Environmental Review Team Report

MANITOOK LAKE WATERSHED

Granby, Connecticut

RC&D

EASTERN CONNECTICUT RESOURCE CONSERVATION AND DEVELOPMENT AREA, INC.

Environmental Review Team
Report

MANITOOK LAKE WATERSHED

Granby, Connecticut

May 1985

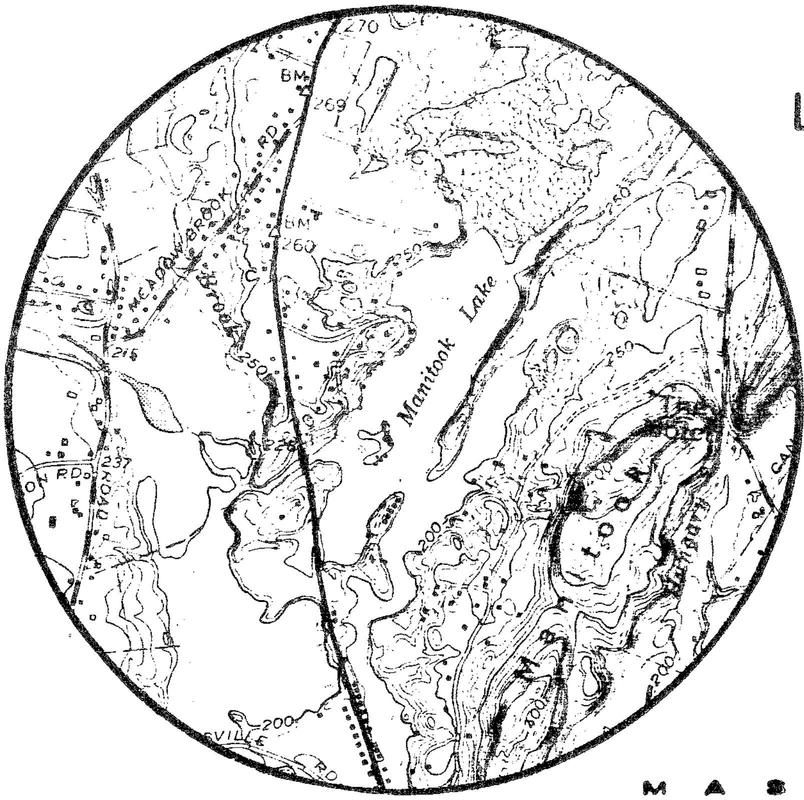
Eastern Connecticut Resource Conservation & Development Area

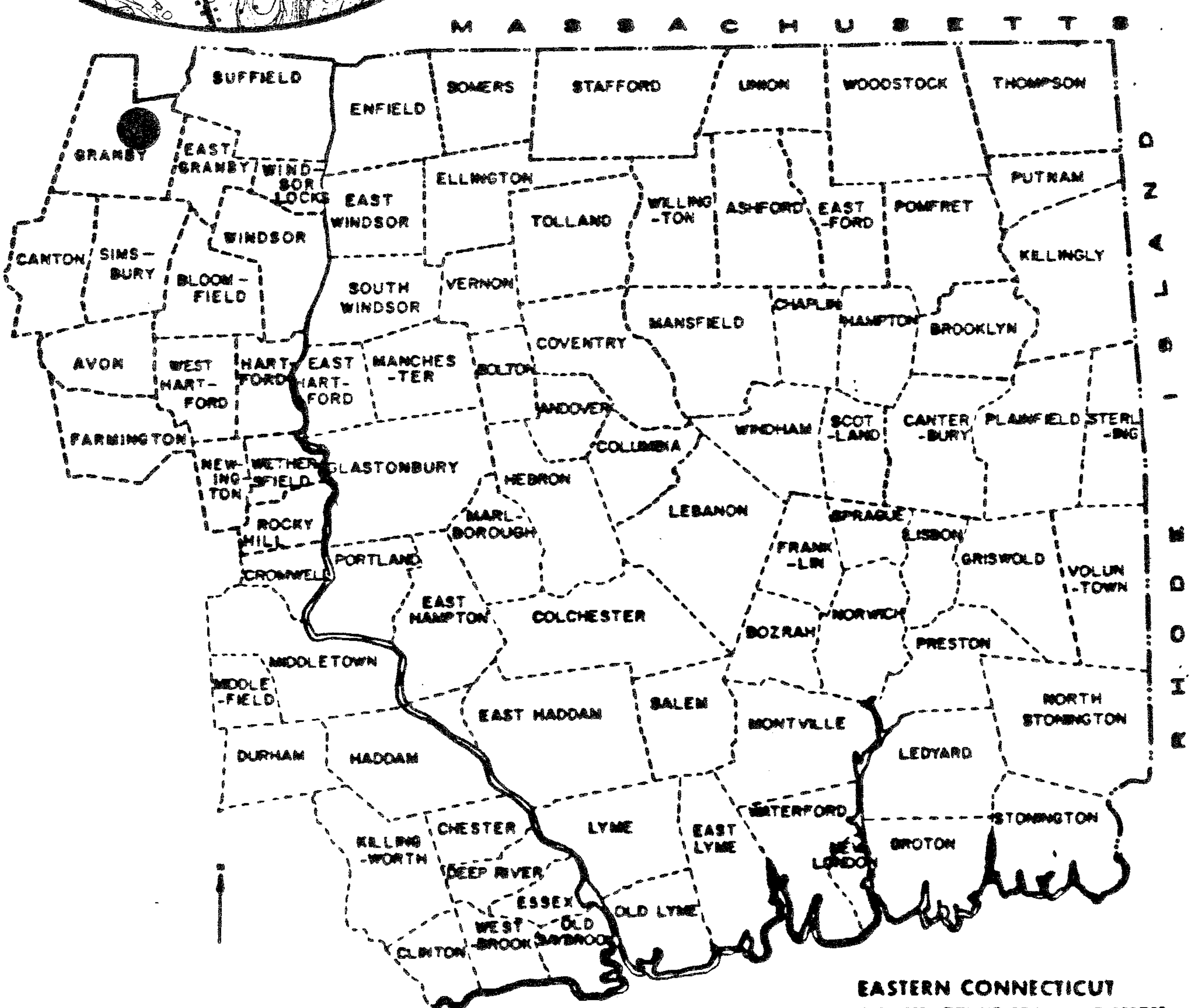
Environmental Review Team
PO Box 198
Brooklyn, Connecticut 06234

Location of Study Site

MANITOOK LAKE WATERSHED

GRANBY, CONNECTICUT





EASTERN CONNECTICUT
RESOURCE CONSERVATION AND DEVELOPMENT PROJECT

ENVIRONMENTAL REVIEW TEAM REPORT
ON
MANITOOK LAKE WATERSHED
GRANBY, CONNECTICUT

This report is an outgrowth of a request from the Granby Conservation Commission to the Hartford County Soil and Water Conservation District (S&WCD). The S&WCD referred this request to the Eastern Connecticut Resource Conservation and Development (RC&D) Area Executive Committee for their consideration and approval. The request was approved and the measure was reviewed by the Eastern Connecticut Environmental Review Team (ERT).

The soils of the site were mapped by a soil scientist from the United States Department of Agriculture, Soil Conservation Service (SCS). Reproductions of the soil survey map, a table of soils limitations for certain land uses and a topographic map showing property boundaries were distributed to all Team members prior to their review of the site.

The ERT that field-checked the site consisted of the following personnel: Vern Aderson, District Conservationist, Soil Conservation Service (SCS); Bill Warzecha, Geologist, Connecticut Department of Environmental Protection (DEP); Joe Nestico, Lake Biologist, DEP; Bill Hyatt, Fish Biologist, DEP: Kip Kilesinskas, Soil Scientist, SCS; and Jeanne Shelburn, ERT Coordinator, Eastern Connecticut RC&D Area.

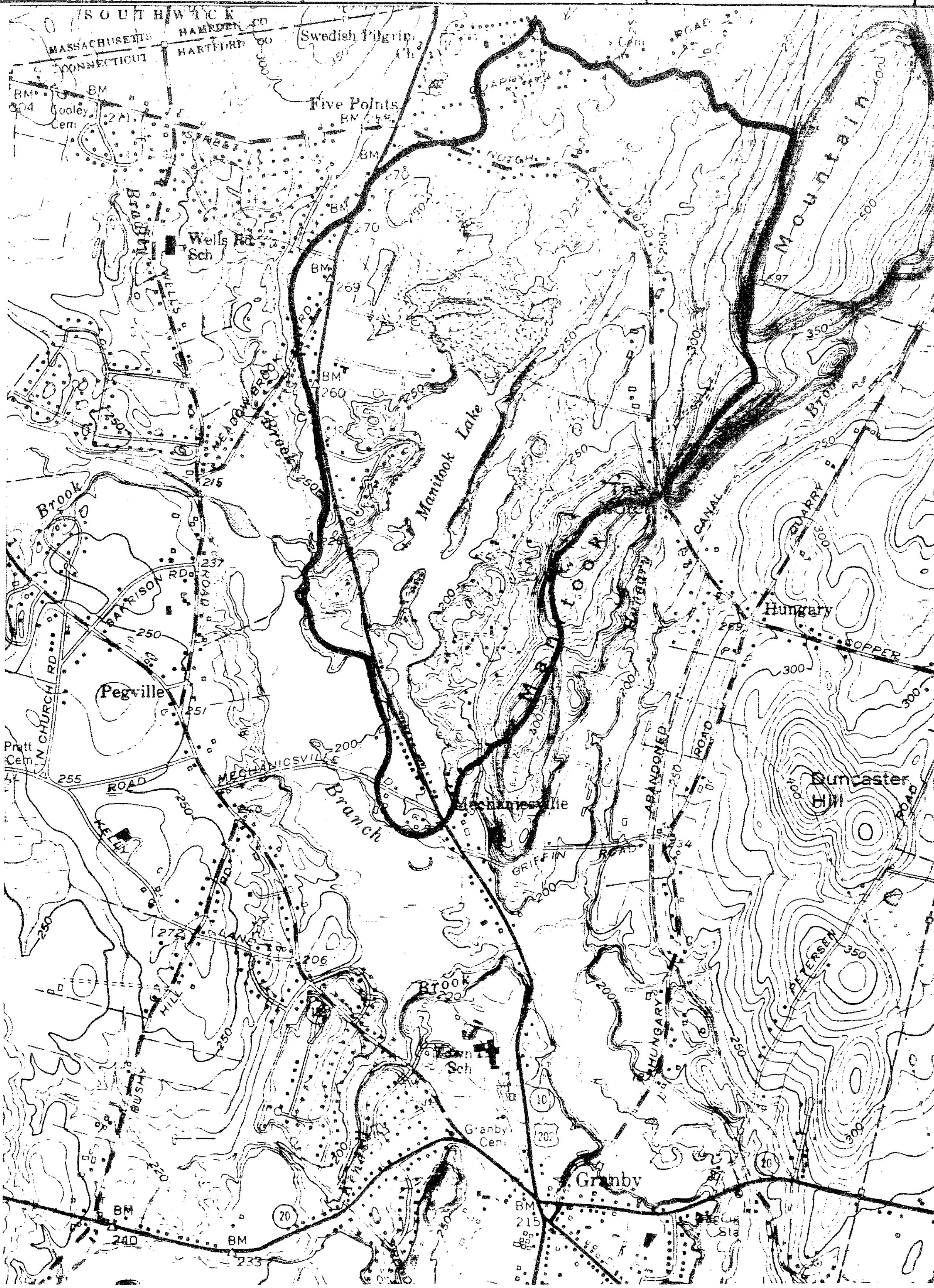
The Team met and field checked the site on Thursday, January 31, 1985. Reports from each contributing Team member were sent to the ERT Coordinator for review and summarization for the final report.

This report is not meant to compete with private consultants by supplying site designs or detailed solutions to development problems. This report identifies the existing resource base and evaluates its significance to the proposed development and also suggests considerations that should be of concern to the developer and the Town of Granby. The results of this Team action are oriented toward the development of a better environmental quality and the long-term economics of the land use.

The Eastern Connecticut RC&D Area Committee hopes that this report will be of value and assistance in making any decisions regarding this particular site.

If you require any additional information, please contact Ms. Jeanne Shelburn, Environmental Review Team Coordinator, Eastern Connecticut RC&D Area, Route 205, Box 198, Brooklyn, Connecticut 06234, 774-1253.

Topography	Site Boundary	0 24000" scale	N



INTRODUCTION

The Eastern Connecticut Environmental Review Team was asked to prepare a natural resource inventory for the watershed of Manitook Lake in northern Granby. The Town hopes to use this document in future planning for the watershed area and maintenance or improvement of the current water quality of the lake.

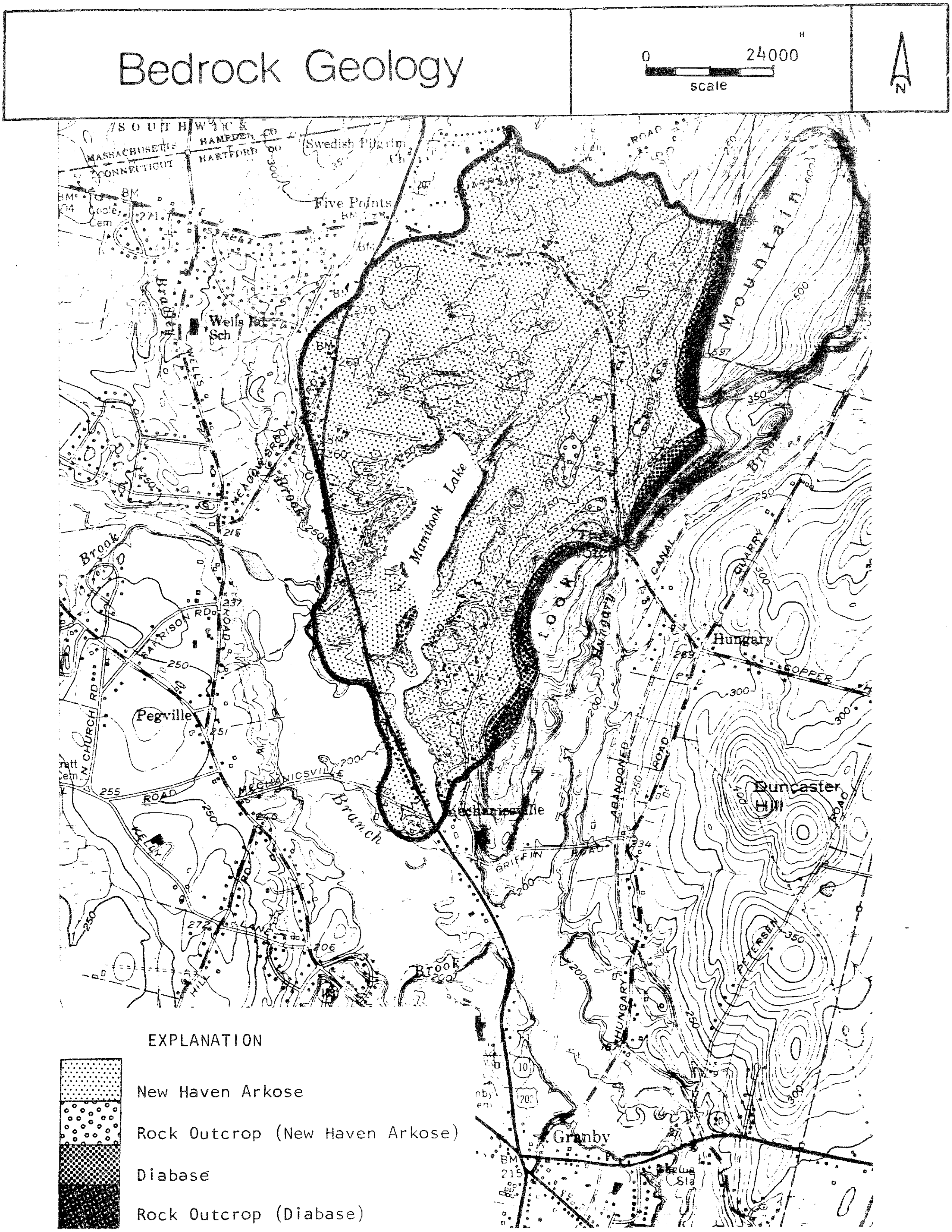
Manitook Lake has about 55 acres of surface water area. The concrete structure at the outlet has created a part artificial, part natural lake. The concrete structure with its control gate serves as the principle spillway. There is no defined emergency spillway. It is estimated that the deepest part of the lake at the northern end is about 20 feet in depth. Black bass, pickeral, perch, bluegills, and sunfish are the major fish species of the lake.

The main watershed of the lake is about 2.35 square miles. There is a canal feeding into the lake from the west. The flows in the canal and into the lake are controlled with diversion dams located on the East Branch Salmon River and on Bradley Brook. The incoming flows into Manitook Lake from these streams are controlled by a culvert under Route 10. The culvert is partly filled with sediment. At this date there was no flow into the canal.

The watershed size of the East Branch Salmon River at the canal is 23 square miles. The Bradley Brook watershed is 2.7 square miles.

The Team discusses the natural resource base of the watershed in detail in the following sections of this report. It is suggested that town commissions consider this information carefully. There are many limitations for development with regard to steep slopes, filtering capacity, drainage, soil shallowness to bedrock and high erosivity. Precautions will need to be taken for development in many cases.

Bedrock Geology



ENVIRONMENTAL ASSESSMENT

TOPOGRAPHY/GEOLOGY

Manitook Lake is located in the northern section of Granby. The lake has a surface area of about 54.5 acres, a maximum depth of about 20 feet and an average depth of 8.0 feet.* It is natural in origin, but has had its level raised by a low, earthen and masonry dam at the south end of the lake near Route 10.

The terrain throughout most of the lake's watershed is characterized by slopes which range from flat to precipitous. As shown by the accompanying topographic map, precipitous slopes occur along the western flank of Manitook Mountain in the eastern parts of the watershed. The topography throughout this area is controlled by the underlying bedrock. The central and western parts of the watershed are located within a massive series of stratified drift (sand and gravel) deposits. Slopes throughout this area are controlled by those unconsolidated materials (sand and gravel) overlying bedrock and range from flat to very steep. The sand and gravel deposits north of Manitook Lake are presently being mined by the Roncari Company.

The lowest elevation in the watershed is the surface of Manitook Lake, which is ±194 feet above mean sea level. The highest point in the watershed is 638 feet above mean sea level which is at the top of Manitook Mountain in the northeast corner of the watershed.

The bedrock geology of the Tariffville topographic quadrangle, which encompasses the entire lake watershed, was mapped by Robert W. Schnabel and John H. Erie in 1958-1959 and in 1961. The U.S. Geological Survey published the map (GQ-370) in 1965. An accompanying bedrock geologic map, adapted from GQ-370 shows the bedrock geology of the watershed.

Bedrock underlying or cropping out within the watershed may be grouped into two principal rock types. The most extensive type is described as the New Haven Arkose, a unit of middle to late Triasic age, approximately two hundred million years old. Most of the rock consists of a reddish-brown conglomerate with minor reddish-brown feldspathic and micaceous sandstones and siltstones. The rock outcrops extensively along the eastern boundary of the watershed. The rock is described as a medium to dark gray, medium to coarse-grained dense diabase. The term "diabase" refers to an igneous rock (rock formed from magma) which is composed predominantly of the minerals labradorite and pyroxene. These rocks intruded into the New Haven Arkose Unit as molten material and subsequently hardened to the way we see it today in outcrops in the watershed. It is, therefore, younger in age than the New Haven Arkose unit.

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*A Fishery Survey of the Lakes and Ponds of the Lakes and Ponds of Connecticut by State Board of Fisheries and Game. Lake and Pond Survey Unit, 1959.

Surficial geologic materials consist of those unconsolidated rock particles or other debris that overlie bedrock. The surficial geology of the Tariffville quadrangle was mapped in 1953-61 by Allan D. Kandall. The U.S. Geological Survey published the map (GQ-798) in 1970. The surficial geology of the Manitook Lake watershed adapted from GQ-798, is shown in an accompanying map.

The surficial geologic materials in the Manitook Lake watershed may be broadly classified into five major units: (1) stratified drift; (2) till; (3) swamp deposits; (4) talus or slide rock; and (5) alluvial deposits.

As mentioned earlier, the predominant surficial deposit in the watershed is stratified drift. Stratified drift consists of rock debris that was sorted and generally layered by meltwater issuing from wasting glacier ice. Sand and gravel are the predominant components of the stratified drift, but silt, clay, and occasional cobbles or boulders are interspersed in small percentages. In the watershed, the stratified drift consists chiefly of coarse to very fine sand with some gravel layers below the top 5 to 20 feet. Stratified drift deposits north and northeast of the Manitook Lake have been and are presently mined as an economic resource.

Stratified drift deposits, which are comprised of porous coarse sand and gravel and which are thick (greater than 40 feet), may have excellent water storage capability. Thicknesses of the stratified drift in the watershed range from zero at rock outcrop areas to approximately 80 feet in the central parts of the watershed.

In the hillier eastern part of the watershed, till forms the predominant surficial deposit. Till is a glacial sediment composed of rock debris deposited directly from an ice sheet. The rock particles and fragments include sizes ranging from clay to boulders and shapes ranging from round to angular to flat. There is little or no sorting of grain sizes within the deposit and textures may vary from sandy to loose to silty, stony, and tightly compact. It generally forms a thin (10 feet or less) mantle over the bedrock surface. "Hardpan" is a colloquial term for till in Connecticut.

Overlying stratified drift deposits in scattered areas around Manitook Lake are swamp deposits. Two large wetland areas comprised of swamp deposits are located at the southern end of Manitook Lake. These deposits consist largely of silt, clay, fine-grained sand, and decomposing plant remains.

Inland wetland areas play a very important role in slowing runoff, trapping sediments that would otherwise enter watercourses, and through biochemical processes, remove certain pollutants. Based on visual observations within the Roncari Property, it appears that in some areas the floor of excavated pits are deeper than or at least close to the water table. As a result, new inland wetlands have been created subsequent to the completion of the surficial geologic map and, therefore, are not shown on the accompanying map.

Another type of surficial geologic material found within the watershed along Salmon Brook (East Branch) in the southern parts are alluvial deposits. These materials, which consist of silt to medium sand overlying sand and gravel were deposited post-glacially along major streams. "Alluvial deposits" are comprised of regulated inland wetland soils and are, therefore, regulated by law.

Surficial Geology

0 24000"
scale
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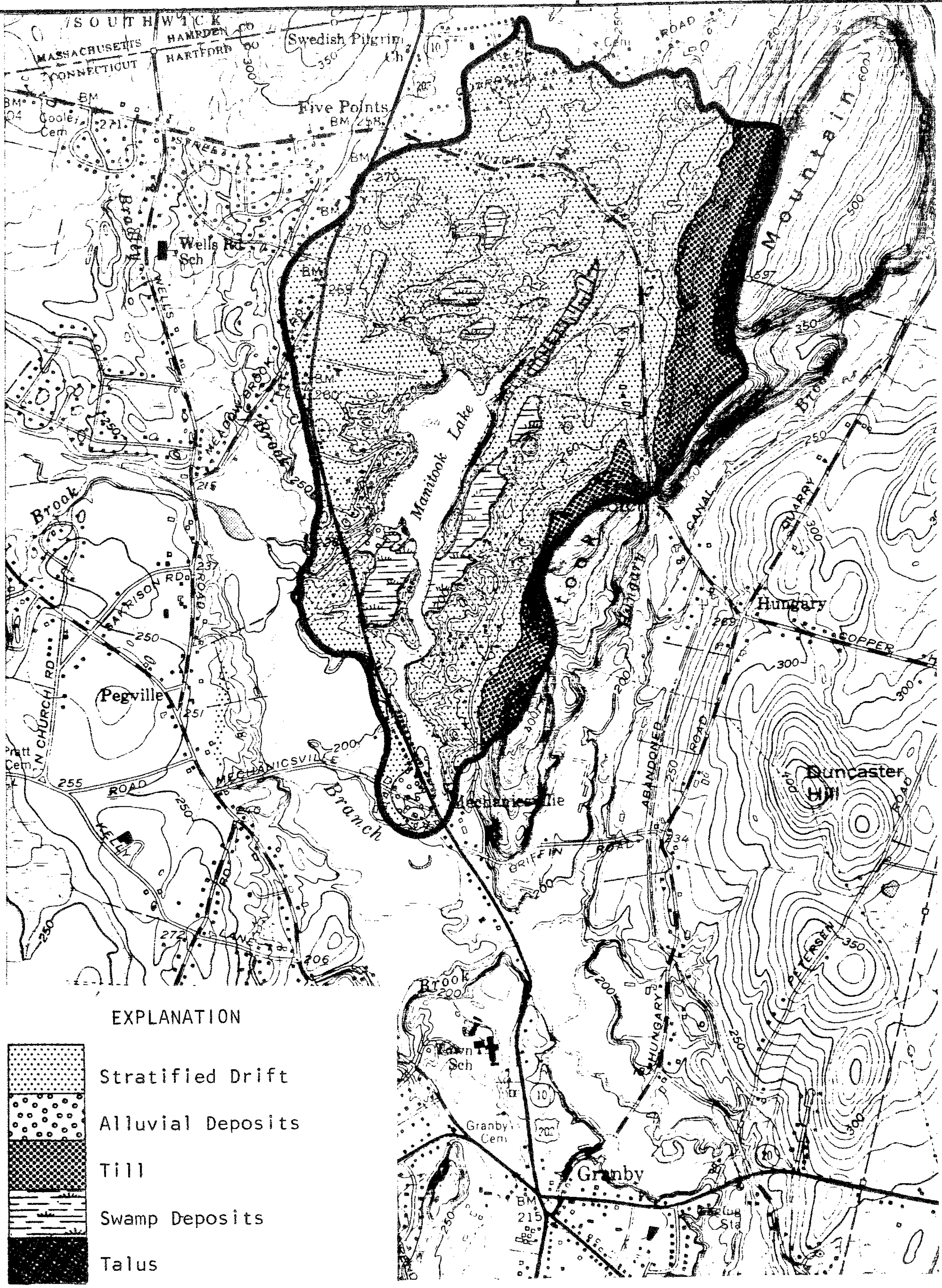

The final surficial geologic deposit found in the watershed is talus or slide rock. "Talus" refers to large angular rocks that have fallen from a scarp and accumulated at the base of cliffs because of weathering and gravity effects.

HYDROLOGY

The watershed of Manitook Lake may be defined as that land area from which all of the natural water input to the lake is derived. It should be pointed out that the watershed also receives input from Bradley Brook which is located just west of the watershed.

Based on information supplied by town residents and visual observations during the field review, this is accomplished by a diversion which consists of a dam constructed of cobble sized stones that span the width of Bradley Brook. During periods of heavy precipitation, it seems likely that some surface water from Bradley Brook, may be directed into a man-made canal which was constructed from Bradley Brook to Manitook Lake. This 1,250 foot long canal, which was constructed for water power (according to town residents on the review) during the 1840's, transports the diverted water in a northeast direction passing through an 18 inch culvert under Route 10 and ultimately discharges into Manitook Lake. The canal was not transporting water on the field review day. Based on visual inspection during the field review, the entrance to the canal is presently dammed by stones, sticks and other debris, which prevents surface water from Bradley Brook to flow into the canal. Another historic canal, which is located northwest of the canal mentioned above, diverts water from Salmon Brook (East Branch) into Bradley Brook. Therefore, it may be said that Manitook Lake also receives water from the Salmon Brook (East Branch) watershed. Again, it seems likely that this would only be the case during periods of heavy precipitation and provided the dam at the entrance to the canal which diverts water from Bradley Brook to Manitook Lake was removed (see Drainage Area Map).

As shown by the accompanying Drainage Area Map, the watershed boundary, excluding water input from Bradley and Salmon Brooks, tends to follow along the west of the local ridges and hills, i.e., Manitook Mountain. The watershed as depicted comprises about 1,050 acres or about 1.14 square miles.

Precipitation which takes the form of surface runoff flows across the surface of the land until it reaches a brook or other surface water body. Precipitation may also be absorbed into ground, especially in those areas covered by permeable sands and gravel (stratified drift). Once absorbed, the water may either be returned to the atmosphere through evaporation and transpiration, or it may percolate downward to the water table and eventually become part of the groundwater. Once the water reaches the groundwater table, it moves downslope by the force of gravity, ultimately discharging to the surface in the form of a spring, wetland areas, stream or directly into the lake. Water readily penetrates the permeable sands and gravels comprising stratified drift in the watershed. Because of the highly permeable nature of the stratified drift deposits in the watershed, they are better able to absorb rainfall and release it to streams in dry weather. To a large extent, groundwater flow in the watershed parallels the surface flow pattern.

Drainage Areas

NOT TO SCALE

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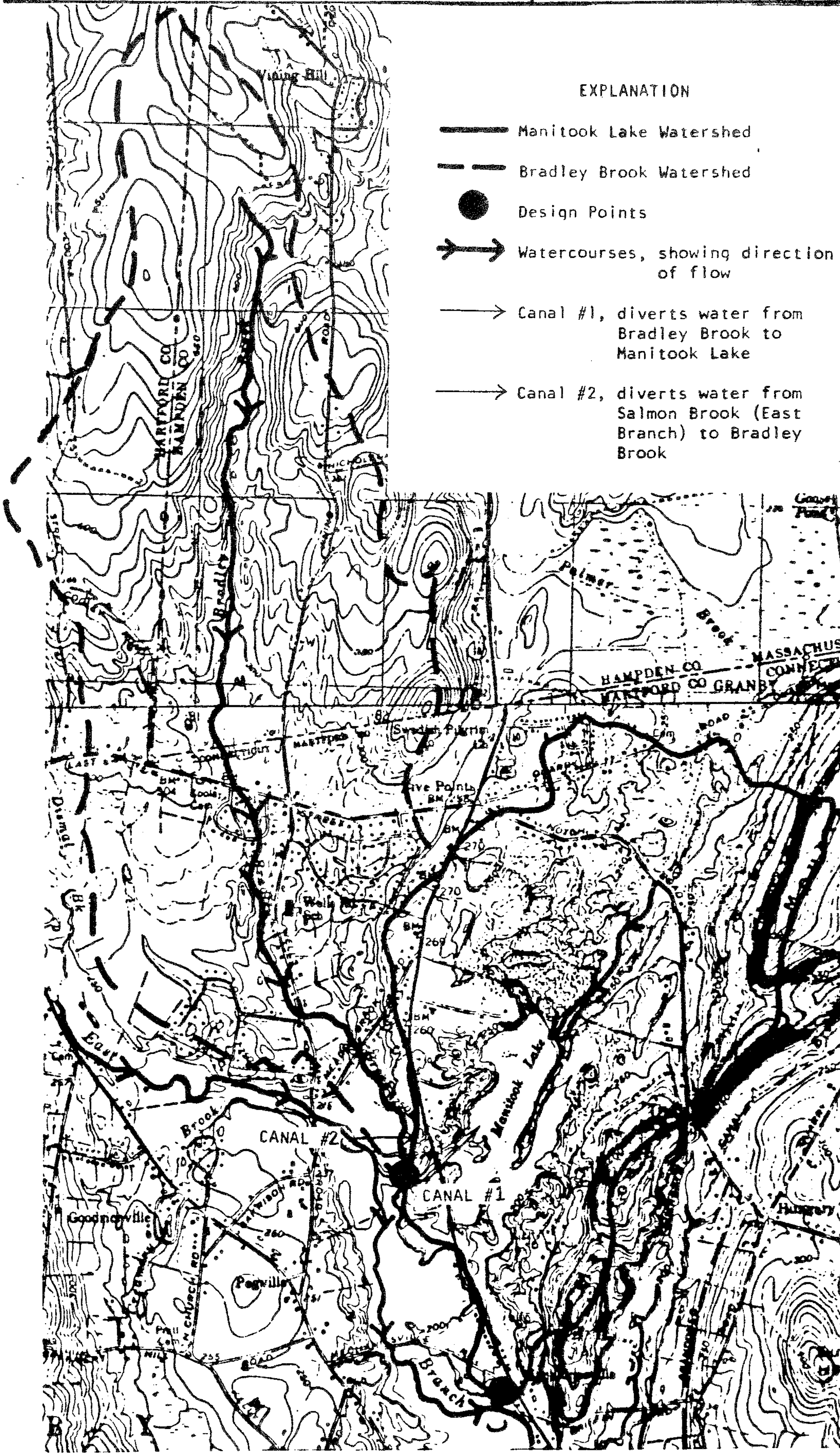

Water level in the lake is maintained by inflow from Salmon Brook (East Branch) and Bradley Brook (via the canal in the western parts of the watershed and at least two other small streams [see Drainage Area Map]). Numerous intermittent drainage channels arising in the upland areas to the east feed the Lake during periods of precipitation and/or wet times of the year.

Although there is no gaging station at the outlet of Manitook Lake, it is possible to estimate the flow duration characteristics of the outlet stream using a method described in Connecticut Department of Environmental Protection Bulletin No. 35. It should be pointed out that these estimates exclude input from Salmon Brook and Bradley Brook. Gaging stations would need to be installed on these streams and monitored periodically in order to determine how much water is actually diverted from these brooks into the Manitook Lake Watershed. It should be pointed out that the maintenance or construction of a diversion(s) such as the one mentioned above, may be subject to the permitting requirements of the Connecticut Water Diversion Policy Act (P.A. 402). Persons concerned with the diversion law should contact the Department of Environmental Protection's Water Resources Unit at 566-7220.

The estimates are tabulated below in units of both cubic feet per section (cfs) and million gallons per day (mgd).

Estimated flow duration characteristics for the outlet stream for Manitook Lake.

Percent of time flow equalled or exceeded.	1	5	10	30	50	70	90	95	99
Flows equalled or exceeded in million gallons per day	4.95	3.5	2.9	2.0	1.3	.72	.32	.24	.16
Flows equalled or exceeded in cfs	7.7	5.4	4.5	3.1	2.0	1.10	.5	.4	.25

The mean annual outflow from Manitook Lake is estimated to be 2.98 cubic feet per second or 1.87 million gallons per day.

Water quality in the Lake is determined in part by the nature of the earth materials the water comes in contact with and by the length of time in which the contact occurs. As a result, the natural mineral composition of the surficial geology deposits and underlying bedrock may effect the chemical quality of the Lake. The Team has no reason to believe at the present time, that the earth materials in the watershed are adversely effecting the water quality, e.g., elevated iron, hardness levels, etc. of the Lake.

Based on a report* submitted to Team members on the review day, the water quality of the Lake appears to be in satisfactory condition (mesotrophic). A "mesotrophic"

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*"Water Quality Survey for Manitook Lake in Granby," by Joe Nestico, Senior Environmental Analyst, DEP, Water Compliance, 1/24/85.

lake is intermediate in trophic conditions between an oligotraphic lake (lakes low in nutrients, few algae and clear water) and eutrophic lakes (nutrient-rich, supporting very dense growths of algae which allows light to penetrate only a few feet).

Surface water and groundwater in the rural, undeveloped parts of the watershed, under near natural conditions, should be good in water quality. On the other hand, water in the more heavily developed areas may be poor in quality. Poor quality water may result from a number of various non-point sources of pollution such as septic systems, erosion and sedimentation, road runoff, waterfowl, etc.

Based on air photos, topographic map and visual inspection, the Manitook Lake watershed is moderately developed at the present time. Heaviest development, which is largely residential, has occurred (1) along the western shores of Manitook Lake; (2) along Notch Road and Quarry Roads in the northern parts of the watershed; and (3) along Stagecoach Road in the eastern part of the watershed. As mentioned earlier in the report, sand and gravel is presently being mined for commercial purposes in a large area north of Manitook Lake. This land, as well as other lands along Route 10, in the eastern part, is zoned industrial/commercial. Finally, the Town presently operates a landfill site in the eastern parts of the watershed. All of these land uses can have an important effect on surface runoff and infiltration within the watershed and ultimately to the water quality of Manitook Lake.

Sources of contamination in the watershed will generally have a greater impact on surface water quality if they are relatively close to the water body. Surface runoff originating in the upper reaches of the watershed may pass through wetland areas, wherein the removal of many contaminants may occur. Runoff will also be purified, at least in part, by passage through soils.

More intensive development in the watershed may degrade the water quality of Manitook Lake. As mentioned earlier, major causes of water quality changes, which may be attributed to development as well as other land uses, i.e., erosion and sedimentation from sand and gravel operation, etc., waste water discharges and leachate from a landfill site.

Erosion and sedimentation is commonly associated with development and results primarily from clear cutting of vegetation, improperly planned or monitored excavations or fillings and concentrated surface water discharges. Erosion causes surface waters to become turbid and allows surface water bodies to fill with sediment more rapidly than otherwise would be the case. Due to the high erosion potential of soils in the watershed, particularly within the sand and gravel operation, any significant future development as well as sand and gravel extraction operation should be accompanied by a comprehensive erosion and sediment control plan.

In addition, transportation related activities such as road salting and street runoff ladened with automobile residue, i.e., oil, gasoline, etc., may carry salt, sand, oil into the Lake. At this time, the Team has no reason to believe that any of the above mentioned transportation related contaminants (i.e., deicing compounds, oil, etc.) are a potential threat to the water quality of Manitook Lake.

Perhaps a survey could be conducted to determine if any street drainage is discharging into the Lake and whether or not it is causing a problem. If moderate to large volumes of road salt are building up at a particular discharge point to the Lake, every effort should be made to remove the sediment and consideration should be given to minimizing road salting/sanding on streets near these areas.

Septic system discharge may also cause serious deterioration of water quality depending upon the nature of the discharges and the means used (if any) to mitigate the detrimental effects. Septic system effluent is one of the most common pollutants of lakes in Connecticut.

As mentioned earlier, the heaviest concentration of development (residential) has occurred along the west shore of the Lake. Because of the highly porous nature of the sand and gravel deposits covering this area, any pollutants, i.e., septic system and effluent, etc., that are disposed of directly, or otherwise make their way into the ground, will have little opportunity to be renovated by the soil components before reaching the lake. On the other hand, natural dilution by infiltrating precipitation will be increased.

Based on visual inspection of homes along the western shore of the Lake, many appear to have been constructed on undersized lots and very close to the shore of the Lake. As a result of these conditions and the presence of highly permeable soils, it seems that these septic systems could malfunction and discharge seepage effluent into the Lake. It should be pointed out that the Team has no reason to believe that any septic systems are discharging into the Lake at the present time.

According to the water quality report submitted to Team members on the review day, the bacteriological quality of the samples indicate very low levels and would be acceptable for swimming. Nevertheless, if septic effluent finds its way into the Lake, it could ultimately threaten the water quality of the Lake as well as to create a public health nuisance condition.

The correction of individual or scattered failing septic systems is the responsibility of the town health official. 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 Manitook Lake watershed. These include the following: (1) conducting sanitary surveys to identify potential sources of pollution. This may include the introduction of fluorescene dye into 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 Manitook Lake 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 routing 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 state health code requirements at the time of building conversion from seasonal to year round use.

Finally, it should be pointed out 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 water body 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 and is available from the Department at 566-2588.

Additional residential development or other activities which do not employ best management practices will serve to worsen these conditions. Local agencies should consider developing and implementing watershed management practices to mitigate the effects of land-use changes in the watershed.

SOILS

The landscapes of the Manitook Lake watershed are dominated by nearly level to steep glacial outwash soils. The western side of the watershed consists of deep to shallow, steep and very steep, glacial till soils. Becuase of the large number of map units involved, a chart of important soil features has been prepared. Large portions of the northern part of the watershed have been highly modified by the excavation of sand and gravel and cannot be interpreted as natural soil areas. The information in this report cannot be substituted for an onsite investigation.

The future direction of development in the watershed should be influenced by the soil limitations of this area. Below are listed some of the major soil-landscape relationships to future development.

1. The undisturbed glacial outwash soils (see map and chart) have rapid to very rapid permeability (how fast water moves through the soil) in the lower horizons and thus a poor filtering capacity for onsite septic systems. High density development with underdesigned septic systems could lead to groundwater and Manitook Lake contamination.

2. The soils in map units EsB, EsB2 are very erosive and should be developed with adherence to strict erosion and sediment control measures.

3. Future development along Manitook Mountain will be more difficult and costly because of steep slopes and soils that are dominately shallow or moderately deep to bedrock (HzE, RkE).

4. Those map units of highly disturbed soils (Pg, Vd) have, in many areas, been excavated realtively close to the apparent water table. The remaining soils are very sandy and gravelly with rapid to very rapid permeability. Depending on how these areas are reclaimed, dense development with septic systems could lead to contamination of the groundwater and Manitook Lake.

5. Wetland soils make up a small portion of the watershed, but they are playing an important role in maintaining the water quality of Manitook Lake. This is especially true of the wetland (PkA) soils adjacent to the landfill site. There are currently no recognized leachate seeps from the landfill to the wetland; if this situation were to occur, the wetland has the potential to attenuate some pollutants.

6. The sanitary landfill located on the eastern side of the watershed will certainly influence any development directly to the south; it has contaminated a few wells in the past.

Further information on the potential movements of leachate can be found in the 1982 Hydrogeolgic Study by Geological Services, Inc.

In summary, the major soil limitations to development in the Manitook Lake watershed are the potential for groundwater contamination, slope, and the depth to bedrock. Careful consideration of the density and type of development, properly designed and installed septic systems, and good erosion and sediment control are necessary to maintain the water quality of Manitook Lake. The best protection of the groundwater and surface water is, of course, for the land use to remain as grassland, woodland, and land for wildlife and recreation.

FISHERIES CONCERNS

Manitook Lake is a 54.5 acre body of water located in the township of Granby. It is reported to have a maximum depth of 20 feet and an average depth of 8 feet. The pond has a bottom consisting mostly of mud and swampy ooze. Historically, Manitook Lake has been stocked at one time or another with smallmouth bass, landlocked salmon, lake trout, bullheads, yellow perch, chain pickerel, white sucker, golden shiners, calico bass and pumpkinseed sunfish. A 1959 survey of the lakes and ponds of Connecticut found Manitook Lake to be inhabited by bluegill sunfish (abundant), largemouth bass, yellow perch, pumpkinseed sunfish (all common) and chain pickerel (scarce in 1959 but now believed to be abundant). Brown trout are occasionally found in the Lake. All fish species were found to sustain average growth except that the sunfish species exhibited signs of stunting. The 1959 survey commented that vegetation was scarce except in shoal areas. As the Lake is now heavily weed covered, this could account for the suspected increase in the numbers of pickerel inhabiting the Lake and would indicate the overpopulation and stunting of both sunfish species has continued. It appears that Manitook Lake currently provides local residents with a warm water fishery (primarily for sunfish, largemouth bass and pickerel) which is of moderate quality.

Weed growth is believed to cover roughly 50-60% of the surface area of the Lake's northern basin, while nearly 100% of the southern arm is chocked by weeds. Weed growth becomes detrimental to the fisheries of a lake at a density where efficient predation by bass and pickerel on forage species is inhibited. When this density is reached, overcrowded and stunted populations of sunfish, bullheads and perch, and depressed growth rates in bass often result. Additionally, large numbers of stunted sunfish tend to prey heavily on bass eggs and fry, drastically reducing spawning success and the subsequent recruitment of bass into the fishery. A population made up of a few old bass, unable to produce a large successful spawn and insufficient in number to support truly good fishing, often results. Moderate weed growth, however, should be considered beneficial in that it provides escape cover for all fish species, and spawning habitat for pickerel, largemouth bass and yellow perch. Recent research has shown that the total biomass of largemouth bass, and the numbers of legal sized bass, increase with corresponding increases in the amount of macrophyte cover until vegetation exceeds 20% of the total lake acreage, decreases in the capture rate of prey are likely to lead to prey species overabundance and to a decrease in bass biomass.

A second means by which weed growth may become detrimental to the fisheries of a lake or pond is via the inducement of "winterkill" in bodies of water having marginal depth. Winterkill occurs when light penetration into the water is reduced under the cover of ice and snow. This results in conditions where life supporting oxygen is being removed from the water by bacterial decay of abundant plant matter, while it is not being added by photosynthesis. A fish kill results when oxygen concentrations drop to critical levels. A bass fishery can be severely impacted by winterkill as the larger fish present are particularly sensitive to low oxygen concentrations.

It is the opinion of the Team's fisheries biologist that the excessive proliferation of aquatic vegetation throughout Manitook Lake is detrimental to the Lake's warmwater fisheries. It would benefit the Lake's fisheries if some means of weed control were undertaken which would reduce the vegetation cover to between 20 and 30% of the total lake surface. It is also recommended that the vegetation be divided up rather than confined to one dense area (if chemical or weed harvesting techniques are applied). Doing this will provide a "patchy" environment and thus increase the amount of "edge" habitat. This will most likely increase the number of bass the pond is capable of supporting and will allow anglers access to some of the best bass cover.

The most economical means by which the weed growth in Manitook Lake can be controlled is by treatment with aquatic herbicides. Granular 2,4-D Ester (a systemic herbicide) may be applied in the spring to control water lilies in specific areas of the lake, and Diquat (a contact herbicide) may be applied later in the spring/early summer to control pondweeds, elodea and duckweed (treatment may have to be repeated on a yearly basis). Still, it should be noted that the application of herbicides may result in a quick release of nutrients into the water as dead plant matter decays. This is usually accompanied by an increase in phosphorous levels and may result in greater plankton productivity. Additionally, in a lake or pond ecosystem macrophytes act as buffers of exogenous nutrients and may thus repress phytoplankton productivity by limiting nutrient availability. If the biomass of plants and the corresponding foliar uptake of nutrients is reduced, runoff will proceed to enrich the water column. Phytoplankton may increase due to the greater availability of limiting nutrients. Algae blooms and turbidity may then serve to reduce both the fishing quality and aesthetic value of the pond, particularly if blue-green blooms occur. The use of copper sulfate is most often recommended for the control of algae in lakes and ponds not containing trout. Some aluminum compounds may be used to precipitate phosphorous (usually the limiting nutrient) from the water, thus limiting algae growth. However, aluminum is highly toxic to fish and is thus not recommended. The DEP has available a publication entitled "Control of Water Weeds and Algae" which provides information on the chemicals which may be used in the control of different types of nuisance vegetation, instructions for determining the proper dosage, and the procedures to follow to apply for a permit.

Alternatives to chemical treatment are more effective but unfortunately also initially much more expensive(initial layout is greater but chemical treatment must be repeated yearly so long term cost difference is not as great as appears). Some of the advantages are (1) that chemicals foreign to the ecosystem are not being introduced to the water, and (2) the removal of harvested or killed plant material prevents the quick release of nutrients into the water as dead plant matter decays (thus preventing the often associated increase in phosphorous levels and phytoplankton productivity). Dredging the pond bottom offers the most permanent method of weed control available. A depth of 10 feet or more is best for preventing the development of nuisance vegetation as sunlight penetration is usually insufficient for the stimulation of plant growth. Additionally, dredging removes nutrients from the pond ecosystem which have built up in the sediments through years of decay. Concurrent with this could be the use of the existing drainage facilities to drawdown the water level of the pond by approximately 4 feet. The water level could be reduced during late fall and allowed to remain down until early February. Exposed plant material would be killed by freezing and should be physically removed from the lake basin (lily pad roots and tubers are resistant to freezing and would require the removal of up to 12 inches of exposed sediment or chemical treatment with a systemic herbicide the following spring; also, drawdowns do not help in the control of unicellular phytoplankton blooms). Additionally, periodic drawdowns often benefit fish populations by concentrating all fish into a smaller volume of water, temporarily increasing the efficiency of predation on sunfish and perch, thus helping to prevent overpopulation. A drawdown on Manitook Lake will not exacerbate the chances of winterkill as the depth of the north basin is believed to be sufficient for the maintenance of acceptable oxygen levels throughout the winter months.

Commercial weed harvesters may also be used to remove weeds from selected areas of the lake. Harvesters allow the greatest control over where and when the weeds are to be removed. As with the drawdown technique, plant material should be transported far enough from the pond so as to prevent the re-entry of nutrient rich leechate. Done correctly, this will prevent the quick release of nutrients into the water from decay, however, an increase in the concentration of nutrients from runoff would still occur and some increase in turbidity may result.

Some new methods of weed control are being developed. Information on the use and relative success of "Dartex" (semi-permiable plastic) and "Aquashade" (photosynthesis retarding dye) have been requested by the Fisheries Bureau and may soon be available.

During the review meeting, it was revealed that some members of the Lake Association were engaged in actively diverting water from the East Branch of Salmon Brook into Manitook Lake via an old canal. This was being done in hopes of improving the water quality and reducing weed growth in the Lake. It is very unlikely that this would be successful given the low fertility and high water quality already existing in the lake; rather, it is possible that the influx of stream water could add to the Lake's nutrient load increasing the possibility of a plankton bloom. It should also be noted that a diversion permit from the water resources unit of the State DEP is required for such actions to be legally undertaken. Also, the diversion of water during mid-summer could have a deleterious effect on the cold water fish fauna of the East Branch of Salmon Brook.

NOTE: The introduction of weed eating fish species is prohibited by law as the effects of such introductions on the complex biology of lakes, ponds and rivers has not yet been adequately quantified. Contrary to what has been published in much of the popular literature, there is substantial evidence that the weed eating white amur, also called grass carp (members of the minnow/carp family) does effect the food chain in lakes and ponds. Some of the negative impacts observed during scientific studies are: (1) a reduction in crayfish production; (2) an increase in the populations of some plant species due to preferential feeding on others; (3) the inducement of algal blooms due to the concurrent elimination of macrophytes and influx of nutrients via grass carp feces; (4) interference with the reproduction of gamefishes requiring vegetation for spawning; (5) reduced production of fishes requiring weed beds for refuge; and (6) the creation of unbalanced ecosystems where species diversity was reduced and fish populations became unstable. These negative effects do not occur in all cases. However, we do not yet have the knowledge to predict what will happen in a specific pond or lake and, therefore, cannot allow grass carp introductions to be made. The danger that introduced fish may be caught and subsequently transported to other bodies of water must also be considered.

WATER QUALITY

Manitook Lake, which is located in Granby, Connecticut, is a 54.5 acre lake that has a maximum depth of 18 to 20 feet. Based on one (1.0) sampling day (8/23/84), it appears that the Lake is a dimictic lake which stratifies into epilimnetic and metalimnetic zones. Dissolved oxygen and temperature profiles indicate that a cold water fisheries could be supported through the year. Transparency and nutrient measurements when compared to the DEP classification system, appear to place Manitook Lake in an early mesotrophic state, i.e., low in fertility. Further support of this was witnessed by the low productivity and density of the phytoplankton community. No nuisance species and bloom conditions were identified on this late summer day.

Although aquatic weeds are dense and contain nuisance species, the possibility of weed control should be further studied for Manitook Lake. Assessments should be made by fisheries personnel and lake users to balance the benefits of maintaining weeds for fish habitat and controlling weeds for improving other recreational activities, e.g., swimming, boating. The DEP handbook entitled "Control of Water, Weeds and Algae" should be used as a guide.

In summary, Manitook appears to be a very clean fishable/swimmable lake. Any changes in land use in the lake watershed should be carefully controlled to minimize adverse impacts on lake water quality. The DEP handbook entitled "A Watershed Management Guide for Connecticut Lakes" should be consulted in this regard.

WATER SUPPLY

The rate at which groundwater moves through various earth materials depends in part upon the size, the percentage, and the degree of inter-connection 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 bedrock and other surficial geologic materials. It should be pointed out, however, that bedrock wells tapping very highly fractured rock have produced high yielding wells. Because of the high transmissibility (ability to transmit water) of coarse grained stratified drift, it is a particularly important resource for the development of high yielding wells. Based on the "Ground Water Availability Map for Connecticut" by Daniel Meade, most of the central and western parts of the watershed are underlain by sand and gravel deposits known or inferred to be capable of yielding moderate to very large amounts of water (50-2,000 gallons per minute [gpm]). Other sand and gravel deposits which may be capable of yielding moderate to large amounts of water (50-500 gpm) are found in the northern parts of the watershed and consists of coarse grained stratified drift overlying fine-grained stratified drift.
The deposits, which may be capable of yielding moderate to very large amounts of water (50-2,000 gpm) are found in the central and western parts of the watershed. These deposits consist entirely of coarse grained stratified drift or coarse grained stratified drift overlain by fine-grained stratified drift. Test wells would need to be drilled in order to determine the actual potential of the stratified drift aquifer. At the same time, water samples could be collected so that water quality can be determined.

It seems likely that bedrock-based wells would be the most important source of water in the upland areas of the watershed. The bedrock underlying the watershed should be capable of providing small (less than 20 gpm) yields to wells. The sedimentary rock (New Haven Arkose) underlying most of the watershed is generally more productive than the diabase rock of the eastern section.

PLANNING/DEVELOPMENT CONCERNS

The land use in the Lake Manitook watershed is quite varied, but is dominated by woodland (WL) and areas excavated for sand and gravel (EL). A map of the major land uses is included. Below are brief descriptions of the designated units.

EL - Excavated Land - currently being excavated for sand and gravel or has been excavated and has a poor to good cover of grass, shrubs, and small trees.

-LAND USE-
LAKE MANITOOK WATERSHED

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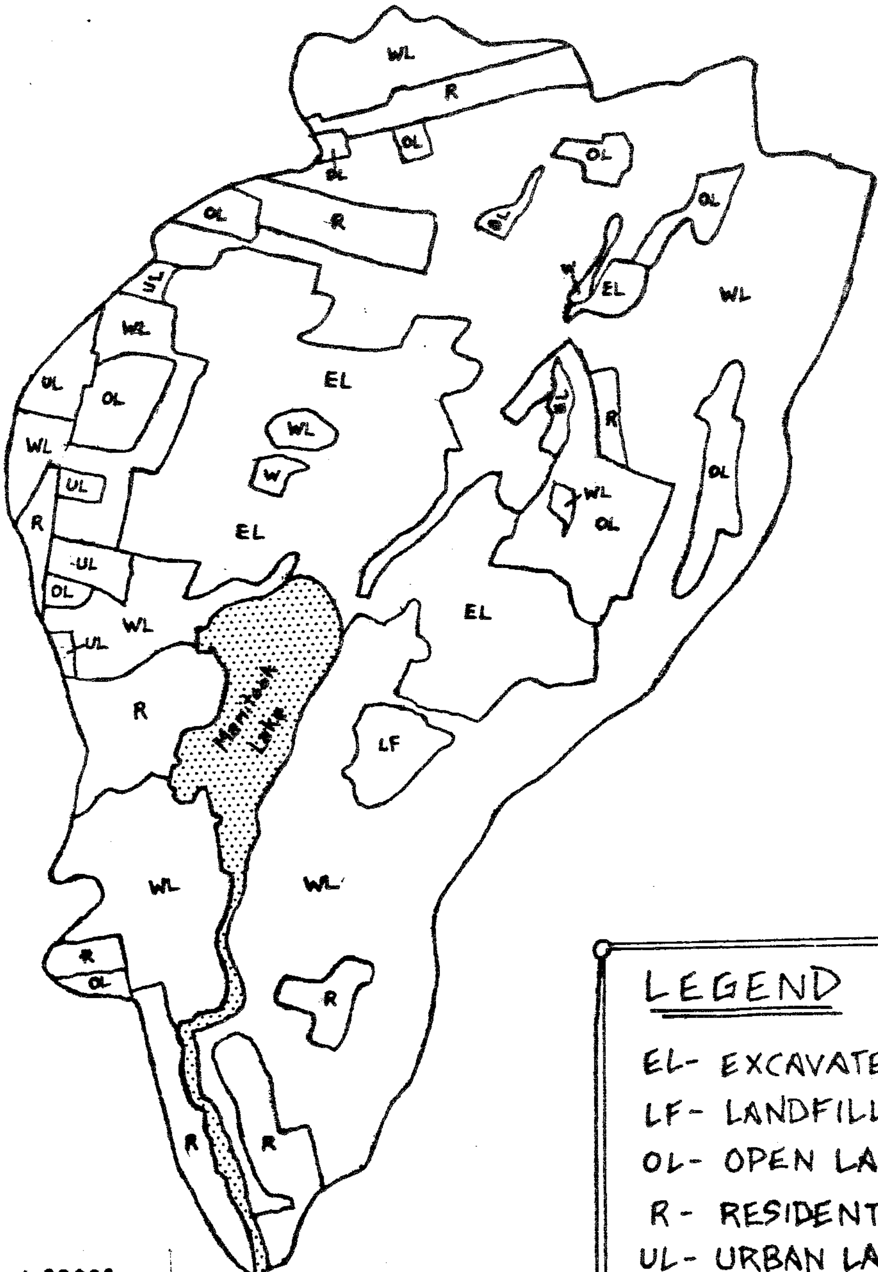

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LEGEND

EL- EXCAVATED LAND
LF- LANDFILL
OL- OPEN LAND
R- RESIDENTIAL
UL- URBAN LAND
W- WATER
WL- WOODLAND

LF - Landfill - contains the area of actively used landfill and those areas which have been capped.

OL - Open Land - consists of idle farmland, active hayland, pastureland and brushland.

R - Residential - predominately homes and associated areas in a complex with woodland and open land.

UL - Urban Land - areas of commercial or light industrial operations with mostly impervious cover in a complex with open land.

Current land uses in the watershed have been limited and influenced by the soil resources, ownership patterns, and zoning.

Gravel Borrow Area

The Roncari sand and gravel operation is located on about 200 to 225 acres at the north end of the lake. A washing operation is in use for washing the excavated sands and gravels. The runoff from the washing operation empties into a sediment basin. The basin is partially excavated with a backhoe each year. Enough sediment is removed to allow storage of additional sediment for one year. The basin will be eliminated at the close of the gravel operation which can be in the indefinite future. Water for the washing operation comes from pumping out of the small brook and spring area.

The existing banks along the southerly portion of the property adjacent to Manitook Lake should be partially retained as a buffer strip to protect water quality, retain aesthetic and wildlife values, and reduce the hazards of erosion and sedimentation to the lake. To accomplish these goals excavations should be stopped 150 feet or more from the lake's edge. Retaining bank height would help maintain aesthetic values.

In 1975, 10 acres of the gravel area were finished off by shaping, grading, topsoiling, and planting a grass mix and trees. In the Spring of 1985, another area of about 15 acres will be planted with shrubs and trees. It was shaped and topsoiled (5" to 6" depth) in 1984. A late fall grass seeding was planted in 1984. If there are problems with a good catch, parts or all of the area will need to be reseeded. A good seed catch will depend on a fertilizer application of 500 pounds of 10-10-10 per acre. An application of two tons of lime per acre will also be important to a good establishment. Ky31 tall fescue and redtop is a suitable grass mix, some birdsfoot trefoil seed could be added to provide some wildlife value.

Topsoiling, fertilizing, liming, seeding rates, mulching and scheduling of the planting dates are extremely important, especially on droughty, infertile gravel pit areas. Onsite recommendations may vary for different portions of the area.

Trees and shrubs can be planted on reclaimed areas. Trees can be planted at spacing varying from 8' by 8' to 15' by 15' apart. Shrubs planted in clumps of 15 to 25 per clump will be effective. The spacing in the clump is 6' by 6' apart.

As future gravel areas are finished, a similar procedure of reclaiming the land will be followed.

Landfill Area

The Granby Landfill located on the northeast side of the lake has been operating since the mid-1950s. It is used by Granby residents only. Residential refuse and some commercial material is dumped at the landfill. A total of eight acres of a 14 acre parcel is presently being used. Four of the eight acres has a cover and is capped. The landfill will need additional leveling and capping on acres that have been disturbed, and as unfinished areas are completed.

A planting program of legumes and grasses will be a good mix to use as the areas are completed. The following is a mix for erosion control and wildlife use.

20 pounds Ky31 tall fescue
8 pounds Vikings birdsfoot trefoil (inoculated)
2 pounds redtop

Apply 500 pounds of 10-10-10 fertilizer per acre with the seeding. Apply 3 tons of lime per acre before seeding.

A surface runoff plan to handle waters from above the landfill area has been completed. Constant annual maintenance of the watercourses and structures will be necessary for assurance of continual proper functioning.

Residential

Almost two-thirds of the 864 acre watershed is undeveloped. Most of this area is in the northern portion of the watershed. This area includes the gravel barrow acreage, the landfill and adjoining area, and the wooded area to the north. There are also some open crop and hay fields.

There probably will be future development on much of the watershed acreage. This will considerably increase storm water runoff flows. Manitook Lake will receive at least some additional increases in runoff and pollutants if appropriate measures are not implemented. Pollutants can be from sands and salts on the roads, septic field overflows, groundwater aquifer contamination, nitrate runoff from lawn applications and from other sources.

Under present conditions there would be individual septic fields and wells for water at each home site. If town sewage and water lines are installed in the future, there will be less potential problems associated with downstream contamination.

Minimal downstream sedimentation would result if erosion and sediment control is done at the site by the use of appropriate measures prior to soil disturbance. Emphasis should be on seeding the areas as soon after disturbance as possible.

Sedimentation and detention ponds should be a strong consideration for all subdivision developments within the watershed. This will help to decrease downstream flooding and sedimentation problems.

Beach Area

The private beach at the north end of the lake that is owned by the Granby Lions Club is presently not being used as a beach and swimming area because of algae and other aquatic weed problems. In 1969, a 200 foot long beach existed.

Studies of the lake area will be necessary to determine if this site can be developed into a beach. Existing federal, state and local laws will need to be reviewed. Some dredging of the lake may be necessary for weed control and a quality beach area.

Prime Agricultural Lands

Two grassland fields exist along the east side of Route 10. The soil types of these fields are dominately Enfield and Enfield eroded phase soils. The fields total 16 acres and both are dominately prime agriculture land. The fields are level to gently sloping.

Two crop fields located along Notch Road are also prime and important agriculture land. The soil types of the 15 acres are Merrimac and Hinckley soils. Other areas of the watershed are prime and important farmland soils but are currently used as woodland.

The best use of Prime farmland soils is agricultural production. The value of these soils as farmland should be considered, and development encouraged on less productive soils.

Appendix

Soils

0 20000''
scale

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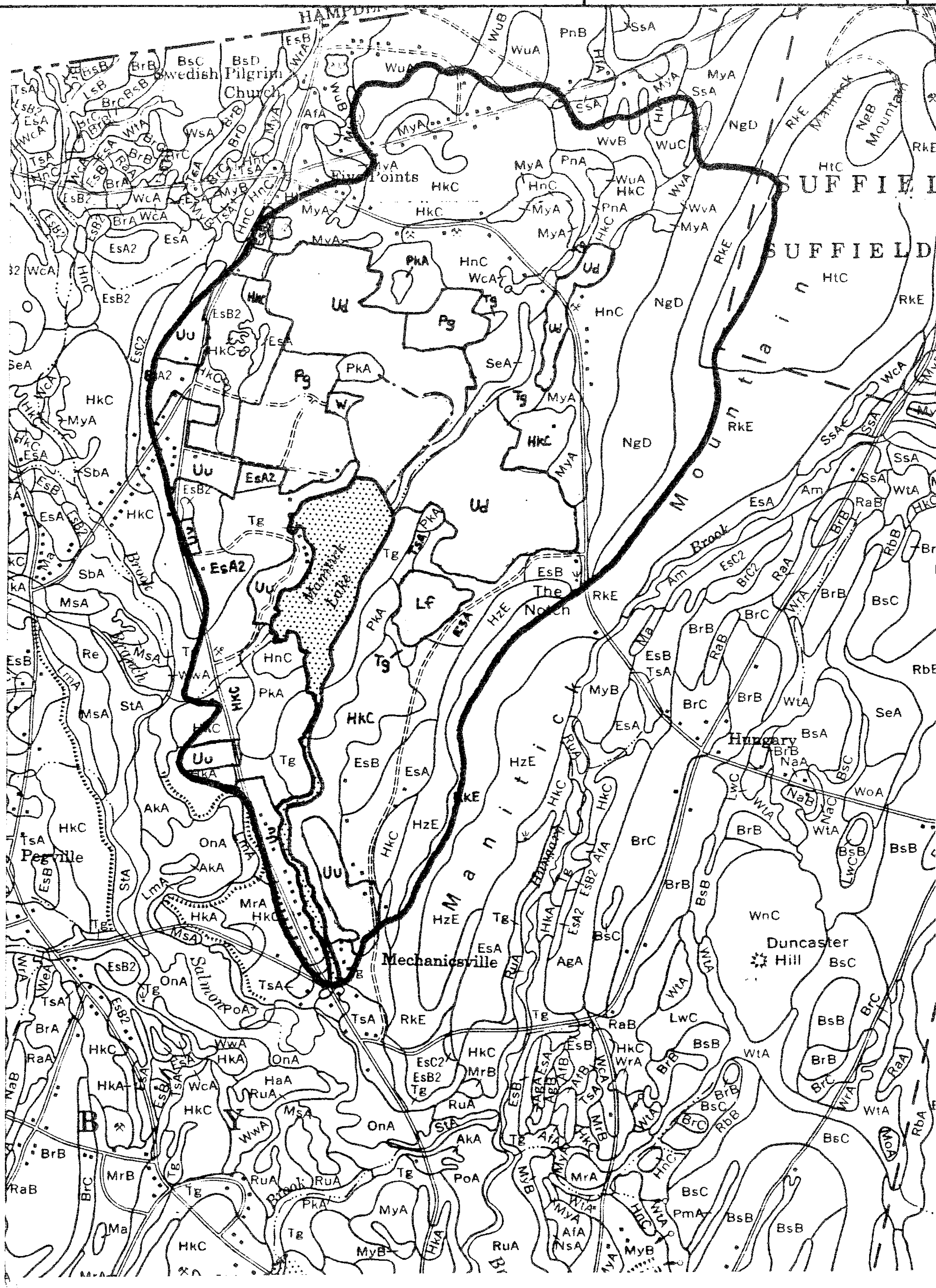


MAP UNIT NAME	MAJOR SOIL FEATURES	DRAINAGE CLASS	DEPTH TO SEASONAL HIGH WATER TABLE	MAJOR LIMITATIONS TO DEVELOPMENT
GLACIAL OUTWASH SOILS				
EsA-Enfield sil, 0-3% slopes	Deep, silty surface and subsoil over sand and gravel	well drained	>6'	poor filtering capacity
EsA2-Enfield sil, 0-3% slopes, eroded	Deep, silty surface loamy subsoil over sand and gravel	well drained	>6'	poor filtering capacity
EsB-Enfield sil, 3-8% slopes	Deep, silty surface and subsoil over sand and gravel	well drained	>6'	poor filtering capacity
HnC-Hinckley ls, 3-15% slopes HkC-Hinckley gsl, 3-15% slopes	Deep, sand and gravel deposits	excessively drained	>6'	poor filtering capacity, droughty for lawns and landscaping, slope on some units
MyA-Merrimac sl, 0-3% slopes	Deep, loamy surface over sandy subsoil over sand and gravel	somewhat excessively drained	>6'	poor filtering capacity
PnA-Penwood ls, 0-3% slopes	Deep, sand deposits	excessively drained	>6'	poor filtering capacity
SeA-Scarboro l, 0-3% slopes	Deep, loamy surface and subsoil over sand and gravel	very poorly drained	+1-1.'	wetness, poor filtering capacity high frost action
SsA-Sudbury fsl, 0-3% slopes	Deep, sandy surface and subsoil over sand and gravel	moderately well drained	1.5-3.0'	seasonal wetness poor filtering capacity
TsA-Tisbury sil, 0-3%	Deep, silty surface and subsoil over sand and gravel	moderately well drained	1.5-2.5'	seasonal wetness poor filtering capacity, high frost action
Tg-Terrace escarpments, sand and gravel	Deep, sand and gravel deposits on steep to very steep slopes	excessively drained	>6'	poor filtering capacity, slope, droughty for lawns and landscaping
WcA-Walpole l, 0-3% slopes	Deep, loamy surface and subsoil over sand and gravel	poorly drained	0-1.'	wetness, poor filtering capacity
WuA-Windsor ls, 0-3% slopes WvA-Windsor lfs, 0-3% slopes	Deep sands	excessively drained	>6'	poor filtering capacity, droughty for lawns and landscaping

UNIT NAME	MAJOR SOIL FEATURES	DRAINAGE CLASS	DEPTH TO SEASONAL HIGH WATER TABLE	MAJOR LIMITATIONS TO DEVELOPMENT
ACIAL OUTWASH SOILS				
B-Windsor ls, -8% slopes B-Windsor lfs, -8% slopes	Deep sand deposits	excessively drained	>6'	poor filtering capacity, droughty for lawns and landscaping
C-Windsor ls, -15% slopes	Deep sand deposits	excessively drained	>6'	poor filtering capacity, slope for some uses, droughty for lawns and landscaping
GLACIAL TILL SOILS				
HzE-Holyoke very rocky l, 5-35% slopes	complex of dominately moderately deep loamy soils, with large areas of shallow soils and rock outcroppings	well drained to excessively drained	>6'	depth to bedrock slope
NgD-Narragansett tony sil 5-25% slopes	Deep,silty surface over loamy subsoil and sandy substratum	well drained	>6'	slope
kE-Rocky land, lyoke materials, 5-35% slopes	Complex of dominately shallow soils and moderately deep soils with large areas of rock outcrop	excessively drained	>6'	steep slopes depth to bedrock
MISC. SOILS				
-Pits, sand and avel	Active excavation of sand and gravel, highly disturbed, variable slopes	variable	variable	poor filtering capacity, droughty difficult to revegetate
-Udorthents, othed	Highly disturbed areas of past gravel excavations. Sand and gravel with variable slopes	variable	variable	poor filtering capacity, droughty difficult to revegetate, slope on some units
dorthents- n land complex % slopes	Complex of disturbed soils and homesites and buildings. Some areas of undisturbed soils are included.	well drained to excessively drained	>6'	poor filtering capacity, slope on some units

MAP UNIT NAME	MAJOR SOIL FEATURES	DRAINAGE CLASS	DEPTH TO SEASONAL HIGH WATER TABLE	MAJOR LIMITATIONS TO DEVELOPMENT
ORGANIC SOILS				
PkA - Peats and Muck, deep	moderately deep to deep deposits of decomposed organic matter (muck) over sand or silts	very poorly drained	+1-1.0'	wetness, ponding low strength high frost action

SURFACE TEXTURE DESIGNATIONS

sl - sandy loam
fsl-fine sandy loam
gsl-gravelly sandy loam
ls-loamy sand
lfs-loamy fine sand
l-loam
sil-silt loam

PHYSICAL DATA

1. A transparency reading of 14.5 feet (4.5 meters) was measured at the deep water station. Maximum water depths ranged from 17 to 20 feet. The water appeared clear with a sparse amount of particulate matter.

2. Temperatures ranged from 23.5ºC at the surface to 17.0ºC near the bottom. Epilimnetic and metalimnetic zones were formed and separated at the 3 meter depth.

3. Dissolved oxygen ranged from 10.0ppm (116% saturation) at the surface to 0.4ppm (4.1 % saturation) near the bottom (17.0 feet). It should be noted that the d.o. at 16.25 feet was 5.5 ppm (57.8% saturation).

4. Sediment samples indicated that the bottom is coarse sand and gravel overlain by several inches of mud.

CHEMICAL DATA

1. Water samples taken at the surface (deep water and out flow) had total PO_4-P and total N values of 430 to 480 ppb. and 10 ppb and respectively.

2. A near bottom water sample had demonstrated recycle in the form of NH_3 (200 ppb) and PO_4-p (30 ppb). All values were approximately 3 times the control at the surface.

BIOLOGICAL DATA

1. A bacterial sample taken at the surface of deep water station had a total coliform (m.p.n.) value of 15/100 mls. and fecal coliform (m.p.n.) value of less than 3.0/100mls.

2. A total of six (6.0) phytoplankters were identified in the tow sample. One (1.0) Blue Green (*Microcystis cyanae*). One (1.0) Green (*Eudorina* sp.), two (2.0) Diatoms (*Asterionella formosa*, *Fragilaria crotonensis*). One (1.0) Golden Brown (*Dinobryon sertularia*) and one (1.0) Dinoflagellate (*Ceratium hirundinella*). All appeared to be at a similar density level of abundant to common. No one taxa appeared to be dominant.

3. Aquatic weed sampling (see map) has located dense beds at water depths up to 10 feet. Sparse to no weeds were observed from 10 to 20 feet. The following zones were observed from shallow to deep waters: <u>0-3 feet</u> - White and Yellow Lillies (abundant); <u>3-5.0 feet</u> - Tape Grass (abundant), Robbinson's Pond weed (rare); <u>5-8.0 feet</u> - Large Leaf Pond Weed (abundant); <u>10-15 feet</u> Robbinson's pond Weed (sparse). In general the lake had dense weed beds throughout.

DISCUSSION

1. A secchi disk transparency reading of 4.5 meters when compared to D.E.P.'s trophic classification system indicates early mestrophic conditions (4-6 meters). The low level of particulate matter in the water and good clarity indicates low plankton productivity and the absence of nuisance algae blooms.

2. The temperature profile indicates that the lake stratifies forming a shallow metalimmetic zone. This cold water zone appears deep enough (6.0 feet thick) and cold enough (18 to 21°C) to support a cold water fisheries (see dissolved oxygen next paragraph).

3. The dissolved oxygen protile has indicated the following: (a) the d.o. levels are above the 5.0 ppm minimum needed to sustain fish life even to a depth of 16.0 feet (b) algal productivity (d.o. is supersaturated at 116%) is evident in the epilimnion but appears to be normal for a pond with this low fertility.

Productive ponds would sustain supersaturation at 130% and greater (up to 200%) (c) the near bottom waters appear to be experiencing a localized Sediment Oxygen Demand which contributes to the low level nutrient recycle observed in the chemical sampling. The low S.O.D correlates to the low level of organic material observed in the sediments.

4. Based on the D.E.P classification system, total PO4-P and total N values of 10 ppb and 430 to 480 ppb would place the lake in an early mesotrophic state. The classification range is 2 to 10 ppb and 200 to 500 ppb respectively.

5. As supported by the D.O. data, release of mutrients in low levels is apparent from the sediments i.e. approximately 3 times background. The contribution to the lake should be minimal because of a shallow anoxic zone and subsequent large dilution by overlying waters during the overturn.

6. Total and fecal coliform bacterial numbers are very low below the standard of 1000/100mls for bathing areas. Based on one sample, it appears that the water is very supportive of fishable/swimmable conditions.

7. The phytoplankton data indicate that the community is well balanced and rather diverse for the season*. This correlates to the oligo-mesotrophic conditions established by the various physical/ chemical parameters discussed earlier.

*Ponds with elevated nutrients would be experiencing nuisance Blue Green blooms.

8. Aquatic weed sampling and mapping indicate that there are dense weed bed formations throughout with distinct species zones found at different water depths. The Pond Lillies in the shallow waters and Large Leaf Pond weed in the deeper waters appear to be the only ones having the potential to interfere with recreation.

CONNECTICUT LAKES MONITORING PROGRAM

SURVEY DATA SHEET

Date: 8/23/84

Time:

Reported By: NESTICO/FREDETTE

Sample Station No. and Description: MANITOOK LAKE - DEEP WATER #1

Depth	Temperature °C	D.O.% Sat.	Dissolved Oxygen
Surface	23.5	116	10.0
1 (3.25)	23.0	115	10.0
2 (6.5)	22.5	112	9.9
3 (9.75)	21.0	94.4	8.5
4 (13.00)	20.0	65.2	6.0
5 (16.25)	18.0	57.3	5.5
~~6 (19.5)~~ 17.0'	17.0	4.1	0.4
7 (22.75)			
8 (26.0)			
9 (29.25)			
10 (32.5)			
11 (35.75)			
12 (39.0)			
13 (42.25)			
14 (45.5)			
15 (48.75)			
16 (52.0)			
17 (55.25)			
18 (58.5)			
19 (61.75)			
20 (65.0)			
21 (68.25)			
22 (71.5)			
23 (74.75)			
24 (78.0)			
25 (81.25)			
26 (84.5)			

Total depth: 17.0' (Max. 20.0 on Sonar)

Secchi depth: 14.5

pH: Surface - Grab

Thermocline - 14-16'

Upper hypolimnion -

Lower hypolimnion -

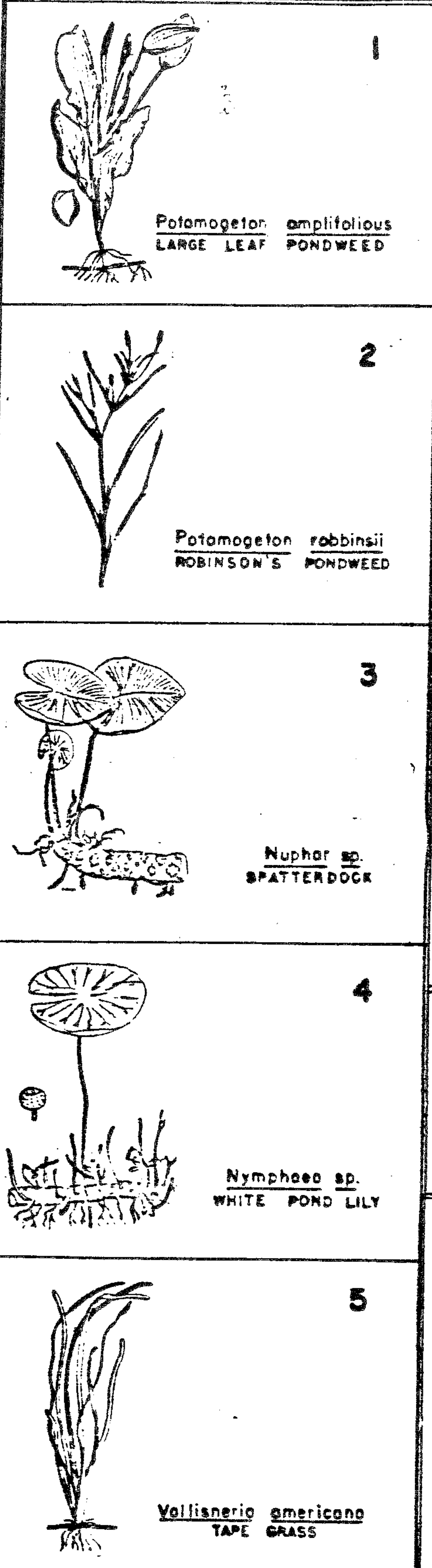
Chemical grabs taken at:

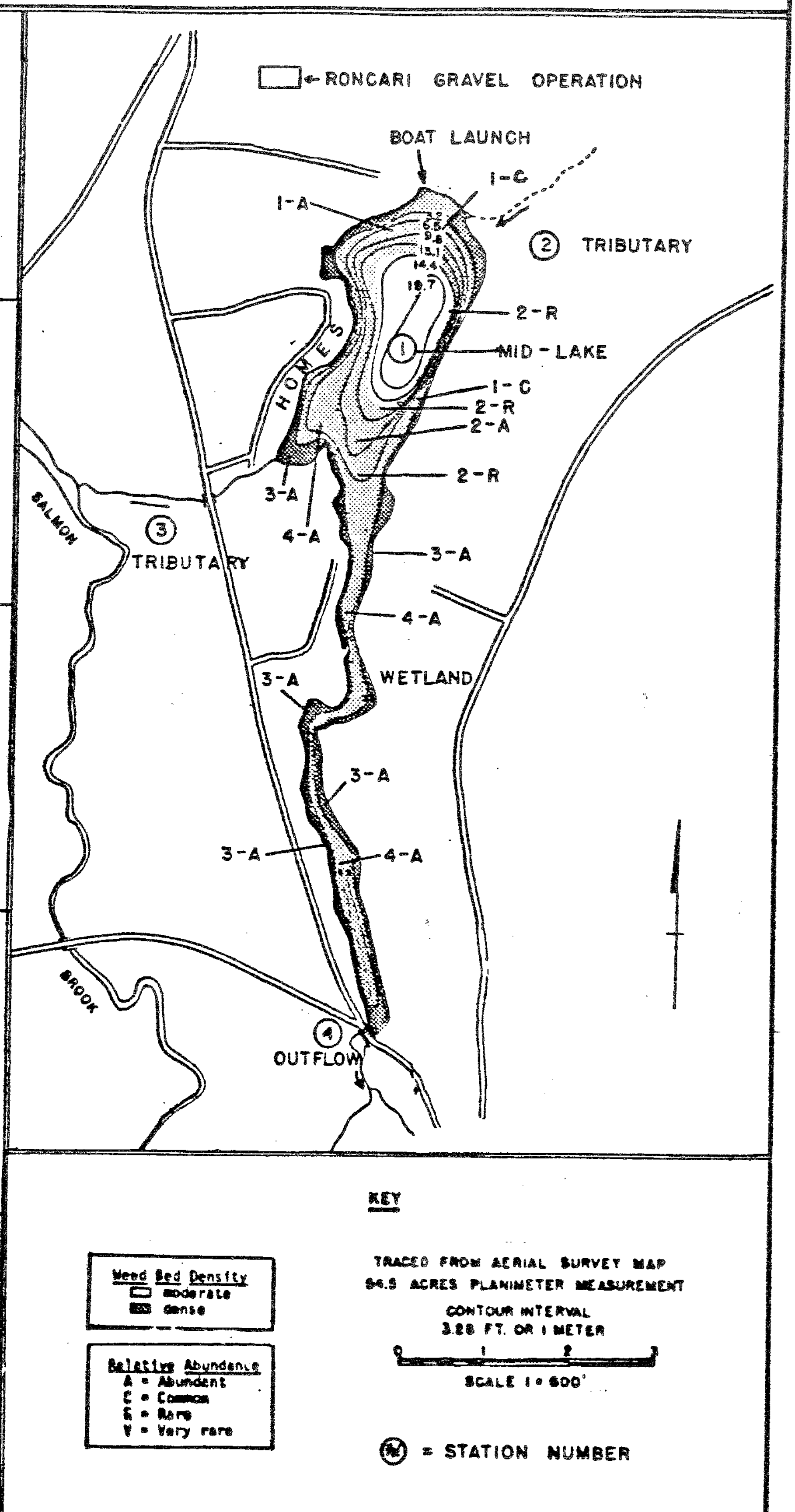
COMMENTS:

Manitook Lake

GRANBY, CT

RELATIVE DENSITIES OF MACROPHYTES -8/23/84





Carol M. Smith, Cartographer, Water Compliance Unit, Depart… …nmental Protection, State of Connecticut

ORGANISM	TALLY	c/ml	RELATIVE ABUNDANCE %
CYANOPHYCEAE			
Non-filamentous blue-green algae			
Microcystis cyanae (Polycystis aeruginosa)	A		
TOTAL			
Filamentous blue-green algae			
TOTAL			
CHLOROPHYCEAE			
Non-filamentous green algae			
Eudorina sp	A/C		
TOTAL			
Filamentous green algae			
TOTAL			

Phytoplankton Sedgwick-Rafter Count

Part A

Manitak Lake

STATION NUMBER:

COLLECTION LOCATION:

COLLECTED BY: 8/23/84

DATE COLLECTED: J. Nestico, C. Fredette

DEPTH: Horizontal Tow

CONCENTRATION FACTOR:

TOTALS: PARTS A & B

TOTAL PHYTOPLANKTON (count/ml):

DIVERSITY INDEX: 6

TOTAL ~~GENERA:~~ TAXA: 6 - Phyto, 3 - Zoo

AMORPHOUS MATTER:

PLANKTON BIOMASS:
Dry Weight
Ash-free weight

IDENTIFIED BY:

N.Q. = not quantitative

A = Abundant
C = Common
R = Rare

Phytoplankton Sedgwick-Rafter Count

Part B

ORGANISM	TALLY	c/ml	RELATIVE ABUNDANCE %
CHLOROPHYCEAE			
Flagellated green algae			
TOTAL			
BACILLARIOPHYCEAE			
Centric diatoms			
TOTAL			
Pennate diatoms			
Asterionella formosA	A		
Fragilaria crotonensis	C/A		
TOTAL			
CHRYSOPHYCEAE			
Other pigmented algae			
Dinobryon sertularia	A		
TOTAL			
Other pigmented flagellated algae			
TOTAL			
DINOPHYCEAE			
Dinoflagellates			
Ceratium hirundinella	C/A (Daughter Cells)		
TOTAL			
OTHERS (Zooplankton)			
Nauplius larvae	C/A		
Keratella cochlearis	C/A		
Cyclops	S		
TOTAL			

REMARKS:

As witnessed by the mild bloom observed on the day of sampling, the algal community appears to be diverse and balanced for the summer and especially for August.

About the Team

The Eastern Connecticut Environmental Review Team (ERT) is a group of professionals in environmental fields drawn together from a variety of federal, state, and regional agencies. Specialists on the Team include geologists, biologists, foresters, climatologists, soil scientists, landscape architects, archeologists, recreation specialists, engineers and planners. The ERT operates with state funding under the supervision of the Eastern Connecticut Resource Conservation and Development (RC&D) Area.

The Team is available as a public service at no cost to Connecticut towns.

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 activitis. To date, the ERT has been involved in reviewing a wide range of projects including subdivisions, sanitary landfills, commercial and industrial developments, sand and gravel operations, elderly housing, recreation/open space projects, watershed studies and resource inventories.

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 officials of a municipality or the chairman of town commissions such as planning and zoning, conservation, inland wetlands, parks and recreation or economic development. Requests should be directed to the Chairman of your local Soil and Water Conservation District. This request letter should include a summary of the proposed project, a location map of the project site, written permission from the landowner 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 Eastern Connecticut RC&D Executive Council, the Team will undertake the review on a priority basis.

For additional information regarding the Environmental Review Team, please contact Jeanne Shelburn (774-1253), Environmental Review Team Coordinator, Eastern Connecticut RC&D Area, P.O. Box 198, Brooklyn, Connecticut 06234.