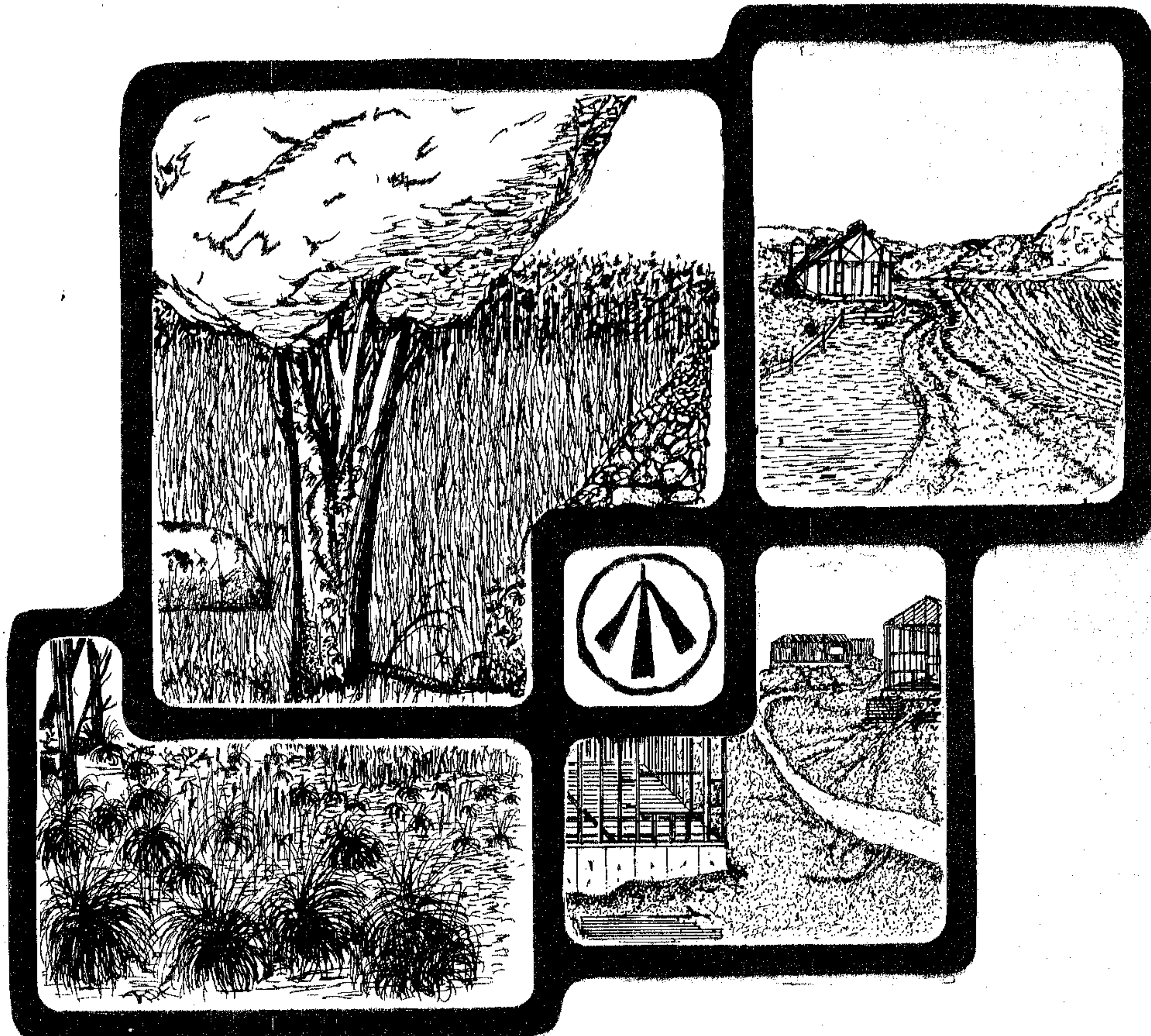
ENVIRONMENTAL REVIEW TEAM REPORT



REGION #15 SCHOOL SITE
MIDDLEBURY, CONNECTICUT

KING'S MARK
RESOURCE CONSERVATION & DEVELOPMENT AREA

KING'S MARK
ENVIRONMENTAL REVIEW TEAM REPORT

ON

REGION #15 SCHOOL SITE
MIDDLEBURY, CONNECTICUT

DECEMBER 1979

King's Mark Resource Conservation and Development Area

Environmental Review Team
P.O. Box 30
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
DEPARTMENT OF TRANSPORTATION
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
LITCHFIELD HILLS REGIONAL PLANNING AGENCY
CENTRAL NAUGATUCK VALLEY REGIONAL PLANNING AGENCY
HOUSATONIC VALLEY COUNCIL OF ELECTED OFFICIALS
AMERICAN INDIAN ARCHAEOLOGICAL INSTITUTE

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KING'S MARK RESOURCE CONSERVATION AND DEVELOPMENT AREA

Victor Allan, Chairman, Executive Committee
Stephen Driver, ERT Committee Chairman
Moses Taylor, Coordinator

Staff Administration Provided By

NORTHWESTERN CONNECTICUT REGIONAL PLANNING AGENCY

Bruce M. Ridgway, Chairman
Thomas A. J. McGowan, Director
Richard Lynn, ERT Coordinator
Rebecca West, ERT Draftsman
Irene Nadig, Secretary

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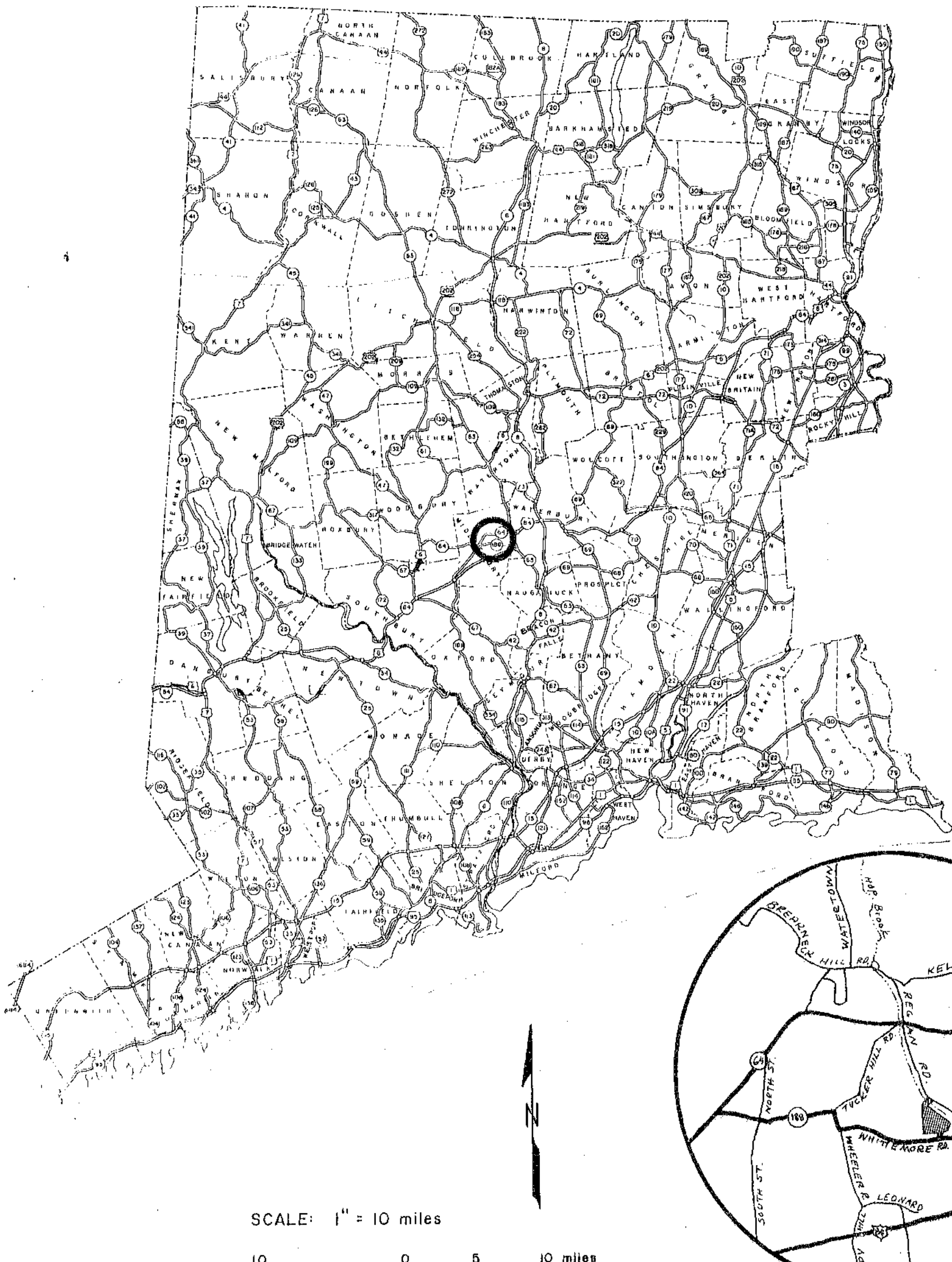
MIDDLEBURY, CONNECTICUT



ENVIRONMENTAL REVIEW TEAM REPORT
ON
REGION #15 SCHOOL SITE
MIDDLEBURY, CONNECTICUT

I. INTRODUCTION

The Region #15 School District in the Town of Middlebury is proposing to construct a new elementary school on ± 12 acres of land in the central portion of town. The subject site is irregularly shaped but generally bounded by Whittemore Road (Rte. 188) on the south, woodland on the west, Regan Road on the north, and vacant land or homesites on the east (see Figure 1). The property is mostly wooded and characterized by gently sloping to moderately steep slopes. Inland wetland soils are located along the western and northeastern borders of the property.

The preliminary site plan for the project, shown in Figure 2, calls for the construction of a school building, access road and parking lot, two play areas, and an athletic field. The school would be designed for a capacity of 500 students, according to the Superintendent of Schools for District #15. The proposed project would be served by on-site wells and public sewers.

The Inland Wetlands Commission from the Town of Middlebury requested the assistance of the King's Mark Environmental Review Team (ERT) to help them in analyzing the suitability of the land for the project, and the probable impact of the project on the natural environment. The Team was asked to pay particular attention to the effect of the project on inland wetlands and watercourses. The King's Mark RC&D Executive Committee considered the town's request, and accepted the project for study by the Environmental Review Team.

The ERT met and field reviewed the site on October 17, 1979. Team members for this review consisted of the following:

Frank Indorf..........	District Conservationist.....	U.S.D.A. Soil Conservation Service
Robert Rocks...........	Forester....................	State Dept. of Environmental Protection
Dwight Southwick.......	Engineer....................	U.S.D.A. Soil Conservation Service
Charles Vidich.........	Regional Planner.............	Regional Planning Agency, CNV
Mike Zizka.............	Geohydrologist...............	State Dept. of Environmental Protection

Prior to the review day, each team member was provided with a summary of the proposed project, a checklist of concerns to address, a detailed soil survey map, a soils limitation chart, a topographic map, and a simplified site plan of the development proposal. Copies of a geotechnical report on the project, prepared by a private consultant, were made available to the Team the day of the field

FIGURE I.

GENERAL SITE LOCATION

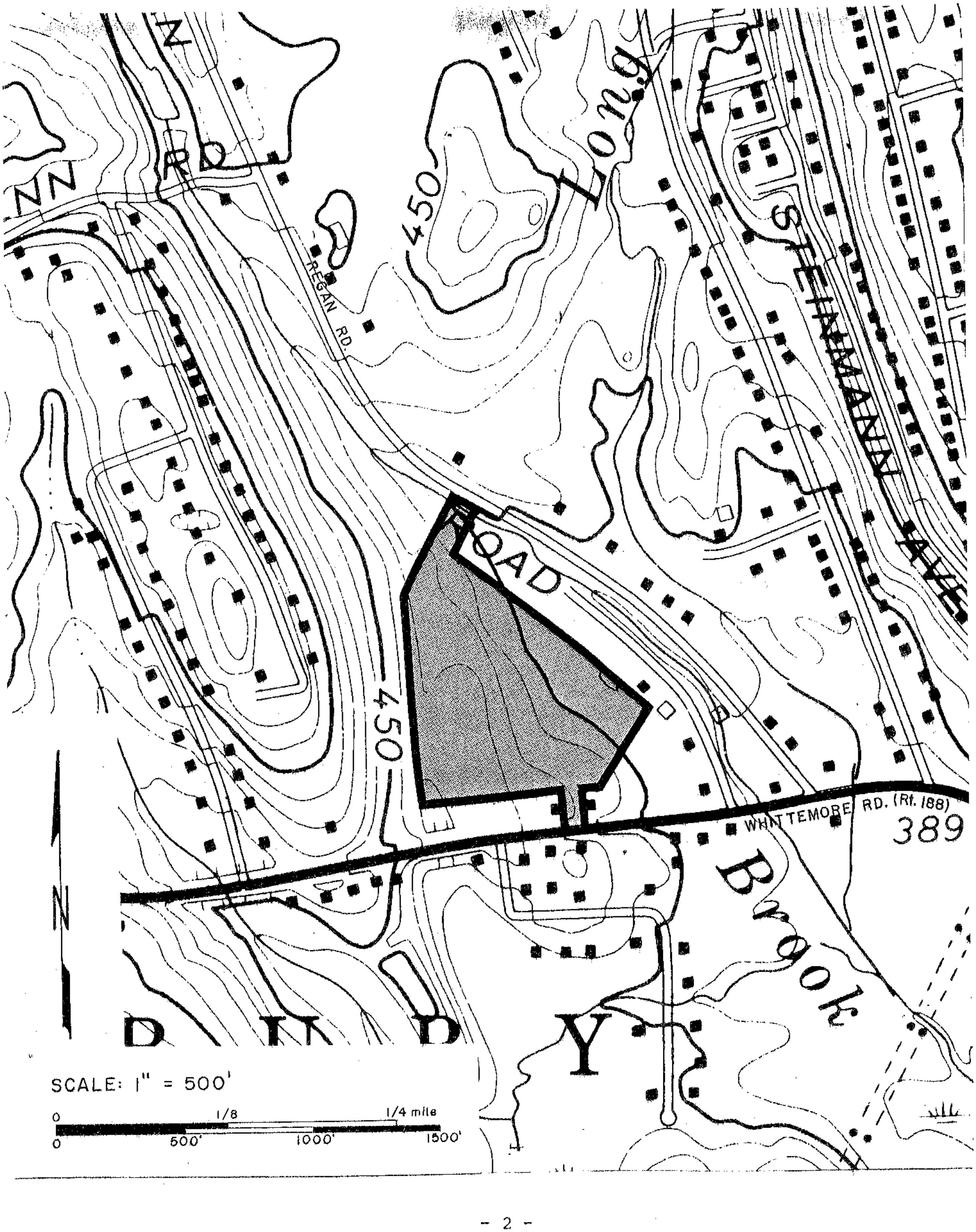
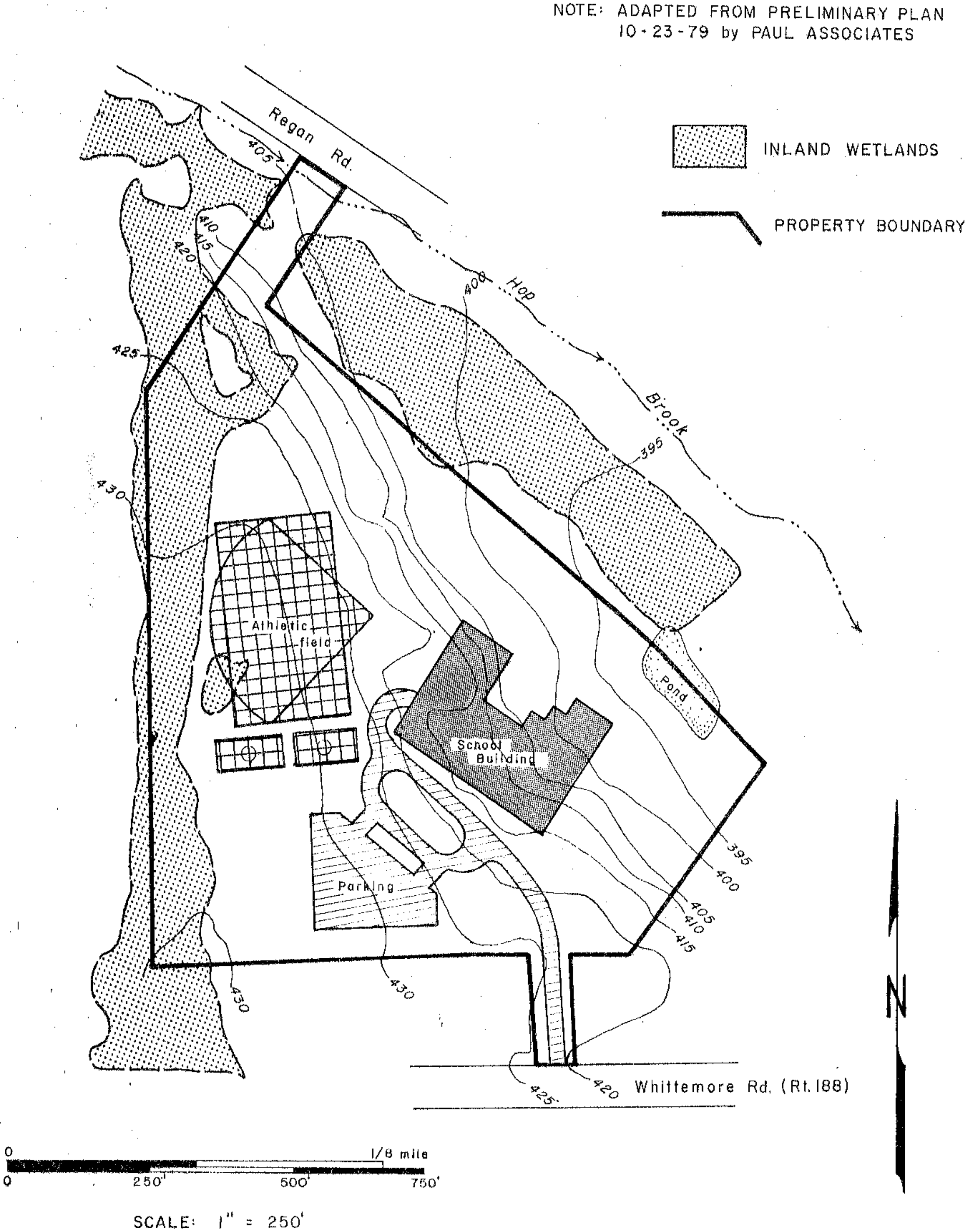


FIGURE 2.

SIMPLIFIED SITE PLAN



review. 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 and recommendations. 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. Nor does the team recommend what ultimate action should be taken on a proposed project. The ERT concept provides for the presentation of natural resources information and discussion of preliminary land limitation considerations. All conclusions and final decisions rest with the town and developer. It is hoped the information contained in this report will assist the Town of Middlebury and the Region #15 School District 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, P. O. Box 30, Warren, Connecticut 06754.

* * * * *

II. GEOLOGY

The proposed school site is located within the Waterbury topographic quadrangle. The bedrock geology of that quadrangle has been mapped and described in Connecticut Geological and Natural History Survey Quadrangle Report No. 22, by R. M. Gates and C. W. Martin (1967). No bedrock outcrops were observed on the property, but bedrock underlying the site is interpreted as being mainly a thin to thick interlayered assemblage of light to dark grey, fine-grained to medium-grained gneisses. Gneisses are crystalline rocks in which elongate minerals and more rounded minerals form thin, alternating bands. Major minerals in the local bedrock are muscovite, biotite, oligoclase, andesine, and quartz. Kyanite is a minor component.

Sediments of glacial origin form the principal surficial geologic material on the site. Most of these sediments were deposited directly from glacier ice; such deposits are known as till. Till consists primarily of rock particles and fragments of widely varying shapes and sizes. It is characterized by the paucity or absence of stratification and sorting. In the northeastern section of the property, in a narrow strip adjacent to Hop Brook, the surficial material appears to be stratified drift, a coarse-grained, generally sandy and gravelly sediment deposited by meltwater streams that issued from a wasting mass of glacier ice.

III. HYDROLOGY

Drainage from the southwestern corner of the property collects in a small depression adjacent to Whittemore Road, and from there flows southerly underneath the road toward a tributary of Hop Brook. Drainage from the rest of the site flows more or less directly into Hop Brook (see Figure 3). Although the proposed school development would cause an increase in runoff from the site, it would have a negligible effect on flows in Hop Brook since the brook has an extensive drainage area (several square miles) upstream from the site.

It was unclear from the field review whether the small area draining southward from the property is piped under Whittemore Road or whether it simply flows through the road fill. The drainage swale south of Whittemore Road leads to a tributary of Hop Brook that flows through a culvert under Tower Road, approximately 1000 feet southeast of the site. Flooding problems from this tributary have occurred recently on Tower Road and have been discussed in an earlier report of the King's Mark Environmental Review Team (Woods Hill and Conton Drive Subdivisions). In that report, it was suggested that the town keep a close watch on future development within the tributary's watershed to prevent aggravation of these flooding problems. The overall effect of the proposed facilities on peak flows in the Hop Brook tributary would depend on the types of engineering measures that are used. For instance, placement of a culvert under Whittemore Road (or clearing of the culvert if one presently exists) would allow more rapid drainage from the depression area southward. Natural drainage from the area to be developed, however, accounts for only two percent of the watershed of the tributary to the culvert on Tower Road. The effect of a new or improved culvert on Whittemore Road should therefore be small <u>if</u> natural drainage patterns are not significantly disturbed. However, if parking lot drainage were channeled to the Whittemore Road culvert or if final grading caused an

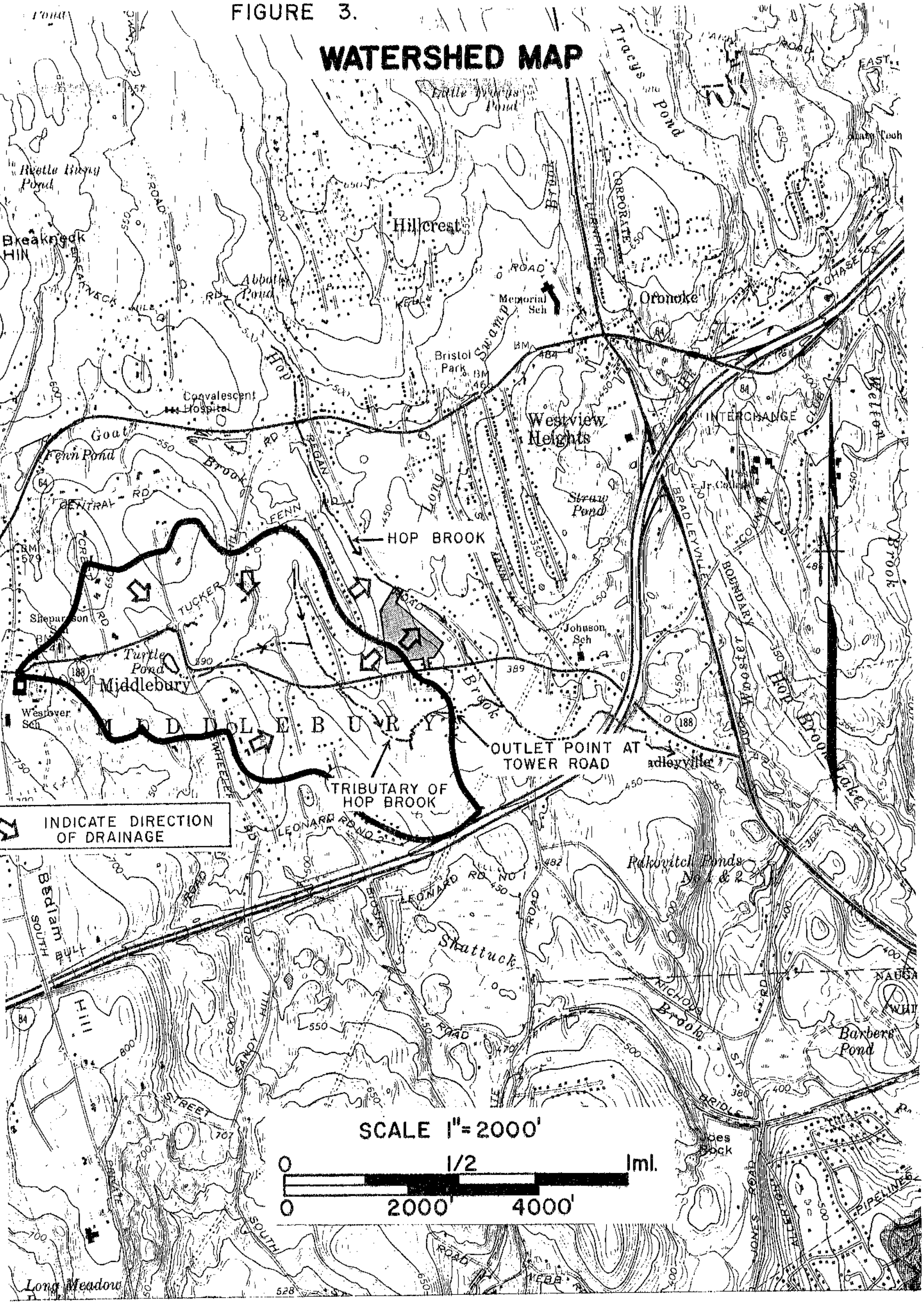


FIGURE 3.

WATERSHED MAP

effective increase in the contributing area north of Whittemore Road (that is, if more of the site were graded to slope southward rather than eastward), an appreciable effect on peak flows in the tributary could result. Hence, it is recommended that drainage from the site be channeled and land graded primarily in an easterly direction to take advantage of the greater buffering capacity of Hop Brook's larger flows.

IV. WATER SUPPLY

The new school is proposed to be provided with water from on-site wells. Some problems with water supply may be encountered if bedrock-based wells are chosen. In general, crystalline bedrock such as that underlying the site is a low-yielding aquifer, with individual wells ordinarily supplying only enough water to meet the needs of one or two families. Yields from crystalline bedrock depend upon the number and size of water-bearing fractures that are encountered by the well. In some places, fractures may be highly concentrated in the bedrock, with high potential yields as a result. However, it is extremely difficult to predict the location of such subsurface concentrations of fractures. Well-completion records of homes located immediately south of the site may offer some clues as to the yields that can be expected in the area.

Higher yields can usually be obtained from gravel-packed wells but the opportunity for siting such a well on the property is uncertain. Sand and gravel deposits apparently may be found along Hop Brook, but the thickness of these deposits on the site is not known. Nevertheless, testing of the sand and gravel for water-supply purposes should precede any attempts to use bedrock wells. In the event that a sand-and-gravel well is used, it is likely that it would be located very close to Hop Brook, so that a high rate of pumping would probably induce infiltration of brook water into the well. It is important, therefore, that the quality of Hop Brook's water be good. A preliminary water-quality test of Hop Brook would be desirable. It is also recommended that any drainage from the site that may be channeled or piped to Hop Brook be located south (downstream) of any gravel-packed well. Without further information, it may be stated only that the secondary access point to the site (from Regan Road) is the most promising location for a gravel-packed well.

If a gravel well producing at least moderate yields can be obtained on the site, then bedrock wells may provide a useful supplement. Water quality from bedrock wells depends mostly on the nature of the bedrock and the proximity of sources of contamination. Natural water quality from the local bedrock should be good.

V. SOILS

A Soils Map of the site is presented in the Appendix of this report together with a Soils Limitation Chart. The Soils Map identifies the distribution of soil types on the property. The Soils Limitation Chart identifies limiting factors for various land uses.

Also included in the Appendix of this report is a brief description of each of the soils which have been identified on the property.

As shown in the Soils Map, five soil types are present on the site. In general, the site is flanked on the east and west by wetland soils. The central portion of the property is characterized by gently to moderately sloping well drained upland soils (Charlton-Hollis soils). As shown in Figure 3, it is this central portion of the property which is being proposed for development.

The Charlton-Hollis soils have fair to poor potential for community development according to U.S.D.A. Soil Conservation Service criteria. The Charlton portion of this complex has fair potential for community development. It is limited mainly by steepness of slopes and stoniness. The Hollis portion of this complex has poor potential for community development. It is limited mainly by bedrock at a depth of 10 to 20 inches.

Construction of the school and support facilities in the south central portion of the site (as planned) will prove difficult and costly due to the nature of the existing soils and topography on the site. The shallow to bedrock soils will make foundation preparation difficult. The topography of the site indicates that deep cuts and fills will have to be made in order to develop the site as planned. Also, in some areas of the site high groundwater is apparent. Handling of this problem will add considerably to the overall development cost of the site. Conservation measures (such as temporary vegetation and siltation basins) will be essential to prevent excessive run-off, erosion, and siltation with implementation of the project.

The latest revisions of the site plans (dated 10/23/79) are much more acceptable than previous plans submitted. Many of the problems associated with previous plans are no longer valid, particularly with respect to wetlands impact. Under the current plan, a minimal amount of wetlands will be intruded upon. Providing suitable plans are made for stormwater control, the project should not significantly affect the wetlands on or adjacent to the site.

As discussed in the previous section of this report, stormwater runoff from the project should be directed east of the parcel to Hopp Brook. This storm drainage system should be piped from the site into an impact basin where it outlets into Hop Brook on the Regan Road side. This approach to stormwater management is preferred as it will divert stormwater away from the sensitve Town Road area. Such a plan will also control stormwater runoff to the wetland area east of the property. This wetland area is reported to spill over during the wet seasons of the year and cause flooding problems for residents on Regan Road.

Since considerable site preparation will be necessary to construct the proposed project, erosion and sediment problems could be serious as the soils on the site are very erosive when disturbed. It will, therefore, be necessary to prepare a complete and extensive erosion and sediment control plan, including stormwater management to mitigate environmental harm.

From the field review it was determined that inland-wetland boundaries as described on the site plan, except in areas noted as needing further investigation by a soil scientist, give a reasonably accurate representation of wetland conditions as they exist on the site.

VI. VEGETATION

The 12+ acre site proposed for the development of the Region 15 School may be divided into four vegetation types (see vegetation type map). These vegetation types are described below.

Vegetation Stand Descriptions

STAND A. Mixed hardwoods. This 6 acre over-stocked stand consists of pole-size red maple, white ash and scattered American elm. Eastern red cedar, white pine, blackcherry seedlings, alder and occasional white spruce seedlings are present in this stand's understory. Ground cover is dominated by club moss.

STAND B. Mixed hardwoods. Sapling size red maple, gray birch and apple trees are present in this 4 acre under-stocked stand. The understory is dominated by highbush blueberry, red cedar, arrowwood and barberry. Club moss and grasses form a complete ground cover in this area.

STAND C. Hardwood swamp. Poor quality sapling to pole-size red maple, white ash and widely scattered black gum are present in this 2 acre over-stocked stand. The understory is made up of highbush blueberry, spice bush, arrowwood and maple leaf viburnum. Cinnamon fern, skunk cabbage and sphagnum moss form the ground cover vegetation in this area.

STAND D. Mixed hardwood/brush area. This one-acre stand is dominated by brush species such as highbush blueberry, arrowwood and sweet fern with gray birch and red maple seedlings beginning to become established. Club moss, grasses, spirea, goldenrod and assorted wildflowers are also present.

Aesthetics and Preservation

No unusual or exceptionally valuable vegetation types or conditions were observed on this tract.

Impact of Proposal on Vegetation

A substantial amount of clearing of vegetation will be necessary for the development of this project. Increased runoff during and after construction may cause erosion and loss of soil from the site. Proper erosion controls and the reestablishment of vegetative cover (sod) as soon as possible will reduce sedimentation and siltation of Hop Brook. Removal of the vegetation as required by the project should not negatively affect surrounding vegetation.

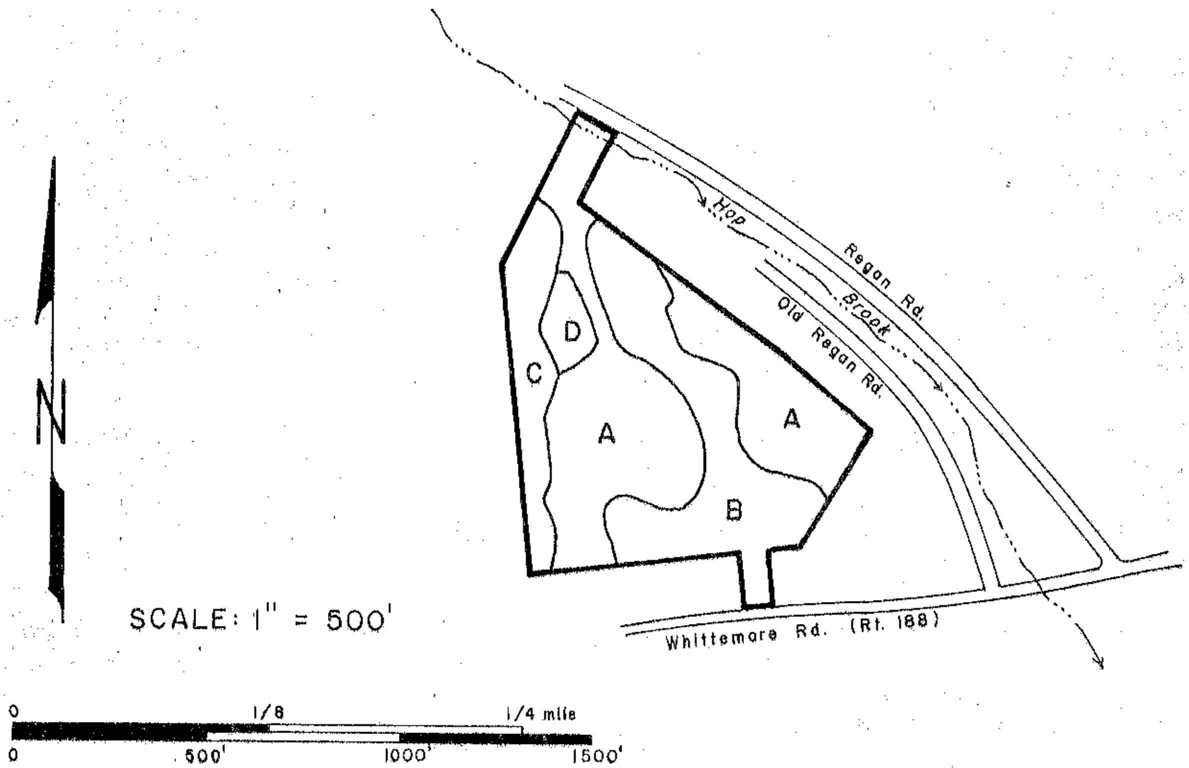
Limiting Conditions

The permanently high water table and poor soil aeration in Stand C (hardwood swamp) limits vegetation growth to species that can tolerate excessive moisture conditions. Early crowding of the red maple and white ash which are able to survive under these conditions has resulted in trees which are presently slow growing, tall and small crowned.

The soils in Stand B (specifically the Hollis part) are shallow to bedrock. The shallowness of this soil limits moisture reserves for plants and also restricts the depth of tree root systems. These conditions cause the trees present to be slow growing and widely dispersed.

FIGURE 4.

VEGETATION MAP



VEGETATION STAND DESCRIPTIONS*

STAND A Mixed hardwoods, overstocked pole-size, 6 acres.

STAND B Mixed hardwoods, understocked sapling size, 4 acres.

STAND C Hardwood swamp, overstocked sapling to pole size, 2 acres.

STAND D Brush, 1 acre.

LEGEND

- Road
- Stream
- Property Boundary
- Vegetation Type Boundary

*Seedling size = trees less than 1 inch in diameter at breast height (d.b.h.)
Sapling size = trees 1 to 5 inches in d.b.h.
Pole size = trees 5 to 11 inches in d.b.h.

Potential Hazards and Mitigating Practices

Windthrow is a potential hazard in the hardwood swamp (Stand C). As a result of the high water table, the trees present in this stand are extremely shallow rooted and unable to become securely anchored. The tallness and crowded condition of the pole-size trees in this stand increases the potential for windthrow. At present these trees rely on each other for stability. If linear openings are made in, or right along side, this stand, the windthrow hazard may be increased. Any openings, which would allow wind to pass through rather than over this stand, should be avoided if at all possible.

Suggested Management and Utilization of Resources

The trees in Stand A (mixed hardwoods) are crowded; this condition is starting to cause a general decline in tree health and vigor. A thinning in this stand, removing approximately one-third of the total volume will reduce competition between residual trees for space, light, water and nutrients. Over time, the trees remaining in this stand will respond by becoming healthier and more stable. This fuelwood thinning should be focused on removing poor quality trees, damaged trees, and those trees that are directly competing with high quality desirable trees. This thinning, if implemented, will produce between four and five cords of fuelwood per acre. A publicly employed service forester could be contacted if further assistance is desired.

The nature of this project demands extensive clearing of the vegetation on up to 50% of this tract. Trees which are removed should be utilized as fuelwood.

VII. PLANNING CONSIDERATIONS

Consistency of Project with Adopted Plans

The proposed school site has been identified as best suited for residential development in both the Middlebury Plan of Development and the Central Naugatuck Valley Regional Planning Agency's Regional Plan of Development. The development of a school facility at the subject site is not necessarily inconsistent with either Middlebury's zoning regulations or the Regional Plan of Development as long as proper steps are taken to buffer the school facility from nearby residential dwellings. According to the Zoning Regulations of the Town of Middlebury, schools are listed as a permitted use in this residential district.

The proposed school facility would be within 500 feet of approximately 20 dwellings located on Route 188, Regan Road, Edwards Road and Algin Drive. Consequently, the school facility should include consideration for planting vegetative buffers along property lines so as to minimize aesthetic and noise problems with the surrounding neighborhood.

Sewer Service

According to the Middlebury Sewer Commission clerk the proposed school site is served by an eight inch sewer line on Route 188. The sewer line has ample capacity to handle the wastes generated by a projected school population of 500 students and 37 staff. Furthermore, the wastes generated by the projected school population will not have any adverse effect on the remaining capacity of the Naugatuck sewage treatment plant.

Access

Vehicular access to the site will be off of Route 188. Route 188 is a State road with relatively low traffic volumes. In 1977 the average daily traffic count on Route 188 was 2100 vehicle trips. It is estimated that the proposed school facility will generate about 150 vehicle trips per day. This level of traffic volume can easily be accommodated on Route 188 since this road has a relatively low vehicle to capacity ratio. Furthermore, it is unlikely that any road improvements would be needed on Route 188 since it is a well maintained State highway.

Energy Considerations

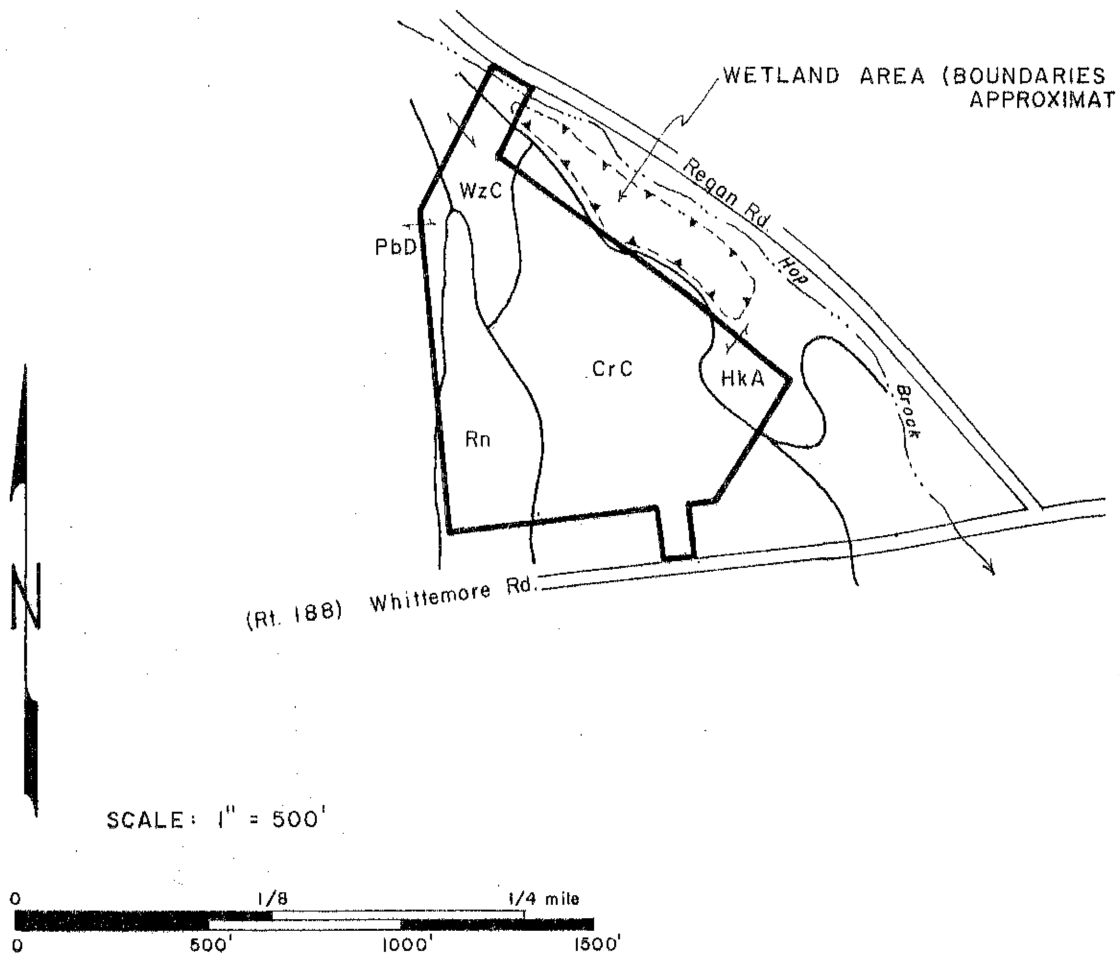
With the rising cost of fossil based fuels, alternative energy sources have become more attractive options. There are several ways that the proposed school facility could optimize the use of renewable energy resources and be adapted to the local micro climate. Orienting buildings to the south and including south facing double or triple glazed windows is one of the easiest ways of making use of passive solar design concepts. This would require amending the latest school site plan proposal so that the front of the building faces more toward true south. In addition, consideration should be given to 1) earth berming of outside walls where appropriate (to reduce heat loss), 2) reduced window surface on the north sides of the school facility (to reduce heat loss), 3) increased insulation for walls and ceilings and 4) vegetative windbreaks along the north and northwest corners of the building to reduce the speed of prevailing winter winds. Furthermore, tree plantings along the east and west sides of the building could also be useful for shading classroom windows from extreme summer sunlight.

* * * * *

APPENDIX

SOILS MAP

- ADAPTED FROM NEW HAVEN COUNTY SOIL SURVEY, DEVELOPER'S SITE PLAN, & ON-SITE INVESTIGATION.
- SOIL BOUNDARY LINES DERIVED FROM SMALLER SCALE MAP (1" = 1320') AND SHOULD NOT BE VIEWED AS PRECISE BOUNDARIES BUT RATHER AS A GUIDE TO THE DISTRIBUTION OF SOILS ON THE PROPERTY.



SOILS LIMITATION CHART

MAP SYMBOL	SOIL NAME	SHALLOW EXCAVATIONS		BUILDINGS WITHOUT BASEMENTS		LAWNS AND LANDSCAPING		DRIVEWAYS	
		RATING	REASON	RATING	REASON	RATING	REASON	RATING	REASON
RN	Ridgebury, Leicester, and Whitman extremely stony fine sandy loams	Severe	Wetness, Large Stones	Severe	Wetness, Frost Action, Large Stones	Severe	Wetness, Large Stones	Severe	Wetness, Frost Action
CrC	Charlton-Hollis fine sandy loams, 3 to 15% slopes	Severe	Large Stones, Depth to Rock	Severe	Large Stones, Depth to Rock	Severe	Large Stones, Depth to Rock	Severe	Depth to Rock
WzC	Woodbridge, extremely stony fine sandy loam, 3 - 15% slopes	Severe	Wetness, Large Stones	Severe	Frost Action, Large Stones	Severe	Large Stones	Severe	Frost Action
PbD	Paxton, fine sandy loam, 15 to 25% slopes	Severe	Slope	Severe	Slope	Severe	Slope	Severe	Slope
HKA	Hinckley gravelly sandy loam, 0 to 3% slopes.	Severe	Sm. stones, Cutbacks cave	Slight	--	Severe	Sm. Stones, Droughty	Slight	--

EXPLANATION OF RATING SYSTEM:

1. SLIGHT LIMITATION: indicates that any property of the soil affecting use of the soil is relatively unimportant and can be overcome at little expense.
2. MODERATE LIMITATION: indicates that any property of the soil affecting use can be overcome at a somewhat higher expense.
3. SEVERE LIMITATION: indicates that the use of the soil is seriously limited by hazards or restrictions that require extensive and costly measures to overcome.

NOTE: Based upon U.S.D.A. Soil Conservation Service limitation ratings.

SOIL DESCRIPTIONS

REGION #15 SCHOOL SITE, MIDDLEBURY, CT.

CrC -- Charlton-Hollis fine sandy loams, 3 to 15 percent slopes.

This complex consists of gently sloping and sloping, well drained soils on uplands where the relief is affected by the underlying bedrock. Slopes are concave or convex and mostly 50 to 300 feet long. The areas have a rough surface with bedrock outcrops and a few narrow intermittant drainageways and small wet depressions. In most areas, 3 to 25 percent of the surface is covered with stones and boulders. The areas are mostly 5 to 125 acres in size. Approximately 45 percent of these areas is Charlton fine sandy loam, 30 percent is Hollis fine sandy loam, and about 25 percent is other soils.

The Charlton and Hollis soils are in such a complex and intermingled pattern that they could not be separated in mapping. The typical Charlton soil has a dark brown fine sandy loam surface layer 2 inches thick. The subsoil is dark brown, yellowish brown, and light olive brown fine sandy loam 24 inches thick. The substratum, to a depth of 60 inches, is grayish brown, gravelly fine sandy loam that has a few firm lenses up to 4 inches thick. The typical Hollis soil has a very dark brown fine sandy loam surface layer 3 inches thick. The subsoil is dark brown fine sandy loam 11 inches thick, and it overlies hard, unweathered schist bedrock.

Included with this complex in mapping are small areas, generally less than 1 acre in size, of moderately well drained Sutton soils, well drained Paxton and Agawam soils, and poorly drained Leicester soils. In a few areas the stones and boulders have been cleared. Also included are many small and intermingled areas where the bedrock is 20 to 40 inches from the surface. Included areas make up 5 to 20 percent of this map unit.

The Charlton soil has moderate or moderately rapid permeability. It has a high available water capacity. Runoff is medium to rapid. This soil has a low shrink-swell potential. The Hollis soil has moderate or moderately rapid permeability above the bedrock. It has a low available water capacity. Runoff is medium to rapid. Both soils are very strongly acid through medium acid, if they are not limed.

Most of this complex is in woodland. Cleared areas are mainly used for pasture or are idle. Only a few areas are used to grow hay. A significant and rapidly increasing acreage is being used for community development.

This complex has fair to poor potential for community development. The Charlton soil has fair potential for community development. It is limited mainly by the steepness of slopes and stoniness. The Hollis soil has poor potential for community development. It is limited mainly by the bedrock at a depth of 10 to 20 inches. Excavations are often difficult on this soil complex because of the shallowness to bedrock in many places. Very careful planning, site location, design, and installation are necessary to insure that onsite waste disposal systems function satisfactorily.

Many areas of this complex provide a scenic and picturesque setting for homesites. Outcrops, stones and boulders are often left undisturbed for their esthetic value. In many places they provide acreative opportunity for the unusual design of homes or other structures.

During construction of community developments, conservation measures such as temporary vegetation and siltation basins are frequently needed to prevent excessive runoff, erosion and siltation.

This soil complex is suitable for growing trees. Most of this complex is presently in woodland. The Charlton soil has moderate productivity. The Hollis soil has low productivity because of a severe hazard of seedling mortality and a moderate hazard of tree windthrow caused by the shallow rooting zone above the bedrock. Machine planting is somewhat difficult, but feasible in areas without stones and boulders; however, it is not feasible in most areas because of the stoniness, rock outcrops, and shallowness to bedrock. Trees to favor in existing woodlots are eastern white pine, northern red oak, sugar maple, and red maple. Tress to plant are eastern white pine, white spruce, European larch, and eastern hemlock.

The included Sutton, Leicester, and Paxton soil have fair or poor potential for onsite septic systems: Sutton and Leicester soils because of a slowly permeable substratum. The included Agawam soils have good potential for onsite septic systems. The areas with bedrock at a depth of 20 to 40 inches have poor potential for onsite septic systems.

HkB -- Hinckley gravelly sandy loam, 3 to 8 percent slopes.

This gently sloping, excessively drained soil is on outwash terraces of stream valleys. Slopes are smooth or complex and are mostly less than 200 feet long. The areas dominantly are irregular in shape and 3 to 45 acres in size.

Typically, the surface layer is dark brown gravelly sandy loam 8 inches thick. The upper part of the subsoil is strong brown gravelly sandy loam 5 inches thick, and the lower part is brown gravelly loamy sand 3 inches thick. The substratum, to a depth of 60 inches, is yellowish brown stratified sand and gravel.

Included with this soil in mapping are small intermingled areas, generally less than 1 acre in size, of the well drained Agawam and Haven soils and the moderately drained Ninigret soils. In a few areas, the soils are not so gravelly. Included areas make up 5 to 15 percent of this map unit.

Permeability is rapid inthe surface layer and subsoil and very rapid in the substratum. This soil has a low available water capacity. Runoff is medium. This soil dries out and warms up rapidly in spring. It has a low shrink-swell potential. Unless the soil is limes, the reaction ranges from medium acid through very strongly acid.

HkB - Continued

Most areas of this soil have been cleared and are used as cropland. Much of the acreage is now idle. A small acreage is woodland. A rapidly increasing acreage, mainly in the southern part of the county, is used for community development.

This soil has good potential for community development. It is easy to excavate; however, the steep slopes of excavations are unstable. The droughtiness of this soil is a major concern in landscaping. Irrigation or sprinkling is needed in summer. Waste disposal systems, such as septic tank absorption fields, will function satisfactorily with normal design and installation; however, the very rapid permeability requires that caution be taken to prevent the pollution of ground water. This soil has fair potential for use as sites for commercial buildings and is limited mainly by steep slopes. During periods of construction, simple conservation measures generally are adequate to prevent excessive runoff, erosion, and siltation.

This soil is fairly well suited to growing trees. Productivity is low because this soil is droughty. Seedling mortality is severe because the soil lacks sufficient moisture to sustain the seedlings. Trees to favor in existing woodlots are eastern white pine, northern red oak, and sugar maple. Trees to plant in open areas are eastern white pine and European larch.

The included Agawam and Haven soils are similarly suited to community development. They are better suited to landscaping than this Hinckley soil because they are not droughty. This included Ninigret soil has poor potential for septic tank absorption fields because it has a seasonal high water table at a depth of about 20 inches.

PbD - Paxton fine sandy loam, 15 to 25 percent slopes.

This moderately steep, well drained soil is on the sides of drumlins, hills, and ridges of glacial uplands. Slopes are smooth and convex and generally are 150 to 600 feet long. The areas are dominantly bong and narrow or oval in shape and 5 to 60 acres in size.

Typically, the surface layer is dark brown fine sandy loam 8 inches thick. The subsoil is dark yellowish brown and olive brown fine sandy loam 15 inches thick. The substratum, to a depth of 60 inches, is olive, very firm gravelly fine sandy loam.

Included with this soil in mapping are small intermingled areas, generally less than 1 acre in size, of well drained Charlton soils, moderately well drained Woodbridge soils, and somewhat excessively drained Hollis soils. In a few areas, up to 15 acres in size, as much as 3 percent of the surface is covered with stones and boulders. Included areas make up 5 to 15 percent of this map unit.

Permeability is moderate in the surface layer and subsoil and slow in the substratum. This soil has a moderate available water capacity. Runoff is rapid. This soil tends to dry out and warm up slowly in spring. It has a low shrink-swell potential. Unless limed, this soil is strongly acid through slightly acid.

This soil has poor potential for community development. It is limited mainly by the steepness of slopes and the slowly permeable substratum. Building houses and roads and installing septic systems and water and sewer lines are more expensive on this soil than on less sloping soils. This soil is fairly easy to excavate, but the substratum is very firm and generally has stones and boulders. Because of the slowly permeable substratum, waste disposal systems, such as septic tank absorption fields, generally do not function satisfactorily without very careful design and installation. Precautions need to be taken to insure that effluent does not seep to the surface in areas downslope from the disposal system. Intensive conservation measures are needed to prevent excessive runoff, erosion, and siltation during periods of construction.

This soil is suited to trees. Productivity is moderately high. Use of equipment is somewhat limited by the steepness of slopes. Machine planting is practical in the open areas, although it is hampered somewhat by slope. Trees to favor in existing woodlots are eastern white pine, northern red oak, and sugar maple. Trees to plant in open areas are eastern white pine, European larch, and Norway spruce.

The included soils have poor potential for septic systems. Charlton soils are limited by the steepness of slopes. Woodbridge soils by a seasonal high water table at a depth of about 20 inches and a slowly permeable substratum, and Hollis soils by bedrock at a depth of 10 to 20 inches.

RN -- Ridgebury, Leicester, and Whitman extremely stony fine sandy loams.

This undifferentiated group consists of nearly level to gently sloping, poorly drained and very poorly drained soils in drainageways and depressions on glacial uplands. Slopes are 0-5 percent and are mostly 50 to 300 feet long. Stones and boulders cover 3 to 25 percent of the surface. Approximately 40 percent of the acreage consists of Ridgebury extremely stony fine sandy loam, about 35 percent is Leicester extremely stony fine sandy loam, about 15 percent is Whitman extremely stony fine sandy loam, and about 10 percent is other soils. The areas of this unit are dominantly long and narrow or irregular in shape. They are mostly 3 to 80 acres in size.

The soils of this unit were not separated in mapping because they react similarly to most uses and to management. The composition of this unit is more variable than that of other units in the survey area, but the mapping and interpretations will not affect the expected use of this unit. Individual areas may have only one of the named soils; other areas may have all three of the soils in this unit. In many places, these soils are in an intricate pattern.

The typical Ridgebury soil has a very dark gray fine sandy loam surface layer 6 inches thick. The subsoil is mottled, grayish brown fine sandy loam 13 inches thick. The substratum, to a depth of 60 inches, is mottled, olive, very firm gravelly sandy loam.

Typically, the Leicester soil has a black fine sandy loam surface layer 6 inches thick. The subsoil is 17 inches thick. It is mottled, grayish brown, light grayish brown, and pale brown fine sandy loam. The substratum, to a depth of 60 inches, is mottled, dark yellowish brown, friable, gravelly fine sandy loam that has discontinuous firm lenses up to 4 inches thick.

The Whitman soil typically has 4 inches of decomposed and undecomposed litter over a black fine sandy loam surface layer, which is 6 inches thick. The subsoil is gray mottled fine sandy loam 16 inches thick. The substratum, to a depth of 60 inches, is olive, mottled, very firm gravelly sandy loam.

Included in mapping are areas, up to 3 acres in size, of the poorly drained Walpole soils, the very poorly drained Palms soils, and the moderately well drained Sutton and Woodbridge soils. In a few areas the surface is more than 25 percent stones and boulders, and in a few small areas slopes range to 10 percent. In a few areas, the surface layer is silt loam.

The Ridgebury and Leicester soils have a seasonal high water table at a depth of about 8 inches from late fall until mid-spring. The Whitman soils have a water table at the surface from fall through spring and after heavy rains. In many places, they are ponded for several weeks in winter. In summer, the water table may drop to a depth of 5 feet or more. These soils have moderate or moderately rapid permeability in the surface layer and subsoil. The Ridgebury and Whitman soils have slow or very slow permeability in the substratum , and the Leicester soils have moderate or moderately rapid permeability in the substratum. These soils have a high available water capacity. Runoff is slow or very slow. They have a low shrink-swell potential. Unless limed, the Leicester and Ridgebury soils are very strongly acid through medium acid; the Whitman soils are very strongly acid through slightly acid.

The soils of this unit have poor potential for community development. They are limited mainly by their seasonal high water table and stoniness. The Ridgebury and Whitman soils are also limited by a slowly permeable substratum. These soils are difficult to excavate because of the high water table and stoniness. The steep slope of excavations tend to slump when saturated. These soils have poor potential for building foundations and basements because footings are placed below the depth of the high water table. Because of the high water table much of the year and because of the slowly permeable substratum in the Ridgebury and Whitman soils, waste disposal systems, such as septic tank absorption fields, do not function satisfactorily without very unusual and costly design and installation. Even if carefully designed, they often have a high failure rate. The stoniness limits the use of these soils for homesites and landscaping. Removal of stones and boulders is very costly, and small areas are often left undisturbed for their esthetic value. During periods of construction, conservation measures are needed to prevent excessive siltation, runoff and erosion.

This unit has fair suitability for use as woodland. The Ridgebury and Leicester soils have moderate productivity; the Whitman soils have low productivity. These soils are limited mainly by their wetness and stoniness. Seedling mortality is high and windthrow is common because the high water table restricts the rooting depth for trees during much of the year. Woodland may, however, be one of the best uses of this unit. Trees to favor in existing woodlots are eastern white pine, sugar maple, red maple, and northern red oak. Trees to plant on the Ridgebury and Leicester soils are eastern white pine and white spruce.

The included Sutton and Woodbridge soils are better suited to community developments than the major soils. The Walpole and Palms soils have poor potential because of a high or very high water table much of the year. In addition, the Palm soils have 16-50 inches of organic material over the

WzC -- Woodbridge extremely stony fine sandy loam, 3 to 15 percent slopes.

This gently sloping and sloping, moderately well drained soil is on the top and sides of ridges and hills on glacial uplands. It has 3 to 25 percent of the surface covered with stones and boulders. Slopes are mostly smooth and concave. They are mostly 100 to 500 feet long. The areas are dominantly irregular or rectangular in shape and are mostly 5 to 50 acres in size.

Typically, the surface layer is very dark brown fine sandy loam 2 inches thick. The subsoil is 23 inches thick. It is dark yellowish brown fine sandy loam in the upper 16 inches and olive brown, mottled fine sandy loam below that. The substratum, to a depth of 50 inches, is olive, mottled, very firm gravelly fine sandy loam.

Included with this soil in mapping are small intermingled areas, generally less than 1 acre in size, of well drained Paxton soils, moderately well drained Sutton soils, and poorly drained Ridgebury soils. A few small areas have less than 3 percent of the surface covered with stones and boulders. The included areas make up 5 to 15 percent of this map unit.

From late in fall until mid-spring, this soil has a water table at a depth of about 20 inches. This soil has moderate permeability in the surface layer and subsoil and slow permeability in the substratum. The available water capacity is high. Runoff is medium to rapid. This soil tends to dry out and warm up slowly in the spring. It has a low shrink-swell potential. In areas that are not limes, this soil is strongly acid through medium acid.

This soil is mostly in woodland. A small acreage is cleared and is used as pasture, or it is idle. An increasing acreage is being used for community development.

This soil has fair potential for community development. It is limited mainly by the seasonal high water table at a depth of about 20 inches, its stoniness, and, in places, the steepness of the slopes. This soil is fairly easy to excavate, but in many areas it has stones and boulders below the surface as well as on the surface. Because of the seasonal high water table, excavations are frequently inundated. When the soil is saturated, steep slopes of excavations are unstable and tend to slump. Particular attention needs to be given to building houses that have a basement because the basement generally is below the depth of the water table. A wet basement results unless the soil is drained. Waste disposal systems, such as an onsite septic system, will generally not function with only normal design and installation because of the seasonal high water table and the slowly permeable substratum. Very careful and often costly design and installation are required to insure that onsite septic systems function satisfactorily.

WzC - Continued

Particular attention needs to be given to insure that effluent does not seep to the surface downslope from the system, especially if the system is installed on the steeper slopes. The stones and boulders hinder the installation of onsite septic systems in places. They also limit the use of this soil for landscaping. Removing the stones and boulders is costly, and large boulders are sometimes left undistrubed for their esthetic value. During construction of community developments, conservation measures are needed to control runoff, erosion and sedimentation.

This soil is well suited to trees. Productivity is moderately high. The stones and boulders somewhat hinder the use of some harvesting equipment and make planting generally not feasible. Trees to favor in existing woodlots are eastern white pine, sugar maple, and northern red oak. Tress to plant in open areas are eastern white pine and European larch.

The included Paxton and Sutton soils have fair potential for community development. Paxton soils are limited because of a slowly permeable substratum and Sutton soils because of a seasonal high water table at a depth of about 20 inches. Ridgebury soils have poor potential because of a high water table at a depth of about 8 inches and a slowly permeable substratum.