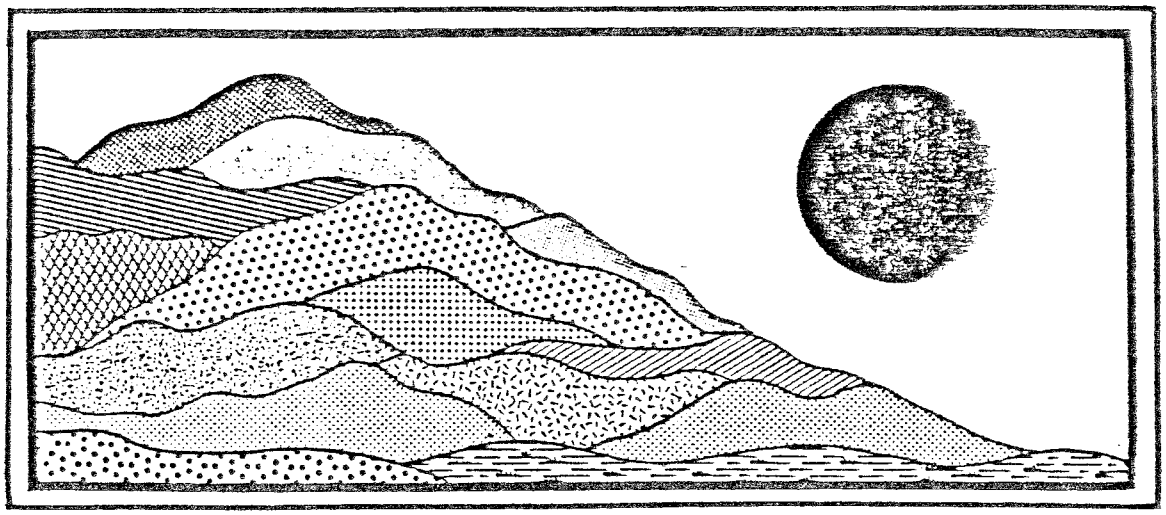
Black Ledge River

Marlborough, Connecticut

March 1987



ENVIRONMENTAL REVIEW TEAM REPORT

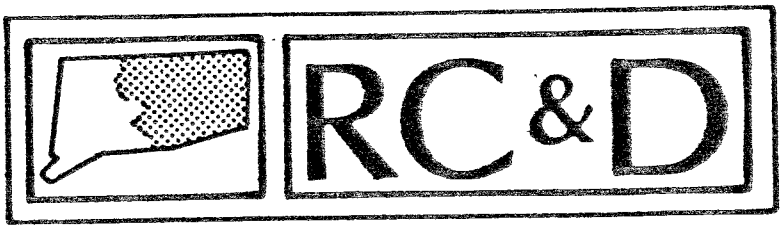
EASTERN CONNECTICUT RESOURCE CONSERVATION AND DEVELOPMENT AREA, INC.

Black Ledge River

Marlborough, Connecticut

Review Date: JANUARY 6, 1987

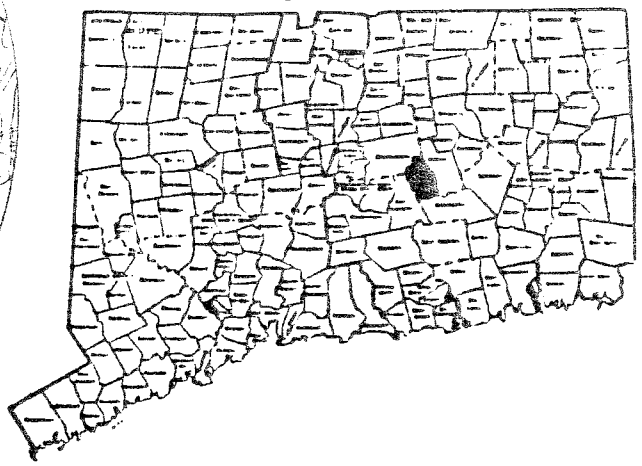
Report Date: MARCH 1987

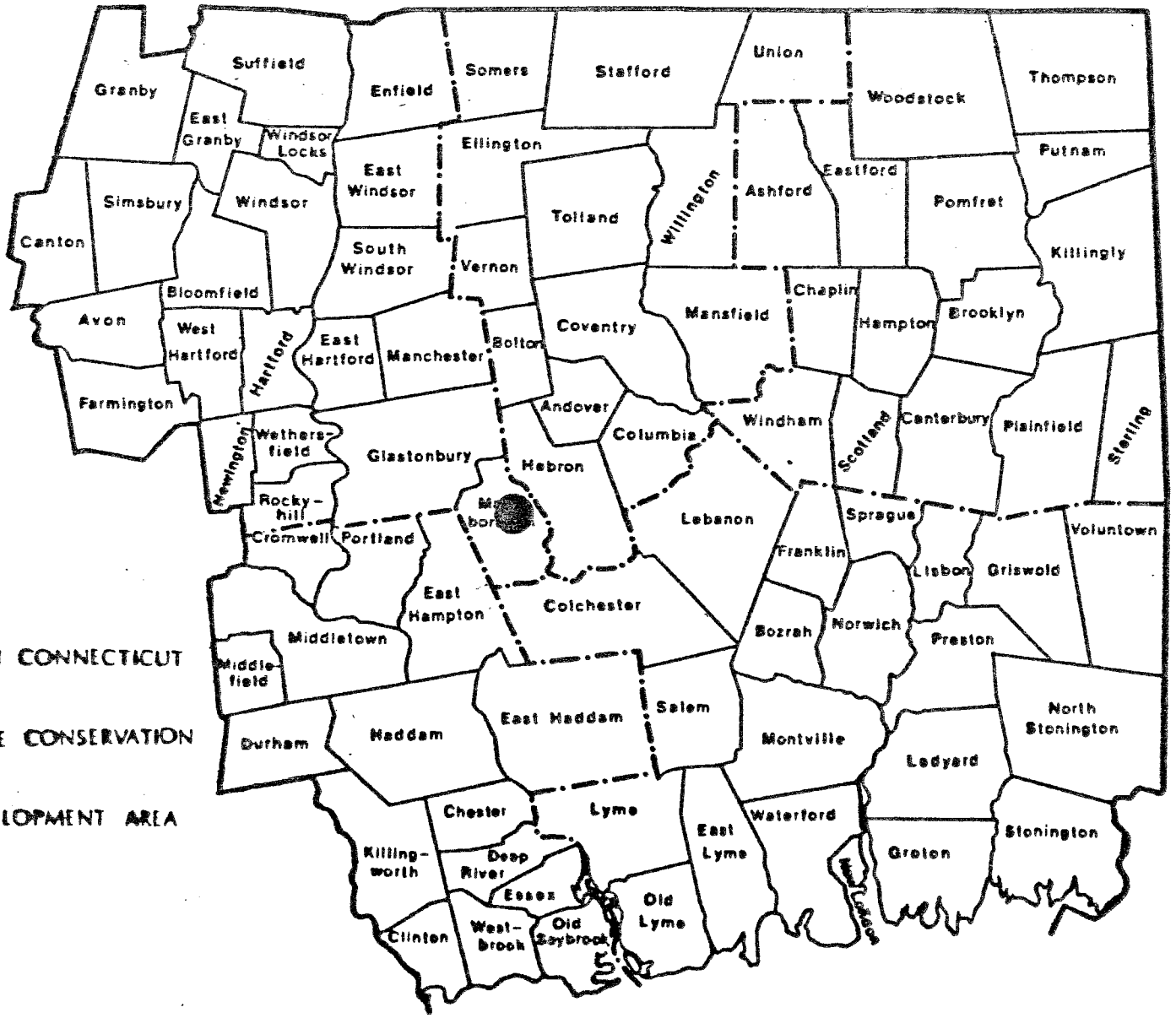


ENVIRONMENTAL REVIEW TEAM
PO BOX 198
BROOKLYN, CONNECTICUT 06234

Site Location

The Blackledge River
Diversion and Subdivision
Marlborough, Connecticut





EASTERN CONNECTICUT

RESOURCE CONSERVATION

& DEVELOPMENT AREA

ENVIRONMENTAL REVIEW TEAM REPORT

ON

The Blackledge River Diversion and Subdivision

Marlborough, Connecticut

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

The ERT met and field checked the site on Tuesday, January 6, 1987. Team members participating on this review included:

Denise Conkling	--District Manager Hartford County SWCD
Timothy Dodge	--Resource Conservationist U.S.D.A. - Soil Conservation Service
Kip Kolesinkas	--Soil Scientist U.S.D.A. - Soil Conservation Service
Jim Parda	--Forester DEP - Eastern District
Meg Rollins	--Data Handler DEP - Natural Resources Center
Eric Scherer	--District Conservationist U.S.D.A. - Soil Conservation Service
Eric Schluntz	--Fisheries Biologist DEP - Eastern District
Dwight Southwick	--Civil Engineer U.S.D.A. - Soil Conservation Service
Elaine Sych	--ERT Coordinator Eastern Connecticut RC&D Area
Bill Warzecha	--Geologist DEP - Natural Resource Center
Judy Wilson	--Wildlife Biologist DEP - Eastern District
Mike Wosniak	--Community Development Planner Capitol Region Council of Governments

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, topographic map and a soils map. During the field review the Team members were given plans for the river diversion and a preliminary subdivision plan. The Team met with, and were accompanied by the Town Planning Coordinator, the Town Engineer, the landowner and developer, and his engineers and consultants. 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 decision on this proposed river diversion and subdivision.

If you require any additional information, please contact:

Elaine A. Sych
ERT Coordinator
Eastern Connecticut RC&D Area
P. O. Box 198
Brooklyn, CT 06234
(203) 774-1253

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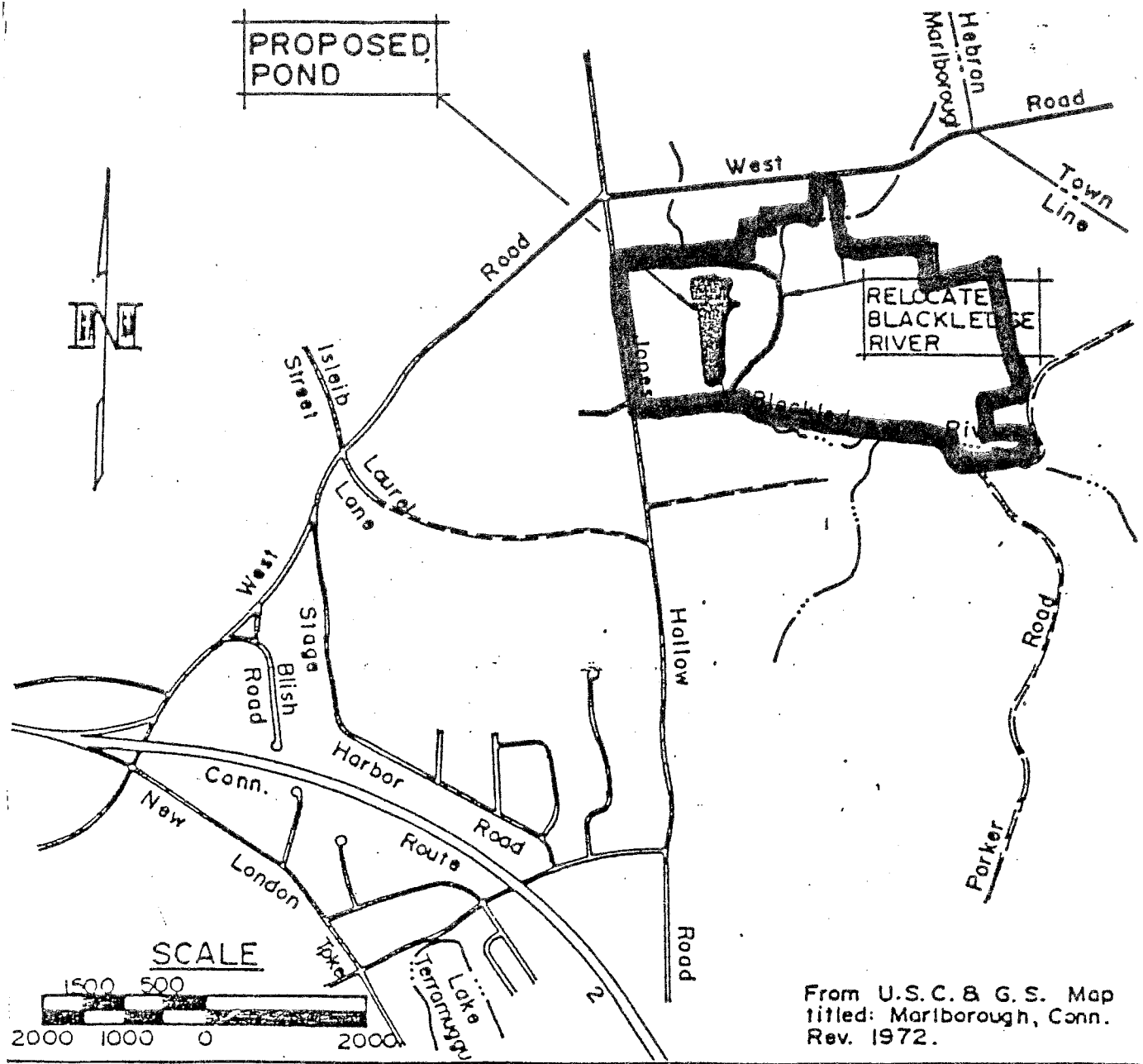
I. INTRODUCTION

The Eastern Connecticut Environmental Review Team has been asked to assist the Town of Marlborough in reviewing the Blackledge River Diversion and Subdivision.

According to present plans prepared by Moffit and Duffy Consulting Engineers, the applicant (MacClain Trucking Company) wishes to divert ±2,900 feet of the Blackledge River on the site, creating a new channel, create a ±24 acre pond in the Blackledge River floodplain, re-grade the area formerly mined for sand and gravel to a more aesthetic state and establish approximately 60 house lots on the upland parts of the site. Homes in the proposed subdivision would be served by individual on-site wells and septic systems. In this whole process ±800,000 cubic yards of material will be removed.

The report contains a natural resource inventory of the site, as well as an evaluation of the existing resource base and its significance to the proposed development. This report also highlights areas of concern, potential problems, alternatives, mitigating measures and recommendations to the Town and the developer. This report does not recommend what final action should be taken on this proposed project -- all final decisions and conclusions rest with the Town and landowner.



From U.S.C. & G.S. Map titled: Marlborough, Conn. Rev. 1972.

Purpose: Sand & Gravel Excavation

Datum: N.G.V.D. 1929

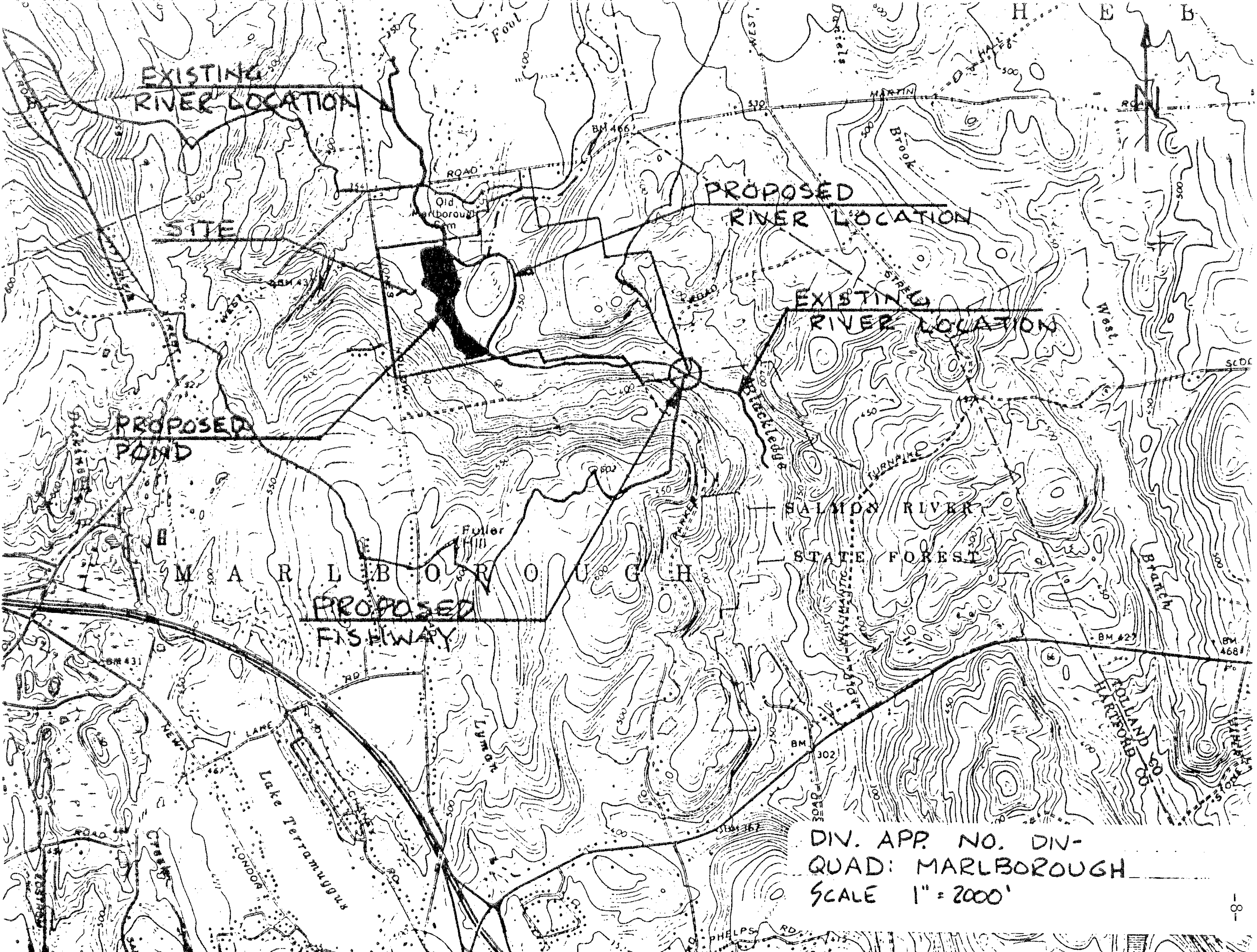
Latitude: 41° 40' 00"
Longitude: 72° 27' 30"

BLACKLEDGE RIVER PROJECT
AT MARLBOROUGH, HARTFORD COUNTY, CONNECTICUT. REV. AUG. 1986

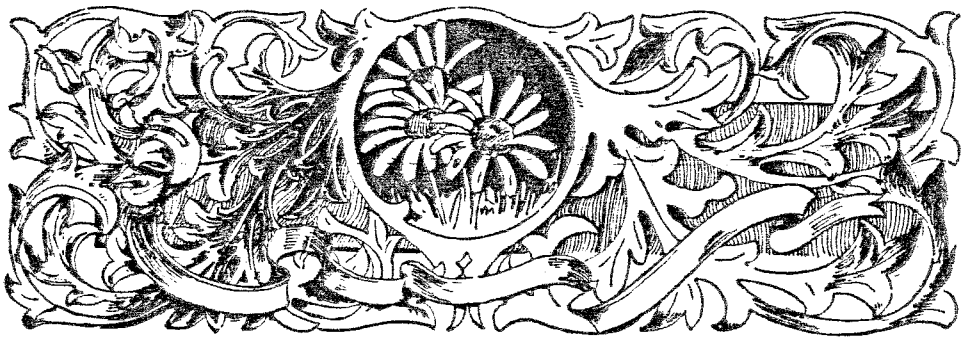
Application by:

Mac CLAIN TRUCKING CO.

AGENT: MOFFITT & DUFFY, INC.


EXISTING
RIVER LOCATION
SITE
PROPOSED
POND
PROPOSED
RIVER LOCATION
EXISTING
RIVER LOCATION
PROPOSED
FISHWAY
MARLBOROUGH
SALMON RIVER
STATE FOREST
Lake Terramuggus
Fuller Hill
Old Marlborough Cem
Blackledge
Lyman
Brook
West Branch
TOLLAND CO
HARTFORD CO
DIV. APP. NO. DIV-
QUAD: MARLBOROUGH
SCALE 1" = 2000'

II. TOPOGRAPHY AND SETTING



The ±235 acre site consists of an irregularly shaped parcel of land located in northern Marlborough. Access to the parcel is via a dirt road off of West Road to the north and along Jones Hollow Road on the west.

The Blackledge River and its accompanying wetland/floodplain bisects the western half of the parcel. The Blackledge then makes a 90° turn eastward at the southern boundary and generally parallels the property line to the southeast limits (Parker Road dam site). The Blackledge River is a tributary to the Salmon River.

Land use surrounding the parcel is predominantly residential. The heaviest concentration is north of West Pond with lesser densities along Jones Hollow Road.

The western parts of the parcel, primarily along the Blackledge River, was the site of a former sand and gravel extraction operation. As a result of this activity, the land surface has been extensively disturbed throughout the westcentral parts. Remains of the former mining operation are still visible on the site, including open gravel pits, areas with no top soil, stock pile areas, eastern berms surrounding mined areas and man-made ponds. This activity has also resulted in the disruption of the natural drainage of the site. Sand and gravel removal activity does not appear on a 1970 air photo of the site so that mining of the material must have started at some time after 1970. Inspection of a 1934, 1965 and 1970 air photo revealed that the western limits of the parcel had been used for agricultural purposes.

While the westcentral parts of the site have a "moonscape" topography due to the former mining activity, land surface in the western limits, central, and eastern parts does not appear to have been disturbed by the mining operation. The western limits of the site are characterized by moderately east sloping land which is forested. The central and eastern parts of the site are characterized by slopes which range from gentle to steep. They slope mainly west and south to the Blackledge River. Gentle slopes occur in the eastern parts, while the steeper areas parallel the southern boundary. The steep slopes in this area are associated with rock outcrops.

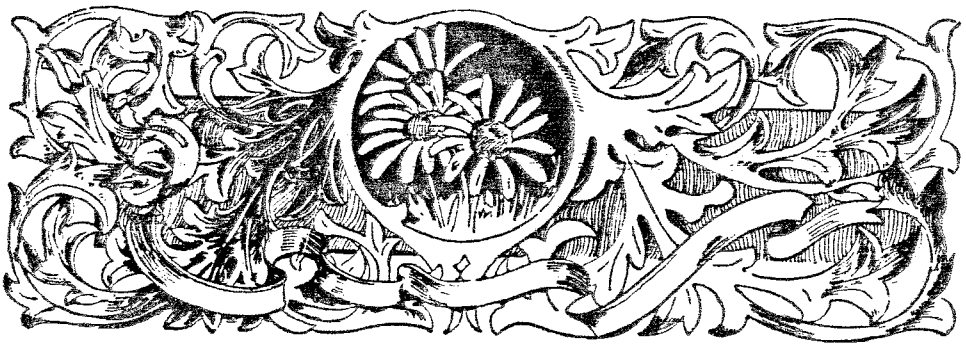
Approximately 160 feet of relieve separate the upland parts of the site from the Blackledge River valley.

TOPOGRAPHY

Approximate Site Boundary

1" = 1000'

III. GEOLOGY



A. Bedrock Geology and Development Limitations

Ledgerock is exposed at ground surface mainly in the extreme eastern limits of the site and along the steeply sloping areas that parallel the Blackledge River in the southern parts.

According to map GQ-791 (Bedrock Geologic Map for the Marlborough Quadrangle, East-Central Connecticut, by George L. Snyder), four (4) rock types underlie the site; 1) two subunits of Brimfield Schist, a mica schist; 2) Hebron Formation and 3) pegmatites.

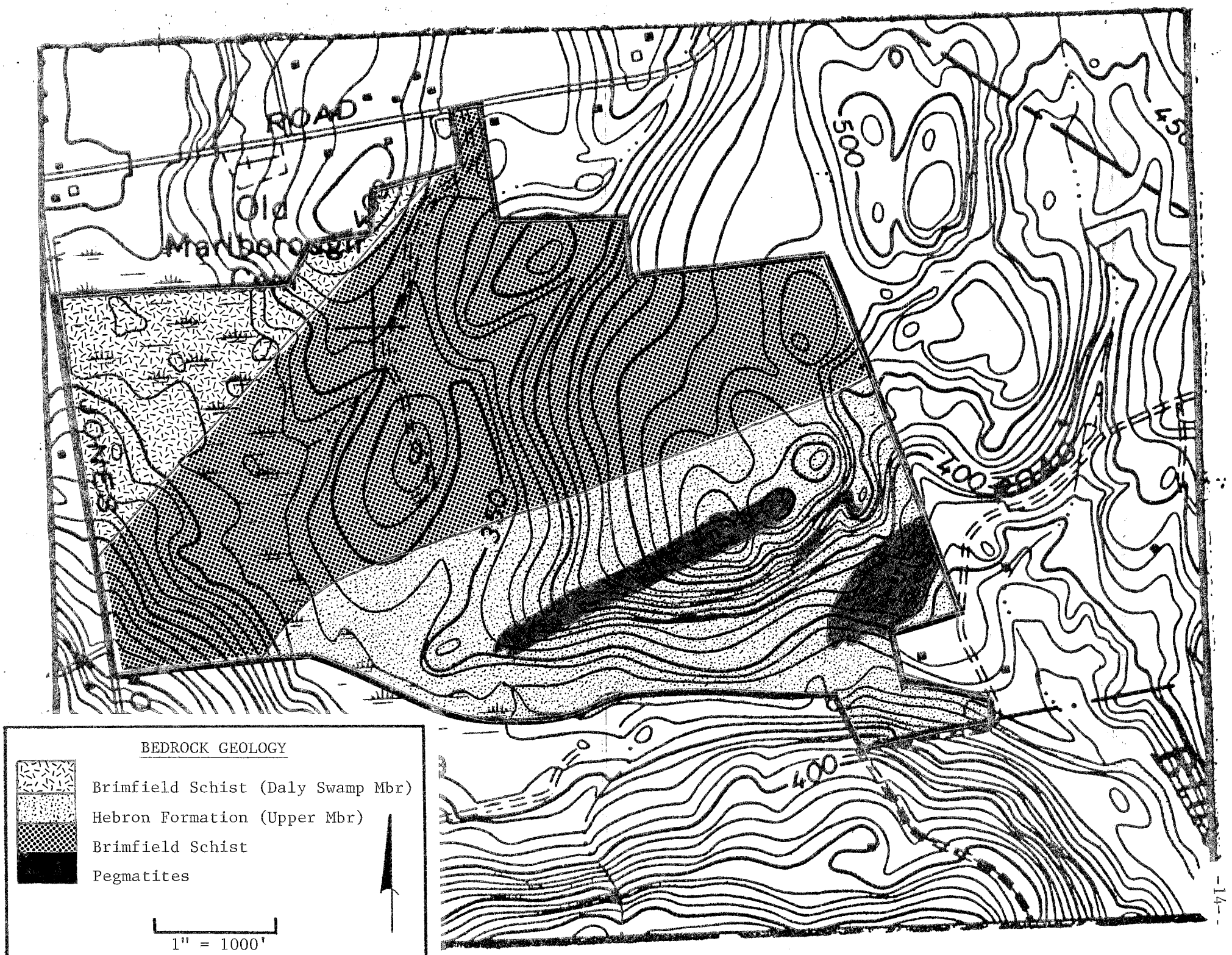
Nearly two thirds (2/3) of the site (central and northern parts) is underlain by the Brimfield Schist. Two subunits of this formation may be found within the site; 1) the upper member and 2) Daly Swamp Member.

The upper member, which underlies the northwest corner, consists of a rusty to silvery medium to coarse grained schist composed of the minerals oligoclase, quartz, biotite, muscovite and garnet. The Daly Swamp member underlies the central parts and is described as a gray medium grained schist. Major minerals includes quartz, plagioclase, biotite, diopside, actinolite, and orthoclase.

The southern parts of the site are underlain by the Hebron Formation. Snyder describes these rocks as a green, fine to medium grained calc-silicate rock (rocks rich in calcium and silicate minerals) composed of the minerals andesine, labradorite, actinolite, diopside, scapolite and orthoclase. All of these rocks are metamorphic, that is, geologically altered by great heat and pressure. They were deposited during the Ordovician geologic period (438 to 505 million years ago). Schists are rocks in which the alignment of elongate or flaky minerals is pervasive. This mineral arrangement gives the rock a slabby or well-layered structure.

The final rock type which is found along the southern parts of the site are pegmatites. They are predominantly in association with the Hebron Formation on the site. The pegmatites on the site are gray-white coarse grained rocks. They formed by solidification of hot liquids or vapor in spaces in the older surrounding rocks (Hebron Formation) during the Devonian geologic period, approximately 340 to 408 million years ago. They are younger than the other rock types found on the site. The major minerals include quartz, albite, oligoclase, microcline, muscovite, biotite and tourmaline. Because the pegmatites are resistant to weathering compared to the Hebron Formation, they form most of the ledges on the site along the Blackledge River.

The differences in the bedrock units should not have a major effect on construction activities except that the upper parts of the Brimfield Schist and the Hebron Formation, especially if weathered, are weak and may yield easily to a backhoe. It is unlikely that this could be done with the pegmatites. Blasting would undoubtedly be necessary in these areas, or where more competent zones of bedrock are encountered.


ROAD
Old
Marlboro
500
450
400
400
BEDROCK GEOLOGY
Brimfield Schist (Daly Swamp Mbr)
Hebron Formation (Upper Mbr)
Brimfield Schist
Pegmatites
1" = 1000'

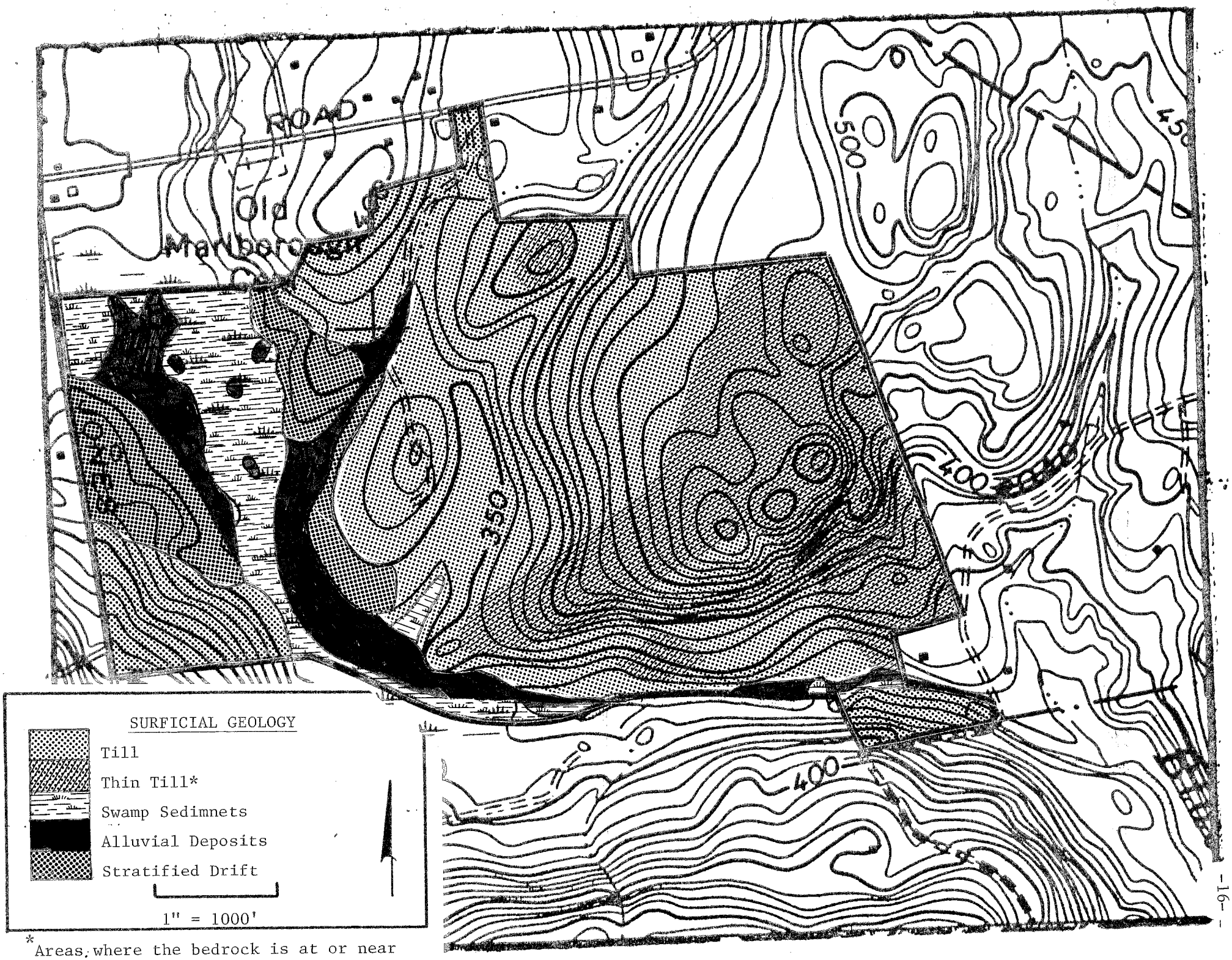
Variations in the mineralogy of the rock types on the site may have an influence on well water quality. Moderate to excess concentrations of iron and/or manganese are often found in bedrock wells that tap the Brimfield Schist Hebron Formation. This results from the dissolution of minerals that contain iron and manganese minerals. Another potential water quality concern is the impact of chemically-active rock or soil on the Blackledge River and associated surface water bodies in the site. Some materials leach iron or sulfur or both. The pH of the water can change as well as the appearance. High concentrations of iron and manganese and low pH levels can have severe impacts on aquatic life. This could be a potential problem if, for example, the diverted section of the Blackledge River is in contact with freshly exposed Brimfield Schist rocks. Especially if there is stagnant, slow-moving water or if freshly blasted rock from the site is stockpiled along the river.

In terms of the proposed subdivision, the shallow to bedrock areas, which are primarily along the southern boundard and eastern limits of the site may become a hindrance for placement of on-site septic systems. The Connecticut Public Health Code requires that the bottom area of the leaching system be at least four (4) feet above bedrock. This separating distance is necessary so that there is sufficient overlying soil to allow for adequate treatment of the sewage effluent. Experiences has shown that well contamination problems are more likely to occur in areas where bedrock is at or near ground surface and where a number of building lots relying on both on-site septic systems and water supply wells are proposed. Detailed soil testing will need to be conducted on each proposed lot so that an accurate determination of the bedrock surface can be made.

B. Surficial Geology and Development Limitations

With the exception of the sand and gravel deposits in the Blackledge River Valley, the site is covered by a glacial sediment known as till. It covers the western limits of the site as well as the hillier sections in the central and western parts. As the glacier moved across the area in the northwest to southeast direction, it covered the site with a relatively thin blanket of till. Till consists of a non-sorted, non-stratified mixture of particles ranging in size from clay to boulders. These sediments were deposited directly by the ice sheet. Most of the house lots proposed for the site would be located on the till soils. The major hindrances associated with till-based soils with respect to on-site septic systems are potentially high water tables and slow percolation rates. Where these hindrances are encountered, engineered septic systems are generally required. In some cases, a particular lot may be unsuitable for on-site sewage disposal if these limitations, i.e., slow percolation rates, high groundwater, shallow to bedrock conditions, etc. are extreme (see Sewage Disposal comments, also). Therefore, a sufficient number of test holes will be required for each lot in the subdivision in order to determine its suitability for on-site disposal of sewage effluent.

As mentioned earlier, stratified drift covers bedrock and till in the Blackledge River Valley. Stratified drift is a term given to sediments that



*Areas where the bedrock is at or near ground surface.

were deposited by glacial meltwater streams. These sediments were sorted by flowing waters emanating from glacial ice and were subsequently deposited in regular or irregular layers. According to Map GQ-1509 (Surficial Geologic Map for the Marlborough Quadrangle, East-Central Connecticut, Dennis O'Leary), the stratified drift on the site consists of yellowish brown, non-sorted cobble-pebble gravel. As mentioned earlier, this material was mined probably for fill and road base material at some point after 1970. The exact amount of materials extracted from the site is unknown. According to present plans, it has been calculated that approximately 893,500 cubic yards of sand and gravel would be excavated from the area in order to construct Blackledge Pond. The excavated material will be used for the construction of the dam, roads and river channel. According to the applicant, the remainder would be trucked off site but probably within Town limits. An additional 33,000 cubic yards would be excavated to create the proposed river channel. This material may consist of stratified drift as well as till. The excavated material would be partially used on the site and the remainder trucked off the site.

Water Resources Bulletin Number 31 for the lower Connecticut River Basin suggests that the stratified drift within the site may be as much as 39 feet thick. According to a 1971 Town report entitled Occurence of Groundwater in the Town of Marlborough, Connecticut by Ward S. Motts, the saturated thickness along the Blackledge River may be in the order of 20 to 40 feet. Assuming there is 20 to 40 feet of saturated thickness, the sand and gravel is coarse grained and a well properly developed, may have a potential yield of at least 100 gallons per minute and some possibly as high as 300 gallons per minute. A well yielding 100 to 300 gallons per minute would be capable of producing 108,000 and 324,000 gallons of water, respectively. The latter figures are based on an 18 hour pumping period.

Team members were made aware that the Town has purchased an adjoining parcel of land to the north for a potential municipal water supply well site. The Town asked Team members to discuss the impacts of the proposed activity, i.e., diversion, creation of the pond(s), and subdivision, on the potential municipal well site. This will be discussed later in the Hydrology Section of the report.

Overlying stratified drift deposits along the Blackledge River are post-glacial sediments called swamp deposits and alluvium. The water table is at or near the surface throughout this area. Swamp deposits consist of dark colored, non-sorted mixtures of sand, silt, clay and decayed or semi-decomposed vegetal matter, in typically poorly and very poorly drained areas. Alluvium consists of poorly-bedded to well-bedded, well-sorted gravel, sand and silt, typically colored gray by organic material, which was deposited by the modern Blackledge River.

Soils comprising swamp sediments and alluvial deposits are regulated under P.A. 155, Sections 22a-36 through 45, inclusive, of the General Statutes of Connecticut. Based on map GQ-1504, it is estimated that fifteen percent (15%) of thirty-five (35) acres of the site is designated regulated land. A detailed investigation of the wetland soils on the site, including alluvial soils by a certified soil scientist would allow for a more accurate estimate of the percentage of the regulated soils.

The permanent wetness in areas covered by swamp sediments and alluvial deposits perform valuable ecologic and hydrologic functions such as flood control, pollution renovation, trapping sediments, and providing habitats for wildlife. The man-made ponds west of the Blackledge River, whose water levels are coincident with the water table, also perform the same valuable functions mentioned above.

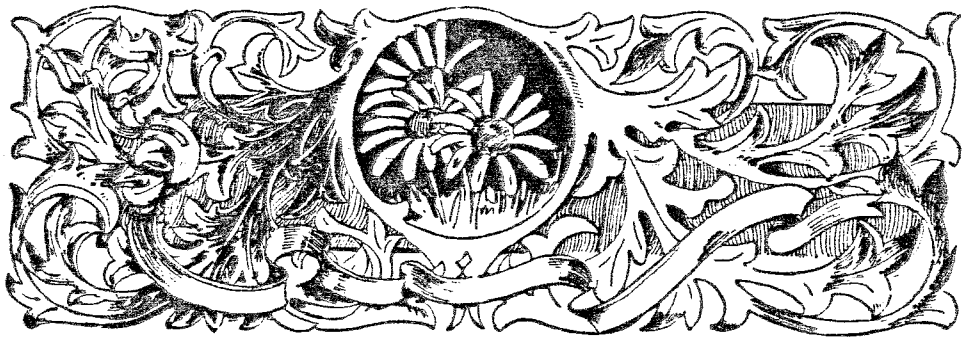
It is generally the westcentral parts which will require extensive improvements in order to make the property more aesthetically pleasing for the proposed residential development. Regrading of stockpiled areas, construction of a ±24 acre pond and a ±2,900 foot diversion of the Blackledge River will be the major activities. A high percentage of the area to be regraded comprises natural wetlands or man-made wetlands created during mining activities in the area.

Modifying, filling and constructing on inland wetlands/floodplains can have adverse environmental impacts because of the important roles they play in maintaining water quality, reducing runoff, and providing habitat for wildlife. In order to protect these important hydrologic and ecologic functions, the filling of inland wetland and floodplain in the State are regulated under P.A. 155, Sections 22a-36 through 45, inclusive, of the General Statutes of Connecticut.

Any activity involving filling, modifying or removing materials from any inland wetland floodplain soils requires approval from the Town of Marlborough Inland Wetland and Conservation Commission. It is not known how much wetlands/floodplain soils on the site need to be filled or modified in order to make the area suitable. If more than one acre of wetland is filled, a permit from the U. S. Army Corps of Engineers may be required. It is suggested that they be contacted.

Prior to any decision concerning the filling of wetland/floodplain soils on the site, it is encouraged that the Town require the applicant to address all potential environmental impacts to the wetland/floodplain as it exists at the present time from a hydrologic and ecologic standpoint. Special attention should focus on the ability of the wetlands areas to be filled to: 1) provide flood storage; 2) trap sediment; 3) clean inflowing water; and 4) provide habitat for wildlife. Also, consideration should be given to the effects of the proposed wetland fillings off-site.

IV. HYDROLOGY




WATERSHED BOUNDARY
Site
Watershed Boundary
Direction of surface flow
Point of outflow - for the Blackledge River at its intersection with Parker Road dam.
Not to Scale

A. Surface Water Classification

According to the Department of Environmental Protection (DEP), surface water classifications for the Blackledge River on the site is classified as class B/A. This means that the Blackledge River is class B, but DEP's goal is to upgrade it to an A classification. "Class B" streams may be suitable for bathing, other recreation purposes, agricultural uses, certain industrial processes and cooling; excellent for fish and wildlife. Class 'A' streams are suitable for drinking water supply and/or bathing, suitable for all other water uses; and character uniformly excellent and possibly subject to absolute restrictions on the discharge of pollutants. According to the Leachate and Wastewater Discharge Map for the Upper Connecticut River by DEP, the reasons for downgrading the water quality of Blackledge River from A to B is a result of an active industrial/manufacturing wastewater discharge. The discharge is located about 1.5 miles north of the site off Marlborough Road in Glastonbury.

Groundwater in the area is classified by the DEP as GA, which means that it is suitable for drinking water supplies without treatment.

Despite the 'B' classification mentioned earlier, every effort should be made to protect the Blackledge River from possible siltation and other potential contaminants commonly associated with the type of activities presently proposed.

B. The Blackledge River Watershed

The subject site lies entirely within the Blackledge River watershed. From the Parker Road dam, the Blackledge River watershed is linear shaped and extends northward into Bolton. From its point of intersection with Parker Road dam, it is generally narrow in the upper and central parts, but broadens in the southern parts. At its intersection with the Parker Road dam, the river drains an area of about 14.9 square miles or 9,536 acres. Land use in this watershed is characterized by medium density residential development. The Blackledge River flows generally in a southerly direction through the watershed. Although no monitoring wells have been placed on the site, surface as well as groundwater is probably towards the Blackledge River Valley.

The Team's Geologist analyzed and compared air photos of the site taken in 1934, 1965, 1970, and 1986. As mentioned earlier, the sand and gravel operation commenced at some point after 1970. Inspection of the air photos revealed little or no change in the location of watercourses in the Blackledge River floodplain within the site from 1934 to 1970. The photos delineate the Blackledge River as a meandering streamcourse with a tributary to the west. This tributary generally parallels the Blackledge River on the site. Wetland boundaries in this area have changed very little between 1934 and 1970, also. The major changes on the site came after 1970 but it should be noted that the main course of the Blackledge River is basically the same today as it was in the 1936, 1965, 1970 and 1986 air photos. It appears that the major changes on the site, which resulted from the former mining operation occurred west of the Blackledge River and mainly affected the tributary mentioned above.

One major pond and several smaller surface water bodies north of the major pond were created in the former tributary channel probably as a result of mining sand and gravel below the water table.

It is possible to estimate the mean annual outflow from the watershed at the Parker Road dam by using a method outlined in the Connecticut Department of Environmental Protection Bulletin No. 35 Streamflow Information for Connecticut with Applications to Land-Use Planning by Michael A. Cervione, Jr. The mean annual outflow from Blackledge River at the Parker Road dam site is estimated to be about 26.82 cubic feet per second or 17 million gallons per day.

Although there is no gaging station at the Parker Road dam site, it is possible to estimate the flow duration characteristics of the River at the dam using a method described in Connecticut Water Resources Bulletin No. 24 (Upper Connecticut River Basin). The estimates are tabulated below in units of both cubic feet per second (CFS) and millions gallons per day (MGD).

Table 1 Estimated flow duration characteristics of Blackledge River at Parker Road Dam Site

Percent of time flow equal/or exceeded	1	10	30	50	80	90	95	99
Flow equalled or exceeded in million gallons per day	94	31	16	9	3	2	1.5	.9
Flow equalled or exceeded, in CFS	146	47	24	13	5	3	2	1.5

C. The Proposed Pond and Wetland

The major concerns expressed by Town officials are the potential impact of the proposed ±24 acre pond, regrading in the former sand and gravel pit, and re-routing ±2,900 feet of the Blackledge River.

The excavation of ±24 acre pond as well as regrading the area to more aesthetic state will undoubtedly disturb and mobilize fine-grained particles. This will be the case since water is at or near ground throughout this area.

In order to avoid environmental damage on-site (to the Blackledge River and its tributaries) and off-site, a well-run activity will need to contain and filter silt-laden water. Since this type of activity is regulated under Connecticut's Soil Erosion and Sediment Control Act (Public Act Number 83-388), the applicant will need to develop a sound erosion sediment control plan. Once the plan has been approved by the Town it must be thoroughly enforced.

The area proposed for pond construction consists of several hydraulically connected surface water bodies separate by regulated wetland/floodplain type soils. Present plans indicate the removal of the wetland/floodplain soils within the ±29 acres. It is expected that this activity would result in at least a minor drain on the Blackledge River aquifer system to fill the pond, i.e., replacing the stratified drift deposits with water from the aquifer. This would be a one time event, occurring during the actual pond excavation. There is a possibility that the "drain" could effect nearby shallow dug wells that are hydraulically connected to the Blackledge aquifer. Therefore, it is recommended that a survey be conducted to determine if any such wells exist and measures taken to eliminate the chance of reducing their water levels.

As indicated earlier in the report, wetland areas are effective in attenuating flood flows by naturally storing the water during rainy periods and releasing it at a slower rate. Town officials questioned whether or not the proposed pond would be as effective as the existing wetland soils in reducing flood flows. Because knowledge in the area of this specific hydrologic function is too little to allow a definite answer, the question is a very difficult one to address. In most cases, watersheds are evaluated for flood capabilities by adding total swampy and ponding areas; these two deficient systems are not distinguished. This suggests that the two are approximately equally effective for reducing flood flows. Nevertheless, to the extent that rainfall onto the wetland may percolate through the hummocks of "land" above the water table, while rainfall onto the pond would reach the surface instantly, a certain additional retentive ability (i.e., a "sponge" effect) may exist in the swamp. This, of course, would be partly offset by the volume of potential storage space that the "land" itself occupies. Another factor to consider is the extent to which the swamp vegetation and microtopography itself slows surface flow rates, thereby reducing the potential for stream bank erosion downstream. This factor would, in turn, depend upon the existing water or ice level at the time of the flood-causing storm event or snowmelt; the lower the water, the greater the slowing effect of the wetland on surface flows. In conclusion, it seems likely that the difference between the two would be relatively small.

The applicant should be required to demonstrate that no hydrologic problems, i.e., flooding, would result on or off-site following the residential development. Development of the site would be expected to increase the amount of runoff shed from the parcel. The amount of increases will depend upon the extent of development, the amount of impervious surfaces created and the amount of vegetation removed or preserved.

It should be pointed out that wetlands can be effective in minimizing nitrate impacts through denitrification. As mentioned earlier in this report possible nitrates arising from septic system effluent or lawn and garden fertilizaers may find its way to the proposed pond. Since wetlands have the ability to denitrify, consideration should be given to leaving at least some wetland soils in this area rather than creating the proposed ±24 acre pond. Perhaps a few smaller ponds separated by wetlands could be constructed as an alternative.

D. The Blackledge River Diversion

Another major activity which the Town expressed concern about is the proposed ±2,900' re-routing of the Blackledge River. Present plans indicate that the river would be diverted around the oval shaped hill in the central parts of the site. The re-routing would allow the river to circumvent the proposed ±24 acre pond so that the river would not flow through the pond. It is understood that a through flowing stream into the pond would not be ideal from a fisheries standpoint. Pond water would tend to increase the temperature of the outflowing stream, especially during the hot summer months which may have a negative impact on aquatic life, particularly the salmon population in Blackledge River.

It should be pointed out that the project engineer stated on the review day that the present course of the Blackledge River had been diverted during the sand and gravel operations on the site about 13 years ago. Careful examination of air photos from 1930, 1965, 1970 and 1986 by the Team's Geologist revealed that the Blackledge River streamcourse has deviated little, if any, since 1936. The area disturbed by the sand and gravel mining operation took place west of the Blackledge River and mainly affected the tributary mentioned earlier.

The stratified drift covering the west central parts of the site receives more infiltration rainfall than the till covered areas on the site because of its high permeability and topographic position. Groundwater and surface water on the site are hydraulically connected; groundwater flowing from the site into the Blackledge River valley becomes surface water when it discharges to surface water bodies. In fact, because of the stratified drifts' ability to store groundwater, most streams located in this type of geologic setting keep flowing during the dry summer months because groundwater discharges into them from the saturated zone. The proposed diversion route takes place in an area which may contain till. Till, on the other hand, is not as permeable as the porous stratified drift and therefore does not have such a great ability to store groundwater. This is one reason why most intermittent streams occur on till based soils. As a result, it seems likely that if the river is relocated, there will be little opportunity for groundwater discharge to the relocated portion of the river. This may lead to extremely low-flows or dry conditions which would undoubtedly have an adverse impact on aquatic life in this seciton of the river as well as downstream sections.

Present plans indicate that the river will be diverted at a 90° angle eastward at the north end of the proposed pond. An overflow berm would be constructed at the north end of the pond to allow inflow during major storm events. Given the large size of the watershed (±14 square miles or ±9,000 acres) flows in Blackledge River can be quite significant during major storm events, e.g., 50 and 100 year storm events. As an example, Connecticut Water Resources Bulletin No. 36 (Evaluation and Design of a Streamflow - Data Network For Connecticut, by Lawrence A. Weiss) indicates a flow of 655 cubic feet per second for the 100 year storm event at its intersection with Route 94 north of the site. At this point, the river drains an area of about 6.75 square miles. Given the potential for significant flows, there appears to be a chance that the proposed berms could fail and allow the river to take its former course. Another scenario could find the river flowing through the pond; as mentioned earlier in the report this could have a negative impact on aquatic habitat, particularly salmon, if the problem was not corrected. This brings to question who will be responsible for maintaining the proposed diversion structures and berms once the proposed project is completed. It seems likely that a regular maintenance and inspection program would be required.

In conclusion, it is in the opinion of the Team's Geologist that the proposed river relocation poses too great an environmental risk, especially since the main course of the Blackledge River has really never been greatly disturbed even during the sand and gravel mining operations. Granted the disturbed area must be regraded to make it more aesthetic, it seems this can be accomplished without re-locating the river. Consideration should be given to leaving the river as is, create some smaller ponds, but retain wetlands, and regrade the area to more aesthetic appearance. A conservative buffer should be established between the river and proposed pond(s).

If the proposed diversion is permitted it is recommended that borings or on-site excavation be conducted along the proposed route. This will allow this project engineer to determine a profile of the bedrock surface. There is a possibility that bedrock may be encountered particularly where cuts are deep.

E. Potential Town Water Supply

As mentioned earlier in this report, the Town has purchased land north of the site in the Blackledge River floodplain. It is understood that this land was purchased for the purpose of a potential municipal water supply site. As a result Town officials questioned the potential impacts of the proposed subdivision and the regrading activities on the site with respect to the potential Town water supply site. This is a very difficult question to address since there is no well information such as yields, area of influence for a well, or potential well site(s). Other hydrogeologic information such as the texture of the stratified drift covering the site and the distance to major surface water bodies would also be very important. However, it seems likely that if a pumping well was located in the Blackledge River Valley, in relatively close proximity to the river (within 500 feet), it would probably lower the water table below the level of the river, drawing water from the

river into the well. This phenomena is known as induced infiltration. As a result, it is imperative that the water in the river be maintained at the highest quality. In addition, if a surface water body is created on the study site and is in relatively close proximity to a pumping well, the same phenomena (induced infiltration) mentioned above might also occur. Therefore, it is imperative that water quality in the proposed pond be maintained at a high standard. Surface runoff, sewage effluent and road drainage emanating from the proposed residential development would be the greatest threat of water quality in the proposed pond and ultimately to a potential well. Based on present plans, it appears that the land to be developed west of the Blackledge River/floodplain would be of greatest concern, since this area will drain directly to the proposed pond site. Most of the development that occurs in the central and eastern parts of the site will drain to the Blackledge River, downstream from the potential well site and would also by-pass the proposed pond. If the river is diverted around the oval-shaped hill in the central parts, then runoff arising from homes constructed on the hill would also drain into the proposed pond area. The applicant should be required to address the short as well as long term effects of possible contaminants, i.e., nitrates from septic system effluent, and fertilizers, storm water runoff and road salt, etc., arising from residential development of water quality of the proposed pond. Contaminants that reach the proposed pond may eventually reach the pumping well if the two are hydraulically connected and therefore, poses a potential threat. The closer the well and pond are to each other, the greater the impact will be. There will be a need to develop a storm water management plan for the project so that runoff laden with heavy metals, oils and greases from roadways has minimal impact on water quality.

It should be pointed out that if a pumping well was developed near the Blackledge River, it may lower the water table below the level of the river and ultimately the water level in the river. During certain times of the year (low flow periods) this could result in warming the temperatures of water in the river and during the extremely dry periods could dry the river completely. In either case, this would undoubtedly have a serious impact on aquatic habitat and other water dependent organisms in the river. This issue as well as others would have to be addressed once more information regarding a potential well and well site are made available.

F. Water Supply for the Subdivision

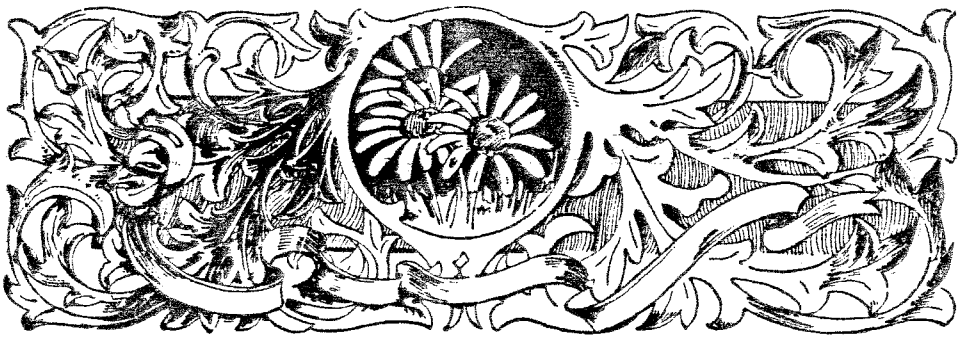
Each lot in the proposed subdivision will be served by an individual on-site water supply well. The water will be driven from drilled wells which tap the underlying metamorphic bedrock. The exact yield of a bedrock-based well is a function of many hydrogeologic factors including the the number and size of fractures present in the bedrock. Because the fractures are unevenly spaced throughout the rock, there is no practical way, short of expensive geophysical tests, to assure the postential of any particular site for a satisfactory well. A well drilled no more than 200 feet into the underlying bedrock should be capable of yielding a few gallons of water per minute (gpm), but there is at least a slight chance

that drilling in any particular location will result in a very low yield (i.e., less than a one (1) gpm) or a very high yield (i.e., greater than ten (10) gpm. A yield of two (2) to three (3) gpm is usually sufficient for residential demands.

In order to ensure that water quality throughout the parcel and off-site is adequately protected, all wells will need to be installed in accordance with all applicable Town regulations, the Public Health Code, and the State Well Drilling Board. The Town Sanitarian will need to inspect all well locations before the wells are drilled. Also, all wells will need to be properly cased into the underlying bedrock.

The natural water quality should be generally adequate, but because of the particular mineralogy of the bedrock underlying the parcel, there is a chance that the water will have elevated concentration of iron or manganese which will discolor the water and cause a metallic taste. Depending upon the ultimate concentrations of these minerals, there may be a need for filtration devices.

V. SOILS CONCERNS



A. Wetland and Non-Wetland Soils

The current floodplain of the Blackledge River, in the vicinity of the proposed diversion and pond construction, has been highly disturbed in the past from sand and gravel excavations. The resultant landscape consists of a complex of excavated depressions, areas of natural soils, and mounds of spoil (topsoil, stumps, overburden) material.

The wetland and non-wetland soils in this area have been mapped out by a consulting soil scientist at a more intensive scale than the Hartford County Soil Survey, 1962. In general, this map shown at a scale of 1" = 200' accurately shows boundaries of wetland soils. However, some of the soils mapped as Ma (Made Land) may be excavated to the point where they have the moisture regime of a wetland soil--or may be excavated to the elevation where the soils flood frequently. A good estimate to use in defining the boundaries of the floodplain on disturbed soils is the 100 year flood boundary elevation. Federal Emergency Management Agency maps, effective May 17, 1982 for Marlborough, show the approximate 100 year boundary elevation as 339 for much of this area. Using this elevation would include a larger regulated area affected by this proposal. There are also several small watercourses to the west of the floodplain that are not shown on the maps.

B. The Pond and River Diversion

1) Existing berms at the northern edge of the proposed pond area are vegetated with trees and shrubs and are of unknown materials with unknown properties. Often piles of spoil material contain stumps and other organic materials. Such embankments may not hold up to the velocities and turbidity should the Blackledge River wish to change its course north of the subject property.

2) Currently a number of small channels with active flows enter from the north, cross the dirt roadway and run into the floodplain in the proposed pond area. It is assumed that these channels will flow into the east-west channel just to the north of the "Berms". Streams, however do not like to flow at right angles and no details are given on protecting the berms and channel from scouring and piping. No details are also given for maintenance of berms or channels.

3) The "seepage analysis" calculated for the two "worst condition" lots is based on some erronious assumptions. Worst case lots around the pond would be on moderately well drained to excessively drained glacial outwash soils and those lots where septic systems will be placed on "fill" from the excavated materials from the pond. Typically Merrimac, Hinckley, and Sudbury soils have very sandy and gravelly substratums which are poor filters for waste disposal. Permeability rates in the zone where the distribution lines would be placed in these soils are typically greater than the 6.3 inch per hour rate used and may be greater than 20 inches per hour. Sudbury soils also have a seasonal high water table of 1.5 feet to 3 feet.

4) No areas have been designated on the plans for the dewatering and stockpiling of dredged materials to be used on-site or trucked off the property.

5) Sediment accumulation rates have not been shown for the pond. Could some flood storage be lost?

6) More information is needed on the hydraulic geometry of the present stream channel and the proposed diverted channel: What is the suspended sediment land and bedload under current and future conditions? What will the response be from moving the stream into more erosive materials? Are the overflow structures of adequate size, shape, and position to allow high velocity and turbidity over flows during the appropriate storm event? Who will provide maintenance of these structures in the event of ice or debris jams? To maintain the velocity in the smaller diverted channel, greater slopes will probably be needed, but not steep enough to allow eroding and downcutting.

7) Some data needed on the pond/relocation phase includes: seeding mixtures; temporary seeding rates/dates; proposed cut/fill contour lines; construction entrance pads, etc.

C. The Subdivision

The landscapes of the proposed subdivision are dominated by deep, gently sloping to very steep, well drained to poorly drained glacial till soils on the eastern half of the parcel. Included in this portion are areas of soils that are a complex if deep (>40 inches) to shallow (<20 inches) soils over bedrock. A thin band of alluvial (floodplain) soils is along the Blackledge River on the southside of the property. The western half of the parcel is dominated by glacial outwash soils and alluvial soils highly disturbed by past sand and gravel excavations. Small areas of undisturbed glacial outwash soils and a larger area of glacial till soils with a firm, dense substratum (hardpan) occupy the remainder of the acreage.

The soil map included in this report has been compiled from limited on-site investigations, the Soil Survey of Hartford County, 1962 and information provided by Soil Science Services. The intensive soil survey of the parcel by the private consultant was mapped at a scale of 1" = 200', and should help in making decisions on a lot by lot basis. The map prepared at a scale of 1" = 1,000' is for discussion purposes of this report. Because of the large number of map units involved, a chart of important soil features has been prepared. Many of the map unit symbols and names are unique to this report and cannot be used in other areas. Below are listed some additional soils information and concerns:

1) The soils map of a scale of 1" = 1,000' should not be used in discussions about wetland values and acreage. A soils map prepared for the developer by a private soil scientist at a scale of 1" = 200' shows many wetland areas that could not be shown at the scale of the map in this report.

2) A number of the proposed lots have driveways and roads that will cross wetlands and watercourses. Some of these watercourses are not shown on the maps.

3) Included in mapping in the CrB, CrC, and CrD map units (Charlton) are areas of soils that have a sandy and gravelly friable substratum.

4) Included in the mapping of the Ud unit are small areas of undisturbed glacial outwash soils.

5) A number of lots are dominated by steep to very steep slopes. Substantial cutting and filling may be necessary. It may be difficult to install suitable on-site waste disposal systems.

6) A number of ltos are dominated by complexes of shallow (<20") to deep (>40") soils. Extensive deep test pits will be necessary to locate areas of deep soils for on-site waste disposal.

7) The sand and gravel glacial outwash soils and disturbed soils (Udorthents) have fast percolation rates and act as poor filters for on-site waste disposal systems. This may influence the separating distances between wells and septic systems, and the size and layout of systems.

8) Details on the proposed subdivision are needed to make lot specific comments.

D. General Comments

1. The plans do not adequately address erosion and sediment control measures at the site. E & S measures need to be presented in greater detail before they can be reviewed.

2. The proposal falls way short of addressing basic engineering designs and environmental considerations.

3. The Town should probably consider some type of long term bonding on a project of this size.

4. Much more detail is needed to review the subdivision proposal.

5. As with any project, all alternatives should be examined and evaluated.

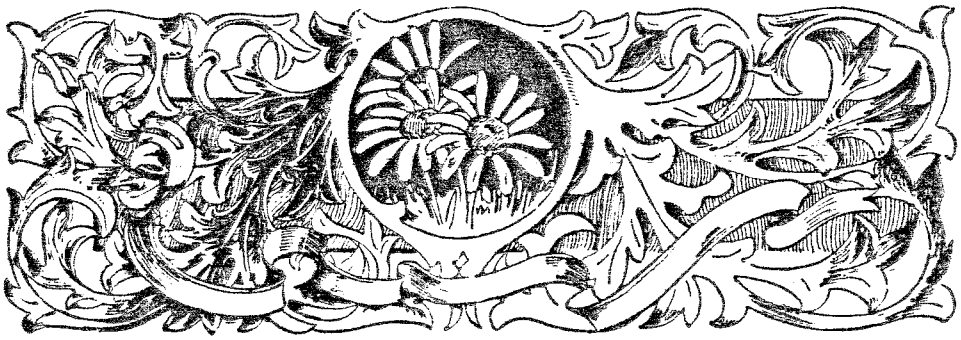
E. MAJOR LIMITATIONS FOR THE DEVELOPMENT OF: BLACKLEDGE RIVER SUBDIVISION

MAP SYMBOL	MAP UNIT NAME	GENERAL SOIL PROPERTIES	DRAINAGE CLASS AND DEPTH TO SEASONAL HIGH WATER TABLE	HOMES WITH BASEMENTS	ON-SITE SEPTIC SYSTEMS	ROADS AND STREETS
CaB	Charlton Fine sandy loam, 3-8% slopes	Glacial Till Soils formed in loamy materials	Well drained >6 feet	None	None	None
CHC	Charlton-Hollis complex, very rocky 3-15% slopes	Complex of glacial till soils from deep to shallow over bedrock. Formed in loamy materials	Well drained to excessively drained >6 feet	Variable depth to bedrock	Variable depth to bedrock	Variable depth to bedrock
CrC	Charlton very stony fine sandy loam, 8-15% slopes	Glacial till soils formed in loamy materials	Well drained >6 feet	Slope	Slope	Slope
CrD	Charlton very stony fine sandy loam, 15-35% slopes	Glacial till soils formed in loamy materials	Well drained >6 feet	Steep slopes	Steep slopes	Steep slopes
DsB	Disturbed soil-Saco complex	Complex of floodplain soils disturbed by man and very poorly drained silty floodplain soils	Very poorly drained ±1 foot	Flooding wetness	Flooding wetness	Flooding wetness subject to frost action
FL	Fluvent-Fluvaquent complex	Complex of well drained to very poorly drained frequently flooded Alluvial soils with variable textures	Variable well drained to very poorly drained	Flooding	Flooding	Flooding
HCC	Hollis-Charlton complex, very rocky, 3-15% slopes	Complex of glacial till soils from shallow to deep over bedrock. Formed in loamy materials.	Excessively drained to well drained >6 feet	Variable depth to bedrock	Variable depth to bedrock	Variable depth to bedrock

MAJOR LIMITATIONS FOR THE DEVELOPMENT OF: BLACKLEDGE RIVER SUBDIVISION

MAP SYMBOL	MAP UNIT NAME	GENERAL SOIL PROPERTIES	DRAINAGE CLASS AND DEPTH TO SEASONAL HIGH WATER TABLE	HOMES WITH BASEMENTS	ON-SITE SEPTIC SYSTEMS	ROADS AND STREETS
HCE	Hollis-Rock outcrop complex, 15-45% slopes	Complex of glacial till soils and exposed bedrock soils are shallow to moderately deep to bedrock.	Excessively drained >6 feet	Depth to bedrock steep slopes	Depth to bedrock steep slopes	Depth to bedrock steep slopes
HKA	Hinckley gravelly sandy loam, 0-3% slope	Glacial outwash soils formed in sand and gravel.	Well drained >3 feet	None	Substratum may be poor filter	None
HKD	Hinckley gravelly sandy loam, 15-35% slopes	Glacial outwash soils formed in sand and gravel	Well drained >6 feet	Slope	Slope substratum may be poor filter	Slope
Ld	Leicester, Ridgebury, and Whitman, very stony soils, 0-15% slopes.	Glacial till soils formed in loamy materials. Some areas may have a firm dense substratum.	Poorly drained to very poorly drained +1 -1.5 feet	Wetness	Wetness	Wetness Subject to frost action.
PeC	Paxton very stony Fine sandy loam, 8-15% slopes	Glacial till soils formed in dense loamy materials	Well drained 1.5-2.5 feet	Slope	Slope substratum percs slowly	Slope
Pm	Palms, muck	Soils formed in deposits of decomposed organic matter over loamy or sandy materials	Very poorly drained ±1 foot	Ponding Wetness	Wetness	Wetness Subsides low strength
MyB	Merrimac sandy loam 3-8% slopes	Glacial outwash soils formed in sandy materials over sand and gravel.	Somewhat excessively Drained >3 feet	None	Substratum may be poor filter	None

VI. ENGINEERING CONCERNS



A. Design Analysis

The drainage area of Blackledge River at the proposed pond and relocated river is about 15.0 square miles. The hydraulics for the river relocation and dams for the pond is based on the FEMA studies and peak discharges are determined by a regression analysis. This analysis may or may not be adequate for the design of a river relocation and a dam.

B. Downstream Effect

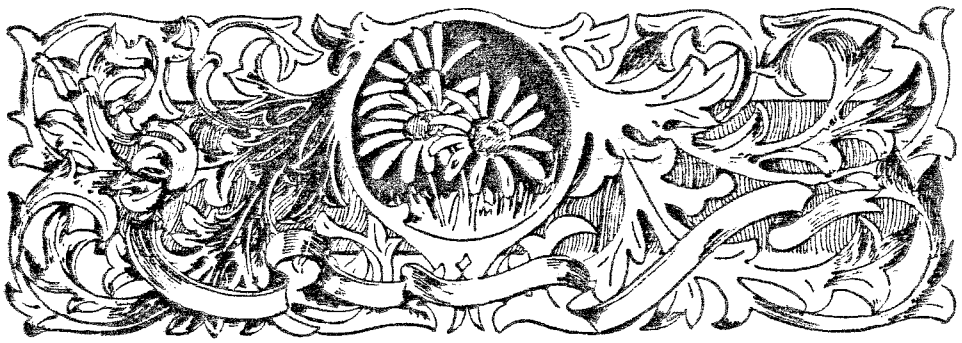
There is no evaluation of the effect downstream in the event of a dam breach. There will be about 100 acre feet of storage (at the Emergency Spillway Crest) that will flood the stream valley below. Some of the potential damage that may occur is (1) Parker Road washed out (2) Houses near Route 66 damaged (3) Old Willimantic Turnpike washed out and (4) Route 66 washed out. Since a DEP Diversion permit and Dam safety permit are required this section will only identify some potential damage spots. This project will have to have a Corps of Engineers permit also. The diversion overflow that will operate on a yearly basis will be an area of high maintenance as this water flows over the riprap on a 4:1 slope and over natural vegetation on a 25:1 slope. It is suggested that this riprap be carried to a point two (2) feet below normal water level instead of discharging onto the 25:1 vegetated slope.

In actual conditions, the relocated stream will have dead trees or logs caught on the sides, especially on the curves and cause water deflection into the gravel banks and create spots of bank failure. This is seen as another maintenance problem.

C. Auxiliary Spillway Channel

The alignment of the Auxiliary Spillway Channel, the main spillway channel and the relocated river could cause a hydraulic jump that needs to be evaluated. The last paragraph of page 15 of the application for Water Diversion Permit states "For flows below the one year event, most of the flow stays in the diverted river. For greater storm events, the major flows shift to the pond through the diversion overflow and overflow berm. The main spillway handles the full discharge of the pond up to near the one year storm event. Greater storms increase the use of the auxiliary spillway dramatically." By this statement the auxiliary spillway operates on a yearly basis. This is too frequent for a vegetative spillway on a large drainage area like this.

VII. RESOURCE CONCERNS



A. Four Alternatives

From a planning standpoint, the developer has considered three (3) alternatives. The one proposed, no action, and diverting the entire stream into and through the pond. There may be a fourth, and that would be to leave the stream in its present location, leave an unexcavated block of material along the pond side, and then excavate the sand and gravel to the westerly side to create the pond. This would result in a smaller pond, but no excavation for the bypass or relocated stream, and maybe most important, have the least impact on the fishery and environmental attributes of the site. If the developer's desire is to maximize excavation of sand, gravel, and other soil materials for resale, then the alternative proposed will meet his goal.

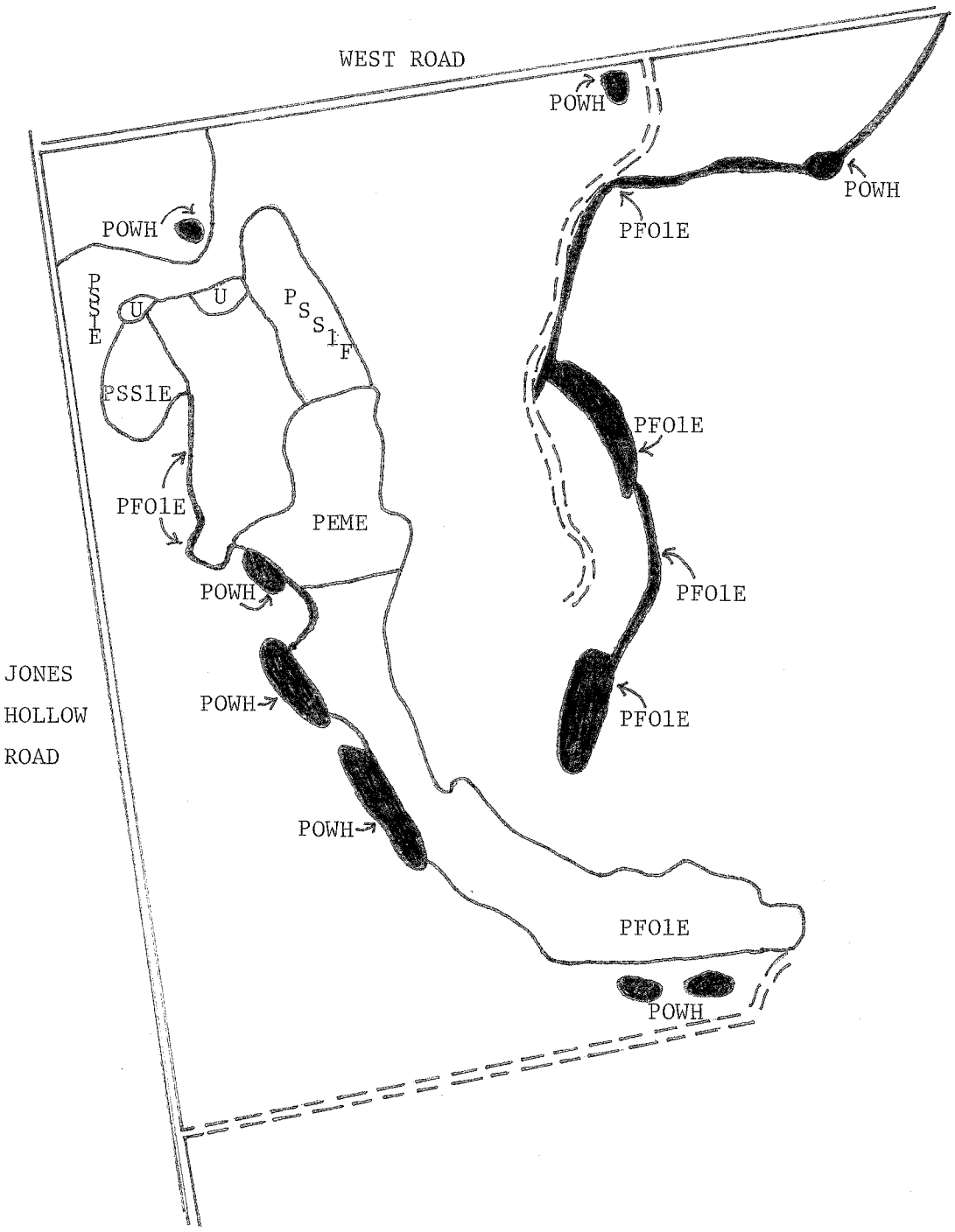
B. The Proposed Plan

1. A New Channel

The plan as proposed calls for construciton of 2,900-3,000 feet of new channel. The Resource Conservationist has three (3) major concerns with this proposal. The first is that the stream gradient by necessity is almost flat, a gradient of .00028-.00053. For practical purposes, the relocated stream will be sluggish to ponded with little velocity of flow. As such, it will be a zone of deposition not scouring, and may not have any value for spawning habitat, it would, however, allow fish passage. Secondly, the cuts required in the existing ground vary up to 15 feet in depth, with a top width of about 100 feet at Station 20+00. This will create long banks (up to 45 feet at a 3:1 slope) and subject to erosion and seep lines which are difficult to establish to vegetation.

At least three (3), better yet four (4) to five (5) inches, of topsoil should be replaced on the banks as a growth medium. As increments of the bank are final, graded topsoil should be replaced and they should be revegetated rather than waiting to complete all banks before seeding. The gravel bottom proposed should be of varying sizes so that all interlock and provide stability to the streambed. This should include large boulders for shelter placed randomly along the stream course. It would then offer a wider variety of habitat conditions for benthic invertebrates and other aquatic life. Rip-rap may also be needed on the streambanks at critical locations, such as opposite the emergency spillway where high flows would create scour and bank erosion.

The third concern is that by cutting and removing this material, existing wetlands in this drainage corridor will be lost. It isn't clear from the Engineers tally of wetlands whether or not this loss was included. If the material encountered in construction of the stream is unstable, and if higher flows than predicted occur, the natural tendency of the stream to meander



WETLANDS

PEME - Palustrine Emergent Marsh-seasonally saturated

PFO1E - Palustrine Forested Broadleaf

POWH - Permanent Open Water

PSS1F - Palustrine Scrub Shrub Semi-permanent

PSS1E - Palustrine Scrub Shrub Seasonally Saturated

U - Uplands

SCALE - 1" = 1000'

could cause additional erosion of the bed and banks. There is also concern as to whether or not the stream can actually be diverted to achieve the new configuration. the diversion along the northerly portion of the property will cause the stream flow to initially change directions by about 90°.

The steam's natural tendency will be to go where it now goes. That means the subsurface as well as surface flows. Can the overflow berm, a diversion, effectively change and control this direction of flow? It would be the Resource Conservationist's opinion that armouring the overflow berm with riprap would be a necessity. Also, it would seem necessary to have an impermeable core so that excess seepage did not reduce the effectiveness of it.

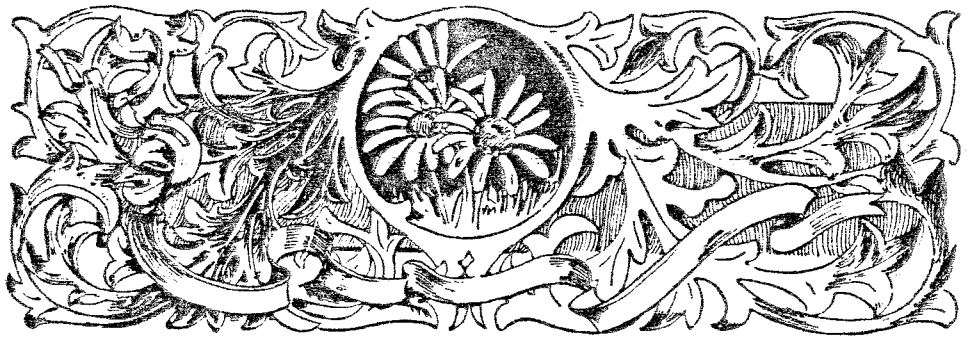
2. The Pond

Included in this section is a rough interpretation of wetlands as mapped by the U. S. Fish and Wildlife Service under the National Wetland Inventory conducted over the last three (3) years. If the pond is excavated, it will represent a loss of those wetlands that may or may not be offset by the shallow shelf created along the perimeter of the pond. For wetland plants to become readily established in this zone, three to six inches of muck will have to be put down as a growth medium. If none is put down, colonization by plants will be much slower as the mineral soil or gravel medium is less fertile or otherwise suitable. One side note is that considerable changes can occur to the pH of stockpiled muck when exposed to the air. What was suitable pH for wetland plants prior to excavation may not be after re-spreading. Someone needs to keep an eye on stockpiling. The shelf would create emergent wetlands, but not necessarily scrub shrub wetlands as now occur. When the developer applies for an Army Corps 404 Permit, the agency will look closely at wetlands, losses, and the need for mitigation. If planning proceeds, the developer should invite the Army Corps out early, before formal application, to determine these needs.

The pond, if properly constructed, should be suitable for fish habitat, probably as trout habitat due to the apparent rapid recharging with ground-water around 53°F from the underlying aquifers. It may or may not help the needs of the Atlantic Salmon. If the bypass stream is sluggish, heating within it may approach heating that would occur within the pond. If so, then nothing would be gained by rerouting of the stream channel vs. through the pond. Obviously, by building the stream first, sedimentation created by pond excavation can be controlled more easily, as all normal flows are isolated. However, the time duration for project completion will be considerable and the opportunity for something to go wrong is increased as the need for maintenance increases. It is possible that flood flows passing through the pond would carry sediment in suspension through the pond and downstream. This may not be of that great a concern, however, from a fishery standpoint, it could be harmful if it occurred during migration periods, either upstream or downstream. Close coordination with the fishery unit could reduce any major conflict on this item. Other damages from sediment would be hopefully minimal if excavation proceeds as proposed.

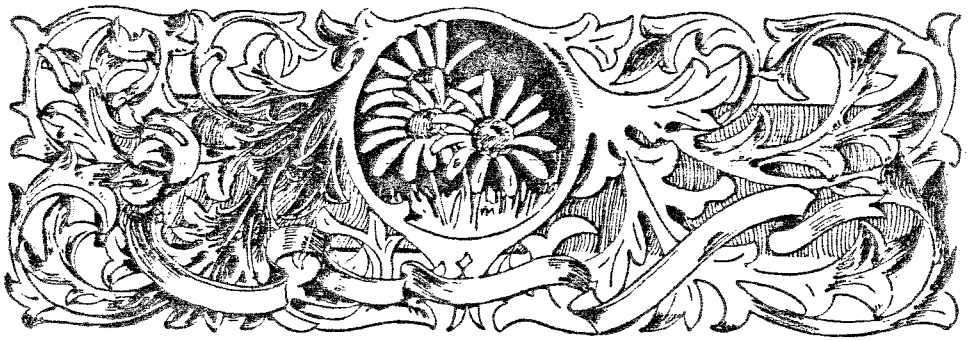
The current appearance of the floodplain presents high value to waterfowl and possibly furbearers. These values will be lost or severely reduced by construction of the pond. What now provides small open bodies or compartments of water and vegetation will be one large pond which does not provide the same mix of water and vegetation.

VIII. CONNECTICUT NATURAL DIVERSITY DATA BASE



According to the Natural Diversity Data Base maps and files, there are no known extant populations of Federally Endangered or Threatened Species, Connecticut Species of Special Concern or critical habitats that will be affected by the proposed project.

IX. VEGETATION



A. Vegetation Type Descriptions

The tract proposed for development can be divided into several vegetative types. These include three mixed hardwood stands, one oak hickory stand, open swamp, hardwood swamp, old fields and a mining operation that was never reclaimed and revegetated naturally.

TYPE A: Mixed Hardwood. This 20 acre area is understocked and composed of sapling, pole and sawtimber sized trees as a result of pasture abondonment. Species include white oak, black oak, mountain laurel, grey birch and white pine. The understory is predominantly blueberry, occasional juniper, grasses and seedling oaks.

Type B: Old Field. This is a 12 acre area composed of aspen, red cedar, grey birch, occasional white pine, black cherry and choke cherry. Trees vary in size, but are generally 2"-4" diameter and 10-30 feet tall as this area is just growing up after being abandoned as open land. Other vegetation includes steeple bush, apple trees, milkweed, dogwood, juniper, alder, golden rod, multiflora rose and high bush blueberry.

TYPE C: Hardwood Swamp. These areas are 14 acres characterized by pole sized red maple, black cherry, white oak and some elm. Shrubs include hawthorn, hophornbeam, shadbush, spice bush, viburnums, with fern and club moss.

TYPE D: Open Swamp. These areas are 18 acres of brushy swamps composed of shrubs and open water which have usually occurred since the gravel was removed from the land. The predominant vegetation is speckled alder, with hophornbeam, shadbush, red-osier dogwood, swamp azalea, high bush blueberry and autumn olive.

TYPE E: Oak-Hickory. This forested type is the largest type on the parcel totalling 95 acres. The area is 90% oaks including black oak, white oak, scarlet oak and red oak with shagbark and pignut hickory and occasional red maple, black birch and white ash. this stand is a fully stocked poletimber and sawtimber stand of good quality. Other vegetation includes low bush blueberry, spicebush, viburnum and hophornbeam.

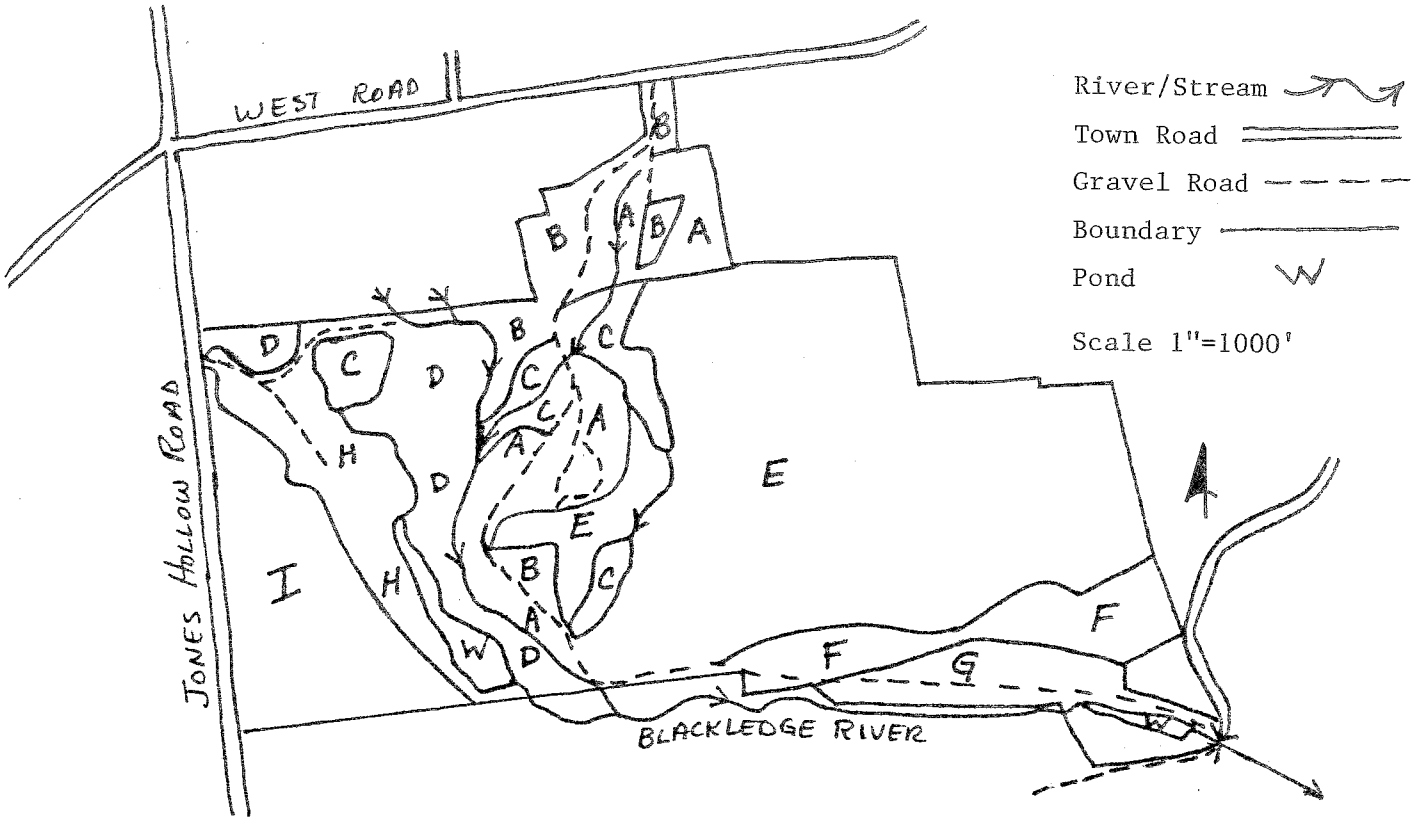
TYPE F: Mixed Hardwood. Oaks in association with black birch, red maple, black cherry and remnants of old field red cedar comprise this 12 acre area.

TYPE G: Softwood-Hardwood. White pine predominates this 12 acre area in association hemlock, red cedar, oaks and red maple of all sizes.

TYPE H: Excavated area. Formerly a gravel pit this area is about 33 acres of early succession old field vegetation. Species include big tooth aspen, cottonwood, grey birch, red cedar, milkweed, golden rod, black cherry, elm, dogwood, staghorn sumac, and steeple bush.

TYPE I: Mixed Hardwood. This 25 acre sapling-pole stand on a moist slope is composed of red maple, black cherry, white ash, apple, red cedar, sugar maple, hickory, red oak and white oak.

VEGETATION TYPE MAP



TYPE A: Mixed Hardwood - 20 acres - Sapling, Pole, Sawtimber, Understocked

TYPE B: Old Field - 12 acres

TYPE C: Hardwood Swamp - 14 acres

TYPE D: Open Swamp - 18 acres

TYPE E: Oak-Hickory - 95 acres - Pole, Sawtimber, Fully Stocked

TYPE F: Mixed Hardwood - 12 acres - Pole Timber - Fully Stocked

TYPE G: Softwood-Hardwood - 12 acres - Sawtimber - Fully Stocked

TYPE H: Excavated Area - 33 acres

TYPE I: Mixed Hardwood - 25 acres - Sapling, Pole - Overstocked

Seedling size - less than 2" D.B.H. (4½' above the ground diameter breast height
Sapling size - trees 2"-5" D.B.H.
Pole size - trees 5"-11" D.B.H.
Sawtimber size - trees 11" D.B.H. and greater

B. Aesthetic Considerations

Many of the large trees throughout vegetation types E and G have excellent aesthetic and shade value. These high value trees, especially red oak and white pine, should be well-formed and large crowned for the best shade and aesthetic value. Trees are very sensitive to the condition of the soil within the entire area under their crowns. Development practices near trees such as excavation, filling and grading for construction of road ways and buildings can disturb the balance between soil aeration, soil moisture level and soil composition. These disturbances can cause a decline in tree health and vigor resulting in tree mortality within three to five years. Mechanical injury to trees from equipment can cause the same results. Research has shown that trees on a house lot can enhance the value of that lot. Dead trees resulting from injury during construction will reduce the aesthetic quality of an area and become hazardous and expensive to remove if near roadways, buildings or utility lines.

During construction be careful not to disturb trees that are to be retained. Favor healthy, high vigor trees because they are usually more resistant to environmental stresses than low vigor, unhealthy trees. Where possible, threes should be retained in groups or "islands" especially on slopes in excess of 10% to reduce soil disturbance and reduce injury. Especially good specimen trees or islands of trees favored for retention should be clearly marked and avoided. Also, as a guideline for avoiding injury to tree roots and trunks stay at least 30 feet away on taller, small crowned trees and at least as far as the drip line of the crown on trees with a fuller, spreading crown.

In the northeast corner of Type E the scattered mountain laurel has good aesthetic value when blooming. Flowering can be stimulated by removing the overstory trees and increasing the sunlight to the laurel.

C. Limiting Conditions and Potential Hazards

Windthrow is a hazard in Type E and G. Trees which are crowded in a natural forested condition depend on each other for stability and support as they grow. On north and west facing slopes openings for houses and roads would intensify the potential for windthrow or crown breakage as wind would pass through rather than over these areas. Openings along wetlands would also increase the potential for windthrow due to wet soils. Timber harvesting prior to clearing for development would help improve tree stability.

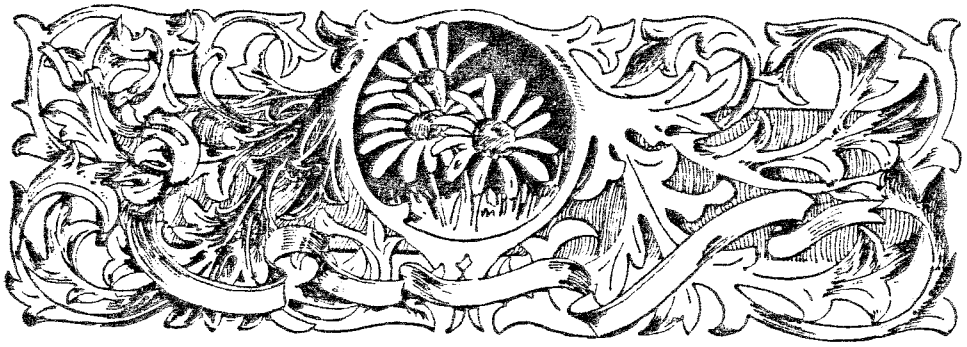
Alteration in wetland areas which raise or lower the water table such as changing or altering stream flows may have a negative effect on vegetation. In rerouting the Blackledge River stream bank disturbance may cause tree mortality and/or blowdowns into the stream after the banks are cut. Too much bank clearing could increase sunlight to the stream and cause warming of the water. Exercise caution in construction to both avoid too much root cutting and stream bank clearing to maximize shade on the stream.

D. Management Considerations

Trees which are growing in a crowded condition and not growing vigorously (growth has slowed in Type E due to crowding) are most susceptible to further degradation from environmental stresses due to development, disease, insects and adverse weather conditions. Thinnings in forests like Types E and G to remove undesirable trees and reduce competition for space, sunlight, soil moisture and nutrients is warranted. Over time a properly thinned forest is healthier, faster growing and more attractive. In addition wildlife habitat is improved and the forest provides wood products and revenue for the landowner. A thinning to remove about half of the sawtimber trees in Type E and about one third (1/3) of the sawtimber trees in Type G would improve the areas for either future forestry or eventual development. In Type I the poorest quality trees could be removed for fuelwood. Any harvesting should occur prior to development of the property. This will allow uniform quality of the thinning operation and uniform removal of hazards throughout the tracts.

A Connecticut Forestry Bureau Forester should be contacted to help with implementation of the suggested thinnings. A State Forester can recommend private foresters to provide timber sale assistance, outline timber sale procedures and give general recommendations. The Connecticut Forestry Bureau office for the Eastern District is in Marlborough at 295-9523.

X. WILDLIFE



A. Wildlife Habitat

The area currently offers good wildlife habitat because of the variety of habitat to cover types along with the additional feature of the Blackledge River and its associated wetlands.

All wildlife have the basic requirements of food, cover, water and space in which to live in. Habitats (vegetative classes) and habitat components (snag and den trees, etc), randomly dispersed over an area best meets the requirements of most wildlife. This variety of habitats is known as habitat diversity.

Currently the area offers a good diversity of habitats. In addition to an abundance of wetlands, the area also contains forest, old fields and areas of seedling and sapling growth.

The forested area contains a variety of tree species including red and white oaks, (Quercus rubra, Q. alba) shagbark hickory (Corya ovata) and some red maple (Acer rubrum). The oaks and hickory provide mast for a variety of wildlife, including deer, squirrels and turkeys. In some forested areas the understory is sparse, but other areas offer enough understory to provide cover and browse for some species of wildlife.

Old field areas are especially valuable to wildlife because they provide for a variety of wildlife requirements and also because it is a type of habitat which seems to be decreasing in the area. Some of these old field sites have been stripped to gravel and/or topsoil and are in the process of reverting to grasses and shrubs. The old field sites contain juniper (Juniperus communis), red cedar (Juniperus virginiana) and a variety of hardwoods such as cherry (Prunus serotina), quaking aspen (Populus tremuloides), white and black birch (Betula papyrifera, B. lenta) and red maple (Acer rubrum). Poverty grass along with other grasses are found in some of the old field areas.

These old field areas can provide nesting sites for birds. They also provide cover, and feeding areas for a variety of wildlife. These areas often produce good rodent populations which attract both mammalian predators such as foxes and avian predators such as hawks and owls.

Some of the gravel burrow sites which had a longer time to recover are growing back to seedling-sapling size trees. Although not the most vegetatively productive areas because of soil removal, these areas of seedling-sapling size trees such as cherry, black birch and aspen do offer browse to a variety of wildlife species, such as deer and cottontails.

A large wetlands area, associated with the Blackledge River covers a major portion of the site. The wetland is dominated by speckled alder (Alnus rugosa) but contains willow (Salix spp.), buttonbush (Cephalanthus occidentalis), along with a variety of other wetland associated vegetation.

Wetlands are absolutely essential areas for many species of wildlife. This habitat can provide a rich variety of food, cover, nesting and brood rearing sites for a great number of wildlife species. They can provide breeding and nesting sites for waterfowl and other birds such as the great blue heron.

The river associated with the wetlands makes this area even more attractive to wildlife. The open water can provide travel ways and feeding sites for aquatic type mammals, and feeding and breeding areas for some waterfowl. The river provides an additional habitat feature along with providing an increased amount of edge, (the area where two different types of habitat meet). The river also would support some fish production along with small aquatic organisms which would provide food for many species higher up on the food chain.

Not only are wetlands important to wildlife they are are important to man also. They act as water storage and absorption areas that help prevent flooding. There are usually severe inherent limitations in developing wetlands due to poorly drained unstable soil types.

Both snag (standing dead trees) and den trees (living or dead tree with a cavity in it) are found on the property. Snag trees can provide food in the form of insects for many birds like chickadees and woodpeckers. Cavities in den trees are utilized by both birds and mammals such as owls, wood ducks and racoons.

B. Recommendations

As proposed, this project would greatly change a 235 acre area and would cause considerable disturbance to wildlife, and long term disturbance and changes to wildlife habitat.

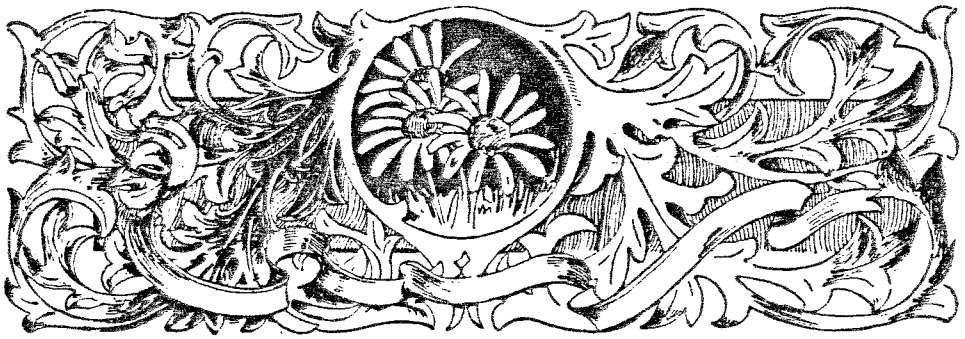
Development of this area will decrease the amount of habitat simply because the land will be occupied by physical buildings and roads. Man's activity in the area will greatly increase, even after construction is completed. Some species of wildlife will find not only the changes in habitat intolerable, but also the increased human activity and will probably emmigrate from the area. Others, more tolerable of man's activities, might even be attracted to the area.

Developing a major portion of wetlands into a pond as proposed would probably not be as useful to wildlife as the alder wetland swamp and river already there. As explained before wetlands are important to a wide variety of wildlife because they offer a type of habitat used by many species for a variety of reasons. Although ponds do offer open water utilized to some extent by wildlife such as waterfowl and birds for nesting and feeding, it is the edge of the pond where there is both open water and vegetation that is most useful and critical to wildlife. As proposed there would be a "25 foot wildlife habitat zone left around the pond". Twenty-five (25) feet of vegetation left around a large body of open water would probably have limited use by wildlife due in part to its small size. Therefore maintaining the river and the wetlands as such is far more beneficial to wildlife because there is more edge and a greater diversity of vegetation (including aquatic vegetation) and habitats.

Diversion of the river would probably not benefit wildlife because it would be difficult to reproduce the same physiography and vegetation now associated with the river and wetlands. Because the stream does not take a straight course, it provides much more edge (area where water and vegetation meets) which in turn provides more habitat for wildlife. Specific vegetation is usually associated with wetlands and/or rivers and might not be growing or be able to be grown in the area where the diversion is planned.

Less impact might be made in the area if a much smaller pond were built without interruption of the present course of the river and a larger vegetative edge or "buffer" was provided for around the pond. The pond should then be planned and constructed to be attractive to wildlife.

XI. FISHERY RESOURCES



A. Fish Habitat

The Blackledge River is a high quality stream supporting populations of wild brook trout, stocked trout and Juvenile Atlantic salmon. The river also supports populations of blacknosed dace, common shiners and white suckers. The State stocks the Blackledge with approximately 9,000 trout each year, the second highest number for New London County streams.

The fish production of the river is directly related to summer minimum flows and water quality. The preservation of wetlands within the watershed is vital to the maintenance of current water quality, flow rates and sediment control to protect the excellent fish habitat. Sedimentation reduces the holding areas for larger trout (>6") and reduces the production of aquatic invertebrates, their primary food source.

The existing stream stretch proposed for diversion is deep with stable banks and gravel substrate. Several small ponds were created during previous gravel excavations. At the downstream end of the property there is a small dam which prevents the migration of fish. The State requires the installation of a fishway when the dam is next modified.

B. Diversion Impact

The proposed diversion will result in degradation of fish habitat. The proposal calls for establishing stream depths capable of passing adult Atlantic salmon and substrate consisting of gravel. It is highly questionable whether the gradient of the proposed channel will be sufficient to maintain a gravel bottom or water deep enough to permit salmon migration. In addition, routing the stream away from the wetland will eliminate recharge from the wetland. Water will also be lost, primarily during critical summer low flow periods, through evaporation of pond surface waters.

C. Mitigating Measures

The river will best be protected if it remains in its existing channel. Stablization of the western bank is recommended to prevent the stream from being channeled through the pond(s). A planting of red maple and hemlock along the stream will supplement existing alder growth in providing shade and stream bank stability. The plantings will also serve to make the area more aesthetically pleasing. The construction of a pond with a lesser surface area than proposed is recommended for the area presently having the small ponds. The river should completely bypass the pond to eliminate the warming of stream water temperatures.

The implementation and maintenance of proper erosion and sedimentation control devices will be essential throughout the development period to protect stream insect and fish populations.

This section will address the design of the proposed subdivision, which is basically sound, but could be improved with some minor modifications. These are primarily two aspects of the subdivision design which will be addressed. One is the fact that no public access had been provided for the very scenic stretch of river located downstream from the proposed diversion. The other issue is the lot and road configuration on the eastern portion of the site.

A. Public Access

First of all in regard to the matter of public access to the river, it would be preferable for the proposed nature trail to continue east along the river from the southern limit of the pond to Parker Road. A sensitively designed trail through this area paralleling the river would make available an excellent area for fishing and would also provide a very scenic walking trail. It would seem preferable to accommodate access along the river for residents of the subdivision other than the owner's of those lots abutting the river. If access for the general public would be desirable it would be necessary for the Town to accept dedication of the trail easements. Based on increased liability risk the Town may or may not wish to add this open space to its inventory of Town owned/controlled lands. The alternative would be for the trail to be used just by residents of the subdivision and maintained with revenue from a homeowner's association fee. In either case, as long as a trail system is going to be a component of the project it is highly recommended the trail be extended along the full length of the Blackledge River as it traverses the site.

B. Subdivision Design

Overall the proposed density and lot configuration of the subdivision is appropriate. It is suggested that the configuration of several lots in the northeastern corner of the subdivision could be designed more efficiently (see Diagram A). It appears that the loop drive serving these lots is not really necessary, the lots could be served more effectively with a cul-de-sac which could reduce the number of rear lots. Also, use of a cul-de-sac would reduce the amount of pavement (impervious surface) required and would eliminate the common green area. The green, although a nice feature, is not necessary in a development of such low density and would represent an added maintenance cost to a homeowner's association.

Sketched out in Diagram B, is the Team Planner's idea of a better lot and street configuration for the northeastern corner of the subdivision.

The proposal plan for the subdivision site represents a suitable use based on the physical characteristics of the land in conjunction with the existing impact of previous sand and gravel mining operations. One of the controversial issues regarding the development is the impact the truck traffic

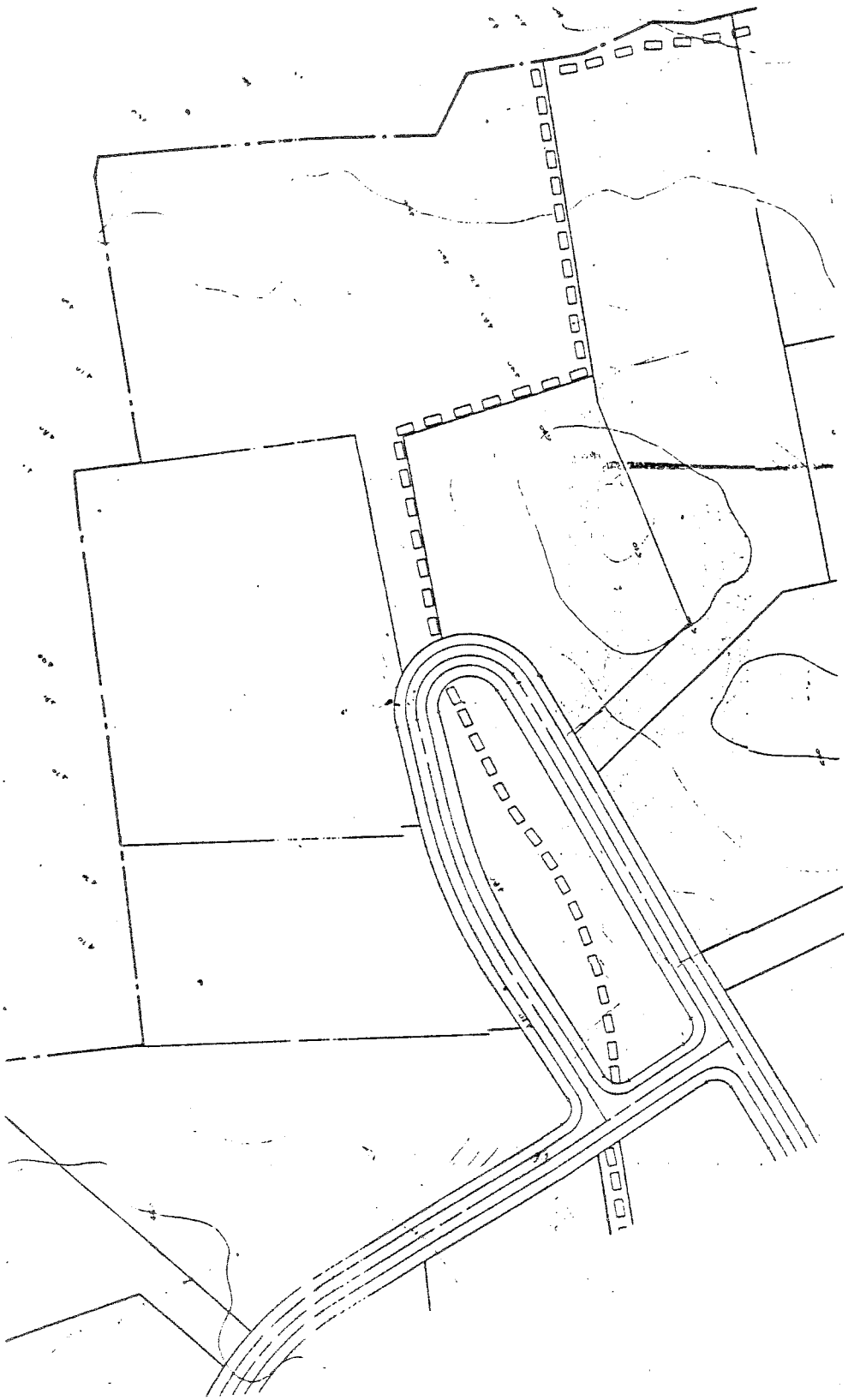


DIAGRAM A DESIGN AS PROPOSED

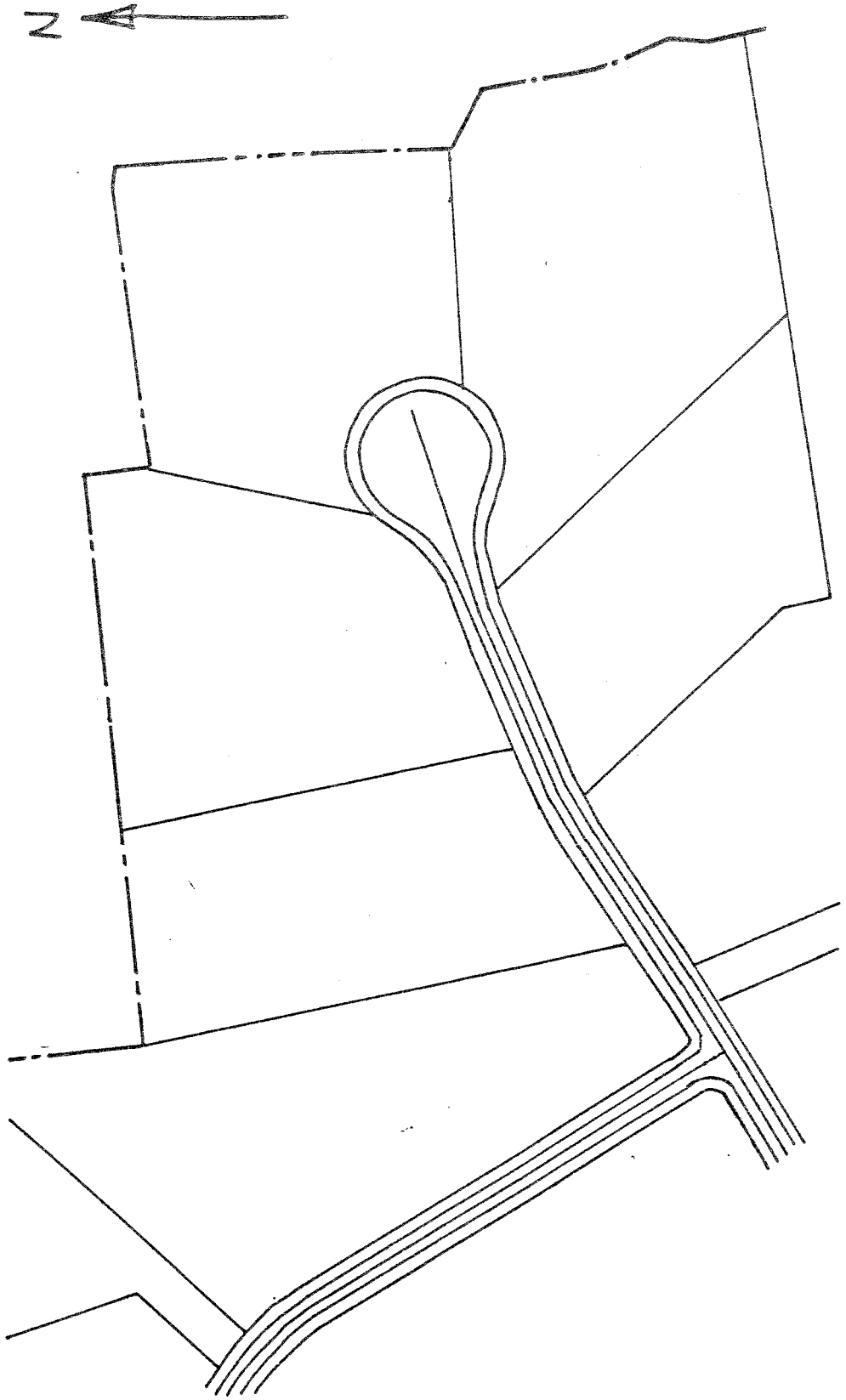


DIAGRAM B SUGGESTED DESIGN

which will be generated by removal of sand and gravel from the site. Based on the proposed rate of removal, over three (3) years, the volume of truck traffic which will be generated does not appear so heavy that it will cause an excessive amount of damage to local roads or interfere greatly with local traffic flow. However, a detailed look should be undertaken by the Marlborough Town Engineer. If specific deficiencies are found it could be suggested that the developer bear the cost of needed improvements. ConnDOT should perhaps evaluate the impact of the traffic on State roads.

About The Team

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

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

PURPOSE OF THE TEAM

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

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

REQUESTING A REVIEW

Environmental reviews may be requested by the chief elected officials of a municipality or the chairman of town commissions such as planning and zoning, conservation, inland wetlands, parks and recreation or economic development. Requests should be directed to the Chairman of your local Soil and Water Conservation District. This request letter should include a summary of the proposed project, a location map of the project site, written permission from the landowner allowing the Team to enter the property for purposes of review, a statement identifying the specific areas of concern the Team should address, and the time available for completion of the ERT study. When this request is approved by the local Soil and Water Conservation District and the Eastern Connecticut RC&D Executive Council, the Team will undertake the review on a priority basis.

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