# Yale Farm Golf Club

## Norfolk, Connecticut

## King's Mark
## Environmental Review Team Report

King's Mark Resource Conservation & Development Area, Inc.

# Yale Farm Golf Club
# Norfolk, Connecticut

## Environmental Review Team Report

Prepared by the
King's Mark Environmental Review Team
of the
King's Mark
Resource Conservation and Development Area, Inc.

for the
Inland Wetlands Commission
Norfolk, Connecticut

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# Acknowledgments

This report is an outgrowth of a request from the Norfolk Inland Wetlands Commission to the Northwest Conservation District and the King's Mark Resource Conservation and Development Area (RC&D) Executive Council for Environmental Review Team assistance. The request was approved and the project reviewed by the King's Mark Environmental Review Team (ERT).

The King's Mark 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 Monday, June 16, 2003.

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I would also like to thank Martin Johnson and Sue Frisch, Norfolk Inland Wetlands Commission, David Tewksbury, project manager, Yale Farm Golf Club, William Root, wetland and biological consultant, Milone and MacBroom, Dan McGuinness, director, NWCCOG, Jean Cronauer, NWCD, and Richard Sachs, for their cooperation and assistance during this environmental review.

Prior to the review day, each Team member received a summary of the proposed project along with location and soils maps. During the field review Team members were given plans and additional information. Some Team members made additional field visits to the area. 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 the proposed use, and also suggests considerations that should be of concern to

the towns. The results of this Team action are oriented toward the development of better environmental quality and the long term economics of land use.

The King's Mark RC&D Executive Council hopes you will find this report of value and assistance in the review of the proposed Yale Farm Golf Course.

If you require additional information please contact:

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# Table of Contents

# Introduction

## Introduction

The Norfolk Inland Wetlands Commission has requested assistance from the King's Mark Environmental Review Team in reviewing a private golf course development that is being proposed for the Yale Farm Property in Norfolk and North Canaan. This ERT report deals primarily with the application that concerns the proposed development in Norfolk, Connecticut.

The YaleFarm consists of 780 acres that straddle the municipal borders of the towns of Norfolk and North Canaan, with 245 acres are in North Canaan and the remaining 535 acres in Norfolk. There are four existing homes, three in Norfolk and one in North Canaan. They will all be used by the Golf Club.

The proposed Yale Farm Golf Club will consist of an 18 hole championship golf course with a clubhouse, pro shop, locker room and maintenance building. Parking will be provided for approximately 80 cars. These will all be constructed in Norfolk. The golf club acreage in Norfolk totals 208 acres and includes construction of holes #1-9, and a portion of holes #10, 17 and 18.

The owners are also planning a conservation subdivision for some time in the future. A preliminary layout is shown on the golf course master plan, but the residential subdivision is not included in the application that is before the commission. There are 38 lots proposed in Norfolk and 23 lots in North Canaan. Some Team members have included comments concerning the future residential development in their sections of this report.

## Objectives of the ERT Study

The commission has asked for ERT assistance with the review of this project because it sees the need for a third party assessment/opinion on certain aspects of the information presented by the applicant and on the potential environmental consequences of the proposed development. The commission is requesting information in the following areas: soils, water supply, hydrology and water quality, inland wetland resources and impacts to local & regional watersheds, stormwater management plans and regulations, vegetation and botanical survey, wildlife habitat impacts and land use planning relating to local, regional and state plans. The ERT report suggests and recommends measures that could be included to minimize adverse impacts on site resources and the surrounding area.

## The ERT Process

Through the efforts of the Norfolk Inland Wetlands Commission, this environmental review and report was prepared for the town of Norfolk.

This report provides an information base and a series of recommendations and guidelines which cover the topics requested by the town. 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 Monday, June 16, 2003. 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. Some Team members made additional site visits as time allowed.

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.

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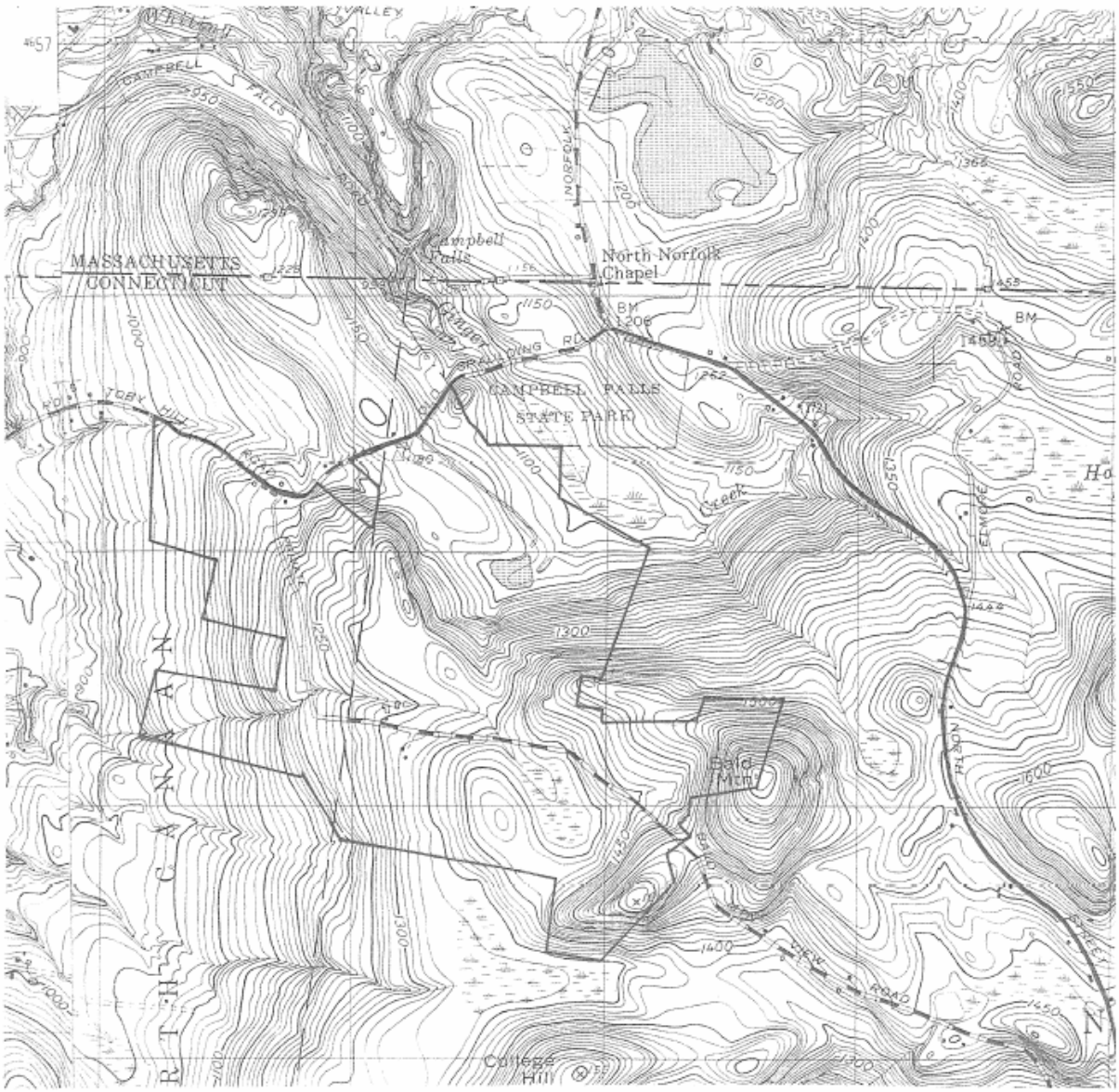
**Location Map**
**Scale 1" = 2000**




SITE PLAN – GOLF COURSE
AND CONSERVATION SUBDIVISION

- Dwelling Location (Preliminary – 2/03)

# Topography and Geology

The Yale Farm parcel(s) is located in an area of diverse topography that ranges from relatively flat upland surfaces and gentle valley slopes to rather steep and even cliffed slopes. Elevation of the land surface is related to the underlying bedrock and its resistance to chemical and mechanical (glacial) weathering. For instance, Bald Mountain, the highest elevation (~1770') in the immediate area, is underlain by a massive, rather granular amphibolite that is poorly fractured and hence is resistant to erosion and entrainment by the Ice Age glaciers. Likewise, the remaining upland surfaces are underlain by rusty weathering muscovite-garnet schist that resists the mechanical abrasion of glacial erosion. Slopes are underlain by gneiss and quartzite that is fractured and easily entrained by moving glacial-ice. The deep valleys (Housatonic River Valley) are underlain by soluble marble.

Movement of glacial ice over a bedrock surface does two things to the rock.

1. Ice locally and seasonally melts, allowing water to seep into fractures in the rock. Upon refreezing, ice expansion breaks various sized pieces of the bedrock from the ledge. The fragments are frozen into the base of the glacier and taken away by the slowly moving ice. The steeper slopes around Yale Farm were eroded in such a manner.
2. Rock particles, ranging in size from boulders to mud, frozen into the base of a moving glacier act abrasively on the underlying ledge in a manner similar to the way sandpaper abrades wood over which it is moved. Local depressions may be ground into the ledge by the abrasive movement of the glacier over the bedrock beneath it.

In many localities, especially where soils are thin, glacially scoured bedrock basins collect water and become vernal pools. Such pools may have a perched water table. Several vernal pools are located on a relatively-flat scoured upland-surface adjacent to holes #6 and #7 of the proposed golf course.

Soil thickness is a function of how much debris was frozen into the glacier. When the glacial ice melted the debris was left behind as a veneer, covering the bedrock, of soil-like material referred to as either ground moraine or glacial till. Till thickness may be variable over short distances, but it is mostly thin. This creates areas of numerous bedrock outcrops, such as along the north facing slopes north of the main house at Yale Farm. The water table may be closer to the surface in areas of thin glacial till, such as the area of proposed holes #9 and #18. Mid-slope areas with thin soils are prone to seasonal wetness, especially over areas where bedrock is poorly fractured. In essence, the water cannot seep into fractures to recharge regional groundwater, so it flows down slope within the soil. If the soils are too thin, water will breech the surface creating wet areas.

Bedrock geology of the area is extremely complex in detail, as is most of the Appalachian area. Between 800-500 million years ago the edge of the proto-North American continent was located where western Connecticut currently exists. The location of a limestone reef near the edge of the ancient continental shelf can be inferred by the location of modern day marble deposits, which are metamorphosed limestone. Mica schist and quartzite, rocks that underlie much of Yale Farm, are metamorphosed equivalents of mud and sand deposited in shallow water on the ancient continental shelf and shallow slope.

The Appalachian Mountain area (including western Connecticut) was subjected, between 500-275 million years ago, to several episodes of mountain building caused by plate-tectonic induced collisions of several continental-sized landmasses with North America. Continental collisions cause extreme compression of the landmasses resulting in portions of continental crust being thrust over and piling up on each other. This causes Alpine-sized mountains.

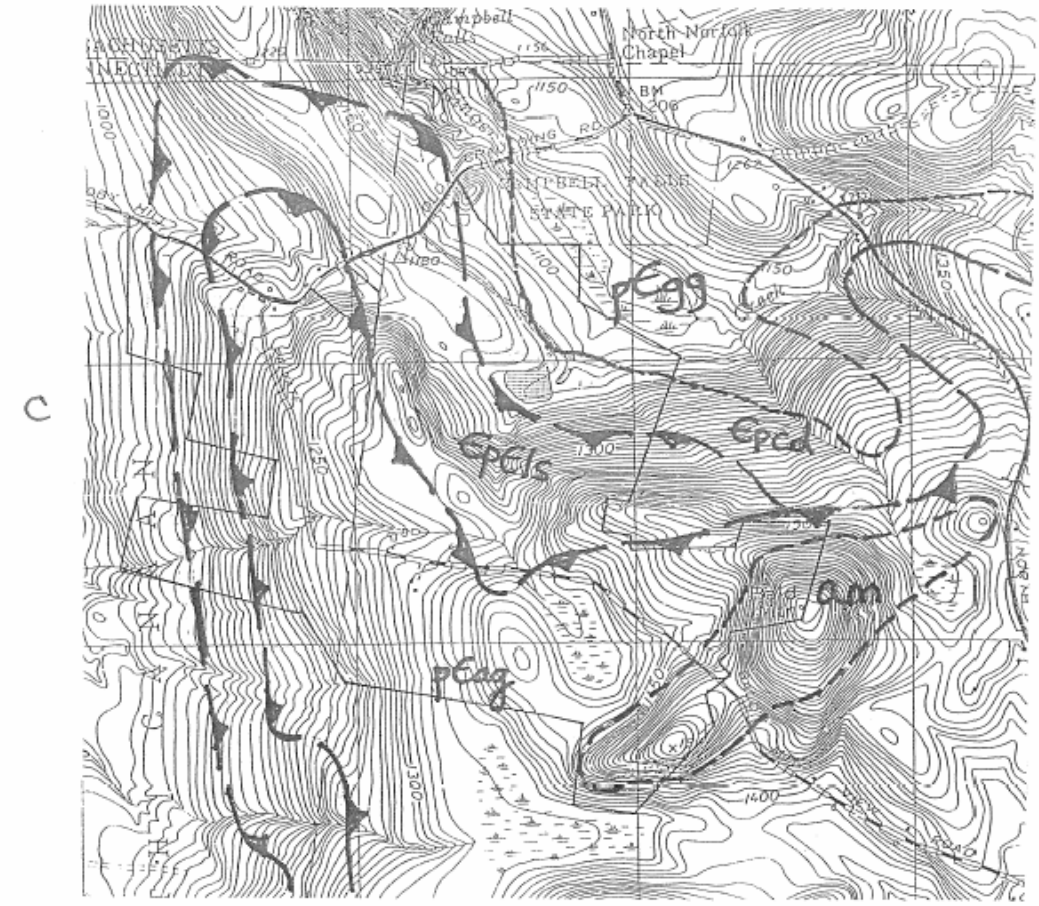
Underlying rocks are depressed closer to the hot interior of Earth and, of course, bear the immense pressure of the overlying thrust slice. Thus, they become metamorphosed from sandstone, shale and limestone to quartzite, schist, and marble. Volcanic basalt metamorphoses into amphibolite. A large thrust slice has been mapped (Harwood, 1979) passing through the north and west facing slopes of Yale Farm (see following map and cross-section). Rocks from the east were thrust westward during one or several of the collision episodes. 10-20 kilometers of overlying rock have been eroded over the past 250 million years to expose the complexities of extremely deformed terrain.

## Summary

Geologic conditions do not seem to pose limitations to the proposed development that proper planning and engineering will not mediate. Soils are locally thin; the water table is locally high; some of the bedrock is not highly fractured. This may affect slope grading, seasonal drainage and wetness problems, and water well yield. Certainly wetlands requiring protection exist because of geologic factors. These concerns seem to be considered in planning for the project.

## References

Harwood, D.S, 1979, Geologic Map of the South Sandisfield Quadrangle, Massachusetts and Connecticut. U.S. Geol. Surv. Geol. Quad. Map, GQ 1519.





| | |
|---|---|
| am | Massive, fine to medium-grained hornblende amphibolite |
| Cpcd | Tan wellbedded quartz-feldspar gneiss and quartzite |
| CpCl s | Canaan Mountain Fm, lower thrust slice: rusty weathering coarse-grained schist with quartzite |
| pCag | Biotite calc-silicate gneiss interbedded with amphibolite gneiss |
| pCgg | Granite gneiss |

Contact between adjacent rock masses

Thrust fault; teeth on over-riding plate

Scale 1″ = 2000′

. Geologic sketch map and cross-section (after Harwood, 1979).

# Soil Resources

The total acreage of the proposed golf club and associated residences in Norfolk is ±535 acres. Of the 535 acres, approximately 25 acres and 3 acres are Classified by the United States Department of Agriculture as Prime Farmland Soils (PFS) and Highly Erodible Land (HEL), respectively. In other words ~4% of the proposed project area is PFS and >1% is classified as HEL. Please note that PFS cover ~13 % of Litchfield County. Therefore, the areas proposed for a golf course and residencies contain much less than the average PFS for the county.

The soil information for the Northwest Corner of CT has just been updated. The USDA has performed field sampling and ground truthing to update soil maps of the region. The new soil type delineations have changed substantially from the original soils types published in 1970 (USDA, 1970). Please note that the applicant has represented the original (published in 1970) soil data on the plan-of-development (Sheet SM-1). The new delineations have not been translated into computer format. However, updated soil maps have only been rendered onto orthographically corrected aerial photos and could be digitized into the plan of development. Please note that the new data is qualified as "Advanced Updated Information" by the USDA and subject to change once all map updating is reviewed for the State of CT. This reviewer understands that this soils information is not in published form. However, this data is more representative of actual soil conditions as they occur on site because of the extensive field work that was accomplished by the USDA-NRCS soil scientists.

### Recommendations

- "Frigid" soil types also occur on the property. Frigid soils occur in areas with a mean annual air temperature between 37 and 47 degrees F°. In addition, Frigid soils have a mean annual soil temperatures below 47 degrees F°. Areas of frigid soil should be assessed for their potential of hosting rare or listed plant/animal communities (see Botanical Inventory Section). Please note that frigid soils rarely occur in CT.

- The Commission should require the applicant to render the new soils information in their plan-of-development. Specifically Sheet SM-1 Existing Soil Map. The soil types delineated by the USDA are at a scale of 1 to 12,000. At this scale they are required to map soil units down to 1.5 acres. Soil data at this scale is used for large scale land use assessments such as regional planning. When construction is taking place in specific locations a more detailed soil survey must be accomplished to assure proper site design (and assure adequate erosion and sediments control measures). Consider having the applicant perform and illustrate on the plan-of-development (sheets with the scale of 1 to 1200 or 1 inch = 100 feet) an "order one" soil survey in the areas were cutting/filling and changes in vegetation are proposed. The minimum delineation size for rendering soil types on a 1 to 1200 scale map is one tenth of one acre (USDA, 1993). Detailed soil mapping in disturbed areas will assist with the Erosion and Sediment Control Plan and with final soil stabilization. Also, specialists reviewing environmental impact issues can better advise the developer on project design.

## Prime Farm Land Soil

Prime farmland soils (PFS) have the best combination of physical and chemical properties for producing food and livestock feed. In general, PFS have an adequate and dependable moisture supply, favorable temperature and growing season, acceptable acidity and alkalinity and few rocks. PFS are not excessively erodible or saturated with water for long periods of time. The

soil series on site that make up most of the prime farmland is PdB (Paxton Stony Fine Sandy Loam, 3%-8% slope). This soil type at the present time is being cultivated for corn and is located under the proposed Hole #5's tee-boxes and fairway. The remaining areas of PFS are proposed to be developed with house lots.

### Recommendation

- Given the relatively low concentration of prime farmland soils in the proposed project area consider having the applicant grant an agricultural easement to the Canaan Valley Agricultural Cooperative to keep this land agriculturally productive and preserve what is left of the agricultural heritage in this area.

## Highly Erodible Land

Highly erodible lands are made up of soils that are excessively susceptible to sheet, rill and gully erosion. There is very little HEL located within the proposed project area. The soil series that makes up the area of HEL on site are Bice (Gravely-Very Stony Fine Sandy Loam, 15% - 25% slope) and PbC (Paxton/Montauk Fine Sandy Loam, 8%-15% slope). Most of the Bice soil located on site is just south and east of the 1st Hole green. The Paxton/Montauk is located between the 5th fairway and the proposed houses off Todd Hill Road. The areas of HEL do not seem to be in areas that will be cleared of vegetation for the purpose of course construction. Residential house construction may occur on these soil types.

### Recommendation

- When house construction is proposed for the areas of HEL, the erosion and sediment control plan should be prepared by and/or reviewed by a Certified Profession in Erosion and Sediment Control (CPESC). Also, the erosion and sediment control program should be drafted using the 2002 CT Guidelines for Soil Erosion and Sediment Control (CT DEP, 2002). Once vegetation is removed from these soils it is extremely difficult to control soil movement.

## Erosion and Sediment Control Plan

### Recommendation

- If the application were to be accepted the town of Norfolk should hire a part time employee to inspect the site on a regular (bi-weekly and within 72 hours of rain event greater than 0.5 inches) basis. The inspector can draft reports to the Norfolk Land Use staff and commissioners to assure that the developer is implementing the application. The goal of the erosion and sediment control plan is to never allow water leaving the site to be any color but clear. If the water in streams or rivers ever become cloudy or turbid with sediments the town should notice the project with a violation. All other work on the site should stop until the problem is rectified. The site inspector should be used until all areas of exposed soil are stabilized.

## Stormwater

### Recommendation

- The large size of the proposed project will require the applicant to permit construction activities under the Federal NPDES Construction Storm Water Program. This program is

administered through the CT Department of Environmental Protection, Stormwater Unit (860 424-3850).

## References

Connecticut Department of Environmental Protection, (CT DEP, 2002). Connecticut Guidelines For Soil Erosion and Sediment Control. Bulletin #34.

Environmental & Human Health, Inc. 1999. A Survey of Private Drinking Water Wells For Lawn and Tree Care Pesticides in a Connecticut Town. New Haven, CT.

United States Department of Agriculture,1993.Soil Survey Manual,Soil Survey Division Staff,USDA Handbook #18.

United States Department of Agriculture,1970.Soil Survey of Litchfield County,Soil Conservation Service.USDA,Washington D.C.

# Water Quality and Quantity Information

## Surface Water

The area proposed for development in Norfolk is within the Whiting River Watershed. The Whiting River and its tributaries have a water quality rating of "A". The "A" classification is given to a surface water feature by the Connecticut Department of Environmental Protection (CT DEP). This water quality standard indicates that this surface water feature "is suitable for a drinking water supply and/or bathing: suitable for all other uses; character is uniformly excellent; may be subject to absolute restrictions on the discharge of pollutants". The excellent water quality in the Whiting River can be directly attributed to the healthy high quality wetland systems and inflows from groundwater/springs. Vegetated (forested, emergent and watercourse) wetlands such as the ones located on site are very efficient at renovating and maintaining the excellent surface water quality rating.

The Whiting is the largest tributary to the Blackberry River and represents approximately 40 percent of the Blackberry River Watershed. The proposed project area is approximately 1 square mile and the Whiting River Watershed is approximately 19 square miles. The segment of the Blackberry River from the confluence of the Whiting River to the Housatonic River is classified as a Class 3 Wild Trout Management Area. The water quality and quantity is of a quality that allows the stocking of fingerling (3" to 5" inch trout) and have them mature (9+ inch trout) for anglers. Changes made to high quality headwater wetlands may likely change the water quality of the Whiting River.

If the project is approved the Commission should require the applicant to address the following recommendations. Addressing the recommendations will assure a more complete application to facilitate protection of surface water quality. The following recommendations will serve to protect both the Whiting and Blackberry Rivers.

### Recommendations

1) The Commission should request that the surface water monitoring plan include flow, water temperature and dissolved oxygen measurements before, during and after development. The large capacity ground water wells, numerous residential wells, increased evaporation from irrigation and impoundments, and wetland impacts all have the potential of reducing available water and increasing the Whiting River tributaries maximum temperature during low flow summer periods.
2) In addition to the proposed water sampling described in the application, the Commission should request the applicant sample the surface water for potential toxic metabolites of the pesticide, herbicides, fungicides and insecticides once use commences. The Commission should require the applicant to update sampling regimes regularly to account for any reformulation in chemicals used in the maintenance of the golf course. Manufactures of chemicals are constantly adjusting their formulations to improve their effectiveness. This is an important consideration because, the compounds-of-concern will vary as chemicals change with reformulation. Please note that if reformulations occur under the same compound name and if you are using a sampling method that is looking for the outdated formulation, the new compound-of-concern can be missed. The compounds-of-concern sampling regime needs to be as rigorous as the chemical application schedule.
3) A similar Human Health and Environmental Risk Assessment (see Section IV of the Natural Resource Management Plan for the Yale Farm Golf Club) should be

accomplished for any metabolites that are of concern and possible reformulated compounds. The town should retain a certified toxicologist to assess the potential for dangerous metabolites degrading from the compounds being used in the maintenance of the golf course.

4) The sampling plan should include the data validation process by a qualified laboratory. Data validation is a necessary step in assessing the results of compound of concern sampling. A named representative (or municipal position) should be designated for the distribution and interpretation of the validated data. The designee must be supplied with concentration thresholds that cause human and/or environmental problems along with the sampling methods lower detection limits.
5) Illustrate the Whiting/Blackberry River Watershed boundary on the site plan-development sheets. Especially the sheets that are at a scale of 1 inch = 400 feet.

It would be environmentally insensitive to assume that this project will not permanently alter the surface water quality, quantity and hydrology of the Whiting River. If the project is considered for approval consider requesting the above listed recommendations to help minimize the potential negative environmental impacts from the proposed project. Recommendations number 1 through 4 will help create an early warning system, which would serve to minimize potential negative environmental impacts. Please note that there are most likely stream segments associated with the Whiting River and its tributaries, that recharge groundwater. Surface water from irrigation can also re-charge groundwater systems through infiltration. Therefore, groundwater needs equal attention when considering methods of protection.

## Ground Water

The elevated location of the proposed golf course puts many existing and proposed residential wells down gradient of the development. Environmental & Human Health, Inc. accomplished a study of 53 residential wells in a suburban neighborhood in Connecticut (EHHI, 1999). Seventy two percent of the well owners used pesticides and fertilizers on their lawns. Eleven percent of wells had contained water with traces of pesticides. Five of these wells had more than one pesticide identified in them. There was also no correlation between homeowners that used pesticides and contaminated wells. "Choosing not to use pesticides on one's property is not a guarantee that pesticides will not be found in ones well water. Pesticides used in one part of the community may show up in the ground water in another part of that community" (EHHI, 1999). If the project is approved the Commission should require the following to assure the preservation of ground water quality and quantity. These recommendations are important to consider given the proposed applications rates for water, chemical and fertilization.

### Recommendations

1) Residential wells within approximately one mile (or a distance recommended by a hydrologist retained by the town) of heavy chemical use areas on the golf course should be identified and mapped and included with applications to the town. Once residential wells are plotted on a site map, the applicant and the commission can better design a network of monitoring wells that will best serve as an early detection system. If compounds-of-concern do start to migrate into drinking water supplies, impacts can be minimized through mitigation techniques before a contaminant plume reaches residential water resources.
2) Each well within the prescribed radius of chemical use areas should be sampled pre-construction. The initial sampling round should include scanning for all known chemicals to be used on the golf course and a measurement of the well's production

rate (i.e. gallons/per minute). This would not be an extravagant request given the volume of water to be extracted from the regional bedrock formations during dry periods. The residents of North Canaan and Norfolk would benefit from this attention to environmental accountability and the minimization of potential risks to human health.

3) In addition to the proposed water sampling described in the application, the commission should request the applicant sample the ground water for potential toxic metabolites of the pesticide, herbicides, fungicides and insecticides once use commences. The commission should require the applicant to update sampling regimes regularly to account for any reformulation in chemicals used in the maintenance of the golf course.
4) A similar Human Health and Environmental Risk Assessment (see Section IV of the Natural Resource Management Plan for the Yale Farm Golf Club) should be accomplished for any metabolites that are of concern and possible reformulated compounds. The town should retain a certified toxicologist to assess the potential for dangerous metabolites degrading from the compounds being used in the maintenance of the golf course.
5) The sampling plan should include a data validation process by a qualified laboratory. Data validation is a necessary step in assessing the results of compound of concern sampling. A named representative (or municipal position) should be designated for the distribution and interpretation of the validated data. The designee must be supplied with concentration thresholds that cause human and/or environmental problems along with the sampling methods and method detection limits.

The above recommendations will help minimize the potential negative environmental impacts of the proposed project. The commission should require the applicant to accomplish the five comments above if the proposed plan is to be approved. If wells ever become contaminated or dry up it would be partially the town's responsibility to supply the residents with potable water.

# A Watershed Perspective

## Introduction

These comments and recommendations to the Norfolk Inland Wetlands Commission (Commission) are given from the perspective of improving and maintaining water quality and supporting designated uses of the State's waters per the State of Connecticut Water Quality Standards[1]. These comments also reflect the Connecticut Department of Environmental Protection's (CT DEP) growing commitment to address water resource concerns from a watershed perspective, taking into account the cumulative impact that assorted land use activities within a given watershed may have on water quality and quantity.

It is important to note that while the Commission has asked that this King's Mark Environmental Review look only at the golf course portion of the proposed Project which lies in Norfolk, this request runs counter to watershed management philosophy. The proposed Project lies within both the towns of Norfolk and North Canaan and also potentially entails a subdivision consisting of approximately 61 units. To examine only one element of an issue and also isolate it according to political boundaries does not make for good water resource management. Therefore, the portion of proposed golf course in Norfolk which is the subject of this Environmental Review is necessarily examined in light of these other aspects of the proposed Project.

Some of these comments may overlap with those of other Environmental Review Team (ERT) members who are dealing with more specialized aspects of the review (i.e. - stormwater, fisheries, pesticides, etc.). In such cases, these comments are meant to support or supplement these specialized reviews, not supplant them. The Commission may also wish to refer to the FINAL DRAFT "Report of the Advisory Committee on Potential Best Management Practices for Golf Course Water" developed by the University of Connecticut - Connecticut Institute of Water Resources for guidance[2]. (This draft document can be viewed on the following website: http://www.ctiwr.uconn.edu/Projects/Golf/finalbmp.pdf)

## Watershed Context

As a way of describing Connecticut's water resources in terms of the landscape, CT DEP has divided the state along natural drainage divides into eight "major basins" or watersheds. These, in turn, are divided into increasingly smaller watersheds which are described as "regional", "subregional" and "local" drainage basins. At each level, these watersheds are named after the brook, river or waterbody into which all of the water within that topographically-defined area ultimately flows. Every water feature, no matter how small, has its own distinct watershed.

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[1] CT DEP Bureau of Water Management - Planning and Standards Division. Effective 1996 & 1997. Water Quality Standards. CT DEP. Hartford, CT.

[2] Connecticut Institute of Water Resources (University of Connecticut). October 4, 2001. FINAL DRAFT Report of the Advisory Committee on Potential Best Management Practices for Golf course Water. (Special Report No. 37). Submitted to Connecticut Department of Environmental Protection. Storrs, CT. 75 pp.

The proposed Yale Farm Golf Club project (Project) land is drained by several unnamed streams located within the Whiting River Subregional Basin (No. 6101) [3]. The Whiting River Subregional Basin is one of two subregional basins which make up the Blackberry Regional Basin (No. 61). The Blackberry Regional Basin, in turn, is one of ten regional basins in Connecticut that comprise the Housatonic Major Basin (No. 6). A tiny portion of the Project site also appears to lie in the Blackberry River Subregional Basin (No. 6100).

It is important to note that the Whiting River begins in Massachusetts and then flows into North Canaan, Connecticut before emptying into the Blackberry River. While several of the unnamed streams on the Project site (including one unofficially named Hollow Brook) drain directly to that portion of the Whiting River which lies within Connecticut, one of the unnamed streams flows northeast from Mead Pond which is on the Project site to Ginger Creek which lies a short distance from the Project boundaries. From this point, Ginger Creek flows north and empties into the Massachusetts section of the Whiting River. The "downstream" distance from the point at which this unnamed stream leaves the Project site to the point at which Ginger Creek enters Massachusetts appears to be approximately 0.8 miles. A short segment of Ginger Creek also passes through the northeast corner of the Project site.

Because of their location in the watershed, the streams that drain the Project site are considered headwater sources for the Whiting River and, ultimately, the Blackberry River. Headwater streams such as these 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 Norfolk (and North Canaan) are developed, streams handle increasing amounts of runoff that degrades headwater streams as well as major tributaries. 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; and headwater streams are good indicators of watershed quality. Specific concerns regarding the Project are discussed below.

## Water Quality Concerns

Per federal Clean Water Act requirements as well as Connecticut's own Clean Water Act, the State has adopted Water Quality Standards which establish policy for water quality management throughout the state. The State classes surface and ground water quality based upon these standards and describes water quality goals in terms of designated uses and criteria for each water quality class. Using these classifications, the State's water resources have been broadly evaluated and assigned a classification based upon presumed or known water quality as well as desired use goals. These classifications are used to make decisions as to how these water resources will be managed and what sorts of water-related withdrawals or discharges will be allowed or not allowed. According to water quality classification maps, the surface waters within the proposed Project area are classified as Class A; ground waters are classified as GA[4]. The Whiting River - to which almost all of streams on the Project site eventually drain - is also classified as a Class A surface water.

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[3] Connecticut Geological and Natural History Survey. (Compiled by Marianne McElroy). 1981. Natural Drainage Basins in Connecticut (Map). CT DEP Natural Resources Center in cooperation with the USGS. Hartford, CT.

[4] **Class A surface waters** have overall excellent water quality and the following designated uses: potential drinking water supply; fish and wildlife habitat; recreational use; agricultural, industrial supply and other legitimate uses, including navigation. **Class GA ground waters** have overall excellent water quality and the

As mentioned previously, the unnamed stream that flows from Mead Pond joins Ginger Creek which flows north into Massachusetts and empties into the Whiting River. Not only is it important that the Project applicant maintain the Class A surface water and Class GA groundwater quality designations of the State of Connecticut, it is likewise important that water leaving Connecticut does not violate water quality standards in the Commonwealth of Massachusetts.

According to a conversation with Massachusetts Department of Environmental Protection staff, the Whiting River and Ginger Creek have not been sampled for water quality and therefore are considered "unlisted waters"[5]. The Massachusetts code of regulations states that "unlisted waters" not otherwise designated (as in this case) "are designated Class B, High Quality Waters for inland waters"[6]. The "antidegradation provisions" of these regulations also state that, High Quality "waters shall be protected and maintained for their existing level of quality unless limited degradation by a new or increased discharge is authorized by the Department"[7].

Like Massachusetts, the State of Connecticut has not conducted water quality assessments of the Whiting River to determine whether actual water quality conforms to designated Connecticut water quality standards. However, CT DEP has been assessing water quality in the Blackberry River with regard to specific issues related to PCBs, wastewater treatment plant effluent and nonpoint source runoff. In addition, there is currently an ongoing investigation of a significant fish kill that occurred in the lower part of the Blackberry River this past July (2003) presumably associated with a toxic release.

Besides these issues, CT DEP is concerned about the high level of nutrients within the Blackberry River watershed. In addition to the Norfolk and North Canaan wastewater treatment plants, both of which discharge to the Blackberry River, the watershed is home to a number of active dairy farms. According to a 2001 report on the "Blackberry River Watershed Nutrient Reduction Project", a study funded by U.S. EPA and CT DEP and conducted by the (then) Litchfield County Soil and Water Conservation District[8], "the Blackberry River Watershed has the highest population of animal units in Litchfield County"[9]. Disposal of manure, a nutrient rich waste, is a growing concern, not only in the Blackberry Watershed but across the country. Excessive or improper application of manure to fields and croplands can result in nutrient-laden stormwater run-off to surface water resources that can cause

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following designated uses: existing private and potential public or private supplies of water suitable for drinking without treatment; baseflow for hydraulically connected surface water bodies.

[5] Conversation on 7/25/03 with Mark Schleeweis, Watershed Chief for the Hoosic and Housatonic Watersheds, Massachusetts Department of Environmental Protection. To determine the status of the Whiting River and Ginger Creek, Mr. Schleeweis referenced the Massachusetts Stream Classification Program "Inventory of Rivers and Streams"(July 1982). Under the Massachusetts coding system, the relevant watersheds and water resources are coded as follows: Housatonic Basin (No. 21); Whiting River (No. 03457); Ginger Creek (No. 03500). In this reference, the descriptor for both the Whiting River and Ginger Creek is "Class B", "High Quality Waters".

[6] Massachusetts code of regulations - 314 CMR 4.06(2); As per the Massachusetts Surface Water Quality Standards, **Class B waters**: "are designated as a habitat for fish, other aquatic life, and wildlife, and for primary and secondary contact recreation. Where designated they shall be suitable as a source of public water supply with appropriate treatment. They shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value." Massachusetts code of regulations - 314 CMR 4.05(2)(3)(b)

[7] Massachusetts code of regulations - 314 CMR 4.04(2)

[8] The Litchfield County Soil and Water Conservation District is now the Northwest Conservation District

[9] The Litchfield County Soil and Water Conservation District. Blackberry River Watershed Nutrient Reduction Project. (Report to CT DEP Bureau of Water Management - NPS Program; 319 Contract No. 99-17; Funded through U.S. EPA CWA Sec. 319 Program.) Sec. I - Introduction.

eutrophication. The purpose of this particular project was to assess the nutrient content of selected agricultural fields within the watershed and determine which fields are capable of accepting additional nutrient-rich wastes without oversaturating them. As stated in the report, "[f]ields chosen for the Blackberry River Nutrient Reduction Study were selected based on the field's potential of adding nutrients to the river"[10]. The study concluded that, if agronomic needs for phosphorus were to be used as a criteria for land application of manure, then only a small portion of the total agricultural fields surveyed would be capable of accepting additional nutrient application. To their credit, the farmers of the Canaan Valley Agricultural Cooperative are working on creative solutions to address the problem of manure disposal within their region.

The CT DEP is currently in the process of developing water quality nutrient criteria as required nationwide by U.S. EPA. In the meantime, U.S. EPA has developed "Ambient Water Quality Criteria Recommendations" for rivers and streams for specific "ecoregions" across the country[11]. Limited nitrogen testing of the Blackberry River conducted by CT DEP yielded samples that exceed the recommended U.S. EPA levels of 0.42 milligrams/liter (ppm). Limited phosphorus testing showed levels at or below the recommended U.S. EPA levels of 5 micrograms/liter (ppb).

Although fish and benthic invertebrate surveys generally reveal a relatively healthy aquatic community in the Blackberry River, further increases in nutrients or other substances such as pesticides or nonpoint source runoff would have a negative cumulative impact. During the 6/16/03 ERT site visit, representatives for the Project applicant remarked that they felt that their new, proposed use of the property would probably have less of an impact in terms of fertilizers and pesticides than the previous land use which included raising corn and hay crops. Whether or not this supposition is accurate is beyond the scope of this reviewer's analysis. However, the Commission should consider the proposed Project in light of the water quality concerns described for the Blackberry River Watershed and the potential for the Project to aggravate this situation.

Toward this end, there are several design and management aspects of the proposed Project that merit further scrutiny to ensure that wetlands, watercourses and waterbodies are not degraded by activities on the site. These are as follows:

- The BMPs for golf course design, construction and management as proposed by the Project applicant's consultant, Audubon International, should be compared to golf course BMPs developed by other qualified institutions and organizations. For example, the proposed BMPs should be compared to the FINAL DRAFT "Report of the Advisory Committee on Potential Best Management Practices for Golf Course Water" developed by the University of Connecticut - Connecticut Institute of Water Resources, cited earlier in this chapter. The BMPs should address the full range of issues associated with golf courses, including but not limited to: water conservation, incorporation of buffers, use of fertilizers and pesticides, etc.

- The juxtaposition of numerous golf course elements near wetlands, watercourses and waterbodies on the property is of particular concern. According to the Project application,

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[10] The Litchfield County Soil and Water Conservation District. Blackberry River Watershed Nutrient Reduction Project. (Report to CT DEP Bureau of Water Management - NPS Program; 319 Contract No. 99-17; Funded through U.S. EPA CWA Sec. 319 Program.) Sec. III - Description of Work ñ Field Selection.

[11] U.S. EPA. December 2001. Ambient Water Quality Criteria Recommendations - Information Supporting the Development of State and Tribal Nutrient Criteria - Rivers and Streams in Nutrient Ecoregion VIII. EPA 822-B-01-015.

all but one of the 18 holes will have primary or secondary wetland impacts to a total of more than 13 acres of wetlands[12]. Although this reviewer was not able to consider all scenarios, the following observations have been made:

- ⇒ According to the Project master plan map, one of the unnamed streams on the property - unofficially referred to as Hollow Brook - would be crossed eight times for play-through of holes numbered 2, 7, 11, 12, 13, 15, 16 and 17[13]. In addition, Hollow Brook drains an extensive wetland which would be potentially impacted in other ways by hole number 2, as described below.
- ⇒ As per site visit observations and comparison to Project maps, the play-through area for hole number 2 seems to be located extremely close to and parallels the entire length of an extensive wetland area which is drained by Hollow Brook. The narrow width of the proposed buffer and the potential removal of trees and other vegetation in this area should be carefully considered.
- ⇒ As per site visit observations and comparison to Project maps, hole number 8 is located close to a small impoundment in Hollow Brook that the Project applicant is proposing to enlarge. Again, the width and quality of the buffer adjacent to this impoundment should be carefully considered.
- ⇒ As per site visit observations and comparison to Project maps, the play-through area for hole number 3 crosses an unnamed stream toward the bottom of a ravine that drains to Mead Pond.
- ⇒ As per site visit observations and comparison to Project maps, the play-through area for hole number 4 crosses Mead Pond which drains to Ginger Creek.

In all of these examples, golf course elements cross over or are located adjacent to wetlands, watercourses and waterbodies and represent areas where the landscape will be modified and managed both physically and chemically. Unless diligently overseen, these areas could serve as conduits for pollutants such as fertilizers, pesticides and sediments to enter waterways and impact the greater watershed.

Although well planned buffers may help mitigate deleterious effects in some of these instances, it should not be assumed that buffers can address all of the concerns raised by the above impacts. For example, the multiple crossings of Hollow Brook also mean that the tree canopy will be broken in numerous locations which could result in less shading of the stream and increased water temperatures. Depending on the situation, even slight increases in water temperature can have negative effects on fish and other aquatic species. In this case, the low-growing, vegetated buffers which would be needed for golf course play-through might address the issue of nonpoint source runoff but not the issue of decreased shading.

In instances where buffers are proposed, they should be evaluated for potential effectiveness in mitigating runoff and protecting water quality. The importance of vegetated streamside buffers has been well documented in the scientific literature. Buffers play a major role in helping to maintain the overall health and integrity of a watershed. Determining the appropriate width of a buffer is site-specific and is dependent upon the geography of the land and the intended function of the buffer. The CT DEP Fisheries Division recommends a 100 foot buffer zone along perennial streams, and a 50 foot buffer zone along intermittent streams.[14] DEP Fisheries

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[12] Milone & MacBroom. March 2003. Yale Farm Golf Club,L.P. - Inland Wetlands and Watercourses Permit Application - Sec III - Project Narrative. Table 4-4. Page 4-3.

[13] Map. February 2003. Master Plan - Yale Farm Golf Club - Towns of Norfolk and North Canaan, CT.

[14] CT DEP Fisheries Division. 1991. Policy Statement - Riparian Corridor Protection; Position Statement - Utilization of 100 Foot Buffer zones to Protect Riparian Areas in Connecticut.

further recommends that this buffer zone remain in a naturally vegetated and undisturbed condition. There may be instances, due to steepness of terrain or other considerations, where a wider buffer would be more appropriate.

- In addition to the potential impacts of golf course elements described above, other facilities and features - such as parking lots, roads and cart paths - associated with the golf course should be examined in terms of possible cumulative nonpoint source water quality impacts. As described in the Project application:

  > An on-site storm drainage system is proposed to collect stormwater runoff from the proposed golf course, clubhouse, recreation center, maintenance building, access driveways and parking areas (in Norfolk). The proposed system will use several Best Management Practices (BMPs) to provide stormwater management and water quality measures.
  >
  > The stormwater management system will use a combination of conventional subsurface pipe systems as well as overland grass-lined swales. The stormwater runoff will be directed to several on-site detention/water quality basins that will be used to attenuate peak flow rates as well as provide stormwater treatment before discharge to receiving waters ...[15]

  While the Project applicant proposes to use retention basins and other BMPs to mitigate the impact of stormwater runoff, the Commission should evaluate the proposed system in terms of how stormwater flow is handled and its potential effectiveness in renovating water quality for potential pollutants such as fertilizers, pesticides, oils, grease, sediments, etc. Long-term maintenance of stormwater structures is also an important consideration.

  It is noted that two of the three parking areas shown on the master plan map are located near Hollow Brook, and the third is situated near another unnamed stream. Presumably, drainage from these parking areas will ultimately be discharged to these streams. Given this scenario as well as the multiple stream crossing issue discussed earlier, it is important that the Commission study the potential cumulative impacts to Hollow Brook carefully.

- To insure that operation of the completed golf course and its associated facilities and features are not degrading water quality in the streams that flow from the project site, regular monitoring should be conducted and reported to the Commission. The Project applicant has proposed an "Environmental Monitoring Program"[16] which should be reviewed carefully by the Commission. As a condition of approval, the Commission may wish to request that the Project applicant provide yearly funding to hire an independent consultant of the Commission's choosing to review and/or conduct the monitoring program.

- In addition to the potential impacts that the golf course may have on water quality, the potential impacts associated with subdivision of the land into 61 proposed house lots must be considered. Each house lot will have water supply, septic and drainage issues to address, not to mention other potential impacts such as fertilizer and pesticide usage for lawn care and maintenance.

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[15] Milone & MacBroom. March 2003. Yale Farm Golf Club,L.P. - Inland Wetlands and Watercourses Permit Application - Sec V - Engineering Report - Hydrology Study. Page 5.

[16] Milone & MacBroom. March 2003. Yale Farm Golf Club,L.P. - Inland Wetlands and Watercourses Permit Application - Sec VII - Natural Resource Management Plan - Sec. 5.5 Environmental Management Plan.

Although the Project applicant proposes to place conservation restrictions on these lots which will vary in size from 3 to 34 acres[17], their intention to monitor homeowner activities throughout a 780 acre area seems unrealistic. The Project applicant would most likely have much better control over homeowner activities if the 61 conservation restricted lots were to be much smaller. Protection of the remaining acreage would be better accomplished if it were to be set aside as permanently protected conservation land. Such an area would still need to be regularly monitored to prevent homeowner encroachments as well as other inappropriate activities. Ideally, the permanently protected conservation land would be held and overseen by an outside conservation entity such as the Norfolk Land Trust.

## Water Quantity Concerns

From a watershed perspective, the cumulative impact of water usage must be assessed carefully, particularly since the water resources on the Project site contribute headwater flow to the Whiting River and, ultimately, the Blackberry River. The period of highest water consumption coincides with the time of year when natural systems are also most stressed. This is especially important since water quantity is intimately tied to water quality. The calculations and assumptions presented by the Project applicant for estimated water requirements and proposed conservation measures should be reviewed to determine if they are realistic, accurate and consistent. This being said, the following comments are offered:

The proposed Project will require the use of four wells and creation of a storage pond for irrigation of the golf course. According to well pumping tests conducted by the Applicant, the available supply for irrigation is 298,080 gpd, less 14,400 gpd which will be released to Hollow Brook from a small impoundment on the stream, making the total available supply for irrigation 283,680 gpd. [18]. The Applicant has developed an irrigation management plan with the goal of keeping total water usage between 250,000 to 280,000 gpd[19]. Various irrigation scenarios utilizing water conservation measures have been developed to address potential irrigation needs under a range of normal to drought conditions. Irrigation needs are highest during the months of June, July and August, with July being the month of greatest need.

According to the Application, July turfgrass irrigation requirements (for putting greens, tees, fairways and rough) range from 326,616 gpd under normal conditions to 518,081 gpd under extended drought conditions[20]. Given that this range greatly exceeds total irrigation supply available, it must be assumed that these figures are for "ideal" golf course conditions with unlimited water supply available. It is noted that the Applicant has revised these estimates in the "Water Diversion Permit Application" submitted to CT DEP. The revised estimates for July range from 307,469 gpd (for putting greens, tees, fairways and rough) under normal

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[17]Milone & MacBroom. March 2003. Yale Farm Golf Club,L.P. - Inland Wetlands and Watercourses Permit Application - Sec III - Project Narrative. Page 1-7.

[18]Milone & MacBroom. March 2003. Yale Farm Golf Club,L.P. - Inland Wetlands and Watercourses Permit Application - Sec. I - Project Introduction and Overview of Document Organization - Potential Impacts to Instream Flow. Page I-12.

[19]Milone & MacBroom. March 2003. Yale Farm Golf Club,L.P. - Inland Wetlands and Watercourses Permit Application - Sec. I - Project Introduction and Overview of Document Organization - Irrigation Demand. Page I-13.

[20]Milone & MacBroom. March 2003. Yale Farm Golf Club,L.P. - Inland Wetlands and Watercourses Permit Application - Sec. VII - Natural Resource Management Plan - Sec.4.0 Water Conservation Management - Table 4.5. Page 4.6.

conditions to 174,784 gpd (for putting greens, tees and fairways but not primary rough) under extended drought conditions[21].

Although CT DEP will ultimately be making the decision as to whether or not to grant a water diversion permit to the Project, the Commission should none-the-less be supplied with the same information given to CT DEP. According to dates on the materials, the CT DEP diversion application preceded the Commission inland wetlands application.

In both the CT DEP diversion permit application and the Commission inland wetlands application, identical tables are provided giving various irrigation scenarios under normal and drought situations. In the table showing "two normal, average-year scenarios", it is shown that in July, 264,453 gpd would be required if all areas were to be watered to 100%[22]. This figure differs by approximately 40,000 to 60,000 gpd from the daily irrigation demand estimates given for normal conditions in the turfgrass irrigation requirement tables described above - which are 307,469 gpd and 326,626 gpd, in the CT DEP diversion and Commission inland wetland applications, respectively.

Likewise, the numbers given for July in the table showing "four drought scenarios" appear to use a different set of assumptions than those used to predict turfgrass irrigation requirements under extended drought conditions as per the tables described previously. For example, the "four drought scenarios" table shows that in July, 417,080 gpd would be required to water all areas to 100%[23]. This number differs by approximately 100,000 gpd from the presumed "worst case" scenario given as 518,081 gpd in the table showing turfgrass irrigation requirements under extended drought conditions in the Commission inland wetlands application. In addition, the "four drought scenarios" table does not include the turfgrass irrigation requirement estimate of 174,784 gpd which assumes primary rough areas are not watered under extended drought conditions, as put forward in the CT DEP diversion application.

In addition to the estimated irrigation needs of the golf course, the water supply needs for the proposed club house, maintenance buildings, and overnight accommodations are expected to be around 5,000 gpd, not including two guest houses which will continue to be served by existing on-site wells[24]. The potential water usage of the proposed 61 lot subdivision has not been estimated. From the stand point of cumulative impact, these additional water use needs should also be considered.

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[21]Milone & MacBroom . November 2002. Yale Farm Golf Club - Water Diversion Permit Application. (Submitted to CT DEP). Attachment M - Sec. 3.0 Irrigation Demand Analysis. Pages 3-1 to 3-2 and table in Appendix A at end of Attachment M labeled "Turfgrass Irrigation Requirements for Yale Farm Golf Club, Norfolk and North Canaan, CT under Normal and Extended Drought Conditions".

[22] Milone & MacBroom. March 2003. Yale Farm Golf Club,L.P. - Inland Wetlands and Watercourses Permit Application - Sec. I - Project Introduction and Overview of Document Organization - Irrigation Demand. Page I-13.

[23]Milone & MacBroom. March 2003. Yale Farm Golf Club,L.P. - Inland Wetlands and Watercourses Permit Application - Sec. I - Project Introduction and Overview of Document Organization - Irrigation Demand. Page I-13.

[24]Milone & MacBroom. March 2003. Yale Farm Golf Club,L.P. - Inland Wetlands and Watercourses Permit Application - Sec. I - Project Introduction and Overview of Document Organization -Drinking Water Supply, Use, and Sewage Disposal. Page I-11.

## Bibliography

CT DEP Bureau of Water Management - Planning and Standards Division. Effective 1996 & 1997. Water Quality Standards. CT DEP. Hartford, CT.

CT DEP Fisheries Division. 1991. Policy Statement - Riparian Corridor Protection; Position Statement - Utilization of 100 Foot Buffer zones to Protect Riparian Areas in Connecticut.

Connecticut Geological and Natural History Survey. (Compiled by Marianne McElroy). 1981. Natural Drainage Basins in Connecticut (Map). CT DEP Natural Resources Center in cooperation with the USGS. Hartford, CT.

Connecticut Institute of Water Resources (University of Connecticut). October 4, 2001. FINAL DRAFT Report of the Advisory Committee on Potential Best Management Practices for Golf course Water. (Special Report No. 37). Submitted to Connecticut Department of Environmental Protection. Storrs, CT.

The Litchfield County Soil and Water Conservation District. Blackberry River Watershed Nutrient Reduction Project. (Report to CT DEP Bureau of Water Management - NPS Program; 319 Contract No. 99-17; Funded through U.S. EPA CWA Sec. 319 Program.).

Massachusetts Department of Environmental Protection. (Conversation on 7/25/03 between Mark Schleeweis, MA DEP Watershed Chief for the Hoosic and Housatonic Watersheds and Susan Peterson, CT DEP Housatonic Watershed Coordinator)

Massachusetts code of regulations - 314 CMR 4.04(2); 4.05(2)(3)(b); 4.06(2)

Milone & MacBroom . November 2002. Yale Farm Golf Club - Water Diversion Permit Application. (Submitted to CT DEP).

Milone & MacBroom. March 2003. Yale Farm Golf Club, L.P. - Inland Wetlands and Watercourses Permit Application (to the Town of Norfolk) .

Map. February 2003. Master Plan - Yale Farm Golf Club - Towns of Norfolk and North Canaan, CT.

U.S. EPA. December 2001. Ambient Water Quality Criteria Recommendations - Information Supporting the Development of State and Tribal Nutrient Criteria - Rivers and Streams in Nutrient Ecoregion VIII. EPA 822-B-01-015.

# Water Quality and Pesticides

## Introduction

This section of the Environmental Review Team (ERT) report addresses the subject of the potential impact by pesticides to the water resources environment. The area of concern is the 780 acre Mead Farm now known as the proposed Yale Farm Golf Course site located in Norfolk and North Canaan, Connecticut. At this time the focus of the ERT is the initial golf course proposal although in the future large lot residential housing in a conservation subdivision is envisioned for areas in and around the golf course.

## Purpose

The purpose of this chapter of the ERT report is to assess the vulnerability of the bedrock aquifer to the introduction of pesticides as listed in the project documents. This assessment of the relationship of the site's hydrogeology to the potential migration of pesticides is critical because routine usage of pesticides has resulted in the unintended consequence of the migration of pesticides to surface water and groundwater. Because the hydrogeology forms the matrix through which water and any water-borne constituents travel, this chapter will examine the site hydrogeology with regard to the pesticides selected for use in the Yale Farm Golf Course plan.

## Background

The ERT review has been conducted in response to the request from the Inland Wetland Commission of the town of Norfolk, CT. An initial meeting followed by a field site evaluation was held at the Yale Farm in Norfolk/North Canaan on June 16, 2003. ERT field team members, the Yale Farm Golf Club, L.P. developers and consultants were in attendance. At the meeting the developers and their consultants presented various maps and descriptions of the Yale Golf Course Project plan proposal. In addition to the project plans and documents, the Yale Farm Golf Course developers provided a color copy of a New York Times article published on June 6, 2003. This article described golf courses built in a natural style to minimize environmental impact. In the article, natural golf courses, such as Bandon Dunes and Pacific Dunes in Oregon, were featured. Pacific Dunes' golf course superintendent, is quoted as saying only organic products are used in golf course maintenance. Surprisingly, despite that positive outlook for a "natural" golf course alluded to at the meeting and described in the news article, no further mention of an organic approach to the golf course appeared in project documents. Indeed, golf course maintenance using an organic approach is a viable alternative to conventional maintenance of a golf course using pesticides. Organic methods are the preferred method for a variety of reasons. The principal reasons revolve around the issues of #1 protection of public health and #2 preservation of environmental integrity. Specifically, organic maintenance will allow the project to protect not only the existing domestic water supplies in the area but the new water supplies developed for the golf course and the new homes. Further, liability for potential contamination of the water supplies will be avoided. It should be pointed out that liability for contamination through the migration of pesticides lies with the pesticide applicator who is responsible for providing remediation and an alternative water supply. (1) Later discussion in this chapter will present the uncertainties associated with clean-up methods for low level pesticide occurrence in water. The following sections will address issues related to this approach and explain why an organic golf course approach is the preferred strategy.

# Findings and Issues

## Pesticides and the Norfolk/North Canaan Hydrogeological Setting

The major issue in this section is to consider the potential fate and transport of pesticides. Pesticides can be detected throughout the hydrologic cycle, in groundwater, surface water, in the atmosphere, and in rainfall. Here we are focusing on the potential occurrence and migration of pesticides in the groundwater and the surface water. In Norfolk and North Canaan, groundwater movement is bedrock controlled through a system of fractures and faults. This movement is linear and is related to how well the system of fractures, faults or discontinuities are interconnected. This is termed the secondary permeability of the rock type. Another term used to describe this movement or flow of groundwater is hydraulic conductivity which describes the rate of flow for groundwater.

The bedrock of the Yale Farm area reflects extensive tectonic transposition. The major bedrock types are schist and gneiss. Fractures within the rock mass conduct the flow of groundwater. Often, where a rock contact occurs, a discontinuity will preferentially direct water flow. The bedrock mapping for the area reveals many thrust faults, potential sites for groundwater movement. The unusually high well yields in the site's Irrigation wells #6 & #7 are likely intersecting through thrust slices, the coarse-grained schist of the Canaan Mountain thrust and the amphibolitic gneiss of the Haystack Mountain thrust. Thrusts are structural fault features reflective of tectonic movement. These allochthonous formations, meaning the rocks were tectonically moved from their original location, are thought to have become emplaced during the Taconic orogeny. (2)

The other factor governing the potential movement of water and pesticides is the runoff or overland flow component where surface water and its constituents move according to the existing topographic contours. The panoramic ridges, hills and valleys of Norfolk and North Canaan are also the result of tectonism and subsequent erosion. The unique topography provides the considerable relief or variable elevation over which surface water runoff and its constituents move.

In summary, pesticide migration from its point of application can travel via surface water runoff and by vertical and horizontal groundwater movement.

The bedrock aquifer at Norfolk and North Canaan is vulnerable to the potential fate and transport of pesticides.

Among the many factors influencing the above described hydrogeological scenario are the following:

## Selected Pesticides Migrate to Groundwater

The selected pesticides found in the project documents were compared to recent US Geological Survey and other literature on the subject of pesticides and their occurrence in water. Nearly all of the pesticides selected for use at the proposed Yale Farm Golf Club have already been detected in groundwater beneath golf courses. (3 & 4) The selected pesticides include: fungicides, herbicides, insecticides, a nematicide, and a plant growth regulator. The exceptions were a few new pesticides and a biological. The lists are found in the Yale Farm Golf Club project proposal document, Part VII, entitled, Natural Resource Management Plan in Tables 3-8 and 3-9 and in Appendix I, "Analysis of Pesticides for Use at Yale Farm Golf Club" written by the Audubon International Institute.

Ironically, in Section 3.2.2, p. 3.13 of Part VII, the statement is made that "the most important aspect of the fertilizer program at the Yale Farm Golf Club is to ensure that the nutrients (nitrogen and phosphorus) applied to the golf course turf and landscape areas do not migrate to surface or groundwater." No similar statement was found in the document to ensure that pesticides do not migrate to surface water and groundwater. To the contrary, a risk assessment to evaluate the potential toxic effects of pesticides was run for the pesticides selected for use on the proposed Yale Farm Golf Course. This action assumes some level of pesticide exposure both to the environment and to human health. Eliminating an exposure altogether by simply not using pesticides is not considered.

Audubon International Institute, the author of Part VII, the Natural Resource Management Plan for the Yale Farm Golf Course proposal is described elsewhere as a US Golf Association (USGA) partner that promotes golf courses as wildlife sanctuaries. The Audubon Cooperative Sanctuary System is a division of Audubon International. The Sanctuary Program seeks to enlist golf courses to attain certification. It is financially supported by the USGA and other golf course development groups and is not affiliated with the National Audubon Society. (5)

Consideration of the use of a pesticide must be weighed against its potential to migrate to what is termed a receptor. In this case, many receptors exist as the downgradient and downstream end point impacts. For example, existing and future drinking water wells, irrigation wells, wetlands, surface water and groundwater ecological habitats can reflect the migration and occurrence of pesticides introduced to the environment. In the case of an existing or proposed residential well, pesticides or their degradation compounds can migrate to those wells. Degradation compounds are also called metabolites. They can be, in some cases, more toxic than the parent compound. Sometimes, metabolites are less well known and can present extra difficulties with regard to their laboratory analytical detection. So, ironically, unintended consequences of pesticide use may result. Responsibility for contaminating a drinking water well or other receptor rests with the pesticide applicator.

## Recent Data

New data from current research reveals that pesticide products once thought to be non-leachers are being discovered in groundwater.(3,4) Previously, there were screening tools to evaluate the physical and chemical characteristics of pesticides, such as the solubility, half-lives and the KOC or soil/water partitioning coefficient. Heretofore, the screening tool would categorize the pesticide as a leacher or an adsorber meaning the pesticide would display a tendency to leach into surface and groundwater or to adsorb onto soil or sediment particles. Of course, as an adsorber, the residual pesticide would then function as a source (pollutant) for periods of time and be available for migration into the groundwater resource for longer residence times. Now, however, the data is revealing that those products thought to be categorized as non-leachers are migrating to the groundwater. An important concept to keep in mind is that the knowledge of pesticide occurrence in surface and groundwater has been developing since about 1979 when discoveries were made on Long Island of the pesticide aldicarb. Refinements in analytical tools together with an emphasis on discovery is resulting in more and more information about how sensitive the water resource environment really is to pesticides applied according to label directions.

## Additional Hydrogeologic Data for Site

Well completion reports for five irrigation/test wells indicate high yields, 150 gpm, in two of the five wells. (6) These are uncharacteristically high well yields for this type of bedrock setting. The high yields indicate that the borehole drilling intersected a fracture or fault zone. The implications from this data are two-fold. Although the two high-yielding wells indicate a

high productivity, the long term yield beyond the five day pump test or seasonal pumping at a rate of 283,680 gallons per day (gpd) may not be sustainable. Additionally, the potential effect on the productivity of any existing or future domestic wells from long term seasonal pumping must be considered. Similarly, the occurrence of a fracture zone and its corresponding connectivity to other fractures illustrates the great potential for high transmissibility of groundwater and its constituents through this bedrock aquifer. The implications for potential pesticide migration (fate and transport) through this bedrock aquifer are significant.

Recent monitoring of surface and groundwater has documented the fact that pesticides are being detected more and more as efforts to monitor have become more refined and widespread. Low level occurrences of pesticides in the water resources environment are inferred to be the result of routine pesticide use. This is considered to be the unintended consequence of pesticide usage. It is known that the legal labeled usage of a pesticide can result in the migration of the pesticide to surface and groundwater.

## Ineffective Water Treatment Methods

Once low level residues of pesticides occur in water, conventional water treatments, such as, filtration, coagulation, flocculation and sedimentation have little to no effect on the removal of mobile (hydrophilic) pesticides. (7) Advanced water clean-up methods, such as, granulated activated carbon (GAC) and powdered activated carbon (PAC) are rarely used in smaller water systems. Glyphosate, the popular herbicide known as Round-up, is not removed from water supplies by conventional treatments and furthermore is not removed with ultrafiltration membranes. GAC appears to remove glyphosate but only if organic matter is present, an alum coagulant is used and turbidity is zero. (8) Again, this discussion refers to low levels of pesticides, those concentrations expected from ordinary labeled usage of pesticides as contrasted to a grossly contaminated situation that may be caused by a spill or an accident.

# More Issues of Concern

## Pesticide Usage at Golf Courses

Typical pesticide usage at an 18-hole golf course can amount to several hundred gallons of liquid products and a few to several tons of granular products per year according to annual summary sheets maintained by golf course supervisory pesticide applicators and submitted to the Connecticut Department of Environmental Protection. Upwards of 50 or more products are routinely used at many individual golf courses. Multiple applications are made daily, or several times weekly according to record-keeping.

One popular product, imidicloprid, is used preventatively for grub control on turf meaning the product is applied as a pretreatment, before actual evidence of insect damage is seen. One golf course recorded the use of imidicloprid at 15,000 lbs. for one season. Imidicloprid is an insecticide that carries the red warning label, "This chemical demonstrates the properties and characteristics associated with chemicals detected in groundwater. The use of this chemical in areas where soils are permeable particularly where the water table is shallow may result in groundwater contamination." Imidicloprid is listed for usage in the project documents for the proposed Yale Farm Golf Club.

Before the change to organic practices, pesticide usage was analyzed for 52 golf courses on Long Island, NY. It was found that the average golf course application rate is 18 pounds per treated acre per year. This is about seven times the agricultural rate of 2.7 pounds per treated

acre per year. (10) Now, however, most Long Island golf courses are practicing some form of organic maintenance.

## Water Quality Monitoring

The inherent problem with a water quality monitoring program designed for a traditional golf course is that detections of pesticides become an after the fact situation necessitating clean-up. Remediation is costly, incomplete or impossible to achieve for low levels of pesticides. Refer to section ***"Ineffective Water Treatment Method"*** on the ineffectiveness of clean-up of low levels of pesticides.

Moreover, analytical testing for many pesticides compounds and their degradates can be very difficult if not impossible to test for. This can be related to equipment requirements, technician capability or incomplete information on degradate (metabolite) compounds. Most pesticides degrade by way of soil or hydrolysis half-lives into other compounds that may be more toxic than the parent compound. Furthermore, routine monitoring or screening for large number of pesticides typically used on an old-style golf course can be impractical, expensive and difficult.

Data from Long Island, New York suggests that pesticide degradates may occur significantly more often in groundwater that the parent compounds. (4)

## MCLs Maximum Contaminant Levels

Only 14 currently registered pesticides have MCLs. MCL stands for Maximum Contaminant Level and is the enforceable limit for the federal Safe Drinking Water Act (SDWA). These limits, however, are applied to public drinking water supplies. (water utilities). However, where there is no MCL, an Unspecified Organic Contaminant (UOC) standard of 50 ppb can be applied. (4)

## Screening Tools Less Useful

Previously, screening tools were employed to ascertain the relative tendency of a pesticide to either leach or be adsorbed onto soil particles. Adsorbers were considered to be non-leachers. These screening methods are now less valuable since products once determined to be adsorbers or non-leachers have now been discovered in groundwater. (3,4).

Only recently, especially over the last ten years, have analytical techniques become sufficiently refined to detect pesticides in water at parts per billion (ppb) and even parts per trillion (ppt) range. Low levels of pesticides can cause both acute and chronic public health and environmental impacts. As discussed earlier, low levels of pesticides in a water supply are difficult if not impossible to clean up with traditional as well as more sophisticated treatment systems. Even sewage treatment plants are finding residues of pesticides after the treatment process has been completed. (9)

## Combination Effects Unknown

Another important consideration when evaluating pesticide usage and potential impact to the environment is the fact that very little is known about the combination effect of several or more than one pesticide in usage.

## Shallow Depth to Groundwater

One important condition prevalent virtually everywhere in Connecticut, shallow depth to groundwater, makes many areas especially susceptible to the migration of pesticides to groundwater. Depth from the ground surface to groundwater at the water table is almost everywhere less than 35 feet and frequently less than 15 feet from the land surface. (11)

Specifically, in the bedrock aquifer at the Yale Farm site, depth to water is shallow, as indicated on the well completion reports for the pump test/irrigation wells. (6)

Although the bedrock aquifer (crystalline gneiss and schists) would be expected to yield in the single digit gallons per minute (gpm) ranges, the well completion reports for two of the five pump test/irrigation wells record a yield 150 gpm which means that during the drilling, a major discontinuity (fracture or fault zone) was intersected. It is through these fractures that groundwater moves. As discussed earlier, these fractures form the secondary permeability of the bedrock aquifer. In fact, the well records indicate the depth at which these major discontinuities occurred: In well #7 in Norfolk, the water-bearing fractures occurred at the 175' and 185' depths. In well #6 in North Canaan, the water-producing fractures were logged at 60', 80', 145' and 280' depths or distances from the ground surface. (6) Informative drilling reports such as these are very helpful in understanding the location of these water-bearing fractures as well their potential interconnectedness. Although high yielding wells are not the norm in northwestern Connecticut, the significance of their occurrence is not only limited to a potentially larger supply of water. Implications point to the particular susceptibility of this bedrock aquifer to transmit the groundwater and any accompanying constituents rapidly through this interconnectedness.

## Metabolites

Metabolites are another issue of great importance when considering the use of pesticides. A metabolite refers to the breakdown product of the original pesticide product's "active ingredient." A metabolite is also called the degradate. The half-life property of a pesticide is related to the conversion of some of the pesticide's active ingredient into its respective metabolite.

Full information on metabolites of all pesticides particularly their human and environmental toxicity is incomplete but it is known that some metabolites can be more toxic than the original parent compound. One example is the metabolite tetrachloroterephthalic acid (TCPA), a metabolite of the parent compound, dacthal (DCPA), a favorite of golf courses. TCPA is more readily found to leach to groundwater. (4) Oddly enough, dacthal has a low solubility, which earlier screening tools would have classified as a non-leacher. See section entitled, **"Screening Tools Less Useful."**

Analytical identification capability of the metabolite may be absent or incomplete. It is also critical to identify metabolites since monitoring and detections for pesticides in soil or water would be occurring after the fact. Because the half-life conversion is underway, analyzing for the metabolite as well as the parent compound is necessary.

Data from Long Island, NY suggests that pesticide metabolites or degradates may occur significantly more often in groundwater than the parent compounds. (4)

## Inerts

A pesticide is composed of the active ingredient and the inerts. The active ingredient is the chemical that controls or eliminates the targeted organism (e.g. insect, weed, fungus) The other component of pesticides is called the inert ingredient. This term "inert," however, is quite misleading since often the inert ingredient is not truly inert and actually can be quite toxic. The New York State Office of the Attorney General found that more than 200 chemicals used as inert ingredients in pesticides are actually hazardous pollutants according to federal environmental statutes. They also determined that fewer than 10 percent of pesticide products list any inert ingredients on their labels. (9A) Industry resists disclosure of inert identification claiming that the information is confidential or proprietary. Ironically, there is a move to eliminate the use of the word by EPA and substitute the word other in the manner of the FDCA for example, in the labeling of cosmetics. The use of the word inert is intended to protect proprietary information but also imparts a misleading innocuous connotation. EPA has only addressed the issue of inerts since 1989 and has categorized common inerts into the four categories: List # 1 consists of "Inerts of Toxicological Concern." As an example, trichlorethylene is on List # 1. List #2 contains "Potentially Toxic Inerts with a high priority for testing." An example of a compound on List #2 is toluene. EPA strongly encourages pesticide product registrants to substitute or remove from their products List 1 or List 2 ingredients. Despite this, EPA has recently registered some products that still contain inerts from List #2 chemicals that are supposed to be phased out of usage. Nonetheless, it is very important to ascertain what the inert is in a pesticide product since it can be a hazardous material and just as toxic or acutely toxic as the "active ingredient" in a pesticide. As an example, one popular golf course fungicide contains 85% solvents as the inerts. The percentage amount of active ingredient and inerts of the product will appear on the label but the actual identification of what the inerts are may not. One way to possibly find out what the inerts are is to refer to the Material Safety Data Sheets (MSDS) for the product.

## Resistance

Resistance is the condition whereby a pest (an insect, weed or fungus) develops a resistance to the repeated usage of a pesticide. In other words, the pesticide is no longer effective. One example is the number one pest of golf course turf, Dollar spot (Sclerotinia homoeocarpa) which has developed resistance to the repeat applications of fungicides. There are biological control alternatives, such as common soil-borne bacteria, to control Dollar spot. (12)

## Organic Alternatives

The document, Standards for Organic Land Care, Practices for Design and Maintenance of Ecological Landscapes is included in full in the ERT report. See Appendix.

This document sets out the principles and goals of organic land care. These principles can be adapted to and applied to many different landscapes agriculture, lawn care and golf courses. It is reportedly the first publication of a comprehensive Standard for Organic Land Care, published in 2001.

There are many golf courses that have adopted an organic maintenance strategy. Many are on Long Island where some organic maintenance is mandatory by county law. Locations include: Huntington, Timber Point, Yaphank, and Sands Point. Sagamore-Hampton in New Hampshire has been not only organic but pesticide-free since the mid 1960's. Squaw Valley resort in California has a no spray program since 1988. (13) Organic and IPM (Integrated Pest

Management) pest control approaches are used at the Presidio in San Francisco, CA; Desert Willow in Palm Desert CA; Widow's Walk in Scituate, MA; and, Pinehurst Resort, Pinehurst, NC (14).

Resource materials on the topics of organic and IPM pest control approaches are detailed in the following resources: Common Sense Pest Control by W. S. Olkowski et al, The Taunton Press, Newtown, CT; Bio-Integral Resource Center, P.O. Box 7414, Berkeley, CA; Cornell University IPM Program, New York State Agricultural Experiment State, Geneva, NY 14456.

## Conclusion

Geologic mapping and irrigation well yields indicate that the bedrock aquifer at the Mead Farm/Yale Farm Golf Club project location is vulnerable to the introduction of any contaminants. The only way to guarantee that pesticide parent compounds and their metabolites do not migrate to the surface water and groundwater resources of the area is to avoid their use. An organic maintenance strategy for the Golf Club safeguards the water supplies of the Club, neighbors and future residents and eliminates the liability issue of pesticide migration to those water supplies.

## References

(1) http://pmep.cce.cornell.edu/facts

(2) Harwood, David S., Geologic Map of the South Sandisfield Quadrangle, Massachusetts and Connecticut, 1979.

(3) Barbash, Jack, Pesticides Used On And Detected in Groundwater Beneath Golf Courses, 4-3-1997 and 11-24-1998. National Water Quality Assessment (NAWQA), Pesticide National Synthesis Project.

(4) Suffolk County Department of Health Services, Water Quality Monitoring Program to Detect Pesticide Contamination in Groundwaters of Nassau and Suffolk Counties, New York, 1999, 2000, 2001.

(5) Massachusetts Audubon Society, Golf Courses and the Environment, August, 1999.

(6) Sima Drilling Company, Inc., Drilling Well Completion Certificates, #s 1, 2, 5, 6, 7, Norfolk and North Canaan, June, 2002.

(7) U.S. EPA Office of Pesticide Programs, The Incorporation of Water Treatment Effects on Pesticide Removal and Tranformations in Food Quality Protection Act (FQPA) Drinking Water Assessments, October 25, 2001.

(8) Speth, Thomas F. "Glyphosate Removal from Drinking Water," Journal of Environmental Engineering, vol. 119, no. 6, Nov./Dec. 1993. pp. 1139-1157.

(9) Central Contra Costa Sanitary District, California, http: / /www.centralsan.org

(9A) Office of the New York State Attorney General, Eliot Spitzer, The Secret Ingredients in Pesticides: Reducing the Risk: www.oag.state.ny.us

(10) Office of the Attorney General, New York State, Toxic Fairways: Risking Groundwater Contamination from Pesticides on Long Island Golf Courses, 12-95.

(11) Singer, J. "Pesticides" in Protecting Connecticut's Water Supply Watersheds: A Guide for Local Officials, CT DEP, 2000.

(12) http://www.msue.msu.edu

(13) http://www. HANS.org

(14) New York Times, Metro 4-20-99.

# Stormwater Review

Since the site construction involves the disturbance of over five acres, Connecticut's General Permit for the Discharge of Stormwater and Dewatering Wastewaters (the "Permit") will cover the project. The permit requires that the site register with the Department of Environmental Protection (CTDEP) at least 30 days before the start of construction. The registrant must also prepare, submit and keep on site during the construction project a Stormwater Pollution Control Plan (the "Plan"). The Plan must be followed and updated as needed during the course of construction. For example, if the single row of silt fence along the ponds and wetlands is inadequate then the erosion controls should be re- evaluated and updated to prevent pollutants from discharging off site.

Please note that while this review is based primarily on the State Permit, many of the erosion and sedimentation issues are included in the Connecticut Guidelines for Soil Erosion and Sediment Control (the "guidelines"), and are issues that must be dealt with on a local level before being included in the Plan, Silt fence installation must comply with the guidelines, and may be used only in drainage areas of one acre or less.

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 and limits of disturbance that will be used during each phase of construction. Specific site maps and controls must be described in the Plan, as well as construction detail; for each control used. *Wherever possible, the site shall be phased to avoid the disturbance of over five acres at one* time. The Department recommends each phase of construction be stabilized before proceeding to the next phase. It is not clear from the plans if the golf club amenities construction will take place before, during or after construction of the golf club facilities. Again, the Department recommends that one phase be stabilized before moving on to the next. The more disturbed soil exposed the greater potential source of pollution to the waters of the state.

For construction activities which result in the disturbance of ten or more acres of land area at one time, the Plan shall be submitted to the commissioner no later than thirty days before the initiation of construction activities.

This project has steep slopes, a large amount of wetlands, and sensitive surface waters that must be protected, (both on-site and in close proximity off-site), which will make ongoing inspections and adjustments of controls an important 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. Although the plans indicate the contractor will contact the owner when conditions warrant additional erosion control measures, 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 potentially needed, a full time erosion and sediment control inspector, approved by the Department, should be required by the town during construction.

The permit (Section 6(C)(i)) requires when construction activities have permanently ceased or been temporarily suspended for more than seven days or when final grades are reached at any portion of the site, stabilization must occur within three days.

Structural practices including sedimentation basins are required for any discharge point that serves an area greater than 5 disturbed acres at one time. The basin must be designed in accordance with the guidelines and provide a minimum of 134 cubic yards of water storage per acre drained. *Particular care must be taken near surface water locations*. Leave as large a vegetative buffer as possible in these areas. Maintenance of all structural controls shall be performed in accordance with guidelines and the Plan must identify these practices.

The permit (Section 6(b)(6)(C)(iii)) requires that the plan include a design for post-construction stormwater treatment of 80% of total suspended solids from the completed site. In order to comply with this requirement, the Department recommends incorporating swirl concentrator technology.

## Other Issues

Upon completion of construction, if the site has more than five acres of impervious surface construction, it may be necessary to register for the General Permit for the Discharge of Stormwater Associated with Commercial Activity and prepare a stormwater management plan.

On Page EC-1, Section II A.8 it indicates inspection will be conducted weekly during the spring and monthly during the summer and after 0.5 inches of rainfall. However, the Stormwater General Permit requires that the developer shall inspect disturbed areas of the construction activity that have not been finally stabilized, structural control measures, and locations where vehicles enter or exit the site at least once every seven calendar days and within 24 hours of the end of a storm that is 0. 1 inches or greater. Where sites have been finally stabilized, such inspection shall be conducted at least once every month for three months.

If a maintenance garage is being built and will generate wastewater it may be necessary to obtain a General Permit for the discharge of wastewater associated with Vehicle Maintenance.

# Wetlands Review

After the field review on June 16, 2003 this reviewer assembled the 1:100 scale sheets of the plan into one large, detailed sheet. The footprints of the houses and the broad extent of the wetlands were highlighted. This resource, in combination with the several hours of field walk, has yielded these observations, comments and questions.

## Observation

17 of the 18 holes directly impact wetlands.

**Comment:**

- 94% of the proposed holes impact wetlands to some degree. Only hole six avoids direct wetland impact. However, it is located within the minimal 25 foot buffer line. A look at the plan shows that there is abundant upland area to relieve the wetlands of impact - only to find these upland areas used by the footprint of a house.

- The second fairway is a good example of wetland and wetland buffer impact that could, at least on paper, easily be moved to the west reducing the 1 1/2 acre wetland loss.

- The third fairway plays directly down 600 linear feet of wetland (the length of two football fields). This wetland is one of the two main inflowing streams that feed Mead Pond which hole four plays over. This stream, as observed on our field walk, was a well established woodland stream with quick flow over glacially rounded rocks and boulders. Small waterfalls and pools highlight the run as is typical of headwaters streams. The stream passes into Mead Pond and then into Ginger Creek. Both of these have a surface water quality of "A."

- Not one of the house footprints is in a wetland or even approaches a wetland buffer. The proposal has the appearance that the wetlands are being impacted by the golf course to provide for the placement of the house lots.

## Observation:

The cart path has 30 wetland and/or watercourse crossings.

**Comment:**

- Following the cart path from the clubhouse through the course and back to the point of origin, there are 30 different wetland/watercourse crossings. In all, these pass through or over at least one thousand six hundred (1,600) feet of wetland and watercourses. This pathway directly impacts over three tenths of a linear mile of wetlands.

## Observation:

A large amount of wetland acreage is impacted, including the obliteration of a wetland area near hole 3. Some mitigation areas are proffered but they are they are enlargements of existing wetlands systems, and impoundments of standing water.

**Comment:**

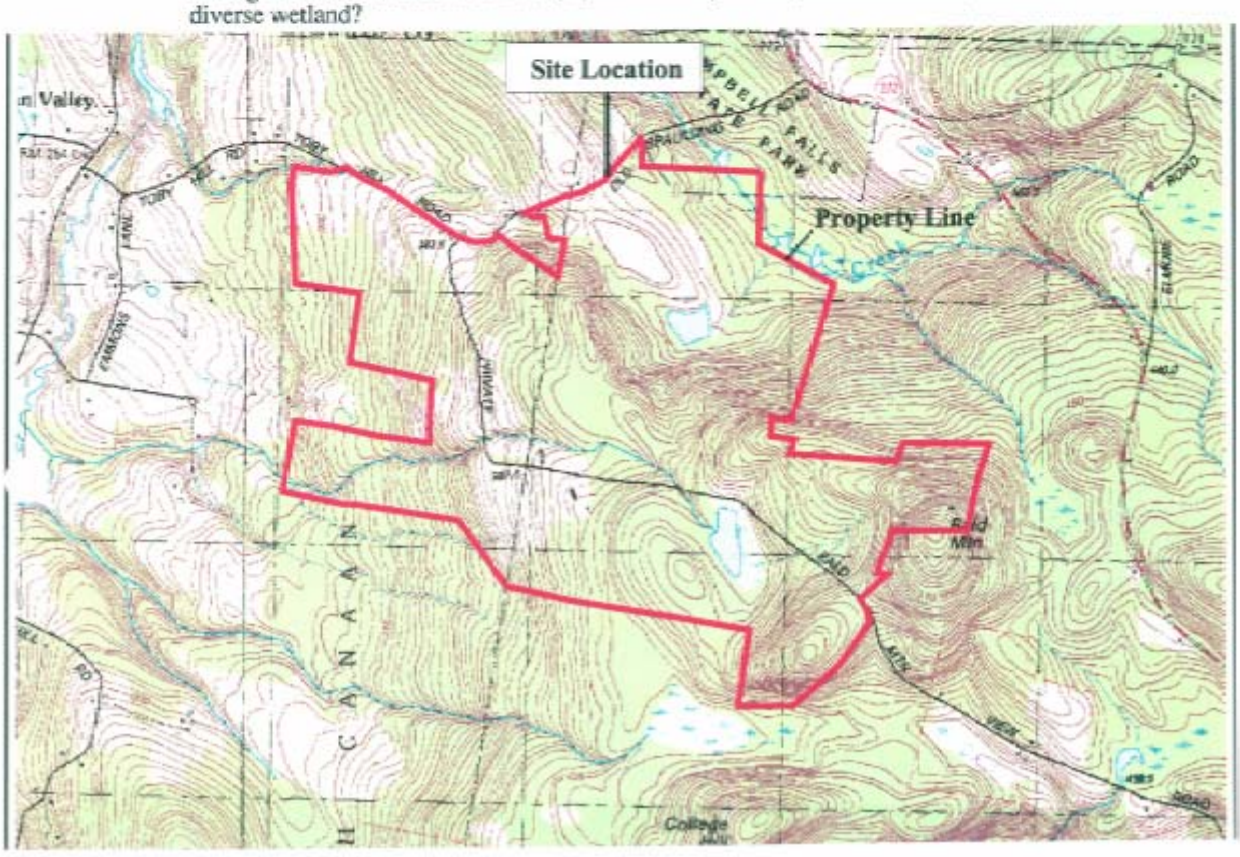
- Different types of wetlands have different values. A breeding vernal pool can be exceptionally productive, whereas an impoundment of water does not offer the same habitat as wooded wetland. Also valuable are wetland regimes with lengthy edge, varied habitat classes (herb, shrub and tree levels, standing water, and damp soil conditions). Created wetlands should try to match the areas they abut and have their value questioned if they are proposed as stand alone mitigation areas (wetland creation area #3).

## Observation:

Mitigating the big pond reclamation phragmites.

**Comment:**

- It is commendable that the large wetland east of hole 2 is targeted for renovation. The topographic map included in the Milone and MacBroom documents shows that at one time this area was impounded. Indeed, the tumble-down boardwalk along the northwest edge of the wetland would indicate a higher water level at a previous time. It is likely that the phragmites invaded once the ponded water drained and left the mud flats exposed. Has the commission discussed, or was part of the renovation option, to review the pros and cons of raising the water level somewhat to (re)introduce a pond aspect to this already rich and diverse wetland?




The topographic map above shows the ponded area south of Bald Mountain road which is now a large marsh.

## Observation:
The plan as proposed would entail scores of acres of tree removal.

**Comment:**

- Removal of vegetation en masse regularly leads to soil erosion and sedimentation problems downslope and downstream. Clearly spelled out phases and preservation of notable trees if present is needed. Additionally, the final plans should locate all the soil stockpiles and detail their sedimentation collection systems.

## Observation:
Because so many of the holes impact wetlands, by default the proximity of manicured grasses is very close to wetlands.

**Comment:**

- Valid concerns were raised by the field walk participants about the proximity of the turf grasses to wetlands. A very close watch must be kept on fertilizer and pesticide runoff. Without controls, Mead Pond (at hole four) could very well become algae covered with subsequent water quality degradation (i.e. dissolved oxygen, water temperature, etc.). Best management practices should be followed and plans of action to prevent this should be officially submitted to the town(s). The water quality sampling that is proposed should be regularly supplied to one point of contact qualified to understand the implications of the changes over time.

## Observation:
Seasonal study should to be in place regarding the vernal pool breeding amphibian population and its use of the uplands for non-breeding habitat.

**Comment:**

- The complex of vernal pools and wetlands to the west of the fairway on the seventh hole are breeding amphibian habitat. Tadpoles were seen darting about on the day of the field walk. The range of woodfrogs is several hundred feet from their breeding pools. Salamanders may go upslope these distances as well. The steepest and highest upland in the pools' vicinity is 300 feet to the east, near the middle of the seventh fairway. If this upland is used the amphibians would find themselves crossing the golf cart path as they move away from the pools seeking the higher, drier ground necessary for their adult lives. Upland review should be part of the vernal pool wetland assessment. Dr. Klemen's studies of vernal pool species and their upland needs should be an integral ingredient in the final decision making process.

## Observation:
There is an absence of dedicated open space.

**Comment:**

In most cases, when this type of development is reviewed by the Team, it is typical for the developer to dedicate 10, 15 or even 25% of a parcel as deeded, contiguous open space. Frequently, the property is deeded to the town and/or the local land trust. This proposal offers no such provision.

Equally often in these large private-road communities there is a combination interior/perimeter walking trail. This is also absent from the proposal.

## Questions:

- Will the locations of the leach fields for the existing buildings be located before construction begins?

- Acres of tree removal and stump removal will occur if the proposal goes forth. How will the stumps be dealt with? Chipped on site? Buried? If composted, the compost pile location should be located on the final plans.

- How will the trees be removed? If skidded out, care should be taken near the wetland breeding areas to regrade the land surface after work is done. Without regrading, in the springtime equipment tracks and ruts could become a sort of "decoy" wetland pool. These "decoys" can fool amphibians into breeding there - with the result of drying out too soon in the spring to maintain water levels for the young.

- Page 5-9 of Section Seven of the Milone and MacBroom report states that water samples will be collected of pre-build water quality - including temperature, pH, phosphorus and total dissolved solids. Who in the town(s) will be the recipient of these and future comparative reports?

- The buffering of the ponds not "in-play" with shrubs and trees is an excellent idea; especially to keep Canada geese and their individual pound-per-day of "output" away from the wetlands and watercourses.

- Is there a long-term use plan for the land? Is here a drop-dead date for the success of the golf course? Statistics on golf course closings are difficult to obtain. But in *Grounds Maintenance* magazine which is a "technical magazine of landscape construction, design and maintenance, serving landscape contractors and superintendents of golf courses . . since 1966" an article dated January 01, 1998 on the subject appeared. It stated that the National Golf Foundation was able to verify 41 non-military golf course closures for the year 1996. Of these 41, twenty-four (59%) closed in favor of land development.

  (See article on line at: http //grounds-mag.com/ar/grounds_maintenance_golf_course_development

- With no open space set aside, with a proposal that seems to show preservation of house lots in favor of wetlands, and with a propensity of closed golf courses developing the land, this Team member can't help but question the long term use of the farm.

## Summary

This proposal is a very large undertaking in dollars, in real estate and in impact. The clarity of its vision and scope increases with the time spent studying the plans and documentation. This time allows the reviewer to "drive the cart paths and walk the holes" and, as best as possible, get the feel of the landscape. But the plan on paper cannot replace months of actual field

observation, hiking the hills and woodlands, and mapping the wetlands, greens and fairways. Those proposing the plan always have that first hand advantage.

This proposal will have a revolutionary impact on the landscape. Acres of forested wetlands will be impacted, uncounted tons of earth will be moved, and thousands of board feet of timber will be taken off site.

The plan shows wetland impact through loss or alteration of more than 13 acres. The plan also shows, through its creation and enhancement of wetlands a net gain of more than 3.5 acres of wetlands. But, in practice, effective replacement and enhancement of wetlands can be a difficult challenge - which makes one wonder again why so much impact? Thirteen acres of wetland impact *is a lot* of impact.

Reasonable and prudent alternative is always a key phrase in this type of review. The burden falls to the various town commissions to protect the wetlands as they exist on the landscape before construction begins. In many cases there appear to be alternatives to the wetland impacts proposed. But in almost all of these cases a house lot is in the way of the alternative.

Thus, the decision that only the commissions are empowered to make is - do they require the preservation of the wetlands and wetland systems as they exist, or do they compromise these systems in favor of house lots. In this proposal there are alternatives to many wetland impacts. The commission will have to decide which will prevail on the land - house lots or wetlands.

# Aquatic Resources

## Site Description and Aquatic Habitat Characteristics

The Yale Farm Golf Club is proposed for a 780 acre parcel of land that straddles the municipal borders of Norfolk (535 acres) and North Canaan (245 acres). The golf club is to consist of an 18 hole golf course, two club houses, golf practice area and associated support facilities, tennis courts, an equestrian center, and skating rink. Site development is proposed to occur on 324 acres (208 acres in Norfolk and 1 16 acres in North Canaan) of the site which presently consist of cultivated fields, hayfields, pasture and woodland. The aquatic resources of the Yale Farm Golf Club site include a 1.2± mile length of Hollow Brook, an unnamed flow through impoundment on Hollow Brook, a 1,300± foot long reach of an unnamed tributary to Ginger Creek, an impoundment of an unnamed Ginger Creek tributary known as Mead Pond, and two segments of Ginger Creek totaling 1,800± feet in length.

***Hollow Brook is*** physically characteristic of a coldwater stream found in Connecticut. The stream transitions notably from a low to moderate gradient channel upstream of the unnamed pond to a steep gradient channel from the base of the pond dam to the south-western property boundary. Hollow Brook is contained in a channel approximately 12 feet in bankfull width. Normal flow depths within the stream are approximately 1 foot. Stream substrate is composed of boulder, cobble, gravel, coarse sand, and sand-silt fines. Dense growths of hardwoods and woody shrubs predominate as riparian vegetation along the stream. Physical in-stream habitat is provided by primarily by water depth in pools, boulders, undercut banks and fallen or overhanging vegetation.

The ***Unnamed Pond on Hollow Brook is*** artificial in nature and is the result of excavating and impounding the stream with an earthen, stone, and concrete dam. Bathymetric information for the 0.14 acre pond is unavailable although it was informally suggested that the pond may be 7 to 8 feet in depth given the height of the dam. Based upon field observations, it appears that the pond has relatively shallow water depths given the gradual slope of the bottom from the shoreline and the abundance of submergent aquatic vegetation. Physical habitat observed in the pond is composed of aquatic plant growth and possibly boulders and/or tree stumps on the pond bed. The pond can be classified as coldwater.

The ***Unnamed Tributary to Ginger Creek*** originates in Mead Pond and passes through the remnants of a smaller pond then transitions into low gradient, meandering channel. The stream is contained in a channel approximately 8 feet in bankfull width; water depth at normal flow is approximately 9 inches. Stream substrate is composed of cobble, gravel, coarse sand, and sand-silt fines. Dense growths of hardwoods and woody shrubs predominate as riparian vegetation along the stream. Physical in-stream habitat is provided by primarily by water depth in pools, undercut banks and fallen or overhanging vegetation. The stream is characteristic of cool-water streams found in the state.

***Mead Pond is*** an artificial 4.4± acre excavated impoundment at the headwaters of the unnamed tributary to Ginger Creek. Bathymetric information for the pond is unavailable. Based upon field observations, it appears that the pond is relatively shallow given the height of the earthen and concrete dam, the gradual slope of the bottom from the shoreline, and growths of emergent and submergent aquatic vegetation. Physical habitat observed in the pond is composed of aquatic plant growth, fallen or overhanging perimeter vegetation and possibly boulders and/or tree stumps on the pond bottom. The pond can be classified as warmwater.

***Ginger Creek*** meanders through two sections of the Yale Farm Golf Club along the northern property bound. The stream is contained in a low gradient channel approximately 15 feet in bankfull width; water depth at normal flow is approximately 18 inches. Stream substrate is composed of small boulder, cobble, gravel, coarse sand, and sand-silt fines. Dense growths of hardwoods and woody shrubs predominate as riparian vegetation along the stream. Physical in-stream habitat is provided by primarily by water depth in pools, undercut banks and fallen or overhanging vegetation. Ginger Creek is physically characteristic of a low gradient coldwater stream found in Connecticut .

The site of the proposed Yale Farm Golf Club has a long history of land use change. Approximately 164± acres of the site were modified for agriculture during the operation of the Yale Farm. Timber harvests have also been conducted within the 468 acres of forest. However, historic land use practices have allowed the preservation of riparian vegetation along Hollow Brook, the unnamed tributary to Ginger Creek, Ginger Creek, and roughly half of the perimeter of Mead Pond. The existing riparian vegetation along all of the site's surface waters provides an adequate "filter" to renovate overland stormwater runoff which in turn has maintained water quality at levels to be currently classified as *Class A* surface waters by the Department of Environmental Protection. Surface waters of this classification are existing or potential drinking water supply, fish and wildlife habitat, recreational use, agricultural and industrial supply and other purposes.

## Aquatic Resources

### *Hollow Brook*

Based upon channel grade, morphology, and substrate composition, Hollow Brook can be classified as a coldwater resource. Staff of the Inland Fisheries Division had conducted a fish survey of the stream on June 30, 2003 in conjunction with the King's Mark environmental review (the "ERT"). Three discrete 330 foot sections of stream were surveyed with back-pack electrofishing equipment. The stream survey sections and the fish collected are as follows:

- *Section 1.* This survey section of Hollow Brook was immediately upstream of the unnamed impoundment. Although the stream had surface flow, there were no fish collected.
- *Section 2.* This survey section of Hollow Brook was immediately upstream of the Bald Mountain View Road crossing in the vicinity of the proposed 16th and 17th holes. The stream had surface flow, however, no fish were collected.
- *Section 3.* This survey section of Hollow Brook was downstream of the Bald Mountain View Road crossing in the vicinity of the proposed 12th and 13th holes. Brook trout *(Salvelinus fontinalis)* were collected. Three year classes of brook trout were noted; young-of-the-year, yearling, and 2-year old adult. The presence of multiple year classes indicates a viable self-sustaining population.

### *Unnamed Pond on Hollow Brook*

The pond contained a full water volume and had spillway flow on the two site visits conducted for the ERT (June 16 and 30). Fish surveys of the pond were not conducted; fish were not visually observed. There are no records available which document fish stocking of the pond. The water turnover rate in the small pond should be quite rapid; as such the pond may be able to provide suitable brook trout habitat.

### *Unnamed Tributary to Ginger Creek*

A fish survey of the *Unnamed Tributary to Ginger Creek* was conducted June 30, 2003 by Inland Fisheries Division staff. The 150 foot long stream reach surveyed was approximately mid-way between Mead Pond and Ginger Creek. The fish population was found to contain blacknose dace *(Rhinichtys atratulus)* and creek chub *(Semotilus atromaculatus)*.

As previously mentioned, ***Mead Pond*** can be classified as warmwater given it's shallow water depths and the likelihood for support of moderate aquatic plant growth. Formal fish surveys have never been conducted to evaluate the resident fish population nor are there any records available which document intentional fish liberation. The pond is anticipated to have habitat suitable to support bluegill *(Lepomis macrochirus),* largemouth bass *(Micropterus salmoides)* golden shiner *(Notemigonus crysoleucas)* and brown bullhead *(Ameiurus nebulosus).* These fish species are common to warmwater lakes and ponds in Connecticut.

***Ginger Creek*** was included in a comprehensive stream survey conducted by the Inland Fisheries Division in the upper Housatonic and Naugatuck River drainage basin as part of a multiple year study of Connecticut streams and rivers. A 330 foot long reach of Ginger Creek immediately downstream of the Spaulding Road crossing (north-west of the Yale Farm property) was surveyed on July 7, 1992. The stream was found to support a fish population of brown trout *(Salmo trutta),* blacknose dace, and creek chub. These fish species are commonly associated with cool- and coldwater streams.

## Impacts to Aquatic Habitats/Resources

### *Land Cover-type Change*

Although portions of the proposed Yale Farm Golf Club site has been altered by previous agricultural development, the agricultural practices had been conducted in a manner maintaining buffers of wetland, unutilized field, and/or forest adjacent to the site's surface waters. This in turn has maintained the quality of water and physical aquatic habitat. The land cover-type change and other activities associated with the conversion of abandoned/lightly used pasture and forest to a golf course and related facilities as proposed are of concern as they can produce adverse impacts to the habitats and resources of Hollow Brook, Mead Pond and the unnamed tributary to Ginger Creek.

The following components of site design and future maintenance are of concern for the impacts they are likely to promote:

- **Alteration of riparian habitats**. Changes to existing riparian habitat from golf course encroachment can remove the natural filtering effect of vegetation which has the ability to prevent sediments, nutrients, fertilizers, and other non-point source pollutants from upland sources from entry into surface waters; such non-point source pollutants can degrade habitat and water quality.

  Additionally, the removal of riparian vegetation can decrease stream bank stability thereby increasing surface water siltation and habitat degradation; eliminate or drastically reduce the supply of large woody debris provided to the surface waters (such material provides critical physical habitat features for numerous species of aquatic organisms); reduce a substantial proportion of food for aquatic insects which in turn constitutes a reduction in a significant proportion of food available for resident fish; stimulate excessive aquatic plant growth; and decrease the riparian corridor's ability to serve as a "reservoir" storing surplus runoff for gradual release back into the streams during summer and early fall low flow periods.

- **Soil erosion**. Soils eroded from areas cleared of vegetation which are subsequently transported to surface waterbodies can degrade both water quality and physical habitat. Suspended sediments can cause a depletion of oxygen within the water column or disrupt the gill function and respiration of both fish and aquatic insects.

Deposited sediments can reduce or eliminate habitats used by fish for feeding, cover, and spawning; reduce fish egg survival; reduce aquatic insect production; and promote excessive aquatic plant growth.

- **Fertilizer, herbicide and pesticide application**. Should excess nutrients from fertilizer runoff reach surface waters, there will be a stimulation of aquatic plant growth potentially to levels decreasing habitat diversity. Herbicide or pesticide runoff may result in fish kills and water quality degradation.

### *Irrigation Water Withdrawal*

The Yale Farm Golf Club has planned to use water from a series of bedrock wells for irrigation of the proposed 18 hole golf course. Four bedrock wells were drilled on the Yale Farm during May and June 2002. The well locations, depths, and proposed rates of groundwater withdrawal are as follows:

***Well 2*** - located south of the proposed 8th hole tee boxes; the 530 foot deep well is reported to have a withdrawal rate of 30 gpm.

***Well 5*** - located north of the proposed 15th hole tee boxes; the 550 foot deep well is reported to have a withdrawal rate of 10 gpm.

***Well 6*** - located south of the proposed 15th hole green; the 350 foot deep well is reported to have a withdrawal rate of 60 gpm.

***Well 7*** - located north of Mead Pond near the proposed 4th hole green; the 190 foot deep well is reported to have a withdrawal rate of 100 gpm.

Well water is to be pumped to a newly created 1.55 acre pond then distributed to the irrigation system. The pond is to be created in uplands adjacent to the 10th and 18th holes. It is reported that peak withdrawals of irrigation water are assumed to be approximately 298,080 gallons per day (gpd).

Hollow Brook is within the area of influence of *Well* 2 and *Well 6*. Pump tests conducted from August 22 through August 27, 2002 to determine the impacts of groundwater withdrawal on stream flow. Reportedly, the pump test results and 180-day projections for groundwater withdrawal indicate the potential for flow loss in the lower reaches of Hollow Brook in the vicinity of the proposed 11th and 12th holes.

Studies of New England streams conducted by the U.S. Fish and Wildlife Service indicate that August flow is the most stressful for a stream system and is the flow to which stream organisms have adapted. Flow reductions, even for discrete time periods, can be a key factor inhibiting the productivity and community structure of aquatic organisms including fish. The specific concerns associated with stream flow reductions are:

- **Water temperature change**. Diminished flow in small streams lead to decreased water depth, increased solar penetration and prolonged exposure to low water velocities. The end result are higher summer water temperatures. As water temperatures rise, cold water species such as brook trout are excluded and are replaced with more "tolerant" cool and warmwater species.

- **Dissolved oxygen reduction**. Diminished flows create less turbulence thereby decreasing aeration rates. Warm waters have reduced oxygen saturation levels which threaten the productivity of the aquatic species community and in extreme cases increases the chance of fish kills.

- **Alteration of sediment transport and substrate composition**. Streams with heavy sediment loads depend upon sufficient flow to transport sediment. During periods of low flow, reduced velocities and water volumes limit sediment transport and encourage deposition in slack water areas. As a result, coarse substrate (e.g. cobble and gravel) are embedded with fine material rendering the substrate unsuitable for fish spawning, egg incubation and juvenile development. The production of aquatic insects can be reduced significantly.

- **Reshape the channel morphology**. A broad range of flows, including flood flows, are necessary to maintain the shape of a stream channel and the formation of pools and riffles. Sustained periods of low flow, particularly when combined with the regulation or absence of flood flows, encourages sediment deposition leading to pool and rime habitat degradation.

*Well 7* is approximately 75 feet west of Mead Pond. Although the five day pump test could not determine an area of influence of the well, there is a high degree of probability that the well will lower the pond water surface elevation given it's close proximity of the pond, drilled depth of 190 feet, and production rate of 100 gpm. The level to which the water surface elevation drops is dependent upon the time of year and rate of inflow from the 100 acre watershed.

The lowering of the water surface elevation in Mead Pond is anticipated to expand the aerial coverage of rooted aquatic plants as the amount of available sunlight conducive to plant growth will extend further into the pond basin. Aquatic vegetation in amounts of 30% to 40% coverage is considered optimum for small ponds. However, an overabundance of aquatic plants, that is in excess of 40% coverage, can produce the following impacts:

- Eliminate or dramatically reduce fish spawning areas.

- Cause fish kills. Fish kills occur frequently in small ponds that are subject to abundant aquatic plant growth. Winterkills, which occur under the cover of ice, arise when heavy snow cover on the ice inhibits sunlight penetration and photosynthesis. Oxygen levels for fish survival are reduced to critical levels by plant respiration occurring over a prolonged period of time. Summerkills result from several causes. An algal bloom may prevent sunlight from reaching deeper water areas inhibiting photosynthesis. Under this condition oxygen is consumed but not produced. A die-off of aquatic plants and subsequent bacterial decay can also create a condition where oxygen is being consumed at a greater rate than that being produced. The detrimental effects of these events are worsened when several cloudy days occur in succession.

- Cause stunting (an overabundance of small fish with extremely slow growth rates) due to inability of large predator fish to find and consume small fish in heavy plant cover.

- Interfere with access to water-based recreation.

- Detract from the pond's aesthetic value.

A lowering of the Mead Pond water surface elevation will increase the duration of time that water is not passing downstream to the unnamed tributary to Ginger Creek. A delayed passage of flow is predicted to occur during the summer months when irrigation needs are the greatest and precipitation the lowest. The impacts to the unnamed tributary to Ginger Creek are those previously stated for flow loss to Hollow Brook.

## Mitigative Recommendations

The following measures are recommended to mitigate the impacts which may befall the habitats and living resources found within Hollow Brook, the unnamed tributary to Ginger Creek, and Mead Pond from the current proposal to develop the Yale Farm Golf Club:

- Reconfigure the portion of the golf course proposed for the 2nd, 7th, 11th, 12th, 13th, 15th, 16th, and 17th holes. These holes cross Hollow Brook in the current course layout. In total, the construction of the holes will alter approximately 1,400 feet of forest riparian habitat along the 6,450 foot length of stream on the Yale Farm property. It is apparently feasible to avoid all crossings of Hollow Brook by:
  1 ) shortening the lengths of the 2nd, 7th and 11th holes;
  2) shortening the lengths of 15th, 16th, and 17th holes or relocating the holes farther northward;
  3) relocating the 12th hole northerly of the 10th hole and the 13th hole north of Hollow Brook.

  In addition to eliminating the Hollow Brook crossings, the course layout can be reconfigured in accordance with Inland Fisheries Division recommendation of maintaining the existing riparian forest to a minimum width of 100 feet along both banks of the stream. Please refer to the attached documentation presenting Division policy and position regarding vegetated riparian buffers for additional information (see Appendix).

- Relocate the 3rd and 4th holes to the area adjacent to the 5th hole. This will avoid the crossing of an intermittent tributary to Mead Pond and Mead Pond and will preserve the existing riparian areas.

- Supplement flow throughout the entire length of Hollow Brook on the property rather than augmenting flow only to the lower stream reach as currently proposed. The supplemental flow, most readily obtained from *Well 1* and *Well* 2, should be discharged to the stream at the Bald Mountain View Road bridge immediately downstream of the emergent marsh referred to as Wetland 1. The supplemental flow should be of a volume that, when combined with the natural flow, maintains a base stream flow equivalent to the median of the mean daily flow for each month. Listed below are the median of the mean daily flows for each month (in cubic feet per second per square mile of drainage), as developed by and modified from Apse (2000), and herein known as the Connecticut Base Flow Method. This method is considered superior to the New England Aquatic Basc Flow Mcthod (Larson 1981), the desktop standard previously advocated by the Inland Fisheries Division. Further, the Water Planning Council (WPC), which was recently established by the Connecticut General Assembly, supports this method as a reconnaissance-level approach to estimating ecologically protective instream flows (WPC 2003).

| | | | |
|---|---|---|---|
| January | 1.53 | July | 0.33 |
| February | 1.77 | August | 0.23 |
| March | 2.60 | September | 0.22 |
| April | 2.54 | October | 0.45 |
| May | 1.63 | November | 1.14 |
| June | 0.77 | December | 1.52 |

- Develop an alternative irrigation water supply source(s) which will collect stormwater runoff and reduce groundwater withdrawals. Alternative supplies which are seemingly practical are the construction of additional ponds, further enlargement or deepening of the proposed irrigation pond, and/or installing large surface or subsurface cisterns.

- Increase the depth of the unnamed pond on Hollow Brook, however, the surface area of the pond should not be increased as proposed. The increased pond depths should provide additional habitat for brook trout and provide a refuge for trout in the upper reaches of Hollow Brook during prolonged periods of diminished stream flow.

- Install a low level water release structure in the unnamed pond on Hollow Brook to allow the release of cooler water downstream to Hollow Brook.

- Restore instream habitat within the segment of Hollow Brook in the vicinity of the proposed 15th hole. Large boulders, presumably from the clearing of agricultural fields on the Yale Farm, had been pushed into the stream channel. This has resulted in subsurface stream flow. The boulders can either be removed or repositioned in the channel to create a series of step pools.

- Stabilize the eroding banks of Hollow Brook adjacent to the breached dam in the vicinity of the proposed 16th hole. The banks can be made stable by repositioning scattered rock of the breached dam and/or placement of boulders brought from another location.

- Reestablish a brook trout population in the Hollow Brook segment from the proposed 15th hole upstream to the outlet of Wetland 1. A number of barriers to upstream fish passage exist within this segment of stream which preclude a natural recolonization of trout. The source for a "founder" population would either be the capture and transfer of brook trout from the lower segment of Hollow Brook or from a commercial trout hatchery. Either activity would require approval from the Inland Fisheries Division.

- Make use of native grass species selected for resistance to drought and to various turf problems such as insects and disease. For areas of the course other than greens, turf management programs should have an emphasis placed on cultural practices such as mowing, watering, aerification reseeding, rather than the more common place practices of chemical and fertilizer application. Maintaining vegetated filter strips along all of the site's surface waters (including intermittent drainages) and applying compounds at curative rates are suggested as measures to minimize off-site chemical/nutrient transport.

- Establish comprehensive erosion and sediment control plans with mitigative measures (haybales, silt fence, etc.) to be installed prior to and maintained through all development phases. Land clearing and other disturbance should be kept to a minimum with all disturbed areas being protected from storm events and restabilized in a timely manner.

- Limit regulated activities adjacent to riparian buffer zones to historic low precipitation periods of the year. Reduced precipitation periods of summer to early fall provide the least hazardous conditions when working near sensitive aquatic environments.

## Literature Cited

Apse, C.D. 2000. Instream flow protection in New England: Status, critique, and new approaches to standard-setting. Masters Thesis., Yale School of Forestry and Environmental Studies. 112 pgs.

Larson H.N. 1981. New England flowpolicy. Memorandum, interim regional policy for New England stream flow recommendations. USFWS, Newton Corner, Massachusetts.

Water Planning Council (WPC). 2003. State of Connecticut Water Planning Council. Annual Report to the General Assembly Pursuant to P.A. 01-177 and 02-76. 19 pgs.

# The Natural Diversity Data Base

The DEP Environmental & Geographic Information Center has had much correspondence during the last year regarding the Yale Farm Golf Club project. Following are recent letters on this project. The ERT team members can consult with Julie Victoria (DEP-Wildlife; 860-642-7239 and Ken Metzler (DEP-EGIC; 860-424-3585) regarding state-listed species and important natural communities that are in the vicinity of this proposed golf course and subdivision. Connecticut Inland Fisheries biologist and ERT team member Don Mysling (DEP-Fisheries; 860-567-8998) can provide recommendations on state-listed fish that may occur in the general vicinity of this project.

Natural Diversity Data Base information includes all information regarding critical biological resources available to us at the time of the request This information is a compilation of data collected over the years by the Natural Resources Centers 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 substitutes 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.

Also be advised that this is a preliminary review and not a final determination. A more detailed review may be conducted as part of any subsequent environmental permit applications submitted to DEP for the proposed site.

# Botany Report

## Introduction

The Kings Mark ERT botany team surveyed the vegetation of the Norfolk portion of the proposed Yale Farm Golf Course on June 16, June 17, June 23, June 28, July 1, and July 4, 2003. They spent approximately 29 hours on-site and explored a portion of the parcel that is proposed for the golf course development, including some of the areas that the applicant has informally proposed for subdivision. In addition, two invertebrate zoologists spent approximately 6.25 hours on-site surveying the insect component of several priority natural communities on the site. The primary purpose of the reconnaissance was to determine if the site had potential or actual habitat for rare plants (i.e., State-listed per CT-DEP 1998) and/or natural communities of special significance with respect to their biodiversity conservation value. Having discovered that both entities occur on the site, the botany team's further purpose was to determine if the applicant's proposed activities posed a risk to these resources, and if the applicant had adequately addressed this issue in his application, both in terms of his biological/ecological inventory of the site, and in his site plan and proposals for mitigation and habitat management.

## Results of Vegetation Reconnaissance

The botanical team discovered a total of six populations of six different State-listed rare plants species on the site (four confirmed and two probable), which are listed below in Table 1. It should be noted also that, in addition to the rare plant populations observed by the ERT botany team, at least one additional rare species population has been reported by consulting botanist Chris Mangels (Mangels 2003), based on his observations on-site during the public hearing site walk. Thus the total number of known populations observed to-date on the site is at least seven.

The Kings Mark ERT botanical team identified the following nine significant natural communities and classes of natural communities on the Norfolk portion of the site of the proposed Yale Farm Golf Club:

1. ***Carya* - *Fraxinus* Forest/Woodland**
2. **Circumneutral Seepage Forests**
3. **Circumneutral Seepage Swamps**
4. **Rich Fen**
5. **Cold Talus Community**
6. **Northern-affinity Transitional Forests**
7. **Northern/transition Hardwoods Plateau**
8. **Oak - Pine - *Deschampsia flexuosa* Summit Community**
9. **Rich, mesic *Acer-Fraxinus* Forests**

All of these communities are of special conservation concern because they are rare or uncommon in Connecticut and/or they have a relatively high potential for rare plants. All of the six State-listed plants discovered on the site by the King's Mark ERT botany team occur in one or more of these communities. Most of the State-listed plants potentially occurring on the site (refer to Table 2) are known to occur, or have occurred, in one or more of these (or closely related) community types not far from the site. These natural communities are described in some detail in the final section of this report beginning on page 14.

**Table 1. State-listed plants identified on the Norfolk portion of the proposed Yale Farm Golf Course by the Northwest Conservation District botany team, 16 June – 4 July 2003.**

| Scientific Name | Common Name | State Listing Status | Comments |
|---|---|---|---|
| *Carex novae-angliae* | New England sedge | Special Concern (historic) | Confirmed; one population observed by ERT botany team and at least one additional population reported by Mangels (Mangels 2003) |
| *Anemone canadensis* | Canada anemone | Endangered | Confirmed; more may exist on site |
| *Ribes triste* | Swamp red currant | Endangered | Probable; confirmable only earlier in season in flower, or in mid- to late summer in fruit (if fertile plants can be found) |
| *Salix serissima* | Autumn willow | Special Concern | Plant found is probably a hybrid, which strongly suggests presence of pure parent in same wetland |
| *Schizachne purpurascens* | Purple oats | Special Concern | Confirmed; more may exist on site |
| *Hepatica acutiloba* | Sharp-lobed hepatica | Threatened | Confirmed; more may exist on site |

"State-listed" rare species are species listed in the Regulations of the State of Connecticut as Endangered, Threatened, and Special Concern pursuant to Connecticut's Endangered Species Act (Public Act 89-224), an Act which recognizes the need for conservation of native biodiversity and gives limited legal protection to the those species that are most vulnerable to extinction in the State. Included on this list are Federally Endangered and Threatened species, globally rare species, regionally rare species (e.g., rare in New England but common in some other part of their range), and species that are rare in Connecticut, but not rare in nearby states. As a rule of thumb, no State-listed species has more than 20 occurrences still known in Connecticut. Out of Connecticut's approximately 1700 native plant species, 350 are State-listed rare plants. State-listed species are divided into the legal categories "Endangered", "Threatened", and "Special Concern", which correspond to differing degrees of known rarity and different degrees of legal protection. The rarest species on the list that are still known to be extant are listed as Endangered (species with, as a rule, five or fewer known occurrences) or Threatened (species with, as a rule, 6-9 known occurrences), and these species are those that receive the greatest degree of legal protection under the Act (CT-DEP 1998). The remaining species on the list are in the Special Concern category: this includes species with either 10 or more known occurrences (as a rule), those species with fewer than 10 known occurrences but which are suspected to be more common, and species that are only known historically from Connecticut. This last category a relatively large group, comprising about 30% of the State-listed plants, which have not been recently observed in Connecticut and may no longer be extant in the state. Plants in this category are denoted "Special Concern (historic)" or "State-Historic", and some portion of them are actually extant but are among the rarest plants in the state. On average, in the last decade, between 3 and 4 of these plants per year are rediscovered in Connecticut. The State's legal list is revised every 5 to 7 years, the last revision occurring in 1997 (taking effect in 1998), and the next due to occur this year or the next. There are a number of "Special Concern (historic)" that have been rediscovered since 1998 that are due to have their listing status changed in this next list revision. Among these is one of the species the botany team found on the Yale Farm site, *Carex novae-angliae,* which was rediscovered in Connecticut in 1997.

That six State-listed plants already occur on the parcel makes the Yale Farm site comparable to many of the State's foremost natural areas, in terms of concentration of rare plants. Considering the limited time spent by the botany team on the site, the limited portion of the site that was explored, and the narrow temporal window through which team was able to view the site, and number, extent, and quality of the significant natural communities found on the site, it is highly improbable that the six rare plant occurrences discovered by the ERT botany team are the only rare plant occurrences on the site.

Presented in Table 2 is a list of 98 State-listed rare plants that might reasonably be expected to occur on the site, and which should be surveyed for in the appropriate habitats at the appropriate time for detection and identification. This list of survey target species is derived in part from the authors' collective experience with habitat-affinities of the species (i.e., the authors' have documented a large number of these species in habitats

similar to those they found during their partial exploration of the Yale Farm site), and in part from published habitat-affinity informaton, in combination with the documented geography of these species (i.e., the site is in the documented geography of these species, and in all or most cases, the species have been documented within a few tens of miles of the site). The length of this list results from the habitat diversity discovered at the site, the particular habitats occurring on the site, and the geographic location of the site in a region of exceptionally high biodiversity. It is highly improbable that all 98 species occur together on the site, but the co-occurrence on the site of 10 to 20-plus of the species on this list would not be surprising.

***Table 2. State-listed rare plants potentially occurring at Yale Farm*** *(the asterisked species are already known from one on-site occurrence – other occurrences may exist on the site)*

*Agastache nepetoides*
*Agrimonia parviflora*
*Alopecurus aequalis*
*Anemone canadensis**
*Antennaria neglecta* ssp. *petaloidea*
*Asclepias purpurascens*
*Asplenium montanum*
*Asplenium rutamaria*
*Betula pumila*
*Blephilia ciliata*
*Blephilia hirsuta*
*Botrychium simplex*
*Calamagrositis stricta* ssp. *inexpansa*
*Cardamine douglassii*
*Carex aestivalis*
*Carex alopecoidea*
*Carex aquatilis* var. *altior*
*Carex bushii*
*Carex castanea*
*Carex crawei*
*Carex crawfordii*
*Carex cumulata*
*Carex foenea*
*Carex formosa*
*Carex hirsutella*
*Carex molesta*
*Carex novae-angliae**
*Carex prairea*
*Carex pseudocyperus*
*Carex schweinitzii*
*Carex sterilis*
*Carex tetanica*
*Castilleja coccinea*
*Chamaelirium luteum*
*Coeloglossum viride* var. *virescens*
*Corallorhiza trifida*
*Cypripedium parviflorum*
*Cypripedium reginae*
*Dalibarda repens*
*Dicentra canadensis*
*Diplazium pycnocarpon*
*Dryopteris campyloptera*
*Dryopteris goldiana*
*Elymus trachycaulus* ssp. *subsecundus*
*Equisetum pratense*
*Equisetum scirpoides*
*Galium labradoricum*
*Gaultheria hispidula*
*Gentiana quinquefolia*
*Goodyera repens* var. *ophioides*
*Hepatica acutiloba**
*Isotria medeoloides*
*Linnaea borealis* var. *americana*
*Liparis liliifolia*
*Lycopodium selago*
*Lythrum alatum*
*Malaxis monophyllos*
*Malaxis unifolia*
*Milium effusum*
*Mitella nuda*
*Moneses uniflora*
*Morus rubra*
*Ophioglossum pusillum*
*Panax quinquefolius*

*Pellea glabella*
*Petasites frigidus* var. *palmatus*
*Picea rubens*
*Pinus resinosa*
*Platanthera dilatata*
*Platanthera flava*
*Platanthera hookeri*
*Platanthera orbiculata*
*Potentilla tridentata*
*Pycnanthemum clinopodioides*
*Ranunculus pensylvanicus*
*Ranunculus sceleratus*
*Rhynchospora capillacea*
*Ribes glandulosum*
*Ribes lacustre*
*Ribes rotundifolia*
*Ribes triste*
*Salix pedicellaris*
*Salix petiolaris*
*Salix serissima**
*Schizachne purpurascens**
*Scirpus acutus*
*Senna hebecarpa*
*Smilacina trifolia*
*Stellaria borealis*
*Thuja occidentalis*
*Triphora trianthophora*
*Trichomanes intricatum*
*Trollius laxus*
*Viola canadensis*
*Viola nephrophylla*
*Viola renifolia* var. *brainerdii*
*Viola selkirkii*
*Waldsteinia fragarioides*

## IMPORTANCE OF PROTECTING RARE SPECIES AND THE NATURAL COMMUNITIES THAT SUPPORT THEM

This section has been included to aid in the understanding of the larger implications and significance of the occurrence of rare species and special communities on the Yale Farm Golf Club site. The reader is also referred to the excellent discussion of some of these issues and concepts that is found in Dowhan and Craig's Rare and Endangered Species of Connecticut and Their Habitats (Dowhan and Craig, 1976).

**Why protect rare species?** Protection and conservation of rare species is important for many reasons, involving both human self-interest and ethics. These are essentially the same as the reasons for preventing further loss of biodiversity on a global, regional, and local scale. Rare species deservedly receive special attention because they are those species that are closest to the "precipice" of local, regional, and/or global extinction. Rare species represent genotypes that are close to the point of disappearing, and from a human economic self-interest point of view, they represent potential sources of new drugs and other products useful to humans. From a health of the ecosystem point of view, the functions of rare species are most often poorly understood and therefore it is prudent not to casually discard that which may be critical ecological link to an ecosystem. Perhaps ultimately most important function of rare species, from both a health of the ecosystem and human self-interest point of view, is that of the "indicator species" (also referred to as "bellwether species" or "canary in the coal mine" species) which are particularly sensitive to environmental changes and as such are early warning indicators of environmental changes which are difficult hard to otherwise detect until more advanced and harder to mitigate or reverse.

Rare species are often characterized by those seeking to rationalize not protecting them as poor competitors, evolutionary losers, or species at/beyond the limits of their "natural" ranges (referring to "geographically marginal" species, i.e., species that are common somewhere else in their native range). In fact, it is easily demonstrated that most rare species in a given geographic area are rare because they are habitat specialists and their habitat occupies only a relatively small portion of the local landscape. For the great majority of rare species the declines and losses to date have resulted from human-caused destruction and alteration, both direct and indirect, of these specialized habitats, as opposed to lack of viability or "fitness to survive" on the part of the rare species.

The majority of the State-listed rare plants, and all of those found to-date at the Yale Farm site, are so-called "geographically marginal" species, i.e., species that are common enough in other parts of their range to not be considered globally rare species. The evolutionary resiliency of most species is correlated with the genetic diversity that exists *within* the species over its entire range. For plant species especially (as opposed to animals) genetic isolation of populations and metapopulations, promotes within-species genetic diversity, and thus promotes overall resiliency of the species. Genetic isolation of small populations can also promote inbreeding "suppression" and loss of viability, but this negative effect is evidently much more important in animals than in plants, as evidenced by the much more prevalent occurrence of self-fertilization and various forms

of asexual reproduction in the plant kingdom than in the higher animal kingdom. The majority of rare species of a given locality are geographically marginal species that are considered common somewhere else in their range, and arguably not at immediate risk of extinction globally, but which exist as widely separated and genetically isolated populations in the parts of their range where they are rare. Evolutionary theory compels us to predict that most of the adaptive genetic variability that exists in the species as a whole should occur in the isolated populations that occur in the portion of the species' range where it is rare, in the peripheral zones of its range. This hypothesis has in fact been tested, in relatively few cases to-date, and substantial genetic variation between isolated populations has been documented for some species, and relative genetic uniformity in other species. Thus, the reality of this within-species genotypic variation borne of geographic isolation appears to depend on the individual species. The frequency of the high-variation versus low-variation situation is as yet unknown. Thus, from the point of view of conserving genetic diversity and erring on the side of conservation, it makes sense to assume that a geographically marginal Connecticut population of a rare species is genotypically substantially different from populations in, for example, Nebraska, where the species might be common.

Rare species are often ecological "indicator" and/or "keystone" and/or "flagship species". Indicator species are species whose presence and status tell things about the ecology of a system that are otherwise very hard to measure or assess accurately. Keystone species are species upon whose presence/abundance/health other components of an ecological system depend. Flagship species are a type of indicator species whose health as a population can be considered a measure of the health of an entire ecosystem (or some subset of an ecosystem, such as an individual natural community). Geographically marginal rare species, i.e. those that are rare in a given locality or region but common somewhere else in their range, often serve one or more of the above-listed roles in the parts of their range where they are rare. In many cases, these functions are probably more significant than an individual population's contribution to the species' overall within-species genetic diversity. This is a second compelling argument for the protection of geographically marginal rare species.

**Relationship of rare plants to significant natural communities.** What are referred to as "significant" or "priority" natural communities are specific assemblages of organisms that together occupy the same area of more or less uniform habitat conditions. Like rare and uncommon plants, rare or uncommon natural communities often occur in habitats comprised of rare or uncommon combinations of factors that are often interrelated and interdependent, such as soil type, bedrock geology, surficial geology, climate and/or microclimate, landform, history of disturbance, and current land use. Rare and uncommon natural communities typically occur on effective ecological "islands", such as, e.g., an island of high pH soils in a regional matrix of acid soils. While a small number of a rare species occur seemingly at random in widespread and common natural communities, the great majority of the rare species in a given locality are associated with rare or uncommon natural communities, or with common natural communities that are in uncommon condition (e.g., a common forest type that is in old-growth condition).

Though natural communities may be named (e.g., Circumneutral Seepage Swamp) for the combination of the specific abiotic factors that are believed to determine their characteristic species assemblages, or their several alternative characteristic assemblages, natural communities are *distinguished* and *recognized* by their total floristic assemblage, not simply by their structural types and/or one or a few dominant species with little indicator value.

Traditional habitat and vegetation classifications that ignore total species assemblages and emphasize the more easily observed vegetation structure and dominance types have generated entities that have little correlation with high biodiversity occurrences the occurrence high biodiversity values, and therefore government and private entities such as state natural heritage programs and The Nature Conservancy, who are charged with identifying and conserving biodiversity "hot spots", have developed natural community classifications (e.g., Reschke 1990) and vegetation classifications (e.g., Lundgren 2000) which consider total species assemblage. Although such classifications specific to Connecticut have not yet been published, guidance and working drafts of such classifications have been available from the CT-DEP-NDDB since 1990 (e.g., Metzler and Barrett 2003).

Two facts of life sabotage and confound rare protection and the conservation of rare plant populations. One is the often-observed phenomenon of "under-saturation of available habitat" by rare species occurring in a specific natural community. That is, rare species often occupy only a small portion of a natural community that is more or less uniform over a much larger area than the rare species occurrence. The reasons for this are most often not easily understood, but among the reasonable hypotheses is that at any given moment in time, only a subset of the natural community is suitable habitat for the species. In may cases this is strongly suggested by field observations, e.g., the rare species population is confined to the "pit" or "mound" of a wind thrown tree, or, it is under canopy gap of a fallen or cut tree, or it is associated with an area kept free of deep leaf litter by ephemeral watercourse scouring. These kinds of observations strongly suggest that within a natural community the suitability for a rare species of a given microsite will change over time, due to disturbances, vegetation development/succession, and to many other factors, such as cyclic climate changes (i.e., "meteorological droughts", that may last over several consecutive years). Theoretically, rare species survives in a natural community undergoing such changes by dispersing from microsites that have become unsuitable to microsites that have become suitable. Though relatively few rare plant populations have been monitored rigorously over the long periods that are required to statistically test this hypothesis, it is supported by a number of subjective observations of the natural translocation of rare species populations within a natural community.

The companion fact of life that works with the above-described phenomenon to confound rare species protection is that Connecticut's Endangered Species Act at present does not legally protect critical habitat for Endangered and Threatened rare species that is not actually presently occupied by such species. Thus, the situation may arise where an applicant for a State permit reasonably argues that his project avoids a taking of a State-listed species, because he proposes to" fence off" and protect only the area actually

occupied by the rare species, and perhaps a small buffer. This argument may be accepted even though the project destroys most of the associated natural community and critical habitat that is not currently occupied by a protected species. Local land use commissions are largely able to address this gap in the State's protection of significant natural communities and the long-term viability of their associated rare species populations. The inland wetlands commission may require stronger protections to wetlands that have been identified to be especially sensitive and/or of higher ecological significance than other wetlands. The conservation commission may recommend that wetland and upland communities of special ecological significance be afforded special protection, including open space set-aside.

## IMPACTS OF THE PROPOSED DEVELOPMENT ON STATE-LISTED RARE SPECIES AND SIGNIFICANT NATURAL COMMUNITIES

1. Construction of the golf course and associated infrastructure in sensitive areas will outright destroy or replace most of the existing natural plant communities under the proposed footprint.

2. Construction will eliminate a significant portion of the northern transitional/hardwood forest, including the population of the state-listed sedge, *Carex novae-angliae*, which was identified by the botanical team.

3. The southern end of Golf Hole #7 destroys the rich, mesic *Acer-Fraxinus* forest and possibly some of the seepage forest community, both of which are among the higher quality occurrences (i.e. low invasives component, high native species richness).

4. A significant portion of a high quality occurrence of the *Acer-Fraxinus seepage* forest will be eliminated by the construction of tees, cart paths and rough of Golf Hole #8. The remaining portion of this community will be close to the edge of the developed area and will therefore be at high risk for invasives, contaminated leachates and run-off.

5. Edges created by clearing for the golf course and associated infrastructure will increase the susceptibility of the forest to penetration and infestation by invasive plants that will in turn degrade ecological communities; grass mixes, imported fill, soils introduced with ornamental plantings and birds depositing seed near the newly created edges are potential sources. Cart paths will serve as corridors for invasive plant dispersal agents. Invasive seeds and propagules are easily transported on shoes and on vehicles such as carts and maintenance equipment.

The *Carya-Fraxinus* forest/woodland may be impacted from clearing for the tees and cart paths for Golf Hole # 6 by increasing its susceptibility to invasion by non-native plants from sources mentioned above. The circumneutral seepage swamp is also at risk from invasive infestations for the same reasons. In addition, it is at risk from contaminated leachate and run-off from the fairway which is just upslope from the seep.

6. The clearing of forest to create play-over conditions at Golf Hole #5 potentially threatens the population of the State-Endangered swamp red currant (*Ribes triste*). The currant population and the circumneutral seepage swamp are both potentially threatened by contaminated leachate and run-off from the fairways, which are less than 20 ft. from the wetland boundary. This community is also threatened by invasive plants for reasons previously mentioned.

7. Rare plant populations and significant natural communities such as the circumneutral seepage swamps and seepage forests can be negatively impacted by changes to the surrounding forest. Close proximity of clearing will increase near-edge light levels, thereby changing its floristic composition and its ecology. Changes in landform by cutting and filling, required both for golf course and subdivision development, has the potential to alter hydrology and drainage patterns, which may significantly affect the hydrology of natural communities downslope that are dependant on seasonal or perennial seepage. This includes several of the significant natural communities on the site.

8. The rich fens, which are of especially high conservation significance, are low-nutrient peatland systems and are therefore especially vulnerable to nutrient input from development. Increases in the already present reed canary grass (*Phalaris arudinacea*) and common reed (*Phragmites australis*) populations, especially in the southeastern fen, can be expected if nutrient levels increase.

9. As depicted on current site plans, the "conceptual" subdivision would permanently alter the unique plant assemblage of the *Carya-Fraxinus* communities on Bald Mountain. Direct impacts of clearing, grading, road construction, and homesite development will not only result in outright habitat destruction but will set the stage for degradation of the adjacent forest. Currently, this community is free of non-native invasive plants but the edges created by the clearing for homesites and for views will enable non-native plants to gain a foothold and eventually invade the remainder of the forest.

10. Hole #8 displaces one of the higher quality occurrences of the rich, mesic Acer-Fraxinus forest while another higher quality occurrence is displaced/impacted by the "conceptual" subdivision to the northwest of Hole 8. There are a large number of State-listed species that occur in this community type, though none were found by the botany team. Several State-listed rare native orchids may occur in this community. Several of the potential rare species are spring ephemerals that would be undetectable by late June.

## RECOMMENDATIONS

1. The number of rare plant occurrences found on the site by the botany teams found is high in light of the limited amount of time spent in the field and their limited coverage of the site. In addition, there are many other rare plants and special communities known in the greater vicinity (CT-DEP-NDDB Biodiversity Maps). These facts combined strongly suggest that there is a high probability of finding other state-listed species and significant natural community occurrences on the Yale Farm site. Therefore, land-use commissions

should require – *prior* to any decisions- that the applicant perform a full and competent inventory for rare species and significant natural communities of the entire portion of the site for which activities are, or might be, proposed. Otherwise, in a setting such this site, where there is a high potential for rare species and/or communities to exist virtually anywhere on the site that is not already developed or actively farmed, any proposed activity should be assumed to have a significant environmental impact, unless competent biological/ecological inventory has demonstrated otherwise.

2. The Commission should require that the applicant classify and map the vegetation/natural communities of the Yale Farm site, mapping the full extent of the 9 significant communities already identified on the site by the ERT botany team, and occurrences of any other significant communities on the site. The Commission should require that the applicant use the most current draft of Metzler and Barrett's "Vegetation Classification of Connecticut" (Metzler and Barrett 2003) as a guide to the classification of the site, and consult with the CT-DEP-Natural Diversity Data Base on questions regarding rarity and significance. The applicant should identify all occurrences of natural communities of high biodiversity conservation significance, distinguish between higher and lower quality occurrences of such occurrences, and provide a rationale for such distinction. Having and mapped such communities, the applicant should demonstrate that he has made all reasonable and prudent provisions in his proposal to first avoid, then minimize, and at last resort mitigate and compensate for impacts to the natural communities of higher significance and quality.

4. Since there are no standards for botanical survey designated by law or professional society in Connecticut, the Commission should specify a performance standard for the botanical/ecological inventory of the site. The Commission should require no less than a full-growing-season inventory of the site for State-listed plants and their potential habitats, using Table 2 of this report as a minimum starting list of target species for which to look. The ERT botany team did not explore the entire site – other communities may occur on the site which may be potential habitat for additional State-listed plants not listed in Table 2). These botanical surveys should be performed by a person or persons with demonstrable botanical expertise with the flora of southern New England in general and rare species inventory in particular. Botanical surveys must be conducted at various times throughout the growing season, as most of the herbaceous rare species listed in Table 2 are detectable and/or identifiable for only a portion of the growing season. A substantial number of these species are reliably detectable/identifiable only in early spring, while on the other end, some of the species are not detectable/identifiable until late summer or fall. Upon exploring the site, the qualified expert[s] should be able to develop and justify a target list of species (and justify any exclusions of species that are listed in Table 2 as potential rare species occurring on the site), and schedule site visits such that the chances of detecting each species are appropriately maximized. The Commission should require that surveyors document their survey in such a way that it may be evaluated by other experts in their field, *i.e.*, with written community descriptions, documentation of timing of visits and routes of survey, and lists of all plant taxa observed in the course of their survey.

5. Newly discovered rare plant populations and significant communities, including those located by the Kings Mark botanical team should be mapped. It is important that this is done *prior* to any further excavation or scarification of the soil and vegetation until the applicant has completed a comprehensive botanical inventory: two of the State-listed species occurrences that the botany team discovered on the site were in areas where numerous perc tests had been dug. The area of these rare species populations were such that either of the occurrences could have been easily obliterated by a perc test excavation, and other populations of these or other rare species may well have been destroyed by excavation or heavy equipment traffic. In addition to mapping the occurrences, all populations of rare plants should be identified and effectively marked in the field so that they may be avoided, before any further soil/vegetation disturbance occurs in a given area.

6. As discussed in the impacts section, construction, contaminated run-off, increased sunlight entering from created openings in the canopy, alteration of seepage drainage patterns, and/or invasion by non-native species will permanently alter the inherent natural characteristics and ecology of this biologically unique and diverse parcel (refer to impacts); all of these issues should be addressed.

- The extent of clearing and grading and their proximity to sensitive areas, such as seeps, must be carefully planned to prevent *any* negative impacts to rare plant populations and significant communities; the protection of the rich fens are contingent on the protection of the up-slope seeps and watercourses that ultimately flow into the fen.

- There is a high potential for nutrient laden run-off and leachate; contaminated water should be renovated in an upland areas and not in existing wetlands. Contamination of wetlands may exacerbate and promote non-native plant infestations. Areas with frequent, seepy microsites that were not mapped as wetlands should be mapped and treated as such and therefore should not be considered as appropriate renovation areas.

7. There are large portions of the site in which invasive plants are either absent or are a relatively minor component of the natural communities. Significant portions of the site, including some of the significant natural communities have considerable infestations, most prominently Japanese barberry (*Berberis thunbergii*). There are few areas on the the parcel where invasives have completely displaced natural communities. For example, Japanese barberry (*Berberis thunbergii*) and multiflora rose (*Rosa multiflora*) are abundant in the forested seepage swamps and seepage forests that will be eliminated by Golf Hole 2. However, these communities still have a strong and appropriate, native species component that is diminished but not eliminated by the invasive shrubs. Thus, the mere abundance of invasive shrubs in these communities is not comparable to the ecological destruction of the community that conversion to a golf hole represents. On the contrary, it should be viewed as an opportunity for mitigation and enhancement.

8. It is important that *all* wetlands and fairways are flagged; impacts cannot be accurately evaluated if the actual location of fairways is not marked in the field. Also,

edges of proposed clearings need to be marked in the natural communities that will be converted into non-natural areas

9. Commissions should be cognizant that much of our knowledge regarding invasive plant control is from artificial or managed environments and that invasive plant management in natural areas is not well-understood. Ultimately, the early detection and removal of invasives is the most prudent method to prevent incursions. This approach, combined with planting wide buffers of native vegetation (which are left undisturbed) between the developed areas of the parcel and natural communities will help stave off infestations into new areas.

10. Based on statements made by the applicant's consultant during the initial ERT orientation site walk, the applicant may be proposing significant changes in golf course layout during the public hearing process. This has created a situation where the Kings Mark Environmental Review Team, among others, must review the purported most current proposal without plans that represent the purported proposed activity. If the application has been modified, land-use commissions should deny the application without prejudice, and "freeze" the application for the period of the public hearing, in order for the public and other stakeholders to have the full period as designated by law to review the proposal.

11. A large portion of the Northern/transition hardwoods stream ravine community is shown being replaced by the fairway for Hole 3, on the applicant's plans dated 13 June 2003. On June 16, 2003 site walk led by the applicant's consultant, Bill Root, it was stated by Mr. Root that the proposal was being revised such that the proposed fairway would no longer occupy the ravine but a portion of the ravine forest would be permanently cleared of trees to allow for play across the ravine. As of 13 July 2003, the botany team had not received plans reflecting any such change.

## DESCRIPTIONS OF SIGNIFICANT NATURAL COMMUNITIES IDENTIFIED AT THE SITE OF THE PROPOSED YALE FARM GOLF CLUB

The Kings Mark ERT botanical team identified the following nine significant natural communities and classes of natural communities on the Norfolk portion of the site of the proposed Yale Farm Golf Club:

1. ***Carya - Fraxinus*** **Forest/Woodland**
2. **Circumneutral Seepage Forests**
3. **Circumneutral Seepage Swamps**
4. **Rich Fen**
5. **Cold Talus Community**
6. **Northern-affinity Transitional Forests**
7. **Northern/transition Hardwoods Plateau**
8. **Oak – Pine –** ***Deschampsia flexuosa*** **Summit Community**
9. **Rich, mesic** ***Acer –Fraxinus*** **Forests**

Below is a brief description of each community with some of the plants that were identified, including indicator species. It is important to note that all of these communities host actual rare plant occurrences and/or have significant potential for rare plant occurrences. The number of rare plants found is considerably high in light of the limited amount of time spent in the field. This, and the fact that there are many other rare plants and special communities in the vicinity suggests there is a high probability of finding other occurrences of state-listed rare plants and significant natural communities on the Yale Farm parcel.

## 1. *Carya – Fraxinus* Forest/Woodland

This is an uncommon community in Connecticut that may be found on dry but fertile summits and upper slopes, topographic positions much more commonly occupied by oak-heath communities. The factors producing *Carya - Fraxinus* communities are not completely understood, but a combination of microclimate and higher pH bedrock at or close to the soil surface is implicated. These communities are marked by a stunted tree layer dominated by hickories (*Carya* spp.) and White Ash (*Fraxinus americana*), and a characteristically open aspect in the understory. The sedge *Carex pensylvanica* is generally the dominant herb in a relatively species-rich ground layer assemblage. The closed-canopy forest expression of this community occurs on the relatively less dry sites, while the woodland expression, which has sunny gaps between trees, occurs on sites that are relatively drier, due to greater convexity, aspect, shallower soils, more exposed ledge, and/or previous site disturbance. The woodland expression is frequently the higher-diversity of the two expressions, as it can also support shade-intolerant species not found in the closed-canopy forest. The woodland expression typically occurs as a smaller inclusion in the larger *Carya-Fraxinus* forest. While both expressions are significant communities and have high potential for rare plants, the woodland expression is the relatively rarer of the two, and has the greater potential for rare species. Because of droughtiness of this expression, it is very slow to develop into closed -canopy forest after disturbance, and this promotes continuity of open-canopy and partial-canopy conditions over long periods. This in combination with richer than average soils are the most likely reason for the high correlation of State-listed species with this community.

In the occurrences of this community (both expressions) that the botanical team has identified to date, there is an admixture of stunted White Oak (*Quercus alba*) and Red Oak (*Quercus rubru*) that are of spreading habit and may be old-age trees (>100 years). Other species that are typical of this habitat type that were noted at Yale Farm were Choke-cherry (*Prunus virginiana*), hawthorn (*Crataeagus* sp.), Plantain-leaved Pussy's-toes (*Antennaria plantaginifolia*), Common Hairgrass (*Deschampsia flexuosa*), Thicket Shadbush (*Amelanchier stolonifera*), Hop-Hornbeam (*Ostrya virginiana*), Round-leaved Ragwort (Scenecio obovatus). Among the State-listed plants that potentially occur in this community are Slender Wheatgrass (*Elymus trachycaulus* ssp. *subsecundus*), Downy Wood-Mint (*Blephilia ciliata*), a globally rare form of Reed Bentgrass (*Calamagrostis stricta* sub. *inexpansus*), and rare orchids, e.g. Hooker's Orchid (*Platanthera hookeri*).

That this southern-affinity community occurs on the Yale Farm site underlines the broad community diversity that the site encompasses.

One occurrence of this community that the botanical team has identified to date is on the southern extension of Bald Mountain, where it would be largely obliterated by the development of the ridge-top subdivision, if it was built as shown on the current plans.

### 2. Seepage Forests

These high-fertility communities occur on sloping sites where, due to higher pH seepage, soil conditions are either 1) uniformly seasonally saturated, becoming mesic for the better part of the growing season, or (the more common situation at Yale Farm) 2) there is a complex mosaic of higher mesic microsites and lower seasonally and/or perennially inundated or saturated microsites. These communities are, overall, relatively less wet and/or wet for a shorter portion of the growing season than the Circumneutral Seepage Swamp communities (though in many cases the wetter microsites in the Seepage Forest are essentially the same as the Seepage Swamp). They occur at Yale Farm as deciduous, mixed evergreen-deciduous, and evergreen forests. Sugar Maple (*Acer saccharum*), White Ash (*Fraxinus americana*), Yellow Birch (*Betula allegheniensis*), and often Basswood (*Tilia americana*) are dominant or prominent trees in the deciduous and mixed expressions, and are usually present as subordinate associates in the expressions dominanted by White Pine (*Pinus strobus*) and/or Hemlock (*Tsuga canadensis*).

This community is characterized by high plant species richness and a prevalence of species requiring high-base soils. Characteristic species include Foamflower (*Tiarella cordifolia*), *Carex hirtifolia*, Round-leaved Ragwort (*Scenecio obovatus*), Silvery Spleenwort (*Deparia acrostichoides*), Spinulose Shield Fern (*Dryopteris carthusiana*), and Ironwood (*Carpinus caroliniana*). The wetter microsites support *Carex leptalea*, *Carex bromoides*, False Hellebore (*Veratrum viride*).

The botany team encountered occurrences of two State-listed species, Purple Oat (*Schizachne purpurascens* [Special Concern]) and Sharp-lobed Hepatica (*Hepatica acutiloba* [Threatened]), in the mixed expression of this community, in areas that on lots of the conceptual subdivision, as shown on most recent plans. Both occurrences are not far from one or more perc test sites. The botany team did not explore all of this community type that exists on the site, so there may well be additional populations of *Schizachne purpurascens* and *Hepatica acutiloba* at the site, and there are a large number of other State-listed plants that potentially occur in this community type. At many, if not all, of the known occurrences of *Schizachne purpurascens* and *Hepatica acutiloba* in Connecticut, other State-listed plants occur with them or in their near vicinity.

### 3. Circumneutral Seepage Swamp

These communities occur on sloping sites where seasonal seepage of neutral or higher pH breaks out at or near the ground surface, creating hydric soil conditions in spite of there being no wetland basin to trap water. Several types of Circumneutral Seepage Swamp communities were identified on the site by the ERT botany team. In one of the deciduous expressions it is dominated by red maple (*Acer rubrum*), American Elm (*Ulmus americana*) and Green Ash (*Fraxinus pennsylvanica*), and prominent in the understory and herb layer are the following indicator and/or characteristic species: *Carex bromoides*, Water Avens (*Geum rivale*), Nannyberry (*Viburnum lentago*), and Woodland Horsetail (*Equisteum sylvaticum*), Common Horsetail (*Equisetum arvense*), Golden Ragwort (*Scenecio aureus*), and *Carex prasina*. Mixed and evergreen expressions with White Pine (Pinus strobus) and/or Canada Hemlock (*Tsuga canadensis*) dominant has a more or less different assemblage of understory and herb layer plants. State-listed rare plants found in this community at the Yale Farm site are Canada Anemone (*Anemone canadensis*) and Swamp Red Currant (*Ribes triste*), both which are State-Endangered. Both of these seepage swamp communities have the potential for additional state-listed rare calciphiles.

**4. Rich Fen**

Large portions of the two large open-canopy basin wetlands on the site that have been identified by the applicant as emergent marshes are actually rich fens, sedge-dominated peatlands with circumneutral or higher pH. Rich fens are not only uncommon but are of high ecological integrity due to their rich, diverse native plant assemblages. As such, they have a high potential for state-listed species and are of high conservation significance. Prominent indicator species occurring in the fens at Yale Farm include the sedges *Carex interior*, *Carex hystericina*, *Carex leptalea*, *Carex bromoides, Carex atlantica* ssp. *atlantica*, and Autumn Willow (*Salix serissima*). Common Cattail (*Typha latifolia*) is common but not generally dominant. Uncommon species of these communities include *Carex diandra*, *Epilobium strictum*, *Epilobium leptophyllum*, and the northern-affinity *Scirpus atrocinctus*. The northeastern fen is many respects similar to the southeastern fen, but it has been influenced by beaver activity along Ginger Creek, which has promoted the development of semi-permanently inundated emergent marsh in many areas, and fen portion is denser and ranker than the southeastern fen. Also, certain species, such as *Carex flava*, *Rhamnus alnifolia*, and *Geum rivale*, were noted in the northeastern fen, which may indicate that it is a higher pH wetland.

While both fens are significant natural communities, the southeastern fen is the more exceptional and uncommon of the two entities. Especially significant features are areas with a firm "peat-dome" that supports a harsh low herb layer in which several of the above-listed uncommon plants are prominent. One probable State-Special Concern plant was found by the ERT botany team in this community: Autumn Willow (*Salix serissima*). Another exceptional feature of this wetland is the small, clear-flowing stream that transects its entire length. This stream is doubtless an important breeding resource for Odonates (dragonflies and damselflies), and is not a habitat feature found in many fens. Invertebrate zoologist Michael C. Thomas, a research technician with the Connecticut

Agricultural Experiment Station and affiliations with the invertebrate collections of the University of Connecticut, Florida State University, and Yale, spent a few hours surveying the insect community of this fen on 30 June 2003. No currently State-listed species were encountered, but Thomas documented a robust community of Odonates (dragonflies and damselflies), which included three species believed to be uncommon to rare: Eastern Red Damsel (*Amphiagrion saucium*) – the highest density of this species ever encountered by Thomas in Connecticut; Spatterdock Darner (*Aeshna mutata*); and Red-waisted Whiteface (*Leuccorrhina proxima*) – a species with les than 10 sites currently known in Connecticut). Odonates all have aquatic larval stages of up to two years for some species, and the fen's transecting stream doubtless provides nursery habitat for many of these species, while the nearby meadows/hayfields provide important adult foraging habitat for some of the Odonates. Thomas encountered two uncommon butterflies, Pepper & Salt Skipper (*Amblyscirtes hegon*) and Silver-bordered Fritillary (*Boloria selene*). The latter species is in northwest Connecticut uncommon and appears to be exclusively associated with our most important and high quality rich fens. In Thomas' estimation, this wetland had a high potential for State-listed invertebrates (Thomas 2003).

The invasive species *Phalaris arundinacea* and *Phragmites australis* are also present in the fen. *Phalaris arudinacea* is locally abundant on the western margin of the southeastern fen, and its prevalence in that area may be due to past agricultural activities on the adjacent slope. The extent of *Phragmites australis* is also limited, especially in the northeastern fen. Due to the isolated nature of the wetlands it is possible that the *Phragmites* is the native race and not the introduced genotype.

### 5. Cold Talus Community

This is one of the northern affinity communities on the property. It occurs on a protected north-facing slope below ledges, on and about boulder talus. It is most developed in a cove transected by a small stream. Characteristic and/or indicator-species of this community are Yellow Birch (*Betula alleghaniensis*), Striped Maple (*Acer pensylvanicum*), Mountain Maple (*Acer spicatum*), Hobblebush (*Viburnum alnifolium*), Rosy Twisted-Stalk (*Streptopus roseus*), Corn Lily (*Clintonia borealis*), Oak Fern (*Gymnocarpium dryopteris*), American Fly-Honeysuckle (*Lonicera canadensis*), and woodferns (*Dryopteris* spp.). This community is potential habitat for State-listed rare plants are more common only far to the north of Connecticut as well as some species that are more common in the Appalachian Mountains. Among these are some of our rarest State-listed species, which may have been genetically isolated from the rest of the species soon after the Wisconsin glacier retreated.

### 6. Northern/transition Hardwoods Stream Ravine Community

This deciduous and mixed *Tsuga canadensis*-deciduous forest community occurs on stony mineral soils in the stream ravine above and below the Cold Talus Community, and may occur elsewhere along the northeast-facing lower slope of the main ridge crossing the site. It is characterized by several of the same northern-affinity plants as that of the Cold Talus Community, plus several others, such as Painted Trillium (*Trillium undulatum*), Round-leaved Violet (*Viola rotundifolia*), and an orchid tentatively identified as Leafy Northern Green Orchis (*Platanthera hyperborea*) - the plant was not mature enough on 16 June 2003 to identify with certainty.

As the name indicates, the plant assemblage of this community is transitional in vegetation character between so-called "Central Hardwoods" and "Northern Hardwoods".

Like the other northern-affinity forest communities found on the site, this community is potential habitat for State-listed plants that are more common in the Spruce-Fir forest zone to the north of Connecticut, but which rarely occur in Connecticut as populations disjunct from the main part of their range, in places where the microclimate resembles conditions in the main part of their range.

### 7. Northern/transition Hardwoods Plateau Community

This hardwood forest community occurs on a broad, plateau-like area north of Bald Mountain Road and west of the spine of the main ridge running northwest/southeast across the northern half of the site. Hole #6 is proposed at the north end of this area. This community is transitional between a *Quercus-Viburnum* forest and Northern Hardwoods forest, with White Oak (*Quercus alba*), Red Oak (*Quercus rubra*), Sugar Maple (*Acer saccharum*), Red Maple (*Acer rubrum*), and Black Cherry (*Prunus serotina*) as prominent canopy-layer trees. The prevalence of Maple-leaved Viburnum (*Viburnum acerifolium*) and Horned Hazelnut (*Corylus cornuta*) and a dearth of American Beech (*Fagus grandifolia*) are southern-affinity characteristics of this community, while the northern-affinities are indicated by Striped Maple (*Acer pensylvanicum*) as a prominent and often dominant understory tree and shrub, the prevalence in the herb layer of the uncommon sedge *Carex brunnescens*, and the more sporadic occurrence of the State-Special Concern New England Sedge (*Carex novae-angliae*).

### 8. Oak – Pine – *Deschampsia flexuosa* Summit Community

This community occurs on dry rocky summits and has at least one known occurrence on the site just northwest of the tees for proposed Hole #7 and just east of much of the length of proposed Hole #6. There may be additional occurrences of this community on other summits on the site that were not explored by the botany team. This is an acid-soil community dominated by Red Oak (*Quercus rubra*), White Oak (*Quercus alba*), and White Pine (*Pinus strobus*), with some Chestnut Oak (*Quercus primus*). It is distinguished from the more common acid oak summit communities of the region by the

prominence of Common Hairgrass (*Deschampsia flexuosa*) in the herb layer. Also, it has been recognized since at least the early 1960's as a community of conservation interest and significance, when it was first described by ecologists William Niering and Frank Egler (Niering and Egler 1961).

It appears likely that the trees in the occurrence of this community near Holes #6 and #7 are in old-age condition, i.e., the trees appear by their form and size to be well over 100 years old, and perhaps over 150 years old. This occurrence is not directly threatened by the proposed activities, though location of Holes #6 and #7 nearby may encourage the establishment and increase of some invasive plants which can tolerate dry, acid conditions (e.g., *Rumex acetosella*). However, if it is not recognized as an area to avoid and protect, it is potentially threatened by changes in the golf course layout that may be proposed to address other concerns, such as impacts to wetlands to the west and south.

### 9. Rich, mesic *Acer - Fraxinus* Forests

This non-wetland forest community occurs on well-drained sites of higher fertility, and it is closely related in terms of species composition to the Seepage Forest, into which it frequently grades (it is essentially the Seepage Forest minus the seeps). It is characterized by the prominence of Sugar Maple (*Acer saccharum*) and White Ash (*Fraxinus americana*) in the tree layer, and the prominence of a variety of nutrient-demanding species, such as *Carex hirtifolia*, Smoother Sweet Cicely (*Osmorhiza longistylis*), and many spring ephemerals in the herb layer. It occurs both as a deciduous forest and as a mixed forest with White Pine (*Pinus strobus*) and/or Canada Hemlock (*Tsuga canadensis*). The herb layer is also characteristically diverse in the higher quality occurrences in which invasive species, such as Japanese Barberry (*Berberis thunbergii*), are not dominant. At the Yale Farm site, the ERT botany team found both higher quality occurrences of this community, with few or no invasive species, and lower quality occurrences, where native species were subordinate to invasive exotic species.
There are a large number of State-listed species that may occur in this community type, though none were found at the Yale Farm site by the ERT botany team. Of particular note, several State-listed rare native orchids may occur in this community. Several of the potential rare species are spring ephemerals that would be undetectable by late June.

## Other Communities at the Yale Farm Golf Club Having Potential as Rare Plant Habitat

Two communities that were identified on the Yale Farm parcel by the botany team deserve special attention in spite of the team's judgment that they do not rise to a level of biodiversity conservation significance comparable to the above-described natural communities. In the geographic setting of Yale Farm, both of these communities have arguable potential as rare plant habitat for the reasons explained below:

The first community is a wet meadow occurring in the existing hayfield which is in part proposed to be Holes #9 and #18. A portion of this wetland is a low- to medium-height herbaceous community with a prominent native species component that contrasts with the taller, denser, exotic-species-dominated potions of the hayfield. Several species in the low-to medium-height wet meadow community (e.g., *Carex conoidea*, *Carex pallescens*, *Carex histericina*) indicate circumneutral or high-base soil conditions. Based on its structure and species assemblage, this community has some potential for certain rare species, e.g., Adder's-Tongue (*Ophioglossum pusillum*), Stiff Gentian (*Gentiana quinquefolia*), and Green Woodland Orchid (*Platanthera flava*). Though too little is known of the community's distribution to confidently designate it as rare or uncommon, and exotic/weed species are too prominent to call it exemplary, its native species richness precludes its being discounted as a low-quality wetland or a habitat that need not be surveyed for rare plants.

The other communities that merit some attention and discussion are the *Quercus-Viburnum* Forest and the *Acer-Fraxinus/ Osmunda claytoniana* Forest communities, which are among the common "matrix forest" types that occupy most of the Connecticut landscape, and at the Yale Farm site occupy relatively mesic/less dry, relatively infertile mid-slope, upper slope, and summit landscape positions. State-listed rare species are generally absent from these communities, but at the Yale Farm site, the botany team's observations suggest that these communities have a relatively higher-than-average potential as rare plant habitat. The site has a generally well-developed and species-rich herb layer in which invasive species are not prominent, and which deer-browse has not reduced to unnatural sparseness, as opposed to many other parts of Connecticut and the Northeast. Also, the botany team discovered a population of the uncommon native orchid Large Whorled Pogonia (*Isotria verticillata*) in the *Quercus-Viburnum* community. Orchids of different species tend to occur gregariously, perhaps because of their dependence upon symbiotic relationships with fungi in the soil that are not species-specific in their associations. That *Isotria verticillata* occurs on the Yale Farm site increases the probability that its Federally Endangered and globally rare congener, Small Whorled Pogonia (*Isotria medeoloides*), also occurs on the site. Potential habitat for this plant includes Rich, mesic *Acer –Fraxinus* forests, *Quercus-Viburnum* Forest, and *Acer-Fraxinus/ Osmunda claytoniana* Forest.

## REFERENCES

Metzler, K. J., and J. P. Barrett. 2003. Vegetation classification for Connecticut. Draft 07/11/03. State Geological and Natural History Survey of Connecticut, Department of Environmental Protection. Hartford, CT. 135 pp.

Dowhan, J. J. and Craig, R. J. 1976. Rare and endangered species of Connecticut and their habitats. State Geological and Natural History Survey of Connecticut, Report of Investigations No. 6. 137 pp.

Niering, W.A. and F. E. Egler. ca. 1961. The vegetation of Connecticut natural areas: Canaan Mountain Wilderness Area. Unpublished report, in draft form. Files of the Conn. Natural Diversity Data Base, Connecticut Dept. of Environmental Protection, Hartford, CT. 34 pp.

Connecticut Dept. of Environmental Protection. 1998. Connecticut's Endangered, Threatened, and Special Concern species, 1998. Connecticut Dept. of Environmental Protection, Hartford, CT. Pamphlet. 19 pp.

Mangels, C. R. 2003. Report on permit application review and preliminary botanical survey of the Yale Farm property, Towns of Norfolk and North Canaan, Connecticut. Technical report prepared for the Coalition For Sound Growth. 13 pp.

Thomas, M. C. 2003. Damseflies and dragonflies (Odonata), butterflies (Lepidoptera), and robberflies (Asilidae) observed by Michael C. Thomas and Bill Moorhead, June 30, 2003 [at the Norfolk portion of the porposed Yale Farm Golf Club]. Technical report prepared for Northwest Conservation District. 3 pp.

Reschke, C. 1990. Ecological communities of New York State. New York State Natural Heritage Program. N. Y. S. Dept. of Environmental Conservation. Latham, NY. 96 pp.

Lundgren, J. A., editor. 2000. Plant communities of the Lower New England – Northern Piedmont Ecoregion. Adapted from: Sneddon, L., M. Anderson and J. A. Lundgren. 1999. International classification of ecological communities: terrestrial vegetation of the northeastern United States. January 1999 working draft. Assoc. for Biodiversity Information/The Nature Conservancy, Eastern Regional Office, Boston, MA, and Natural Heritage Programs of the Northeastern U. S. 77 pp. + index.

# Wildlife Resources

## General Background

The ±535 acres of property in Norfolk contains a variety of conditions and habitat types and provides habitat for a variety of wildlife. The following wildlife were observed during the June 16, 2003 field visit either directly or indirectly by identifying calls, tracks, scat or other sign; whitetail deer *(Odocoileus virginianus)*, red fox *(Vulpes vulpes)*, raccoon *(Procyon lotor)*, gray squirrel *(Sciurus carolinensis)*, eastern chipmunk *(Tamias striatus)*, meadow vole *(Microtus pinetorum)*, American robin *(Turdus migratorius)*, wood thrush *(Hyocichla mustelina)*, gray-cheeked thrush *(Catharus guttatus)*, great crested flycatcher *(Myiarchus crinitus)*, mourning dove *(Zenaida macroura)*, American crow *(Corvus brachyrhynchos)*, bluejay (*Cyanocitta cristata)*, downy woodpecker *(Picoides pubescens)*, red-bellied woodpecker *(Melanerpes carolinus)*, American redstart *(Setophaga ruticilla)*, yellow warbler *(Detroicha petechia)*, red-eyed vireo *(Vireo olivaceus)*, eastern wood-pewee *(Contopus virens)*, scarlet tanager *(Piranga olivacea)*, eastern towhee *(Pipilo erythrophthalmus)*, Ovenbird *(Seirus aurocapillus)*, black-capped chickadee *(Parus atricapillus)*, chipping sparrow *(Spizella passerina)*, house finch *(Carpodacus mexicanus)*, *savannah sparrow *(Passerculus sandwichensis)*, bobolink *(Dolichonyx oryzivorus)*, red spotted newt *(Notophthalmus v. viridescens)*, green frog *(Rana clamitans melanota)*, and wood frog *(Rana sylvatica)*.

**Connecticut species of special concern (grassland bird specialist).*

A more detailed wildlife survey is required to learn more about the property' s wildlife inhabitants and habitat use.

## Conversion of Existing Plant Communities to Open and Mowed Habitat

In general, the conversion of some of the existing plant communities to open and mowed habitat will be detrimental to most forest-dwelling, shrub swamp-dwelling wildlife and many of the grassland-dependent wildlife currently occupying the site. A predictable shift in the type of wildlife communities occupying the developed portions of the 535 acre property will occur once the golf course, homes and other development actions are completed. Species such as the Canada goose, American crow, European starling, house sparrow, cowbird, bluejay, red fox, woodchuck, cottontail rabbit, and other generalists (i.e. deer, eastern coyote, northern cardinal, American robin, raccoon, opossum, and skunk) will benefit from the proposed habitat changes. Wildlife that are considered habitat specialists are more sensitive to the effects of the proposed land alteration will be the most adversely affected (i.e. grassland specialists such as Savannah sparrow, bobolink and interior forest specialists such as red-eyed vireo, and eastern wood peewee). Other wildlife that may be negatively affected from the proposed habitat changes will be the reptiles and amphibians which thrive best in areas with abundant coarse woody debris on the ground, interconnected forests with clean unaltered water sources and minimal road crossing hazards.

## Discussion of Wildlife Species Changes

Many of the wildlife species that are likely to benefit from the open and mowed habitats of this proposed development are, today, considered nuisances in many parts of the state. In

particular, the Canada goose has been associated with causing nuisance situations on golf courses. They congregate in large numbers, feed on turf grasses, nest on open water ponds, get in the way of golfers, and leave large volume of feces in and around the greens and waterbodies. Maintaining woody buffers of 50 to 100 feet along waterbodies helps reduce the use of water by geese. Other detrimental wildlife species that benefit from open and mowed areas are Brown-headed Cowbirds which parasitize the nests of other birds which leads to lower recruitment of young especially for many area-sensitive songbirds that are declining in Connecticut due to forest fragmentation.

There are many scientific studies in wildlife ecology that indicate a strong relationship between fragmented forests and high human use leads to declining function as meaningful reserves for area-sensitive (wildlife that require larger unbroken parcels) wildlife (Bond 1957, Levenson 1981, Hohne 1981, Askins et al. 1987). As forest and habitat sizes shrink in size, they are less viable as breeding places for interior forest birds and an increase in predation and parasitism of nests occurs (Blake and Karr 1985).

## Wildlife That Will Benefit From the Golf Course Development

The proposed habitat alterations will increase opportunities for some generalist native songbirds such as bluejays and northern cardinals which are becoming more common with suburbanization. With proper nest box placement and maintenance, desirable songbirds such as bluebirds and tree swallows can also benefit from a golf course environment.

## Management Recommendations

In reviewing the proposed development plans and inspecting the site conditions, the following wildlife impacts and concerns were enumerated:

### Wildlife Impact #1

Golf holes #2, 4, and 5 require alteration of wetlands or wetland habitat buffers. Greens, fairways and tees should be moved away from wetlands and wetland buffers. A minimum of 50 feet of undisturbed wetland buffers should be in place along these holes. Golf course designers should look to change the proposed residential development sites to move holes to reduce wetland impacts.

### Reducing Wildlife Impacts # 1

**Golf Hole #2 -** Golf hole #2 is impacting wetland buffer habitat and should be moved westerly into proposed residential lots to maintain a minimum of 50 wetland buffer along the pond.

**Golf Holes #4 and #5** - Golf holes #4 and #5 configurations disturb and impact wetlands and wetlands buffer. The two holes should be reconfigured to lessen wetland impacts by utilizing the land to the north (proposed road and house lots). The proposed cul-de-sac to the north of hole #5 should be shortened and kept further away from wetland boundary and buffer.

## Use of Native Plantings

The use of native trees, shrubs, wildflowers and grasses is encouraged to maintain wildlife diversity. Although some non-native invasives were located in areas, the property has a

significant wealth of native plants and natural plant communities. Any plantings that are to be done associated with the development should be native. Please check the invasive plant list for Connecticut maintained by the Connecticut Invasive Plant Working Group (see attached list in the Appendix). The Team wildlife biologist is available for further consultation on enhancing habitat using native plants for wildlife.

## Summary

Building a golf course requires major alteration of existing natural vegetation, soils, and topography. Inherent with these changes are the expected changes to wildlife and habitat currently found on the property (discussed earlier). It is difficult to recommend minimizing the impacts from habitat alteration without requesting significant alteration of some of the golf holes and associated residential development. The proposed residential development should be changed to accommodate the changes in golf hole configuration to reduce environmental impacts.

This review was limited by time. A more detailed field survey of the wildlife occupying the diverse habitats is warranted for this property. More information should also be gathered on the seasonal use of the habitats by birds, reptiles, amphibians and invertebrates; especially during the breeding seasons.

## Literature Cited

Askins. R. A., Philbrick, M. J., and Sugeno, D. S., 1987. Relationship between the regional abundance of forests and the composition of forest bird communities. Biol. Conserv. 39: 129- 152.

Bond, R. R. 1957. Ecological distribution of breeding birds in the upland forests of southern Wisconsin. Ecol. Mongr. 27:351-384.

Hohne, L. M. 1981. The goundlayer vegetation of forest islands in an urban-surburban matrix. Pages 41-54 in R. L. Burgess and S. M. Sharpe eds. Forest islands dynamics in man-dominated landscapes. Springer-Verlag, New York, NY.

Levensen, J. B. 1981. Woodlots as biogeographic islands in southeastern Wisconsin, Pages 13-39 in R. L. Burgess and D. M. Dharpe eds. Forest islands dynamics in man dominated landscapes, Springer-Verlag, New York, NY.

# Archaeological Review

The Office of State Archaeology (OAS) and the State Historic Preservation Office (SHPO) note that Archaeological Consulting Services (ACS) has undertaken archaeological investigations *[Phase I and Phase II Intensive Archaeological Survey Report of the Yale Farm Golf Club in the Towns of Norfolk and North Canaan, Connecticut]*, which identified five areas of archaeological sensitivity (Tobey Barn, Tobey House, Hart-Rood Foundation and bridge, Couch Barn West and Gaylord-Kirby archaeological sites). Three additional archaeological sites (Rood West prehistoric site, the mid-20th century trash dump, and the Couch Barn East site) were identified, however, they warrant no further archaeological investigations.

The OAS and SHPO recommend professional implementation of either of the following courses of action in regard to the five areas of archaeological sensitivity:

- *In situ* preservation of the five historic archaeological sites through project redesign or avoidance and use of pertinent conservation or historic preservation easements.

- Further archaeological studies to determine site boundaries, scientific integrity, historic contents, and eligibility, or lack thereof, for the National Register of Historic Places. National Register-eligible archaeological resources should be considered for designation as State Archaeological Preserves, including the preparation of public-oriented publications. All archaeological investigations must be carried out pursuant to the Connecticut Historical Commission's *Environmental Review Primer for Connecticut's Archaeological Resources*.

The Office of State Archaeology and the State Historic Preservation Office strongly encourage the preservation and public interpretation of the Yale Farm's historic archaeological resources, which reflect the 19th century agrarian lifeways of rural northwestern Connecticut.

# Planning Considerations

## Consistency of Project with State and Regional Plans

The "Conservation and Development Policies Plan for Connecticut, 1998-2003" was prepared by the Connecticut Office of Policy and Management and adopted by the State legislature. The Plan provides a statewide perspective on land use and was prepared to promote a "balanced response to human, environmental, and economic needs in a manner which best suits the future of Connecticut." The State encourages consideration of the State Plan by municipalities in their land use decisions. The State Plan classifies the Yale Farm property as predominantly "rural land," with a comparatively small "conservation area" straddling the town line, and areas of inland wetland soils which are classified as "preservation areas."

The State strategy for "Rural Land" is to avoid support of structural development forms and intensities that exceed on-site carrying capacity for water supply and sewage disposal and therefore cannot function indefinitely on a permanent basis and are inconsistent with adjacent open rural character or conservation areas. Rural lands are generally remote and lack public water and sewer services. These areas are characterized by single-family housing with water supply and waste disposal provided by on-lot systems. These lands include forest resources, wildlife habitat, and scenic values of general concern. The State Plan ranks rural lands fourth in State conservation priorities, behind conservation areas, preservation areas, and existing, preserved open space.

The State strategy for "Conservation Areas" is to "Plan and manage, for the long-term benefit, the lands contributing to the state's need for food, fiber, water and other resources, open space, recreation, and environmental quality and ensure that changes in use are compatible with the identified conservation values." An area astride the town line on the Yale Farm property is classified as a conservation area because it consists of prime agricultural soils.

The State strategy for "Preservation Areas" is to "Foster the identification of significant resource heritage, recreation, and hazardous areas of statewide significance and advocate their protection by public and quasi-public agencies in their planning and investment decisions. Avoid support for structural development except as directly consistent with their preservation values." As mentioned above, those areas of the Yale Farm property that consist of inland wetland soils are classified as preservation areas in the State Plan.

According to the "Regional Growth Policy Map," an advisory document prepared by the Litchfield Hills Council of Elected Officials (LHCEO), the proposed development site in Norfolk is primarily classified as a "rural area". These are outlying areas where densities even less than the minimum needed to sustain on-site sewage disposal and well systems are reasonable in order to direct growth to more cost-effective and less remote locations. Conservation subdivision options should be considered with any proposed development of these lands in order to protect important natural and cultural features.

The LHCEO has also prepared a Regional Economic Development Plan. Although the development of additional outdoor recreational facilities is not specifically addressed in this Plan, the Plan does recognize the importance of maintaining the region's rural character while at the same time encouraging, appropriate new business development for job creation and tax revenues. According to the applicant, the project is expected to employ approximately 15 people for turf maintenance operations during the summer months, and various clubhouse and dining area activities.

According to the Northwest Connecticut Council of Government's (NWCCOG) Regional Plan of Development, the North Canaan area is in a rural area where the Plan's goal is "to preserve and conserve areas ... that are of environmental historic, archaeological and cultural significance and to encourage development occurring outside the village centers to be environmentally sound and consistent with the region's rural landscape."

## Land Use and Design Considerations

The subject site is located in a rural residence zone in Norfolk, which allows golf courses by special permit. The North Canaan portion of the property is zoned residential/agricultural which also allows golf courses by special permit. The land surrounding the proposed development site is zoned for large lot residential use, with minimum lot sizes of 1.5 to 2 acres.

The landscape surrounding the project site is characterized by wooded land, open fields, and residential development on large lots. Campbell State Park is located on the northern border of the property.

As part of their long range plan, the applicant is proposing the development of 38 residential building lots in Norfolk and 23 in North Canaan. The exact location of these lots will not be determined until after the decisions are made on the golf course portion of the subdivision. The applicant, however, has shown preliminary layouts for the residential section.

The applicant refers to the residential portion of the project as a "conservation subdivision." Neither the Town of Norfolk nor the Town of North Canaan have provisions in their zoning regulations for "conservation subdivisions." The applicant is proposing minimum lots sizes of 3 acres. North Canaan requires a minimum of 60, 000 square feet (approximately 1.5 acres) and Norfolk has a minimum of 2 acres. Neither Town has provisions for "open space" or "cluster" subdivisions that would allow the minimum building lot area to be reduced in return for dedicated open space.

All of the land within the project is to be privately owned and managed. North Canaan's subdivision regulations allow the Town to require up to 15% of the area of a residential subdivision to be set aside as public open space that is accessible from a public road. The applicant estimates that 129 acres in North Canaan are to be used for residential purposes. The Town could, therefore, require up to 19.3 acres as public open space. The Norfolk subdivision regulations allow up to 1,000 square feet of open space to be set aside for each building lot. The applicant is proposing 38 lots. Norfolk could, therefore, require 38,000 square feet (.87 acres) of open space to be set aside.

The applicant is proposing extensive areas be covered by deed restrictions and common interest ownership association agreements. The specific areas, however, are not shown on the plans. Deed restrictions and common interest agreements restrict the owner's use of their property. With such restrictions, there is usually widespread understanding about the details of the restrictions among the initial purchasers and developers of the project. Over time, the initial consensus is likely to erode as property owners are prohibited from making "improvements" and "enhancements" to their property.

The continuing enforcement of the proposed conservation restrictions is the most significant component to mitigating the long term impact of this project on the area. With private restrictions, there is the chance that enforcement of the restrictions could ease or that the restrictions become less stringent. This is especially true since those making the rules are also those responsible for enforcing the rules. The proposed restrictions would have a greater chance of long term effectiveness if conservation easements were held by an outside

conservation organization such as a land trust that did not have a direct financial stake in the property.

The applicant is proposing to access the entire project with private roads. In Norfolk the minimum road width for private roads is twenty feet, in North Canaan, the minimum is twenty-six feet. The applicant is proposing road widths below the minimum width in both Towns.

The residential lots are laid out primarily along cul-de-sacs. Norfolk's regulations allow no more than four houses to be served by a private road. Several of the proposed cul-de-sacs in Norfolk exceed this limit. North Canaan's regulations call for a maximum cul-de-sac length of 1,000 feet. One of the proposed cul-de-sacs in North Canaan exceeds this limit.

One of the proposed cul-de-sacs begins in North Canaan and ends in Norfolk. Having cul-de-sacs that begin in one town and end in another is not good planning practice. It causes problems with emergency services as well as routine town services and school buses.

A number of the potential house lots are split by the Norfolk - North Canaan Town line. Because the towns have different zoning regulations, splitting a lot between the two towns can lead to confusion concerning yard setbacks from property lines, minimum lot sizes, accessory buildings, driveway access and the number of houses allowed on the property.

In the southwest corner of the site is an unnamed hill. The applicant is proposing to place three building sites near the top of this hill. Houses constructed in the area proposed will most likely be visible from the surrounding area. Slopes exceeding 15% characterize the areas near the hilltop. To create a level building pad on such slopes would require clearing and grading significantly beyond that needed just for the pad itself. This grading and clearing would increase the sites' visibility from the surrounding areas. As a result, these building sites will have a greater impact than if they were placed lower down on the slopes. Neither Norfolk nor North Canaan have regulations that restrict building on hillsides or ridgelines.

A project's impacts on neighboring properties are frequently judged by whether or not the project can be seen or heard from the neighboring property. To minimize these impacts, buffers of a specified width are commonly required between adjoining uses - especially when one of the uses is residential and the other is non-residential.

In certain locations, the proposed golf course comes within 20 feet of the property lines. For example, a part of the cart path for the 1st hole is within five feet of the property lines (see sheet GR-6). Another example, the detention pond serving the clubhouse is within 20 feet of the property line A third example, the clearing and grading for the 14th hole is within 10 feet of the property line. The applicant and the Planning and Zoning Commissions may wish to consider modification to the Site Plan to provide more separation distance between these golf course facilities and the abutting properties.

# Appendix

**Invasives List - January 2003**

**Standards for Organic Land Care - 2001**

**DEP - Inland Fisheries Division**

- **Policy Statement - Riparian Corridor Protection**
- **Position Statement - Utilization of 100 Foot Buffer Zones to Protect Riparian Areas**

**Natural Diversity Data Base Letters**

*Contact ERT Office for Appendix Information*
*At: (860)345-3977*
*Or email connecticutert@aol.com*

# About the Team

The King's Mark Environmental Review Team (ERT) is a group of environmental professionals drawn together from a variety of federal, state and regional agencies. Specialists on the Team include geologists, biologists, soil scientists, foresters, climatologists and landscape architects, recreational specialists, engineers and planners. The ERT operates with state funding under the aegis of the King's Mark Resource Conservation and Development (RC&D) Area - an 83 town area serving western Connecticut.

As a public service activity, the Team is available to serve towns within the King's Mark RC&D Area - *free of charge*.

### Purpose of the Environmental Review Team

The Environmental Review Team is available to assist towns in the review of sites proposed for major land use activities or natural resource inventories for critical areas. For example, the ERT has been involved in the review of a wide range of significant land use activities including subdivisions, sanitary landfills, commercial and industrial developments and recreation/open space projects.

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

### Requesting an Environmental Review

Environmental reviews may be requested by the chief elected official of a municipality or the chairman of an administrative agency such as planning and zoning, conservation or inland wetlands. Environmental Review Request Forms are available at your local Conservation District and through the King's Mark ERT Coordinator. This request form must include a summary of the proposed project, a location map of the project site, written permission from the landowner/developer allowing the Team to enter the property for the purposes of a review and a statement identifying the specific areas of concern the Team members should investigate. When this request is reviewed by the local Conservation District and approved by the King's Mark RC&D Executive Council, the Team will undertake the review. At present, the ERT can undertake approximately two reviews per month depending on scheduling and Team member availability.

For additional information regarding the Environmental Review Team, please contact the King's Mark ERT Coordinator, Connecticut Environmental Review Team, P.O. Box 70, Haddam, CT 06438. The telephone number is 860-345-3977.