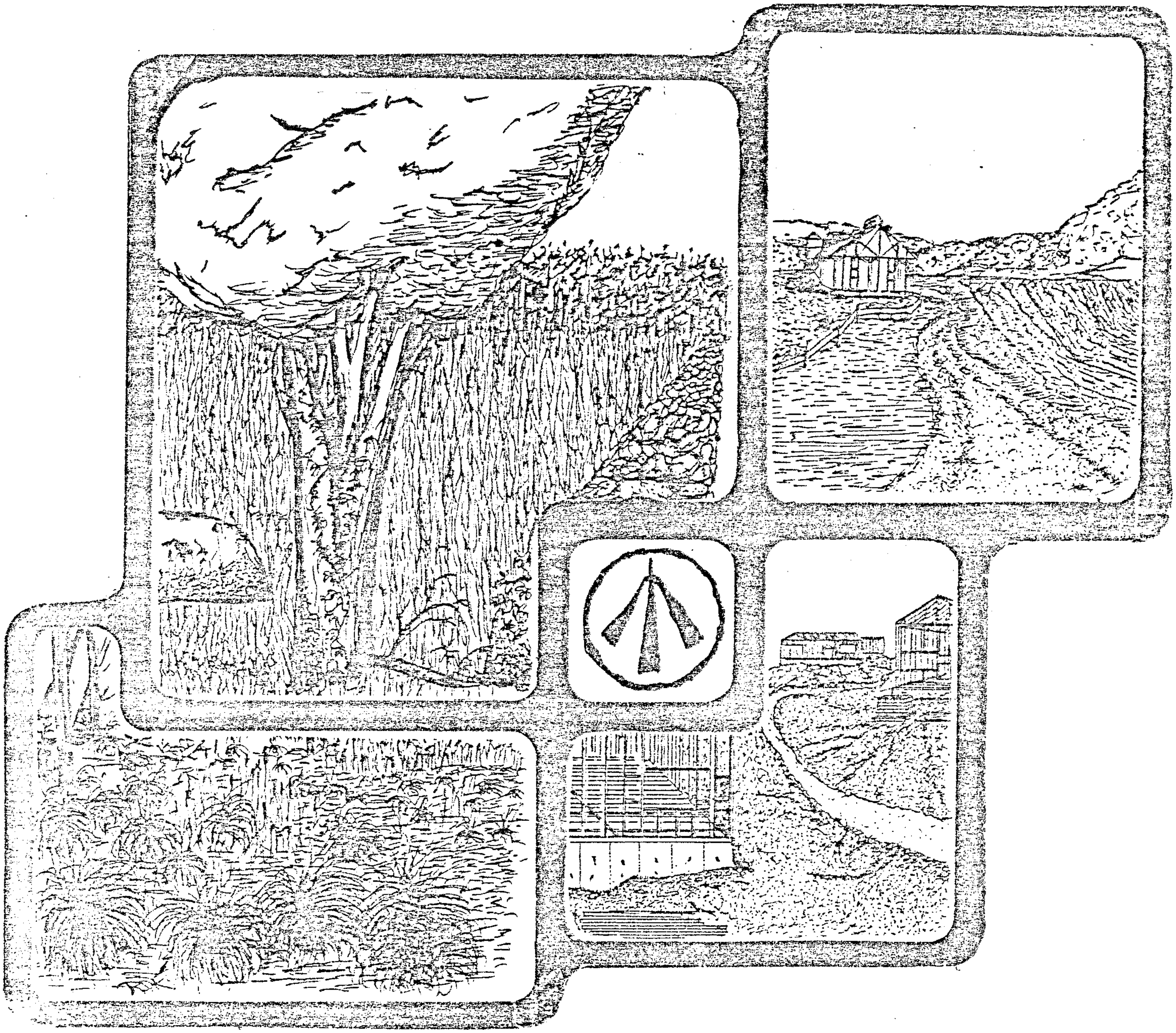
ENVIRONMENTAL REVIEW TEAM REPORT



PROPOSED ELDERLY HOUSING COMPLEX
OXFORD, CT

KING'S MARK
RESOURCE CONSERVATION & DEVELOPMENT AREA

KING'S MARK
ENVIRONMENTAL REVIEW TEAM REPORT

PROPOSED ELDERLY HOUSING COMPLEX
OXFORD, CT
APRIL 1985

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

ACKNOWLEDGMENTS

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

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

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

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

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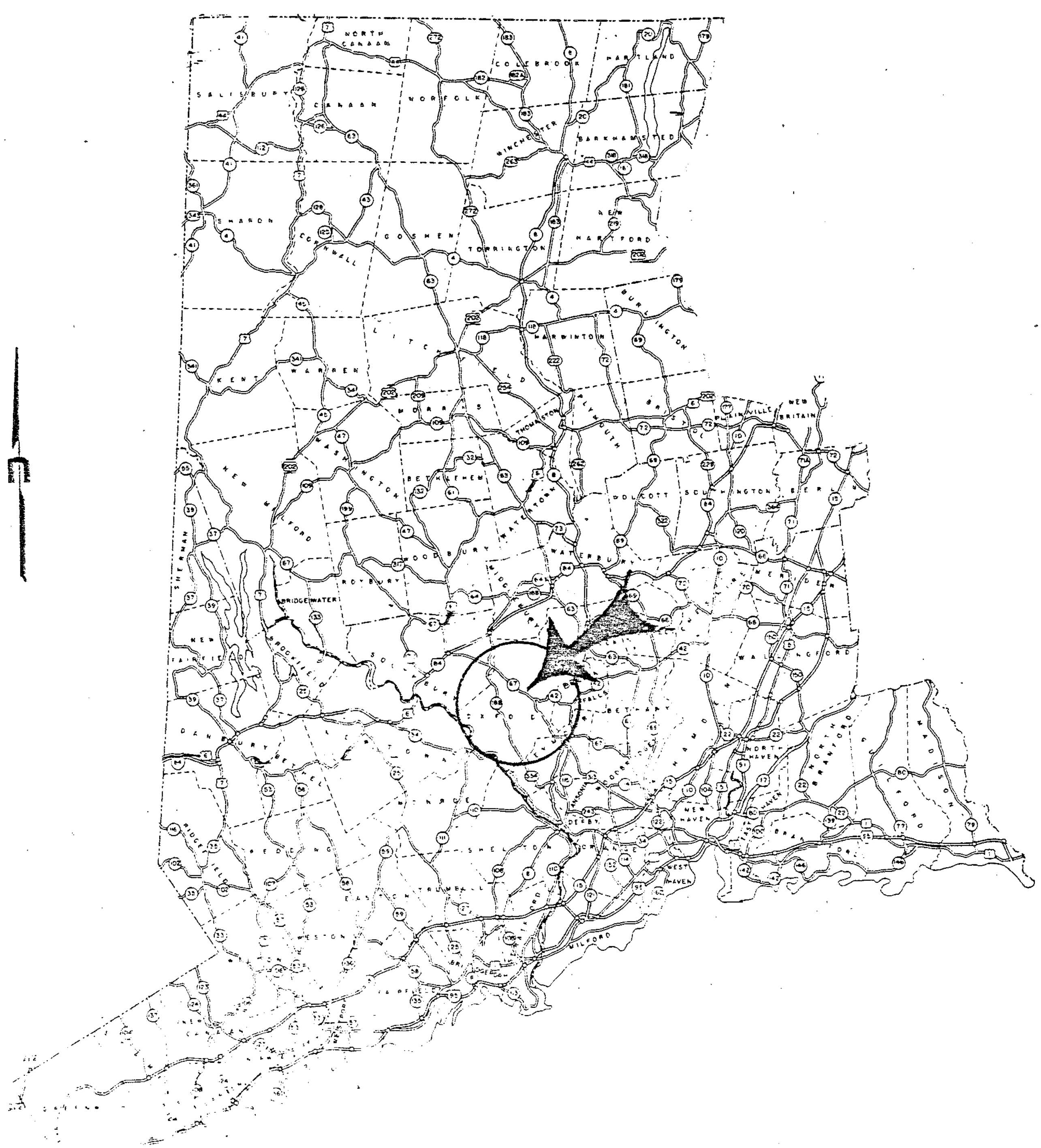
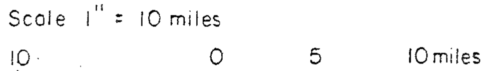


Scale 1" = 10 miles



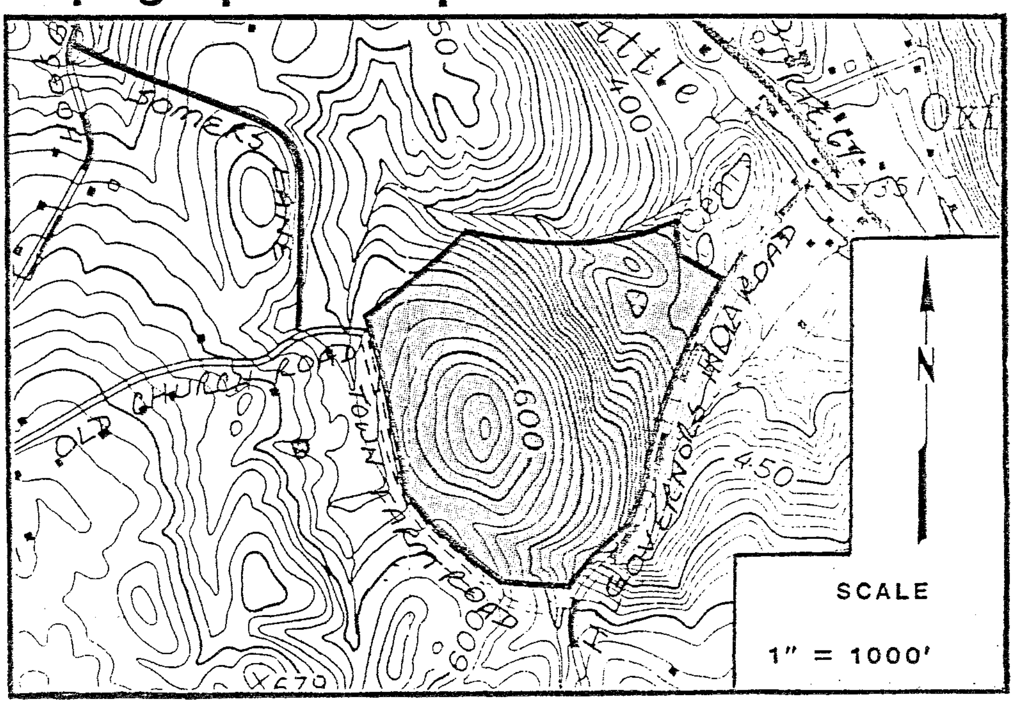
PROPOSED ELDERLY HOUSING COMPLEX

I. Introduction

The Town of Oxford is considering the purchase of a 48 acre tract of land near the town center for the purpose of constructing an elderly housing complex. Ancillary uses being considered for the site include park and recreational use and possibly the construction of a day-care center. The preparation of this report on the site was requested by the First Selectman of Oxford.

The subject site is entirely wooded and characterized by moderate to steep slopes (see Figure 1). Access to the site is available off Governor's Hill Road, Town Farm Road, and Old Church Highway.

Figure 1 **Topographic Map**



The proposed project is in the preliminary planning stages and no site plan has yet been prepared. The Oxford Housing Authority envisions a phase one project at the site of 24 elderly housing units to be followed by subsequent phases for a total of 80-100 elderly housing units. It is anticipated that the project would be clustered with 4-6 single story units per cluster. Those portions of the site not developed for elderly housing would be reserved for town recreation use and possibly a day-care center. Since there is no public water supply and no sewer system in the area, each of the units would be served by on-site wells and subsurface sewage disposal systems.

The Oxford First Selectman requested this ERT study to assist the town in analyzing the suitability of the site for the proposed uses. The ERT was asked to identify the natural resource base of the subject site and to discuss the opportunities and limitations of the site for the envisioned uses. Of particular concern is 1) the suitability of the site for on-site sewage disposal and water supply development, 2) 2) traffic and access impact, 3) feasibility of solar development, and 4) general land use suitability for the proposed uses.

The King's Mark Executive Committee considered the Town of Oxford's request for an ERT study, and approved the project for review by the Team.

The ERT met and field reviewed the site on March 21, 1985. Team members participating on this project included Marc Beroz, Soil Scientist, U.S.D.A. Soil Conservation Service; Duncan Graham, Planner, Central Naugatuck Valley Council of Governments; David Lord, District Conservationist, U.S.D.A. Soil Conservation Service; Richard Lynn, ERT Coordinator, King's Mark RC&D Area; Randy May, Sanitary Engineer, CT Department of Environmental Protection; Don Smith, Forester, CT Department of Environmental Protection; William Warzecha, Geohydrologist, CT Department 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 topographic map, a soils map, and a soils limitation chart. During the ERT's field review, team members met with representatives from the Town of Oxford and the Oxford Housing Authority and walked the property. 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. The report identifies the natural resource base of the subject site and discusses opportunities and limitations for the proposed land uses. It is hoped the information contained in this report will assist the Town of Oxford and the Oxford Housing Authority in making environmentally sound decisions.

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

* * *

II. Highlights

1. *The subject site is characterized by moderate to steep slopes. The steepest slopes, which are primarily associated with areas where bedrock is at or near ground surface, occur in the eastern half of the property. Because of these limitations (slope and shallow soil cover) this part of the site holds little potential for residential development. On the other hand, it does appear to have good potential for passive recreation uses which the town is also interested in for this site. Moderate slopes characterize the western part of the property where the residential development is proposed.* (p. 6)

2. *On-site wells will need to be developed to service the site. Since no extensive sand and gravel deposits exist within the site, the underlying bedrock would be the most likely aquifer to be tapped. If it may be assumed that each housing unit under Phase I (24 units) would contain two residents a total of 48 residents would have to be served by the arrangement. If each resident needed 60 gallons of water per day to meet his/her needs, a total of 2,880 gallons per day would be needed. A single bedrock well yielding 4 gallons per minute continuously would provide twice that amount. Of course, the peak demand on any given day may be greater than 4 gallons per minute; therefore, a storage system of some kind would have to be provided. Under Phase II (60 units) and Phase III (100 units), a bedrock well yielding at least 5 gallons per minute and 8.3 gallons per minute, respectively, would be required using the same values mentioned above. Based on statistical information it seems likely that the chances of obtaining a yield of 2 to 4 gallons per minute on the site from a single well would be reasonably good. More than one well may be needed to meet the needs of subsequent phases of the project, however. The natural quality of groundwater in this area should be satisfactory.* (p. 9, 10, 11)

3. *Development of the site will lead to increases in runoff. As a result, runoff from the site could have a substantial potential for erosion. The potential is further increased by the presence of moderate to steep slopes in the area. In order to mitigate this potential problem, it is recommended that a comprehensive erosion and sediment control plan be developed and implemented for each phase of the proposed development.* (p. 11, 14)

4. *Another concern with regard to increases in runoff is potential flooding downstream. Unless some provisions are made to control runoff, the projected peak flow increases, particularly for Phase II and III, are expected to be significant. This should be of particular concern to the town, since flooding problems along Little River are well documented and are presently being studied by the Soil Conservation Service for a possible flood control project. Any increase in the peak flows from the development could further aggravate the existing flooding problems. Stormwater management principles that would maintain the peak discharge at present levels after development should be considered in the over all planning of the site.* (p. 14)

5. *A likely resolution for maintaining off-site flows following development at present levels would be the installation of one or more detention basins. The presence of moderate to steep slopes and limited area in the northwest corner of the property may pose problems for locating a detention basin on the site. A possible alternative would be to pipe the stormwater to the wetland area in the southern parts of the property. Based on visual inspection of this area during the field review, this area may be able to support a detention basin.* (p. 14, 15)

6. *A Soils Map of the site is presented in the text. This map shows a ± 15 acre area in the western portion of the site which is the most suitable area on the property for residential development. The remainder of the property has low potential for community development but is generally suitable for passive recreation such as hiking trails.* (p. 17)

7. *Much of this site is worthless for on-site sewage disposal, however an area exists that can easily support the initial development. The area can also support additional discharge, probably to 5000 gpd, with careful health code compliance. The area probably can support the ultimate desired density, however this cannot be accurately determined at this time. A qualified engineer should be engaged immediately to determine this. The usable area of the site is quite good, but permeable till materials are fragile and can easily be ruined by sloppy construction techniques, therefore considerable care in site preparation and installation is required, including substantial supervision.* (p. 22)

8. *The site may be divided into seven different forest stands. A description of each stand and management suggestions are presented in the text. The DEP's Natural Diversity Data Base does not have any record of rare or endangered species on this site.* (p. 22, 25)

9. *Trip generation rates for this type of land use are estimated at 3.3 average weekday vehicle trips per dwelling unit. Given 24 units, traffic volume would increase by approximately 80 trips per day. Saturday and Sunday trips are estimated at even a lower rate of 2.6 and 2.5 respectively. Adjacent roads are capable of absorbing this increase without any reduction in the normal flow of traffic. Construction of 100 units, as ultimately envisioned for the site, would increase traffic volume by roughly 330 trips per day. This naturally becomes more of a concern when viewing the impact on nearby roads and residences.* (p. 26)

10. *While the site has principally northeastern exposure it is possible to locate the structures on the buildable portion of the lot to take advantage of solar orientation. Careful structure siting would be required to optimize this situation, however it can be accomplished.* (p. 26)

III. Topography and Setting

The proposed elderly housing complex site consists of a ± 48 acre tract of land located in central Oxford. Access to the property is proposed off of Old Church Highway (Road) from the west.

The property is encompassed mainly by a hill which takes the shape of an inverted teaspoon. This topographic feature is probably a drumlin. Drumlins are hills composed of glacial sediment (till) which was deposited directly from glacial ice and which was simultaneously overridden and streamlined by the ice. The long axis of the hill parallels the direction of flow of the former ice sheet. In this case, the direction is generally to the south.

The subject site is characterized by moderate to steep slopes. The steepest slopes, which are primarily associated with areas where bedrock (ledge) is at or near ground surface, occur in the eastern half of the property. Because of these limitations (slope and shallow soil cover) this part of the site holds little potential for residential development. On the other hand, it does appear to have good potential for passive recreation uses which the town is also interested in for this site. Recreational development potential will be discussed in more detail later in the report (see <u>Geologic Development Concerns</u>). Moderate slopes characterize the western part of the property where most of the residential development is proposed.

Elevations on the site range from a low of about 400 feet above mean sea level at the northeast corner of property to about 630 feet above mean sea level at the top of the drumlin in the central parts.

No major streamcourses were observed on the site during the ERT's field review. However, at least two intermittent drainage channels are visible in the southern and northeastern parts of the site.

IV. Geology

The proposed elderly housing complex is located within the Southbury and Naugatuck topographic quadrangle areas. Both the surficial and bedrock geology of the Naugatuck quadrangle have been mapped. Publications containing these maps are, respectively, Connecticut Geological and Natural History Survey Map QR-35, by Richard Foster Flint (1974 and 1975) and Map QR-9, by Michael Carr (1957 and 1958).

The bedrock geologic map (QR-30 by Robert B. Scott) for the Southbury quadrangle, has been published by the Connecticut Geological and Natural History Survey. The surficial geologic map for the quadrangle has not been published to date. However, there is preliminary information available which can be reproduced at the Department of Environmental Protection's Natural Resources Center in Hartford.

It should be pointed out that the Team's geologist also referenced John Rodger's "Preliminary Bedrock Geological Map of Connecticut" in the preparation of this report.

Bedrock is exposed at, or near, ground surface throughout nearly 40 percent of the site. Map QR-9, which includes that part of the site located in the Naugatuck quadrangle classifies the bedrock as Waterbury gneiss. These rocks consist of quartzite and biotite-muscovite schists interbanded with gneisses. According to Map QR-30, bedrock which underlies, or crops out on the site within the Southbury quadrangle is classified as a member of the Hartland Unit Formation. These rocks consist of a non-rusty weathering, laminated, fine-grained schistose gneiss composed of the minerals quartz, biotite, plagioclase, and muscovite.

Rodger's map groups the bedrock cropping out and underlying the property as Collinsville Formation and Taine Mountain Formation. The Collinsville Formation consists of a gray and silvery, medium grained schist, and dark, fine to medium grained amphibolite and hornblende gneiss. The Taine Mountain Formation consists of gray, medium-grained, well laminated "granofels".

All the rock types mentioned in the paragraphs above (i.e, gneisses, schists, amphibolite, quartzites and granofels) may be grouped together as intensely metamorphosed crystalline rocks, geologically altered by heat and pressure within the earth's crust. These rocks are very old and have complex histories. The "schists" are rich in mica (muscovite and biotite) minerals, but also contain noticeable amounts of quartz. These rocks are characterized by the alignment of platy or flaky minerals. This characteristic alignment allows the rock to split into thin slabs. "Gneisses" are rocks in which platy or flaky minerals alternate in thin layers with the more rounded minerals. This mineral arrangement gives the rocks a banded appearance.

The term "granofels" refers to a rock whose grains are not noticeably aligned. They are composed mainly of the minerals quartz and feldspar and lack the compositional banding seen in the gneisses. A very large surface boulder located in the northeast corner appears to be a granofel. It was probably quarried out of a nearby bedrock outcrop by the former ice sheet.

The term "amphibolite" refers to a dark-colored rock which contains the minerals amphibote, plagioclase and hornblende. Commonly, this rock contains little or no quartz. Lastly, quartzites are light-colored rocks consisting essentially of the mineral quartz.

The differences among the five major rock types have been described above primarily for the thoroughness of this report and for possible use on the environmental impact statement which the town will need to complete for project funding.

The differences in the texture and/or mineralogy of these rocks should not have a direct impact on the potential of the site for elderly housing and/or recreational uses. It should be pointed out that the underlying bedrock may affect water quality and quantity of water withdrawn from any bedrock wells drilled on the site. (see Water Supply Section of this report).

Depth to bedrock ranges from zero in rock outcrop areas to probably not much more than 10 feet at various points in between the outcrops. Bedrock outcrops on the site have resulted from the layering of the bedrock (which dips moderately toward the east) and the forces of both glacial weathering and erosion along cracks (fractures) in the rock.

A blanket of glacial sediment known as till covers the bedrock on the site. The till, which consists of a non-sorted non-stratified mixture of rock particles of widely varying shapes and sizes, was deposited directly from glacier ice without substantial reworking by meltwater. The texture of the till on the site appears to be mostly sandy with some silt and is relatively loose in the upper few feet. However, with depth, the till may become more silty and more firm. This firmer layer may impede groundwater percolating downward through the soil resulting in a high water table during the wet times of the year.

Thicknesses of the till range from zero in areas where bedrock is exposed to probably not much more than 10 feet throughout the site. Deep test hole information supplied by the town sanitarian indicates that the till is at least seven feet in the northwest corner of the site. Based on soil mapping, the till is probably thickest in this part of the site.

Seasonally wet areas, comprised of regulated inland-wetland soils generally parallel intermittent drainage channels in the northeast corner and southern parts of the site.

GEOLOGIC DEVELOPMENT CONCERNS

The exact location of bedrock in relation to the ground surface poses potential problems for septic system placement. The shallow-to-bedrock areas depicted on the accompanying soils map (see Figure 3) would be least acceptable for septic systems; however, in the northwest corner of the site, it appears (based on deep test hole data supplied by the Town sanitarian) that till depths of 7 feet and possibly more exist. Therefore, it seems likely that this part of the site would be most favorable for the location of a potential septic system(s) to serve the elderly housing complex. More test holes would probably be needed in this area to determine the feasibility of its use for waste disposal. Development should be within the limits of acceptable density as established by the capacity of the soil to accept sewage wastewater discharges. It is recommended that further on-site soil testing be conducted preferably during the spring of the year (February 1 to May 31) to determine groundwater levels. Additional soil testing would also be needed to determine whether there is any shallow underlying bedrock. The presence of bedrock or groundwater at shallow depths are significant limiting factors which will require careful planning and engineering to overcome.

Team members were also asked to comment on the recreation potential of the site. It seems likely that most of the eastern parts of the site could be used for passive recreational purposes if the site is developed. Due to the presence of shallow bedrock conditions and steep slopes throughout this area, it appears that active recreational uses such as playing fields would be very difficult to develop. Blasting as well as extensive filling which is very costly would probably be required in order to create a suitable grade for playing fields. On the other hand, the above limitations should pose less of a problem for recreational uses such as hiking trails, cross-country skiing trails, jogging trails, etc.

V. Water Supply

Although the town of Oxford has a public water supply system, the proposed elderly housing complex is located too far away to tie into this sytem. On-site wells will therefore need to be developed to service the site.

Since no extensive sand and gravel deposits exist within the site, the underlying bedrock would be the most likely aquifer to be tapped. If sand and gravel deposits are thick enough and are saturated, they can generally yield water at a high rate compared to wells tapping crystalline bedrock. The exact yield of a bedrock based well is a function of many geologic factors, including the number and size of fractures present in the bedrock. Since the fractures in bedrock are irregular, there is no practical way of predicting the yield of a bedrock well drilled in a specific location. Even with geophysical exploration, it is extremely difficult to predict such yields. Nevertheless, wells drilled in bedrock are generally capable of supplying small but reliable yields.

An assessment of presently installed bedrock-based wells has been conducted for the lower Housatonic River basin which includes the subject site. (Source: Connecticut Water Resources Bulletin No. 19). All of the 294 wells surveyed in Bulletin #19 tap crystalline bedrock, which is the same as the bedrock underlying the site. This assessment allows one to predict the chances for any new well to achieve certain minimum yields. Based on Bulletin #19, 85 percent of the wells tapping the type of rock underlying the site yielded about 2.0 gallons per minute or more; 70 percent yielded about 4.0 gallons per minute or more; 50 percent yielded about 6.0 gallons per minute or more and only 28 percent yielded 9.0 gallons per minute or more.

A survey of well reports for existing bedrock based wells serving homes along Somers Lane and Ancient Highway west of the site indicates yields which range between 2.5 gallons per minute and 20 gallons per minute at varying depths of 160 feet to 305 feet.

Town officials questioned on the field review day what the potential yield of a well or wells would need to be in order to serve the proposed elderly housing complex for each Phase. If it may be assumed that each housing unit under Phase I (24 units) would contain two residents a total of 48 residents would have to be served by the arrangement. If each resident needed 60 gallons of water per day* to meet his/her needs, a total of 2,880 gallons per day would be needed. A single bedrock well yielding 4 gallons per minute continuously would provide twice that amount. Of course, the peak demand on any given day may be greater than 4 gallons per minute; therefore, a storage system of some kind would have to be provided. This can be accomplished by the installation of a single water storage tank or an individual tank in each building. Storage tanks are sized based on the "peak hour demand". The "peak hour demand" occurs during the hour in which the largest volume of water is consumed and shall be considered one third of the average daily consumption. For example, under Phase I (24 units), where the average daily consumption is estimated to be 2,880 gallons, approximately 1,000 gallons of usable storage would be required. Of course, this figure would increase as the average daily consumption increases.

Under Phase II (60 units) and Phase III (100 units), a bedrock well yielding at least 5 gallons per minute and 8.3 gallons per minute, respectively, would be required using the same values mentioned earlier.

It should be pointed out that the above mentioned design criteria does not include requirements for fire protection. It is the responsibility of the design engineer and the water supply owner to insure that the applicable federal, state and local fire protection requirements are satisfied.

In addition, water supply systems serving over 100 people will require a minimum of 2 distinct well sources. Each well must be capable of meeting the average daily consumption demands plus usable storage.

Based on statistical information regarding minimum yields reported in Connecticut Water Resources Bulletin

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*"Community Water Supply Design Criteria For Water Systems Serving Less Than 1,000 People" (DRAFT) by Connecticut Department of Health Services, Public Water Supply Sections, Part 2.

No. 19, it seems likely that the chances of obtaining a yield of 2 to 4 gallons per minute on the site would be reasonably good. However, it must be kept in mind that the yield of any well drilled into bedrock depends upon the number and size of water bearing fractures encountered by the well.

If more than one well is needed to fulfill the needs of the residents of the elderly housing complex, the wells should each be conservatively separated (at least 300 feet), if possible. This will hopefully help to prevent the chance of interference of one well with another during pumping periods.

Since the Public Water Supply section of the State Health Department reviews and approves community water supplies, they should be contacted as soon as possible in order to discuss the following: (1) projected needs of the development in terms of water quantity, (2) location of the community well or wells on the site, (3) water quality testing requirements, and (4) plans for pumpage, storage, treatment (if necessary), and the distribution system.

The natural quality of groundwater in this area should be satisfactory. However, due to the mineralogy of the rock types underlying the site, there may be a chance that elevated iron and manganese levels could affect well water quality. As a reuslt, it may be necessary to install an appropriate water treatment filtration system.

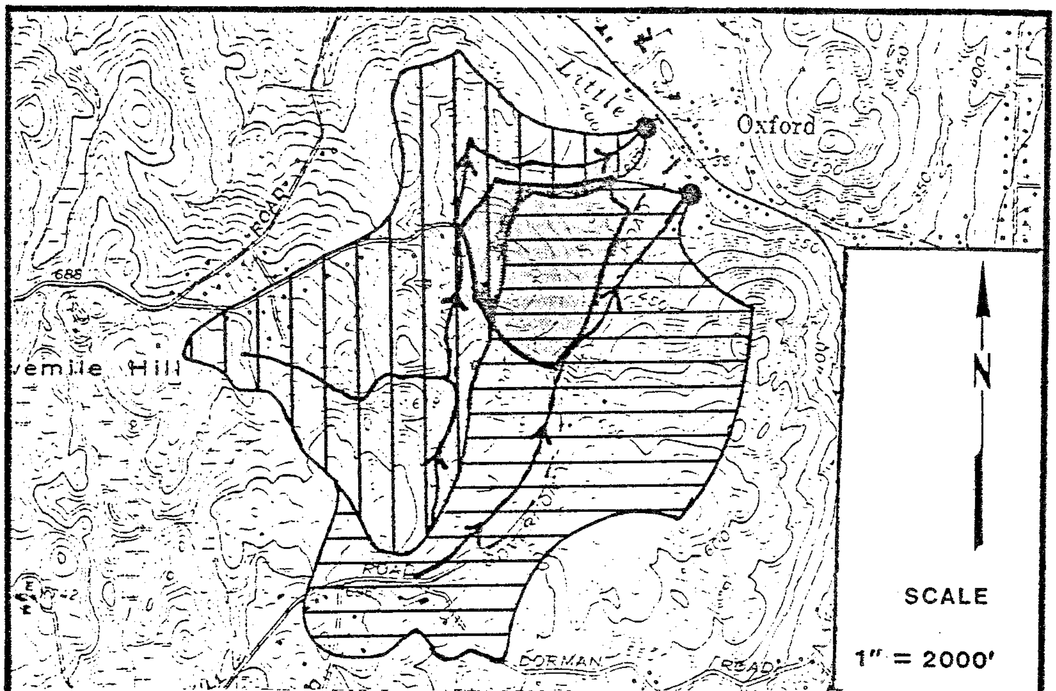
VI. Hydrology

Surface drainage within the site may be divided into two areas (see Figure 2). Surface runoff emanating from the eastern half of the parcel drains via seasonal drainage swales and sheet flow towards Governor Hill Road and ultimately empties into an unnamed tributary to Little River. This stream joins Little River about 375 feet southeast of the intersection of Route 67 and Governor Hill Road. Little River ultimately empties into the Naugatuck River.

Surface runoff from the western half of the parcel drains to an unnamed tributary of Little River which parallels the western and northern property boundary to a large extent. The unnamed tributary is impounded by a small pond northwest of the Governor Hill Road and Route 67 intersection before the stream discharges into Little River. Based on discussions with town officials during the field review, it appears that all of the elderly housing units would be located in the western half of the parcel.

Development of the site will lead to increases in runoff. The amount of the increases will depend upon the extent of development, the amount of impervious surfaces created, and the amount of vegetation removed.

Figure 2 Watershed Boundary Map



- Property boundary

- Watershed boundary and design point for unnamed tributary to Little River which drains the western half of the property

- Watershed boundary and design point for unnamed tributary to Little River which drains the eastern half of the site

- Watercourses showing direction of flow

Peak flows for certain storm events (such as the 10 year, 25 year, 50 year, and 100 year storm) may be estimated by a method described in Technical Release No. 55 of the Soil Conservation Service. This method considers soil types, vegetative cover, land use, slopes, and other factors. In order to calculate runoff changes and peak flows, TR-55 requires the estimation of curve numbers, which relate amounts of precipitation to amounts of runoff. It should be noted that rainfall figures indicated represent an amount that would occur within a 24 hour period. A higher curve number indicates that a greater volume of runoff would occur following a given amount of precipitation.

Since no plans were made available to Team members, several assumptions were made in order to analyze the potential runoff and peak flow conditions following development. Two of the major assumptions included: 1) estimating that approximately 1.5 acres of impervious surface would be created for Phase I, 3.0 acres for Phase II and roughly 3.5 acres for Phase III (these estimates include impervious surfaces such as roof tops, paved parkings lots and roads), and 2) all of the development would occur in the western half of the parcel and therefore, would drain to the unnamed tributary to Little River which is west of the site. It should be pointed out that the peak-flow estimates shown in Table II do not take into account potential engineering measures that could affect the natural channel. For example, piping may increase the peak flows while energy dissipators would reduce them.

The runoff estimates for pre- and post development conditions are as follows:

TABLE 1.
Estimated runoff depths, in inches for pre-development and post-development conditions (Phase I-24 units, Phase II-60 units, and Phase III-100 units)

Storm Recurrence Interval	Precipitation Inches	Present	Phase I	% Increase
10 yrs	5.0"	1.37"	1.51"	10%
25 yrs	5.6"	1.74"	1.90"	9%
50 yrs	6.3"	2.21"	2.39"	8%
100 yrs	7.1"	2.77"	2.98"	7.5%

Storm Recurrence Interval	Precipitation Inches	Present	Phase II	% Increase
10 yrs	5.0"	1.37"	1.58"	15%
25 yrs	5.6"	1.74"	1.98"	14%
50 yrs	6.3"	2.21"	2.48"	12%
100 yrs	7.1"	2.77"	3.07"	11%

Storm Recurrence Interval	Precipitation Inches	Present	Phase III	% Increase
10 yrs	5.0"	1.37"	1.73"	26%
25 yrs	5.6"	1.74"	2.15"	24%
50 yrs	6.3"	2.21"	2.67"	21%
100 yrs	7.1"	2.77"	3.28"	18%

As the table indicates, the overall increases from the site would be moderate especially following Phase II or III. Since the development would be clustered in one area of the parcel, the increase in runoff would occur over a concentrated area. As a result, runoff from a storm drainage system on the site could have a substantial potential for erosion. The potential for erosion due to concentrated runoff from the site may be further increased by the presence of moderate to steep slopes in the area. In order to avoid the problem, it is recommended that a comprehensive erosion and sediment control plan be developed for each phase of the proposed development. Strict controls and engineering measures will be needed in order to overcome the potential erosion problems.

The effect of increased runoff to the unnamed tributary to Little River may now be analyzed. The watershed area analyzed for the peak flows is shown in Figure 2. It is based upon a certain point of outflow (on Little River) and shows all of the land from which runoff ultimately reaches that point.

As mentioned earlier, TR-55 techniques were used in the analysis to determine peak flow. Several factors which ordinarily would be incorporated into the calculations were not included (i.e., piping) because no site plan has been devised to date. Nevertheless, the results of the peak flow calculations should prove useful as "ball park" guides to anticipated peak flow increases. Table II lists the results.

As indicated by Table II the calculated peak flow increases for Phase I are moderate and for Phases II and III are quite high. Unless some provisions are made to control runoff, the increases shown in Table II, particularly under Phase II and III would be expected to be significant. This should be of particular concern to the town, since flooding problems along Little River are well documented and are presently being studied by the Soil Conservation Service for a possible flood control project. Any increase in the peak flows from the development could further aggravate the existing flooding problems. Stormwater management principles that would maintain the peak discharge at present levels after development should be considered in the over all planning of the site.

A likely resolution for maintaining off-site flows following development at present levels would be the installation of one or more detention basins. The presence of moderate to steep slopes and limited area in the northwest corner of the property may pose problems for locating a detention basin on the site. A possible alternative would be to pipe the stormwater to the wetland area in the southern

TABLE II.
Peak flows for before development and after development conditions (Phase I, II and III) at the point of outflow shown in Figure 2.

All flows given in cubic feet per second.

Storm Frequency	10 yr	25 yr	50 yr	100 yr
Before Development, Curve Number 61	90	116	149	191
After Development Phase I, 24 Units Curve Number 63 -	104	132	168	214
Percent Increase	15%	14%	13%	12%
After Development Phase II, 60 Units Curve Number 64 -	113	143	181	229
Percent Increase	26%	23%	21%	20%
After Development Phase III, 100 Units Curve Number 66 -	128	161	202	253
Percent Increase	42%	39%	36%	32%

parts of the property. Based on visual inspection of this area during the field review, this area may be able to support a detention basin. An engineering study would need to be conducted to determine whether or not 1) this area would be feasible for detention purposes and 2) if it would be too costly to pipe the stormwater to this area.

Since much of the watershed analyzed is undeveloped at the present time, there is a possibility that a series of developments could occur which taken together could create much larger increases in Little River's flood flows. Therefore, each developer should do his part to prevent a cumulative impact, particularly where a development is dense.

It is recommended that once plans are prepared, that the applicant be required to submit detailed hydrological information on pre- and post development runoff volumes and peak flows from the site. This should include all phases of the development. Estimates should be provided for the 2, 10, and 100 year design storms. Detailed design specification for all stormwater control facilities (including ponds) should also be submitted for town review.

VII. Soils

The following soil survey map (see Figure 3) and narrative is a revision of the data contained in the Soil Survey of New Haven County, Connecticut. The symbols on the map identify map units. Each map unit has a unique composition of soils. Areas with the same symbol have the same composition.

A. SOIL DESCRIPTIONS

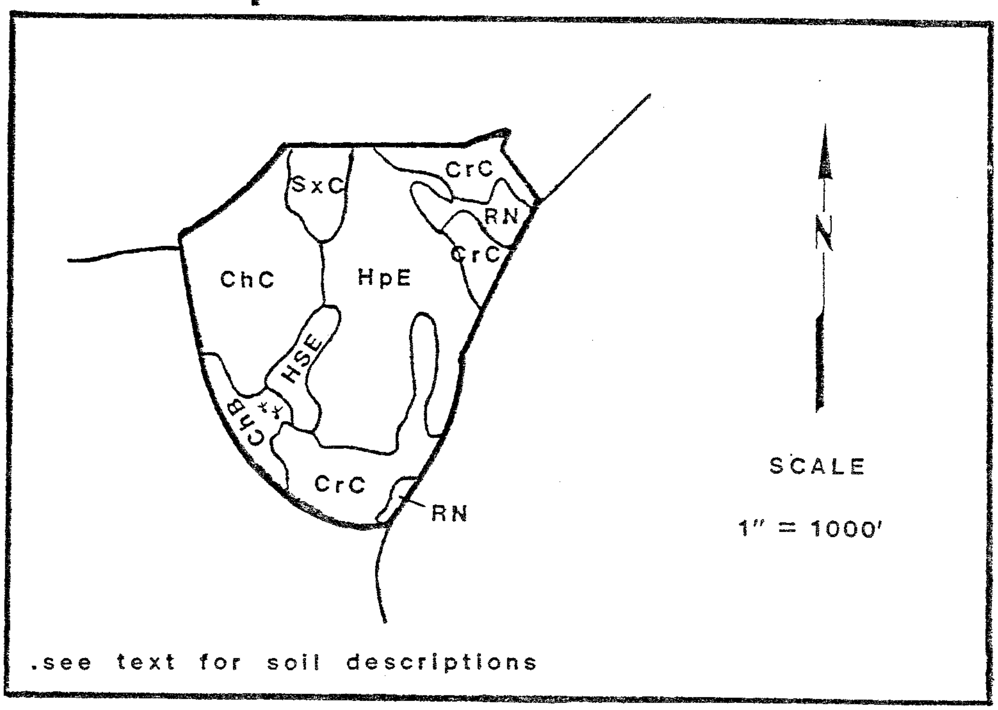
Map Unit ChB and ChC - These map units are composed primarily of Charlton soils on 8 to 15 percent slopes. Charlton soils are very deep and well drained. Typically, they have fine sandy loam textures to a depth of 60 inches or more.

These map units contain the best soils on the site for septic tank absorption fields. Generally these soils do not have a high water table that would interfere with the proper functioning of a septic system.

One specific area within map unit ChB is an exception. This area is indicated on the map with the symbol (Y). Here the water table is very close to the soil surface. Absorption fields at this location would be extremely costly.

There is a great deal of soil variability in these map units. Other soils besides Charlton can also be found here. The proposed site of the septic tank absorption field should be carefully investigated prior to construction.

Figure 3 **Soils Map**



Map Unit CrC - This map unit is composed primarily of 2 kinds of soils that are so intermingled on the ground that they could not be separated on the map. Slopes are 3 to 15 percent. One kind of soil is named Charlton. The Charlton soils are very deep and well drained. Typically, they have fine sandy loam textures to a depth of 60 inches or more.

The other soil is named Hollis. Hollis soils are shallow and well drained. Typically, they are fine sandy loam in texture and overlie hard bedrock at a depth of 10 to 20 inches. The Hollis soils make up about 40 percent of the map unit.

The Charlton soils are well suited for building site development. However, the Hollis soils have severe limitations due to their shallow depth to bedrock. Construction of roads and building foundations may require blasting. Septic systems would be extremely costly.

Map Unit HpE - This map unit is composed principally of 2 kinds of soils that are so intermingled on the ground that they could not be separated on the map. Slopes are dominantly 25 to 35 percent. One kind of soil is named Hollis. Hollis soils are shallow and well drained. Typically, they are fine sandy loam in texture and overlie hard bedrock at a depth of 10 to 20 inches.

The other soil is named Charlton. Charlton soils are very deep and well drained. Typically, they have fine sandy loam textures to a depth of 60 inches or more. The Charlton soils make up about 40 percent of the map unit.

This site has very low potential for community development due to its steep slopes and presence of shallow soils.

Map Unit HSE - This map unit is composed primarily of Hollis soils and rock outcrops on 15 to 35 percent slopes. The Hollis soils are the same as described above in map units HpE and CrC.

The rock outcrops consists of exposures of consolidated bedrock.

This map unit has very low potential for community development. The steep slopes and shallow depth to bedrock would make site development extremely expensive.

Map Unit RN - This map unit is composed primarily of Leicester soils on 0 to 5 percent slopes. Leicester soils are very deep and poorly drained. Typically, they have fine sandy loam textures to a depth of 60 inches or more. These soils have a seasonally high water table within 18 inches of the soil surface and are inland wetlands.

This map unit has very low potential for community development due to the presence of a high water table.

Map Unit SxC - This map unit is composed principally of Sutton soils on 8 to 15 percent slopes. Sutton soils are very deep and moderately well drained. Typically, they have fine sandy loam textures to a depth of 60 inches or more. Sutton soils have a seasonal high water table between 18 and 30 inches of the soil surface.

The Sutton soils have low potential for community development. Extensive design and site preparation are required to overcome the problems associated with the high water table. In spite of this, these soils are commonly used for building site development in this area.

B. RECREATION POTENTIAL

The ChB, ChC, CrC and SxC map units have good potential for hiking trails. The slopes are relatively flat and erosion of the trail surface will not be a problem. These map units have good potential for picnic areas where the slopes are less than 8 percent.

The HpE and HSE map units are also good sites to develop for trails but care must be taken to prevent erosion on the steep slopes. Trails should be constructed with switch backs and water bars to control surface water runoff. A small area along the east edge of the HSE map unit is suitable for development as a picnic area.

C. IMPORTANT FARMLANDS

There are no prime farmlands or farmlands of statewide importance located on this property.

D. SOIL EROSION AND SEDIMENTATION CONCERNS

Due to the steep slopes found on this site potential soil erosion and sedimentation impacts are significant.

All soil erosion and sediment control planning should follow the planning principles found in chapters 3, 4 and 5 of the new Connecticut Guidelines for Soil Erosion and Sediment Control.

Planning principles that will be especially critical for this site include:

1. Fitting development to the existing terrain.
2. Limiting clearing and grading to the smallest practical area at any one time during construction.
3. Utilizing temporary vegetative measures to control soil erosion on distrubed areas that will not receive permanent stabilization within 30 days.

VIII. Sewage Disposal

A. REGULATORY CONSIDERATIONS

Authority over potential subsurface sewage disposal on this site is divided depending on the size and type of sewage system proposed. The authority to grant permits and the standards for such systems rest with the town sanitarian assisted by the State Department of Health Services unless any of the following conditions exist:

1. The total discharge to the site is in excess of 5000 gallons per day.
2. Separate residential buildings are connected to a common sewer line or treatment system (including septic tank/leachfields), in which case this would be deemed a "community sewerage system".
3. Any form of sewage treatment other than septic tank-leachfields are proposed.

Item (3) can be discounted in this discussion, but items (1) and (2) must be explored in some detail since the regulatory jurisdiction involved can significantly impact the cost of the project, the time frame for approval, and prospect for complete development. If the project comes to the Department of Environmental Protection it will require exhaustive site testing and engineering demonstration that the site can transmit and rennovate the wastewater as well as good system design, engineering supervision of installation and an operational permit requiring system monitoring. In addition any DEP application is subject to several months delay to comply with the public notice/ hearing requirements of section 22a-430 of the Connecticut General Statutes.

Smaller systems under jurisdiction of the Public Health Code do not have to undergo the lengthy public notice and hearing process, and except in areas of special concern (section 19-13-B103d R.C.S.A.) are not required to undergo the engineering evaluation for in-situ soil permeability, hydrogeologic evaluation, and pollutant rennovation analysis required by DEP. The Health Code utilizes different set-back distances and built in safety factors in lieu of the techniques utilized by DEP. When properly enforced, as it is in Oxford by the very able Mr. Mark Cooper, the Health Code methodology yields good results in terms of system performance and protection of the public health.

At this time an exact determination of design sewage flow cannot be made since the bedroom mix has not been determined and the town is considering specific covenants on occupancy which could result in lowered design flows.

DEP practice is to assign a sewage flow of 100 gpd/ bedroom to covenanted elderly housing projects. This is based on 2 people potentially occupying each bedroom, each using 50 gpd. This is normally a moderately conservative number. If the town proposes an ordinance providing, in perpituity, lower occupancy, then DEP would consider a lower flow rate than the aforementioned 100 gpd/bedroom.

Taken at existing figures the site could have up to 50, one bedroom units without requiring a DEP permit, while anything in excess of that figure would place the entire project under DEP jurisdiction. The site is also highly likely to require a community collection system since the suitable area for leaching systems is limited while housing units may well be spread out along a fairly large area. Such an engineering design would also require DEP approval and examination and approval of system management by the Oxford Water Pollution Control Authority, pursuant to section 7-246 of the Connecticut General Statutes.

B. SITE SUITABILITY

Much of the site is unsuitable for subsurface sewage disposal due to extremely steep slopes, shallow or exposed rock, and very high groundwater tables. No mitigating measures are proposed for those areas, specificially those mapped as HpE, CrC, RN and PbD. Such mitigating measures are unlikely to work for rather large systems located in these soils.

Despite this adversity an area of relatively good soil for leaching systems exists on the southwest portion of the property. This area has been well tested by Mr. Cooper and is characterized by relatively loose tills with groundwater tables at 30" or greater depth. This is fairly easy soil to install a conventional household septic system in, but difficulties increase as size increases, primarily due to the fact that the available unsaturated soil section has a rather fixed ability to transmit the water discharged from a septic system. Larger systems also require more leaching trench interface area. This can often lead to stacking of multiple trenches downhill of each other, which is hydraulically undesirable.

A rough hydraulic calculation of the site's hydraulic capacity has been made utilizing Darcy's Law and the following assumptions:

1) A length of suitable area approximately 1000 ft. long exists with a minimum unsaturated soil depth of 30" (2.5').
2) Hydraulic gradient is 5%.
3) Permeability range from SCS is 1.2 to 12 feet/day; typical for these soils is 5 ft/day.

therefore:

$Q = K.A. = 5 \text{ ft. day} \times 0.05 \times (1000 \times 2.5) = 625 \text{ Ft.}^3$

$625 \text{ ft.}^3 \times 7.48 \text{ gallons/ft}^3 = 4675 \text{ gallons per/day.}$

This calculation is fairly rough, but is probably conservative with regard to hydraulic capacity which is the principal limiting factor on this site. An available capacity of approximately 5000 gpd indicates that the initial phase of development should not be problematic and development up to 100 occupants should be reasonable with normal health code compliance. Development above that level both from the regulatory standpoint and engineering principal should be carefully examined by an engineer with experience in performing the analysis required by DEP. In the preliminary opinion of the ERT's sanitary engineer, development at the desired level of elderly housing is likely to be feasible if covenants strictly regulate occupancy and if architectural care is taken to specify water conserving plumbing fixtures. It is further recommended that the design engineer begin this project with the assumption that ultimate development will exceed 5000 gpd or may require a community system so that base site testing data and calculations will include information needed by DEP; to wit, permeability testing, seepage analysis and pollutant renovation analysis, in addition to deep test pits and percolation testing.

C. SYSTEM DESIGN CONSIDERATIONS

Two principal problems appear in making the available land area ready for leaching systems. The first of these is site preparation and the second is installation of an upgradient curtain drain. The following procedure is recommended as part of septic system design.

1) The maximum suitable leachfield area and its capacity be determined by further testing and analysis.
2) The suitable area and an upgradient curtain drain area be clearly marked as off limits for construction activity, construction equipment or spoils piles from road, utility or building construction.
3) The design engineer prepare careful plans for the removal of trees, topsoil removal and filling (if any) in the total system area. This construction activity is critical to preserve the upper "B" horizon permeable soils in this area, and should take place under frequent inspection and guidance from Mr. Cooper and the design engineer.
4) An upgradient curtain drain consisting of 4" or larger discharge pipe, suitably stone wrapped in engineering filter fabric, should be installed 25' upgradient of the leachfield area or areas.
5) Leaching systems should utilize either conventional trench construction or shallow gallery units with the latter preferred due to storage capacity.

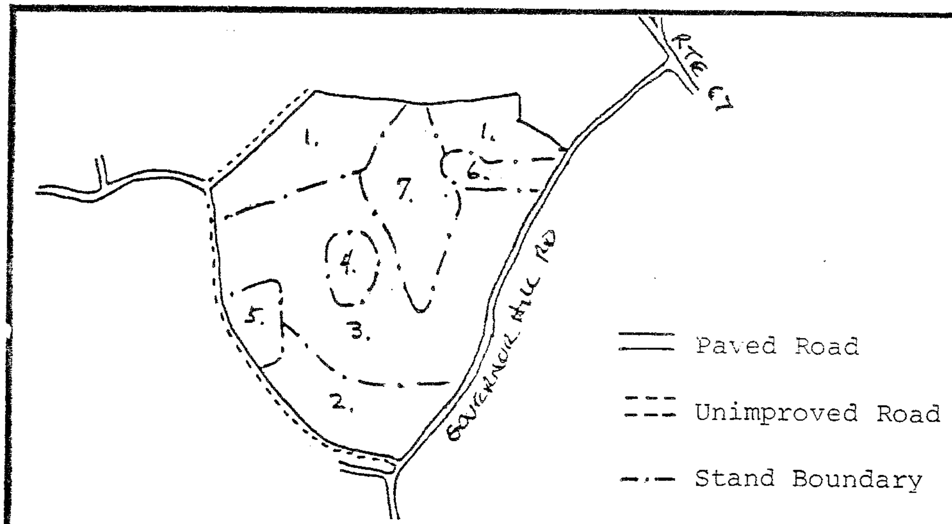
D. SUMMARY AND CONCLUSIONS

Much of this site is worthless for on site sewage disposal, however an area exists that can easily support the initial development. The area can also support additional discharge, probably to 5000 gpd, with careful health code compliance. The area probably can support the ultimate desired density, however this cannot be accurately determined at this time. A qualified engineer should be engaged immediately to determine this. The usable area of the site is quite good, but permeable till materials are fragile and can easily be ruined by sloppy construction techniques, therefore considerable care in site preparation and installation is required, including substantial supervision.

IX. Forest Management

As shown in Figure 4, the site may be divided into seven different forest stands. Each of these is described below.

Figure 4 Forest Stand Map



ACREAGE BREAKDOWN

STAND	ACRES	DESCRIPTION
1.	10	Mixed Hardwoods
2.	6	Mixed Hardwoods
3.	20	Oak/Mixed Hardwoods
4.	2	Oak Ridge
5.	2	Old Homestead Area
6.	2	Wetland
7.	6	Inaccessible/Inoperable
	48	

N

SCALE

1" = 1000'

Stand #1. Mixed Hardwoods, 10 acres - This well stocked stand is composed of medium quality, pole-sized* black birch, grey birch, yellow birch, red oak, white oak, black oak, ash, red maple, black cherry and cedar. These trees are growing at a medium rate on a medium quality growing site and are approximately 45 years old.

The understory species encountered include maple-leaved viburnum, red maple regeneration, black birch regeneration, and scattered mountain laurel.

The ground cover here includes ground pine, scattered tufts of grass, low bush blueberry, poison ivy, and scattered green briar.

As the westernmost portion of this stand is the area primarily considered for development, management here should be aimed at maintaining or improving aesthetic quality.

Thinning and weeding aimed at removing the diseased, deformed, and otherwise defective stems will achieve this in large part. Products from this would be primarily firewood, since the aim would be to retain larger stems for shade and windbreaks.

Plantings here should be biased towards softwoods, as they will utilize the available nutrients and moisture better than would hardwoods.

Stand #2. Mixed Hardwoods, 6 acres - This well stocked stand is composed of medium quality, sawlog-sized red maple, black birch, red oak, black oak, and ash. These trees are growing at a fair rate on a good quality growing site and are approximately 75 years old.

The understory species encountered include spicebush, scattered dogwood, maple-leaved viburnum, and poles of red maple and black birch.

The ground cover here is somewhat limited by overstory shading but does include some raspberries, grasses and multiflora rose in more open areas.

An improvement harvest of the poorest quality stems here would serve two purposes. First, the overall quality of the stand would be upgraded through the removal of the poorest quality stems, leaving the best to develop further. Second, the openings in the canopy created by this thinning would allow sunlight to reach the forest floor, stimulating new growth.

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*seedling size - less than 1" in diameter at breast height (d.b.h.)
sapling size - 1-5 inches in d.b.h.
pole size - 5-11 inches in d.b.h.
sawlog size - 11 inches and larger in d.b.h.

Stand #3. Oak/Mixed Hardwood, 20 acres - This well stocked stand is composed of medium quality, sawlog-sized red oak, white oak, chestnut oak, and red maple. These trees are growing at a medium rate on a fair quality growing site and are approximately 75 years old.

The understory species encountered include poles of the same species, scattered beech poles, high bush blueberry, and multiflora rose.

The ground cover here includes patches of ground pine, low bush blueberry, and poison ivy.

As there is a substantial amount of oak mortality present from past gypsy moth infestations, this stand has been thinned naturally and does not need further thinning. However, if recreational use of this area is anticipated, it would be desirable to remove all oak mortality as firewood in order to minimize the danger of injury from falling dead stems and branches.

Stand #4. Oak Ridge, 2 acres - This medium stocked stand is composed of poor quality, pole to small sawlog-sized white oak, chestnut oak, scarlet oak, red maple, and red cedar. These trees are growing at a poor rate on a poor quality growing site and are approximately 55-65 years old.

The understory species encountered include scattered dogwood and virburnum.

The ground cover here includes grasses, low bush blueberry, huckleberry and poison ivy.

Management of this area should be of lowest priority as this represents the poorest soils on the property.

Stand #5. Old Homestead, 2 acres - This poorly stocked old field area is composed of medium quality, sapling to pole-sized red cedar, poplar, red oak, red maple, and black birch. These trees are growing at a good rate on a good quality growing site and are approximately 35 years old.

The understory species encountered include multiflora rose, barberry and reproduction of the above hardwood species.

The ground cover here includes primarily grasses, with some goldenrod, and poison ivy.

Several decrepit apple trees can be found here and m might be brought back into some semblance of production for wildlife habitat by pruning and removing competing undesirable stems.

No meaningful forest management is feasible here due to the young nature of the area and sparse stocking.

From a wildlife standpoint the diversity in habitat type this area offers is valuable. For this reason, maintaining this area in an open state may be desirable.

Stand #6. Wetland, 2 acres - This area is characterized by a high watertable. Primary forest species to be found here consist of red maple, with ash and black birch on the drier margins. Understory species to be found include spicebush, sweet pepperbush, and viburnum. The ground cover encountered includes skunk cabbage, jewelweed, and grasses but may be non-existent under heavy understory cover.

Due to the sensitive nature of the wetland soils found here, no management activities are anticipated.

Stand #7. Inaccessible/Inoperable - This area is characterized by steep slopes, generally boulder-strewn, with frequent ledge outcrops. Available moisture and nutrients range from relative abundance at the base of the slope to relatively poor conditions at the crest of the slope.

Vegetative cover on this area varies depending on the conditions found in any particular spot. In general, these slopes are covered with mature stems, due largely to the inaccessibility of the area, which precludes any harvesting activity.

It is strongly recommended that these areas be left intact. Topography prevents meaningful management anyway, and soils here will be very sensitive to erosion.

Rare and Endangered Species - The DEP's Natural Diversity Data Base does not have any record of rare or endangered species on this site.

X. Planning Considerations

A. CONSISTENCY OF PROJECT WITH TOWN, REGIONAL AND STATE PLANS

TOWN PLAN

The Oxford town plan prepared in 1965 is very general and greatly out of date. The plan does identify this area as "open space rural residential". While there is no definition of that term, it would appear that the senior housing proposal is in general accord with that document. Present zoning is Residence District A requiring 1-1/2 acres per dwelling unit.

REGIONAL PLAN

The 1977 adopted regional plan designates the acreage under review in the Natural Area category. This category is for those areas of the Region which, by soil and slope criteria, have severe or very severe limitations for urban development. Less than one third of the 48 acre tract or about 15 acres is classified as suitable for development. Given the reported purchase price of $215,000.00 this equates to approximately $14,333.00 per buildable acre.

STATE PLAN

The State Plan of Conservation and Development classifies the subject area as Rural, which is defined as "Forest resource and scenic values of general concern. Generally remote and lacking public water and sewer".

B. CIRCULATION, ACCESS AND LAND USE

Principal access roads to the site are Governors Hill Road and Hogsback Road. Both roads have adequate pavement width (no sidewalks) and are in good condition; however, grades approach 10% in several areas. Principal access into the site and to the buildable land area should be from Hogsback Road preferably along Somers Lane to Old Church Road on the southwest side of the property. Somers Lane is of adequate width and condition to handle the estimated increased traffic to and from the site. Given the location of the buildable land, access into the actual site will have to be on at least a portion of Old Church Road. A question local officials will have to answer is whether dual access should be provided for fire protection purposes, either from Somers Lane or Town Farm Road.

Trip generation rates for this type of land use are estimated at 3.3 average weekday vehicle trips per dwelling unit. Given 24 units, traffic volume would increase by approximately 80 trips per day. Saturday and Sunday trips are estimated at even a lower rate of 2.6 and 2.5 respectively. Adjacent roads are capable of absorbing this increase without any reduction in the normal flow of traffic. Utilization of senior mini-bus service to the site, which would be a necessity, will further reduce the vehicle trips to and from the site. Construction of 100 units, as ultimately envisioned for the site, would increase traffic volume by roughly 330 trips per day. This naturally becomes more of a concern when viewing the impact on nearby roads.

In the opinion of the Team's planner, the physical impact of the 24 units should be minimal on the single family residences which are located principally to the west and southwest of the site. The construction of 100 units on the site becomes more of a concern however due to the increased visual impact of the project on the landscape and increased traffic flows on nearby residential roads (e.g., Somers Lane).

C. DESIGN POTENTIAL AND SOLAR CONSIDERATIONS

While the site has principally northeastern exposure it is possible to locate the structures on the buildable portion of the lot to take advantage of solar orientation. Careful structure siting would be required to optimize this situation, however it can be accomplished. A bigger question is what the remainder of the site can be utilized for. A 200 foot rise in elevation with gradesapproaching 40% over much of the unbuildable portion (33 acres) eliminates many possible uses outside of passive recreation.

* * *

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.