CANTERBURY ESTATES

Canterbury, Connecticut

AUGUST 1988

ENVIRONMENTAL REVIEW TEAM REPORT

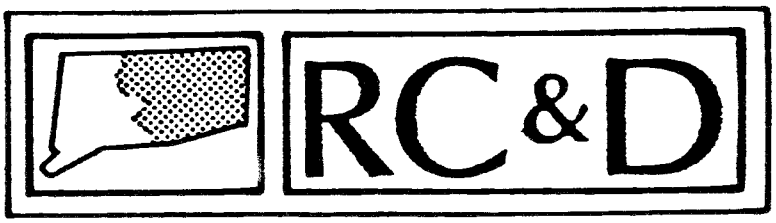
EASTERN CONNECTICUT RESOURCE CONSERVATION AND DEVELOPMENT AREA, INC.

CANTERBURY ESTATES

Canterbury, Connecticut

Review Date: MAY 17, 1988

Report Date: AUGUST 1988



ENVIRONMENTAL REVIEW TEAM

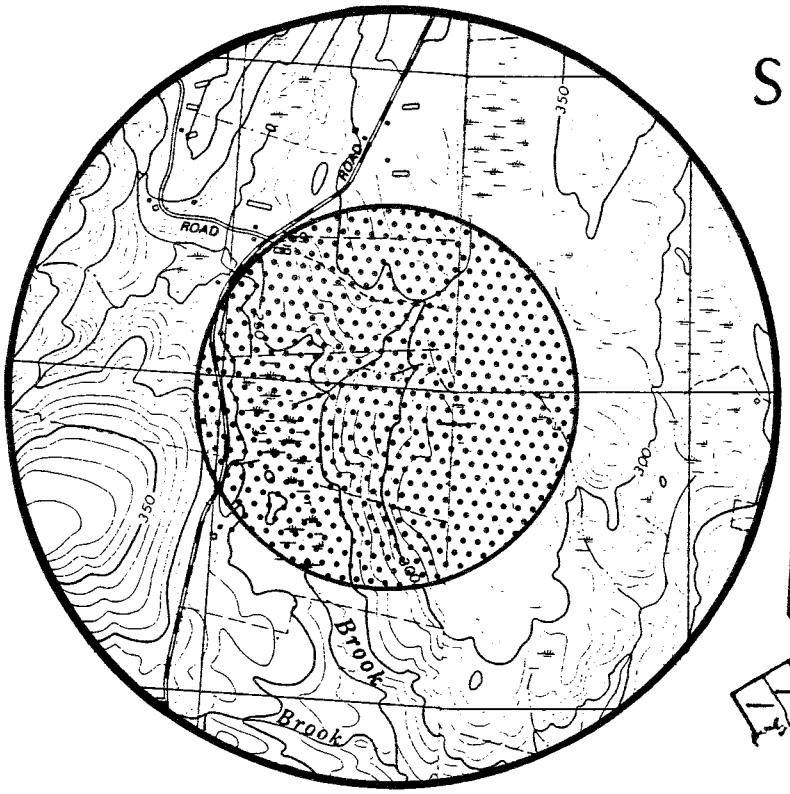
PO BOX 70

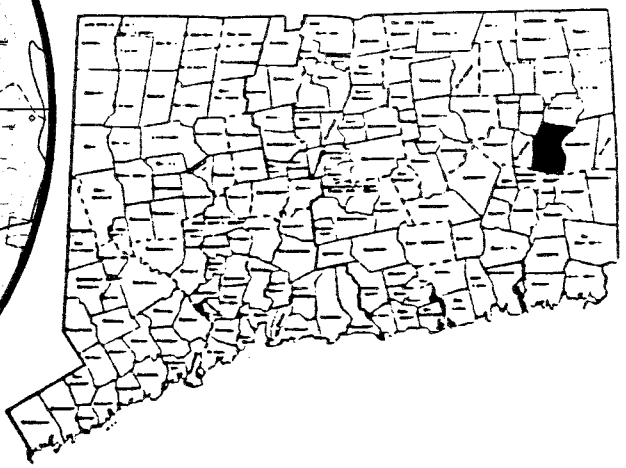
HADDAM, CONNECTICUT 06438

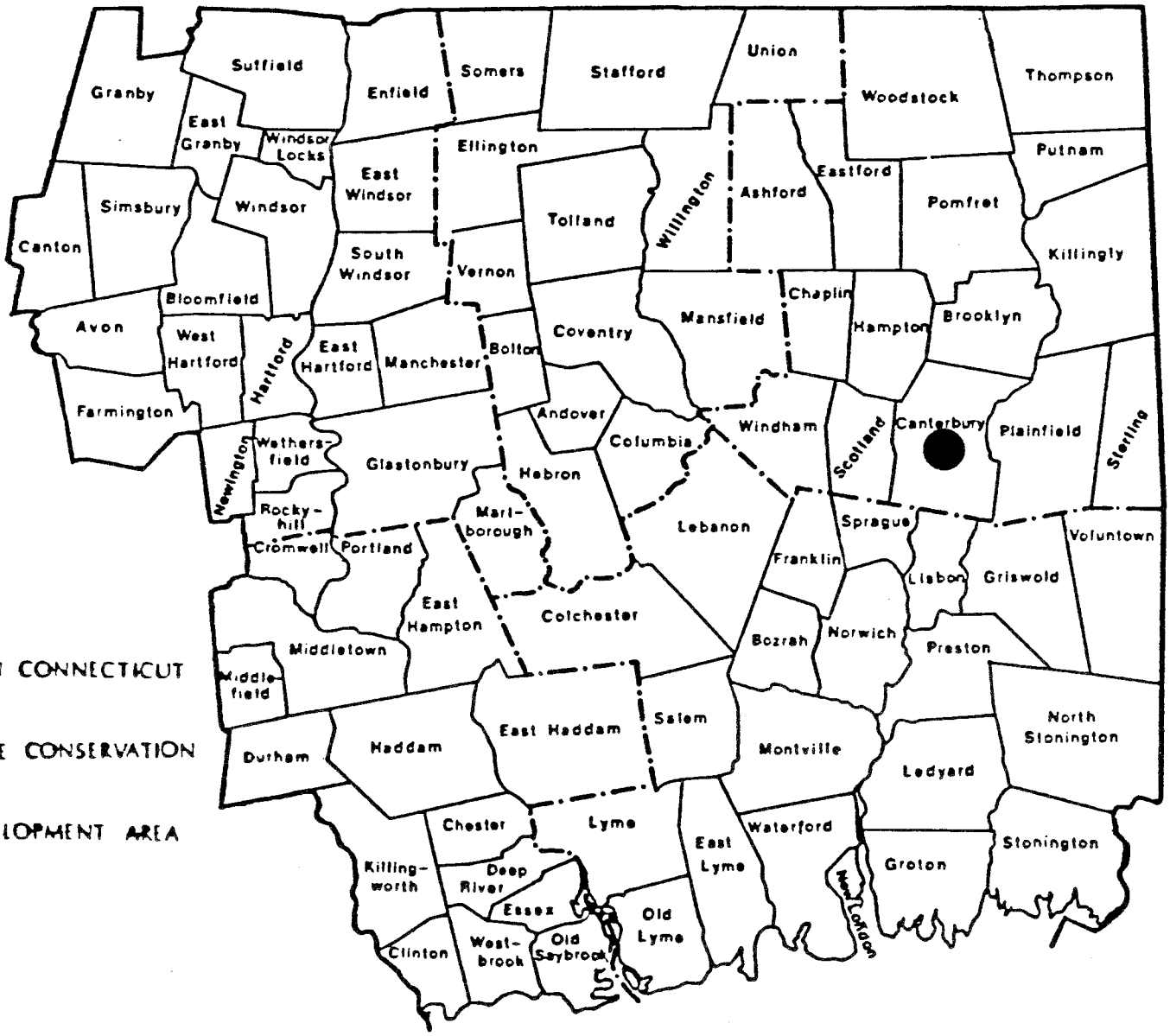
Site Location

CANTERBURY ESTATES SUBDIVISION

CANTERBURY, CONNECTICUT







EASTERN CONNECTICUT

RESOURCE CONSERVATION

& DEVELOPMENT AREA

ENVIRONMENTAL REVIEW TEAM REPORT
ON
CANTERBURY ESTATES SUBDIVISION
CANTERBURY, CONNECTICUT

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

The ERT met and field checked the site on Thursday, May 17, 1988. Team members participating on this review included:

Howard Denslow	--District Conservationist - U.S.D.A., Soil Conservation Service
Dan Mayer	--Environmental Analyst - DEP, Water Resource Unit
Brian Murphy	--Fisheries Biologist - DEP, Eastern District
Judy Bouse Pahl	--Regional Planner - Northeast Council of Governments
Elaine Sych	--ERT Coordinator - Eastern CT RC&D Area
Bill Warzecha	--Geologist - DEP, Natural Resources Center

Prior to the review day, each Team member received a summary of the proposed project, a list of the Town's concerns, a location map, a topographic map, property map and information regarding the wetland crossings. During the field review the Team members were given plans. The Team met with, and were accompanied by the First Selectman, members of the Planning and Zoning Commission and Inland Wetland Commission, the engineer for the project, concerned citizens and a Department of Health Sanitarian. Following the review, reports from each Team member were submitted to the ERT Coordinator for compilation and editing into this final report.

This report represents the Team's findings. It is not meant to compete with private consultants by providing site designs or detailed solutions to development problems. The Team does not recommend what final action should be taken on a proposed project--all final decisions and conclusions rest with the Town and landowner. This report identifies the existing resource base and evaluates its significance to the proposed development, and also suggests considerations that should be of concern to the developer and the Town. The results of this Team action are oriented toward the development of better environmental quality and the long-term economics of land use.

The Eastern Connecticut RC&D Executive Committee hopes you will find this report of value and assistance in making your decisions on this proposed subdivision.

If you require any additional information, please contact:

Elaine A. Sych
ERT Coordinator
Eastern Connecticut RC&D Area
P. O. Box 70
Haddam, CT 06438
(203) 345-3977

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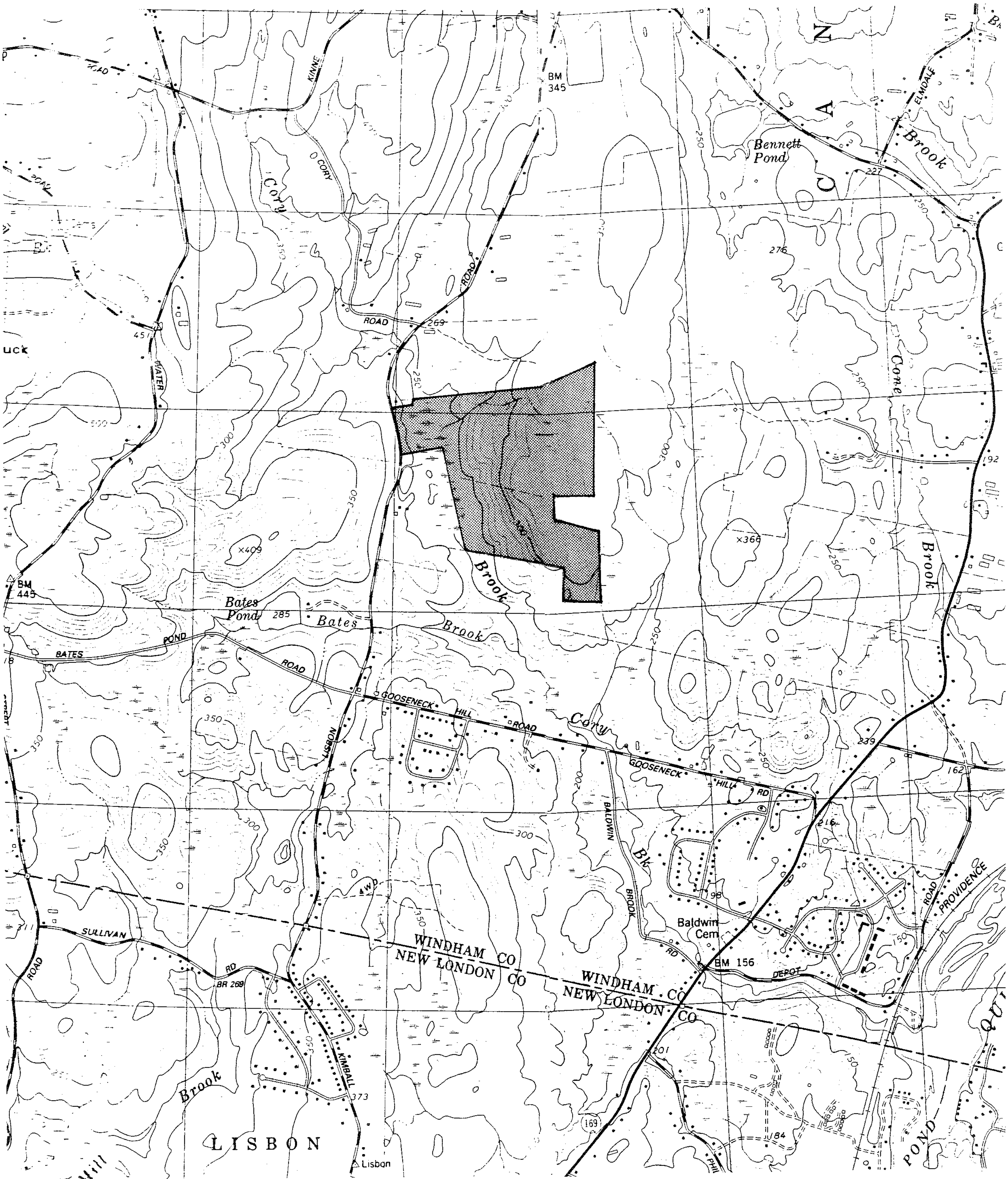
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RD
BR 269
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WINDHAM CO
NEW LONDON CO
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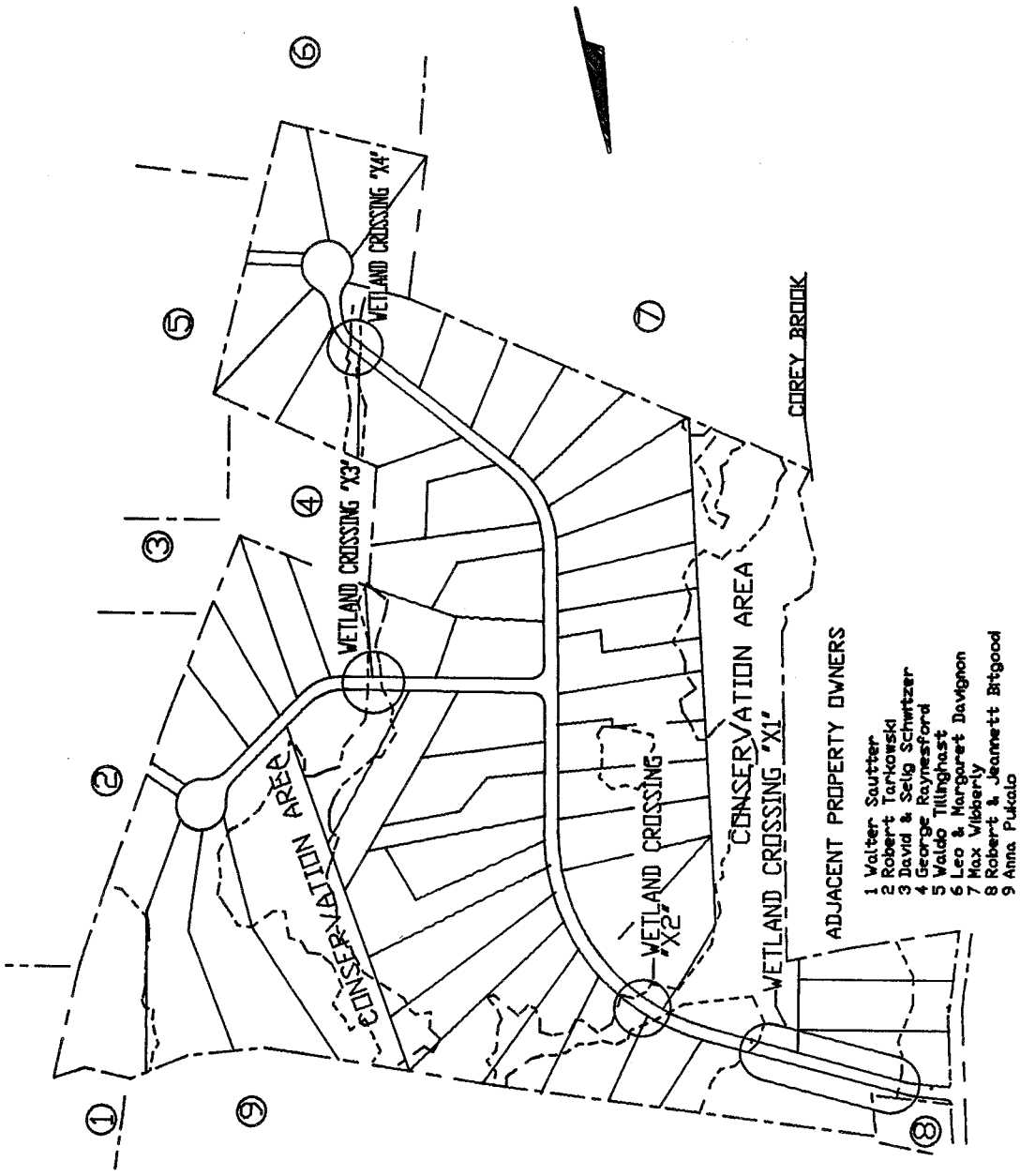
Brook
201
169
184
LISBON
Lisbon
POND

SCALE 1" = 2000



PURPOSE:

TO ACCESS BUILDING LOTS EAST OF CORY BROOK

PROPERTY MAP

scale: 1"=700'

CME Associates, Inc.

WOODSTOCK,CT. 06281

PROPOSED ENTRANCE ROAD
IN: CORY BROOK
AT: CANTERBURY,CT.
COUNTY: NEW LONDON
APPLICATION BY: CME ASSOC.

SHEET / of 23 DATE 3-01-88

I. INTRODUCTION, SETTING AND TOPOGRAPHY

The **Canterbury Estates** subdivision site, about ±172 acres in size, is located in the southcentral parts of Canterbury. It is bounded on the west by Lisbon Road, which will be the main access point to the site, and private undeveloped lands on the north, east and south. Cory Brook and its accompanying floodplains/wetlands flows in a southerly direction through the western limits of the site. A seasonal watercourse on the site, which is a tributary to Cory Brook originates on Lot 39, flows westward toward Cory Brook. Regulated wetland soils parallel the streamcourse.

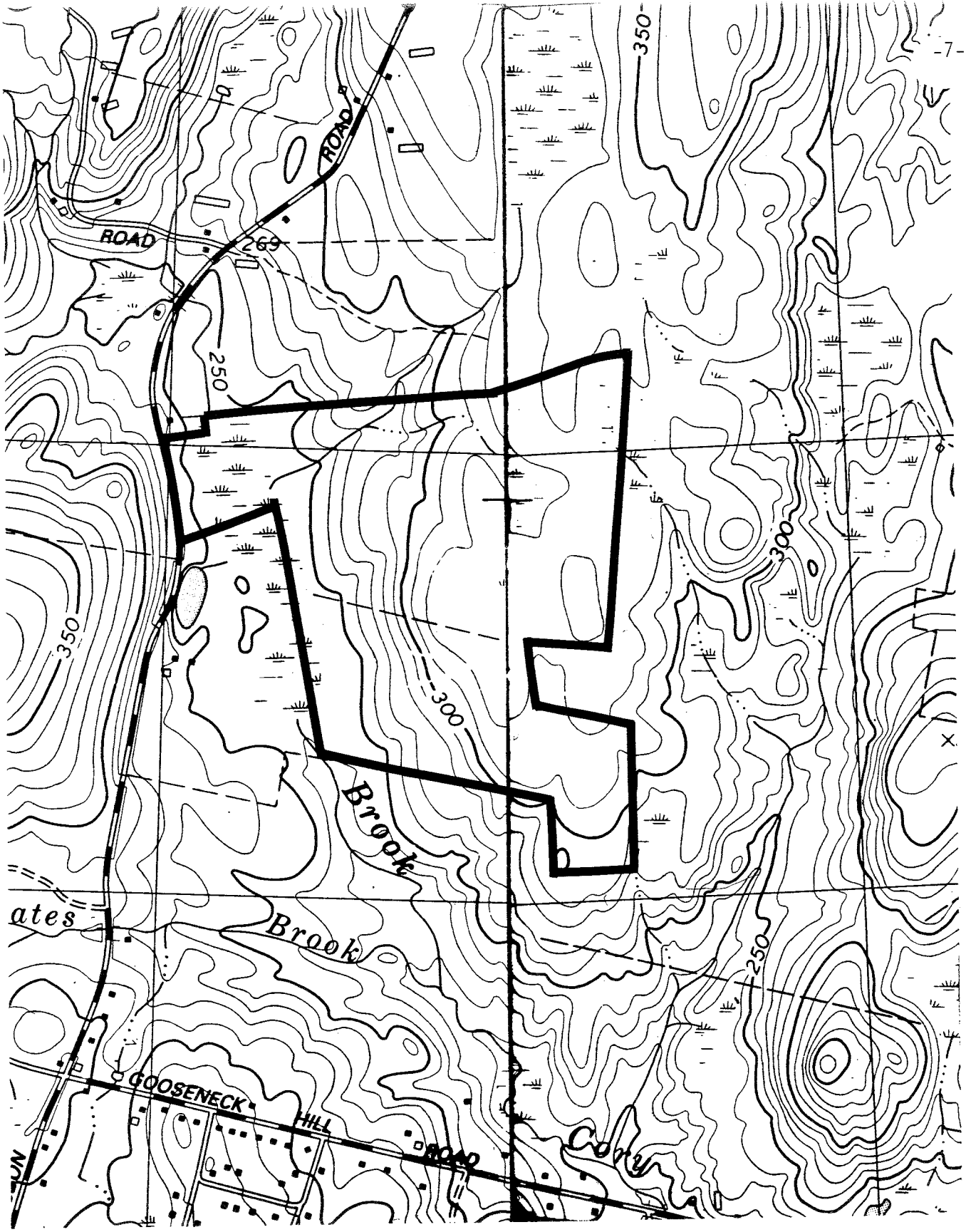
The minimum lot size for residential purposes is 80,000 square feet or about two acres. According to the project engineer, all lots exceed the 80,000 square feet minimum. Land-use in the area includes low to medium density residential and agriculture. The front portion of the site near Lisbon Road is comprised of open farm fields. The presence of numerous stonewalls transecting the site indicates its agricultural past.

Slopes within the site range from flat (in the Cory Brook floodplain and the tableland at the eastern limits) to moderate (in the central part). Site elevations range from about 250 feet above mean sea level in the wetland along Cory Brook to 330 feet above mean sea level at the eastern limits. As mentioned above, the steepest slopes are concentrated in the central part. They rise eastward from the Cory Brook floodplain for about 750 feet.

II. GEOLOGY

The western two thirds (2/3) of the site lies within the Scotland topographic quadrangle. The eastern third of the site lies within the Plainfield topographic quadrangle. A combined surficial and bedrock geologic map (GQ-392 by Shaw and Dixon) for the Scotland quadrangle has been published by the U.S. Geological Survey. A surficial geologic map (GQ-1422, by Stone and Randall) and bedrock geologic map (GQ-481 by Dixon) for the Plainfield quadrangle has also been published by the U.S. Geological Suvey.

No bedrock outcrops or ledge were observed during the ERT field walk. According to maps GQ-392 and GQ-481, the subdivision site is underlain by two subunits of Tatnic Hill Formation. For the most part, these rocks consist of gray to dark gray medium grained gneisses and schists.



TOPOGRAPHY

Scale 1" = 1000'

The terms gneiss and schist refer to the textural aspects of the rock. "Gneisses" are generally medium to coarse grained, foliated rocks characterized by alternating bands of light and dark minerals. "Schists" are generally cleavable rocks with layering defined by parallel arrangement of platy or flaky minerals. Both are metamorphic rocks, which means they have been altered by great heat and pressure within the earth's crust. The underlying bedrock is the principal source of water to residences throughout the region. It will also be the source of domestic water to homes in the proposed subdivision.

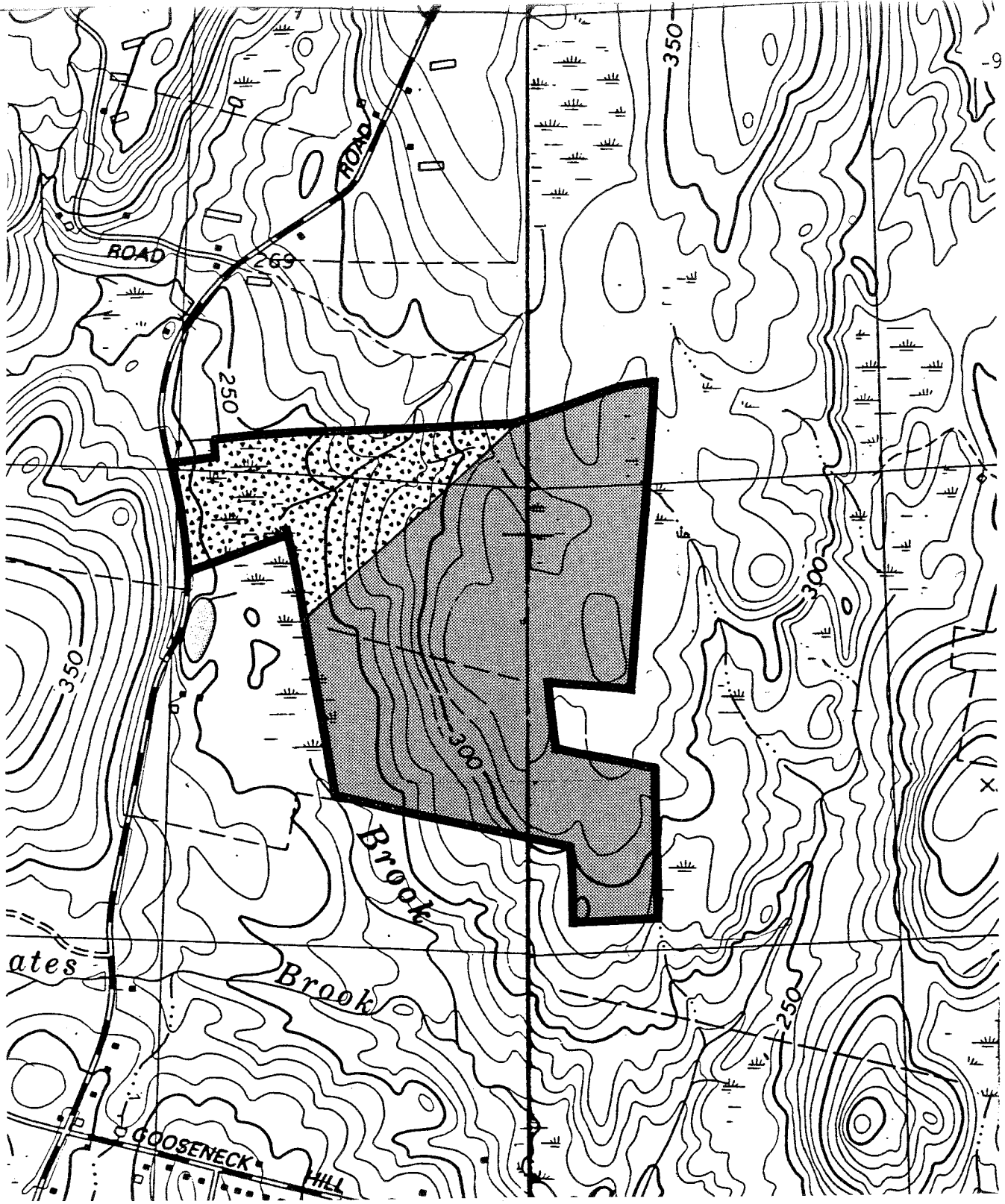
Except for sandy, gravelly deposits underlying the Cory Brook floodplain area and Lots 1-3 in the western limits, the site is covered by glacial sediments called till. Till is a glacial sediment that was deposited directly from glacial ice. The sediment consists of varying proportions of sand, silt, gravel, clay and boulders. Particles of different sizes are generally mixed together in complex fashion. According to the soil survey for Windham County, the texture of the till on the site ranges from sandy, stony and moderately loose to silty, moderately stony and compact. The latter type of till is characterized by a "hardpan" layer which has developed at a relatively shallow depth (1.5-2.0 feet below ground surface). Because of the low permeability of the "hardpan" layer, the soil zone above the "hardpan" layer becomes saturated with groundwater during the wet time of the year. On the other hand, the sandy, moderately loose variety of till found on the site lacks the "hardpan" layer and is not usually characterized by a seasonally high water table.

The exact thickness of the till deposits on the site is unknown, but it probably does not exceed much more than 10 feet in most places.

As mentioned earlier, the western third of the site is covered by strafified drift deposits (sand and gravel). These deposits were laid down by glacial meltwater in the Cory Brook Valley. Water Resources Bulletin #8 (Quinebaug River Basin) suggests that the sand and gravel beneath Cory Brook may be as much as 39 feet thick.

Regulated inland-wetland boundaries have been delineated in the field by a certified soil scientist and put on the subdivision plan. These soils primarily parallel Cory Brook and the unnamed watercourse on the site. It is suggested that the Town require that the private soil scientist who performed the field work review and sign a statement on the map(s) certifying that the information is substantially correct. The certification statement should be similar to the following:

> "The wetland soils on this site were identified in the field using the criteria required by Connecticut Public Act 72-155 as amended by Connecticut P.A. 73-571, Connecticut P.A. 87-338 and P.A. 87-533. The boundaries of these soils and of identified watercourses are accurately represented in the plot plan."

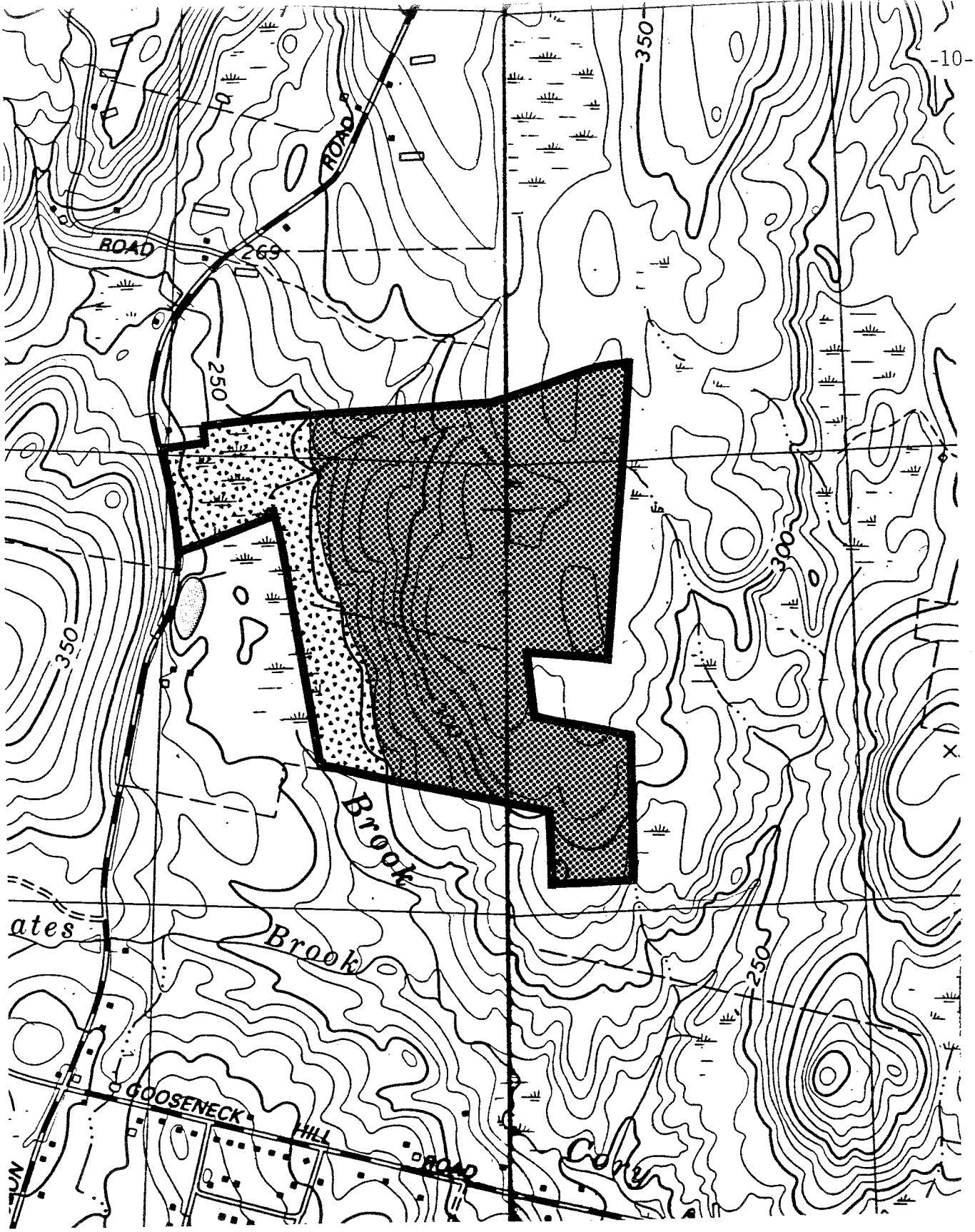


BEDROCK GEOLOGY

Tatnic Hill Formation (biotite muscovite schist)

Tatnic Hill Formation (sillimanite gneiss)

Scale 1" = 1000'



SURFICIAL GEOLOGY

Till

Stratified Drict (sand & gravel)

Scale 1" = 1000'

III. SOILS

A Soil Map is included in this section. It shows the general pattern of soils located on the property. The wetland soils have been flagged in the field and plotted on a base map to show relationship to proposed lots. Soils are wetlands basically where drainage draws develop on the hillside, and in the flood plain of Cory Brook. Soils on the hillside are well-drained (CcB, CdC, HkC), and moderately-well drained (WyA, WzC, PdB) fine sandy loams. In general the upland is drier ground than one might expect. However, it is important not to locate future houses in low pockets or drainage draws where runoff could "pond" when winter ground is frozen. Septic tanks and leach fields should not be located on such low areas either. In moderately-well drained soils, where ground mottling and graying so indicates, footing drains around foundations should be installed. Outlets could be into lower wetland drainage-ways or into street storm drainage piping.

The well-drained Hinckley (HkC) soil between Lisbon Road and the Cory Brook wetlands is easily excavated for building, but does have the limitations of being very permeable. State Health Code requires a doubling of the distance between wells and septic tanks if the perc rate exceeds one minute per inch. It is suggested septic leach fields not be closer than 50 feet to wetlands on proposed Lots 1, 2, and 3.

Cory Brook, with a large watershed, flows through a wetland which is a flood plain for the brook. The soil is a very poorly drained Saco silt loam (Sb). The area does show as a Zone A, 100 year event flood area on the Flood Insurance maps for Canterbury. There are slightly higher wetland areas, most not subject to a 100 year flood, adjacent to this Saco wetland. These are mapped as Rn wetlands. The wetlands flagged on site, and located on the base map, account for both these wetland soils. It is expected that building with necessary driveways and septic fields would stay out of these wetland areas. The exception is where a development entrance road is proposed across Cory Brook, and where interior roads cross seasonal streams and associated Rn wetland widths. CME Associates, Inc. has prepared a comprehensive plan and design for crossing these wetlands. This plan is being reviewed by the Army Corps of Engineers and the state Department of Environmental Protection.

IV. HYDROLOGY

Except for ±25 acres in the easternmost limits of the site, surface runoff and to a large degree subsurface flows drain downslope to Cory Brook. Cory Brook, a perennial streamcourse flow in a southerly direction through the western sections of the site. At its intersection with Gooseneck Hill Road, Cory Brook drains a land area of 5.53 square miles or 3,540 acres. The site therefore represents less than 5% of the watershed at that point.

SOIL MAP

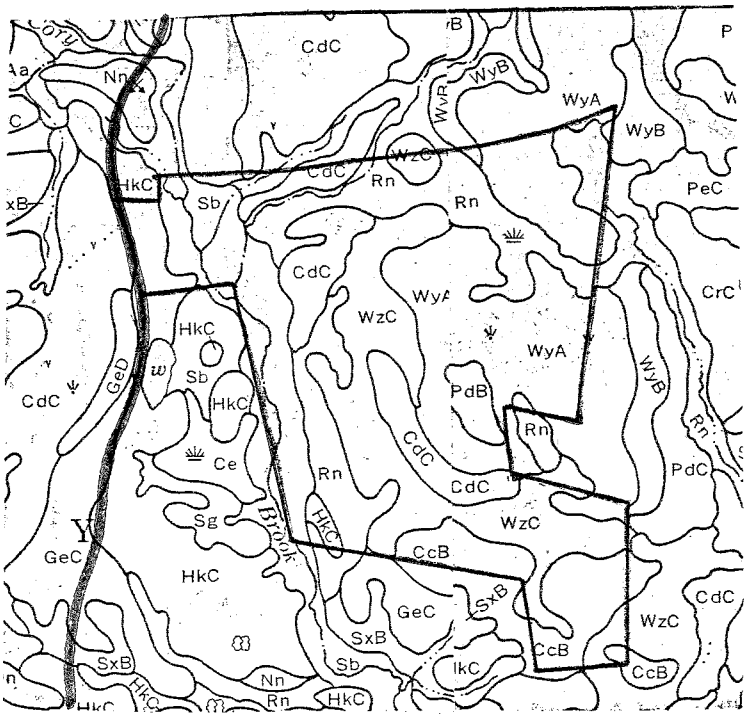
Owner Canterbury Estates Subdivision Operator

County Windham State Connecticut

Soil survey sheet (s) or code nos. #59 & #60 Approximate scale 1"=1320'

N

Prepared by U. S. Department of Agriculture, Soil Conservation Service cooperating with Windham County Soil & Water Conservation District



SOILS

CcB - Canton & Charlton very stony fine sandy loams, 3 to 8 percent slopes.

CdC - Canton & Charlton extremely stony fine sandy loams, 3 to 15 percent slopes.

HkC - Hinckley gravelly sandy loam, 3 to 15 percent slopes.

PdB - Paxton very stony fine sandy loam, 3 to 8 percent slopes.

*Rn - Ridgebury, Leicester & Whitman extremely stony fine sandy loams.

*Sb - Saco silt loam.

WyA - Woodbridge very stony fine sandy loam, 0 to 3 percent slopes.

WyB - Woodbridge very stony fine sandy loam, 3 to 8 percent slopes.

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

* Designated wetland soil by Public Act 155.

The easternmost 24 acres (see **Watershed Boundary Map**) drains to an unnamed tributary to Cory Brook. It enters Cory Brook about 700 feet northwest of Cory Brook's intersection with Gooseneck Road.

Groundwater in the area is classified by the DEP as GA which means that it is suitable for private drinking water supplies without treatment. As a result, discharge of household sewage to the subsurface from homes in the proposed subdivision should be handled with care. A certain chemical/substance could deteriorate groundwater quality in the area.

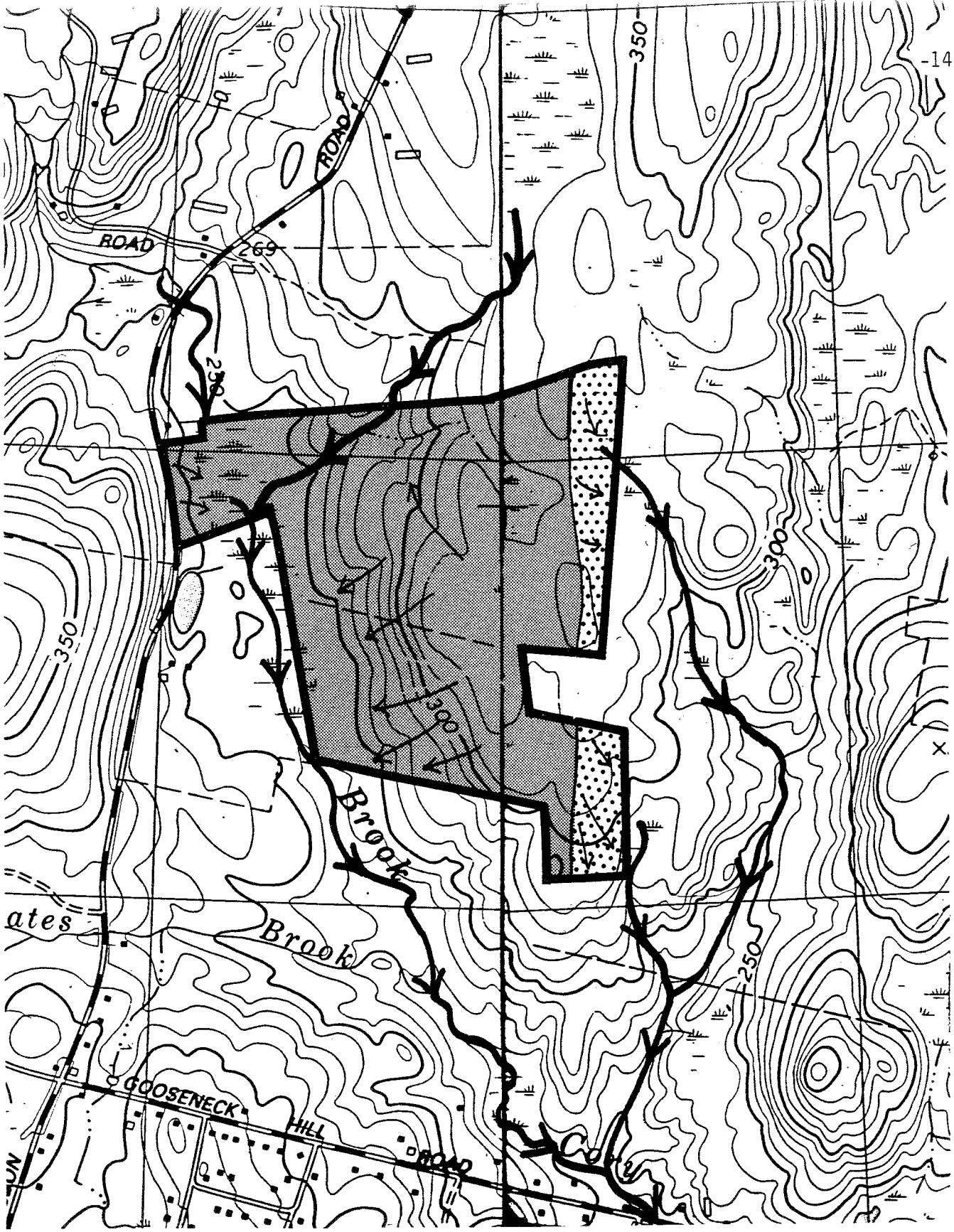
It should be noted that the section of Cory Brook that flows through the site is classified as B/A. That means that water has been degraded (due to a closed mixed waste landfill in its headwater region). The water quality goal is a fishable/swimable condition. The State's long term goal is to restore the surface waters to a Class A through clean-up actions. A class 'A' surface water would be known or presumed to meet water quality criteria which supports potential drinking water supply.

Development of the site for residential use would be expected to lead to some increases in the amount of runoff shed from the parcel. The amount of increases will depend upon the extent of development, the impervious surfaces created and the amount of vegetation removed or preserved.

To date, (5/17/88) the applicant's engineer has supplied drainage calculations only for the proposed road crossings. Because of the natural storage capabilities of the Cory Brook floodplain, the need for on-site detention basins may not be necessary. However, this can only be determined once calculations have been prepared. In this regard, it is suggested that the project engineer follow closely Connecticut's Guidelines for Erosion and Sediment when preparing the report. Once computations have been completed, a written report should be submitted to Town officials for their review. The report should include initial conditions and storm frequencies to be analyzed. A summary table, which includes pre and post-development runoff discharges for all design frequencies should accompany the report. Close examination of all downstream culverts is warranted.

The other concern regarding increased runoff is the chance for streambank erosion and gulleying. Connecticut's Soil Erosion and Sediment Control Act (P.A. number 83-388) requires that the applicant devise a thorough erosion sediment control plan. Because of some moderate slopes present on the site and silty soils (on the eastside of Cory Brook), the concern for erosion becomes a significant one. A well managed activity will need to take all necessary measures to contain and filter disturbed water so that it does not cause environmental damage on and off the site. The best solution for erosion and sediment control is to keep disturbed areas to a minimum.

As noted earlier, road drainage calculations have been prepared for subdivision. Of the four wetland road crossings proposed, Crossing XI will be the primary crossing. It will need to span approximatelty 550 feet of regulated wetland soils and Cory Brook. According to the applicant's engineer, the wetland soils are comprised of organic material (about 2') underlain by sand, gravel and hardpan. It is understood that 2,130 cubic yards of unsuitable material will be excavated along the route



WATERSHED BOUNDARY

Land area that drains directly to Cory Brook

Land area that drains to unnamed tributaries to Cory Brook

Surface runoff showing direction of flow

Watercourses showing direction of flow

Scale 1" = 1000'

and about 4,350 cubic yards of proper fill be placed to construct the road bed at the crossing. A double 6' (H) x 10' (W) concrete box culvert will be installed at the center line of Cory Brook and 20 concrete culverts of 3' diameter will be placed beneath the roadbed in the Cory Brook floodplain at approximately 25' intervals. This will help to pass certain flows beneath the roadbed and to minimize changes in the surface hydrology of the Cory Brook floodplain. Because the construction of the roadbed and placement of culverts will constrict the flow of water in the area north of the road, there is a chance for sediment buildup and clogging of debris during certain storm events at the culverts. This condition could result in the ponding of water or backwater problems to the north or overtopping of the proposed access road. Since there is only one access point into the subdivision, the latter is a legitimate concern. If crossing XI is approved, culverts need to be checked on a regular basis for debris buildup or clogging and maintained as often as necessary. The remaining 3 crossings do not appear to be be overly problematic and have been satisfactorily addressed by the project's engineer.

Although undesirable, wetland road crossings are feasible provided they are properly engineered. The roads should be constructed adequately above the surface elevation of the wetland. This will allow for better drainage of the road and also decrease the frost heaving potential of the road. In cut areas, under drains should be installed on either side of the road. Road construction through wetlands should preferably be done during the dry time of the year, and should include provisions for effective erosion and sediment control. All organic material should be removed and replaced by proper fill material. Culverts should be properly sized and located so as not to alter the water levels in the wetland or cause flooding problems.

V. WETLAND REVIEW

Wetland Description and Classification

The proposed subdivision located on a ±172 acre site on the east side of Lisbon Road, north of Gooseneck Hill Road. The subdivision will consist of 54 single family residential building lots, a brook crossing and 3 wetland crossings. The site contains ±38.2 acres of wetlands, of which ±2 acres will be directly impacted during roadway construction. The 54 lots will be accessed by 2 cul-de-sacs and served by on-site water suply and sewage disposal.

The vegetation found on site is mainly mixed hardwoods, including red maple (Acer rubrum), beech (Fagrus grandfolia), ash (Fraxinus americana), oaks (Quercus spp.) and some birch (Betula spp.) In the areas of the 3 wetland crossings, and the wetlands associated with Cory Brook, similar vegetation exists with an interspersion of some more typical wetland species, such as brambles (Acer rubrum), skunk cabbage (Symoplocarpus foetidus) and highbush blueberry (Vaccinium corymbosum). As defined by the U. S. Fish and Wildlife Service, these wetlands are classified as follows:

PFO1E - Palustrine; forested; broad leaved deciduous; seasonally saturated.

PF01C - Palustrine; forested; broad leaved deciduous; seasonal.

R30WH - Riverine; upper perennial; open water; permanent.

All of the upslope wetland systems found on site ultimately drain into Cory Brook, and are situated on mild slopes of 0-8%.

Wetland Functions

The wetland areas on the upper portions of the property, to the east, act mainly as drainageways for stormwater runoff and seasonal high water levels. These wetlands add diversity to the vegetative composition of the surrounding area, resulting in beneficial habitat and aesthetic attributes.

The wetlands adjacent to Cory Brook possess excellent flood storage capacity and also represent the most viable and diverse wetland environment found on the property. These wetlands also provide excellent habitat area for a wide variety of birds and mammals. Due to their high biological productivity, these wetlands make significant contributions to the nutrient reclamation and water purification functions of this site.

The high quality of these wetlands enhances their potential to provide educational and recreational opportunities. Opportunities for such activities as wildlife study and photography, hiking and biological research all exist on this site. Lastly, the location of the proposal site, abutting a large tract of undisturbed and undeveloped land, increases the overall functional values of the site and broadens the zone of influence of the project impacts.

Development Impacts

The proposed subdivision will include four separate crossings of wetland areas, all of which will be bermed and culverted. Roughly ±2 acres of wetlands will suffer direct impacts from these activities. Other than an obvious loss of functional wetland area, these crossings will create barriers within existing wildlife corridors and disrupt the natural drainage patterns, despite the installation of adequately sized culverts. The culverts will serve to pass flows from significant storm events, but may not maintain the flow patterns during dry or normal flow periods. If these normal or low flow conditions are not maintained significant detrimental impacts could occur to the wetlands.

The major point of concern is the crossing of Cory Brook and its associated wetlands. The construction of this crossing will encompass the removal of approximately 2,130 cubic yards of wetland soils and organic materials and the placement of 4,340 cubic yards of fill for road stabilization. The placement of two box culverts and twenty 3' diameter pipe culverts will create a major barrier to wildlife which commonly use the stream corridor. This structure will require continual maintenance to insure its ability to pass floodwaters from storm events. If this maintenance is neglected major flooding problems could result. Due to the relatively mild slopes which exist on site the potential for sedimentation and erosion problems are relatively low. A proper and complete sediment and erosion control plan should be submitted by the

applicant prior to any decision made by a Town commission.

Recommendations and Conclusions

(1) In view of the number and quality of functions provided by Cory Brook and its border wetlands, the use of some form of viaduct (free spanning bridge), for this crossing, is highly recommended. For the purposes of reviewing the alternatives, by the wetlands commission, the applicant should be required to provide complete documentation on the use of such a structure.

(2) The removal of wetland soils and organic materials should be kept to a minimum, in all cases, in an effort to maintain the highest percentage of natural functional area as possible.

(3) All wetland soils and organic materials which may be removed during construction should be placed in one central spoils area. This area could then be used as a potential wetlands creation site if surrounding environmental factors, (i.e. hydrology, slope, etc.), are favorable for such an activity. The Water Resources and Natural Resources Units of DEP should be contacted and consulted before any such activities are attempted.

(4) This site may not be best suited for a subdivision as proposed by the applicant. Many forms of alternative development techniques such as cluster development or condominiums exist, and should be given full and fair consideration when an evaluation of site alternatives is performed.

VI. GEOLOGIC DEVELOPMENT CONCERNS

It is understood that the applicant wishes to subdivide the ±172 acre parcel into 54 single family residential building lots, 5,900 linear feet of paved cul-de-sac access road and approximately 30 acres of dedicated open space. Every effort should be made to minimize disturbance of lots and keep them wooded. The house will be serviced by individual on-site wells and septic systems.

In terms of the proposed residential subdivision, the major geological limitations found on the parcel include: 1) areas of moderate slopes; 2) the presence of some compact till soils, which may result in elevated groundwater tables and which have slow percolations rates; and 3) areas of permanent or seasonal wetness (regulated inland wetland soils).

These geologic limitations will weigh heaviest on the ability to provide adequate subsurface sewage disposal systems and road and driveway construction. Soil testing to date has been conducted only on Lots 1-3.

Because these lots are located over permeable sandy, gravelly soils, there should be little difficulty for locating on-site septic systems and wells. In order to determine whether or not the remaining 51 lots can support on-site septic systems, detailed soil testing must be conducted on each and every lot. Of particular concern will be those areas dominated by "hardpan" soils which tend to be characterized by slowly permeable soils and seasonally high water tables. Because the water table fluctuates seasonally in these soils, it is suggested that soil testing be conducted during the wet time of the year so that the true water table is accurately determined.

The areas characterized by "hardpan" soils (Paxton and Woodbridge soils) usually allow for the installation of curtain drains. A properly designed and constructed curtain drain installed in accordance with all applicable codes can effectively lower the groundwater so that it does not interfere with the proper functioning of the septic system. A curtain drain may be used in conjunction with building footing drains. Footing drains should be required for all homes constructed in the study area characterized by seasonally high water tables. This will hopefully keep basements from getting wet during the spring months.

Since many lots may require curtain drains, the separation distances between the septic systems on adjoining lots becomes critical. Upgrade lots may have to be widened so that their sewage disposal systems are a least 50 feet away from any downgrade curtain drains. Also, the project engineer should address where each of these curtain drains will be located and where they will be discharged prior to subdivision approval.

Prior to subdivision approval, the applicant, through his engineering firm, must show that each proposed lot meets the minimum soil standards in accordance with Section 19-13-B103e(a) (3) of the Public Health Code. Each lot should be able to hydraulically disperse the expected discharge from the home's sewage disposal system into the site's natural soil layers per Section 19-13-B103e(a) (4) of the Code.

The process should be a coordinated effort between the design engineer and the local health district. Because numerous lots will fall within an "area of special concern" identified by the State Public Health Code, plans for the design of the subsurface sewage disposal facilities (along with the placement of each on-site well water supply) must be prepared by a professional engineer and submitted to the health district for review and approval by their certified staff.

The final configuration of lots should not be approved until the health district is assured of the feasibility of each lot meeting all of the State Health Code requirements and above listed concerns.

Once septic systems are engineered and approved by the proper authorities (i.e., state and local health departments), it is important that the systems be installed properly, according to design specifications and size and be properly maintained (e.g., pumped every 3-5 years by the homeowners).

Based on the plot plan submitted to team members, the proposed access road will need to cross Cory Brook and a seasonal drainageway on the site in at least four places in order to access the subdivision site. These wetland/stream crossings will be in the following sections. (1) Near the entrance of the subdivision (Cory Brook crossing); (2) between Lot 6 and 54; (3) between Lots 17 and 25 and 26 and (4) Lot 33 and 39. It also appears that driveways serving Lot 6 and possibly 7 will need to cross regulated wetlands in order to access these respective lots.

Wetland crossings of the seasonal drainageway are feasible and can be accomplished without much damage to wetlands provided they are properly designed (e.g., culverts are properly sized and installed and permeable road base fill material is used). The crossings should be constructed at least 1.5 feet and preferably 2 feet above the surface elevation of the wetlands. This will allow for better drainage of the roads and decrease the frost heaving potential of the road. It is recommended that any road construction through wetland areas be done during the dry time of year with adequate provisions for effective erosion and sediment control it is strongly suggested that the applicant be required to submit detailed plans for all wetland crossings. The plans would indicate specific site development details, erosion and sediment control measures, fill lines, amount of fill to be placed, the impacts of filling, watercourse channel location and flow direction disturbed areas, etc. Approved wetland activity needs to be closely monitored by town officials.

The major wetland/stream crossing for the subdivision, which warrants very careful examination, will be where the main access road crosses Cory Brook and its accompanying floodplain. This crossing represents about 600 linear feet. Generally speaking, the same measures discussed in the preceding paragraph apply, however, they will be of a larger scale and affect a much greater area of wetlands/floodplain. The impacts of such activity need to be carefully examined. (See **Wetland Review** Section).

Because these soils are classified as inland wetland soils in Connecticut, they are regulated under Public Act 155. Any activity which involves modification, filling removal of soils, etc., will require a permit and ultimate approval by the Town's Inland Wetland Commission. In reviewing a proposal, the Commission needs to determine the impact that the proposed activity will have on the wetlands. If the Commission determines that the wetland is serving an important hydrological or ecological function and that the impact of the proposed activity will be significant, they may deny the activity altogether or, at least require measures that would minimize the impact. If alternate routes exist, they should be given consideration. Finally, since 1.8 acres of wetlands is proposed to be filled, a U. S. Army Corps of Engineer's permit will be required.

VII. SOIL RESOURCE DEVELOPMENT CONCERNS

Residential development of the site will obviously change the character of the area. To minimize impact, mitigating measures to control stormwater runoff and therefore minimize erosion must be applied. A storm water management plan and erosion and sediment control plan, the latter per town regulations, should be carefully prepared and implemented. Such plans should be expected as part of final subdivision plans. The town may wish to ask for a bond to assure that the roads, drainage, erosion and sediment control measures, and certain other utilities, are installed initially before any houses on the hillside are constructed. Development could be phased to allow some building after certain road sections were completed. The Windham County Soil and Water Conservation District would review final subdivision plans if requested by the town. Certainly keeping land disturbance to a minimum is important since the forested site is now in a very stable well vegetated condition. Site clearing limits on each lot should be considered. They could be indicated on the plan.

The developer is encouraged to consider alternative access to the hillside by purchase of surrounding property. Crossing Cory Brook and its associated several hundred feet of flood plain wetland is a major task, if allowed. The cost may exceed what can reasonably be recaptured by selling homes within the site. Purchasing access from the north, possibly along the laneway opposite Cory Brook's intersection with Lisbon Road might be possible.

It is a credit to the developer to recognize and plan to set aside Open Space and Conservation areas. The town needs to decide if they would want to be deeded these if offered or would feel it is a liability to them. Since the proposed areas are basically wetlands they do not appear to be useable for any active recreational use, e.g. playfields.

VIII. WATER SUPPLY

From a standpoint of sanitary protection and flexibility, (as far as location), the underlying bedrock appears to be the most suitable aquifer to serve the proposed 54 individual water supply wells. Obtaining water from any given bedrock well is dependent upon the number and size of water transmitting fractures that are encountered by the well. The metamorphic rock (gneisses and schists) underlying the site responds to geologic forces by fracturing, folding and forming distinct open joints. If the underlying rock contains continous and interconnected fractures and joints, the availability of groundwater for domestic uses should be good. In the Quinebaug River basin, it is estimated that at 85 percent of the sites surveyed in the basin, a well penetrating 100 feet of bedrock could supply at least 3 gallons per minute. Generally, a yield of 3 gallons per minute is satisfactory for domestic purposes. A survey of numerous well completion reports for drilled wells along Lisbon Road revealed moderate yields (none less than 3 gallons per minute).

Proper well construction and separating distances on every lot in accordance with State Public Health Code and Connecticut Well Drilling Board regulations will allow for adequate protection of the quality of bedrock aquifer.

It should be pointed out that there may be a possibility of undesirably high mineral (particularly iron) content in the bedrock beneath the site. Should well water prove to be high in mineral content, several filtration methods are available on the market to overcome such problems.

IX. FISH RESOURCES

Site Description

Cory Brook is the primary surface hydrological feature of fisheries concern on this parcel of land. This section will focus on potential development impacts to Cory Brook, its associated wetlands, and downstream areas.

At this location, Cory Brook flows southeasterly through an extensive wetland area before draining into the Quinebaug River. Distance from this location to the Quinebaug River is approximately 2.5 river miles. Waters of Cory Brook on this property slowly move through wetlands due to a low change in gradient. These wetlands serve a critical role in that they help cleanse stream waters by filtering-out excessive stream sediments and man-made pollutants. The color of Cory Brook is tea-stained due to tannic and humic acids that naturally originate from wetlands. The channel of Cory Brook is approximately 10 feet in width near the proposed road crossing. Deep "pool" habitat in excess of 2 feet in some areas is prevalent along this stretch of Cory Brook. Streambed substrate is best defined as a sandy, mud type bottom overladen with silty sediment. The channel becomes less well-defined as it flows through wetland habitat.

Three unnamed, small watercourses drain off this development site and into the wetlands of Cory Brook.

Fish Population

The exact fish population assemblage of Cory Brook alongside the proposed development is unknown. Several juvenile redfin pickerel were documented on the day of the field review. Other fish expected to inhabit the deep, slow moving waters in this stretch of stream are: bluegill sunfish, pumpkinseed sunfish, and American eel.

Cory Brook directly upstream and downstream of the proposed development contains excellent trout habitat. It is annually stocked by the DEP Bureau of Fisheries with approximately 600 yearling (6-8") brook trout. The stream in these areas contains the following ideal trout habitat characteristics: a series of well-defined "pools" and riffles"; gravel-cobble type bottom substrate; instream cover in the form of large rocks, fallen trees, and undercut banks; and a well-developed streamside overhead tree canopy. Fish expected to inhabit Cory Brook in these areas are: native brook trout, blacknose dace, fallfish, white sucker, and tesselated darter.

The three small watercourses that drain into the wetlands of Cory Brook do not support permanent fish populations.

Surface waters of Cory Brook are classified as "B/A" by the Department of Environmental Protection. Designated uses are; potential drinking water source; recreational use; fish and wildlife habitat; industrial and agricultural water supply. Future goals are to improve water quality to "Class A".

Impacts

1. Construction site soil erosion and sedimentation of Cory Brook and wetlands through increased runoff from unvegetated zones - during construction topsoil within the proposed building lots will be exposed and susceptible to runoff events. Nationally, silt is considered a major stream pollutant. Erosion and sedimentation due to residential housing construction has long been regarded as a major cause of stream degradation. In particular, silt deposition will:

The following impacts to aquatic ecosystems can be expected if proper mitigation measures are not implemented:

* Reduce aquatic insect production - sediment free water is also required for successful aquatic insect egg respiration and hatching. Aquatic insects are important food items in fish diets. Reduced insect levels will adversely effect fish growth and survival since excessive energy demands are required to locate preferred aquatic insects when population levels are low.

* Reduce the amount of usable fish habitat used for spawning purposes - preferred substrate that becomes compacted with silt is no longer available for spawning. Fish will be forced to disperse to other areas of the brooks not affected by siltation.

* Reduce stream pool depth - pools provide cover, shelter, and resting areas for fish. They are important fish habitat areas. Siltation of pools will cause a further reduction in usable fish habitat.

* Adversely affect "gill" function and impair feeding activities - studies have documented that high sediment concentrations and turbidity will disturb fish respiration and gill function.

* Contribute to the depletion of oxygen - organic matter associated with soil particles is decomposed by micro-organisms contributing to the depletion of oxygen in waters overlying sediments.

* Encourage the growth of rooted aquatic plants and promote filamentour algae growth in streams - eroded soils contain plant nutrients such as nitrates and phosphates. Although algae and aquatic plants require these nutrients for growth, most aquatic ecosystems contain very limited amounts. Consequently, these nutrients act as fertilizers once they are introduced into aquatic habitats resulting in accelerated plant growth. Presently, Cory Brook contains very insignificant amounts of rooted aquatic plants.

2. Percolation of septic effluent into Cory Brook - a failure of individual septic systems to operate properly is potentially dangerous to stream environments. Nutrients and assorted chemicals that may be placed in septic systems could possibly enter streamwater in the event of a failure or infiltrate groundwater during the spring when water tables are close to the surface. The introduction of septic effluent could result in a major threat to fish habitat, public health, and overall water quality conditions. Effluent will also simulate the growth of nuisance aquatic vegetation and algae.

3. Aquatic habitat degradation due to the influx of stormwater drainage - roadway runoff that contains pollutants such as salt, sand, gasoline, oil, and other pollutants that may be spilled on driveways and roads can be directly introduced into the brook. Stormwater can cause water quality and aquatic habitat degradation. Fine sediments in stormwaters that remain in suspension for prolonged periods of time cannot be effectively removed from stormwaters since catch basins will only remove heavy coarse particulate matter; thus, they are ineffective against the removal of fine sediments. Stormwater runoff will eventually fertilize stream waters and result in water quality degradation.

4. Degradation of wetland habitat - wetlands are beneficial in several ways. Wetlands serve to: (1) control flood waters by acting as a water storage basin, (2) trap sediments from natural and man-made sources of erosion, and (3) help filter out pollutants from runoff. Wetland habitat of Cory Brook provides a natural sedimentation zone for instream materials and surrounding topography. Its ability to function as a "wetland" and properly filter out and trap sediments may be drastically reduced if "filling" occurs due to erosion, stormwater events, or excavation activities.

5. Transport of lawn fertilizers and chemicals to Cory Brook - runoff and leaching of nutrients from fertilizers on lawns will stimulate filamentous algae growth in streams and degrade overall water quality. The introduction of lawn herbicides can result in complete dieoffs of fish and aquatic insect populations.

6. Impacts to downstream environments of the Quinebaug River - any water quality problems and habitat degradation that directly occurs within Cory Brook can be directly transported to the Quinebaug River and immediately impact resident fish and aquatic insect life and recreational activities. Typically, impacts can be wide ranging including: increased nutrient enrichment of waters, creation of nuisance aquatic weeds and dense algae blooms, sediment accumulation, and increased production of microorganisms that cause fish disease. The probability of partial or complete fish kills will increase. The Quinebaug River supports healthy and diverse warmwater and coldwater fish populations. Annually, the Bureau of Fisheries stocks the river with more than 8,000 adult brook, brown, and

rainbow trout. Future fisheries management plans for the Quinebaug River involve the restoration of anadromous fish species, such as, Atlantic Salmon, American Shad, and river herrings. Anadromous fish are defined as fish which ascend freshwater sections of rivers from marine environments for the purpose of spawning. Hence, it is important that both small and large tributaries of the Quinebaug River be afforded maximum environmental protection so that they provide clean, unpolluted waters to the mainstream.

Recommendations

The wide ranging impacts on Cory Brook, its wetlands, and the Quinebaug River may be partially minimized by implementing the following suggested recommendations:

1. The developer must submit a detailed soil erosion and sedimentation plan for town review - installation and proper maintenance of erosion and sedimentation controls during site construction activities are vital. All exposed areas should be stabilized and seeded as soon as possible. Other basic mitigation measures include: silt fabric fences, staked hay bales, and catch basins. If this development is approved, the Town of Canterbury should have an appointed official that would be responsible for checking this development to ensure that contractors have complied with all stipulated mitigation devices. Past stream siltation disturbances in Connecticut associated with residential housing developments have occurred when individual contractors either improperly deployed mitigation devices as stipulated on individual development plans, or failed to maintain these devices on a regular basis.

2. Maintain at the **minimum** a **100 foot** open space **buffer zone** along side the wetland boundary edge of Cory Brook - no construction or alteration of wetland, riparian resources shall take place in this zone, otherwise, the ability of the buffer zone to function properly will be reduced. Research has shown that 100 foot buffer zones will protect aquatic resources by helping to prevent surface runoff, septic leachate and other pollutants from entering streams. The Town of Canterbury should be responsible for the regulation of all activities that can take place within the buffer zone.

3. Properly design and locate individual septic systems - the addition of septic effluent to streams can be one of the greatest threats to stream ecology. All individual septic systems should be maintained on a regular basis. Prevent the disposal of harmful chemicals into septic systems which may negatively effect operation and possibly result in system failure.

4. The developer plans to install a double 6' X 10' concrete box culvert to cross Cory Brook - it is strongly suggested that this culvert

be installed at least **6 inches** below the existing streambed level. This installation design will allow for the natural accumulation of stream substrate within the concrete culvert and also allow for unobstructed passage for resident fishes to move to upstream and downstream areas of Cory Brook.

5. All instream work and land grading/filling near Cory Brook and the other watercourses should take place during the summer - this will help minimize the impact to the aquatic resources. Reduced streamflows and rainfall during the summer provide the least hazardous conditions in which to work near sensative aquatic environments.

6. Submit a detailed stormwater management plan for town review - the effective management of stormwaters and roadway runoff can be accomplished through proper design, location, and maintenance of catch basins. Maintenance is very critical. Catch basins should be regularly maintained to minimize adverse impacts to streams. Catch basins will only trap heavy, coarse sediments reducing the likelihood of excessive stream sedimentation; however, waters that contain pollutants, such as, salts and even small amounts of fine enriched sediments, will eventually cause water quality and aquatic habitat degradation. This impact can not be prevented, since catch basins will not remove these materials. Stormwaters should not be directly outletted to streams.

7. Limit liming, fertilization, and the introduction of chemicals to subdivision building lots - this will help abate the amount of additional nutrients to the streams. Non-phosphorus lawn fertilizers are currently available from various lawn care distribution centers.

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X. PLANNING CONCERNS

Land Use Density

Canterbury's zoning regulations require a minimum 2-acre lot size in areas with soils characterized as well-drained to moderately

well-drained. The only soils mapping (other than wetlands) available to the Team was a 1"=1320' soils map composite from the Windham County Soil Survey. Using this map as a guide, only the Canton/Charlton soils present slight to moderate limitations for on-site septic system installation. The majority of soils on the site present severe restrictions for septic system installation due to poor filter characteristics, wetness and slow percolation rates. These soils are: Hinckley, Paxton, and Woodbridge. Canterbury's zoning regulations stipulate that in cases where adverse soil types exist, the Planning and Zoning Commission can request larger lot sizes than the minimum 2 acres. The Commission may need to require larger lots when actual percolation data is available. Unfortunately, at the time of the review, no percolation tests were available (other than lots 1 - 3) and no houses and primary and reserve septic areas were sited on the conceptual plan provided by the developers.

Water Supply Availability

At the time of the review, no information was provided on the hydrogeology of the site to prove or disprove whether an adequate potable water supply exists for these new homes. An examination of average production of wells in the nearby area would be useful in determining this factor. (See **Water Supply** Section) Certain areas in Canterbury (Westminster Hill area) have had dry holes and very low yielding wells. Canterbury's subdivision regulations (4.16.b) state that no certification of occupancy for any dwelling unit within an approved subdivision shall be issued until the minimum water supply is established with an average flow of three gallons per minute for each dwelling unit.

Subdivision Streets

Canterbury's subdivision regulations recommend that dead-end streets be limited to 1500'; but also states that when no other option for subdivision of the property exists, longer streets may be permitted. The proposed roadway for these 51 homes is 5900' long. No roadway design plans, drainage plans and drainage calculations were provided with the conceptual plan; thus it is not possible to evaluate the construction standards at this time. It should be noted that rights-of-way at the end of the two cul-de-sacs should be redesigned in order to enable future road extentions. Canterbury's road foreman and fire chief should be consulted as to the adequacy of the roadway and cul-de-sacs for use by town trucks and fire equipment. Canterbury's subdivision regulations stipulate a minimum diameter cul-de-sac of 100'.

Guidelines for Subdivision Streets

Connecticut Department of Transportation, 1987, states the following regarding cul-de-sacs. "Cul-de-sacs, or dead-end streets, should be designed for a maximum ADT of 200 vehicles per day (vpd). This volume of traffic relates to a 20-home generation, assuming 10 trips per day per single unit dwelling. Depending on the size of the lot frontages, the maximum length of cul-de-sacs will vary. For example, if the local zoning requires a minimum lot frontage of 100 feet, then the maximum cul-de-sac length would be 1000 feet, assuming homes on both sides of the street. The recommended maximum length is generally between 700 and 1000 feet...Due to the possibility that an emergency may occur and that the road may be blocked, the use of more than 20 homes on the cul-de-sac is not recommended." Fifty-one residences on this roadway would generate approximately 510 vehicle trips per day.

Public Safety

In addition to a thorough evaluation of the proposed roadway and cul-de-sacs by the Town for adequacy for fire trucks and equipment and town equipment, the provision of fire ponds or water towers may be advisable in order to assure the safety of the residents.

No details on Lisbon Road were given on the day of the field review; but field observation indicates that it may be of sub-standard width in many locations. Lisbon Road also is characterized by many sharp curves and hills. As future subdivisions occur along Lisbon Road and intersecting roads, this north/south connector road may require substantial improvements to accommodate additional traffic and to alleviate safety problems.

Open Space

Canterbury's subdivision regulations (Section 4.17) stipulate that proposed subdivisions shall have an area of open space of not less than 5% of the total tract deeded to the Town. In the case of this proposal, 5% would equal 8.5 acres. Since the wetlands can not be developed, Canterbury can and should require 8.5 acres of land, not wetlands, for open space and recreation and require an ownership agreement for control and management of the area required. Lot 54 would appear to be a logical location for such an open space area since it abuts both the major wetlands at Cory Brook and has road access. The subdivision regulations further stipulate that "Such open spaces shall be graded by the subdivider so as to dispose properly of surface waters, shall be seeded with field grass where the soil is left barren, cleared of all debris, and left in proper condition for use as a park or playground. The work to be performed by the subdivider to comply with this provision shall be covered by proper surety bond."

Lot #2

Lot #2 on sheet 2 of 3 is bisected by drainage from a catch basin marked C#4. A drainage easement should be required and the easement should be moved to the reserve area along the property line.

XI. APPENDIX

A. Soils Descriptions

B. Wetland Crossings Descriptions

CcB—Canton and Charlton very stony fine sandy loams, 3 to 8 percent slopes. This unit consists of gently sloping, well drained soils on ridges, hills, and side slopes of glacial till uplands. The areas are mostly long and narrow or oval and range from 5 to 50 acres. Slopes are mainly smooth and convex and are 200 to 400 feet long. Stones cover 1 to 8 percent of the surface. About 45 percent of the total acreage of this unit is Canton soils, 40 percent is Charlton soils, and 15 percent is other soils. Some areas of this unit consist almost entirely of Canton soils, some almost entirely of Charlton soils, and some of both. The soils were mapped together because they have no significant differences in use and management.

Typically, the Canton soils have a surface layer of very dark grayish brown fine sandy loam 2 inches thick. The subsoil is yellowish brown fine sandy loam, gravelly fine sandy loam, and gravelly sandy loam 21 inches thick. The substratum is pale brown gravelly loamy sand to a depth of 60 inches or more.

Typically, the Charlton soils have a surface layer of dark yellowish brown fine sandy loam 5 inches thick. The subsoil is yellowish brown fine sandy loam and sandy loam 20 inches thick. The substratum is light yellowish brown and light brownish gray sandy loam to a depth of 60 inches or more.

Included with these soils in mapping are small areas of somewhat excessively drained Gloucester and Hollis soils, well drained Paxton soils, and moderately well drained Sutton soils. Also included are a few large, nearly level areas and a few areas that have a compact substratum at a depth of 40 to 50 inches.

The water table in these Canton and Charlton soils is commonly at a depth of more than 6 feet. The permeability of the Canton soils is moderately rapid in the surface layer and subsoil and rapid in the substratum. The permeability of the Charlton soils is moderate or moderately rapid. Both soils have moderate available water capacity and medium runoff, and both are very strongly acid to medium acid.

Most areas of this unit are woodland. The soils in a few areas are used for pasture or hay. In some areas they are in community development or are used for recreation.

The soils of this unit generally are too stony for cultivation. Stone removal makes the soils well suited to cultivated crops but is difficult. The soils are well suited to use as woodland, but the Charlton soils have higher productivity than the Canton soils.

Some excavations in the Canton soils are unstable. The stones on the surface limit landscaping.

The capability subclass is VIs.

CdC—Canton and Charlton extremely stony fine sandy loams, 3 to 15 percent slopes. This unit consists of gently sloping to sloping, well drained soils on ridges, hills, and side slopes of glacial till uplands. The areas are oval or irregular in shape and range from 5 to 100 acres. Slopes are mostly smooth and convex and are 100 to 600 feet long. Stones cover 8 to 25 percent of the surface. About 45 percent of the total acreage of this unit is Canton soils, 40 percent is Charlton soils, and 15 percent is other soils. Some areas of this unit consist almost entirely of Canton soils, some almost entirely of Charlton soils, and some of both. The soils were mapped together because they have no significant differences in use and management.

Typically, the Canton soils have a surface layer of very dark grayish brown fine sandy loam 2 inches thick. The subsoil is yellowish brown fine sandy loam, gravelly fine sandy loam, and gravelly sandy loam 21 inches thick. The substratum is pale brown gravelly loamy sand to a depth of 60 inches or more.

Typically, the Charlton soils have a surface layer of dark yellowish brown fine sandy loam 5 inches thick. The subsoil is yellowish brown fine sandy loam and sandy loam 20 inches thick. The substratum is light yellowish brown and light brownish gray sandy loam to a depth of 60 inches or more.

Included with these soils in mapping are small areas of somewhat excessively drained Gloucester and Hollis soils, well drained Paxton soils, and moderately well drained Sutton soils. Also included are a few nearly level areas and a few areas that have a compact substratum at a depth of 40 to 50 inches.

The water table in these Canton and Charlton soils is commonly at a depth of more than 6 feet. The permeability of the Canton soils is moderately rapid in the surface layer and subsoil and rapid in the substratum. The permeability of the Charlton soils is moderate or moderately rapid. Both soils have moderate available water capacity and medium to rapid runoff, and both are very strongly acid to medium acid.

Most areas of this unit are in woodland. A few areas are used for pasture, and a few others are in community development.

The soils of this unit generally are too stony for cultivation (fig. 5). Stone removal makes the soils suited to cultivation but is difficult. The soils are well suited to woodland, but the Charlton soils have higher productivity than the Canton soils. The stones on the surface hinder the use of some woodland harvesting equipment.

Slope is the main limitation of the soils for community development, especially for onsite septic systems. Slopes of excavations in these soils are unstable. The stones on the surface hinder landscaping.

The capability subclass is VIIs.

HkC—Hinckley gravelly sandy loam, 3 to 15 percent slopes. This is a gently sloping to sloping, excessively drained soil on terraces of stream valleys and on glacial outwash plains. The areas of this soil are oval or irregular in shape and range from 5 to 200 acres. Slopes are convex or undulating and are mostly less than 200 feet long.

Typically, the surface layer is very dark grayish brown gravelly sandy loam 2 inches thick (fig. 7). The subsoil is dark yellowish brown, yellowish brown, and brownish yellow gravelly sandy loam and gravelly loamy sand 16 inches thick. The substratum is pale yellow gravelly sand to a depth of 60 inches or more.

Included with this soil in mapping are small areas of excessively drained Windsor soils, somewhat excessively drained Merrimac soils, well drained Agawam soils, and moderately well drained Sudbury soils. Also included are a few areas of a soil with a surface layer of fine sandy loam and a few small areas with a few stones on the surface. Included areas make up about 15 percent of the unit.

The water table in this Hinckley soil is commonly below a depth of 6 feet. The available water capacity is low. Runoff is rapid. This soil has rapid permeability in the surface layer and subsoil and very rapid permeability in the substratum, and it is extremely acid to medium acid.

Most areas of this soil are in woodland. Some areas are in cropland, and a few large areas are in community development.

Irrigated areas of this soil are well suited to cultivated crops; nonirrigated areas are fairly suited. The soil dries and warms early in the spring and is easy to till. Minimum tillage and cover crops help to minimize the moderate erosion hazard in cultivated areas.

Droughtiness makes this soil poorly suited to use as woodland; it increases seedling mortality.

This soil generally is suited to community development, but the rapid permeability imposes a hazard of ground-water pollution in areas used for septic tanks. The slopes in some excavated areas are unstable.

The capability subclass is IVs.

PdB—Paxton very stony fine sandy loam, 3 to 8 percent slopes. This soil is gently sloping and well drained. It is on the tops and side slopes of drumlins and large hills of glacial till uplands. The areas are mostly oval or irregular in shape and range from 3 to 50 acres. Stones and boulders cover 1 to 8 percent of the surface.

Typically, the surface layer is dark brown fine sandy loam 7 inches thick. The subsoil is yellowish brown and dark yellowish brown fine sandy loam 18 inches thick. The substratum is very firm to firm, olive brown fine sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of somewhat excessively drained Hollis soils, well drained Charlton soils, moderately well drained Woodbridge soils, and poorly drained Ridgebury soils. Also included are a few nearly level areas and small areas that have no stones on the surface. A few large areas have a substratum of loamy sand. Included areas make up about 10 percent of the unit.

This Paxton soil has a seasonal high water table perched at a depth of about 2 feet for several weeks in the spring. This soil has moderate permeability in the surface layer and subsoil and slow to very slow permeability in the substratum. Runoff is medium. The soil has moderate available water capacity and is very strongly acid to slightly acid.

This soil is mostly in woodland. A few areas are in pasture or community development.

This soil generally is too stony for cultivation but is well suited to woodland. Stone removal makes the soil well suited to cultivated crops but is difficult. Cover crops and minimum tillage help to control erosion and maintain tilth in cultivated areas.

The slow to very slow permeability of the substratum limits this soil for community development, especially for onsite septic systems. Steep slopes of excavations in this soil slump when saturated. Lawns are commonly soggy in autumn and spring. The stones on the surface hinder landscaping.

The capability subclass is VIs.

Rn—Ridgebury, Leicester, and Whitman extremely stony fine sandy loams. This unit consists of nearly level, poorly drained and very poorly drained soils in depressions and drainageways of glacial till uplands. The areas are mostly long and narrow or irregular in shape and range from 5 to 150 acres. Slopes range from 0 to 3 percent and are mainly 100 to 300 feet long. Stones cover 8 to 25 percent of the surface. About 40 percent of the total acreage of this unit is Ridgebury soils, 35 percent is Leicester soils, 15 percent is Whitman soils, and 10 percent is other soils. Some areas of this unit consist of one of these soils, and some others consist of two or three. The soils of this unit were mapped together because they have no significant differences in use and management.

Typically, the Ridgebury soils have a surface layer of very dark brown fine sandy loam 8 inches thick. The subsoil is mottled, light brownish gray fine sandy loam 8 inches thick. The substratum is very firm to firm, grayish brown and light brownish gray fine sandy loam and sandy loam to a depth of 60 inches or more.

Typically, the Leicester soils have a surface layer of very dark brown fine sandy loam 7 inches thick. The subsoil is mottled, grayish brown and light olive brown fine sandy loam 23 inches thick. The substratum is mottled, light olive brown and grayish brown sandy loam to a depth of 60 inches or more.

Typically, the Whitman soils have a surface layer of very dark gray fine sandy loam 9 inches thick. The subsoil is gray, mottled fine sandy loam 5 inches thick. The substratum is mottled, light olive gray fine sandy loam and sandy loam to a depth of 60 inches or more.

Included with this unit in mapping are small areas of moderately well drained Sutton and Woodbridge soils and very poorly drained Adrian and Palms soils. Also included are a few areas where stones cover less than 8 percent of the surface.

The Ridgebury soils have a seasonal high water table at a depth of about 10 inches from fall through spring. The permeability of the soils is moderate to moderately rapid in the surface layer and subsoil and slow to very slow in the substratum. Runoff is slow. The Ridgebury soils have moderate available water capacity and are very strongly acid to medium acid.

The Leicester soils have a seasonal high water table at a depth of about 10 inches from fall through spring. The permeability of the soils is moderate or moderately rapid. Runoff is slow. The Leicester soils have moderate available water capacity and are very strongly acid to medium acid.

The Whitman soils have a seasonal high water table at or near the surface from fall through spring. The permeability of the soils is moderate or moderately rapid in the surface layer and subsoil and slow to very slow in the substratum. Runoff is slow. The Whitman soils have moderate available water capacity and are very strongly acid to slightly acid.

This unit is mostly in woodland. A few small areas are used for pasture or community development.

The soils of this unit are too stony for cultivation. The unit is suited to woodland. However, the stones on the surface and the high water table hinder the use of harvesting equipment. The water table causes a high rate of seedling mortality and restricts rooting, causing a hazard of uprooting during windy periods.

The high water table and slow to very slow permeability are major limitations of the soils of this unit for community development. Steep slopes of excavations in these soils slump when saturated. The stones on the surface restrict landscaping, and lawns are soggy most of the year.

The capability subclass is VIIs.

Sb—Saco silt loam. This soil is nearly level and very poorly drained. It is on the low parts of the flood plains of major streams and their tributaries. The areas are mostly long and narrow or irregular in shape and range from 10 to 150 acres. Slopes range from 0 to 2 percent.

Typically, the surface layer is black silt loam about 14 inches thick. It is mottled in the lower 4 inches. The substratum extends to a depth of 60 inches or more. The upper part is mottled, dark gray silt loam, and the lower part is gray stratified sand and gravel.

Included with this soil in mapping are small areas of poorly drained Rippowam and Leicester soils and very poorly drained Adrian, Whitman, and Palms soils. Also included are a few areas that have a sandy substratum at a depth of less than 40 inches. Included areas make up about 25 percent of the unit.

The water table in this Saco soil is at or near the surface during most of the year, and the soil is subject to frequent flooding. The soil has moderate permeability in the surface layer and upper part of the substratum and rapid or very rapid permeability in the lower part of the substratum. Runoff is slow. The soil has high available water capacity and is strongly acid to medium acid above a depth of 40 inches and medium acid to slightly acid below 40 inches.

This soil is mostly in woodland. A few small areas are used for pasture.

Flooding and the high water table make this soil generally unsuitable for most uses other than as wetland wildlife habitat.

The capability subclass is VIw.

WyA—Woodbridge very stony fine sandy loam, 0 to 3 percent slopes. This soil is nearly level and moderately well drained. It is on the tops and lower side slopes of large drumlins and hills on glacial till uplands. The areas are mostly oval or irregular in shape and range from 3 to 30 acres. Stones cover 1 to 8 percent of the surface.

Typically, the surface layer is very dark grayish brown fine sandy loam 8 inches thick. The subsoil is mottled, dark yellowish brown and yellowish brown fine sandy loam 22 inches thick. The substratum is firm to very firm, olive gray fine sandy loam and gravelly fine sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of well drained Paxton soils, moderately well drained Sutton soils, and poorly drained Leicester and Ridgebury soils. A few small areas do not have stones on the surface. Included areas make up about 15 percent of the unit.

This Woodbridge soil has a seasonal high water table at a depth of about 20 inches from fall to spring. It has moderate available water capacity. This soil has moderate permeability in the surface layer and subsoil and slow to very slow permeability in the substratum. Runoff is slow. The soil is very strongly acid to medium acid in the surface layer and subsoil and very strongly acid to slightly acid in the substratum.

This soil is mostly in woodland. A few areas are in pasture, and a few are in community development.

This soil generally is too stony for cultivation but is well suited to woodland. Stone removal makes the soil well suited to crops but is difficult. Seasonal wetness in fall and spring is an additional limitation for crops.

The water table and the slow or very slow permeability in the substratum are the main limitations of this soil for community development, especially for onsite septic systems. Lawns on this soil are soggy in the autumn and spring and after heavy rains.

The capability subclass is Vs.

WyB—Woodbridge very stony fine sandy loam, 3 to 8 percent slopes. This soil is gently sloping and moderately well drained. It is on the tops and side slopes of drumlins and hills on glacial till uplands. The areas are mostly long and narrow or irregular in shape and range from 3 to 25 acres. Stones cover 1 to 8 percent of the surface.

Typically, the surface layer is very dark grayish brown fine sandy loam 8 inches thick. The subsoil is mottled, dark yellowish brown and yellowish brown fine sandy loam 22 inches thick. The substratum is firm to very firm, olive gray fine sandy loam and gravelly fine sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of well drained Paxton soils, moderately well drained Sutton soils, and poorly drained Leicester and Ridgebury soils. A few small areas do not have stones on the surface. Included areas make up about 10 percent of the unit.

This Woodbridge soil has a seasonal high water table at a depth of about 20 inches from fall to spring. The available water capacity is moderate. This soil has moderate permeability in the surface layer and subsoil and slow to very slow permeability in the substratum. Runoff is medium. The soil is very strongly acid to medium acid in the surface layer and subsoil and very strongly acid to slighty acid in the substratum.

Most areas of this soil are in woodland. A few areas are in pasture, and a few are in community development.

This soil generally is too stony for cultivation but is well suited to woodland. Stone removal makes the soil well suited to cultivated crops but is difficult. Seasonal wetness is an additional limitation of the soil for crops.

The water table and the slow or very slow permeability in the substratum are the main limitations of this soil for community development, especially for onsite septic systems. Lawns on this soil are soggy in the autumn and spring and after heavy rains.

The capability subclass is VIs.

WzC—Woodbridge extremely stony fine sandy loam, 3 to 15 percent slopes. This soil is gently sloping to sloping and moderately well drained. It is on the tops of large drumlins and hills on glacial till uplands. The areas are mostly oval or irregular in shape and range from 3 to 60 acres. Stones cover 8 to 25 percent of the surface.

Typically, the surface layer is very dark grayish brown fine sandy loam 8 inches thick. The subsoil is mottled, dark yellowish brown and yellowish brown fine sandy loam 22 inches thick. The substratum is firm to very firm, olive gray fine sandy loam and gravelly fine sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of well drained Paxton soils, moderately well drained Sutton soils, and poorly drained Ridgebury soils. Included areas make up about 15 percent of the unit.

This Woodbridge soil has a seasonal high water table at a depth of about 20 inches from fall to spring. It has moderate available water capacity. The soil has moderate permeability in the surface layer and subsoil and slow to very slow permeability in the substratum. Runoff is rapid. This soil is very strongly acid to medium acid in the surface layer and subsoil and very strongly acid to slightly acid in the substratum.

This soil is mostly in woodland. A few areas are in pasture, and a few are in community development.

This soil generally is too stony for cultivation but is well suited to woodland. Stone removal makes the soil well suited to crops but is difficult. Seasonal wetness in fall and spring is an additional limitation for crops.

The water table and the slow or very slow permeability in the substratum are the main limitations of this soil for community development, especially for onsite septic systems. Lawns on this soil are soggy in the autumn and spring and after heavy rains.

The capability subclass is VIIs.

B. WETLAND CROSSINGS DESCRIPTIONS

Description of the Activity

The activity consists of constructing road embankments and culvert crossings as part of the subdivision of 172 acres of land in Canterbury, CT. The total amount of wetland on the site is 38.2 acre, of which 1.8 acre are impacted by road building and are the subject of this application.

Every attempt has been made to avoid crossing the wetlands on the site. An attempt was made to purchases the land which is east of Cory Brook and north of the property on Lisbon Road to access the site without crossing the brook. This attempt was not successful. In order to minimize the impact on the wetlands, the boundaries were identified in the field by a certified soil scientist (Mike Schaeffer, Enviro-tech Consultants). He flagged the boundaries at approximately 50' intervals with numbered blue tags and the location of each tag was surveyed and plotted on a base map for the property. An existing farm road crossing the swamp was located and the alignment for the proposed road follows it as much as possible. Of the 38.2 acre on the site, 18.6 acre will be deeded to the town as part of recreation and conservation areas, 17.8 acre will remain undisturbed on private land, and 1.8 acre will be altered by road building.

In order to permit free movement of water across the swamp adjacent to Cory Brook during flooding, numerous culverts will be provided at approximately 25' intervals. Since these culverts will carry flow only during extreme flooding, the areas away from their inlet and outlet will be protected by Reed Canary Grass rather than riprapping.

There are four points at which wetlands must be crossed within the project site. These crossings are identified in the attached drawings and technical information as X1, X2, X3, and X4.

Crossing X1: This is the primary crossing. The watershed above the crossing is 3.36 square miles. The wetland consists of Cory Brook as well as approximately 215 feet of swamp west of the brook, and 335 feet of swamp east of the brook. Soils in the wetland consist of approximately 2' of organic material over sand, gravel, and hardpan. It will be necessary to excavate approximately 2130 cubic yards of unsuitable material and to place 4340 cubic yards of fill to build the embankment in this area. This crossing is designed for a 100-year flood flow of 1570 cfs as determined using HEC-1 (output attached). It meets the FEMA requirement that a stream crossing cause no more than one foot of increase in backwater under this magnitude of flow. In order to achieve this, a double 6'(H) x 10'(W) concrete box culvert will be installed at the center line of the brook, and 20

reinforced concrete pipe culverts of 3' diameter will be installed at approximately 25' intervals along the swamp areas adjacent to the brook. All culvert inlets and outlets will be riprapped to prevent erosion. A typical section of a pipe culvert and box culvert is included.

Crossing X2: This is a crossing of an intermittent stream which flows into Cory Brook from the east side of the watershed. The watershed above the crossing is 173 acre (0.27 square miles). Soils at this crossing consist of glacial till with cobbles to 12" in diameter. No unsuitable material will be removed at this crossing, and approximately 860 cubic yards of fill will be placed within in the wetland boundaries. A double 3'(H) x 6'(W) box concrete culvert will be installed at the existing center line of the intermittent stream. This crossing is designed for a 100-year flood flow of 173 cfs, which was determined using HEC-1 (output attached) The box culverts cause 2' of backwater rather than the 1' specified by FEMA, but the effect is negligible because the stream bed is at a slope of 5.6%, and the backwater effects disappear quickly at 36' upstream from the culvert.

Crossing X3: This crossing provides passage for runoff from a 0.1 acre area south of the road. Soils in this area consist of approximately 1.5' of organic material over hardpan. Approximately 230 cubic yards of unsuitable material will be removed and 560 cubic yards of fill will be placed within the wetland boundaries. Because the watershed area is so small, a 100-year storm produces only about 0.30 cfs which is insignificant. A 15" diameter pipe will be installed along with flared ends. Reed Canary Grass rather than riprap will be used to control erosion at the inlet and outlet to the culvert.

Crossing X4: This crossing provides passage for runoff from a 12.6 acre area north of the crossing. Soils in the area consist of 1.5' of organic material over glacial till. Approximately 280 cubic yards of unsuitable material will be removed and 500 cubic yards of fill will be placed within the wetland boundaries at this point. A 100-year storm produces a flow of 18 cfs which is conveyed beneath the road by 2 - 18" diameter reinforced concrete pipe culverts with flared ends. Riprap will be used to protect the inlet and outlet from erosion.

A basin will be excavated to serve as a spoil site for the unsuitable material removed from the wetland areas. Material excavated to make the basin will be used to construct the road embankments. Top soil for the basin will be stockpiled for replacement at the end of construction. The area will then be graded and seeded for use as a public recreation area.

About The Team

The Eastern Connecticut Environmental Review Team (ERT) is a group of professionals in environmental fields drawn together from a variety of federal, state and regional agencies. Specialists on the Team include geologists, biologists, foresters, soil specialsits, engineers and planners. The ERT operates with state funding under the supervision of the Eastern Connecticut Resource Conservation and Development (RC&D) Area --- an 86 town region.

The services of the Team are available as a public service at no cost to Connecticut towns.

PURPOSE OF THE TEAM

The Environmental Review Team is available to help towns and developers in the review of sites proposed for major land use activities. To date, the ERT has been involved in reviewing a wide range of projects including subdivisions, landfills, commercial and industrial developments, sand and gravel excavations, elderly housing, recreation/open space projects, watershed studies and resource inventories.

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

REQUESTING A REVIEW

Environmental reviews may be requested by the chief elected official of a municipality or the chairman of town commissions such as planning and zoning, conservation, inland wetlands, parks and recreation or economic development. Requests should be directed to the chairman of your local Soil and Water Conservation District and the ERT Coordinator. A request form should be completely filled out and should include the required materials. When this request is approved by the local Soil and Water Conservation District and the Eastern Connecticut RC&D Executive Council, the Team will undertake the review on a priority basis.

For additional information and request forms regarding the Environmental Review Team please contact the ERT Coordinator: 203-345-3977, Eastern Connecticut RC&D Area, P.O. Box 70, Haddam, Connecticut 06438.