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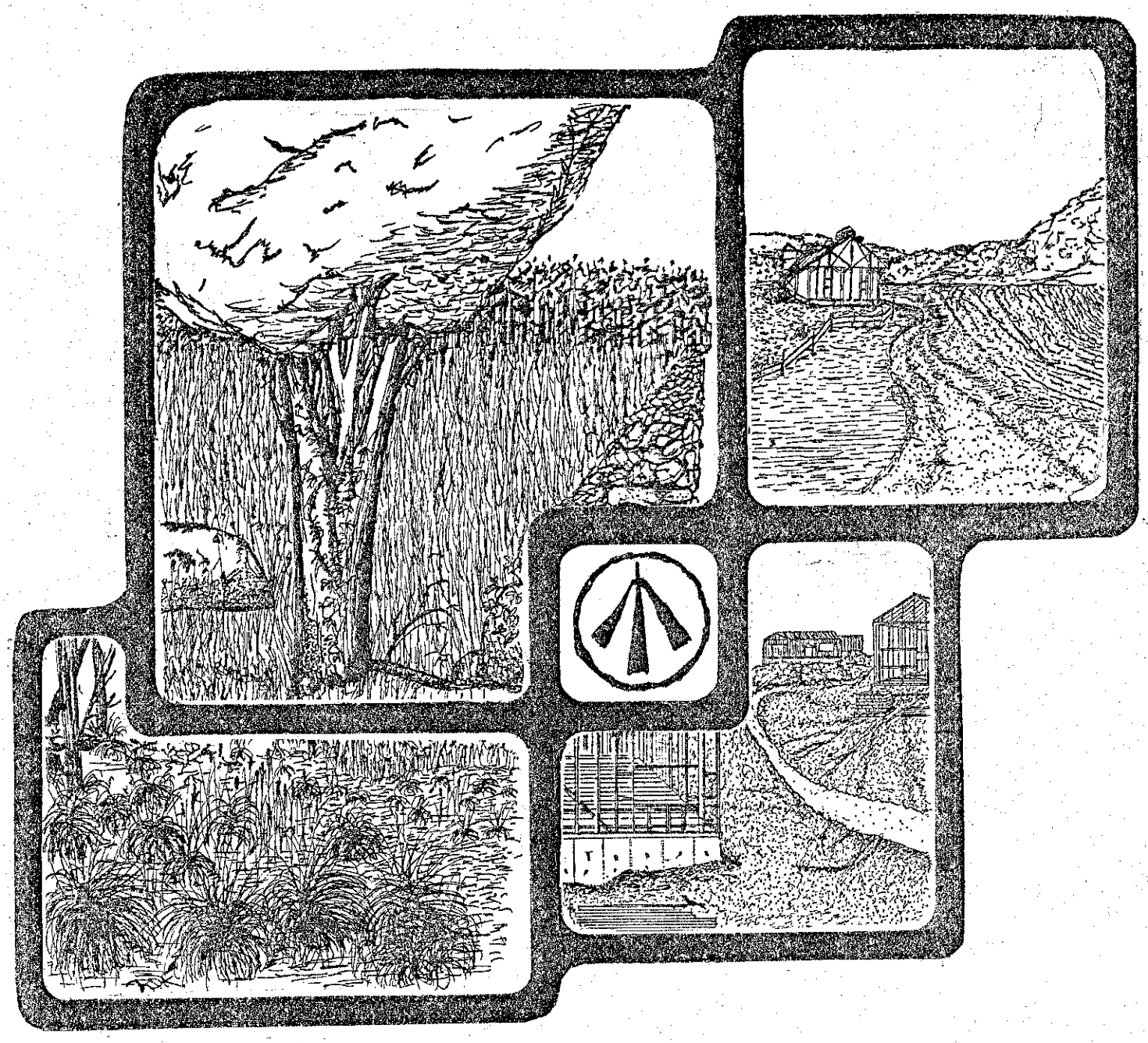
ENVIRONMENTAL REVIEW TEAM REPORT



SKY MEADOW SUBDIVISION
BETHLEHEM, CONNECTICUT

KING'S MARK
RESOURCE CONSERVATION & DEVELOPMENT AREA

KING'S MARK
ENVIRONMENTAL REVIEW TEAM REPORT

ON

SKY MEADOW SUBDIVISION
BETHLEHEM, CONNECTICUT

FEBRUARY 1980

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

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Stephen Driver, ERT Committee Chairman
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Staff Administration Provided By

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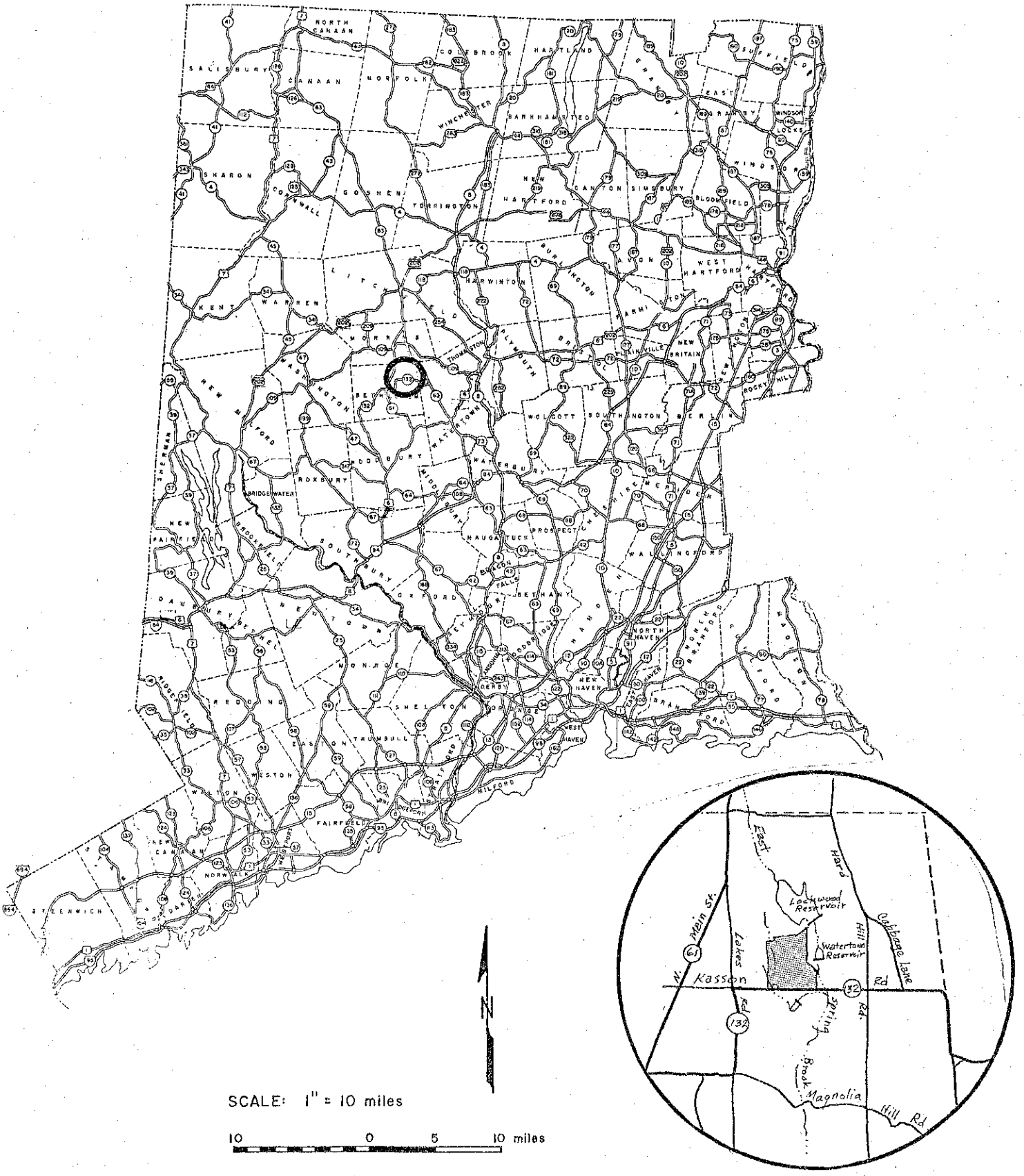
Bruce M. Ridgway, Chairman
Thomas A. J. McGowan, Director
Richard Lynn, ERT Coordinator
Rebecca West, ERT Draftsman
Irene Nadig, Secretary

TABLE OF CONTENTS

LIST OF FIGURES

LOCATION OF STUDY SITE

SKY MEADOW SUBDIVISION
BETHLEHEM, CONNECTICUT



ENVIRONMENTAL REVIEW TEAM REPORT
ON
SKY MEADOW SUBDIVISION
BETHLEHEM, CT.

I. INTRODUCTION

The Bethlehem Conservation Commission is presently reviewing a proposed plan of subdivision for ± 96.3 acres of land in the northeastern quarter of Town. The subject site, located just north of Kasson Road (Route 132), is characterized by open fields of moderate to steep slope (see Figure 1). Watertown Reservoir is located a few hundred feet east of the property and Lockwood Reservoir is located just north of the site. These two reservoirs, owned and operated by the Watertown Fire District, serve as a source of water supply to the Hart Farm well fields located south of the site in Woodbury.

The proposed project, known as "Sky Meadow Subdivision", would create 17 residential lots of 2 - 14 acres in size (see Figure 2). Each lot would be served by an on-site well and septic system. Access to the lots would be provided by constructing a ± 1,500 linear foot interior road off Kasson Road. Approximately 25 acres of the property would remain as open space according to the project plan.

The Conservation Commission from the Town of Bethlehem requested the assistance of the King's Mark Environmental Review Team to help the town in analyzing the proposed development. The Team was asked to identify the natural resources of the site and to highlight opportunities and limitations for the proposed land use. A major concern of the Town in requesting this environmental review is the probable impact of the project on the public water supply system of the Watertown Fire District.

The ERT met and field reviewed the site on January 2, 1980. Team members for this review consisted of the following:

Alan Buzzetti.....Principal Sanitarian.....State Department of Health

Donald Iannicelli.....Sanitary Engineer.....State Department of Health

Norman Cole.....Regional Planner.....Central Naugatuck Valley Regional Planning Agency

Gilbert Roberts.....Chief Sanitarian.....Torrington Area Health District

Robert Rocks.....Forester.....State Dept. of Environmental Protection

Michael Zizka.....Geohydrologist.....State Dept. of Environmental Protection

FIGURE 1.

TOPOGRAPHIC MAP

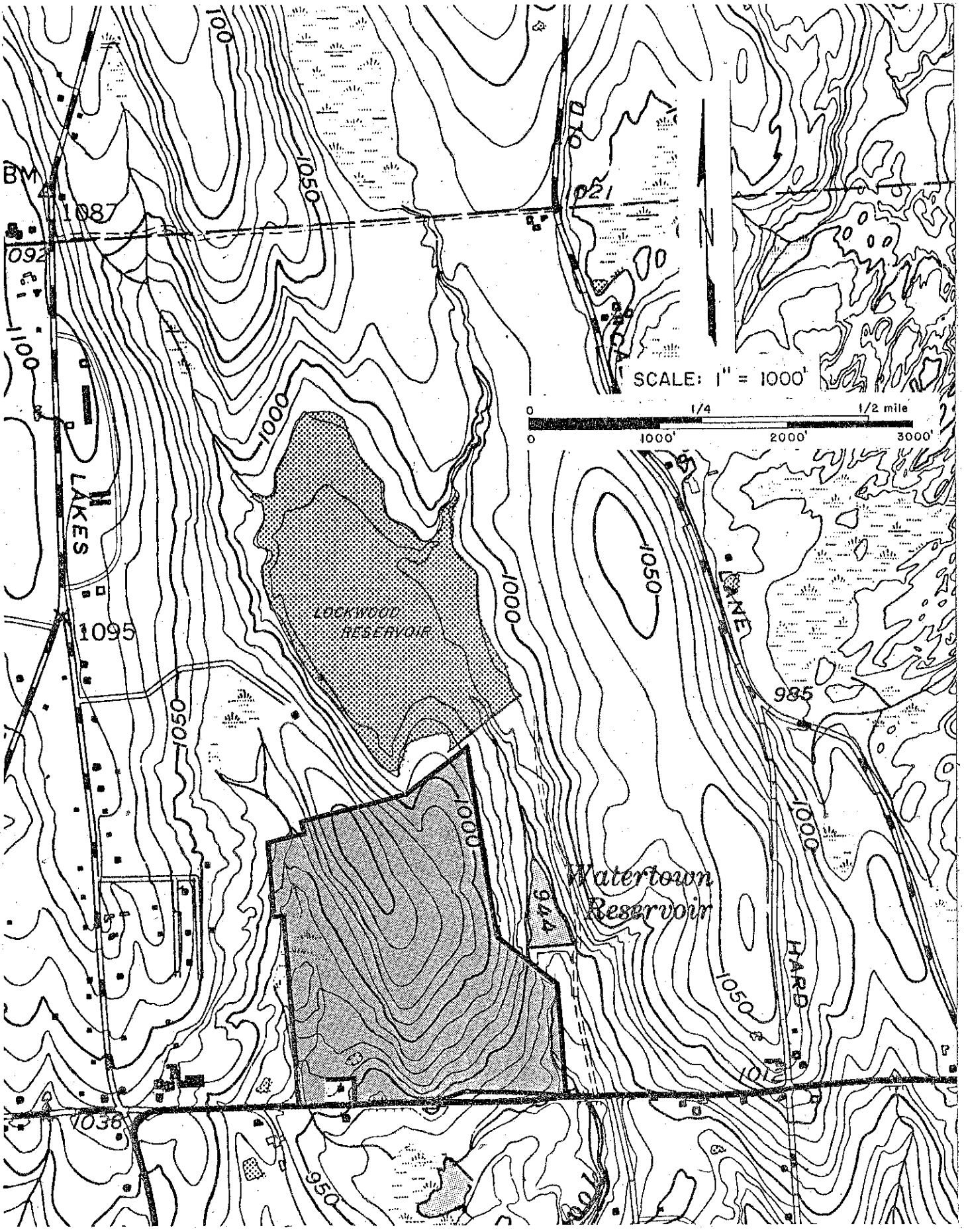
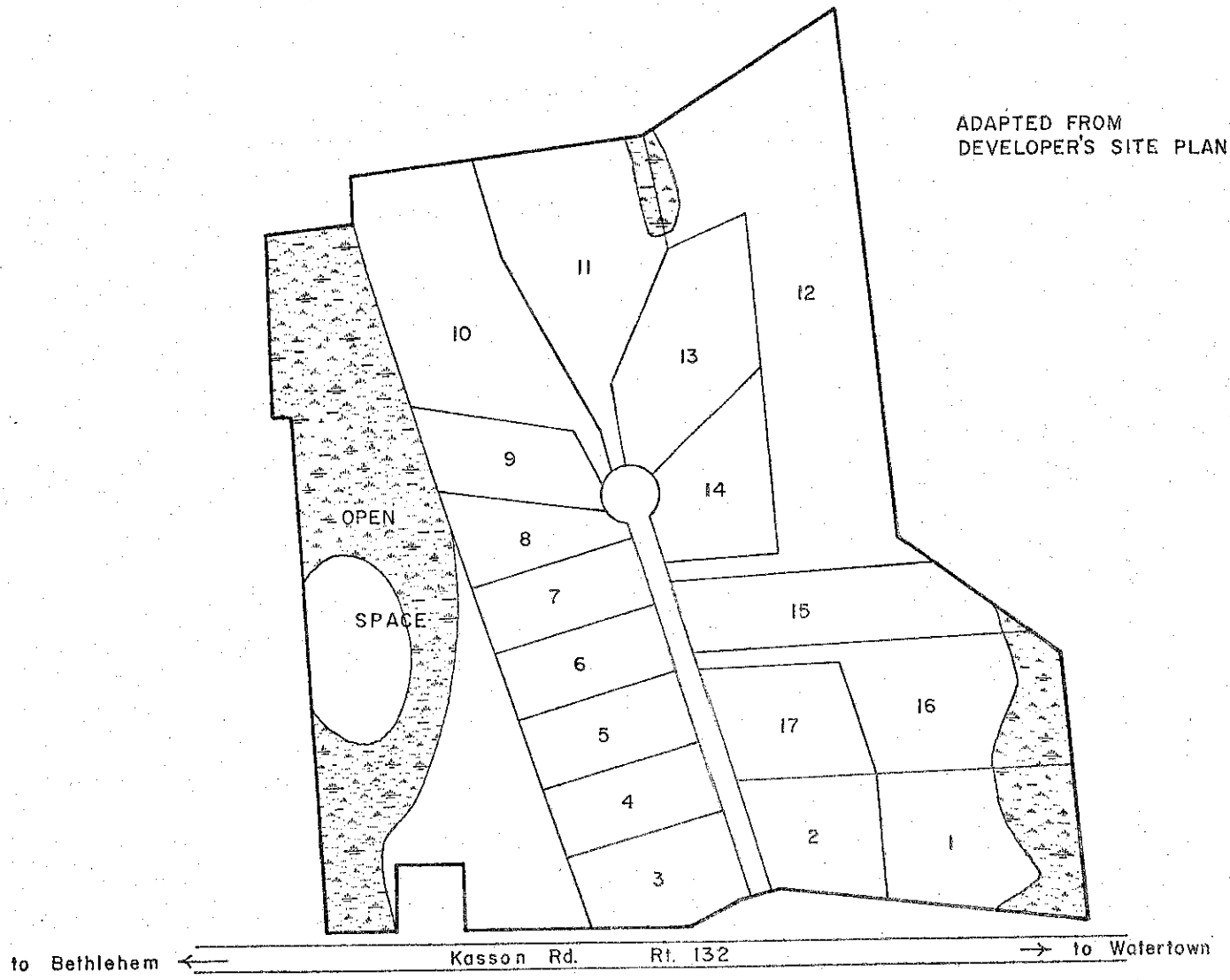


FIGURE 2.

SIMPLIFIED SITE PLAN



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. 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 preliminary development 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 Bethlehem and the landowner/developer 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 Sky Meadow Farm site is located within the Litchfield topographic quadrangle. A bedrock geologic map (Connecticut Geological and Natural History Survey Miscellaneous Series No. 3, by R. M. Gates, 1951) and a surficial geologic map (U.S. Geological Survey Map GQ-848, by C. R. Warren, 1970) of that quadrangle have been published. No bedrock outcrops were observed on the site, but bedrock is inferred to be within 10 feet of the surface in the wetland area on the western side of the property (see Figure 2). The bedrock underlying the site is interpreted to be part of the Hartland Formation. This formation consists largely of interbedded mica quartzites and mica-quartz schists. Less abundant minerals include plagioclase, garnet, staurolite, kyanite, apatite, pyrite, and zircon.

Overlying the bedrock on the site is a loose to compact glacial sediment known as till. Till consists of rock particles of widely ranging sizes (from clay to large boulders) and shapes (from flat to angular to rounded). Most of this sediment was deposited by lodgement beneath the former ice sheet, but some may have been let down from within or from the surface of the ice as it was wasting during the period of glacial retreat. As a result of these different processes, the upper few feet of till are commonly sandy and loose while the lower portion is silty to clayey, blocky, and compact. The long axis of the hill on which the property is located is oriented in the apparent direction of the former glacier's advance.

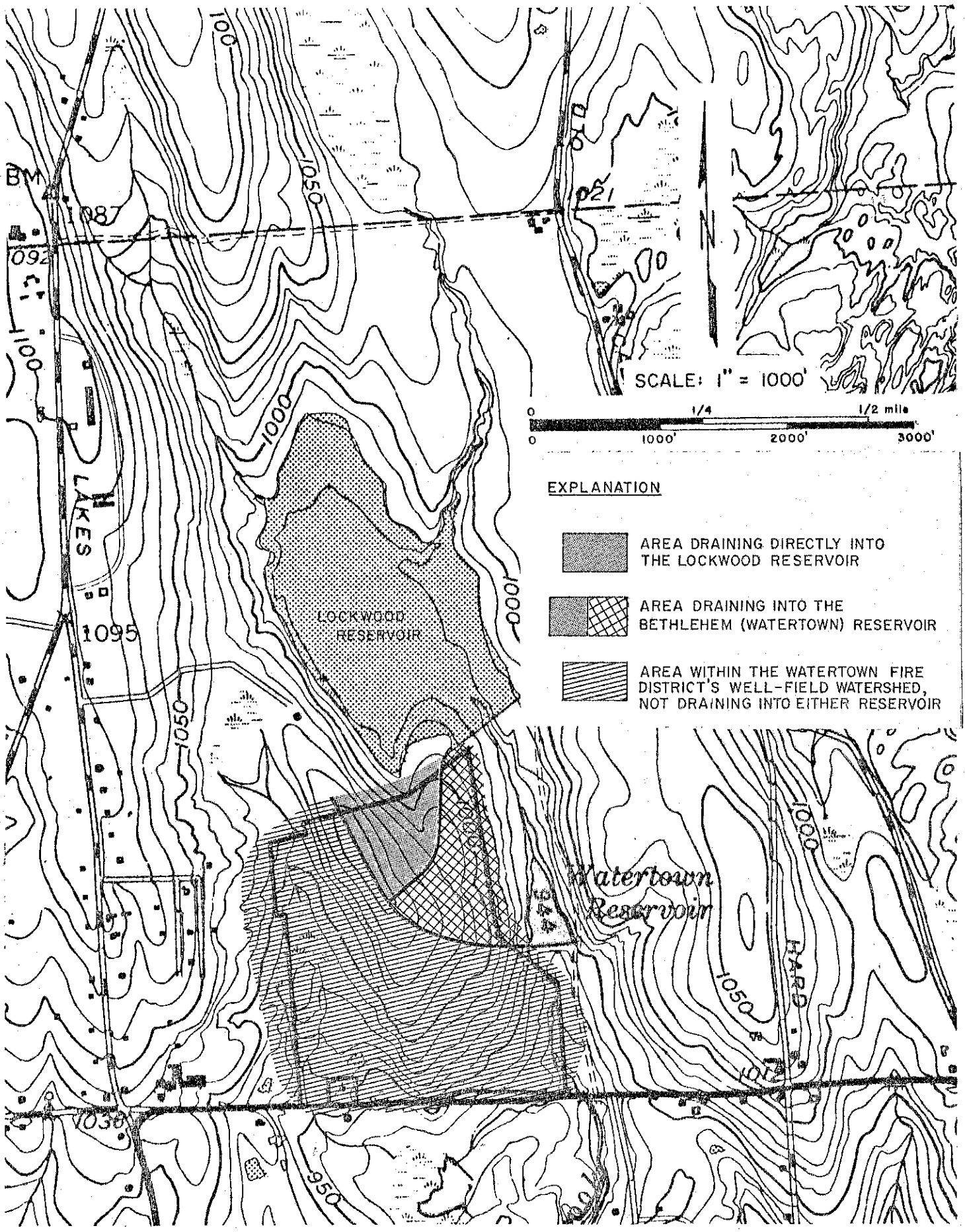
III. HYDROLOGY

The entire site lies within the watershed of East Spring Brook, a tributary of Nonewaug River. The eastern part of the property (parts of lots 1, 15, 16 and 17, and virtually all of lots 11-14) drains directly into the East Spring Brook channel, which includes both the Lockwood and the Bethlehem (Watertown) Reservoirs. The remainder of the property drains into a broad, flat, wet area on the southern and western boundaries of the site. A small stream flows through this wet area, crossing Route 132 twice and ultimately joining East Spring Brook near the southeastern corner of the site. Approximately 3.5 miles to the south, in the northeastern corner of the Town of Woodbury, a series of wells has been drilled in the stratified drift along Nonewaug River to provide water for the Watertown Fire District. Pumping tests from these wells showed yields ranging from 80 gallons per minute (gpm) to 215 gpm (source: Connecticut Water Resources Bulletin No. 20). Part of the yield probably derives from induced infiltration from the river, particularly during drier periods. For this reason, it is important to maintain the quality of the river's water.

Because water is not presently pumped from either the Lockwood or the Bethlehem Reservoirs for water supply, it is incorrect to restrict the designation of "public water-supply watershed" to only those parts of the site that contribute runoff directly to the reservoirs. In fact, the entire property lies within the watershed of the Watertown Fire District's wells (although most of the watershed affects the groundwater quality at the well site only indirectly, through induced infiltration). This does not mean that it is undesirable to examine the reservoirs' drainage area as a separate entity; indeed, the reservoirs may ultimately become sites of water withdrawal. At present, however, the entire parcel must be treated as lying within a public water-supply watershed. Figure 3 shows the section of the site that drains directly into the reservoirs.

FIGURE 3.

DRAINAGE AREAS MAP



Site examination, test pit reports provided by the landowner's engineer, and soils data all indicate that a seasonally high groundwater table is present throughout the area to be developed. Mottling (an indication of prolonged water saturation) was observed by the engineer in all test pits at depths ranging from 18 inches to 36 inches. Moreover, several eroded gullies were seen emanating from wet, spongy areas on the hillside during the field review. These wet areas apparently mark sites at which the water table has risen almost to the surface. The establishment of lawns by the new landowners will help to check erosion following development, but careful erosion-control methods will be especially needed during construction to prevent erosion and siltation problems, particularly with regard to the Bethlehem Reservoir.

The major concern involving the high water table is the potential effect upon proper operation of subsurface sewage disposal systems. As the engineer's report indicates, placement of fill on the sites proposed for leaching fields will be necessary to maintain required distances above the high groundwater level. The engineer has also recommended placing impervious barriers on all fill slopes. This would be necessary to prevent "breakout" of effluent at the toes of such slopes. The impervious barrier should penetrate the topsoil zone to "force" effluent to percolate through the natural soil horizons. This would help to assure proper renovation as well as to minimize the opportunity for leakage at the fill-topsoil interface. A properly engineered septic system can overcome high groundwater limitations, but extreme caution and careful planning is required. Additional discussion of the suitability of this site for subsurface sewage disposal is presented in the "Septic System" section of this report.

IV. WATER SUPPLY

Homes in the proposed subdivision would be supplied with water by on-site wells. The only suitable aquifer available is bedrock. Yields from bedrock wells depend upon the number and size of water-bearing fractures that are intersected by the wells. Density and size of fractures in different bedrock zones vary widely, but in general both are greater in granular rock than in schist. Since the Hartland Formation comprises both types of bedrock, the ultimate yields may depend upon the particular type tapped. In either case, however, there would be at least an 80-percent chance that a well at any site could yield at least 2 gallons per minute (gpm) and at least a 68-percent chance that it could yield at least 3 gpm (source: Connecticut Water Resources Bulletin No. 19). Such yields should prove adequate for the household needs of an average family. In most cases, no more than 150 feet of bedrock should have to be penetrated to obtain these yields. If less than 1 gpm is achieved after drilling through 150 feet of rock, it may be more fruitful to drill in an alternate location than to extend the first well, as the density and size of fractures decreases markedly at such depths. It must be remembered, however, that the 150 feet refers to bedrock only and does not include overburden. In some parts of the site, the overburden alone may be several tens of feet thick.

A properly cased well probably would be safe from effluent contamination on this site. Surface water contamination is the greater threat, as explained above. Natural groundwater quality should be good, although some possibility of undesirably high mineral (particularly iron or manganese) content exists. Should well water prove to be high in mineral content, several filtration methods are available to overcome any problems.

V. VEGETATION

The 96 ± acre site proposed for development into "Sky Meadow Subdivision" may be divided into four vegetation types (see Figure 4). A description of each vegetation type, together with recommendations for management, is presented below.

Vegetation Type Descriptions

TYPE A. Open Field/Agricultural land. Seventy-five acres of open fields are present on this property. At the time of the field review this area was vegetated by grasses, goldenrod, clover, Queen Ann's lace, thistle, burdock and in the wetter areas, near route 132, sedges.

TYPE B. Hardwood Swamp. This 13 acre over-stocked stand is made up of poor quality sapling to pole-size red maple in clumps with scattered sugar maple, white ash, American elm, black cherry and gray birch. The understory is dominated by arrowwood and spice-bush with occasional hardwood tree seedlings, alternate-leaved dogwood, shadbush, raspberry and multiflora rose. Ground cover vegetation consists of skunk cabbage, dewberry, sensitive fern, cinnamon fern and poison ivy.

TYPE C. Open swamp. Several species of sedges are present in this 5-acre open swamp, with tussock sedge predominating. Skunk cabbage, cinnamon fern and sphagnum moss are also present. The edges of this open swamp are densely vegetated with spice-bush and speckled alder.

TYPE D. Open Mixed Hardwoods. This 3-acre stand is made up of widely scattered medium quality white ash, shagbark hickory and sugar maple, all in excess of 34 inches in diameter at breast height. These trees appear healthy but have several dead branches, which should be removed to avoid possible hazards. Understory vegetation includes occasional dense clumps of silky willow, pussy willow and elderberry. Grasses and sedges form the ground cover in this area.

Aesthetics and Preservation

Several stone walls present on this tract have medium quality pole-size black cherry, red maple and white ash growing along them (see vegetation type map). These stone walls and the trees growing along them improve the aesthetics of the area and add to the rural character of this part of Bethlehem and therefore should be preserved if possible.

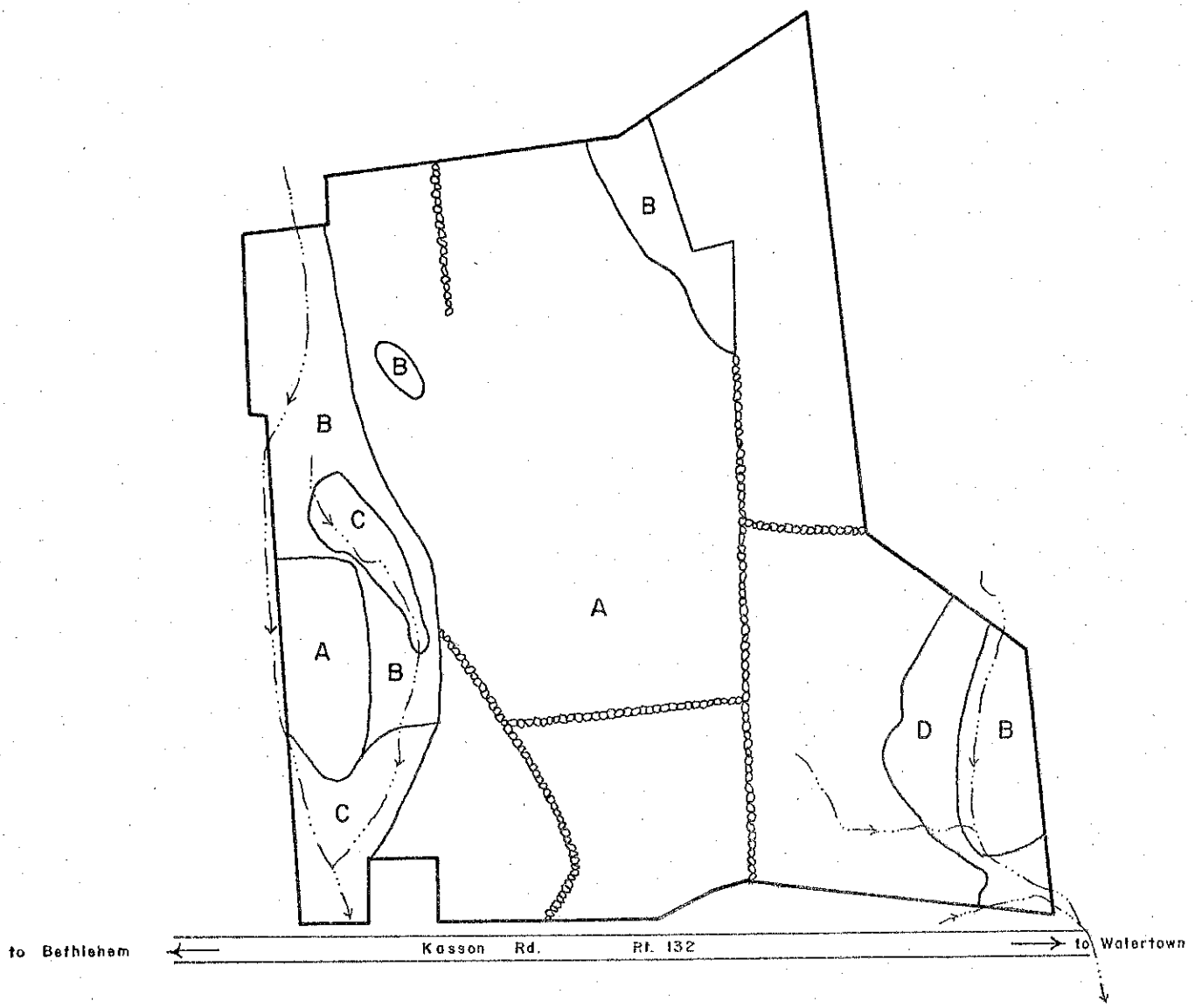
Area D has several mature white ash, shagbark hickory and sugar maple trees which, because of size, have high aesthetic appeal. These trees should also be preserved. The dead branches on these trees should be properly pruned to avoid potential hazards caused by falling branches.

Limiting Conditions

The high water table and accompanying poor soil aeration in the hardwood swamp (vegetation type B) and the open swamp (vegetation type C) limits vegetation growth to species tolerant of excessive moisture. Red maple and occasionally other hardwoods will survive under the conditions present in the hardwood swamp, however growth rates are usually slow and tree quality is generally poor due to over-crowding. The moisture conditions are more critical in the open swamp, where no tree species can survive at present.

FIGURE 4.

VEGETATION TYPE MAP



LEGEND

- ROAD
- PROPERTY BOUNDARY
- VEGETATION TYPE BOUNDARY
- STREAM
- STONE WALL DIVIDING OPEN FIELDS

VEGETATION TYPE DESCRIPTION*

TYPE A – OPEN FIELD/AGRICULTURAL LAND, 75 ACRES

TYPE B – HARDWOOD SWAMP, OVERSTOCKED, SAPLING TO POLE SIZE, 13 ACRES

TYPE C – OPEN SWAMP, 5 ACRES

TYPE D – OPEN MIXED HARDWOODS, UNDERSTOCKED, SAWLOG SIZE, 3 ACRES

*SEEDLING SIZE – TREES 1" AND SMALLER IN DIAMETER AT BREAST HEIGHT (D.B.H.)
SAPLING SIZE – TREES 1" – 5" IN D.B.H.
POLE SIZE – TREES 5" – 11" IN D.B.H.
SAWLOG SIZE – TREES 11" AND GREATER IN D.B.H.

Potential Hazards and Mitigating Practices

Windthrow is a potential hazard in the hardwood swamp. As a result of the high water table and saturated soils, the trees present are shallow rooted and unable to become securely anchored. The crowded condition of the trees in this stand increases the potential for windthrow if land disturbances occur. At present these trees rely on each other for stability. Any openings which would allow wind to pass through rather than over this stand will increase the windthrow hazard and should be avoided if possible.

It should be noted that permanent changes in the water table depth in the hardwood swamp area, caused by increased run-off or changes in natural drainage flows, may cause trees and shrubs in this area to die. Alterations which may permanently raise the water table in this area, and thereby drown vegetation, should be avoided.

Suggested Management Techniques

Although it is usually not feasible from an economic standpoint to practice timber management in hardwood swamp areas (such as area B), light thinnings in these areas from time to time can benefit and improve vegetation stability. Thinnings which remove about one quarter of the volume will reduce competition between residual trees, allowing them to respond by increased crown and root development, without increasing windthrow potentials. As the higher quality trees and desired species (such as white ash and sugar maple) are favored, and become healthy, the entire stand becomes more stable.

Thinnings of this nature become more feasible when a product, such as fuelwood is generated. At present a thinning in stand B will not produce much fuelwood because many of the trees have not reached fuelwood size. The condition of this "open space" hardwood swamp should be reevaluated at 5 to 10 year intervals to determine if management practices applied to improve vegetation health are feasible.

Potential of Proposed Lots for Vegetative Landscaping

Vegetative landscaping, including the planting of ornamental shrubs and trees is not seriously limited in any way, except perhaps due to excessive slopes on some lots.

The well-drained Paxton soils and the moderately well-drained Woodbridge soils with their hardpan layers located approximately two feet below the surface have excellent potential for growing shrubs and trees. These soils have an exceptionally favorable balance between soil moisture and soil aeration during the spring rapid growth season. The hardpan present in these soils may extend the rapid growth season well into the summer months. Ornamental shrubs and trees that normally grow well in direct sunlight in this part of Connecticut will grow very well on all of the proposed lots.

Evergreen trees such as white pine, hemlock or Norway spruce may be planted in 2 or more staggered rows approximately 8 feet apart to produce wind, sound and vision barriers between house lots. Flowering and fruiting shrubs could be planted just outside of these buffer strips to add variety, color, and food for wildlife.

It should be noted that most tree roots are unable to penetrate through the hardpan present in the soils on this property. Most trees are able only to become anchored in the soil above the hardpan. As the trees grow taller, the potential for windthrow may become moderately severe, especially during extended periods of rain and high winds, due to this impenetrable hardpan.

A local landscape architect should be contacted to supply information on availability of planting stock and also specific planting instructions.

VI. SOILS

A Soils Map of the property is presented in the Appendix of this report together with a Soils Limitation Chart. The Soils Map identifies the location of all soils identified on the property. The Soils Limitation Chart identifies the restrictions imposed by the various soils for alternate land uses.

As shown in the Soils Map, the property is dominated by three soil types.

Paxton soils, which occupy about 53% of the property, are well drained soils which developed in glacial till. They have a compact "hardpan" layer at a depth of about 2 feet. These soils are moderately permeable on the surface layer and subsoil but slow to very slow in the substratum. Most use limitations are associated with slow percolation rates, seasonal wetness, and large stones.

Approximately 26% of the site is characterized by Woodbridge soils. These soils consist of moderately well drained, nearly level to sloping soils which developed in compact glacial till. These soils are underlain by a compact layer, or hardpan, at a depth of about 24 inches. Their permeability is moderate in the surface layer and subsoil but is slow in the substratum. Most use problems are related to seasonal wetness and slow percolation.

Inland wetland soils (map symbol Lg) occupy about 17% of the site. These poorly and very poorly drained soils are unsuitable for residential development. They do, however, offer good potential as habitat for wetland wildlife. The wetland soils on the "Sky Meadow Subdivision" site are not proposed for construction according to the project plans.

According to Soil Conservation Service criteria, both Paxton and Woodbridge soils present severe limitations for subsurface sewage disposal due to slow percolation rates. Paxton soils present moderate limitations for buildings and roads, while Woodbridge soils present severe limitations for these uses. Although a severe limitation does not necessarily preclude use of the soil for a particular purpose it does indicate that extensive and costly measures are needed to overcome the limitations.

The U.S.D.A. Soil Conservation Service has prepared two technical reports on the proposed subdivision for the Bethlehem Conservation Commission dated August 1, 1978 and January 8, 1979. These reports discuss the general suitability of the soils for the proposed project, identify major soil problems, and discuss mitigating measures to lessen the impact of the project on the natural environment. Recommendations for erosion and sediment control are also contained in those reports. The interested reader is referred to those reports and the Litchfield County Soil Survey for more detailed discussion of the soils on the property.

VII. SEPTIC SYSTEMS

Based upon review of the engineering data submitted by the developer, as well as field evaluation, the following comments and recommendations are made concerning the feasibility of this site for subsurface sewage disposal.

1) As discussed previously, a major portion of the "Sky Meadows subdivision" site contains soil types which have a high seasonal water table. Septic systems installed in this type of soil must incorporate a curtain drain to prevent systems from "drowning". Curtain drains are groundwater control drains designed to collect and divert groundwater moving laterally away from the sewage disposal area. Curtain drains are located on the uphill side of leaching systems and on the sides if necessary.

The Public Health Code requires a 50 foot separation distance between a curtain drain and sewage disposal system on public water supply watershed lands. Due to the moderate-steep slope conditions characteristic of this particular site, however, the Torrington Area Health District is considering a reduction in this requirement if certain design criteria are met. The reason such a variance is being considered is as follows. Curtain drain efficiency is greatly reduced the further uphill the interceptor portion of the drain is located from the sewage disposal system. Effectiveness of groundwater control by drains located much greater than 25 feet from septic systems is questionable. In order for such drains to be relied upon, installation of the drain and monitoring during the wet time of the year would be required. On the other hand, locating curtain drains any closer than 25 feet from the leaching system runs the risk of septic effluent infiltrating the curtain drains with subsequent discharge via the drain onto the land surface. It is therefore necessary to strike a balance between locating curtain drains too close to the septic system and locating them too far away.

The specific situation where such a variance may be considered on this site is where the location of the bottom of a curtain drain will be hydraulically upgradient of the pipe invert of the highest (uppermost) leaching trench. In no such case, however, will variance be granted for locating the upgradient curtain drain any closer than 25 feet from the leaching system. Under this variance, then, the drain would be placed between 25 and 50 feet from the leaching system. In no situation should any portion of a down gradient curtain drain be located within 50 feet of the leaching system on this property.

The high groundwater elevations throughout the area dictate that curtain drain designs and construction utilize ½ inch broken stone or ½ inch screened gravel for the entire curtain drain depth.

Curtain drain discharges on this property should be located at least 50 ft. from the reservoirs and any other watercourses (intermittent streams included).

2) The Sky Meadow parcel contains a number of small tributaries formed either by runoff from natural swales or by excavated drainage systems. Although these water courses may be dry during summer months, it appears that water flows occur for a major part of the year, particularly following heavy rains. Torrington Area Health District regulations require a minimum separating distance from these watercourses of 75'. The town of Bethlehem requires 150'. These tributaries are not shown on the proposed subdivision map, but it would seem that in some cases the

flow is relatively close to the area chosen for subsurface sewage disposal. With specific reference to Parcel #12, (small eroded watercourse to Watertown Fire District Land) and Parcels #1, 2, 17 and 16, (formation of a "Y" branch tributary which discharges to wetland area) these tributaries must be accurately located on the plan before a complete evaluation of the sewage disposal potential can be made.

3) The data provided by the site engineer indicates that soil tests were conducted at different times of the year. Since high ground water conditions were observed on several of the lots, it would be beneficial to the Torrington Area Health District to know at what time of the year the specific test holes were dug and at what depth (initial and final readings) percolation tests were made. The Torrington Area Health District is requesting this data from the site engineer.

4) Addition of large quantities of fill to overcome the ground water problem could increase the potential for septic failure on the more steeply-sloped lots. Impervious barriers, as recommended by the site engineer, on all fill slopes is necessary to prevent "breakout" of effluent.

5) The location of test pit and percolation test holes are now shown for lots #13, 14, although the data is included in the engineering report. The location of these tests should be noted.

6) Location of the test pits and the proposed septic location for parcel #3 is in error. The proper location should be noted on the plan.

7) Tentative well locations should be revised to reflect a location which is out of the downhill flow pattern for septic systems at higher elevations (e.g. Lot #12).

8) Seepage rates (greater than 30min/inch) and ground water conditions on this subdivision are such that the majority of septic systems installed will require a detailed design by a professional engineer at the time of permit application.

9) Leaching trenches should be spread out along hillsides as much as possible, avoiding "stacking" of large numbers of trenches down hillsides. Leaching trenches must be kept shallow.

10) Some sewage disposal system locations may require relocation to more suitable areas (e.g. lots #7, 8, 9, 17). Testing would be required in these new areas.

11) Erosion and sediment control practices as described in the "Erosion and Sediment Control Handbook" (U.S.D.A. Soil Conservation Service, 1976) should be adhered to during site development.

To conclude, there is a need for additional information from the project engineer before an accurate assessment of the suitability of the proposed lots for subsurface sewage disposal can be made. As this additional information becomes available, the Town of Bethlehem is advised to work closely with the Torrington Area Health District in reviewing the proposed project.

VIII. THREAT OF PUBLIC WATER SUPPLY CONTAMINATION

All of the site falls within the watershed of the Watertown Fire District well field which is located along the Nonewaug River in Woodbury. The northeastern portion of the site drains directly into two surface reservoirs which are used to regulate downstream flow to the well field. The southeastern part of the site drains to the outlet stream from the two reservoirs as do the south and western portions of the site via a small tributary stream and series of wetlands.

The risk of water pollution from this site is directly related to the overland distance separating development from watercourses and reservoirs, and to various factors affecting the rate of stormwater runoff, such as land slope, soil drainage, amount of impervious surface area, and vegetative buffers including wetlands. Potential sources of water pollution include erosion and sedimentation from construction activities, de-icing salts and related pollutants from road and driveway runoff, and bacterial contamination from subsurface sewage disposal systems. In light of these potential pollution sources and the site topography and hydrology, the site can be classified into the following four areas, in order of increasing pollution risk:

A. Western - the western third of the site presents the least risk of public water supply pollution due to the wetlands and the small impoundment south of Route 132 which serve to filter out pollutants and slow the rate of runoff.

B. Central - the higher elevation and southwest sloping central part of the site presents a low to moderate risk of water pollution due to the presence of substantial separating distances to reservoirs and streams, moderately sloping land, and more favorable hydrology.

C. Northeast - the small portion of the site which drains northerly directly into Lockwood Reservoir presents a moderate risk of water supply pollution due to relatively short separating distances.

D. Southeast - the eastern portion of the site below the smaller reservoir presents the highest risk of water supply pollution. At this part of the site, the reservoir outlet stream and a small re-entrant stream run directly across the site and proposed separating distances are minimal.

   In addition, this part of the site is likely to frequently experience high groundwater conditions due to hardpan soil conditions and excess runoff from uphill areas that will seriously complicate the functioning of subsurface sewage disposal systems.

The proposed site development plan appears to adequately reflect the varying potential for pollution throughout the site. The following suggestions outline desireable ways to further reduce the risk of pollution.

1. Increase lot sizes for lot nos. 1, 16 and 17 and require an additional dedication of land and/or 150 foot stream setback of development (including septic systems and reserve areas) to protect against pollution of watercourses in this area.

2. Decrease lot sizes in the vicinity of lot nos. 10 through 14 in keeping with the cluster design principals while providing adequate protection of Lockwood Reservoir through increased land dedication and/or setbacks surrounding the small wetland in this area.

3. Re-allign the proposed subdivision road to minimize steep grades and, to the extent possible, plan storm drainage structures that discharge to the wetland areas on the western part of the property or south of Route 132. Minimum road widths should be used to reduce impermeable surface area and limit the volume of runoff together with gravel shoulders, grassed swales, and other drainage alternatives intended to disperse stormwater runoff instead of concentrating and piping runoff. Similarly, guidelines should be established for lot grading and driveway drainage that minimize off-lot stormwater runoff. Any approved stormwater piping should be equipped at point of discharge with impact basins and settling basins to trap road pollutants and avoid channel scouring.

4. Orient lot lines with the long dimension of the lot running parallel to the direction of slope. This practice serves to optimize the separation distance between subsurface sewage disposal systems and water supply wells on adjacent lots and serves to space out the sources of hydraulic loading to the soil across the slope. This is especially important in sloping hardpan soils with seasonal high water table problems where excess hydraulic loads (septic systems, curtain drains, roof and driveway runoff) can cause severe water table conditions on down-slope lots. In light of this fact, the layout of lot nos. 12, 14, and 15 may warrant reconsideration.

5. The importance of careful planning and engineering of all septic systems on this site cannot be overemphasized. Additional information, as highlighted in the previous section of this report, is necessary to provide an accurate assessment of the suitability of the proposed lots for subsurface sewage disposal.

6. No direct discharge of stormwater runoff or groundwater drainage should be permitted to perennial or seasonal watercourses. Consistent with the standards of section 19-13-B32 of the Public Health Code, "stormwater drain pipes (on water supply watersheds) shall terminate at least one hundred feet from the edge of an established watercourse". It is recommended that curtain drain discharges be located at least 50 feet from all perennial or seasonal watercourses on this property.

7. Organic and inorganic contaminants associated with the discharge of storm drains, curtain drains, and septic systems also need to be addressed.

   The possible problems due to inorganics (e.g. sodium and chlorides) will originate essentially due to road salting practices. The Town of Bethlehem should look into the use of a mixture of calcium chloride and sodium chloride as a de-icing compound to reduce the amount of sodium by approximately 25%. The use of this mixture on the new proposed road on the subdivision and on the portion of Kasson Road which drains to East Spring Brook will perhaps allow for the stabilization of the overall sodium concentration in this portion of East Spring Brook.

The possibility of organic contamination of the Hart Farm well field from activities that may take place in the proposed subdivision is remote. However, a certain amount of background on organics can only help in the overall understanding of these components.

The sources of some of these organic components range from septic tank degreasers to various commonly used household products. The persistent nature of many of these solvents and hydrocarbons (i.e. trichloroethylene, methylene, chloride, petroleum distillates, etc.) and the extent of overall movement in the groundwater dictate special considerations. The addition of these components to septic systems either intentionally or unintentionally and their travel in the ground water and eventual discharge to the surface waters needs to be considered. The tremendous amounts of water available for dilution of any contaminants may reduce the likelihood of any possible problems, however prospective homeowners of this subdivision should nonetheless be educated by officials in Bethlehem and Health District officials as to the impact of organic contaminants on water quality.

IX. PLANNING TOOLS AND STRATEGIES FOR PROTECTING WATER QUALITY IN PUBLIC WATER SUPPLY WATERSHEDS

Municipal tools and strategies for protecting water quality in public water supply watersheds can be categorized as follows:

A. Zoning Regulations
B. Subdivision Regulations
C. Inland Wetlands Regulations
D. Sewage Disposal or Sanitary Ordinances
E. Municipal Ordinances and Policies
F. Town Plan of Development
G. Coordination with Water Company

Currently, the Town of Bethlehem's approach to watershed management is based on subdivision regulations, inland wetlands regulations, the sewage disposal standards of the Public Health Code, and recommendations and policies incorporated into the Town Plan of Development. The Town of Bethlehem has not adopted zoning and exercises control over development density via a town ordinance and subdivision standard requiring a minimum 65,000 square foot lot size for all land uses. Of these municipal tools, only the Town Plan of Development specifically identifies the issue of watershed protection and recommends separate policies to protect watershed water quality. Inland Wetlands regulations, although constrained in their scope by state statute, are aggressively interpretted by the Town of Bethlehem including, to date, the successful enforcement of a policy of 150 foot setbacks from all watercourses. Bethlehem's subdivision regulations do not presently include separate standards for watershed areas and require liberal interpretation to insure appropriate development in watershed areas. In fact, the minimum street pavement width, right-of-way width, and drainage standards of the subdivision regulations may be inappropriate in watershed areas and may actually serve to increase water quality impacts.

Additional watershed management tools and strategies that should be considered by the Town of Bethlehem are as follows:

1. Zoning - as a preface to all other recommendations, it should be noted that the adoption of zoning is the single most important action that is needed to implement a comprehensive and effective watershed management program. Lacking zoning, no legally enforceable control can be exercised over the type and intensity of land uses that are established in public water supply watersheds. This leaves open the continuing possibility that any number of highly polluting activities can be established such as industrial or heavy commercial uses involving bulk storage and handling or on-site disposal of hazardous substances, gasoline stations and other petroleum handling facilities, private sanitary landfills, or extensive paved parking lots, to name a few. In addition to controlling land uses, zoning provides the primary legal basis for regulating lot size and related lot dimensional standards and for setting environmental standards for on-lot development such as erosion and runoff controls, grading and slope standards, and streambelt protection measures.

2. Subdivision Standards - Bethlehem's subdivision regulations should be revised to limit street-related pollution and encourage the appropriate layout of lots consistent with soils capability. Standards for road construction and drainage should be revised to allow flexibility in achieving minimum impact from stormwater runoff in watershed areas through reduced pavement widths and limited stormwater piping. Runoff performance standards should also incorporate the minimum stormwater disposal standards of the Public Health Code (Section 19-13-B32). Soil-based guidelines for reviewing proposed lot sizes and topographic orientation should also be incorporated into the subdivision regulations to implement the soils analysis of the Plan of Development by encouraging the creation of lots where development is environmentally feasible.

3. Sanitary Ordinance - the Torrington Area Health District is in the process of preparing a district-wide sanitary ordinance. This ordinance will more clearly define areas of concern with respect to septic system siting, installation, and maintenance. The ordinance will also set forth the administrative and technical requirements of the permit application. A stronger sanitary code would measurably improve the effectiveness of Bethlehem's effort to protect watershed areas and the efforts of the Torrington Area Health District in this regard should be encouraged.

4. Municipal Policies and Programs - effective management of watershed areas must include a component of on-going preventative maintenance and operational policies. Under operational policies, Bethlehem should establish administrative guidelines for application of road de-icing salts on town roads and other road maintenance activities such as oiling and paving operations. State road maintenance practices should also be standardized to control pollution. Municipal solid waste disposal activities currently conducted within the public watershed area should be phased out. Under maintenance practices, a priority should be placed on stabilizing active erosion areas on any municipal road right-of-way. Public education efforts should also be conducted particularly with regard to septic tank maintenance practices and guidelines for agricultural activities within the watershed. Periodic stream surveys and water quality sampling should be performed either by the Watertown Fire District as part of their annual watershed survey or by the Torrington Area Health District.

X. ADDITIONAL PLANNING CONSIDERATIONS

Consistency of Project with State, Regional, and Local Plans

The Sky Meadow Subdivision, as currently proposed, is generally consistent with the Connecticut Plan of Conservation and Development which shows this area of Bethlehem as a "conservation area" (public water supply watershed, prime agricultural area). The proposed development is also generally consistent with the CNVRPA Plan of Regional Development which shows this area as a low density residential area with a net density of 0.5 or fewer dwellings per acre. However, the proposed subdivision in several respects does not fully conform with the Bethlehem Plan of Development.

The Town Plan of Development identifies the project site as an "agricultural - watershed" area and recommends lot sizes no smaller than 3 acres. Several lots currently do not conform to this recommendation although the project as a whole appears to have an average lot size greater than 3 acres. The Town Plan of Development also recommends that subdivisions should utilize cluster design concepts which this project fails to do. This subdivision can also be considered a form of "leap frog" development which is specifically discouraged in the Town Plan of Development.

Vehicle Access

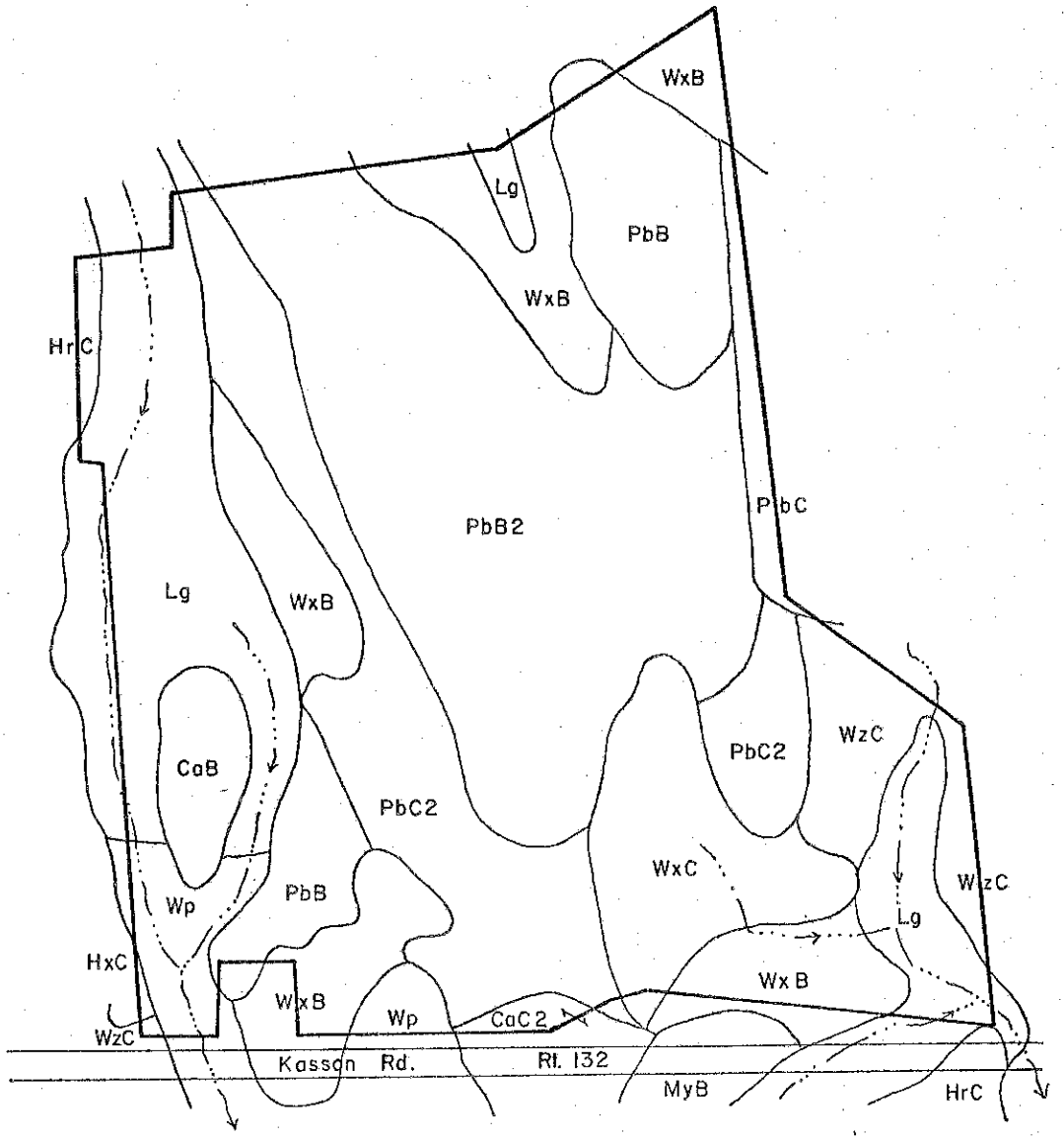
The current proposal for subdivision access onto Route 132 (Kasson Road) would create a potentially hazardous intersection due to inadequate line-of-sight distance. Vehicles leaving the subdivision, turning east onto Route 132 have an obstructed view of traffic traveling east on Route 132 due to a rise in the road. Similarly, vehicles stopped on Route 132 waiting to make a left turn into the subdivision would be hidden from view from eastbound traffic on Route 132. Line-of-sight distance east onto Route 132 is currently approximately 100 feet and the suggested minimum standard is 400 feet for vehicle speeds of 50 m.p.h.

This proposed intersection location should be relocated to provide a minimum of 400 feet line-of-sight in both directions along Route 132. This could most easily be accomplished by relocating the current intersection roughly 100 feet in a westerly direction.

APPENDIX

SOILS MAP

NOTE • 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.



SCALE: 1" = 500'

0 1/8 1/4 mile

0 500' 1000' 1500'

ADAPTED FROM LITCHFIELD COUNTY SOIL SURVEY U.S.D.A. — S.C.S.

SOILS LIMITATION CHART

"SKY MEADOW SUBDIVISION" - BETHLEHEM, CT.

MAP SYMBOL	SOIL NAME	SEPTIC ABSORBTION FIELDS	BUILDINGS WITH BASEMENTS	ROADS OR DRIVEWAYS	LANDSCAPING
CaB	Charlton fine sandy loam, 3 - 8% slopes	Slight	Slight	Slight	Slight
CaC2	Charlton fine sandy loam, 8 - 15% slopes, eroded	Moderate: slope	Moderate: slope	Moderate: slope	Moderate: slope
HrC	Hollis very rocky fine sandy loam, 3 - 15% slopes	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock	Severe: depth to rock
Lg	Leicester, Ridgebury and Whitman very stony fine sandy loams	Severe: wetness	Severe: wetness	Severe: wetness frost action	Severe: wetness
MyB	Merrimac sandy loam, 3 - 8% slopes	Slight	Slight	Slight	Slight
PbB	Paxton fine sandy loam, 3 - 8% slopes	Severe: percs slowly	Moderate: wetness	Moderate: frost action	Moderate: small stones
PbB2	Paxton fine sandy loam, 3 - 8% slopes, eroded	Severe: percs slowly	Moderate: wetness	Moderate: frost action	Moderate: small stones
PbC2	Paxton fine sandy loam, 8 - 15% slopes, eroded	Severe: percs slowly	Moderate: wetness	Moderate: frost action	Moderate: small stones

SOILS LIMITATION CHART

"SKY MEADOW SUBDIVISION" - BETHLEHEM, CT.

MAP SYMBOL	SOIL NAME	SEPTIC ABSORBTION FIELDS	BUILDINGS WITH BASEMENTS	ROADS OR DRIVEWAYS	LANDSCAPING
WP	Whitman stony fine sandy loam	Severe: percs slowly	Severe: wetness	Severe: wetness frost action	Severe: wetness
WxB	Woodbridge fine sandy loam, 3 - 8% slopes	Severe: percs slowly	Severe: wetness	Severe: frost action	Slight
WxC	Woodbridge fine sandy loam, 8 - 15% slopes	Severe: percs slowly	Severe: wetness	Severe: frost action	Moderate: slope

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: Limitation Ratings Based Upon U.S.D.A. Soil Conservation Service Criteria.

ABOUT THE TEAM

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

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

PURPOSE OF THE TEAM

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

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

REQUESTING A REVIEW

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

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