

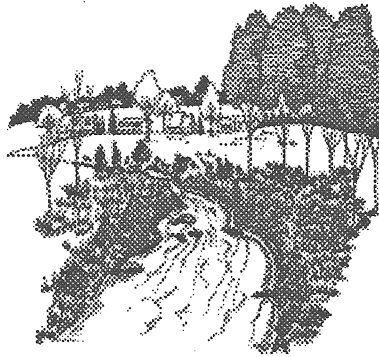
*Sterling Development  
Group Subdivision  
Canterbury, Connecticut*



**Eastern Connecticut  
Environmental Review Team  
Report**

Eastern Connecticut  
Resource Conservation & Development Area, Inc.

*Sterling Development Group Subdivision*  
*Canterbury, Connecticut*



**Environmental Review Team Report**

**Prepared by the  
Eastern Connecticut Environmental Review Team  
of the  
Eastern Connecticut  
Resource Conservation and Development Area, Inc.**

**for the  
Inland Wetlands and Watercourses Commission  
Canterbury, Connecticut**

**December 2000**

**CT Environmental Review Teams  
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## *Acknowledgments*

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

The Eastern Connecticut Environmental Review Team Coordinator, Elaine Sych, would like to thank and gratefully acknowledge the following Team members whose professionalism and expertise were invaluable to the completion of this report.

The field review took place on Tuesday, October 3, 2000.

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I would also like to thank John Tetreault, chairman, inland wetlands and watercourses commission, Kimberly Kelly and Donna O'Neill, commission members, Darlene Gannon, Canterbury inland wetland agent, Mike Schaefer (CME), soil scientist for the applicant, Scott Young(CME), engineer for the applicant and Ian Cole (CME), for the applicant, for their cooperation and assistance during this environmental review.

Prior to the review day, each Team member received a summary of the proposed project with location and soils maps. During the field review Team members were given plans and additional information. Some Team members made individual or additional visits to the project site. 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 plans or detailed solutions to development problems. The Team does not recommend what final action should be taken on a proposed project - all final decisions rest with the town and landowner. This report identifies the existing resource base and evaluates its significance to potential development, and also suggests

considerations that should be of concern to 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 Council hopes you will find this report of value and assistance in reviewing this proposed subdivision.

If you require additional information please contact:

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# Table of Contents

	Page
Acknowledgments —————	ii
Table of Contents —————	v
Introduction —————	1
Watershed and Site Development Considerations —————	6
Soil and Water Conservation District Review —————	25
Inland Wetlands Review —————	40
Fisheries Resources —————	47
The Natural Diversity Data Base —————	53
Stormwater Management Review —————	54
Review of On-Site Sewage Disposal & Water Supply Wells —————	61
Archaeological and Historical Review —————	67
Planning Consideration —————	69

## List of Figures

1. Topographic Map —————	3
2. Location Map and Lot Layout —————	4
3. Soils Map —————	5
4. Vegetated Buffer Strips for Streams, Lakes and Ponds —————	loose brochure
5. 8 Tips for Cleaner Water —————	22
6. Comparing Alternatives #1 —————	23
7. Comparing Alternatives #2 —————	24
8. Map - 4 Ephemeral Headwater Wetland Systems —————	38
9. Photo - 4 Ephemeral Headwater Wetland Systems —————	39
10. Wetland Intrusions —————	46
11. Policy Statement - Riparian Corridor Protection —————	49
12. Position Statement - Utilization of 100 Foot Buffer Zones ... —————	50
13. Required Separation Distance From Private Wells to... —————	66

# *Introduction*

## Introduction

The Canterbury Inland Wetlands and Watercourses Commission has requested assistance from the Eastern Connecticut Environmental Review Team in conducting a review of the proposed Sterling Development Group Subdivision.

The ±240 acre site is located on the east side of Lisbon Road, north of the intersection of Bates Pond Road and Gooseneck Hill Road. The project will consist of 86 single family house lots with on-site sewage disposal systems and on-site water supply wells. Many of the lots will require engineered sewage disposal systems. The minimum lot size is 2 acres, and most lots are just over 2 acres in size.

Approximately two miles of new roads are proposed with six cul-de-sacs. The road system will involve five wetland crossings. The site contains extensive wetlands and Cory Brook runs along the western property boundary.

An ERT review was conducted in 1988 (*Canterbury Estates*) for a 54 lot subdivision on 172 acres. This acreage is included in the present proposal. Additional acreage has been added to the north to eliminate the need to cross Cory Brook for the main access. Some Team members reference this 1988 ERT report in their review of the present proposal.

## Objectives of the ERT Study

The commission is requesting the review to determine the impact that 86 house lots and construction of 2 miles of road will have on Cory Brook and the surrounding wetlands and watercourses. Specific concerns include impacts to wetlands, vegetation, wildlife, and aquatics, issues concerning water quality, stormwater management, erosion and sediment control, open space, sewage disposal, and the preservation of cultural resources. The ERT report will provide a

natural resource inventory, a discussion of impacts, and guidelines and recommendations for the mitigation and protection of natural and cultural resources.

### **The ERT Process**

Through the efforts of the inland wetlands and watercourses commission this environmental review and report was prepared for the Town of Canterbury.

This report provides an information base and a series of recommendations and guidelines which cover the topics requested by the commission. Team members were able to review maps, plans and supporting documentation provided by the applicant.

The review process consisted of four phases:

1. Inventory of the site's natural resources;
2. Assessment of these resources;
3. Identification of resource areas and review of plans; and
4. Presentation of education, management and land use guidelines.

The data collection phase involved both literature and field research. The field review was conducted on Tuesday, October 3, 2000. Some Team members made individual and/or additional site visits. The emphasis of the field review was on the exchange of ideas, concerns and recommendations. Being on site allowed Team members to verify information and to identify other resources.

Once Team members had assimilated an adequate data base, they were able to analyze and interpret their findings. Individual Team members then prepared and submitted their reports to the ERT coordinator for compilation into this final ERT report.

**Figure 1.**

## Topographic Map

Scale 1" = 2000'



Figure 2.

## Location Map and Lot Layout

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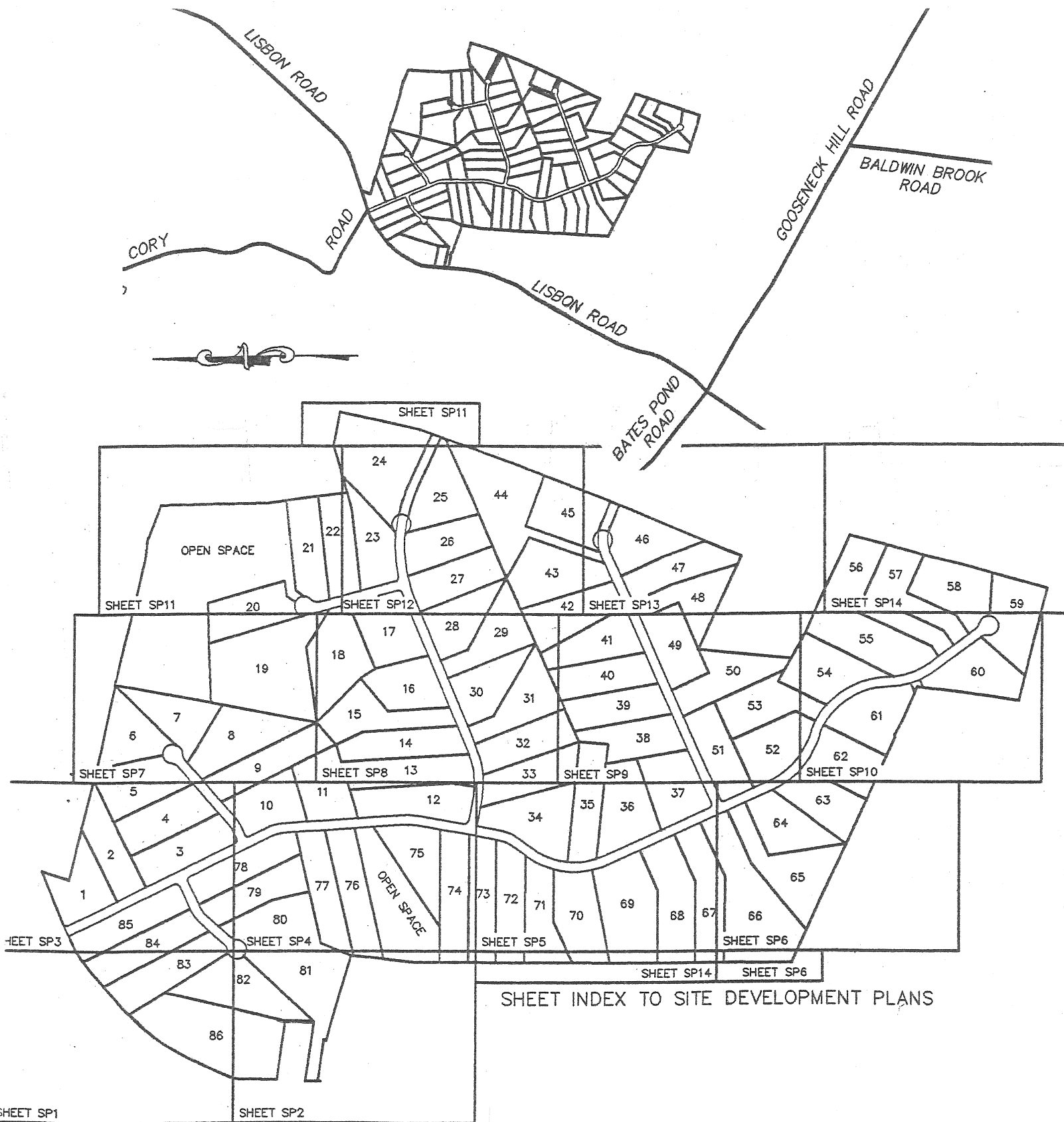


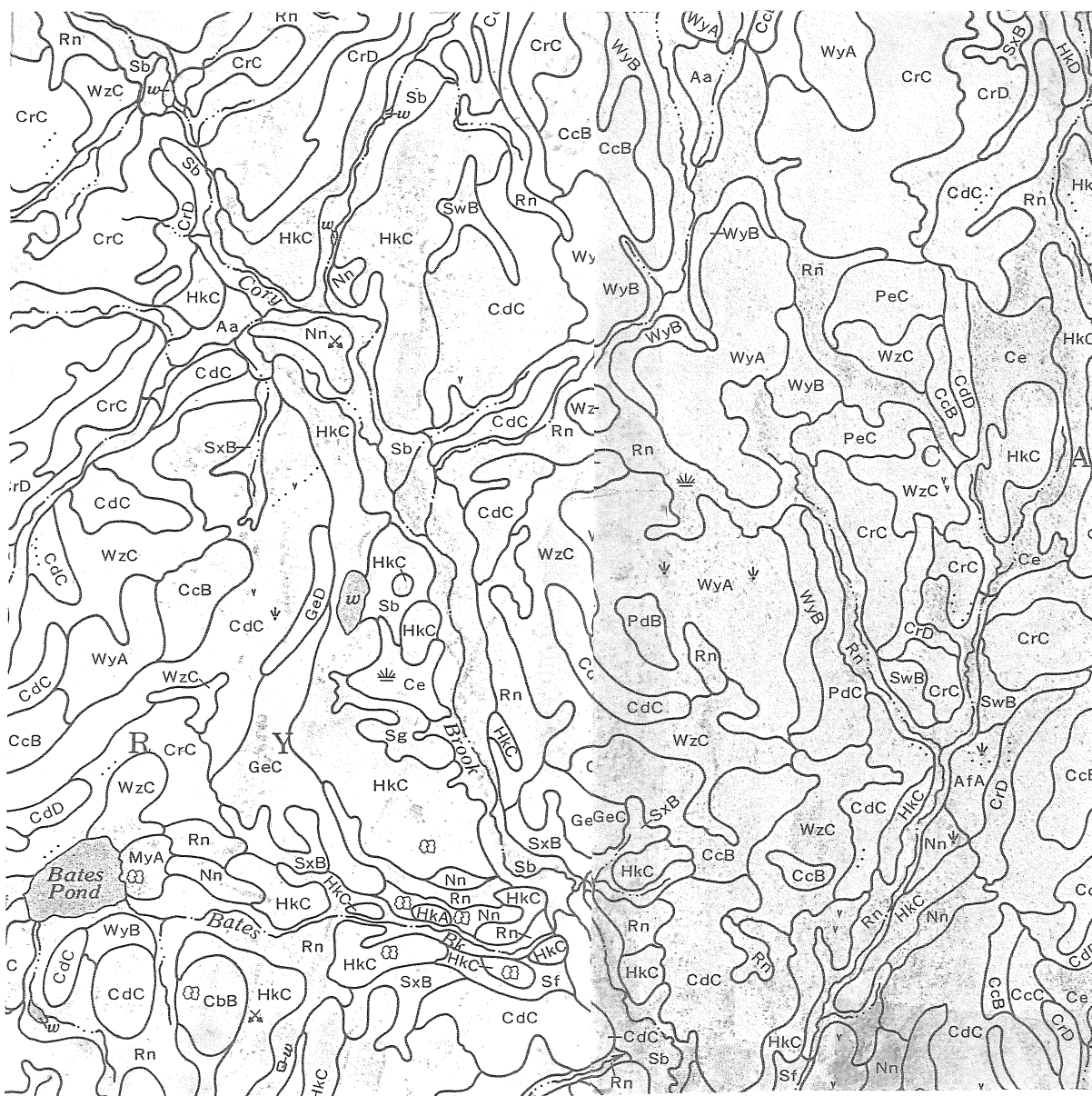


Figure 3.

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## Soils Map

Scale 1" = 1320'



## *Watershed and Site Development Considerations*

### Surface Water Hydrology

The site is entirely within the Cory Brook drainage basin, or watershed. A watershed is the entire surface area that drains to a particular water body. The Cory Brook basin is identified in a statewide drainage basin coding system as basin number 3715. This is a sub-regional basin draining about 7.5 square miles, and discharges east of Route 169 into the Quinebaug River Regional basin (3700) at the Aspinook Pond impoundment of the Quinebaug River. Surface waters on the site include Cory Brook along portions of the property's western boundary, which originates north of the site at the Route 14 corridor. There are at 4 - 5 wetland systems with small intermittent streams feeding Cory Brook on the site. These are first-order streams, originating from headwater wetlands and from groundwater. The eastern boundary of the site contains some intermittent watercourses that flow downhill and southwest of the site as an unnamed tributary before flowing into Cory Brook south of the site.

The State Water Quality Classifications classify surface and ground waters in the state by existing water quality conditions, a classification goal, and its designated uses and the State Water Quality Standards. The Standards and Classifications are designated to manage water quality to protect health, the environment, and legitimate uses of water resources. The complete State of Connecticut Water Quality Standards and Criteria document is available on the CT DEP web site at: <http://dep.state.ct.us/wtr/wqsinfo.htm>.

All the site's streams and water bodies are classified "A" or "B/A" surface water quality. Class A waters overall have excellent water quality and are designated for

use as fishable/swimmable (suitable for recreational use, fish and wildlife habitat), as well as agricultural and industrial water supply, and potential drinking water supply. One resource worth noting is the excellent trout fisheries in the lower stretches of Cory Brook, supplemented with DEP fish stocking and retaining a "wild" population of brown trout. This is due in large part to the overall high quality water resources of the upper Cory Brook watershed.

The entire length of Cory Brook, a segment of which flows south along the western portion of this site, is classified for surface water as B/A water quality, where B is the existing condition and A is the goal. The existing B quality condition indicates it may not be meeting the water quality criteria for one or more designated uses. Review of the state Leachate and Wastewater Discharge Sources Inventory (1998) that supports the Water Quality Classifications, indicates that upstream of the development proposal, there is one known area which would impair the class "A" surface water quality goal. This is a (now closed) mixed materials landfill, located about 1 mile upstream from the intersection of Lisbon and Cory Roads. This review did not find any additional areas of potential pollution threats to surface water quality on-site.

As part of the federal Clean Water Action Plan, the CT DEP and the USDA-Natural Resources Conservation Service conducted a Unified Watershed Assessment for all CT waterbodies in 1998. Based on existing documents and other available water resources information, the overall health of the Cory Brook sub-regional watershed appears to be good. It should be a goal of the state, regional and local watershed stakeholders to protect the overall health of this sub-regional watershed. As stated previously, the watershed is nested within the larger Quinebaug River regional basin. The Quinebaug basin has been identified with several water quality impairments, and is listed as a waterbody not meeting its designated water quality standards with a "B" surface water goal. Non-point source (NPS) pollution from the upper Quinebaug watershed is contributing excessive nutrient loads. Waterbodies downstream of Cory Brook include

Aspinook Pond and Norwich Harbor, and both having degraded water quality due to upstream nutrient loading. Land use development proposals within the Quinebaug River basin should be carefully reviewed for incorporation of best management practices (BMPs) to protect downstream water quality.

### **Groundwater/Aquifer Resources**

The State Water Quality Classifications, indicate groundwaters on the site are classified "GA". Class GA groundwaters have designated uses as existing private and potential public or private drinking water supplies, and as baseflow to adjacent surface water bodies. Water quality is generally good and at a minimal should be suitable for drinking or other domestic use without treatment.

Domestic sewage discharges can be considered consistent with this standard. All the surrounding land is served by on-site private or small community wells. Review of state waste sources inventory and the on-site review did not find any known potential pollution threats. Wastewater discharges to the ground in GA areas are limited to approved treated domestic sewage.

### **Basic Concepts of Watershed Protection**

*"A plan should be made to lay lightly into the land."*

Benjamin Howland, Former Director, National Parks Service

Headwater streams such as Cory Brook are typically short in length and drain relatively small areas, but are important because they comprise the majority of the 8,400 stream and river miles in Connecticut. What happens in the local landscape is directly translated to headwater streams and major receiving waters are affected in turn. As rural areas of Canterbury urbanize, streams handle increasing amounts of runoff that degrades headwater streams as well as major tributaries. Specific resource protection concerns for Cory Brook include contributions to stream baseflow, and to cold temperature levels.

Focusing on the headwater stream level is important in watershed management for several reasons:

- Headwater streams are exceptionally vulnerable to watershed changes;
- Headwater streams are visible at the same geographic scale as development;
- The public intuitively understands streams and strongly supports their protection; and
- Headwater streams are good indicators of watershed quality.

The watersheds and sub-watersheds that drain to these streams are easily identifiable landscape units that tie together terrestrial, aquatic, geologic, and atmospheric processes. Thus, they are the most appropriate geographic unit to protect water resources.

### Potential Water Quality Issues

Nitrogen and phosphorus are the nutrients of concern to water quality. Both can be found in high concentrations in runoff. Nutrients are associated with runoff from agricultural lands, urban runoff from lawns and pet wastes, leachate from landfills and septic systems, and erosion. These pollution sources all exist within the Cory Brook sub-watershed. Unchecked nutrient pollutant management can lead to downstream impacts to Aspinook Pond and Norwich Harbor.

Sediment is another pollutant of concern for Cory Brook. Excessive sedimentation from sources such as unchecked erosion sites and unmanaged road sanding operations can lead to degradation of stream bottom habitat. That can lead to impairment of the downstream fisheries previously mentioned.

Stream water temperature changes stress aquatic organisms that are often fine-tuned to specific water chemistry and temperature regimes. Cory Brook, like

most small stream systems in Connecticut, has a channel under 15 feet in width, with (near) continuous foliage canopy that limits sunlight. Maintaining or enhancing natural(ized) streambank vegetation will shade the water, limiting temperature changes and supporting high dissolved-oxygen levels. The Thames River Basin Partnership Initiative, through the New London County Soil and Water Conservation District office in Norwich, has public outreach information on vegetative buffer areas for streams that can be useful for residents moving into this development. (Enclosed, Figure 4.)

### **Proposed Land Use**

Regional land use data are inadequately described in this site plan. These data are especially important because of the relationship between land use and site development runoff pollution. Any resultant pollution management must be based on the specific site and regional land use conditions for the Cory Brook sub-watershed. The applicant has already compiled some of this information. The site's watershed areas were delineated from two-foot contour line topographic maps and area calculations made through AutoCad technology. The applicant could re-scale and transfer that mapping information onto the site plan, through either an expanded Locational Map or similar overview map in the site plan sequence of maps and assessments.

Another need for descriptive land use data is with the Town's long term resource planning and management of open space areas within this site and how they correspond to adjacent parcels.

Generally the proposed land uses and densities, while able to be supported on-site, need some mitigation and infrastructure support to minimize impacts on existing surface and ground water resources. This is primarily because of the overall development constraints that exist in many areas of the site due to slope, shallow water table, shallow bedrock or inclusions of wetland soil types within

the overall Woodbridge soil units. These soils are described in the Windham County Soil Survey as having inclusions of “. . . small areas of poorly drained Leicester and Ridgebury soils”. Both of these are designated inland wetland soils in Connecticut. Mapped Woodbridge soil units have other soil inclusions as well. In total these inclusions make up about 15% of the mapped soil unit offering the likelihood that other areas of wetland soils may well exist within this mapped soil unit.

Generally residential lots sizes of 1-2 acres or greater is a reasonable density given that general land conditions are good or buildable areas exist within the lot layout. Although the proposed lots are within or greater than this range, buildable areas within some lots will be difficult to construct on. This is evident by the site plan notation for engineered septic systems for virtually all proposed lots. Given this, the following comments are offered in response to inquiries from the Town:

- 1) The State Water Quality Standards for a Class A stream do not promote “zero impact” nor preclude adjacent residential development as long as the development does not result in degradation of the waterbody classification.
- 2) It should be a resource protection goal of the Town to strive for natural stream flow and temperature conditions.

### Stormwater Management

Non point source pollution (NPS) occurs when water runs across the land mosaic, and picks up pollutants and deposits them in surface waters and groundwater. NPS has now become the nation's leading source of water quality degradation. Everyone is a NPS contributor in our everyday lives. The focus of NPS management is to educate ourselves about the inputs and apply NPS management principles to activities such as new site development proposals.

Stormwater from cumulative urbanization can be a significant non-point source of pollution. Management of both the quantity and quality of runoff should be considered to protect receiving waters, such as Cory Brook. The State DEP Water Management Bureau, through a General Permit process, regulates certain stormwater discharges that may have potential significant impacts. This includes construction activities that disturb 5 acres or more, which would include this site. The state permit for construction centers on temporary sedimentation and erosion control during construction and post-construction pollution prevention and treatment measures.

**Although no direct impact is proposed within 100 feet of Cory Brook, properly designed, installed and maintained stormwater controls are critical to ensure a healthy and productive stream corridor.**

It is generally recommended to **minimize the use of impervious surfaces where possible**. Where reduction is difficult, cul-de-sacs can incorporate landscaped areas in between to help maintain natural recharge. It is not necessary to have a fully paved 50-foot radius cul-de sac, as the six are proposed in this site plan. Emergency vehicle turning and snow removal concerns have been adequately addressed in other communities with modified cul-de-sacs. A depressed and pervious (unpaved) cul-de-sac center can be designed to receive and effectively treat road runoff quality before percolating into the ground. A demonstration of this alternative design can be viewed at the Glen Brook Green Subdivision, located in the Jordan Brook sub-watershed and in the town of Waterford.

Another general recommendation is that **road widths should be minimized where possible**. Because this is a large lot, conventionally designed subdivision, the road network is extensive. Any way to reduce road lengths would be desirable. One opportunity for the Town and the applicant to pursue alternative development opportunities is with a program administered by the University of



Connecticut Cooperative Extension System (UConn/CES) with funding support from CT DEP. The primary purpose of the UConn/CES Non-Point Education for Municipal Officials (NEMO) Program is to educate municipal land use decision makers about the connection between land use and water quality, and provide them with technical information on how to reduce the environmental impacts of new development. This reviewer encourages the Town of Canterbury and the applicant to incorporate planning and design, construction and post construction elements of NEMO techniques. To view the myriad of information on NEMO's web site, visit them on-line at:

<http://www.canr.uconn.edu/ces/nemo/>

Typical residential use will have minimal and relatively more dispersed pollution sources, such as household waste and lawn maintenance, which are best handled through education. The Town of Canterbury should consider providing homeowners with information on residential Best Management Practices, much of which is readily available from the UConn-Cooperative Extension System's Home-A-Syst program. The DEP recently developed a brochure (*8 Tips For Cleaner Water*, see Figure 5.) to give people a quick introduction to how our everyday activities impact water quality, and provide eight tips that people can use at home that can lead to cleaner water.

### **Runoff Quality and Structural Control**

The site plan proposes to provide some first flush treatment through use of a pre-fabricated stormwater treatment unit. These treatment systems typically remove grit, contaminated sediments, metals, hydrocarbons and other floatable materials from surface waters. They often contain a grit chamber that is loaded with stormwater tangentially which directs settleable solids toward the center. A center barrier, or baffle wall, may be present to trap floatables in the oil chamber. This barrier is highly resistant to flow surges. A final flow control chamber causes the inlet pipe to become submerged.

For the price of a designed, constructed and properly installed stormwater treatment unit (which are effective with sediment and some nutrient/metals pollutant removal from stormwater, but not with water quantity issues), the applicant/town may be able to install a properly installed detention basin that addresses clean water issues AND peak flow retention, reducing the impacts on the Cory Brook streambelt corridor.

The town land use commissions and public works staff should understand what the requirements for design, installation, and long-term maintenance requirements are for this (or other) type of stormwater management device before accepting this type of stormwater management plan for the project. It is recommended that the town learn about the water quality monitoring and technology assessment program being coordinated by Dr. John Clausen, of the Department of Natural Resources Management & Engineering at the University of Connecticut. For more information about the described treatment system and other similar technologies being evaluated in this program, including direct vendor contacts and field installations in eastern CT, contact Dr. Clausen at (860) 486-2840.

### **Peak Flow Control**

Runoff flow controls may be necessary to protect downstream flooding or streambank erosion. The overall watershed, the site's location within the watershed, and selected downstream design points (stream culverts, structures, or water bodies) should all be considered when determining the potential affect of individual site runoff on peak flows of the receiving waters. When considering the use of detention measures, the following concept can be used:

- In the lower 1/3 of the watershed: little or no detention
- In the middle 1/3: limited detention.
- In the upper 1/3: longer detention.

The development site is primarily in the upper 1/3 watershed. This provides hydrologic support for a limited detention basin to mitigate clean water and peak stormwater runoff flow from the development.

**Concerns Raised By Reviewing This Site Plan Include:**

- 1) The Location Map is functionally unusable with regards to natural or cultural resource reviews. This map and the overall site plan have no descriptions of the overall hydrology/geology/topography or land uses or town zone districts (the latter is briefly addressed by listing the site as within the Rural Zoning District.) One suggested inclusion would be map delineation of the watershed divides within the Cory Brook sub-watershed and the location of the site superimposed on this map layer. The Town may desire additional relevant descriptive information from the applicant toward an effective site plan review.
- 2) What opportunities exist for future connections to the proposed cul-de-sacs with adjacent undeveloped parcels? This should be better articulated to the Town within the site plan.
- 3) There is an unfinished post construction peak flow description located within the project drainage calculations. It begins with "...An increase of flow in Cory Brook tributaries can result in...". It is unclear what the project engineers have determined about the development impacts to the larger watershed.
- 4) The site plan does not provide an analysis of downstream impacts to the Cory Brook riparian corridor by this development proposal. This development, if

approved, will not be isolated within the watershed. It is reasonable for the Town to understand any anticipated downstream impacts to private and public lands, transportation infrastructure and water resources.

5) The calculations reflect a 50% increase in the rate of runoff for a 25 year design storm event. It is unclear whether the applicant calculated a post-development calculation for the 2-year storm event, where NPS pollutants are more commonly associated, and where proper NPS management controls can be most effective. The Town should consider asking the applicant to clarify any expected downstream impacts of this proposal's estimates for the net rate of runoff for both 2-year and 25-year storm events. This should include the net velocity and volume calculations for this site and the downstream remainder of the Cory Brook watershed. This should include a listing of expected specific impacts and what any of the proposed mitigation on Cory Brook would be. Having raised this issue in requesting the ERT report, the Town may now have concerns for additional significant increase in peak flow runoff if similarly-scaled developments are approved and constructed within this sub-watershed.

6) The proposed drainage system at the intersection of Lisbon and Frost District Roads allows for a significant amount of sand and associated runoff pollutants into a 6' X 12' rip rap splash pad within proposed Lot 85. The site plans are unclear in showing cumulative impacts to the nearby wetlands. This information will be needed by the Town to determine the cleaning and maintenance schedule for that energy dissipater structure to protect the wetlands associated with Cory Brook.

### **Watershed Resources Protection and Alternative Development Options**

Canterbury Inland Wetlands and Watercourses commissioners raised several concerns during the site walk about proposed development impacts on the

wetland resources of the site. Inquiries were made for suggested options available to the town toward wetland/watercourse resource protection.

**The DEP Watershed Management Program supports wetland buffer protection areas to retain viable watershed health, as is currently true for the Cory Brook watershed.**

The site plan shows a 100-foot wetland area buffer demarcation but then the applicant does not plan for it. This is contradictory to the natural-resource based planning process, which is an increasingly important planning process for rural northeastern communities. The cumulative impacts of the proposed development, though not quantified with the site plan application, are quite significant within the 100 foot wetland buffer area. This site plan is not reflective of the wealth of available information about wetland buffers and upland area review guidelines. The town should not accept the applicant's use, on one hand, of a delineated wetland buffer area on the site plan, and then on the other hand, find over 50% of the proposed lots to have planned impacts within these areas. Furthermore, there was no description of the Cory Brook watershed beyond the immediate project site. The town should require the applicant to provide a fuller description of the Cory Brook watershed so the town can better assess the impacts of this proposed development on adjacent land parcels and within the larger watershed landscape.

It is unclear how and why the applicant chose the proposed open space areas and what the applicant proposes for the dedication of open space. The applicant has not identified what the purposes of the proposed open space areas are for, and how they were determined (with reference to the town's Plan of Conservation and Development and town subdivision regulations). To provide for a better review of this site plan, the applicant should discuss whether the town of Canterbury has expressed an interest in receiving the types and location of the open spaces depicted on the site plan. This can be clearly spelled out in a

supplemental document to the site plan, along with a note in the site plan that references such a document.

The following is a specific example for the Town to consider: request that the applicant offer better long term support for wetland functional values and open space connectivity by either modifying or deleting lots 19 and 20. This could result in the inclusion of delineated inland wetlands and buffered uplands of the proposed lots 19 and 20 that currently exists between two open space parcels. A supporting objective for consideration would be providing for long term resource protection and management of desirable open space areas. An action strategy would be providing for natural(ized) linkages between land, wetlands, and water resources that can yield accumulated, synergistic benefits as a viable cluster (which can be realized under single owner/management), rather than risk resource fragmentation through isolated management or misuse of individual components over the long term (from multiple owner/managers).

The Cory Brook watershed currently contains a very low percentage of permanently protected open space areas. Most of this watershed is zoned to allow for similar land development as the current Sterling Development Group proposal. The Town of Canterbury can protect and support long term watershed health by incorporating the inland wetlands and watercourses into committed open space protection areas.

The Town should consider the incorporation of the majority of the wetlands and the Cory Brook streambelt into a single ownership (e.g. town) for long term resource protection and management. An alternative, though less favorable, proposal, is to retain these wetland/watercourse resources with private ownership within the final approved lots, along with the execution of permanent conservation (restriction) easements on these areas, specifically for proposed lots 66-77, 81-83 and 86, inclusive.

If either alternative is accepted, it is further recommended that the town consider developing a boundary marker and monitoring plan for these now protected areas. Field marked open space boundaries along road and lot lines will provide the town staff, the site contractor, and all sub-contractors with a clear understanding of where these areas exist, thus minimizing unintentional impacts during construction. The Town could extend this educational outreach campaign by placing a letter in each lot file. The letter would identify to the new lot owners (and subsequent owners) the conservation easements and the desire by the town to protect the wetland and streambelt corridor through the development.

There is a need for the town to require a wildlife habitat assessment for this large parcel. This intensive land development proposal is located within a largely rural area of Canterbury. Cory Brook and the associated wetlands and floodplain probably provide a significant spine to a long-term wildlife corridor connection in the region (between the uplands of Canterbury and the Quinebaug River valley). Networks of streambelts are a logical framework on which to develop most open space systems in Canterbury and throughout Connecticut. Appropriately designated open space within this development can help insure that wildlife can move in and through the residential subdivision. One aquatic resource worth noting is the excellent trout fisheries in the lower stretches of Cory Brook, supplemented with DEP fish stocking and retaining a "wild" population of brown trout. This is due in large part to the overall high quality water resources of the upper Cory Brook watershed.

A creative configuration of the lots, which may include reducing the number of lots, may be necessary to preserve wildlife corridors and habitat connections within this section of the Cory Brook sub-watershed. The applicant in the past has demonstrated a willingness to alter the subdivision design to address resource concerns (e.g. issues with a road crossing over Cory Brook). Enclosed for

the Town's consideration are page copies of the "Comparing Alternatives" section of the publication entitled "*An Inland Wetland Commissioner's Guide to Site Plan Review*" CT DEP, Bureau of Water Management, Inland Water Resources Division, Inland Wetlands Program, 1993 (see Figures 6. and 7.).

A portion of the site plan review includes the following text, which is recommended for consideration by the town land use commissions: "...A *landscaping plan should be considered. The applicant should show existing vegetative patterns. . . and new plantings where existing vegetation is lost to development. Further, the site plan should include the number and types of plant species as well as a planting and watering schedule. The proposed plantings should be consistent with the surrounding ecosystem in wildlife habitat and food chain. . .*" (p.25)

It is suggested that the applicant pursue alternative development techniques for this site. This should include full consideration of a **conservation open space subdivision design**, which would require supportive flexibility by the Canterbury Planning and Zoning Commission as well. A goal of such a development pattern would be to incorporate layout design, construction and post development maintenance of natural resources through protection of the integrity of the streambelt. This would include the wetlands and Cory Brook floodplain in a single unit of ownership (e.g. town of Canterbury) toward the goal of resource protection and perhaps limited, appropriately planned passive recreation opportunities.

For alternate site designs, consideration should be given for a site development reconfiguration, to provide for more effective wetland protection. This could include lot reconfiguration, reduction in the number of utility and drainage crossings, clustering residential units, providing open space and preserving wildlife habitat, and minimizing impacts to surface waters and wetland crossings. Alternative management practices can include: use of a bridge span



crossing instead of fill and culverts/pipes; reducing erosion and sediment during construction and protecting riparian resource values; retaining the maximum amount of existing vegetation during construction; minimize clear-cutting; and preserving wildlife habitat.

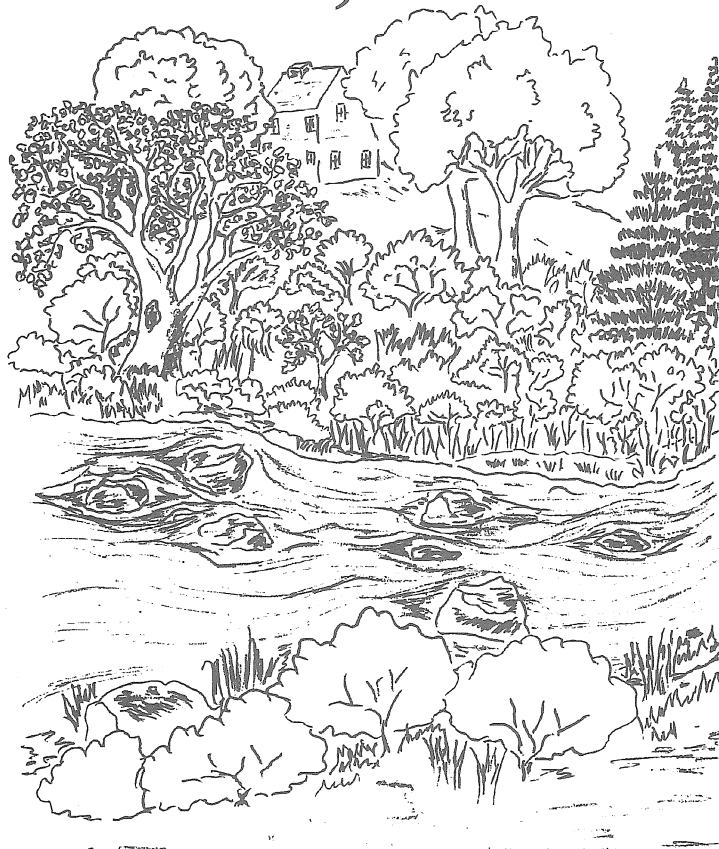
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Conservation District**  
Agricultural Center  
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(860) 774-8397

**Tolland County Soil and Water  
Conservation District**  
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Vernon, CT 06066-4503  
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# VEGETATED BUFFER STRIPS FOR STREAMS, LAKES, PONDS



produced by  
**The Thames River Basin  
Partnership Initiative**

## What is a Vegetated Buffer?

Vegetated buffers are small areas or strips of land in permanent vegetation and can be either naturally occurring or artificially constructed. They can range in size from several feet to hundreds of yards wide.

## What Do Buffers Do?

In "riparian areas" (the areas adjacent to, and upland from, watercourses) buffers can act to protect against erosion, reduce stormwater runoff, serve as habitat for fish and wildlife, protect water quality, and decrease lawn maintenance for property owners.

**Erosion Control** - Erosion is the process by which water or wind move soil along with its organic matter and plant nutrients. Erosion can affect water quality when the transported sediment is deposited into a body of water. This process of sedimentation fills in clean streams and ponds, destroys fish and animal habitat, and degrades water quality.



Keeping the banks of waterbodies vegetated stabilizes soil by binding soil particles together. Vegetation along the edge of waterbodies also serves as a shield for soil against the erosive

power of moving water during high flows or from wave action.

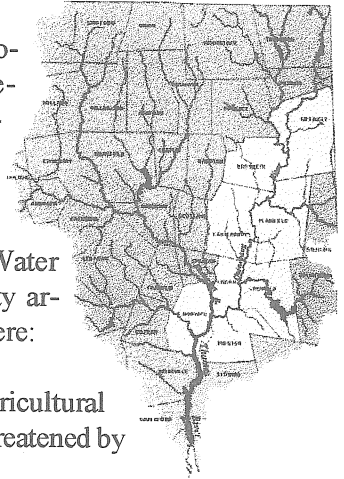
**Floodwater Reduction** - Vegetated areas, unlike pavement, act like sponges. They provide an area where fast moving water can be slowed and absorbed by plants and soil, and then released at a more natural speed to a stream, lake, or pond. In this way, plants naturally help control how high the water will rise during storms and can help reduce flood damage.

In addition, streamside buffer strips trap debris carried during storms and prevent it from being deposited in people's yards.

**Fish and Wildlife Habitat** - Like people, animals need shelter and food to survive. The leaves, branches, limbs, fruits, and roots of the plants along the edge of a waterbody are a major source of food and shelter for the variety of wildlife that live in these areas (including mammals, birds, reptiles, fish, and amphibians). Vegetated buffers can also provide and improve corridors for wildlife to travel from one location to another. The type and amount of wildlife using a buffer will depend on the buffer's width and the mix of plants.

## What is the Thames River Basin Partnership Initiative?

The Initiative is a voluntary, co-operative effort to share resources and to develop a regional approach to resource protection. The initiative grew out of the locally led workshops held by the region's Soil and Water Conservation Districts. Priority areas of concern for the basin were:



- ☐ To protect the region's agricultural and natural areas being threatened by land use changes;
- ☐ Protect ground and surface water quantity and quality being threatened and degraded by contamination;
- ☐ Protect the region's biodiversity; and
- ☐ Improve the coastal zone resource conditions.

## What Is Being Done?

The partnership has developed and is now implementing a pilot project to identify and address regional needs at the local municipal level. The pilot area consists of those towns along the Quinebaug River from Norwich through Killingly. They are: Norwich, Preston, Lisbon, Griswold, Canterbury, Plainfield, Killingly, and Brooklyn. Initiative objectives for the pilot area include:

- ☐ Inventory municipal rules and regulations;
- ☐ Conduct a streamwalk;
- ☐ Develop a Geographic Information System (GIS) resource atlas;
- ☐ Develop a nature-based tourism strategy; and
- ☐ Conduct a regional information and education outreach effort.

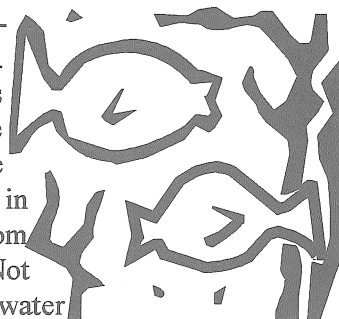
## Who Can I Contact For More Information?

- ☐ New London County District - (860) 887-3604
- ☐ Windham County District - (860) 774-8397
- ☐ Tolland County District - (860) 875-3881

## Recommended Grass Seeding Mixtures for Riparian Buffers

Recommended Use	Common Name	Variety	Seeding Rate (lb. - pure live seed / acre)
Wildlife habitat	Switchgrass	Shelter	2.0
	Big bluestem	Niagara	3.0
	Eastern gamagrass	Pete	1.0
	Indiangrass	Rumsey or NE-54	1.0
	Little bluestem	Aldous or Camper	2.0
	sideoats grama	El Reno or Trailway	1.0
		Total	10.0
Wildlife habitat	switchgrass	Shelter	8.0
	deertongue	Tioga	2.0
	white clover	common	1.0
		Total	11.0
Cover for aisles between trees	red fescue	Ensylv	30.0
	perennial ryegrass	turf type	5.0
		Total	35.0
Erosion Control	birdsfoot treefoil or	Empire	3.0
	white clover	common	
	orchardgrass	Pennlate	6.0
	timothy	Climax	5.0
	perennial ryegrass	turf type	1.0
		Total	15.0

Streamside vegetation also improves or maintains fish habitat. Fish cannot live in water that is too hot or too cold. The shade provided by vegetation near the water's edge keeps water cool in summer, and can prevent it from getting too cold in the winter. Not only does vegetation regulate water



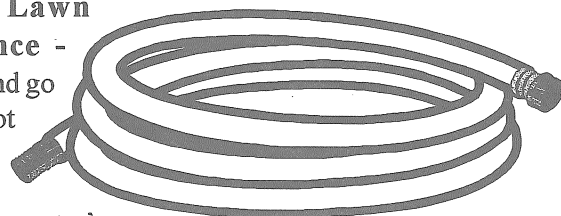
temperature, but plants that fall or hang in the water offer hiding places and breeding areas for fish. Plant leaves provide feeding surfaces for the many insects such as mayflies, caddisflies, and stoneflies which breed in the water; these, in turn, are a major source of food for fish and other animals.

**Water Quality Protection** - Perhaps the greatest threat to water quality comes from pollutants entering water from no particular points of origin. These "non-point source" pollutants include: road salt and sand; fertilizers and pesticides applied to lawns, crop fields, and recreational areas; and manure.

Buffer strips are an effective way to decrease pollutants entering our streams, lakes, and ponds. Plants naturally filter these pollutants by trapping and absorbing them before they enter the water.

### Decrease Lawn Maintenance -

Let it grow and go natural! By not mowing or fertilizing the



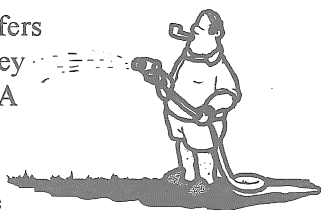
grass near the water's

edge, you will save time, money, and will add color and variety to your yard. In addition, the taller vegetation can screen undesirable views or highlight attractive ones. Many grasses will grow 12 to 14 inches before going to seed.

### Where Do We Use Vegetated Buffer Strips?

Simply put, buffer strips should be placed between people and water. When we develop property, it often results in removing vegetation from the site and replacing it with impervious or compacted areas such as roads, parking lots, and roofs. These impervious and compacted areas cause more rain to run off and less to soak into the ground. As a result, more water reaches streams faster after a rain storm. When the vegetation is removed so are the beneficial functions that the plants and soil perform.

By placing or maintaining buffers downhill from developed areas, they can intercept stormwater runoff. A vegetated buffer can help filter out any pollutants which might have been carried by runoff from those areas before they have a chance to enter a stream, lake, or pond.



## Why Would I Want a Buffer?

Many people consider a well-manicured lawn the only option for landscaping their property. In addition to the many benefits already listed, other positive features of vegetated buffers include: decreasing wind, noise, and odors; increasing your privacy and enhancing the beauty of your property; reducing the risk of plant disease by having a variety of plants; and creating a place for you to enjoy nature, shade, and solitude.

## Creating Buffer Strips

Wondering how to get started? Take a look around your yard to see what natural and/or existing features you can use. You will want to leave depressions and irregularities in your lawn to help slow down water from rain storms. Keep as many trees and shrubs growing as you can, especially on steep slopes. Minimize the amount of bare areas in your yard and stabilize your heavy traffic areas with mulch or other erosion control materials. Last, but not least, do not mow the grass near the water's edge.

**Sizing a Buffer Strip** - How big is big enough? A buffer strip size can be anywhere from a small, unmowed area of a yard to a large forested strip. Buffer width will depend on the desired emphasis (water quality, wildlife habitat, etc.), available land, and the landowner's desired use of the property. Generally, the effectiveness of a buffer increases with its size. Large buffer strips -- 100 feet or greater in width -- provide the best protection for water quality by improving sediment and pollution control, and provide the same benefits to a stream, lake, or pond, but to a lesser extent.

**Planning a Backyard Buffer** - Your yard is unique. Before starting your buffer planting be sure to plan adequately for a successful and properly functioning buffer strip. It is important to select plants that meet the landuse and aesthetic requirements of the site. Consider the following:

⇒ **Soils:** Know the soils on your site. Some plants require more moisture than others. These plants will do best in wet or low spots, or at the water's edge. Plants adapted to

**Buffer Width Guide for Selected Wildlife Species** - The following widths include the sum of buffer widths on one or both sides of water courses or water bodies, and may extend beyond riparian boundaries.

Species	Desired Width or Range in Feet
Wildlife dependent on wetlands and watercourses	30 to 600
Bald eagle, cavity nesting ducks, heron, rookery	600
Pileated woodpecker	450
Beaver, dabbling ducks, mink	300
Deer	200
Lesser scaup	170
Frog, salamander	100 to 200+
• Song Birds	40 to 660
Cardinal	40
Blue jay, Black capped chickadee, Downy woodpecker	50
Brown thrasher, Hairy woodpecker, Red-eyed vireo	130
Red-bellied woodpecker, Warbling vireo	300
Scarlet Tanager, American Redstart, Rufous-sided towhee	660
• Cold Water Fisheries	100 to 300

## Maintaining Your Buffer

Buffer strips are low maintenance -- not *no* maintenance. Occasionally, plants may need to be replaced or trimmed, mulch may need to be replaced, or paths may need to be redefined. Plan an annual inspection to conduct any maintenance that may be needed.

Common Name	Scientific Name	Growth Habit**	pH Range	Season	Tolerance to Wet Soils	Tolerance to Shade	Tolerance to Dry Soils	Tolerance to Flooding
Bluegrass, Kentucky	<i>Poa pratensis</i>	PIR	5.5 - 7.0	Cool	Medium	Low	Medium	Medium
Bluestem, big	<i>Andropogon gerardi</i>	PIB	5.0 - 7.5	Warm	Low	Low	High	Low
Bluestem, caucasian	<i>Botriochloa caucasica</i>	PIB	4.5 - 7.5	Warm	Low	Low	High	Low
Bluestem, little	<i>Schizachyrium scoparium</i>	PIB	5.5 - 7.5	Warm	Low	Low	High	Low
Brome grass, smooth	<i>Bromus inermis</i>	PIR	5.5 - 8.0	Cool	Medium	Low	Medium	Medium
Deertongue	<i>Panicum clandestinum</i>	PIR	3.8 - 5.0	Warm	High	Low	High	Low
Fescue, creeping red	<i>Festuca rubra</i>	PIR	4.5 - 9.5	Cool	Medium	High	Medium	Medium
Lovegrass, sand	<i>Eragrostis trichodes</i>	PIB	4.5 - 8.0	Warm	Low	Low	High	Low

drier conditions will grow better in upland areas. Soils vary in the amount of water they can hold and their fertility. By finding out what soils are present you can choose plants that are best suited for your site. (You can contact the UConn Cooperative Extension System to find out how to get your soil tested for pH and fertility. To identify the general soil types on your property, contact any of the organizations listed on the back of this brochure).

- ⇒ **Sun:** Some plants grow best in the sun while others need shade. On a sunny day, watch where your yard gets sun or shade to determine the best places for each type of plant.
- ⇒ **Views:** What do you like to look at and what would you rather screen from view? Place plants of different heights to enhance good views (such as water), and to screen undesirable views (such as buildings and parking areas). Also, consider the aesthetics of the plants such as flowers, fruits, and seasonal foliage when deciding plant placement. A variety of plant species will offer a diverse and interesting buffer area.
- ⇒ **Activities:** It is important that the buffer plantings be compatible with other uses of your property. Ornamental plantings may be best for sitting areas, taller plantings for screening and shade, and hardy plants for heavy traffic areas. Leave enough open area for lawn games and other activities, as well as a good way to walk to the water.

**What to Plant in Your Buffer** - The following tables contain several native Connecticut plant species that would make excellent buffer plantings.

**Planting Densities for Shrubs and Trees** - Initial plant-to-plant densities for trees and shrubs will depend on their potential height at 20 years of age. Heights may be estimated based on performance of individual species (or comparable species) in nearby areas on similar sites, or from the following table:

Plant Types/Height	Plants Per Acre	Plant-to-Plant Spacing (feet)
• Shrubs less than 10 feet in height	4,500 to 1,200	3 to 6
• Shrubs and trees from 10 to 25 feet in height	1,500 to 450	5 to 15
• Trees greater than 25 feet in height	1,200 to 200	15 to 25

Common Name	Scientific Name	Mature Height (ft.)	Tolerance to Wet Soils	Tolerance to Shade	Tolerance to Dry Soils	Tolerance to Flooding	Aesthetics	Wildlife Habitat	Remarks
Coniferous Trees for Riparian Forest Buffers									
Eastern Redcedar	<i>Juniperus virginiana</i>	20 to 50	H	H	H	H	M	H	Slow growing, Grayish-blue fruit
Tamarack	<i>Larix laricina</i>	49 to 82	M	L	L	M	H	L	Deciduous, loses needles in the Fall
White Spruce	<i>Picea glauca</i>	60 to 70	M	M	H	M	M	H	Often used for Chrismass trees
Black Spruce	<i>Picea mariana</i>	16 to 60	H	M	M	H	M	L	Not suited for coastal areas
White Pine	<i>Pinus strobus</i>	60 to 100	M	H	M	L	H	M	Largest conifer of the eastern forest Arborvitae, Weak wood easily damaged by snow, wind, or ice Needles make soil acidic, killed by woolly adelgid
Northern White Cedar	<i>Thuja occidentalis</i>	50 to 65	M	M	M	M	H	M	
Eastern Hemlock	<i>Tsuga canadensis</i>	65 to 82	L	H	H	L	H	H	
Hardwood Trees for Riparian Forest Buffers									
Red Maple	<i>Acer rubrum</i>	50 to 70	H	M	H	H	H	M	Red flower in early spring, Bright red foliage, Fast growing
Silver Maple	<i>Acer saccharinum</i>	60 to 80	H	L	L	M	M	M	Reddish-brown flower, Yellow foliage, Weak wood
Alder	<i>Alnus rugosa</i>	50 to 70	H	H	M	H	M	M	Often grows in shrubby form, Forms dense thickets
River Birch	<i>Betula nigra</i>	49 to 82	H	M	M	H	H	L	Yellow foliage, Exfoliating bark
Gray Birch	<i>Betula populifolia</i>	33	M	L	M	L	L	L	
White Ash	<i>Fraxinus americana</i>	75 to 100	H	L	M	H	H	H	Fast growing, most common native ash
Green Ash	<i>Fraxinus pennsylvanica</i>	30 to 50	H	L	H	H	L	H	Strong wood, Yellow foliage
American Sycamore	<i>Platanus occidentalis</i>	110 to 120	H	L	H	H	M	L	Fast growing, Large tree, Bark forms scaled pattern, Ball like fruit
Cottonwood	<i>Populus deltoides</i>	80 to 100	H	L	M	H	H	M	Fast growing, Weak wood
Swamp White Oak	<i>Quercus bicolor</i>	60 to 70	H	M	L	H	L	H	Fast growing, Strong wood, Large acorn production
Pin Oak	<i>Quercus palustris</i>	40 to 80	M	M	H	H	M	H	Fast growing, Strong wood, Large acorn production, Scarlet foliage
Black Willow	<i>Salix nigra</i>	30-60	H	L	L	M	H	L	Short lived, fast growing
Bass Wood	<i>Tilia americana</i>	65 to 82	M	H	L	M	M	M	
Shrubs for Riparian Forest Buffers									
Shadbush	<i>Amelanchier canadensis</i>	20 to 30	H	M	H	H	H	H	White flowers, Yellow to red foliage, Purplish-blue fruit
Alternate-leaf Dogwood	<i>Cornus Alternifolia</i>	30	H	M	M	M	M	H	
Silky Dogwood	<i>Cornus amomum</i>	7 to 10	H	L	M	H	M	H	White or yellow flower, Good for streambank stabilization
Dogwood	<i>Cornus stolonifera</i>	4 to 9	H	L	L	H	M	M	Good for streambank stabilization
Winterberry	<i>Ilex verticillata</i>	10	H	M	M	H	H	H	Greenish-white flower, Red berry stays on shrub through winter
Bankers Dwarf Willow	<i>Salix cotteti</i>	6	H	M	M	H	L	L	Good for streambank stabilization
Pussy Willow	<i>Salix bicolor</i>	26	H	M	M	H	H	L	
Streamco	<i>Salix purpurea</i>	10 to 18	H	H	L	H	L	M	Good for streambank stabilization
Purpleosier	<i>Salix purpurea</i>	10 to 18	H	H	L	H	L	M	
Elderberry	<i>Sambucus canadensis</i>	12	H	L	M	M	M	H	White or Yellowish-white flower, Black-blue fruit
Nannyberry	<i>Viburnum lentago</i>	33	M	M	M	M	H	H	
			L = Low, M = Medium, H = High						



# TIPS

Many types of pollution are easy to picture, but there is one type that is all around us that most of us do not see. Its source is difficult to pinpoint, for it is the collective result of hundreds of little things we do everyday without thinking—driving our cars, fertilizing our yards and farmland, sanding our roads, disposing of our waste, building on our lands. Some call it "quality of life pollution," but officially, it is known as

Nonpoint source pollution occurs when water runs across the land and picks up pollutants and deposits them in our surface water and groundwater. It originates over a large area, but through natural hydrologic processes quickly accumulates in our water. Over the past 25 years we had great success in controlling "point-source" pollution from industry and sewage treatment plants. Nonpoint source pollution has now become the nation's leading source of water quality degradation.

Our goal with this brochure is to give you a quick introduction to how our everyday activities impact water quality. We provide eight tips, which you can use at home, that will lead to cleaner water.

## ANER WATER

This brochure was designed to supplement the traveling exhibit, *Trickle Down: Exploring the Relationship Between Land, People and Water Quality*. For more information call 860-424-3332. Both

were produced through a cooperative effort between the Connecticut State Museum of Natural History, at the University of Connecticut and the Connecticut Department of Environmental Protection. This project is funded in part by the CT DEP through a US EPA Nonpoint Source Grant under Section 319 of the Clean Water Act.

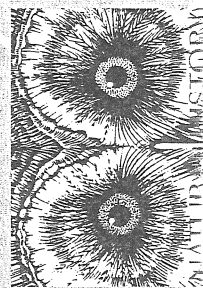


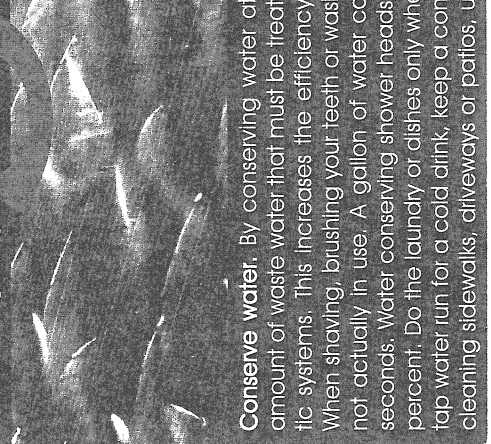
Figure 5.



**Place trash in covered containers.** Litter is more than an eyesore. When trash ends up on the ground, rain water transports it through storm drains into our surface water. Floatable debris can be a serious source of injury for wildlife, clog water intakes on boats and at industrial sites and, in extreme cases, as with medical waste, can even cause beaches to be closed. Don't litter. When transporting trash, make sure containers and truck beds are securely covered. Reduce the amount of trash you produce by reusing and recycling.



**Clean up after your pets.** Pet wastes left on pavement will be carried through storm drains directly to surface waters. These wastes contain bacteria and viruses that can contaminate shellfish beds and close bathing areas. Pet owners should pick up after their pets and dispose of the waste in the garbage or toilet.

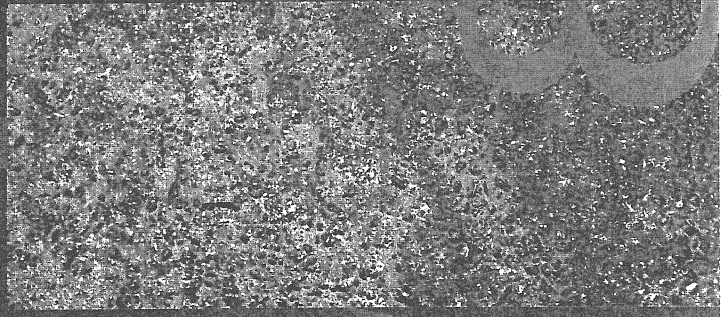


**Conserve water.** By conserving water at home and at work, you reduce the amount of waste water that must be treated by sewage treatment plants or septic systems. This increases the efficiency of treatment and saves you money. When shaving, brushing your teeth or washing dishes, turn off the water when it is not actually in use. A gallon of water can flow from your tap in less than sixty seconds. Water conserving shower heads can reduce water consumption by 25 percent. Do the laundry or dishes only when the machine is full. Instead of letting tap water run for a cold drink, keep a container of water in the refrigerator. When cleaning sidewalks, driveways or patios, use a broom instead of a hose.



**Prevent soil erosion.** Rainwater flowing off your property picks up and carries soil, debris and contaminants to nearby surface waters. Plant ground cover, trees and shrubs over bare patches or on particularly steep grades on your property. When landscaping, rather than using impermeable paved surfaces, choose permeable surfaces such as bricks, stone or wood decks to allow maximum absorption of water into the soil. Divert rain from paved surfaces onto grassy surfaces to encourage absorption. Don't select plants that need a lot of watering, which encourages runoff.

**Limit your use of pesticides and fertilizers.** Tailor garden treatments to the special needs of your soil and vegetation. Test your soil, use low maintenance grasses, and apply fertilizer sparingly when the soil is moist and there is little likelihood of immediate rain. Avoid getting pesticides and fertilizers on sidewalks and driveways, where they can wash into storm drains. Do not overwater your lawn. One inch of watering per week is fine. To make sure this, place a coffee can in the area being watered and monitor the accumulation.



**Perform regular vehicle maintenance.** Motor vehicle fluids can be toxic to humans and wildlife. Regular maintenance prevents leaks of toxic substances that regularly enter our waterways. During maintenance, never dispose of vehicle fluids onto the land or into storm drains or waterways. Recycle motor oil and antifreeze. Use a drip pan beneath the vehicle while performing service.



**Choose household cleaners thoughtfully.** Many household products contain hazardous substances that, when improperly disposed of, enter our water. Read product labels—know what you are buying, how to use it and what the potential hazards are. Use the least toxic product available and buy only what you need. Try to use up products completely, if you can't, give the remainder to someone who can. Never dump excess products on the ground or down household or storm drains. Set aside unused chemicals, batteries, paints, aerosol cans, etc. for Household Hazardous Waste Collection Days.



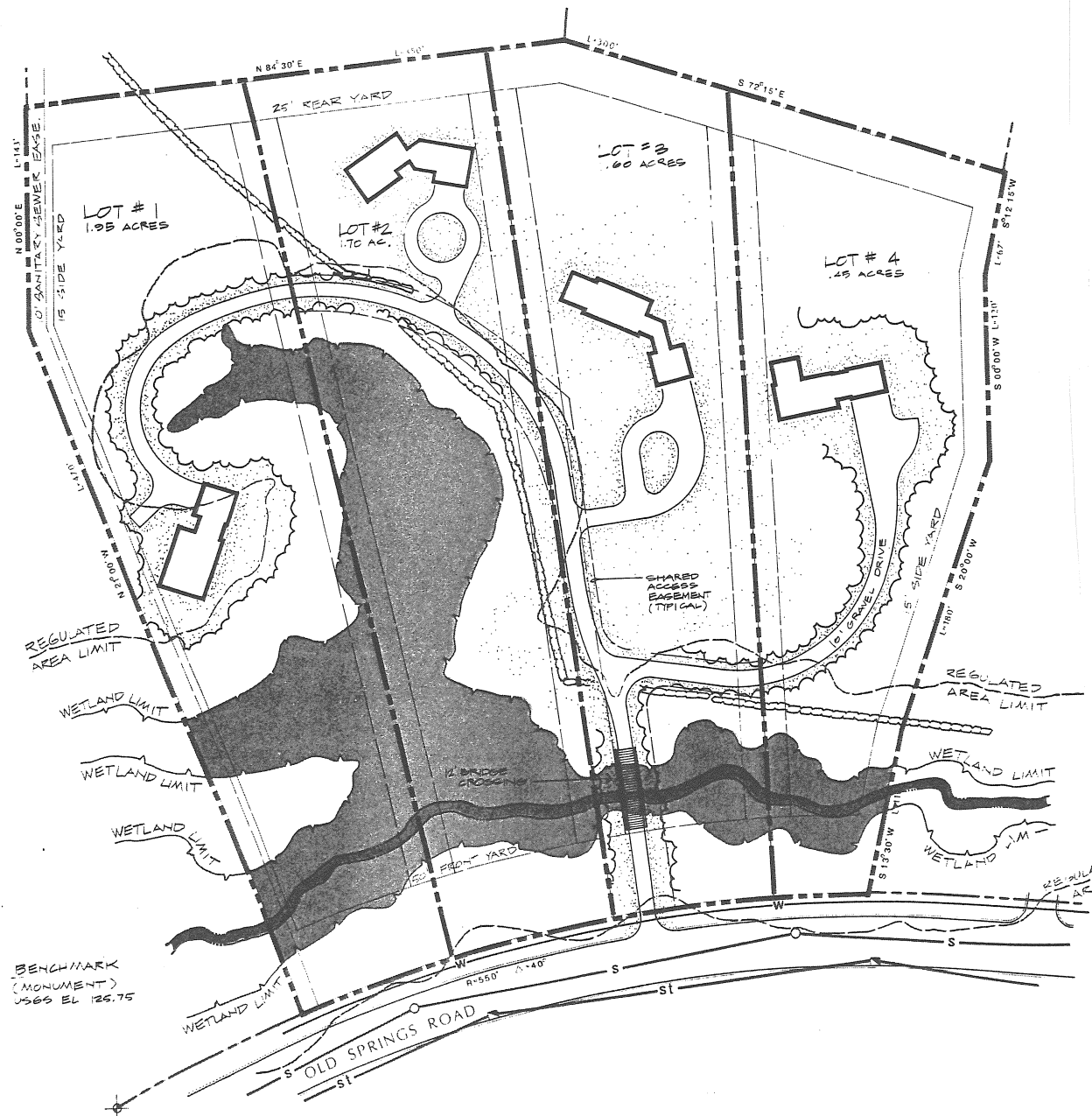
**Have your septic system inspected annually.** Have it pumped out every 3 to 5 years to remove solids and insure it is operating properly. When septic systems function properly they contribute excess nutrients to local waters, robbing them of oxygen. Do not allow solvents or toxic chemicals into your septic tank. Do not put grease or oil down the drain or use your toilet as a garbage can. Septic systems are not designed for these kinds of waste and it will cause them to operate improperly and pollute ground and surface water. Proper use and maintenance is much less expensive than replacement of a failed septic system.

Figure 6.

Let's look again at our hypothetical four-lot subdivision and explore possible alternative solutions:

### Alternative #1

In this alternative, a 12-foot bridge replaces the four initially proposed crossings, thereby minimizing filling and reconfiguration of the watercourse by eliminating culverts. The single crossing is less likely to contribute to flooding, and will also reduce siltation and turbidity during construction. This alternative also eliminates the wetland filling — and related loss of wetland plants and soils — that was proposed as part of the driveway construction on lot #1. This alternative requires a shared access easement; the original number and size of lots do not change.



4

# Comparing Alternatives

This alternative preserves the single crossing concept by proposing a private road (thus creating the benefits discussed in Alternative #1), but reduces the size of the lots and moves the buildings away from the wetland system. The wetlands and adjacent uplands can now be preserved as common open space, adding aesthetic and recreational value to the development. This open space will also provide valuable wildlife habitat.



# *Soil and Water Conservation District Review*

## General Conditions and Landscape Overview

*(Please refer to accompanying map and aerial photograph, Figures 8. and 9.)*

The parcel of land under consideration here is a hillside of west-southwest aspect flanking Cory Brook. It is primarily glacial till upland with a relatively small (approximately 12 acres) sub-parcel of glacial outwash at its foot (essentially the open fields). Below this outwash terrace is the floodplain of Cory Brook.

Surrounding the parcel is a landscape mosaic of rural residences amid active and abandoned agricultural fields and patches of land in various early- to mid-successional stages reverting to forest.

Bisecting the northern portion of the piece is a semi-intermittent watercourse running southwest that drains an approximately 20-acre wooded swamp situated just outside the northern boundary. Although not part of the review, this wetland is a significant feature and is at the head of the local watershed that includes most of the review area; it has a counterpart to its immediate north on the opposite side of an irregular topographic saddle.

The other aquatic features under consideration here, aside from those along Cory Brook, are isolated wetlands arising from the heads of several smaller ephemeral watercourses draining the hillside. They are of particular emphasis in this review.

## Select Features Overview

There is a constellation of four ephemeral headwater wetland systems and their drainages addressed in this report. Though they are ecological siblings, each hosts



a unique physiography and vegetative complement as noted in the more detailed descriptions below. At least one features fairly heavy colonization by sweet pepperbush, *Clethra alnifolia*, on its outskirts with a more diverse mix of vegetation in the interior. All four function as isolated, ephemeral woodland pools—vernal pools. Two in particular are especially noteworthy: WETHEAD D/POOL D and POOL A 1. These two are exemplary woodland pools and very likely host a significant complement of vernal pool indicator organisms in springtime, potentially including wood frogs, *Rana sylvatica*; spotted salamanders, *Ambystoma maculatum*; marbled salamanders, *Ambystoma opacum*; and a suite of invertebrates, including the vernal pool fairy shrimp, *Eubbranchipus vernalis*\*

On the accompanying map and aerial photograph, these headwater wetlands are designated as 'WETHEAD.' Since there are four of note, they are labeled WETHEAD A, WETHEAD B, WETHEAD C, and WETHEAD D. Down slope from their heads, they all feature at least one fairly well-defined pool in one configuration or another; they are isolated in that their ephemeral outlets are subsurface to varying degrees. One - WETHEAD A - feeds a downstream pool - POOL A -that is perhaps best described as a classic or 'textbook' vernal pool.

Another pool, at least as noteworthy as POOL A1 but with a different physiography, is POOL D, beginning at WETHEAD D.

### The Constellation of Headwater Wetlands and their Associated Pools

#### WETHEAD A

This feature is in a topographic pocket that opens and drains generally to the south near its head. Farther down slope, the highly ephemeral, largely subsurface drainage turns more to the southwest before it outlets into the bottomland wetland along Cory Brook.

WETHEAD A and its immediate upland environs are vegetated with, among others, the following plants:

White ash, <i>Fraxinus americana</i>	Winterberry, <i>Ilex verticillata</i>
Maple leaf viburnum, <i>Viburnum acerifolium</i>	Hazelnut, probably beaked, <i>Corylus cornuta</i>
Witch-hazel, <i>Hamamelis virginiana</i>	Christmas fern, <i>Polystichum acrostichoides</i>
Tupelo, <i>Nyssa sylvatica</i>	Red oak, <i>Quercus rubra</i>
Spicebush, <i>Lindera benzoin</i>	Greenbrier, <i>Smilax</i> spp.
Highbush blueberry, <i>Vaccinium corymbosum</i>	Sweet pepperbush, <i>Clethra alnifolia</i>
Shagbark hickory, <i>Carya ovata</i>	Woodfern, <i>Dryopteris</i> spp.
Sphagnum moss, <i>Sphagnum</i> spp.	Royal fern, <i>Osmunda regalis</i>
Tussock sedge, <i>Carex stricta</i>	Black birch, <i>Betula lenta</i>
Ground cedar, <i>Lycopodium complanatum</i>	

### Pool A1

Pool A1 is of particular note in this review. As mentioned above, it is perhaps best described as a classic or exemplary *vernal pool* even though that term can be problematic. Since there are so many nuances in physiography, hydrology, and floral and faunal makeup with these landscape features (each is unique), pigeonholing them too often means that much is lost in the translation. (Even the best definition, one that might pass muster for regulatory purposes and suffice for some scientific purposes, is necessarily an oversimplification of ecological reality.) Various entities are grappling with the subject of labels and definitions for this class of resources and many questions and debates remain. But despite the semantics problems, to anyone familiar with what we've come to recognize as a vernal pool, Pools A1 and D especially - in this review likely fit any working definition, even if direct observation of major macro-scale pool indicator organisms is not possible on this the flip side, so to speak, of their

breeding season (the marbled salamander notwithstanding; please see comments on this species in the endnote\*).

### Pool A1's Characteristics

#### **Vertical Extent**

Obviously rainfall amounts and distributions are different every year, but over longer periods averages are observable. Complicating things is the fact that superimposed on the pattern or patterns that result in what we consider average for a specified period are dynamics - whatever their causes - at other time scales that have shifted, and will shift, conditions in one direction or another.

Nevertheless, water levels in ephemeral pools leave their signatures at the bases of trees growing from the pool bed. These are evident in the moss lines, lichen lines, and bark watermarks on the bases of tree stems. From these, an average pool depth can be estimated even when the pool bed's surface is dry as it was during this field review.

Based on these parameters, the average water depth (temporally) during the major part of the flooded season for this pool appears to be approximately 17 inches in the deepest part of the pool .

Although the pool has a fairly broad inlet coming generally from the north-northeast and an outlet exiting to the south-southwest along a drainage swale originating from WETHEAD A, these are largely subsurface relative to the longer-standing surface water (in the wet season) of the pool proper. In this way, the pool is quite markedly isolated.

### Horizontal Extent

As noted, the pool exhibits an inlet and outlet that appear to be largely subsurface and as such yield a fairly well defined margin all around the pool but especially along the axis perpendicular to the inlet and outlet. The pool is irregularly oval in shape with something of a lobe on the north end. The longer axis is oriented generally north-south and is some ~125 feet in extent (including the aforementioned lobe). The east-west axis through the approximate center is some ~85 feet in extent.

The pool's surface area is very roughly 1/7 acre.

### Vegetation

Two tree species that tend to be associated with ephemeral woodland pools like these are represented here. They are: pin oak, *Quercus palustris*; and tupelo, *Nyssa sylvatica*. Swamp white oak, *Q. bicolor*, is also present here. There is a prominent ~24" dbh (diameter at breast height-4 1/2 ft.) pin oak in the southwest quadrant of the pool, a ~12-13" dbh swamp white oak several feet to the east-northeast of the large pin oak, and a ~20" dbh swamp white oak more or less centered toward the pool's south end. (This is not intended as an exhaustive inventory but merely an account of salient 'landmarks' in the pool.)

The pool has conspicuous areas of un-vegetated, watermarked substrate (leaf litter at the surface). Shrubs and vines present at the pool include northern wild raisin, *Viburnum cassinoides*, juneberry, *Amelanchier* spp., greenbriers, *Smilax* spp., highbush blueberry, *Vaccinium corymbosum*; and sweet pepperbush, *Clethra alnifolia*. Just at the south edge of the northeast quadrant of the pool, in the pool bed, are two small clumps of tussock sedge, *Carex stricta*.



### Probable Amphibians\*

A hallmark of pools such as these is their use by a suite of amphibians that live in forested uplands, often far from the pool, except for brief but critical breeding periods during which they migrate to and rely heavily upon these ephemeral wetlands. Chief among these are: the spotted salamander, *Ambystoma maculatum*; the marbled salamander, *Ambystoma opacum*; and the wood frog *Rana sylvatica*. Also sometimes represented are the blue spotted salamander, *Ambystoma laterale*; and the red spotted newt, *Notophthalmus viridescens* among others.

### Probable Invertebrates\*

A fairly diverse ensemble of invertebrates is associated with vernal pools. One that has come to be considered a quintessential vernal pool indicator organism, the fairy shrimp, *Eubbranchipus vernalis*, most likely inhabits this pool. Observations in the spring when the pool can be expected to be filled may confirm or deny these expectations.

### Pool Environs

Pool A1 's immediate upland areas include the following:

#### To the east-southeast

The landscape here is fairly level. There is white oak, *Quercus alba*, red maple, *Acer rubrum*, black birch, *Betula lenta*, small tupelo trees, *Nyssa sylvatica*, and shagbark hickory, *Carya ovata*, among others. The shrub layer includes sweet pepperbush *Clethra alnifolia*.

### To the west-northwest

The landscape here is fairly level as well. There is scarlet oak, *Quercus coccinea*, tupelo, *Nyssa sylvatica*, black birch, *Betula lenta*, white oak, *Quercus alba*, pignut hickory, *Carya glabra*, red maple, *Acer rubrum*, and sassafras, *Sassafras albidum*. The shrub and herbaceous vegetation include sweet pepperbush, *Clethra alnifolia*, highbush blueberry, *Vaccinium corymbosum*, mapleleaf viburnum, *Viburnum acerifolium*, tree clubmoss, *Lycopodium obscurum*, and wild sarsaparilla, *Aralia nudicaulis*.

Slightly farther upland in this general direction is an open shrub and herb layer with some hazelnut, *Corylus* spp., oak reproduction, *Quercus* spp. hayscented fern, *Dennstaedtia punctilobula*, and oak sedge, *Carex pensylvanica*, under a canopy of black birch, *Betula lenta*, white oak, *Quercus alba*, and red maple, *Acer rubrum*.

### **WETHEAD B/POOL B**

This pool has been partly deforested recently. Residual vegetation includes:

Sweet pepperbush, *Clethra alnifolia*  
 Highbush blueberry, *Vaccinium corymbosum*  
 Sphagnum moss, *Sphagnum* spp.  
 Beech, *Fagus grandifolia*, at margins  
 Red maple, *Acer rubrum*  
 Tussock sedge, *Carex stricta*

Tupelo, *Nyssa sylvatica*, (a large proportion of the basal area here is tupelo)  
 Swamp white oak, *Quercus bicolor*  
 Greenbrier, *Smilax* spp.  
 Yellow birch, *Betula allegheniensis*  
 Pin oak, *Quercus palustris*

The entries under **Probable Amphibians and Probable Invertebrates** for POOL A1 apply to this pool as well.

#### WETHEAD C/POOL C

Fairly dense thickets of sweet pepperbush, *Clethra alnifolia*, at the upland interface surround a pool that is more diverse in its interior, with vegetation that includes:

Tussock sedge, *Carex stricta*

Sweet pepperbush, *Clethra alnifolia*

Sphagnum, *Sphagnum* spp., moss

hummocks

Yellow birch, *Betula allegheniensis*

Red maple, *Acer rubra*

Winterberry, *Ilex verticillata*

Tupelo, *Nyssa sylvatica*

Swamp white oak, *Quercus bicolor*

The entries under **Probable Amphibians and Probable Invertebrates** for POOL A1 apply to this pool as well.

#### WETHEAD D/POOL D

This is an elongate ephemeral pool with patches of well-defined, non-vegetated pool bed interspersed with hummocks at the bases of swamp white oak, *Quercus bicolor*, and other woody vegetation. The distal (southerly) end of the pool proper is demarcated by drainage that becomes essentially subsurface, almost to the exclusion of hydrophytic vegetation.

Vegetation here includes:

Heavy complement of swamp white oak, *Quercus bicolor*

Sweet pepperbush, *Clethra alnifolia* at bases of swamp white oaks

Highbush blueberry, *Vaccinium corymbosum*, hummocks

Large pin oak, *Quercus palustris*

The entries under **Probable Amphibians and Probable Invertebrates** for POOL A1 apply to this pool as well.

### Other Features

#### Old field

The old field (indicated on accompanying map and aerial photograph) is a patch of secondary successional vegetation very roughly an acre and a quarter in size. Its northern edge is fairly straight, running as it does along the dividing line between two tracts of forest showing differing silvicultural treatments.

This feature is noteworthy simply because it seems to host the who's who of native pioneer plants that colonize such a site in southern New England, unencumbered - *for the most part* - by non-native vegetation. This is based just on cursory observations from along and near the footpath bisecting this feature; closer inspection of other portions of this small patch may reveal other conditions.

Some species noted in the old field:

Eastern red cedar, *Juniperus virginiana*  
Ribbed sumac, *Rhus copallina*  
Quaking aspen, *Populus tremuloides*  
Dewberry, *Rubus* spp.

Goldenrod, *Solidago* spp.  
Poverty grass, *Aristida dichotoma*  
Hazelnut, *Corylus* spp.  
Black oak, *Quercus velutina*

### Vegetation Overall

It is notable that the review area overall appears to be remarkably free of introduced plants with the exception of some scattered Japanese barberry, *Berberis thunbergii*, and multiflora rose, *Rosa multiflora*, in the riparian area of Cory Brook, and some autumn olive, *Elaeagnus umbellata*, in the old field (and not counting probable orchard grass, *Dactylis glomerata*, and others in the lower fields). Again, this is not based on an exhaustive inventory but rather a cursory glimpse while viewing other features.

In the southwestern section of the parcel are some black oaks, *Quercus velutina*, that have reached a fairly impressive state of maturity, with forest-grown branching habits and not the sprawling lower limbs of more open grown 'wolftrees'; one in particular is of considerable stature. These trees undoubtedly supply a considerable amount of oak mast in good seed years, providing a wild staple for white-tailed deer, *Odocoileus virginianus*, wild turkeys, *Meleagris gallopavo*, and other mast-feeders.

### Drainage Context

The review area's drainage off this hillside (all but the easternmost edge) is in the local basin 371 5-00-2-R3 within the Cory Brook subregional basin. Cory Brook is in the Quinebaug regional basin of the Thames major basin. From the review area, Cory Brook's most distant headwaters are at a point just under three miles almost due magnetic north, near the intersection of Water Street and Route 14 in Canterbury.

### Benthic Macroinvertebrates

A cursory look at the benthic macroinvertebrate inhabitants in the small riffle sections of Cory Brook just downstream from the Lisbon Road crossing suggest

very good water quality here. Several taxa of aquatic insects having low tolerances of degraded water quality appear to be represented in fairly high numbers, including: roach like stoneflies (order Plecoptera) in the family Peltoperlidae; other stoneflies in the family Perlidae; and saddle casemaker caddisflies (Trichopterans) in the family Glossosomatidae (*Glossosoma* spp.).

### Select Wildlife Observations/Implications

In addition to those organisms who use the woodland pools and their uplands, there are others, including the wood turtle, *Clemmys insculpta*, who primarily inhabit watercourses like Cory Brook but who, from time to time and for reasons that are not completely understood, traverse overland considerable distances, relying on un-fragmented habitat along the way.

Just such a reptile - a female wood turtle perhaps fifty or more years old - was crossing Bennett Pond Road the day before the field review for this site. She was heading north-northeast and had evidently just negotiated the thicket and stone wall along the hill to the southwest of the road. Although the nearest boundary of the review area is a mile to the south-southwest, these distances are not unheard of for a wood turtle.

The point is that the relatively un-fragmented habitat represented by this parcel and others, including that between Lisbon road to the west and Route 169 to the east, and between Bennett Pond to the north and Gooseneck Hill Road to the south, provides species like the wood turtle and others with habitat that becomes more at a premium as development pressures increase.

The wood turtle is on Connecticut's listed species with the designation *Special Concern*.

Although a wildlife inventory would no doubt generate a long list, the following were in evidence by casual observation during the review: A juvenile eastern milk snake, *Lampropeltis t. triangulum*, was crawling amongst low vegetation in the riparian area of Cory Brook; a woodfrog, *Rana sylvatica*, occurred along the parcel's easternmost border; several red-bellied woodpeckers, *Melanerpes carolinus*, foraged among woodland snags at various locations through the parcel; wild turkeys, *Meleagris gallopavo*, were foraging in the lower section of the area labeled 'Black oaks' on the map and aerial photo; an orb-weaver spider, possibly *Araneus* spp., was in the vicinity of the 'central uplands'; and near POOL C, in a black birch, *Betula lenta*, there were cavities suggestive of the pileated woodpecker, *Dryocopus pileatus*. These species are not state listed but since encountered, their mention here might help to indicate something about present overall habitat conditions.

### Comments and Summary

Considering that inhabitants like the spotted salamander, the wood frog, and others rely on isolated woodland pools for their relatively brief but critical breeding period but actually *live* in the surrounding uplands (whether up-slope, down-slope, or otherwise) considerable distances from their breeding pools most of the time, the point is clear - uplands are an integral, functional part of wetlands on the landscape.

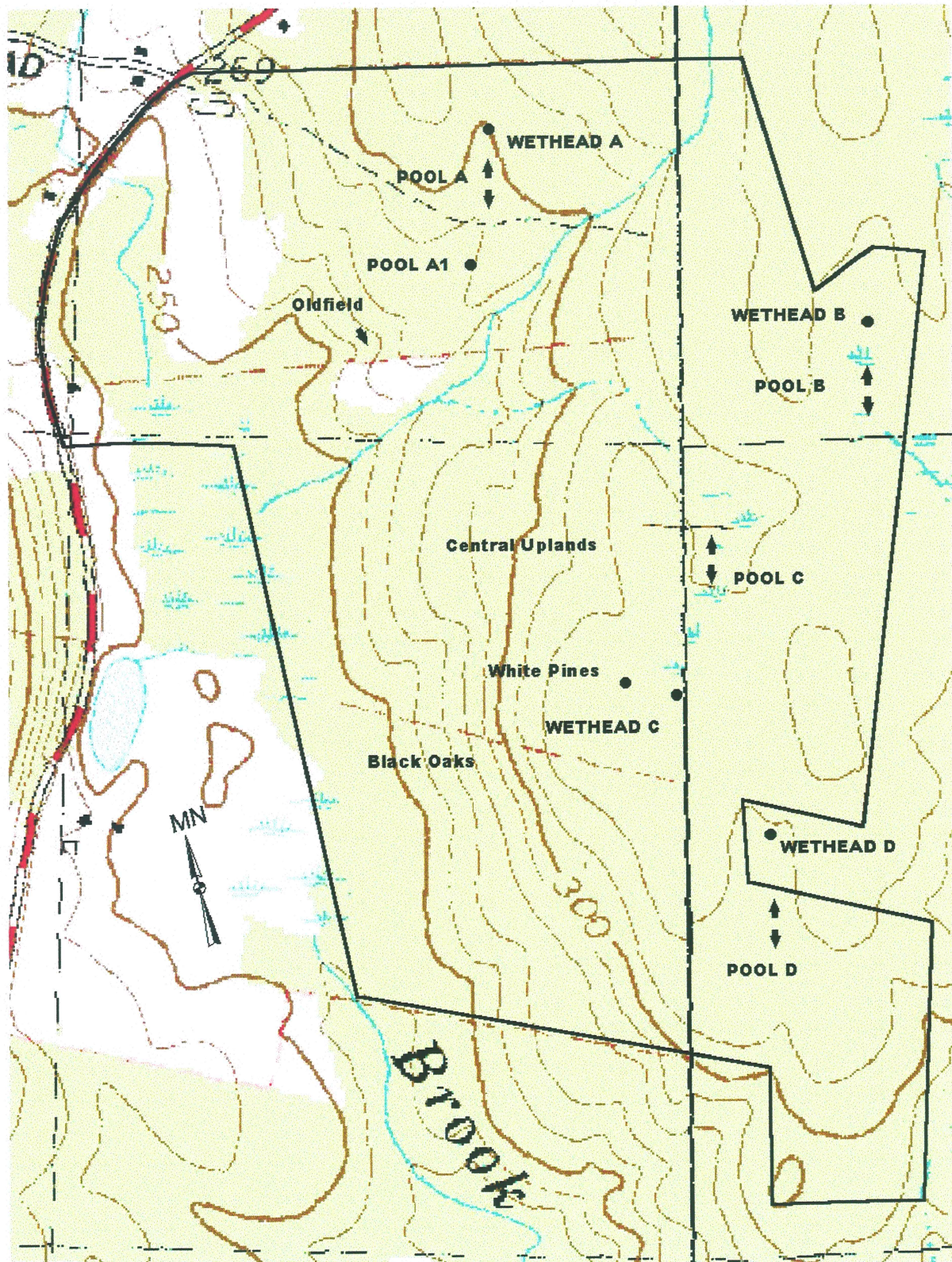
From the standpoint of development there is perhaps a hierarchy or spectrum of preference in how wetlands would be regarded, depending upon one's point of view. At one extreme would be to completely disregard them, filling them or otherwise disposing of them. Another increment would be to draw a line around the wetlands and 'save' or 'protect' them. A still more restrictive stance would be to delineate a buffer, say 50 feet or 100 feet or some other arbitrary number, in recognition that wetland protection cannot simply start and stop at an

upland/wetland line, however it is defined. There is a historical framework for the evolution of these increments.

The reality is that uplands and wetlands - in a diversity of ways on an individual, site-by-site basis - are integral parts of the same system, functioning together ecologically. In cases where there is a constellation of isolated woodland pools like those discussed in this review in juxtaposition to a bottomland watercourse like Cory Brook, the question of how to squeeze development in so that it *truly* minimizes impacts in a significant way is highly problematic. Direct obliteration of pools themselves is obviously inadvisable; on the other hand, leaving pools intact but usurping their uplands is akin to dismemberment and has a significant impact as well over the longer term, through attrition, morbidity, and mortality from the myriad landscape changes that accompany housing development, including such detriments as road and driveway crossings (in general, not just of wetlands), lawnmowers in the paths of migrating amphibians, contaminated runoff entering breeding pools, alteration of drainage patterns and thermal characteristics of water entering pools, deliberate or inadvertent alteration of pools themselves by homeowners, and the general loss of upland forest habitat.

**\*ENDNOTE:** Because the field review occurred during the dry phase for these pools direct observations of vertebrate pool indicator species was not generally achievable. One exception to this (aside from the one wood frog, *Rana sylvatica*, as noted) would have been the marbled salamander, *Ambystoma opacum*, since it enters the dry pools and lays its eggs there in the fall. Discovering these amphibians entails destructive searching and disturbance of the duff on pool substrates. This reviewer did not conduct more than a cursory search even though it might have been fruitful in revealing this species. Stereomicroscopic examination of pool substrate material may reveal various life stages of invertebrate indicators even if dormant.

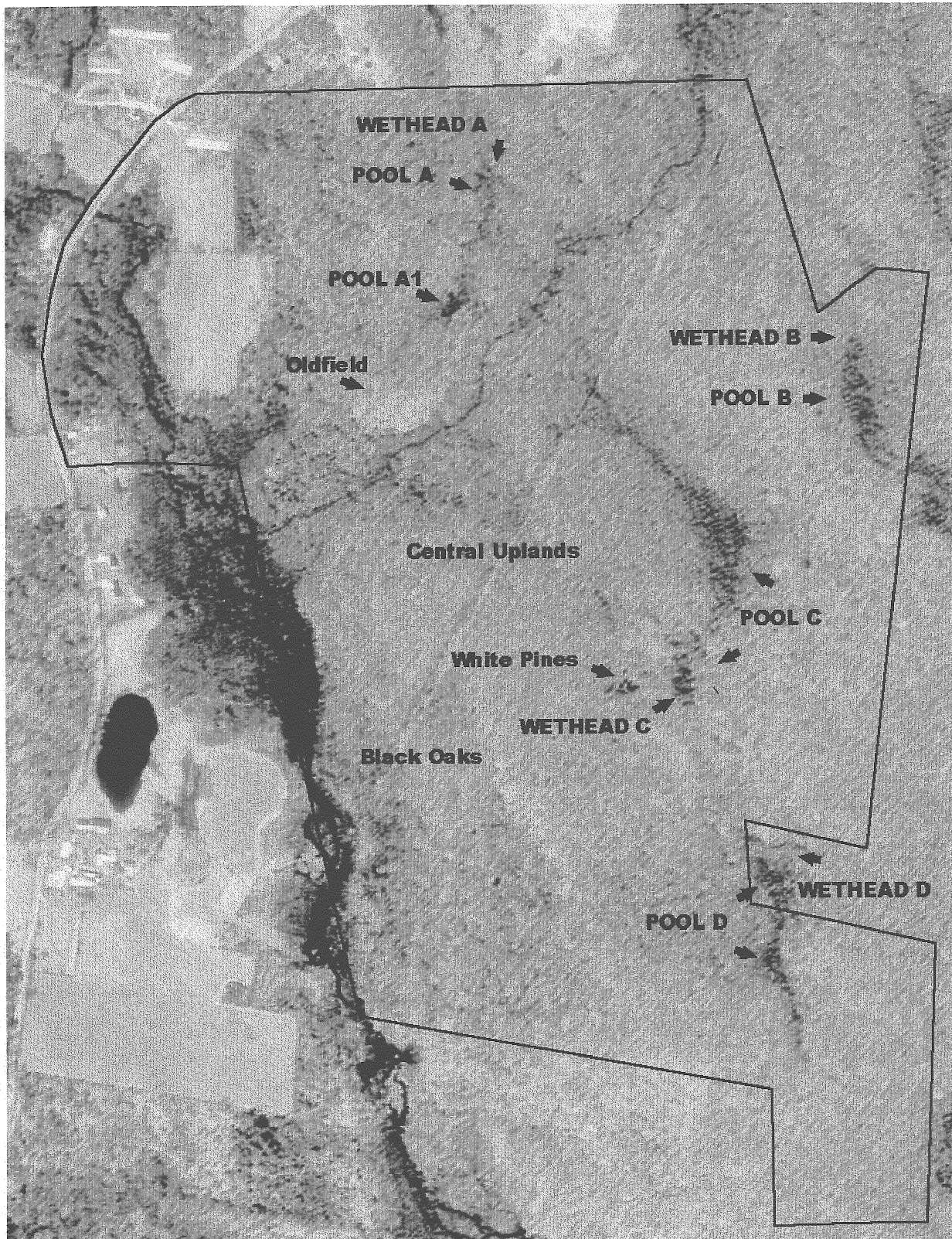




Map is for purposes of general illustration only and scale is undefined. Parcel boundary is an approximation.

Figure 8.





From 1991 Digital Ortho Photo Quarter Quad -- Source: Univ. of Conn. MAGIC. The scale is altered from its native 1:24,000 for this report. Parcel boundary is an approximation.

Figure 9.

## *Inland Wetland Review*

The proposed plan of development (the plan) as presented to the ERT team shows a +240 acre site with 86 house lots planned. The plan indicates 53.87 acres of mapped wetlands and proposes to fill 28,000 square feet of this total. The proposal includes wetlands mitigation of 55,000 square feet to compensate for the impacts. Because of the scope of this project the Town of Canterbury has requested ERT assistance on a wide variety of issues. Regarding wetlands, the two specific concerns are whether the wetland soils have been accurately mapped and what impacts the development will have on wetlands.

The plan shows a main road approximately one mile in length entering the subdivision from the north-northwest and ending in a cul-de-sac after traversing the parcel in a roughly south-to-southeast direction. One short cul-de-sac runs west off this main road and three run east. There is a small cul-de-sac roughly parallel to the main road running north off the middle cul-de-sac. These side roads total an additional mile of road surface. In all, there is no through road and the six road lengths encompassing about two miles of paved surface all terminate in cul-de-sacs.

In general, the parcel features higher ground on the east draining downhill across the site to Cory Brook on the west. As a result of this east-west drainage, the main north-south road system has three wetland crossings (the furthest south wetland has been proposed to be eliminated and mitigated). The two longest east running cul-de-sac roads each have one wetland crossing. The road crossings are discussed below along with other areas of concern regarding the wetlands, mapping, buffers and discharge.

### Road Crossings

The first (north) crossing at Frost District Road is proposed using twin 15 inch pipes. It was the feeling of the Team members after discussion at the crossing that the two pipes could easily dam due to leaf and twig (normal woodland floor) debris and a larger opening would keep the passage from clogging.

Both of the crossings along Frost District Road between Blue Jay Way and Abby Road intercept downhill drainage to Cory Brook. At both crossings the proposed piping adequately carries the surface flow but the concern at these locations is that road construction and the resulting soil compaction could alter the subsurface/groundwater flow. This could lead to upslope ponding with potential standing water problems as a result. In addition, the designed constriction at both of the piped crossings effectively pinch each of these wetlands into two separate wetland units, above and below the road.

Consideration for a new crossing design should be given to both of these areas to allow passage of both surface water *and* groundwater. This consideration should include the use of: 1) bottomless U-shaped culverts to maintain a natural stream bed, and/or 2) geo-textile fabric over existing natural stream bed to allow for structural stability, downhill infiltration and the separation of wetland soils and construction bedding.

Similar considerations should be given to the crossings on Abby Road and Penny Lane shown in the proposed plan as 36 inch and 24 inch buried pipes respectively (not withstanding the likelihood that the Penny Lane crossing is at or near a drainage divide).

Wetland crossing number five is at the proposed intersection of Penny Lane and Frost District Road. The plan calls for the elimination of this estimated quarter acre wetland area. (This wetland was overlooked as a mapped unit in the

original 1988 mapping). The Team wetland reviewer feels it would be reasonable to avoid this known wetland, accommodate its buffer, and rework the road intersection to an adjacent upland area.

### Wetlands Mapping

The wetland area at the road intersection by lots 51 and 66 (at the intersection mentioned above) was overlooked in the previous wetland mapping in 1988. This fact raised the possibility that other wetland areas may have been overlooked as well. The topography of the landscape and the presence of hydrophytes on and around the upper portion of lot 67 indicated the possibility of additional unmapped wetlands on the parcel. This area by lot 67, along with as much as 40% of the western tier of this parcel, is classified as Woodbridge soils. These soils are described in the Windham County Soil Survey as having inclusions of "... small areas of poorly drained Leicester and Ridgebury soils"; both are wetland soils. Woodbridge has other soil inclusions as well. In total these inclusions make up about 15% of the mapped soil unit offering the likelihood that other areas of wetland soils may well exist within this mapped soil unit.

That fact that these soils are damp and frequently feature a high groundwater table of about 20 inches is born out by the fact that nearly all of the septic systems on this soil type will need to be engineered (see plan pages S2, S3 and S4).

Based on the soil description, field observations and the oversight in the previous mapping, it is advised that the town seek new, complete soil mapping for the section of this parcel that was last mapped 12 years ago.

### **Buffers**

The wetlands delineated on this 242 acre proposal are accompanied by a 100 foot buffer line (alternately a solid or dashed and dot line on various pages). Buffers of this distance are commonly recognized as offering wetland protection from a variety of degradation sources. The sources include, though are not limited to, lawn pesticide and fertilizer runoff, automobile oil and gas residue, sediments from construction and road sanding, and various heavy metals.

Regarding the wetland buffers on this plan, a review of the 86 proposed house lots showed that 46 lots, or 54% of the total, had intrusions into the buffer zone. These intrusions included, completely or in part, 28 houses, 27 wells, 22 driveways, 25 septic systems, and 29 reserve septic areas. This total represents a tremendous amount of construction within these wetland buffer areas (a lot by lot review is attached, see Figure 10.).

Given the known and typical erosion and sediment control problems that occur pre- and post development and the broad understanding of buffer values in general, the town should make it the duty of the applicant to revise the plans with full respect to the 100 foot wetland buffer.

### **Phased Construction**

Due to the massive scale of this proposal it is recommended that a concisely phased and scheduled plan of construction complete with erosion and sediment control detail be presented. A plan that depicts the first section of road to be built and stabilized, followed by a house construction and lot stabilization schedule will help local officials should they decide upon the necessity of incremental field reviews during construction.

The impact of construction on this much acreage without a phased plan for stabilizing soils and slopes could easily yield severe erosion problems. The resulting sediment loading from erosion could degrade the surrounding lowlands on and off the site including the wetlands and watercourses.

### Discharge into Wetlands

On lots 34 and 81 of the proposed plans there is direct stormwater discharge into wetlands. On lots 55, 70, 78, and 85 the stormwater outlets from 20 to 60 feet above their respective wetlands. The matter of sediment trapping/detention prior to the entrance of the water into the wetland is of concern and must be specifically addressed in each case as well as a general plan or overview for the site. Some catch basins, but not all, indicate they will have filter fabric installed. It would be beneficial for the applicant to provide the town with the rationale for the choice and permanence of this sediment collection device vis-à-vis other methods (i.e.: sediment basins, less curbing with slightly higher crowned roads, the use of swales and natural grasses, etc.). A mandatory addition to this proposal should be that of a maintenance schedule for the cleaning and/or replacement of the filter fabrics and the name of the individuals or departments responsible for that maintenance.

### Other Points

- The plan as proposed calls for the alteration of 28,000 square feet of wetland. Since this total is in excess of 5,000 square feet but less than an acre, project review will be required by both the U.S. Army Corps of Engineers and the Inland Water Resources Division of the CT DEP.
- Well and septic placement is sometimes questionable and should be reconsidered. Specifically, on at least a half a dozen lots (lots 7, 17, 18, 26, 29, 42)

the well is down gradient from the septic system, although the 75 foot well-septic separation has been met. The public health code indicates the well should be at the high point of the property thus employing the use of a gravity fed system. The use a gravity systems helps eliminate costs (pumping) and maintenance as well as removing the chance that septage could flow down grade into the 75 foot well radius and/or wetland areas.

- Consideration should be made for the existing features of the land. Very often subdivision lot lines are brought *in* alignment to encompass existing stone walls. Certainly a reconfiguration taking advantage of these historic features would add valuable aesthetic appeal to this subdivision proposal.
- Any re-design of this plan will hopefully incorporate the use of existing roads and pathways for the many future residents of these homes to access the open space provided.
- It is recommended that a wildlife habitat assessment be conducted.



**Figure 10.**  
**Sterling Development Subdivision Wetland Intrusions**

y = yes (intrusions into 100 wetland buffer)

Lot #	House	Well	Drive	Septic	Reserve
7	Y	Y			
8	Y	Y			
9	Y	Y			
10	Y	Y			
11	Y		Y	Y	Y
15	Y	Y	Y	Y	Y
16	Y	Y	Y		
17	Y	Y		Y	Y
18	Y	Y			
19	Y	Y	Y	Y	
20					Y
24	Y	Y	Y		
25					Y
26	Y	Y			Y
27	Y	Y	Y	Y	Y
28	Y	Y	Y	Y	Y
29	Y	Y			
34				Y	Y
35				Y	Y
40	Y	Y	Y	Y	Y
41			Y	Y	Y
42	Y	Y	Y	Y	
43	Y	Y		Y	Y
44			Y		
49	Y	Y	Y	Y	Y
54	Y	Y			
55	Y	Y	Y	Y	Y
64			Y		
65			Y		Y
66	Y	Y	Y	Y	Y
67					Y
68				Y	Y
69	Y	Y	Y	Y	
70	Y	Y	Y	Y	Y
71			Y		
75					Y
76	Y	Y	Y	Y	
77	Y	Y	Y	Y	Y
79				Y	Y
80					Y
81				Y	Y
82	Y	Y		Y	Y
83					Y
84				Y	Y
85					Y
86	Y	Y	Y	Y	Y

## *Fisheries Resources*

Fisheries comments provided in the 1988 ERT Report *Canterbury Estates* review of the property are still pertinent to the new proposal known as Sterling Development Group Subdivision. Below are comments specific to the new proposal.

1.) Cory Brook was surveyed by the DEP Fisheries Stream Survey Team on 7/21/93 within a 150-meter stretch of stream adjacent to Depot Road in the Town of Canterbury. Albeit this sample location is downstream of the proposed subdivision, it provides the most recent fish population and ambient water quality data. Survey results show a mixed coldwater/warmwater fish community. Native brook trout and "wild" naturally reproduced brown trout were documented along with other stream fish such as blacknose dace, Longnose dace, tessellated darter, fallfish and white sucker. A very diverse group of warmwater fish was found which included, largemouth bass, bluegill, pumpkinseed, redbreast sunfish, golden shiner, spottail shiner, brown bullhead and yellow bullhead. Also of note was the presence of swamp darter, *Etheostoma fusiforme*. Although not listed as a "species of special concern", swamp darter are located within a very narrow geographic distribution in the state, limited to only six watercourses in Southeastern Connecticut. Found in slow moving water and low gradient sections of streams it is highly likely that suitable habitat can be found within the section of Cory Brook on and/or adjacent to the subdivision parcel. Resident fish such as swamp darter would be susceptible to erosion events since fine and coarse silts naturally tend to accumulate and fall out of suspension in waters with slow velocities.

2.) It is highly recommended that at a 100 foot riparian buffer zone be maintained along the wetland boundary associated with Cory Brook. A large portion of the property and subsurface flows drain downgradient to Cory Brook. Onsite

tributaries will act as a "direct conduit" for any harmful sediment or stormwater runoff to enter Cory Brook. A riparian wetland buffer is one of the most natural mitigation measures to protect the water quality and fisheries resources within Cory Brook. No construction and alteration of existing habitat should be allowed in this zone. Existing subdivision plans show numerous lots that contain development or encroachment within the wetland buffer zone including residential structures, driveways, septic systems, or vegetative clearing. Development within the Cory Brook wetland buffer occurs within lots 65 through 70, 75 through 77, 79 through 84 and lot 86. See attached DEP Fisheries Division policy and position on riparian corridor protection for specifics (Figures 11. and 12.

3.) Wetland crossing detail sheet C1 references detail sheet D2. Subdivision plans provided to team members for review did not include a D2 detail sheet.

**Figure 11.**

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DEPARTMENT OF ENVIRONMENTAL PROTECTION  
INLAND FISHERIES DIVISION

POLICY STATEMENT  
RIPARIAN CORRIDOR PROTECTION

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I. INTRODUCTION, GOALS, AND OBJECTIVE

Alteration and exploitation of riparian corridors in Connecticut is a common event that significantly degrades stream water quality and quantity. Inasmuch as riparian ecosystems play a critical role in maintaining aquatic resource productivity and diversity, the Inland Fisheries Division (Division) recognizes that rigorous efforts are required to preserve, protect, and restore these valuable resources. Consequently, a riparian corridor protection policy has been developed to achieve the following goals and objective:

Goals

Maintain Biologically Diverse Stream and Riparian Ecosystems, and

Maintain and Improve Stream Water Quality and Water Quantity.

Objective

Establish Uniform Riparian Corridor Buffer Zone Guidelines.

II. DEFINITIONS

For the purpose of implementing a statewide riparian corridor protection policy, the following definitions are established:

Riparian Corridor: A land area contiguous with and parallel to an intermittent or perennial stream.

Buffer Zone: An undisturbed, naturally vegetated area adjacent to or contained within a riparian corridor that serves to attenuate the effects of development.

Perennial Stream: A stream that maintains a constant perceptible flow of water within its channel throughout the year.

Intermittent Stream: A stream that flows only in direct response to precipitation or which is seasonally dry.

III. RIPARIAN FUNCTION

Naturally vegetated riparian ecosystems perform a variety of unique functions essential to a healthy instream aquatic environment. The delineation and importance of riparian functions are herein described. Vegetated riparian ecosystems:

- \* Naturally filter sediments, nutrients, fertilizers, and other nonpoint source pollutants from overland runoff.

- \* Maintain stream water temperatures suitable for spawning, egg and fry incubation, and rearing of resident finfish.
- \* Stabilize stream banks and stream channels thereby reducing instream erosion and aquatic habitat degradation.
- \* Supply large woody debris to streams providing critical instream habitat features for aquatic organisms.
- \* Provide a substantial food source for aquatic insects which represent a significant proportion of food for resident finfish.
- \* Serve as a reservoir, storing surplus runoff for gradual release into streams during summer and early fall base flow periods.

#### IV. RIPARIAN CORRIDOR BUFFER ZONE GUIDELINES

Recognizing the critical roles of riparian corridors, the Division provides buffer zone guidelines that are designed to bring uniformity and consistency to environmental review. The guidelines are simple, effective, and easy to administer. The following standard setting procedure should be used to calculate buffer zone widths.

**Perennial Stream:** A buffer zone 100 feet in width should be maintained along each side.

**Intermittent Stream:** A buffer zone 50 feet in width should be maintained along each side.

Buffer zone boundaries should be measured from either, (1) edge of riparian inland wetland as determined by Connecticut inland wetland soil delineation methods or (2) in the absence of a riparian wetland, the edge of the stream bank based on bank-full flow conditions.

The riparian corridor buffer zone should be retained in a naturally vegetated and undisturbed condition. All activities that pose a significant pollution threat to the stream ecosystem should be prohibited.

Where the Division policy is not in consonance with local regulations and policies regarding riparian corridor buffer zone widths and allowable development uses within these areas, local authorities should be encouraged to adopt the more restrictive regulations and policies.

12/13/91  
Date

James C. Moulton  
James C. Moulton  
Acting Director

Figure 12.

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POSITION STATEMENT  
UTILIZATION OF 100 FOOT BUFFER ZONES TO PROTECT RIPARIAN AREAS  
IN CONNECTICUT  
BY  
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I. INTRODUCTION

One tenet of the Inland Fisheries Division Policy on Riparian Corridor Protection is the utilization of a 100 foot buffer zone as a minimum setback along perennial streams. The adoption of such a policy is sure to be controversial. Laymen, developers and natural resource professionals alike will ask questions such as: Why was a standard setting method adopted? What's magical about 100 feet? Will 100 feet be sufficiently protective, or will it be overly protective? In response, this paper outlines the ramifications of adopting a riparian corridor policy including the use of a 100 foot buffer zone.

II. STANDARD SETTING VERSUS SITE SPECIFIC BUFFER ZONES

There are two approaches for determining buffer zone width; standard setting and site specific. Standard setting methods define an area extending from the streambank edge or highwater mark to some landward fixed point boundary. Site specific methods utilize formulas that incorporate and consider special site specific land characteristics, hence, the calculation of a variable width buffer zone. In both case, buffers are employed to define an area in which development is prohibited or limited.

A major advantage of standard setting methods is that they are easy to delineate and administer, thereby improving the consistency and quality of environmental assessments. Furthermore, valuable staff time would not be required to determine site specific buffer zones along each and every watercourse of concern.

The exact width of a buffer zone required for riparian corridor protection is widely disputed (Bottom et al. 1985 and Brinson et al. 1981). Buffer width recommendations found in the literature vary from as little as 25 feet to as great as 300 feet (Palfrey et al. 1982). The 100 foot buffer is widely accepted in Connecticut having been adopted by numerous inland wetland and conservation commissions as an appropriate minimum setback regulation for streambelts. In addition, Division staff have been recommending the utilization of the 100 foot buffer zone to protect streambelts since the early 1980's. Scientific research has not been generated to dispute the adequacy of utilizing 100 foot buffer zones to protect Connecticut's riparian corridors. In fact, to ensure that riparian functions are not significantly altered, recent scientific information points towards maintaining buffer zones that would be at a minimum, 100 feet in width (see section III).

Site specific methods define buffer widths according to the character and sensitivity of adjacent streamside lands. These buffer widths, also referred to as "floating buffers," consider physical site characteristics such as slope, soil type, and vegetative cover. The advantage of site specific methods is that buffer widths are designed using site characteristics and not an arbitrary predetermined width. Unfortunately, there is no "one" universally accepted formula or model and none have been developed for use in Connecticut. Most formulas are based on the degree to which sediment can be removed or filtered by natural vegetation, thus, the primary useage is sediment control. Other weaknesses of site specific techniques are (1) all areas must be evaluated on a case-by case basis and, (2) the subjectivity of different techniques (i.e. if the evaluation technique is inadequate, the buffer width will also be inadequate).

Additionally, these formulas only concentrate on one specific riparian function at a time and do not take into account multiple riparian functions, especially those of inland fisheries values as discussed in Section III. Consequently, site specific formulas approach riparian function on a single dimension rather than taking a more realistic, holistic approach.

In the absence of a scientific model to determine buffer widths suitable to protect Connecticut's riparian corridors, the utilization of a standard setting method is environmentally and politically prudent.

### III. RIPARIAN FUNCTION

To assess the efficacy of a 100 foot buffer zone, the literature was searched to identify studies which have applied a quantitative approach to buffer width determination. Literature was searched for studies which both support and dispute the 100 foot zone. The following is a summary "by riparian function" of quantitative studies which assess buffer widths.

#### Sediment Control

Width, slope and vegetation have been cited as important factors in determining effectiveness of buffer zones as sediment filters (Karr and Schlosser 1977). Wong and McCuen (1981), who developed and applied a mathematical model to a 47 acre watershed, found that a 150 foot zone along a 3% slope reduced sediment transport to streams by 90%. Mannering and Johnson (1974) passed sediment laden water through a 49.2 foot strip of bluegrass and found that 54% of sediment was removed from the water. Trimble and Sartz (1957) developed recommendations as to width of buffer areas between logging roads and streams to reduce sediment load. They determined a minimum strip of 50 feet was required on level land with the width increasing 4 feet for each 1% slope increase. Buffer widths as determined by Trimble and Sartz (1957) have been characterized as evaluated guesses rather than empirically defined widths (Karr and Schlosser 1977). Rodgers et al. (1976) state that slopes greater than 10% are too steep to allow any significant detention of runoff and sediment regardless of buffer width. After a critical review of the literature, Karr and Schlosser (1977) determined that the size and type of vegetative buffer strip needed to remove a given fraction of the overland sediment load cannot be universally quantified. Existing literature does suggest that 100 foot riparian buffers will assist with sediment entrapment, although efficacy will vary according to site conditions.

#### Temperature Control

Brown and Brazier (1973) evaluated the efficacy of buffer widths required to ameliorate stream water temperature change. They concluded that angular canopy density (ACD), a measure of the ability of vegetation to provide shading, is the only buffer area parameter correlated with temperature control. Results show that maximum angular canopy density or maximum shading ability is reached within a width of 80 feet. Study sites were 9 small mountain streams in Oregon that contained a conifer riparian vegetative complex. Whether or not maximum angular canopy density is reached within 80 feet in a typical Connecticut deciduous forest riparian zone is doubtful. Tree height in Connecticut riparian zones is smaller than in Oregon (Scarpino, personal communication), therefore buffers greater than 80 feet in width would be required for temperature maintenance in Connecticut.

#### Nutrient Removal

Nutrient enrichment is caused by phosphorous and nitrogen transport from, among other things, fertilized lands and underground septic systems. Most research on nutrient enrichment has focused on overland surface flow. Karr and Schlosser (1977) report that 88% of all nitrogen and 96% of all phosphorous reaching watercourses in "agricultural watersheds" were found to be attached to sediment particles; thus, successful nutrient removal can be accomplished through successful sediment removal. There are conflicting reports on the ability of buffer widths to remove nutrients with most research being tested on grass plots. Butler et al. (1974) as cited by Karr and Schlosser (1977) found that a 150 foot buffer width of reed canary grass with a 6% slope caused reductions in phosphate and nitrate concentrations of between 0-20%. Wilson and Lehman (1966) as cited by Karr and Schlosser (1977) in a

#### IV. OTHER POLICY CONSIDERATIONS

##### Measurement Determination

The proposed policy states that buffer zone boundaries should be measured from either the edge of the riparian inland wetland as determined by Connecticut inland wetland soil delineation methods or in the absence of a riparian wetland, the edge of the streambank based on bank-full flow conditions. This boundary demarcation is absolutely necessary to ensure that all riparian wetlands are protected. For example, if all measurements were to start from the perennial stream edge and extend landward for a distance of 100 feet, many riparian zones that contain expansive wetlands greater than 100 feet in width would be left unprotected.

Also, since boundary demarcation includes wetland delineation, the ultimate width of the buffer will vary according to site specific features. Consequently, buffer width determination as stated by Division policy is a "hybridization" of both standard setting and site specific methods. This hybridization of methods is advantageous since it acknowledges the sensitivity of streamside wetlands.

##### Home Rule

Where the Division policy is not in consonance with local regulations and policies regarding riparian corridor buffer zone widths, local authorities would be encouraged to adopt the more restrictive regulations and policies. This feature incorporates flexibility to acknowledge the importance of local "home rule" regulations or policies already in accepted practice. Conversely, towns and cities without accepted policies and regulations could choose to enact the Division policy.

##### Allowable Uses in Buffer Zones

The Division policy states that "the riparian corridor buffer zone should be retained in a naturally vegetated and undisturbed condition and that all activities that pose a significant pollution threat to the stream ecosystem should be prohibited." In essence, the buffer zone becomes an area where no development should be allowed. For this policy to be effective, there should be no exceptions, a blanket restriction of all uses would be recommended. Further clarification and more precise definitions of allowable uses will, however, be required in the future if the policy evolves into a departmental regulation.

Recently, the Connecticut Supreme Court has ruled that local agencies can prohibit specific development within buffer zones. The *Lizotte v. Conservation Commission of the Town of Somers*, 216 Conn.320 (1990) decision ruled that the construction or maintenance of any septic system, tank, leach field, dry well, chemical waste disposal system, manure storage area or other pollution source within 150 feet of the nearest edge of a watercourse or inland wetland's seasonal high water level can be prohibited (Wetlands Watch 1990). If this decision is a precursor of the future, Connecticut courts will continue to support the use of buffers, especially those which restrict or prohibit detrimental activities.

#### V. CONCLUSIONS

The following actions are required to preserve, protect, and restore Connecticut's riparian corridors:

1. The Inland Fisheries Division needs to adopt and implement the proposed policy so that staff can use it as a guideline to assist cities, towns, developers and private landowners with making sound land use decisions. This policy will act to solidify a collective position concerning riparian corridor protection.
2. While the proposed policy in its "current form," represents a recommendation from the CTDEP Inland Fisheries Division, the ultimate goal of the Division should be to progressively implement this policy as either a CTDEP regulation or State of Connecticut statute.



study of effluent applied to 300 m grass plots found that nitrogen and phosphorous concentrations were reduced 4 and 6%, respectively. Studies on subsurface runoff as cited in Clark (1977) found high concentrations of nitrates at 100 feet from septic systems with unacceptable levels at 150 feet. Clark (1977) recommended that a 300 foot setback be used whenever possible, with a 150 setback considered adequate to avoid nitrate pollution. Environmental Perspective Newsletter (1991) states that experts who commonly work with the 100 foot buffer zone set by the Massachusetts Wetlands Protection Act are increasingly finding that it is insufficient since many pollutants routinely travel distances far greater than 100 feet with nitrate-nitrogen derived from septic systems moving distances of greater than 1000 feet. Research indicates that the adoption of 100 foot buffer widths for Connecticut riparian zones will assist with the nutrient assimilation; albeit, complete removal of all nutrients may not be achieved.

### Large Woody Debris

The input of large woody debris (LWD) to streams from riparian zones, defined as fallen trees greater than 3 m in length and 10 cm in diameter has been recently heralded as extremely critical to stream habitat diversity as well as stream channel maintenance. Research on large woody debris input has mainly been accomplished in the Pacific Northwest in relation to timber harvests. Murphy and Koski (1989) in a study of seven Alaskan watersheds determined that almost all (99%) identified sources of LWD were within 100 feet of the streambank. Bottom et al. 1983 as cited by Budd et al. (1987) confirm that in Oregon most woody structure in streams is derived from within 100 feet of the bank. Based on research done within old-growth forests, the Alaska region of the National Marine Fisheries Service, recognizing the importance of LWD to salmonid habitat, issued a policy statement in 1988 advocating the protection of riparian habitat through the retention of buffer strips not less than 100 feet in width (Murphy and Koski 1989). All research findings support the use of a 100 foot buffer zone in Connecticut for large woody debris input.

### Food Supply

Erman et al. (1977) conducted an evaluation of logging impacts and subsequent sediment input to 62 streams in California. Benthic invertebrate populations (the primary food source of stream fishes) in streams with no riparian buffer strips were compared to populations in streams with buffer widths of up to 100 feet. Results showed that buffer strips less than 100 feet in width were ineffective as protective measures for invertebrate populations since sediment input reduced overall diversity of benthic invertebrates. Buffer strips greater than 100 feet in width afforded protection equivalent to conditions observed in unlogged streams. The ultimate significance of these findings is that fish growth and survival may be directly impacted along streams with inadequate sized riparian buffer zones. All research supports the feasibility of implementing a 100 foot buffer zone in Connecticut to maintain aquatic food supplies.

### Streamflow Maintenance

The importance of riparian ecosystems in terms of streamflow maintenance has been widely recognized (Bottom et al. 1985). In Connecticut, riparian zones comprised of wetlands are of major importance in the hydrologic regime. Riparian wetlands store surplus flood waters thus dampening stream discharge fluctuations. Peak flood flows are then gradually released reducing the severity of downstream flooding. Some riparian wetlands also act as important groundwater discharge or recharge areas. Groundwater discharge to streams during drier seasonal conditions is termed low flow augmentation. The survival of fish communities, especially coldwater salmonid populations is highly dependent upon low flow augmentation (Bottom et al. 1985). Research, although documenting the importance of riparian zones as areas critical to streamflow maintenance, has not investigated specific riparian buffer widths required to provide the most effective storage and release of stream flows.

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## *The Natural Diversity Data Base*

The Natural Diversity Data Base maps and files regarding the project area have been reviewed. According to Data Base information, there are no known extant populations of Federal or State Endangered, Threatened or Special Concern Species that occur at the site in question.

Natural Diversity Data Base information includes all information regarding critical biologic resources available to DEP at the time of the request. This information is a compilation of data collected over the years by the Environmental & Geographic Information Center's Geological and Natural History Survey and cooperating units of DEP, private conservation groups and the scientific community. This information is not necessarily the result of comprehensive or site-specific field investigations. Consultations with the Data Base should not be substituted for on-site surveys required for environmental assessments. Current research projects and new contributors continue to identify additional populations of species and locations of habitats of concern, as well as, enhance existing data. Such new information is incorporated into the Data Base as it becomes available.

## *Stormwater Management Review*

### General Stormwater and Water Quality Issues

The proposed plan does not show appropriate consideration for the numerous natural resources on the site. The best protection for wetlands and watercourses is buffer zones. Making these areas part of the lots does not ensure their future protection, or ensure that there is adequate space on each lot for septic systems and wells that will not have future impacts on these resources. The project could be significantly improved from an environmental impact perspective by reducing the number of lots and providing for open space buffer zones around wetlands and watercourses. Alternatively, the applicant should be required to demonstrate that lots with a large percentage of wetlands (for example, lots #17 - 19) can be developed (including house, garage, septic, well) without impacts to wetlands (including at least a 100 foot buffer), and permanent deed restrictions placed to prevent any future impacts. Such 100 foot buffer (or even a 50 foot buffer) has not been used in the lot development plans included in the ERT package. The lot development plans also do not show driveways connecting to houses, and most buyers in Connecticut will want garages, so it should be shown that drives can connect to houses without these grading changes causing wetland impacts.

The proposed construction method, which does not include any project phasing, will result in an excessive disturbed area with the resulting transport of sediments to wetlands and watercourses. The difficulty in controlling sediment from such a large area around so many wetland and watercourse areas has been demonstrated in numerous projects, with a resulting degradation of resources. The limited erosion controls shown on the site plans do not account for such a large amount of disturbance. All on-site wetlands are Class A, and Cory Brook is A or B/A, which means that any new impacts, including those from

must be dealt with on a local level before being included in the Plan. It should also be noted that the permit requires compliance with the guidelines. The developer must register for the permit, and the contractor and any subcontractors involved in grading must sign the contractor certification statement in the permit. Any registration submitted by anyone other than the developer will be rejected.

The Plan must include a site map as described in Section 6(b)(6)(A) of the General Permit and a copy of the erosion and sedimentation (E & S) control plan for the site. The E & S plan that has been approved by the Town in conjunction with the CTDEP Inland Water Resources Division (IWRD) and the local Soil and Water Conservation District may be included in the Plan. This plan and site map must include specifics on controls that will be used during each phase of construction. Specific site maps and controls must be described in the Plan, as well as construction details for each control used. The permit requires that "the plan shall ensure and demonstrate compliance with" the guidelines.

Due to the amount of soil disturbance, one of the best ways to minimize erosion potential is to phase construction in order to minimize unstable areas. The Plan must be flexible to account for adjustment of controls as necessary to meet field conditions. At a minimum, the plan must include interior controls appropriate to different phases of construction.

This project has slopes, some silty soils, and numerous wetland areas to be protected, which will make ongoing inspections and adjustments of controls a critical aspect of this project. The permit (Section 6(b)(6)(D)) requires inspections of all areas at least once every seven calendar days and after every storm of 0.1 inches or greater. The plan must also allow for the inspector to require additional control measures if the inspection finds them necessary, and should note the qualifications of personnel doing the inspections. In addition, the plan must include monthly inspections of stabilized areas for at least three months

*following stabilization. Due to the scope and potential wetland and stream impacts of this project, there must be someone available to design and adjust E&S controls for changing site conditions, who has the authority and resources to ensure that such necessary changes are implemented. Due to the size of the project and the variability and complexity of controls both shown on the plans and potentially needed, a full time erosion and sediment control inspector, approved by the Department, may be required by the Department during construction.*

Section 6(b)(6)(C)(ii) of the permit requires the plan to address dewatering wastewaters which this site may generate. Specific details for construction control during installation of all wetland crossings must be provided.

*Minimization of disturbed areas and prompt stabilization will be key aspects to avoidance of pollution from this project.*

Particular attention must be paid to the construction of the eastern portion of Penny Lane, which has very steep slopes.

#### **Post-Construction Stormwater Treatment**

The plan did not include sizing calculations for the sizing of the Vortechincs treatment unit. On a project of this size, the preferred method of treating for sediment is an extended, wet detention basin with a variety of wetland plants and a sediment forebay. There is sufficient land area on this project to implement such a treatment system. While swirl concentrators such as the Vortechincs units are effective at removing sediment, they require a long-term maintenance commitment from the town or a homeowners association greater than that required for a basin once it is fully grown-in and stabilized. Also, Vortechincs units do not treat for other pollutants such as metals and nutrients beyond those bound up with the solids. There have been some preliminary

studies that show that swirl concentrators may in fact leach out metals and nutrients over time. If an in-ground, "black-box" solution is to be used, swirl-concentrator technology is a minimum requirement. Some newer generation swirl concentrators also incorporate filtration systems to address other pollutant issues, but these also require long-term maintenance plans.

There is nothing in the plans to demonstrate that the level spreaders will treat for 80% removal of total suspended solids as required by the general permit. Also, rip-rap level spreaders require pre-treatment to ensure that sediment, including road sand, do not clog them over time and prevent them from functioning. Such clogging can cause the creation of highly erosive point source discharges. Long-term maintenance for any sediment pre-treatment must be taken into consideration by the town.

The wetland crossing under Frost District Road at Station 18 does not show any post-construction stormwater treatment for the drainage line discharging to the 36" RCP. This must be rectified to meet the permit requirements.

#### **Erosion and Sediment Control Notes**

General permit stabilization requirements include the following: "where construction activities have permanently ceased or have temporarily been suspended for more than seven days or where final grades are reached in any portion of the site, stabilization practices shall be implemented within three days". Please note that the erosion and sediment control notes on Sheet ES1 are not in compliance with this requirement.

The catch basin protection detail will be inadequate since the basins used are curb-type. Grates should be covered over and protected from any sediment while they are above grade. Once basins are in use, the use of catch basin inserts is recommended.



Toe of slope perimeter controls are inadequate for a project of this size and should be used only as a last resort. Other controls should include control of runoff, sediment traps and basins installed in accordance with general permit section 6(b)(6)(C)(i)2), diversions, controlling the limits of disturbance and rapid temporary and permanent stabilization, using erosion control mats, turf reinforcement mats and mulch as necessary.

Detail Sheet D2 was not included with the review plans.

### Other Issues

The plan provides for a significant net increase in flow to Cory Brook. The pre-development calculations were not included with the drainage calculation package provided to the Team. Also, the write-up that was provided to describe how post-construction peak flows were developed appears to stop mid-sentence. Although discharging the runoff from the site through as many outfalls as possible is a desirable management practice, increase of flows to the wetlands and brook may result in erosive velocities, bank undercutting, lack of flood control, and other detrimental effects. In order to properly evaluate the stream impacts and the need for detention of peak flows, the entire watershed must be considered, not just the runoff from the site.

It is strongly recommended that the local wetland and zoning commissions ensure that the bond required for this project be adequate to remediate all wetlands and watercourses in the event of control failures on this site. The developer should be aware that regardless of the storm event size, they will be responsible for remediation of any impacts. For example, impacts resulting from a hurricane may not result in penalties if all permit conditions were complied with and all construction best management practices were used, but remediation of any damage caused by such a storm would remain the responsibility of the

developer and permittee. The developer must also be aware that even if all lots are sold off to individual homeowners, they will be responsible for maintenance of all control structures for three months after final stabilization of the site.

This report touches on some of the major issues concerning the project and does not constitute a complete review of the Plans for permitting purposes.

## *Review of On-Site Sewage Disposal and Water Supply Wells*

These technical comments are based on a cursory review of the CME Associates plans dated April 1998 revised through September 26, 2000.

The majority of the lots will require engineered sewage disposal designs due to shallow maximum groundwater levels. Groundwater control drains can be used to control seasonal groundwater conditions. These drains help ensure the effective operation of sewage disposal systems. Strong consideration should be given to identifying feasible drain locations on the worst lots. This would enable the design engineer of the sewage disposal facilities on these lots to have the option available for drain specification if he/she feels it is appropriate. The subdivision plans do not show any groundwater control drains for the sewage disposal systems. Many of the lots would benefit from groundwater control systems, however, some of the tight lot layouts are such that groundwater control drains could not be easily incorporated into the designs. Chapter 7 Ground Water Control Drains of the CT Department of Public Health Design Guidelines can be referenced for additional information on these drainage systems.

Foundation drains help control groundwater whenever the septic system is down grade of the house. None of the homes in the subdivision have any foundation drains. On many of the lots a foundation drain could not be installed because they would not comply with the separation distance requirements to the sewage disposal system or the water supply well. Drains too close to sewage disposal systems can collect partially treated effluent. Most new homes built in CT have foundation drainage systems to protect basement areas per the building code. It is unrealistic not to plan for this. All lots that have houses that require slab on grade construction (no foundation drains) should be clearly designated as

such. Lots that can support a foundation drainage system should have the sewage disposal system area laid out in compliance with the separation distance requirements (25' minimum), and have the drainage outlet piping shown.

Many of the roads in the subdivision have underdrains proposed. Although they may be required for proper road construction they can be problematic if sewage disposal systems are located in close proximity. The engineer must verify proper separation between all underdrains and the proposed sewage disposal systems.

A significant number of the lots will require a pump system to lift the septic tank effluent to the leaching system. These lots should be designated as requiring a pump system with the proposed layout. Feasible septic tank and pump chamber locations should be shown for the pump lots. Homes located less than 50 feet downgrade of the leaching system will not be permitted to have a foundation drain. In these instances the frost wall footing can represent a hydraulic barrier to the movement of groundwater and effluent depending on several factors (e.g., footing depths, soil conditions). Such layouts should be avoided whenever other options are available. The local health department will only be able to approve sewage disposal systems if the naturally occurring soils have the ability to adequately absorb or disperse the expected volume of sewage effluent without overflow, breakout or detrimental effect on ground or surface water. Significant down gradient barriers can result in the natural soils being unable to comply with this requirement.

In many parts of the State four bedroom homes are becoming the standard rather than three bedrooms homes. All the lots in the subject subdivision are designated as three bedrooms for sewage disposal design purposes. Property owners may not be able to build homes beyond three bedrooms due to site constraints. Homes built with a future addition in mind may not be able to increase the number of bedrooms if it is found that the lot cannot support the larger code complying sewage system. Some of the lots in the proposed

subdivision have little ability to provide additional leaching system spreads. If increased spreads are not available additional bedrooms may not be allowable. Reserve leaching areas should provide additional hydraulic relief (additional spread) wherever feasible.

The CT Department of Public Health has provided local health departments with recommendations on siting new private wells to assure reasonable protection of the source of supply. The attached May 7, 1998 DPH memorandum includes the recommendations that include striving for having most or all of the well's protective radius to be within the property bounds of the lot served (see Figure 13.).

The following are the technical comments from a cursory review of the plans:

- **Sheet SPI:**

**Lot 86:** House downgrade of septic system. Pump probable. No foundation drains permitted. Foundation may act as hydraulic barrier. Avoid placement of reserve area in driveway.

**Lot 83:** House downgrade of septic system. Pump probable. No foundation drains permitted. Foundation may act as hydraulic barrier.

- **Sheet SP3:**

**Lot 1:** Under drain in road too close to septic system. Reserve area does not follow contours. Avoid placement of reserve area in driveway.

**Lots 78 and 79:** Significant portion of well protective radius off site does not afford best protection of well.

- **Sheet SP4:**

**Lot 10:** Under drain in road too close to septic system.

**Lot 12:** Borderline separation between under drain and septic.

**Lot 74:** House downgrade of septic system. Pump probable. No foundation drains permitted. Foundation may act as hydraulic barrier.

- **Sheet SP5:**

**Lot 34:** Pump system required.

**Lot 71:** Driveway construction may damage reserve area. Avoid placement of reserve area in driveway. Pump system required.

**Lots 36 and 37:** Pump system required.

**Lot 69:** Significant portion of well protective radius off site does not afford best protection of well. Designated soil stockpile area should not be in a designated leaching area. No foundation drains allowed due to reserve area location.

**Lot 70:** Primary leaching area extends to drainage easement line. Ten feet separation should be provided. Twenty-five feet separation between septic system and drain needed unless special provisions provided. Pump system required.

- **Sheet SP7:**

**Lot 19:** Well too close to storm drain. Pump system probable.

- **Sheet SP8:**

**Lot 19:** Stockpile should not be in designated leaching area.

**Lot 18:** Pump probable. No foundation drains permitted. Foundation may act as hydraulic barrier.

**Lots 28 and 15:** Significant portion of well protective radius off site does not afford best protection of well.

**Lot 28:** Under drain too close to reserve area. Two feet proposed cut in primary area for driveway renders area non-useable.

**Lot 32:** Pump system required.

- **Sheet SP9:**

**Lot 51:** Difficult to locate septic tank.

- **Sheet SP10:**

**Lot 55:** Pump system required. Force main (840 feet long!) should avoid drainage easement area. Restrictive layer is at 19/20 inches. Twenty-five

inches used in MLSS calculation. Spread provided is not sufficient for MLSS calculated with shallower restrictive layer.

- **Sheet SP11:**

**Lot 20:** Significant portion of well protective radius off site does not afford best protection of well.

- **Sheet SP12:**

**Lot 24:** Avoid placement of reserve area in driveway.

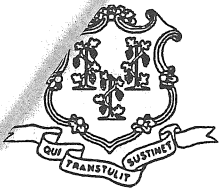
- **Sheet SP13:**

**Lot 42:** Driveway and leaching areas conflict. Fill system will be needed. Gradient? System may be less than 50 feet upgrade of house. No foundation drain permitted.

- **Sheets TPI-TP3:**

Soil testing dates should be noted.

This office is available to discuss any of the above comments or any other sewage disposal concerns.



# STATE OF CONNECTICUT

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## DEPARTMENT OF PUBLIC HEALTH

Figure 13.

### MEMORANDUM

**TO:** Directors of Health, Chief Sanitarians, Licensed Engineers, Installers, and Well Drillers

**FROM:** Frank A. Schaub, Supervising Sanitary Engineer *FAS*

**DATE:** May 7, 1998

**SUBJECT:** Required Separation Distance From Private Wells To Sewage Disposal Systems And Other Sources Of Pollution.

Section 19-13-B51d(a) sets forth the requirements for all private wells with withdrawal rates less 10 gallons per minute. We are all familiar with the required separation distance of 75 feet to sewage disposal systems or other sources of pollution. Location of private wells as far as reasonably possible from potential sources of pollution is a primary goal of this section.

Over the past several years, our section staff have been involved with complaints from concerned property owners who's wells are located close to a property line with much of their protective well radius on the adjacent lot. Activities on the adjacent property such as gardening, storage of manure, construction of garages or other typical residential lot activities have brought forth cries for protection of their valuable private water supply. Unfortunately, they have no direct control of their portion of the protective well radius beyond the property line.

Similarly, we are faced with both new development and repair of sewage disposal systems adversely effected by the location of a well close to a property line with a protective well radius that consumes valuable space on the adjoining lot necessary for septic system installation. Annually, our section engineers routinely review hundreds of septic systems repairs proposed less than 75 feet from existing private wells, many of which were located unnecessarily close to a property line.

Section 19-13-B51d(a) requires "each such well shall be located at a relatively high point on the premises consistent with the general layout and surroundings; be protected against surface wash; be as far removed from any known or probable source of pollution as the general layout of the premises and the surroundings will permit;..." After reviewing intent of requirements in this section with staff engineers in our Water Supply Section, we are requesting your cooperation with respect to review and approval of all new private well locations in assuring reasonable protection of private wells can be provided where feasible. The only way a property owner can be assured that no unwanted activity occurs adjacent to their well is to have all or substantially most of their protective well radius within their property bounds. There may be circumstances where standard well drilling equipment cannot get to sites which would afford this protection and common sense must prevail in approving alternate sites. There may also be circumstances where several wells on adjacent lots are all clustered in the same general location thereby creating a larger singular protective well radius. We are aware of some towns and health districts who, by regulation, ordinances or policy, routinely require all or most of the well protective radius to be located within the property bounds of the lot served. We encourage the rest of you to consider the importance of providing long term protection for private wells with the minimal adverse impact to adjacent property owners. This clarification is consistence with the Water Supply Section's approval of all new public wells which require a water company to either own or have legal easement to assure long term protection from "any known or probably source of pollution adjacent" to their wells site.

If you have any questions concerning this matter, please contact our office.

c: Len McCain, Local Health Administration  
c/sewage/memo/memo22



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## *Archaeological and Historical Review*

A review of the State of Connecticut archaeological site files and maps shows no reported sites for the project area. However, there is at least one archaeological site in relatively close proximity. This is a parcel on the National Register of Historic Places.

The property has a great deal of historic interest. There are old house foundations that should be considered in the land use decision making process. There are reports of what has been called the Greenwich Path having extended through this project area. Historical documentation of these paths could be very important in reconstructing the local historical patterns as well as state-wide patterns. Also, there may be remnants of the path that can give insights into the engineering design of old colonial roads. The road itself is a very significant historic resource. The State of Connecticut has recently considered portions of the Connecticut path that still have integrity for inclusion on the National Register of Historic Places. The possibilities of this Greenwich Path should be looked into not only in terms of historic documentation but actual field review to determine if in fact remnants of the path still are visible and have integrity.

Not only is the Office of State Archaeology (OSA) concerned with colonial resources here, but the project area has a high potential also for Native American settlement especially in the areas adjacent to Cory Brook and especially in areas where drainage patterns flow down into the swamp area associated with Cory Brook. Native Americans often had winter encampments around interior swamps for protection and for utilization of natural resources. Confluences of minor brook system leading into another brook system were often very desirable locations for Native American occupation.

The project area especially because of its size has the potential for a number of different cultural resources both prehistoric and historic. The OSA strongly recommends an archaeological survey for the project area to identify these cultural resources. The survey should be able to locate aspects of the Greenwich Path if they still exist and determine their integrity as well as locating Native American sites and historic foundations and testing them to see what information they could yield about the past. These would be important cultural resources for the town of Canterbury to consider in its planning decisions.

The OSA is prepared to offer any technical assistance they can in conducting the recommended archaeological survey. In addition, they would be happy to assist by coordinating and working with local and state historians in developing the history of the parcel, the Greenwich Path, and other historic resources that may be on the property. They strongly recommend an archaeological survey and historic review prior to any construction activities on the parcel.

The Office of State Archaeology looks forward to working with the Town of Canterbury, as they have in the past, and the applicant in the conservation and preservation of the cultural resources which may lie in the project area.

## *Planning Considerations*

(Note: These are brief comments, a more detailed report will follow shortly)

**1) Subdivision** - The subdivision application appears to be consistent with the Town of Canterbury Subdivision Regulations.

**2) Wetlands** - This reviewer has serious reservations regarding the wetlands based on the site walk. It is suggested that the Town of Canterbury have an independent delineation of the wetlands done.

**3) Traffic and Access** - The intersection of Lisbon Road (a highly used, well known short-cut, with road curvature) and Cory Road and the "subdivision road" are a safety concern. A traffic impact analysis should be conducted.

**4) Burial Grounds** - There is an indication of Indian burial grounds on the site. The State Indian Affairs Office and/or the Bureau of Indian Affairs need to be contacted.

**5) Open Space** - It is recommended that the Town of Canterbury **not** take the open space, but it is recommended that they take cash in lieu of open space.

# **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 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 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: 860-345-3977, Eastern Connecticut RC&D Area, P.O. Box 70, Haddam, Connecticut 06438.