FILL

CLOSELY SPACED OUTCROPS WHERE SURFICIAL DEPOSITS (TILL) ARE THIN material found throughout the watershed area is till. Till can be defined as a glacial sediment composed of rock particles that are nonsorted and range in size from silt to boulders.

Till throughout the watershed is generally less than 10' thick. Thicker deposits, greater than 10', are restricted to areas northeast and northwest of Squantz Pond (see Figure 3).

Another type of unconsolidated sediment in the watershed, found in the northernmost section of Squantz Pond, is alluvium. Alluvium is composed primarily of sand, silt, and gravel and has been deposited on flood plains by modern-day streams.

A small area of artificial fill is also present in the watershed. The fill was placed at the southern tip of Squantz Pond where Route 39 separates Squantz Pond from Squantz Cove.

IV. HYDROLOGY

By definition, the watershed of Squantz Pond comprises all land areas from which water drains into the pond. A raindrop falling on the watershed boundary would have a 50 percent chance of passing into or out of the watershed. As shown on the topographic map (see Figure 1), the watershed boundary or drainage divide tends to follow the crests of local hills and ridges (i.e. Wanzer Mountain, Briggs Hill, etc.). The watershed as depicted comprises approximately 3,667 acres (5.73 square miles).

The two major surface-water bodies located within the Squantz Pond watershed include Squantz Pond and Lake Mauweehoo. Squantz Pond has a surface area of approximately 288 acres (0.45 square miles), a maximum depth of 47 feet, a mean depth of 22.9 feet, and a volume of about 2,228 million gallons.

Lake Mauweehoo has a surface area of approximately 28.4 acres and is generally shallow in depth throughout. The watershed of Lake Mauweehoo is about 2.41 square miles, an area that represents approximately 40 percent of the total drainage area of Squantz Pond.

At the present time there is no gaging station at the outlet of Squantz Pond, which is located under the causeway (Rt. #39) in the southern portion of the pond. However, it is possible to estimate the flow duration characteristics of the outlet using a method described in Connecticut Water Resources Bulletin No. 21. The estimates are tabulated in the table below in units of both cubic feet per second (cfs) and million gallons per day (mgd).

TABLE 1: ESTIMATED FLOW DURATION CHARACTERISTICS AT THE OUTLET OF SQUANTZ POND

Percent of time flow equalled or exceeded	1	5	10	30	50	70	90	99
Flow equalled or exceeded in million gallons per day	37.5	20	13.5	6.5	3.75	1.5	.15	0 (no flow
Flow equalled or exceeded in cubic feet per second	58	31	21	46.4	5.8	2.3	.23	0 (no flow

Precipitation falling within the watershed is either shed quickly across the land surface as runoff, retained temporarily by vegetation or absorbed into the soil. Part of the absorbed water is utilized by plants, part is evaporated from the soil and part percolates down to the watertable (the surface of the zone in which the earth materials are saturated). Water in the zone of saturation moves slowly down slope and ultimately re-emerges at the surface in the form of springs, wetlands or streams. Therefore, the quality of surface water depends in part upon the route by which precipitation has been "transformed". More particularly, water quality is determined by the nature of the materials with which the water comes in contact and by the length of time in which contact occurs. The natural mineral composition of the surficial geologic deposits and underlying bedrock throughout the watershed largely determines the chemical quality of Squantz Pond. Connecticut Water Resource Bulletin No. 21 reports that the chemical quality of streams and ponds in this area (upper Housatonic River Basin) under natural conditions is generally good. Connecticut Water Resource Bulletin No. 21 also reports that the surface waters of the Squantz Pond watershed are relatively low in dissolved solids, and that the "hardness" of the water (which may interfere with the lathering of soap) in the watershed is relatively low. As discussed later in this report, however, natural water quality in a rural watershed can be adversely influenced by various non-point sources of pollution such as erosion and sedimentation, septic systems, agricultural practices, timber harvesting, road runoff, and waterfowl. These sources of pollution, either singularly or in combination, can severely impact the environmental health of a lake.

The rate at which groundwater moves through various earth materials depends in part upon the size, the percentage, and the degree of interconnection of the pore spaces or cavities in the material. Coarse grained materials, such as gravelly stratified drift, tend to transmit groundwater more rapidly than fractured bed rock and other surficial geologic materials. Because of this high transmissibility, coarse stratified drift is a particularly important resource for the development of high yielding wells. However, since no suitable sand and gravel aquifer appears to be present within the watershed, it seems likely that bedrock based wells will continue to be the most important source of water to residences within the watershed.

V. FISHERIES

Squantz Pond is inhabited by a variety of both warm water and cold water fish species. Yellow perch, chain pickerel, largemouth bass, white perch, white cutfish, bullhead (brown and yellow), barded killifish, spottail shiner and various sunfishes (rock bass, redbreasted, bluegill, pumpkinseed) are all common. Smallmouth bass, black crappie, black bullhead and golden shinner exist in limited numbers while the State of Connecticut presently stocks the pond yearly with approximately 2000 brown and rainbow trout. Additionally, a population of landlocked alewives were found in 1976 which contained enough year classes to verify their existence in the lake as far back as 1973. Several small streams flow into Squantz, the larger of which (e.g. Glen Brook) probably provide for a limited amount of small stream trout fishing. Those streams which hold water throughout the summer are likely to be inhabited by brook trout, longnose dace and tessellated darters.

According to local residents, the first serious algal blooms on Squantz Pond were noted in 1974, corresponding closely with the appearance of the alewive. Interestingly, while no fish species is capable of increasing the rate of a lake's eutrophication by adding to the existing nutrient load, some predator species may potentially affect the expression of a particular stage in the eutrophication process. (Note: for a discussion of the eutrophication process, see Section XI of this report.) This may occur when a species with a large reproductive capacity and widely fluctuating population numbers (as is common with alewives) approaches a peak level of abundance. The predator may become so abundant that it is capable of substantially reducing the biomass of the prey organisms upon which it feeds. Survival and reproduction further down the food chain from the prey species are eventually affected resulting in an increase in numbers of these organisms. Landlocked alewives in lakes throughout New England have demonstrated an ability to reduce zooplankton (microscopic animals) abundance to a level where some larger species of plankton are effectively eliminated from the lake. The smaller sized unicellular green algae species and diatoms (phytoplankton) on which the zooplankton feed may then increase during proper climatic conditions and noxious blooms result.

It thus appears that while Squantz Pond is in a state of accelerated cultural eutrophication resulting primarily from the leaching of nutrients into the lake from surrounding properties, the extent of this process during recent years may be exagerated by the predatory effects of the alewive on the zooplankton. It must be noted that blooms of blue-green algae are not believed to be affected by changes in zooplankton production and correspondingly alewive abundance.

The effect of eutrophication on Squantz Pond, from a fisheries standpoint, is considered detrimental. While the present nutrient input may be partially responsible for increasing the production of warmwater fish species, the continuation of this process will cause the lake to become less suitable for cold water species, particularly trout. If present trends continue, the low dissolved oxygen condition of the lake's hypolimnion will become more severe, possibly resulting in 1) increased mortality of stocked trout, 2) the movement of trout to more favorable conditions existing in Candlewood Lake, and 3) the discontinuation of stocking if conditions progress to the point where oversummer and overwinter survival of trout becomes impossible.

VI. VEGETATION

The 3667 acre Squantz Pond watershed is located in a vegetative zone characterized by a transition between Northern and Upland Central hardwoods. The dominant "transition hardwoods" of this region include northern red oak, basswood, white ash and black birch. Included also are tree species of the northern hardwood zone, such as sugar maple, American beech and yellow birch, as well as species more characteristic of the central hardwoods zone, such as white oak, black oak, shagbark hickory and bitternut hickory. White pine and hemlock are also frequent and locally dominant. The early phases of old field vegetation development are dominated by white pine and eastern red cedar. Several northern shrub species such as hobblebush and mountain winterberry are near their southern range limits in the state here. A number of other northern bog and forest species reach their extreme southern range limits in the cooler habitats of this region.

For the purposes of this report, the Squantz Pond watershed may be divided into seven vegetation types. For the most part the boundaries of these vegetation types gradually grade into one another, causing wide transition zones where tree species dominant in one type are present in another. These conditions cause difficulty in mapping. In other areas, transition zones are almost non-existent and mapping is greatly simplified. The composition and potential for management of the seven major vegetation types is discussed below.

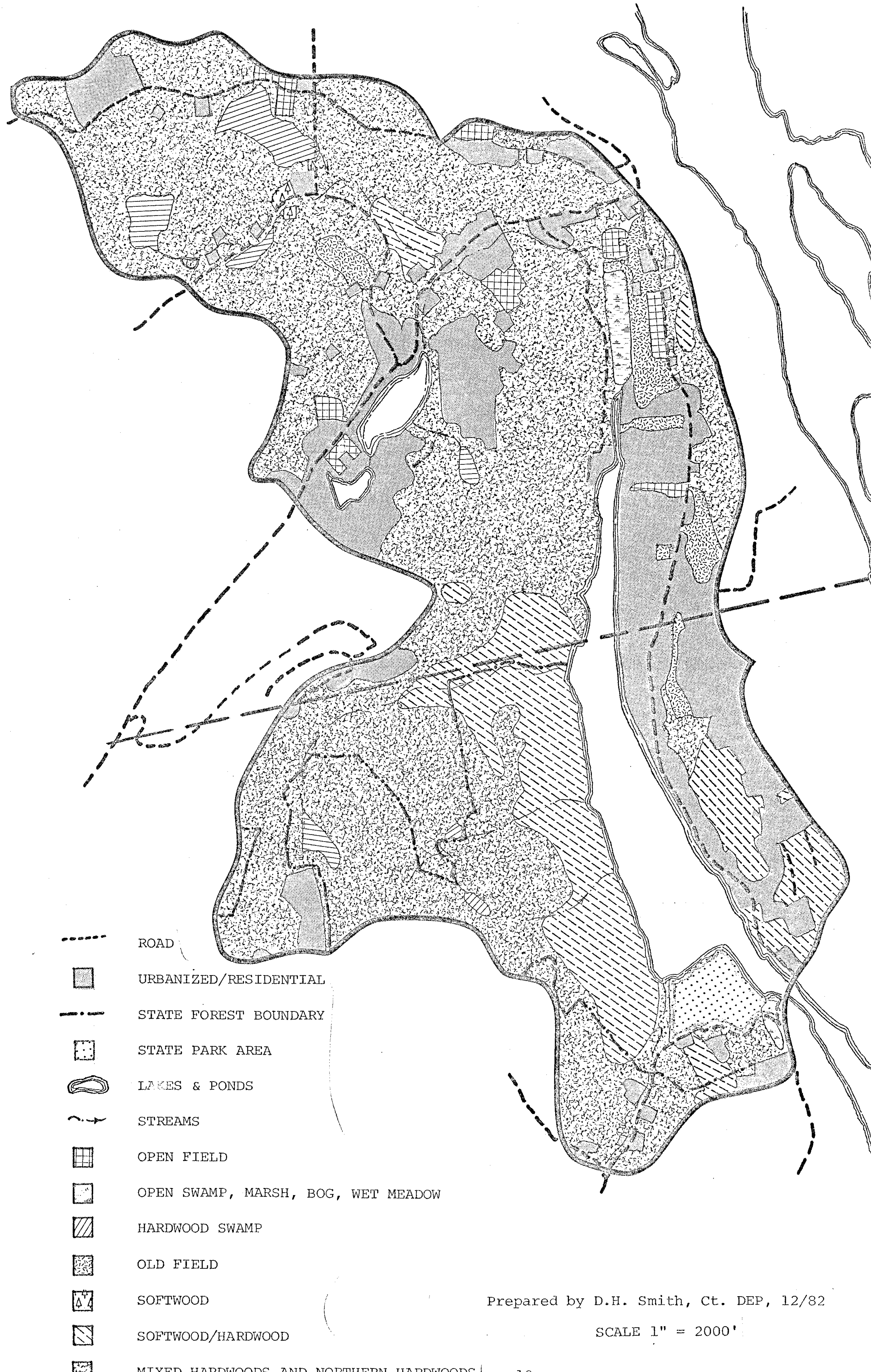
A. GENERAL VEGETATION DESCRIPTIONS (refer to Figure 4)

TYPE A. OPEN FIELDS/AGRICULTURAL LAND - Some of the most highly productive areas in the study area are occupied by open fields. These areas are at present being utilized as either cropland, mowed fields vegetated with grasses and assorted wildflower and weed species, and somewhat less productive pasture land vegetated primarily with grasses. Many of these areas have the potential to produce high quality timber if planted to softwoods or allowed to revert to woody vegetation.

TYPE B. MIXED HARDWOODS AND NORTHERN HARDWOODS - For the purposes of this report, the mixed hardwood and northern hardwood vegetation types are mapped together. In many places the vegetation types merge together and are characterized by a mixture of the species present in each. The overstory in the mixed hardwood area is dominated by white oak, red oak, black oak, sugar maple, red maple, shagbark hickory, pignut hickory, bitternut hickory, black birch and basswood, while the northern hardwood areas are dominated by sugar maple, yellow birch, paper birch, American beech and white ash. The understory and ground cover vegetation varies widely within this mapping unit. Hardwood tree seedlings and saplings, including American chestnut, are widespread, along with many shrub species which include but are not limited to blue beech, tartarian honeysuckle, witchhazel, hazelnut, mountain laurel, large leafed holly, flowering dogwood and ironwood. Ground cover is dominated by club moss, grasses, sedges and many species of ferns.

Many of the tree species which are present in the transition mixed hardwood and northern hardwood vegetation types have high commercial value for sawtimber and fuelwood. The condition of the trees is quite variable, as dictated by site conditions, past land use, and past vegetation management. Areas which do not have major limitations due to excessive slope, rockiness, soil moisture, or fragile soil conditions have a high potential for the production of forest products. The potential can be utilized more fully through proper forest management. Trees in these areas will respond well to periodic thinnings aimed at removing the

Figure 4
VEGETATION TYPE MAP



Prepared by D.H. Smith, Ct. DEP, 12/82

SCALE 1" = 2000'

poorer quality trees. These thinnings will reduce competition between species and result in a healthier, higher quality stand.

TYPE C. HARDWOOD SWAMP - Forested wetlands are relatively common throughout the study area. Red maple is the dominant tree species along with scattered white ash, American elm, black willow and yellow birch. The understories throughout these areas vary widely in both species composition and diversity. Highbush blueberry, spice bush, sweet pepper bush, elderberry, and several species of viburnum are common throughout. Skunk cabbage, tussock sedge, cinnamon fern, sensitive fern and sphagnum moss are widespread as ground cover. The commercial utility of the trees in these areas must be evaluated on an individual wetland basis. Generally, tree growth potential is somewhat limited by the high water table and saturated soils which are present. Under these conditions, trees are shallow rooted and unable to become securely anchored, causing high potential for windthrow. These soil conditions also limit access and operability. Depending on the severity of these limitations, the feasibility of implementing timber management practices may be severely reduced or eliminated completely.

TYPE D. SOFTWOODS/HARDWOODS - Eastern hemlock is the dominant tree species present in this vegetation type. Eastern white pine is a common associate and may be locally dominant. Scattered throughout are sugar maple, black oak, white oak, red maple, black cherry, basswood, American beech, black birch and yellow birch. Eastern white pine seedlings, hemlock seedlings, moosewood, low bush blueberry, huckleberry and mountain laurel are the most abundant vegetation forms in the understory. Ground cover is scarce throughout much of this area. Where it is present, club moss, grasses, sedges and Christmas fern dominate. The tree species present in this area do have commercial value. However, because of poor growth conditions, poor access and poor operability, this value may be low.

TYPE E. SOFTWOOD - The few areas of this type present are primarily plantation areas. These areas are characterized by generally fertile soils, (owing to the agricultural history of the fields the trees were planted in). The vegetation here will be evenly aged and of uniform size. Species which may be represented here include white pine, Norway spruce, white spruce, Douglas fir, and European larch. Due to the dense overstory there is in most cases no understory and very little ground cover. Overcrowding is a characteristic development in these stands and since these soils have a good productivity potential, thinnings to stimulate growth is desirable.

TYPE F. OPEN SWAMPS/MARSHES/WET MEADOWS/BOGS - There are some non-forested wetland areas present within the study area. The diversity of vegetation within and between individual wetlands is very great. Some of these areas may be dominated by red maple seedlings, but the majority of these areas are dominated by shrub species including high bush blueberry, sweet pepper bush, swamp azalea, red alder, speckled alder, spirea, leather leaf, silky willow, pussy willow, buttonbush, large cranberry and arrowwood. The herbaceous vegetation which is common within these wetland areas includes many species of sedges, grasses and sphagnum moss, along with purple loose strife, swamp loose strife, cattail and phragmities.

TYPE G. OLD FIELDS - The old field areas present are either open fields which were abandoned and allowed to revert to woody vegetation, or areas which do not have enough soil or soil moisture to support trees. Generally these old field areas are understocked with poor quality tree species. Those tree species which involving the cultivation and harvesting of timber) does not, for the most part, result in significant deterioration of water quality.

Despite the potential adverse impacts to water quality, the harvesting of trees is a major and necessary tool used in forest land management. Adverse impacts to water quality can be minimized through good planning and responsible implementation.

A pamphlet entitled "Logging and Water Quality in Connecticut: A Practical Guide for Harvesting Forest Products and Protecting Water Quality" has recently been published by the Department of Environmental Protection's Forestry Unit. A series of Best Management Practices (BMP's), which are recommendations designed to minimize the negative impact of silvicultural activities on water quality, are presented in this pamphlet.

Following these BMP's along with the use of common sense will help to avoid water quality degradation resulting from silvicultural operations.

The implementation of the recommended BMP's will most likely be of a voluntary nature, aided through an accelerated educational program and perhaps an incentive program, rather than through regulation. At this time, local regulation of forest product harvesting is contrary to State forestry policy.

Educational and incentive programs may be reinforced by the use of timber sale contracts which reflect the use of BMP's between landowners and loggers. A public or private professional forester can assist landowners in developing an effective timber sale contract. The posting of reasonable performance bonds by the logger may be necessary to help insure proper completion of the logging operation. Periodic on-site inspection may also be essential to see that the logging activities meet the contract terms. Proper education of the landowner and logger can be the key to successful use of BMP's in forest management.

Further guidelines to maintain water quality on managed woodlands may be found in the pamphlet "Timber Harvesting Guidelines" by the Wood Producer's Association of Connecticut. The principles set forth in this publication are aimed at protecting the forest ecosystem from thoughtless timber harvesting practices that may lower environmental quality in both the long and short run. Copies of this pamphlet are available from the Department of Environmental Protection's Forestry Unit and members of the Wood Producer's Association of Connecticut.

VII. SOILS

A detailed soils mapping of Fairfield County has recently been completed by the U.S.D.A. Soil Conservation Service. Copies of this detailed mapping are available from the Fairfield County Conservation District together with detailed soils interpretation information.

For the purpose of this report, the soils on the Squantz Pond watershed may be classified into four major natural soil groups. The geographic distribution of these natural soil groups is shown in Figure 5. A brief description of each of these soil groups is presented below together with comments on the general suitability of the soil groups for various land uses.

are present include eastern red cedar, eastern white pine, gray birch, quaking aspen, big tooth aspen, red maple, sugar maple, sugar maple, white ash, apple trees and black oak. Shrub species are abundant throughout, with gray stemmed dogwood, silky dogwood, arrowwood, high bush blueberry, multiflora rose, hawthorn, male berry and staghorn sumac being most common. Ground cover is dominated by grasses, goldenrod, Queen Anne's lace, and milkweed. The commercial utility of the tree species found within this vegetation type is poor at the present time.

B. LIMITING FACTORS

There are areas which may present limitations to forest management activities. These areas fall into two major categories: Areas where poor access, extremely steep slopes and rockiness may limit forest management practices and areas designated as inland wetlands where poorly drained and saturated soils may limit forest management feasibility.

In both areas, poor operability as related to forest management activities may restrict or even preclude the actual implementation of forest management and harvest operations.

Tree growth, quality and health may be limited by the excessively drained soils, shallow to bedrock soils or saturated wetland soils found in these areas. These conditions may be severe enough to cause the trees which are present to have little or no commercial value.

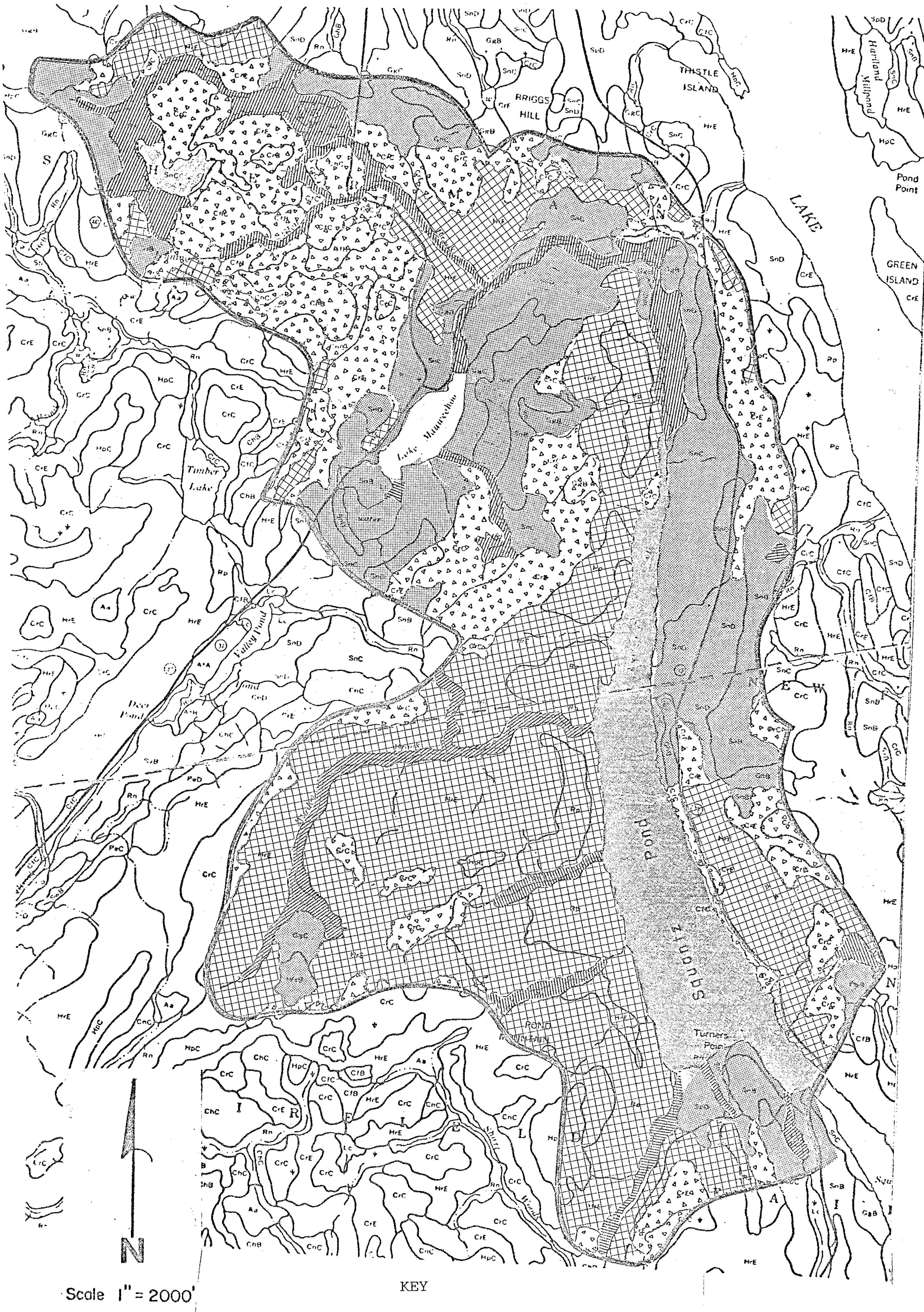
It should be recognized, however, that the limitations described above do not necessarily preclude forest management. The feasibility of forest management within these areas should be evaluated by a qualified forester on an individual stand or woodlot basis. Proper planning and implementation is particularly important in these areas to insure effective, efficient and environmentally sound forest management operations.

C. MANAGEMENT CONSIDERATIONS

The Forestry Unit of the Department of Environmental Protection encourages all woodland owners to manage their forest lands. When properly prescribed and executed, forest management practices will increase the production of forest products, improve wildlife habitat and enhance the overall condition of the woodland with minimum negative environmental impact.

Improper cultivation and harvesting of timber for commercial purposes may, however, lower water quality in several ways: 1) Erosion, siltation and sedimentation caused by improperly located and improperly constructed access roads, skid trails, yarding areas and stream crossings; 2) Siltation and sedimentation caused by logging debris left in streams, interfering with natural flows; 3) Thermal pollution resulting from complete or partial harvesting of streambank vegetation, eliminating shade; 4) Chemical pollution caused by improper application of herbicides and insecticides (it should be noted however that in Connecticut the widespread use of chemicals in forest management is not prevalent and therefore does not constitute a great threat to water quality at this time); 5) Influx of nutrients caused by the application of fertilizer, soil conditioners and wetting agents (used in forest fire control). Research has determined that nutrient loss from normal silvicultural practices (i.e. practices

Figure 5
GENERAL SOILS MAP



KEY

- Upland Soils - Rocky and Shallow to Bedrock
- Inland Wetland Soils
- Upland Soils - Over Friable to Firm Glacial Till
- Upland Soils - Over Compact Glacial Till

GROUP 1 - Upland soils over friable to firm (permeable) glacial till (excluding the poorly and very poorly drained upland soils).

The soils in this group as well as those in the following two groups (Group 2 and 3) are all upland soils that were formed in areas of glacial till. Glacial till is the predominant unconsolidated overburden material (surficial geologic material) found in Connecticut today.

The soils in this group are formed in the thicker, unconsolidated deposits of till usually occurring on hillsides. They generally have good potential for community development except where steep slopes or stoniness present problems.

GROUP 2 - Upland soils over compact (non-permeable) glacial till (hardpan) - (excluding the poorly and very poorly drained compact till soils).

These upland soils occur mostly on the tops and slopes of drumlins (hills that were smoothed and elongated north to south by the movement of glaciers). The soils are underlain by compact glacial till and have a hardpan or fragipan 16 to 36 inches below the soil surface. Permeability above the hardpan is moderate but the pan drastically reduces percolation. During wet seasons, excess water in the soil moves downslope above the hardpan. This characteristic presents formidable problems in the design and construction of septic system absorption fields that function satisfactorily. Septic systems may be flooded by a seasonally high or perched water table and effluent may "break out" down slope of the septic system leaching fields. Careful design and engineering is also required to prevent groundwater seepage into basements and frost heaving of roads and driveways. Steep slopes and stoniness may also present problems in certain areas.

GROUP 3 - Upland soils - rocky and shallow to bedrock. The soils in this group occur mostly in the rougher areas of the uplands. They may occupy narrow ridge tops but most often are on steep side slopes. They are characterized by stoniness and shallow depths to the underlying bedrock. In most places, hard rock is less than 20 inches below the soil surface. These areas provide contrast in the landscape and scenic overlooks, but in most cases pose severe limitations for urban development. Occasionally pockets of deeper soils can be found within this soil group which are more suitable for development purposes (e.g., an individual home site).

GROUP 4 - Inland Wetland Soils - This group includes all soils classified as inland wetlands according to P.A. 155 as amended, Connecticut's Inland Wetlands and Water Courses Act. These soils typically have a water table within 6 inches of the soil surface during the wettest part of the year. The high water table often persists into late spring and may reoccur after prolonged or heavy summer rains. Some of these soils are very poorly drained and have water ponded on the surface for significant periods in winter and spring.

Inland wetland soils present severe limitations for most urban uses. Development is very costly and requires complete alteration of the resource base. Intensive drainage and land fill measures are required to overcome wetness. Inland wetlands and watercourses are regulated in the State of Connecticut because they provide valuable functions and are critical, fragile, and irreplaceable natural resources. They are also an important part of the larger hydrologic system. Disturbance of these areas should be kept to a minimum.

VIII. SEPTIC SYSTEMS

A review of recent aerial photographs indicates that approximately 350 homes are located on the easterly half of Squantz Pond watershed, approximately 250 in New Fairfield and 100 in Sherman. A large percentage of these homes were constructed on relatively small lots less than 1/2 acre in size and are served by on-site sewage disposal and water supply systems. Many of the existing residences were originally constructed for and used on a seasonal basis as summer cottages. These seasonal residences may not have had potable on-site water supplies and therefore required small subsurface sewage disposal systems. Neither New Fairfield or Sherman health department files have accurate information concerning the size and location of sewage disposal systems serving dwellings constructed prior to 1970.

The physical water quality problems observed by Squantz Pond area residents are commonly attributed to nutrient surface wash from farm lands, soil erosion, and ground water pollution from subsurface sewage disposal systems. A review of the soil classification maps identify soil types which are considered marginally suited for subsurface sewage disposal. Subdivision of the Squantz Pond watershed under todays requirements for protection of water quality and public health would probably reduce density of residential development by approximately sixty percent. Many of the small existing lots undeveloped in previously approved subdivisions may not be able to meet minimum Public Health Code requirements for development of on-site sewage and water systems and therefore may be unbuildable.

Wastes typically discharged into sewage disposal systems contain concentrations of nitrates and phosphates which are normally removed by leaching through the soil. Undersized leaching systems which have been directly or indirectly connected to surface and subsurface drainage systems could provide nutrients directly to Squantz Pond and affect algae and weed growth. This potential pollution of water is more apt to occur on those properties which were originally developed for seasonal use and have since been converted for year round usage. Approximately seventy-five percent of the 350 dwelling units located along the easterly shore bordering Rt. 39 are occupied on a year round basis.

In 1975, the State Public Health Code was amended to include regulations concerning conversion of seasonal dwellings to year round use, change in uses, and additions to existing buildings with respect to sewage disposal. The prime concern for lakefront properties was to prohibit conversion of seasonal dwellings on those lots which could not meet Code requirement for expansion of sewage disposal facilities. This regulation was necessary to protect state water supplies and recreation areas as well as individual lot owners and public health. The demand for waterfront property has been ever increasing and combined with the general housing shortage, conversion of seasonal dwellings for year round use has adversely affected water quality in many areas of the state.

There are steps that town agencies can take to further reduce adverse affects of existing and proposed sewage disposal systems on the Squantz Pond watershed. Town health departments may be requested to conduct sanitary surveys to identify potential sources of pollution. This may include the introduction of fluorescene dye in residential toilet systems during the wet spring months in order to determine proper system function. An extensive sanitary survey of the most densely populated areas may burden existing health departments and require additional staff. Strict enforcement of existing Public Health Code requirements with respect to new construction on the Squantz Pond watershed is essential. Qualified sanitarians should be available to observe soil conditions prior to lot development and inspect sewage disposal system installations at several stages of system construction. As previously mentioned, Section 19-13-B100 of the Public Health Code specifically states that each property must be tested and found to be suitable for installation of a septic system meeting all Code requirements except for the hundred percent reserve area prior to permitting conversion for year round use. It does not specifically require that the sewage disposal system be constructed at the time of the building conversion. Both the town of New Fairfield and Sherman may consider adopting ordinances which require installation of sewage disposal systems meeting all Code requirements at the time of conversion approval.

Due to the limited area of many existing small lots, it may not be possible to construct a properly sized sewage disposal system within each lot. For those properties, water conservation and use of expensive non-flush toilet systems may be required. Provisions in the recently revised Public Health Code outline situations where the director of health or the commissioner of health may approve non-discharging toilet systems. Installation of holding tanks for sink and shower wastes or toilet wastes would only be considered as a last resort due to the high cost of maintenance and general unacceptability to the home owners.

IX. EROSION AND SEDIMENTATION

The erosion potential of an area is a function of soil types, vegetative cover and topography. The Squantz Pond watershed has quite good cover, but a critical relationship exists between the predominant soil types and the topography. Rapid runoff from the shallow soils, and the seepage produced by the compact glacial till combine on the lower slopes creating a stability problem. Runoff from the higher elevations coelesces into numerous gullies at about midslope; above this point, leaf litter and the woodland canopy provide sufficient protection to hold the soil. Below this point, two typical hydrologic conditions exist depending on soil type. Where compact till dominates, there are well defined drainage systems consisting of raw, steep sided gullies, that are constantly increasing in width by under cutting their banks. These gullies are typically separated by steep, soggy slopes. The vegetative cover on these slopes is sparce, and soil is eroding in all areas. The second typical condition consists of gullies where the slopes between the gullies are dry and stable. The first condition is typical of the east shore of the pond from Lavalle Avenue north to and along Glen Brook, to and surrounding Lake Maweehoo (see Figure 5). The southern most plateau of Briggs Hill, the easterly slopes of Wakeman Hill, and the State Park area also fit this category. The more stable condition predominates on the westerly shore line and includes Wanzer Mountain, the State Forest, Pond Mountain and the east shore south of Lavalle Avenue (see Figure 5).

Glen Brook exhibits some bank erosion that can be attributed to turbulance caused by obstructions like logs and snagged debris. At one point just up stream of Wagon Wheel Road a significant bank failure has occurred and provides a ready source of sediment. The impact of erosion in the Glen Brook watershed is manifest in the alluvial deposit (soil symbol Sb in Figure 5) at the north end of the pond. A comparison of file air photos show that this land form has advanced by approximately five hundred feet since 1955. Visual observations reveal sediment accumulations in the pond nine hundred feet south of the tip of the alluvial delta. It should be noted that the north cove area of Squantz Pond was dredged in the early 1950's, around 1970, and in 1979. A recent consultant's report (prepared for the Deerhill Road Association in February, 1982), recommends selective dredging in the north cove area and construction of a settling basin at the inlet of the cove.

The sediment accumulation in Squantz Pond is detrimental both in terms of volume and nutrient enrichment.

Any new development in the watershed should include carefully designed stormwater disposal facilities, including minimum runoff concepts, temporary storage facilities and adequately sized and stabilized drainageways. The existing erosion "problem areas" can be improved in many instances through improved landscaping techniques, woodland understory reinforcement, local road improvements, and simple sediment control structures. The U.S.D.A. Soil Conservation Service office in Bethel (743-5453) is available to provide on-the-ground technical assistance in solving erosion and sedimentation control problems.

EROSION AND ROUTE 39

A considerable amount of sediment is being generated on the eastern shore of Squantz Pond. As discussed earlier, due to steep slopes and soil characteristics this area is naturally prone to erosion. The condition has been worsened, however, by development in the area which has interrupted natural run-off flows and increased runoff flows through the creation of impervious surfaces.

The 20+ cross culverts under Route 39 leading to Squantz Pond were designed to transmit existing surface flows interupted by the highway. The water passed by these culverts was dispersed and absorbed by the undeveloped woodland down hill from the road. The dispersion of the water dissipated energy and reduced sediment. This natural dispersion area has been greatly reduced in recent years by residential development. The end result is a more concentrated flow which has considerable energy and the potential to seriously erode and carry sediment in this area.

During the ERT's field review, two severly eroded areas were observed. Both of these occur at pipe outlets west of Route 39 and have resulted in the establishment of a gully. In the opinion of the Team, both gullies are the result of 1) increased runoff due to impervious roofs and roadways, and 2) reducing the size of the needed dispersion areas. For the purposes of this report, the eroding areas can be referred to as 1) the Bliebenicht Drive Ditch and 2) the Lavelle Avenue Gully.

The Bliebenicht Drive ditch runs from a culvert under Route 39, along the northerly side of Bliebenicht Drive to Squantz Pond. The ditch is most severely eroded from the cul de sac at Bliebenicht Drive to Squantz Pond. Here the gully is about 4 feet deep and up to 10 feet wide. A considerable amount of sediment has accumulated as a delta in Squantz Pond at the point where the ditch discharges to the Pond. Residents indicated to the Team that this area has been dredged in the recent past to remove accumulated sediment. One alternative available to correct the problem at Bliebenicht Drive is the installation of piping from the Route 39 culvert to Squantz Pond. This is an expensive proposition (± $20,000) but it would correct the problem in an aesthetically attractive manner. An alternative to piping is to let the ditch "go" for a couple of years until nature establishes a condition of relative equilibrium. Then the channel sides could be riprapped with broken rock to help hold the soil in place. It should be noted however that a rip-rapped channel (perhaps up to 24 feet in width) is not generally regarded as very attractive and adjacent homeowners may oppose this alternative. Regardless of what, if any, corrective measures are implemented, it is recommended that fill material <u>not</u> be added to the sides of the channel, as it has in the past, when portions of it are eroded away. This fill material is washed away during storm events and is deposited either on the beach or in Squantz Pond.

It should be noted that the erosion problem at Bliebenicht Drive has received considerable attention over the past few years. In 1981 and 1982, the area was investigated by DEP, DOT, and the Town of Sherman. That investigation recommended that the expense for correction of the erosion problem be shared by property owners, the town, and the state. That recommendation apparently was not accepted by property owners in the area.

The Lavelle Avenue gully is most noticeable where it is "headcutting" a steep slope created by the cul-de-sac on Lavelle Road. At the headwaters of this ditch is a 24" culvert under Route 39. The discharge of the pipe has been confined by lawns. In addition, interceptor ditches running across lots adjacent to the gully add to the flow considerably. The exposed roots in the gully have hardened and are bark covered, indicating that the gully has been there for some time and is relatively stable. The preferred management alternative in this area would be to install a pipe and manhole system east of Lavelle Avenue with an outlet to a rip-rapped channel west of Lavelle Avenue running to Squantz Pond. A more economical, though less effective, alternative would entail riprapping the entire channel and side slopes with broken rock or boulders.

For additional information on these alternative management measures, the U.S.D.A. Soil Conservation Service in Bethel should be contacted.

The two gullies just described are perhaps the "worst" eroded areas west of Route 39, but they are not the only ones. With over 20 culverts outletting to this steeply sloping and intensely developed area, other erosion "hot spots" occur. The solution to some of these problems can be do-it-yourself type projects undertaken by individuals or neighborhoods. The importance of professional guidance here cannot be over-emphasized however. Some of the most conspicuous, current erosion problems are the result of poorly conceived independent actions. Once again, it should be noted that the U.S.D.A. Soil Conservation Service Office in Bethel is available to provide technical assistance.

Due to the sensitivity of this portion of the watershed, any new residential subdivision in this area should include plans for the effective control of erosion, sedimentation, and stormwater runoff. In order to minimize impacts, future development plans may require the consolidation of present outlets, and the piping of selected outlets to the Pond.

X. ADDITIONAL ROAD IMPACTS

Within the Squantz Pond Watershed exists the following road mileage categories: Sherman, Town and Private 6.1 miles; New Fairfield,Town and Private 4.0 miles; state roads (including park roads) 6.7 miles. For this report, all roads were considered to be 2 lanes and to receive winter salt and sand applications in accordance with the State of Connecticut, Bureau of Highways Snow and Ice Control Policy.

In the opinion of the Team's Environmental Planner, it is reasonable to assume a negligable impact on the Pond from oil and grease resulting from traffic on Route 39 and other roads in the watershed. Some town roads in the watershed are of the oil and sand type. This type of surface treatment or pavement, if improperly applied next to a water course can "bleed" oil for a few days and impact downstream water impoundments. However, there is no reason or evidence to believe this has occurred anywhere in the watershed. Route 39 is a bituminous concrete pavement and does not leach the way an oil and sand pavement could. The only known oil and grease impact on the pond would be from the power boats on it.

Winter safety maintenance of highways requires the use of sand and salt. There are no known stock piles of salt or salt/sand in the watershed, therefore only roadway sanding and salting will be addressed.

The State Department of Transportation has sand and salt application guidelines that are strictly adhered to. Towns generally use the same guidelines. Private roads maintained by private individuals and contractors tend to be more heavily sanded but are not usually salted. For this report, ALL roads in the watershed were considered to be 2 lane and receive salt and sand in accordance with state guidelines. Application quanities are based on an average winter.

Several residents of the Bliebenicht Drive development expressed to the ERT their belief that winter sanding and salting of Route 39 has had a major impact on their beach and the water quality of Squantz Pond. As shown by Chart I, the impact of Route 39 is only 2% of the total roadway mileage impacting the Bliebenicht beach. Also the small 10' x 15' delta of gravel on the beach is definitely not all roadway sand. Considerable organics, leaf and twigs as well as 3" stones were observed on the December 8, 1982 ERT field review. It is unrealistic to assume that all roadway sand is flushed to the lake. Without a comprehensive testing pogram, the total amount deposited is impossible to quantify. The type of sand used and the time of year applied reduces the possibility of sand increasing the water temperatures and turbidity of the Pond.

In the opinion of the Team's Environmental Planner, the amount of sand reaching Squantz Pond as a result of winter roadway operations is negligible when looking at the total system. As shown in Charts I and II, Route 39 is a minor contributor of sand and salt within the watershed.

The use of salt as a deicer to increase winter driving safety can be detrimental to the environment if not properly controlled. The ConnDOT is aware of the potential impacts of deicers and strictly controls their use and storage.

Deicing salts are carried by runoff and infiltrate into the soils and groundwater. Some of the salt remains in soil solutions or is absorbed by soil particles. The rest of the salt would be in solution and move with the water flow continually downstream. Various research has been done on the effects of sodium on algae blooms. Literature indicates that 40 mgl of sodium may be necessary for triggering "blooms" of blue-green algae and 5 mgl of sodium for Anabaens cylindrica.*

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*from "Environmental Impact of Highway Deicing Salts", EPM Water Quality Research, Edison Water Quality Lab, Edison, New Jersey, June 1971, page 85.

CHART I. Route 39 and Candlewood Hills contribution of salt and sand to Bliebenicht Development Area (Note: application rates based upon state guidelines for two-lane roads).

Area and length of roadway	% of Total Miles	Total Sand Per Winter	Total Salt Per Winter
Candlewood Hills - 8000' ± (1.5 miles)	91%	56 cubic yards	12 cubic yards
Bliebenicht Development Drive 600' ± (.1 miles)	7%	4.3 cubic yards	.9 cubic yards
Route 39 - 200' (.04 miles)	2%	1.4 cubic yards	.3 cubic yards

CHART II. Total Salt and Sand Applied in Watershed for Average Winter (Note: application rates based on state guidelines for two-lane roads.)

		Sand per Winter		Salt per Winter	
Roadway	Miles	Tons	Cubic Yards	Tons	Cubic Yar
State roads (includes 1.6 miles of State Park Road)	6.7	325.2T	250 yards	58.7T	54 Yards
Town and Private Roads	10.1	489.5T	376 "	88.4T	82 "
Total in Watershed	16.8	814.7T	626 "	147.1T	136 "
Route 39 adjacent to Squantz Pond	3.1	150.7T	116 "	17.2T	16 "

To achieve a concentration of 5 mgl sodium, 266,800 pounds of salt would have to be dumped directly into Squantz pond. This is based on a volume of 287,286,910 cubic feet for Squantz Pond. Road salt is therefore not expected to have a significant effect on the algal blooms at Squantz Pond. Other chemicals in the salt (e.g. anti-caking agents), are in such small quantities that they only cause concern at major salt stockpile areas.

XI. EUTROPHICATION AND LAKE WATER QUALITY

A. Eutrophication

Eutrophication is the natural process of lake aging by nutrient enrichment. As a lake eutrophies, many water quality changes occur. Fertility increases and macrophyte (weed) beds become denser and more extensive. Algae blooms occur more frequently and water clarity decreases. Organic matter accumulates on the lake bottom from decaying plants and animals. The lake gradually fills in. Decomposition of lake bottom material reduces oxygen levels in the bottom waters. In general, as these changes occur, recreation opportunities decline.

The eutrophication process can be accelerated by man's activities in the lake watershed which increase nutrient inputs to the lake. The major nutrients of concern are phosphorus, nitrogen and carbon. Phosphorus has been found to be the usual limiting nutrient in the eutrophication process. Therefore, most restoration strategies focus on phosphorus control to reduce the supply to a level where it becomes limiting.

Undisturbed woodland contributes lower nutrient loads to a lake than other land uses. The nutrient loading from agricultural land is approximately five times greater than woodland. Residential and commercial land contributes more than ten times the nutrient loading that results from woodlands. Thus, as woodland is converted to other uses, or as agricultural land is converted to residential land, the nutrient contribution to the lake increases, advancing the eutrophication process. Although much of this increase in nutrient export from the watershed is inevitable and unavoidable, best management practices can provide for some degree of mitigation.

Squantz Pond is presently in a middle stage of eutrophication. Algae blooms and weed beds have diminished recreation opportunities to some degree for many years. Additional land development in the watershed will serve to worsen these conditions. It is feasible for local agencies to develop and implement watershed management practices to mitigate the effects of land use changes in the watershed. Appropriate practices are described in the next section of this report.

It should be noted that the Connecticut DEP has recently (1982) released a report entitled "A Watershed Management Guide for Connecticut Lakes". The DEP's report discusses in detail the process of eutrophication and methods of control. According to the DEP's report, the following factors may contribute nutrients to a waterbody and therefore accelerate the eutrophication process: erosion and sedimentation, septic systems, lawn and garden fertilizers, yard and garden vegetation disposal, agricultural land, timber harvesting, stormwater runoff, waterfowl, atmosphere, lake sediments. The key to controlling the eutrophication process is controlling the nutrient enrichment from these sources. The DEP's "Watershed Management Guide" is recommended reading.

B. Lake Water Quality

According to DEP records (see references 1 and 2 of this report), Squantz Pond has the following features:

Surface Area - 288 acres
Maximum Depth - 47 feet, 14.3 meters
Mean Depth - 22.9 feet, 7.0 meters
Mean Hydraulic Residence Time -383 days
Watershed Area - 5.73 square miles

Based upon known research to date, Squantz Pond has the following water quality characteristics:

Trophic State - Squantz Pond was classified as a mesotrophic lake based on 1980 water quality sampling by the DEP.[1] The lake was found to be moderately enriched with plant nutrients, or a "middle age" lake.

Nutrients - Surface waters exhibited moderate concentrations of phosphorus and nitrogen in spring and summer 1980. Bottom waters in the summer exhibited elevated ammonia nitrogen due to anoxic recycle of nitrogen from sediments. Phosphorus was not elevated in bottom waters in the summer, suggesting little potential for internal phosphorus cycling to cause algae blooms.

Algae - No phytoplankton samples have been collected and analyzed for species identification and densities. In 1980, chlorophyll a was moderate and transparency (water clarity) was average for Connecticut lakes. The measurement indicates moderate levels of algal productivity and the absence of dense nuisance blooms. In the summer of 1982, a dense surface bloom of blue-green algae was observed by residents and by DEP personnel.

Aquatic Plants - Dense beds of coontail (Ceratophyllum) were observed to cover most of the bottom in water up to 3 meters deep in the summer of 1980. Pondweeds (Potamogeton) and wild celery (Vallisneria) were present in some coves. The 1959 Fishery Survey reported there is a considerable quantity of submerged and emergent vegetation in the shallows, particularly in the upper lake and near the inlet of Glen Brook.

Dissolved Oxygen - Waters below 25 feet were found to be deficient in dissolved oxygen during the summer of 1980. Similar summer conditions were reported in the 1959 Fishery Survey.

General Comments - Available water quality information suggests that Squantz Pond has exhibited mesotrophic characteristics for the past 30 years. Dense beds of aquatic plants and dissolved oxygen deficiencies in bottom waters were reported in the 1959 Fishery Survey. Those conditions may have worsened slightly due to the natural advancement of eutrophication, and due to watershed development without adherence to best management practices to control erosion and non-point sources of nutrients and sediments. However, no major change in these conditions is evident in the 1980 data.

The dense algae bloom in 1982 is a condition which had not been observed in previous studies. Algae blooms are the result of high levels of nutrients in surface waters. Since surface water nutrient levels were moderate in 1980, it is apparent that the 1982 bloom was not caused by a gradual deterioration in water quality through the process of eutrophication. Rather, the bloom was apparently the result of atypical short term nutrient loadings. Studies of similar problems suggest several sources to be evaluated, as follows:

a. Migratory waterfowl - atypical algae blooms may be caused by enrichment due to an influx of large flocks of geese and ducks. This is an unlikely source of the Squantz Pond bloom since residents and DEP personnel report no unusual waterfowl use.

b. Internal cycling of phosphorus from bottom waters to surface waters. This is an unlikely cause of the Squantz Pond bloom since 1980 water quality data exhibits very low phosphorus levels throughout the water column in the summer.

c. A reduction in nutrient utilization by aquatic plants. If aquatic plant growth was atypically poor in 1982, more nutrients would be available for algal growth. This is a possible contribution to the Squantz Pond bloom. Reduced plant growth may have been caused by an aquatic weed eradication program or by the unusually high water levels which occurred in early summer of 1982.

It is also possible that the drawdown of Candlewood Lake during the winter of 1980-81, which reduced the water levels in Squantz Pond by 5-10 feet, may have reduced aquatic weed growth along the shoreline by killing (through desiccation and freezing) the weeds.

d. Atypically large non-point nutrient loadings. This is a possible cause of the Squantz Pond bloom since a 100-year flood occurred the first week in June of 1982. Runoff of nutrients from agricultural land and residential land probably was unusually high during this event. Also, the high water levels may have caused flooding of septic system leaching fields which may have caused the release of phosphorus which had been retained by soils.

The Connecticut DEP will conduct additional water quality studies of Squantz Pond in 1983. The results of this additional research will be made known to town officials as it becomes available.

XII. MANAGEMENT ALTERNATIVES

A. Watershed Management

As previously discussed, the watershed of Squantz Pond is that land area which drains to the Pond. The watershed is therefore the source of water for the Pond. The water quality of the Pond, to a large extent, is determined by qualities imparted to water by the watershed as the water drains to the Pond. If eutrophication of the Pond is to be controlled, its watershed must be prudently managed to protect the quality of the water which enters the Pond. For this reason, consideration should be given to establishing a "Squantz Pond Property Owner's Association" to develop a watershed managment program for the Pond.

Watershed management should be aimed at identifying and controlling existing and potential watershed characteristics which ultimately influence the Pond's trophic condition. Since phosphorus is the nutrient which governs the productivity of algae and aquatic plants, watershed management should first and foremost be concerned with reducing phosphorus enrichment. An important secondary consideration is reducing sediment inputs which contribute to the physical filling of the Pond.

The DEP's "Watershed Management Guide for Connecticut Lakes" identifies a number of nutrient sources which may contribute to eutrophication. The DEP Guidebook also discusses appropriate measures to control such nutrient sources. At Squantz Pond, the biggest nutrient contributors appear to be septic systems and erosion. Discussion in this report will therefore focus on these two factors. It should be noted however that other factors do contribute to nutrient enrichment of the Pond, and these factors should not be ignored in developing a watershed management program for the Pond. For example, agricultural land in the watershed may be contributing nutrients to the Pond. The Fairfield County Soil and Water Conservation District could be contacted for advice on the best management practices for specific agricultural lands in the watershed.

SEPTIC SYSTEMS

A septic system can fail if it is not properly designed, installed, or maintained. A failing system will either result in the backflow of wastewaters into the house, or the breakout of wastewaters on the surface of the ground. A failing septic system can contribute phosphorus and other pollutants to lake waters. A far more important consideration, however, is that a failing septic system is a public health hazard. The public health threat is an overriding concern which demands correction of the problem, irrespective of lake eutrophication.

In that the soils along the eastern shore are considered only marginally suited for subsurface sewage disposal, the conversion of seasonal dwellings for year round use in this area may be resulting in a significant contribution of nutrients to the Pond. It should be noted that during the construction of the storm drainage on Route 39 in 1976 from Candlewood Hills Road south, strong septic flows were intercepted by ditch excavations.

The correction of individual or scattered failing septic systems is the responsibility of town health officials. As discussed earlier in this report, there are a number of steps which can be taken to reduce the potential adverse effects of existing and proposed sewage disposal systems in the Squantz Pond watershed. These include:

1) Conducting sanitary surveys to identify potential sources of pollution. This may include the introduction of fluorescence dye in residential toilet systems during the wet spring months in order to determine proper system function.

2) Strict enforcement of the Public Health Code requirements with respect to new construction in the Squantz Pond watershed.

3) Educating lakeside residents about the proper operation and maintenance of septic systems via an information pamphlet. The pamphlet should advise homeowners about the consequences of failures, list materials which should not be disposed of in a septic system, state water conservation measures, and stress the need for routine septic tank pumping. An excellent pamphlet for these purposes was developed by the Northeastern Connecticut Regional Planning Agency and the Northeast District Department of Health entitled, "Homeowner's Guide

to Septic System Maintenance - Or How To Save Thousands of Dollars".

4) Encouraging lakeside residents to use nonphosphate laundry detergents. The phosphorus passing through a residential septic system can be reduced 30-40% by the use of nonphosphate laundry detergents.

5) Considering adopting a town ordinance which requires the installation of sewage disposal systems meeting all health code requirements at the time of building conversion from seasonal to year round use.

EROSION AND SEDIMENTATION

The transport of eroded soil to a lake contributes to eutrophication in several ways. Most importantly, phosphorus and other plant nutrients associated with soil particles are introduced into the lake. Erosion and sedimentation can therefore be a dominant cause of phosphorus enrichment of lake waters. Another important effect is the physical presence of solid particles in the lake. Sedimentation reduces water depths, creating shallow shoals which are conducive to the growth of aquatic plants. In addition, organic matter associated with soil particles is decomposed by lake bacteria, contributing to the depletion of oxygen in waters overlying the lake sediments.

Due to steep slopes in the Squantz Pond watershed, sediment and nutrient inputs due to erosion are a particularly important concern. Erosion control practices as outlined earlier in this report should be implemented to correct existing practices and to prevent future problems due to new construction. Methods for controlling erosion and sedimentation are described in detail in the "Erosion and Sediment Control Handbook for Connecticut", U.S. Dept. of Agriculture Soil Conservation Service, 1976. This publication is available at the U.S.D.A. Soil Conservation Service Office in Bethel.

B. In-Lake Management

It may be necessary to supplement watershed management with in-lake management of aquatic plants and algae blooms which impair recreation. Methods for controlling algae blooms include algicide treatments, artificial aeration, chemical precipitation, and hypolimnetic withdrawal. Each of these is described below.

Algicide treatments are commonly conducted in Connecticut lakes to provide temporary, cosmetic relief from nuisance algae blooms. This method does not correct the source of the problem--nutrient enrichment--and usually needs to be repeated annually. One treatment at Squantz Pond would cost approximately $1,000. A DEP pesticides permit must be obtained prior to each treatment. The permit specifies treatment conditions which will protect aquatic life and recreation activities.

Artificial aeration is a high cost method which is employed to increase oxygen levels in a lake's water column to prevent anoxic recycle of plant nutrients from the lake sediments. This method would not be appropriate for Squantz Pond since the lake apparently does not establish anoxic conditions which cause significant nutrient recycle.

Chemical precipitation of nutrients is an experimental approach which utilizes metals, usually aluminum, to precipitate soluble phosphorus from lake waters. This method is most effective when a significant fraction of phosphorus occurs as soluble forms which can be removed from the water column. It is also most effective when a lake has a hydraulic residence time of several years, so that treated water is not rapidly replaced with untreated, enriched water. Squantz Pond could be a good candidate for chemical precipitation since a significant fraction of phosphorus at spring overturn is soluble phosphorus. Also, since the pond flushes only once a year, one treatment would provide benefits for much more than one summer season. However, chemical costs for one treatment could be prohibitive, possibly exceeding $50,000.

Hypolimnetic withdrawal is a high cost, experimental method which may provide relief from algae blooms in lakes where nutrients recycled from sediments contribute to algae blooms. More research on this method, and more detailed water chemistry information for Squantz Pond, would need to be developed in order to evaluate its applicability. However, available water chemistry data indicates that recycle of sediment nutrients is not a major factor in the enrichment of surface waters in Squantz Pond.

It is apparent from this cursory discussion of alternatives that treatment with an algicide is the only phytoplankton management alternative which will provide effective relief at a reasonable cost at this time.

Methods which are commonly considered for control of macrophytes include overwinter drawdown, herbicides, harvesting, and dredging. Overwinter drawdown involves lowering the lake level for several weeks to expose plants to desiccation and freezing. This is a low cost alternative where feasible since drawdown requires negligible labor and no equipment or chemicals. This method is not feasible for Squantz Pond since its water level is controlled by the water level of Candlewood Lake.

In comparison to drawdown, other macrophyte control methods have higher costs but more predictable success. Herbicides provide for effective control of macrophytes by killing plants in local areas of application. The effects are cosmetic and temporary, and repeated treatments on an annual basis would be required to maintain control. Treatment of coontail with Diquat would require the application of two gallons per acre, with a present chemical cost of approximately $100 per acre. A DEP pesticides permit must be obtained prior to each treatment. The permit specifies treatment conditions which will protect aquatic life and recreation activities.

Harvesting is a method which physically removes plants from the lake with specialized barges equipped with harvesting machinery. This is a cosmetic method which needs to be repeated when macrophyte beds recover from cutting. Recent harvesting experiences in Connecticut indicate that costs can exceed $250 per acre for one cutting.

Dredging is a high cost "last resort" method which is considered for recreational lakes with severe macrophyte problems. The objective is to eliminate macrophyte habitat by removing sediment and increasing water depth. This is accomplished by either drawdown and excavation, or hydraulic dredging. A recent drawdown and excavation project in Connecticut conducted with town resources incurred a cost of approximately $2.30 per cubic yard, or $5,500 per acre. A hydraulic dredging project being planned for another Connecticut lake has an estimated cost of $5.00 per cubic yard, or $15,000 per acre. Long term control of macrophytes is a benefit of dredging which is not obtained by other methods.

The "Lake Unit" of DEP is available to provide additional assistance in lake management at 566-2588.

To conclude, it appears that watershed management efforts at Squantz Pond should focus on monitoring (and correcting if necessary) septic systems in the watershed and controlling erosion. If in-lake management is desired, consideration should be given to algicide treatment to control algae; and herbicide treatment, harvesting and/or dredging to control macrophytes.

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ABOUT THE TEAM

The King's Mark Environmental Review Team (ERT) is a group of environmental professionals drawn together from a variety of federal, state, and regional agencies. Specialists on the team include geologists, biologists, foresters, climatologists, soil scientists, landscape architects, recreation specialists, engineers, and planners. The ERT operates with state funding under the aegis of the King's Mark Resource Conservation and Development (RC&D) Area - a 47 town area in western Connecticut.

As a public service activity, the team is available to serve towns and developers within the King's Mark Area --- free of charge.

PURPOSE OF THE TEAM

The Environmental Review Team is available to help towns and developers in the review of sites proposed for major land use activities. To date, the ERT has been involved in the review of a wide range of significant activities including subdivisions, sanitary landfills, commercial and industrical developments, and recreation/open space projects.

Reviews are conducted in the interest of providing information and analysis that will assist towns and developers in environmentally sound decision-making. This is done through identifying the natural resource base of the project site and highlighting opportunities and limitations for the proposed land use.

REQUESTING A REVIEW

Environmental Reviews may be requested by the chief elected official of a municipality or the chairman of an administration agency such as planning and zoning, conservation, or inland wetlands. Requests for reviews should be directed to the Chairman of your local Soil and Water Conservation District. This request letter must include a summary of the proposed project, a location map of the project site, written permission from the landowner/developer allowing the team to enter the property for purposes of review, and a statement identifying the specific areas of concern the team should address. When this request is approved by the local Soil and Water Conservation District and the King's Mark RC&D Executive Committee, the team will undertake the review. At present, the ERT can undertake two reviews per month.

For additional information regarding the Environmental Review Team, please contact your local Soil Conservation District Office or Richard Lynn (868-7342), Environmental Review Team Coordinator, King's Mark RC&D Area, P.O. Box 30, Warren, Connecticut 06754.