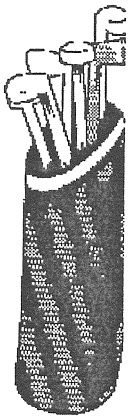

Blackledge Country Club Golf Course Expansion

Hebron, Connecticut

Eastern Connecticut Environmental Review Team Report

Eastern Connecticut Resource Conservation
and Development Area, Inc.

Blackledge Country Club Golf Course Expansion

Hebron, Connecticut

Environmental Review Team Report

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

for the
Conservation Commission
Hebron, Connecticut

September 1997

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Acknowledgments

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

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

The field review took place on Wednesday, July 30, 1997.

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I would also like to thank Mike O'Leary, town planner, John Sonderberg, wetlands agent, Tom Fenton, town engineer, Linda Perelli-Wright, wetlands commission member, James Cordier, conservation commission chairman and Mike Tarbell, the applicant's engineer for their cooperation and assistance during this environmental review.

Prior to the review day, each Team member received a summary of the proposed project with location and soils maps. During the field review Team members were given preliminary plans and additional information. 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. This report identifies the existing resource base and evaluates its significance to the proposed development, and also suggests considerations that should be of concern to the Town and applicant. The results of this Team action are

oriented toward the development of better environmental quality and the long term economics of land use.

The Eastern Connecticut RC&D Executive Council hopes you will find this report of value and assistance in reviewing this proposed golf course expansion.

If you require additional information please contact:

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Introduction

Introduction

The Hebron Conservation Commission has requested assistance from the Eastern Connecticut Environmental Review Team in conducting an environmental review of the proposed 9-hole expansion to the Black Ledge Country Club golf course.

The 60 acre site is located on the east side of West Street opposite the existing Country Club. The Country Club site contains 27 holes of golf, buildings, parking facilities and five water supply wells. The proposed expansion site is made up of five properties and is surrounded by residential and undeveloped land uses. The property is mostly wooded with a few open field areas. Daniels Brook, a tributary of the West Branch of Fawn Brook, flows through the property.

Objectives of the ERT Study

The Conservation Commission has asked for natural resource and planning assistance with this proposal to provide information to better understand the site. This will assist the town commissions, staff and the developer to design a project in harmony with the site and to identify and recommend methods to minimize negative impacts on the land, water resources and wildlife. Major areas of concern include: site suitability for a golf course with regard to soils and geology; hydrology and long term water resource impacts; wetland descriptions, impacts and mitigation; vegetation and wildlife impacts; and land use planning issues.

The ERT Process

Through the efforts of the Conservation Commission this environmental review and report was prepared for the Town of Hebron.

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 July 30, 1997, and various Team members also made separate and/or additional field visits. The emphasis of the field review was on the exchange of ideas, concerns and recommendations. Being on site allowed Team members to verify information and to identify other resources.

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

Figure 1

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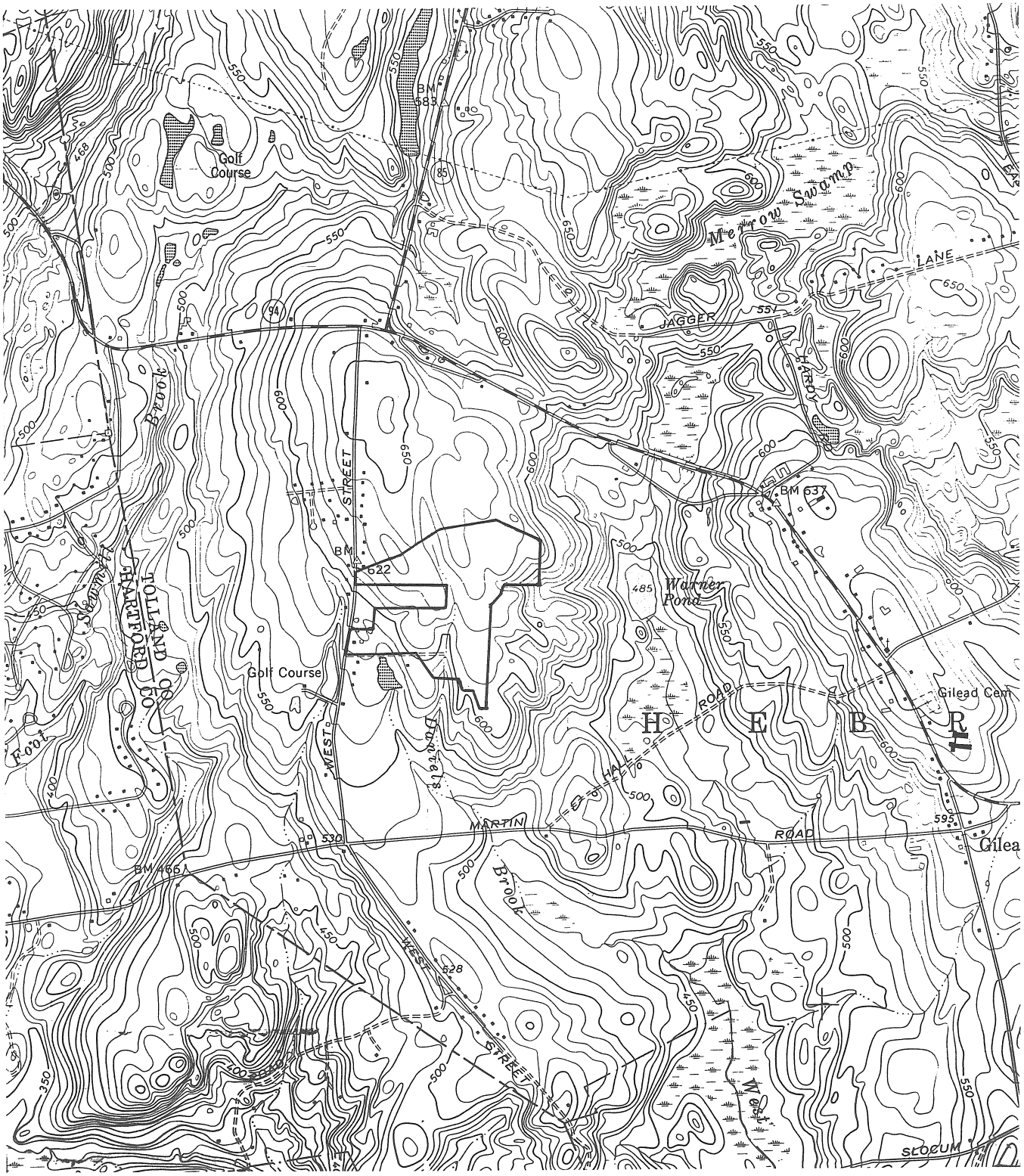
Topographic and Location Map

—— Approximate Site



Geology

The 65 acre site of the proposed Blackledge Golf Course expansion straddles a glacially smoothed streamlined drumlin-like hill. The crest of the hill is fairly level and extends one mile from the intersection of CT Routes 85 and 94 southeasterly to the Gilead Woods Development. Its northeastern, up-glacier, end is relatively smooth and gently rounded whereas the southeastern slopes are steeper and incised by a number of closely spaced ravines and gullies. A sandy gray colored till covers the entire hill. The till appears to be at least several tens of feet thick almost everywhere. Outcrops of a rusty weathering pyrrhotite (FeS)-garnet-biotite-muscovite-feldspar-quartz schist are abundant only on its southeastern slopes. The till is unusually sandy except for a few boulders scattered over its surface and is almost devoid of large stones. Some have been collected into stone walls. The textural and compositional characteristics of the till seem to have been inherited from pre-glacial deep weathering of the underlying bedrock. Due to its small (<1%), but ubiquitous, content of pyrrhotite, the schist decomposes very readily, quickly breaking down into sand-sized mix of quartz and feldspar. During the last ice age the southeasterly moving ice sheet mounded up and molded the weathered material into its present streamlined form. During deglaciation, glacial meltwaters cascading down crevasses, localized on the southeastern lee side of the hill, stripped away the till along ravines and gullies exposing fresh bedrock which today, only 14,000 years later, is rapidly decomposing once again.

The gentle slopes on the site and the substantial thickness and loose textured sandy nature of the till should pose few geotechnical problems for the proposed grading and landscaping. On the other hand, deep excavations, which do not appear to be called for in the present plans, could expose partially weathered material which because of the residual iron sulfides it may contain could quickly oxidize and contribute acidity to the local surface and ground waters.

References

The Marlborough Quadrangle is geologically one of the best mapped areas in the State. Both the Surficial (O'Leary, 1979) and Bedrock (Synder, 1970)

United States Geological Survey Maps are technically of the highest quality and are extremely trustworthy.

O'Leary, Denis, 1979. Surficial Geologic Map of the Marlborough Quadrangle, Connecticut, USGS, GQ-1504.

Synder, George, 1970. Bedrock Geological and Magnetic Maps of the Marlborough Quadrangle, East-Central Connecticut. USGS, GQ-791.

Terminology

Drumlin: A streamlined hill or ridge of glacial drift with a long axis paralleling the direction of flow of a former glacier.

Schist: A well foliated metamorphic rock in which the component platy materials are clearly visible.

Till: Unstratified drift, deposited directly by a glacier without reworking by meltwater, and consisting of a mixture of clay, silt, sand, gravel, and boulders ranging widely in size and shape.

Minerals

Quartz: Crystalline silica, an important rock-forming mineral, SiO_2. It is next to feldspar the commonest mineral. It has a vitreous luster, a concoidal fracture, an absence of cleavage and a hardness of 7 on the Mohs scale.

Feldspar: A group of abundant rock-forming minerals of the general formula, $MAl(Al,Si)_3O_8$, where M can be K, NA, or Ca. Feldspars are the most widespread of any mineral group and constitute 60% of the earth's crust; they occur in all types of rock. Feldspars are white and gray to pink, have a hardness of 6, are commonly twinned, have monoclinic symmetry, and show good cleavage in two directions.

Biotite: A common rock-forming mineral of the mica group: $K(Mg,Fe^{+2})_3(Al,Fe^{+3})Si_3O_{10}(OH)_2$. It is black in hand specimen and has perfect basal (001) cleavage.

Garnet: A red colored mineral with the formula $Fe^{+2}{}_3Al_2(siO_4)_3$.

Muscovite: A mineral of the mica group: $KAl_2(AlSi_3)O_{10}(OH)_2$. It is colorless to pale brown, and is a common mineral in gneisses, schists, granites and pegmatites.

Soil Resources

The soils mapped in the Soil Survey of Tolland County are adequate for basic planning and site plan development Following are the soil types found on the parcel:

- Charlton fine sandy loam
- Charlton stony fine sandy loam
- Paxton fine sandy loam
- Paxton very stony fine sandy loam
- Sutton very stone fine sandy loam
- Leicester stony fine sandy loam
- Leicester-Ridgebury-Whitman very stony complex

Only the Leicester group of soils are hydric/wetland soils. Soil sheets for each soil type are in the Appendix. Limitations of each soil for specific land use activities are listed on the second page of each sheet. In the bottom left corner of each sheet limitations are listed for lawns, landscaping, and golf fairways.

The location of the Leicester soils are generally consistent with the locations of wetlands as delineated on the site plan. Limitations for the Leicester soils are listed as "severe" for fairway development, due to wetness.

The erosion hazards for the soils listed are slight to moderate because slopes on the parcel are gentle to moderate.

Figure 2

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Soils Map

Scale 1" = 1320'

——— Approximate site

Wetland Resources

Existing Conditions

Wetlands on this parcel are arranged in three linear corridors, all tending basically in a north to south direction and situated at or near the top of their respective watersheds. They are all part of the Daniels Brook local watershed, part of the Fawn Brook sub-regional watershed, located within the Salmon River regional watershed. The middle corridor is the main branch of Daniels Brook, with the east and west corridors forming tributaries to it.

Most of the approximately seven (7) acres of wetlands on this parcel are forested wetlands with the prominent members of the vegetative community being the red maple, spice bush, winterberry, jewel weed, skunk cabbage, jack-in-the pulpit and several species of ferns and mosses. Some of the western corridor is in a transitional growth pattern, comprised of tall woody shrubs such as alder, willow, and red-osier dogwood. Their is a narrow watercourse located in the central corridor, with no channels persisting in the eastern and western corridors.

Wetland Functional Values

Being at the "top" of their respective watersheds, all three of these wetland areas have high value in the functional category of flood control. Natural wetlands act to retain stormwater flow which would otherwise rush down the watershed at higher velocities and volumes. The numerous, small wetland areas high up in watersheds very effectively act together to buffer larger streams and rivers from the damaging erosive forces of high storm flows.

The linear shapes of these wetland areas provide a unique pattern which is attractive to wildlife. Wetlands themselves contain particularly diverse assemblages of wildlife. When they are situated in this linear fashion with undeveloped upland buffers surrounding them, their value to wildlife increases. Although there is development surrounding to the north and south of this parcel, it is low-intensity, residential development, which should be able to sustain, to some degree, the north-south wildlife corridor movement. The presence of a channel and upland islands within

the central wetland area would increase its functional value above that of the other two.

Wetlands also effectively function to improve the quality of degraded water as it passes through the wetland system. The onsite wetlands are located downstream of probable sources of nonpoint source pollution emanating from paved road surfaces and residential development.

The "uniqueness" or "noteworthiness" of a particular wetland area is heavily influenced by the presence of critical habitat for endangered or threatened species or an important historical or archeological site. These conditions are not known to exist on this property, however, another functional value, that of "ecological integrity" should be rated high due to the abundance of relatively undeveloped upland areas surrounding primarily the central and eastern wetland corridors.

Proposed Activities

According to the site plan entitled "Plan Showing Land / prepared for/ Blackledge East, LLC / West Street / Hebron, Connecticut," dated 12/31/96, last revised 5/23/97, (as well as hand-sketched revisions made by the applicants surveyor, Mr. Tarbell, in the field) the construction of this nine-hole golf course would result in approximately 0.6 acres (26,446 square feet) of direct wetland impact consisting of earthen fill for the purpose of fairway improvement and water diversion. In addition, there will be approximately 2.5 acres of wetland alteration, which should be considered a regulated activity under Connecticut 's Inland Wetlands and Watercourses Act. This alteration is to consist of the removal of tree canopy, where fairways intersect the wetland corridors. Finally, regulated activities, primarily grading and clearcutting, are proposed within approximately 80% of Hebron's 100 foot upland review area adjacent to these wetlands.

Mitigation for Wetland Impacts

To date, the applicant's current wetland impact mitigation plan consists of hand drawn lines on the site plan indicating proposed wetland creation areas as well as phone conversations with Mr. Tarbell indicating that "wetland enhancements" are being considered on existing country club property. Clearly, this is not enough information to allow for a critical

review. However, it may be helpful at this time to review CT-DEP's mitigation policy.

It is recommended to first avoid and then minimize any proposed impacts to wetland areas. Once the least environmentally damaging alternative has been achieved and areas of wetland impact are still necessary **and approvable** by the Hebron Conservation commission (HCC), only then should compensation be considered to mitigate for unavoidable wetland impacts. This compensation should be undertaken with the goal of replacing these wetland functional values lost as a result of those unavoidable impacts and should be prioritized in the following manner: restoration of degraded wetland areas (highest priority), enhancement of existing wetland areas and creation of new wetland areas (lowest priority). In the case of an application which receives a public hearing based on a finding of significant impact, the HCC must find, in writing, that a feasible and prudent alternative to the proposed wetland alteration does not exist prior to issuing a wetlands permit.

Additionally, please find enclosed U.S.-EPA's "General Guidelines for Wetlands Restoration and Creation Plans," which may be helpful once the applicant has more definitive information.

Finally, information concerning the issues of irrigation and turf management should be submitted by the applicant. These activities may have impacts on wetland resources which need to be evaluated by the HCC.

Other Regulatory Programs

If this project will impact between 5,000 square feet and one (1) acre, project review is required by both the U.S. Army Corps of Engineers (A.C.O.E.) and this division of the CT-DEP. If this project will impact more than 1 acre of inland wetlands, an individual 404 application to the A.C.O.E. will be required. However these are basic guidelines. A.C.O.E. or CT-DEP action may be required for other specific activities proposed for wetland areas. For questions regarding these regulatory programs contact the A.C.O.E. at 617-647-8338 / 800-343-4789 or Sally Snyder of the CT-DEP at 860-424-3019.

Be advised that, inasmuch as it causes the alteration, modification, or diminution of the instantaneous flow of the waters of the state (as a result

of groundwater withdrawals for turf irrigation for example), this project may require a permit from this division as called for in the Connecticut Water Diversion Policy Act (sections 22a-365 through 22a-378 of the Connecticut General Statutes). It is recommended that the applicant call Bob Gilmore of this division at 860-424-3019 to determine the need for such a permit.

If construction activities covering five acres or more are approved, the applicant is required to apply to the CT-DEP for a general permit for the discharge of stormwater under the National Pollutant Discharge Elimination System (NPDES) program. For further information on this permit program contact Christopher Stone of the DEP Permitting Enforcement and Remediation Division at 860-424-3850.

GENERAL GUIDELINES FOR WETLAND RESTORATION AND CREATION PLANS

U.S. ENVIRONMENTAL PROTECTION AGENCY REGION 1
WETLANDS PROGRAM
OCTOBER 1996

For more information, please call Matt Schweisberg at the EPA at (617) 565-4431, or contact him via the Internet at schweisberg.matt@epamail.epa.gov. Matt can also be reached through the regular mail at EPA - Region 1, Water Quality Section (CWQ), JFK Building, Boston, MA 02203.

The following guidelines serve as general specifications for preparing fill removal and wetland restoration or wetland creation plans. As environmental conditions vary at every site, precise specifications will depending on the environmental conditions peculiar to the site in question. The size of the wetland area to be restored or created; the biological and physical characteristics of the land area in question; and, if applicable, the level of disturbance the wetland has experienced, will further define the scope and complexity of the restoration or creation plan. In most cases, the types of information listed below represent the minimum required to formulate an acceptable plan.

I. Project Summary

A. A description of the project location, including a locus map; a brief narrative of the overall project, including current landscape (hydrogeomorphic) and project site settings, and the extent of jurisdictional waters and wetlands; and a list of all responsible parties, including contractors and consultants that will be involved with the project.

B. An explanation of project objectives, including a narrative description of the water and wetland habitats (types and aerial extent) to be restored or created (near-term and long-term); and the primary ecological functions to be restored or created.

II. Existing Site Conditions - Detail

A. A surveyed plan depicting property boundaries; streets; buildings; water bodies (with mean high water or high tide indicated); wetlands; FEMA 100-year floodplain (if applicable); areas of unpermitted fill (if applicable); elevation contours; and other ground surface features at a scale no greater than 1 inch = 40 feet. This plan shall include a cross-section view of the site which shows soil depths, fill depths (if applicable), and average height of surface water or depth to ground water across the site.

B. A narrative of the existing physical and biological conditions, including current ownership status; the area of the site; area of unpermitted fill (if applicable); existing water bodies and wetlands (including the dominant plan community(ies) present); soil types present (including the types of any unpermitted fill present); the hydrologic regime of the site; surrounding upland and wetland habitats and existing, adjacent land uses; and other relevant information.

III. Proposed Site Conditions - Detail

A. Using the site plan described in II.A as a base, show the exact areas where restoration or creation activities will occur (e.g., removal of fill, replacing of dredged material into ditches, etc.). As applicable, indicate proposed finished grades; expected mean high water or high tide elevations; average depth to ground water and the expected depth to the high water table; the location of proposed plantings/seedings; and the location of all sediment and erosion control structures (e.g., hay bales, silt screens, etc.) This plan shall include a cross-section view of the site which shows proposed soil depths, and average height of surface water or depth to ground water across the site.

B. Provide a narrative descrip-

Continued on next page

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tion of the removal and restoration, or creation work to occur, including the methods and equipment to be employed; how the equipment will gain access to the site to perform the work; the location of the ultimate disposal site for any removed fill; how the work will progress across the site; the expected hydrologic regime of the site in its restored or created conditions; if applicable, a listing of the plant species to be seeded/planted at the site; the sources of the plant material (note: as a rule, transplanting of plant stock from adjoining wetlands will not be approved); the planting method(s) and scheme (i.e., physical layout of how plant material will be installed); the type, source, composition, and depth of seed or plant stock bedding (e.g., screened topsoil) to be placed; if applicable, a proposed irrigation scheme to ensure survival of the plant material seeded or planted; any methods to be used to minimize adverse impacts while work is underway (e.g., erosion and sedimentation controls); and other relevant information.

C. Delineate the area(s) on the site to be restored or created by installation of flagging, sedimentation and erosion control structures, or other appropriate method; this delineation shall represent the limit of construction activities such that no work shall occur beyond these boundaries.

IV. Actual Restored or Created Site Conditions - Detail

A. Using the site plan described in II.A as a base, show the actual physical conditions at the site at the completion of grading activities (i.e., as "as-built" plan), including actual finished grades and all pertinent ground surface features. This plan shall include a cross-section view of the site which shows actual soil depths and, as applicable, mean high water or high tide, or average depth to ground water across the site. This as-built plan shall be prepared and submitted prior to planting/seeding activities.

V. Progress Reports

A. From the time of plan approval by the EPA to issuance of the Certificate of Construction Completion, brief quarterly progress reports shall be submitted to EPA. The progress report shall describe activities underway or completed to date, activities remaining to be performed, and explanation of any delays experiences, and other pertinent information.

VI. Monitoring Standards for Success

A. Using the project objectives, and considering the scope and complexity of the restoration or creation efforts, standards shall be established by which achievement of those objectives will be judged (i.e., measures of success). These standards shall be directly related to reestablishing or developing the physical and biological components of the aquatic ecosystem being restored or created. Explicit provision shall be included for corrective action to be taken, at the direction of EPA, should monitoring show that the standards for success are not being, or are not likely to be met.

B. Normally, monitoring shall be performed midway through and toward the end of the first growing season, then annually toward the end of each successive growing season for the duration of the required monitoring period. Monitoring shall be performed for a period of five years; shorter or longer periods may be appropriate depending upon the scope and complexity of the restoration or creation efforts undertaken.

C. The monitoring plan shall incorporate a simple but comprehensive approach to assessing relative success or failure of restoration or creation efforts. Among others, monitoring methods may include establishing permanent sampling plots for measuring plant community features; meander surveys for determining wildlife utilization; and permanent soil pits for profile descriptions. Also, permanent stations shall be established to create a continuous photographic record

Continued on Page 8

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as part of the monitoring plan.

D. A report shall be prepared and submitted after each monitoring event that describes the environmental conditions at the site, the observations and results of the monitoring methods, and assesses relative success or failure of restoration or creation efforts. This report shall include photographic evidence as well. This report shall identify any problems discovered and recommend appropriate corrective action to ensure the success of restoration or creation.

VII. Inspections

A. The plan shall provide for inspection by EPA personnel after installation of all sedimentation and erosion control structures, after completion of grading activities, after completion of initial planting/seeding activities (if applicable), and after monitoring indicates that the standards for success have been attained.

VIII. Verification of Compliance

A. After inspection of initial planting/seeding activities and determining that all construction work has been completed in accordance with the approved plan, EPA will issue a letter verifying that the construction portion of the restoration or creation project has been completed.

B. After receipt and review of the final monitoring report and determining that the standards for success have been attained and maintained, EPA will issue a letter verifying that the monitoring portion of the restoration or creation project has been completed.

IX. Schedule

A. A comprehensive schedule integrating all planning, construction, inspection, and monitoring activities as well as milestones, reports, and product submissions shall be included.

The U.S. Environmental Protection Agency, Region I, reserves sole authority to revise these Guidelines at any time.

WETLAND DELINEATOR CERTIFICATION PROGRAM UPDATE

The Army Corps of Engineers Wetland Delineator Certification program has been placed on indefinite hold. It was anticipated that a final rule regarding the program would have been issued in October, 1996 and the written tests were to be held in January, February and March of this year. At this time, however, the program has been suspended and it is possible that it may not be revived in the future.

Hydrogeologic Setting and Potential Impact by Pesticides to the Water Resources Environment

Hydrogeologic Setting

In the general area, the drainage divide is roughly marked by the orientation of West Street.The existing Black Ledge Country Club golf course is located in the Black Ledge River drainage basin (#4707). Most of the proposed golf course expansion site is an upland area of subdued topography located in the Daniels Brook headwaters of the Fawn Brook Drainage Basin (#4706). Stream courses of Daniels Brook flow southward from the proposed expansion area. Daniels Brook flows into the West Branch of Fawn Brook, joins the Black Ledge River to the Salmon River and ultimately flows to the Connecticut River. A test hole log just north of the site records a 70 foot thickness of Pleistocene till deposits. Commonly thick till such as this is composed of a looser sandy upper till overlying a more compact silty lower till. [1] Wells in the vicinity ofthe site are likely constructed as a shallow well in the till or deeper in the area bedrock, the Brimfield schist. From information exchanged at the ERT briefing, there are, reportedly, five wells at the existing Black Ledge Golf Course, some of which are described as shallow. As many as 70 homes surround the site, presumably all on private domestic well water since a public water supply is not available in the area. [2,3,4]

Golf Course Pesticide Usage and Water Quality

In recent years, existing and proposed golf courses have received considerable attention regarding their potential impact on surface and groundwater quality. All three of the major categories of pesticides (herbicides, insecticides and fungicides) are commonly and routinely used on golf courses. There are numerous studies and documentation concerning pesticides occurrence in surface and groundwater as a result of normal usage practices, that is, pesticides applied according to label directions and not attributed to spills, mishandling or leaks. As one would expect, concentrations are low, generally in the part per billion range.

Two reasons explain in part why we are finding pesticides in water. Only since 1971, and more intensively since 1979, has a nationwide effort been undertaken to survey for the occurrence of pesticides in groundwater and surface water. Secondly, laboratory technology has become sophisticated enough to detect not only in the part per billion (ppb) range but in some cases as low as part per trillion (ppt) range. These sampling and analysis efforts, however, are limited with respect to the actual number of samples taken, and also with regard to the number of analytes tested for. Studies document pesticide occurrence in Connecticut, Massachusetts and nationwide. Specifically, 2,4-D, dicamba, and DCPA have been detected in groundwater of Connecticut. [5]

The two major ways in which pesticides can reach the water resource be it surface water or groundwater are: 1) by the vertical infiltration or percolation pf pesticides with rainwater or irrigation water through soil layers into the groundwater 2) surface runoff or overland flow into streams depending on the antecedent moisture conditions in the soil profile, bedrock at the surface or impermeable (paved) surfaces. The physical and chemical characteristics of a pesticide determine its leachability or surface runoffpotential. For instance, a low solubility pesticide may be less likely to migrate with percolating water down to the water table but its KOC value may enhance its potential to adsorb onto eroded soil particles that are subject to surface runoff forces.

In summary, it is difficult to satisfy all the criteria that would inhibit movement of pesticides to both groundwater and surface water. Consequently, planning ahead of time to prevent pesticide migration to the water resource is of paramount importance since corrective measures after the fact can be expensive, lengthy and difficult to achieve completely.

Therefore, before the expansion plan begins, a ground and surface water monitoring program should be developed. Establishing a background water quality condition is necessary first step. Existing wells and neighboring wells can be used initially and later a monitoring network can be designed, constructed and water quality be monitored regularly for the appropriate analytes during the life and utilization of the golf course. See section on Suggestions and Recommendations.

Today's trend in golf course design and maintenance is toward more natural, less manicured conditions. The “greening of golf courses” is the

term used to describe this growing trend toward more natural, environmentally sensitive golf courses. Shifting to an environmentally-sensitive maintenance operations on a golf course is prompted mainly by concerns about water quality and wildlife habitats. According to a 1995 *Golf Digest* survey, 87% of readers favor golf course measures to prevent golf course pollution or to conserve water.

Suggestions and Recommendations

- Minimize pesticide usage by employing Integrated Pest Management (IPM) techniques into golf course management plans and practices. The underlying principle behind IPM is to strive for the reduction of or elimination of pesticide usage. An essential element of IPM is to correctly identify the pest, be it a weed, insect or fungus. Does the presence of the correctly identified pest constitute an infestation? In other words, there are threshold levels within which a pest population can be tolerated and no treatment measures are necessary.

- When considering the selection of herbicides, insecticides and fungicides for potential use on a golf course, it is recommended that a computerized risk assessment be conducted to determine the leachability and runoffpotential of each pesticide evaluated with regard to the particular soil types at the site. Three available systems are: (1) NPURG, National Pesticide/Soils Database and User Decision Support System for Risk Assessment of Ground and Surface Water Contamination (2) The SCS/ARS/CES Pesticide Selected Properties Database and, (3) NAPRA, the National Agricultural Pesticide Risk Analysis, an automated pesticide risk screening process.

- Pesticide selection for a golf course should consider the pesticide's solubility levels in addition to the KD or KOC and the half-life in soil and water. Suggested criteria values would be: Solubility = less than 10 ppm; KOC more than 300, half-life = less than 7 days. Another protective criteria might be the use of the GUS or Groundwater Ubiquity Score of small or extremely small for leachability potential. The relevant pesticide characteristics should be evaluated in conjunction with the particular soil type on which it is applied. Again, to reiterate the previously discussed concept, while the pesticide's characteristics may be favorable to impede infiltration to groundwater, those characteristics may result in a higher runoff potential to surface water.

- Another concept to be aware of are the degradation products of the original pesticide product, called the metabolites. These compounds must be identified and considered as well with regard to their potential to contaminate the water resource.

- Many golf courses, both existing and proposed, are planning for or have in place a strategically designed monitoring well network to monitor for pesticide occurrence and movement in groundwater. Surface water including ponds and streams should also be monitored for pesticide occurrence. In considering this option, it is important to ascertain the feasibility and practicality of conducting the laboratory analysis for the particular compounds of interest and their metabolites. Before pesticides are chosen for use, a determination should be made about whether equipment, methodologies and expertise are available to test for these compounds.

- To set up the water quality monitoring program, consider utilizing the services of the Audubon Cooperative Sanctuary System which has developed the Audubon Signature Program, a program for golf courses to provide comprehensive integrated approach to environmental planning for proposed developments. See attachments. In Connecticut there are 32 golf courses enrolled in this program and three are fully certified as a "Certified Audubon Cooperative Sanctuary." (Please see Appendix for further information.)

- Pesticide storage provisions should include spill contingency plans. Concrete bermed secondary containment should be built around a separate structure for pesticide storage.

- Finally, pesticide applications and applicators must conform to the statutes and requirements ofthe Connecticut Pesticide Control Act, C.G.S. Chapter 441, Part I and II, particularly in regard to the appropriate certification of the applicator, and the registration of the product contemplated for use. Extreme care must always be used when handling and applying pesticide products. Special attention must be directed to label directions for use, proper mixing and loading procedures and any precautionary statements that appear on the label.

References

1) Stone et al, Surficial Materials Map of Connecticut, 1992.
2) Tarbell, Heintz & Assoc., Inc., Plan Showing Land, Grading Plan, 12-31-96.
3) Hebron Aerial Photo, 54-40-04-25-95.
4) Snyder, George L., Bedrock Geologic and Magnetic Maps of the Marlborough Quadrangle, East-Central Connecticut, 1970.
5) Mullaney, J.R. et al, Pesticides in Groundwater, Soil and Unsaturated-Zone Sediments at Selected Sites in Connecticut, Connecticut Water Resource Bulletin No. 42, 1991.

Erosion Control & Other Considerations

Erosion Control

No erosion control plan has been developed to date. Although slopes on the parcel are relatively gentle, the extent of soil disturbance and presence of wetlands make erosion control on the parcel critical. Careful phasing of the project and daily inspection and maintenance of all erosion control measures will be critical during site development. Special care should be taken to prevent large areas of soil disturbance at one time and to have areas stabilized before moving to a new phase. Generally, standard practices for erosion control should be sufficient for this parcel. The erosion and sediment control plan, when developed, must be consistent with the Connecticut Guidelines for Soil and Erosion and Sediment Control.

The District would appreciate a copy of the erosion control plan for final review.

Wetlands

Wetland fills are proposed in three areas, holes #1, #9, and #5. All alternatives that would eliminate these fills should be explored, and the applicant should be required to demonstrate that there are no alternatives to the fill.

On the site plan provided, no provisions are shown associated with the filling at the first tee to maintain existing flows.

Although clearing limits are not shown on the plan, most of the vegetation within the wetlands and adjacent buffer areas will be eliminated, based on fairway layout. These alterations will significantly reduce a number of wetland values. Wildlife habitat, water quality enhancement values, and flood control values will all be altered. The applicant should provide details regarding all clearing and grubbing activities, including revegetation plans. Conventional golf course design typically encourages removal of all vegetation from fairways and aggressive mowing regimes. However, a number of courses nationwide have adopted more "naturalistic" designs, with success. National Audubon has a program to certify golf courses using

such designs. (Please refer to the Hydrogeologic Setting section and to the information in the Appendix for further information on this program.)

Water Usage and Resources

At the time of the site walk the applicant's agent stated that water for irrigation could be provided by existing supplies across the street. If this changes, it is recommended that a water budget be developed for the entire parcel. Surface water resources on the parcel are very limited.

Stormwater Management and Water Quality

Removal of the existing forest cover, construction of cart paths and other appurtenances will increase both the velocity and volume of runoff. The applicant should provide the town with a hydrologic analysis of the parcel to determine pre and post-development conditions. Increases in peak flows can increase both on-site and downstream channel scour and downstream flooding. A hydrologic analysis will assist the town in determining if on-site stormwater management is necessary.
If not already doing so, the applicant should consult with University of Connecticut Cooperative Extension Service regarding turf management and adoption of an Integrated Pest Management Program. An effective IPM program can significantly reduce the amount of fertilizer and pesticide use and help protect water quality.

Stormwater Management

Erosion and Sediment Control

Since no plan has been prepared for the site, there is no way to evaluate control measures. Large areas of disturbance with wetlands interspersed throughout and numerous wetlands crossings are always problematic. A thorough plan, incorporating the use of multiple types of controls and stabilization measures must be prepared, but the plan must also be flexible, allowing and requiring field changes where necessary. Controls must be designed around cut and fill areas, so that as these activities progress, controls are shifted and stabilization measures are applied as necessary. In other words, continual inspections of and adjustments to changing site conditions are crucial.

Stormwater Management

Since the proposed post-construction activity is a golf course, which is completely pervious, stormwater runoff should not be an issue, since most stormwater will infiltrate. During construction, erosion control measures must be well planned and maintained until final stabilization of the site to minimize off-site and wetlands impacts.

Construction Activities

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). The registrant must then prepare and keep on site during the construction project a Stormwater Pollution Control Plan (the "Plan"). 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.

The Plan must include a site map as described in Part VI.B.3.a. of the General Permit and a copy of the erosion and sedimentation (E & S) control

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

Due to the amount of soil disturbance, it is highly recommended that construction be phased to minimize unstable areas. The Permit (Part VI.B.3.b.(i)(b)) requires that for areas where greater than five acres are disturbed at one time, the Plan must show that a sediment basin will be available that will store a minimum of 134 cubic yards of water per acre disturbed. The Permit (Part VI.B.3.c.) requires inspections at least once every seven calendar days and after every storm of 0.5 inches or greater. The Plan must also allow for the inspector to require additional 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.

In order to fully discuss erosion and sedimentation, a detailed site map of erosion and sedimentation controls and a project-specific description of phasing and controls are needed.

The Natural Diversity Data Base

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

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

Please 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.

Vegetation and Forest Resources

Vegetation Type Descriptions

The vegetation present on the site of the proposed golf course expansion falls into five broad cover type categories which include Mixed Hardwoods, Pine/Hardwoods, Wetlands, Open Field and Conifer Plantations. The approximate locations of these vegetation types have been delineated on the Forest Vegetation Map (Figure 3).

The Mixed Hardwood type (Type A) which totals approximately 42 acres is the dominant vegetation cover. It is made up of pole size trees (6.1 " to 11" diameter at breast height (d.b.h.)) and sawtimber size trees (1 1.1 " d.b.h. and larger) 60 to 100 years of age. Red oak, black oak, white oak, red maple, black birch and white birch are present throughout the type. White ash and yellow birch are scattered within the type especially near the wetlands. In portions of the type, a dense mid-canopy layer is formed by sapling size trees (1.1" to 6" d.b.h.). These saplings became established following a timber harvest 25 to 30 years ago. Present are red maple, hickory, sassafras, black birch, yellow birch, hornbeam and white pine. Understory vegetation includes hardwood tree seedlings, maple leaved viburnum, flowering dogwood, American chestnut sprouts, witch hazel and highbush blueberry. Huckleberry and lowbush blueberry are found on the more well-drained soils within the type. Ground cover vegetation includes several species of ferns and grasses together with poison ivy and club moss.

Some of the property considered wetlands by soil type fall into this vegetation cover type as the individual wetlands are not wide enough to be free of the influence of the surrounding cover type.

The Open Field/Old Field type (Type B) occupies about 10 acres of the subject property. This type is comprised of areas that are in agricultural use (i.e. pasture or hayfield) or previously in agricultural use and now reverting to forest. Areas maintained in agricultural use are dominated by a ground cover of native and cultivated legumes and grasses with a mix of wildflowers and weeds. Areas reverting to forest contain a mix of the fore-mentioned species together with a developing tree and shrub component. Eastern red cedar, white pine, hardwood tree seedlings (trees less than 1"

d.b.h.) and saplings which include aspen, gray birch, cherry, red maple and white ash along with shrub species including sumac, viburnum, hazelnut, highbush blueberry, shadbush and speckled alder have become established.

Approximately 5 acres of the tract is covered by the Pine/Hardwoods type (Type C). It consists of pole and sawtimber size white pine, black oak, red maple, hickory and yellow birch. The white pine is the predominant species found on this site. An understory of white pine and hardwood tree seedlings, viburnums and alder with a ground cover of ferns exists.

Several Wetland Areas (Type D), primarily riparian zones, are present within the property. These areas total approximately 4 acres. Each is dominated by red maple with some yellow birch, black gum, white ash and American elm intermixed. The size class and age class distribution of the trees in these wetland areas are quite variable. Understory vegetation includes spice bush, sweet pepperbush, highbush blueberry, swamp azalea, alder, mapleleaf viburnum and witch hazel. Tussock sedge, flag, green brier, ferns and sphagnum moss form the ground cover.

Two conifer plantations (Type E) which total approximately 4 acres are present. A mix of Norway spruce, Douglas fir and northern white cedar together with scattered sapling to pole size hardwood tree invaders such as red maple and cherry make up these plantations. Neglected in the past, the trees in these plantations are extremely crowded and are declining in vigor.

All of the forest cover types noted during the site walk commonly occur in this part of Connecticut. This woodland developed as a result of human land use history including the abandonment of agricultural fields from the mid 1800's to the early 1900's and the timber harvest of 25-30 years ago. The forest is dynamic and changes will take place even without man's further intervention. Therefore, conservation of this resource is preferable to preservation.

Mitigating Development Impact

Tree and vegetation clearing and removal will take place on a significant portion, approximately 34 acres out of the 65 acres, of this tract should the development of the golf course occur. Development of this property into

one acre homesites would likely result in the same extent of clearing. If development of this tract does occur, the sawtimber size and pole size trees to be removed should be marked, tallied and sold as sawlogs and fuelwood rather than chipped and removed.

Ideally, trees that are to be retained as buffers between the holes or adjoining properties or as aesthetic standards should be healthy, long lived species which are free of damage or decay. Species such as the oaks, hickories, white ash, sugar maple and white pine are suitable. These trees may be left in groups or "islands" to reduce the impact of soil disturbance and mechanical injury during clearing and construction. Construction activities that occur too close to trees that are to be retained will adversely affect their health, vigor and longevity; and potentially create future hazard trees. Trees are very sensitive to the condition of the soil within the entire area of their root systems. Excavation, filling and the general use of heavy equipment will lead to some degree of soil compaction that will adversely affect the soil moisture and aeration balance. This imbalance could lead to a decline in tree health and vigor and could possibly lead to tree mortality within three to five years. Physical damage to the root system (by excavation) or bark damage will allow the introduction of decay organisms which may result in the decline of a tree's health over time. Both individuals trees and "islands" of trees can be designated for retention with vinyl flagging or fencing prior to construction so that tree injury may be avoided. No excavation, filling or driving of heavy equipment should be permitted within 25-50 feet (depending on tree diameter - the larger the tree to be retained, the greater the area of no disturbance) of single trees or groups of trees. A general rule to follow is no excavation, filling or heavy equipment should be permitted within two times the radial spread distance of the tree's crown. When making grade cuts, trees should be removed back from the cut for at least a distance of two feet for each foot of depth of cut, e.g. 20 feet back for a 10 foot cut. Where feasible, undisturbed buffer zones of at least 75-100 feet deep of natural vegetation should be left between the proposed golf course and the adjoining properties to provide a sound and visual barrier. Reinforcement plantings of native conifer trees, hardwood trees and shrubs should be made after the final grading has been completed.

Long Term Management

The selection system of silviculture might be used for the long term management of this tract if development is not pursued. The selection system creates and maintains uneven-aged stands containing at least three age classes intermingled on the same area. The definition of the system has two qualifications. First is that the even-aged aggregations of trees within the stand are small and second, that the regulation of the cut by volume is not an essential characteristic of the system. This system is not to be confused with "economic selection in logging" which many consider to be selective harvesting.

The primary principle of "economic selection in logging" is that only the timber which can be profitably harvested is removed. This may be individual trees, groups of trees or even large areas of sawtimber size trees. The residual stand is then comprised of those trees not profitable at the time of harvest; the unprofitable timber areas, groups of trees or individual trees. Eventually, under this harvesting method, the property will be left with stands of poor trees that cannot be moved economically by the most ingenious logging or the most masterful marketing.

Managing this tract under the selection system will require the creation of at least one additional age class. The oldest trees within the mixed hardwood stands would have to survive another 30-40 years to truly create the uneven-aged condition of the system. A private certified forester should be contracted to develop a long term management plan or short term harvest plan based on a resource inventory and the landowner's objectives prior to initiating management of the woodland.

It is doubtful that this system or any system of silviculture would be viable long term economic use for this property given the land values. The other amenities of trees and forests must be considered. Trees and forests have value in reducing climatic extremes, controlling runoff, filtering out pollutants from the air and water, reducing noise, providing aesthetic enjoyment, creating wildlife habitat, recharging aquifers, supply wood fiber and functioning as a carbon sink. Therefore a good relationship between development and the retention of forested open space is essential if generations to come are to enjoy a high quality of life.

Figure 3

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Vegetation Type Map

Scale 1" =1000'

VEGETATION TYPES

A. MIXED HARDWOODS ..... 42+/- ACRES

B. OPEN FIELD/OLD FIELD ..... 10+/- ACRES

C. PINE/HARDWOODS ..... 5+/- ACRES

D. WETLAND AREAS ..... 4+/- ACRES

E. PLANTATION ..... 4+/- ACRES

NORTH

SCALE: 1' = 1000'

LEGEND

PROPERTY BOUNDARY ————————

VEGETATION TYPE BOUNDARY · · · · ·

ACCESS ROAD — — — —

STRUCTURE

Wildlife Resources

Existing Habitats

The property contains a diversity of habitats including mature and deciduous and coniferous forest, open fields, wooded wetlands, and a small, dense plantation of spruce. The presence of old cart paths, stonewalls and fence posts indicate a past history of farming activity. The majority of the property is comprised of mature hardwood forest dominated by black birch and red and white oak. Other subdominant hardwoods and understory vegetation include red maple, yellow birch, pignut and shagbark hickory, black and scarlet oak, American beech, sassafras, ironwood, highbush blueberry, spicebush, ferns, clubmoss, Canada mayflower and patridgeberry. Scattered throughout the northwest portion of the property are large diameter white pine.

Forested wetlands dominated by red maple traverse the property in three areas containing seasonally wet soils. Other species present include yellow and black birch, highbush blueberry, sweet pepperbush, spicebush, witch-hazel, jewelweed, cardinal flower, ferns, swamp rose and sphagnum moss. A 2.5 acre reverting hayfield containing goldenrod, wild rose, juniper, wax myrtle, and black cherry exists in the southwest portion of the property. Bordering the field is a small shrub wetland containing alder, red maple, black willow, swamp rose, joe-pye weed, and jewelweed. Also present on the southern half of the property is a 2.5 acre agricultural field comprised of timothy grass, clover, and alfalfa, and a 3-acre stand of large diameter white pine, and a dense, 2-acre stand of planted spruce.

Wildlife Use

Hardwood forests provide an abundance of food in the form of mast, berries, buds, insects and catkins. Cover value for wildlife is greatly enhanced by the presence of conifer cover, snags (dead standing trees), cavity trees, and large diameter den trees. Wildlife likely using the mature hardwood forest include scarlet tanager*, ovenbird*, white-breasted nuthatch*, black-capped chickadee*, black and white warbler, eastern wood-peewee, hairy and downy* woodpecker, pileated woodpecker, American redstart, barred owl, broad-winged hawk, redback salamander,

and black rat snake. Mast produced by oaks provide excellent forage for a variety of mammals and birds including white-tailed deer*, gray squirrel*, southern flying squirrel, eastern chipmunk*, white-footed mouse, eastern wild turkey and bluejay*. The conifer trees on the property also provide winter cover and nesting sites for songbirds, hawks, owls, and eastern wild turkeys. The stonewalls and downed logs provide shelter and den sites for short-tailed weasels, eastern chipmunks, short-tailed shrews, striped skunks, northern black racers, and northern ringneck snakes.

Forested wetlands typically contain a high abundance of insects and dense undergrowth of herbaceous plants and berry producing shrubs. Many species of birds use forested wetlands at varying times of the year for breeding, feeding and shelter. Some of these birds include thrush, northern waterthrush, common yellowthroat, veery, eastern phoebe, American woodcock, red-shouldered hawk, and barred owl. Other wildlife likely using this habitat for food and cover include raccoons, short-tailed weasels, star-nosed moles, wood frogs*, pickerel frogs, northern spring peepers, gray tree frogs*, and eastern garter snakes. Additional bird species which use forested wetlands as well as nearby upland forests include American robin, myrtle warbler, tufted titmouse, hermit thrush, dark-eyed junco, gray catbird, rufous-sided towhee*, white-throated sparrow, woodpeckers (downy, hairy and pileated), white-breasted nuthatch, broad-winged hawk and eastern wild turkey.

Open field habitats containing a diversity of grasses and forbs provide cover for small mammals and attract numerous insects, a major food item for songbirds. Field edges containing a variety of berry producing trees and shrubs provide additional structured diversity, food and cover for wildlife. Wildlife likely using the open field habitats and their associated edges on the property include white-tailed deer, woodchuck, red fox, coyote, cottontail rabbit, skunk, meadow vole, mourning dove, eastern bluebird, American goldfinch*, field sparrow, mockingbird, flycatchers, blue and gold winged warbler, American redstart, common yellowthroat, rufous-sided towhee, American robin, American kestrel, and red-tailed hawk. Although agricultural fields mowed for hay or used for pasture contain a less diverse plant community, these habitats also contribute to greater wildlife diversity.

Prognosis of Post-Development Use and Recommendations

Uplands

The amount of forest clearing planned for course construction will decrease wildlife species diversity and abundance. The replacement of forest and field with tees, greens and fairways will result in highly fragmented habitats and eliminate most of the softwood cover. These fragmented habitats tend to attract more common species such as raccoon, woodchuck, Virginia opossum, striped skunk, gray squirrel, house wren, northern flicker, European starling, chipping sparrow, song sparrow, brown-headed cowbird, Northern oriole, house finch, American robin and American crow. Given the distribution of roads and residential development surrounding the property, it is unlikely that significant populations of area sensitive forest breeding birds exist here. However, those individuals that are present will be displaced due to lack of adequate territory and increased disturbance.

Further negative impacts to daily and seasonal movements of wildlife, especially amphibians, reptiles, and larger mammals can be expected. Replacing natural vegetation with manicured grass and creating small isolated islands of habitat should be avoided as much as possible. Travelways should be provided for wildlife by maintaining wide corridors (100'+) of vegetation that link the wetlands to undeveloped upland areas.

Mature, healthy-crowned oaks and hickories, conifer cover, stonewalls, den and cavity trees, and snags should be maintained wherever possible for their value in providing food, nest sites, shelter, and perch sites. Additional improvements for wildlife on the uplands could be made by planting dense clumps of native, berry-producing shrubs around tees, and along cart paths and other "out of bounds" areas. Bluebirds and tree swallows would likely benefit from the addition of nesting boxes placed along fairways; they should be spaced at least 100' apart and placed on poles away from wooded edges.

Wetlands

Extensive cutting in and adjacent to the wetlands should be avoided to minimize impacts to reptiles and amphibians and to maintain travel corridors for wildlife. If revisions to the current site include the addition of

a pond, preserving or planting a buffer of vegetation around the pond would improve its value to wildlife by providing an area of food and cover. In addition, the vegetation would lessen the potential for attracting nuisance Canada geese to the course by creating a natural physical barrier to easy movement on and off the pond (P. Merola, CT DEP Wildlife Division). Minimizing pond size (1/2 acre maximum) and the amount of feeding habitat (i.e. short grass areas) adjacent to the pond also may decrease its attractiveness to geese. To further enhance the pond's value for wildlife, it should be constructed with gently sloping sides and varying water depths (6"-3') to provide a diversity of aquatic plants interspersed with open water.

References

Cole, C. A., T. L. Serfass, M. C. Brittingham and R. P. Brooks, 1996. Managing your restored wetland. Penn State University, University Park, PA. 44 pp.

DeGraff, R. M. and D. D. Rudis. 1986. New England wildlife: habitat, natural history, and distribution. Gen. Tech. Rep. NE-108. U. S. Dept. of Agriculture, Forest Service, Northeastern Forest Experiment Station. Broomall, PA. 491 pp.

Welsh, D. J. Riparian forest buffers: function and design for protection and enhancement of water resources. NA-PR-07-91. U. S. Dept. of Agriculture, Forest Service, Northeastern Area, Radnor, PA. 20 pp.

Fish Resources

Fish Population

The proposed nine hole expansion to the Blackledge Country Club borders Daniels Brook, a tributary of the West Branch of Fawn Brook. No fisheries survey information are available within this watercourse; however, based on a field review of physical instream habitat and the hydrologic regime in this area, the watercourse is not likely to support any fish populations. One of the primary functions of a headwater stream such as Daniels Brook and its associated wetlands is to provide clean and unpolluted waters to downstream areas of the watershed.

Impacts

The following impact(s) can be expected if proper mitigation measures are not implemented:

- **Site soil erosion and sedimentation of watercourses due to extensive vegetation clearing and cut/fill activities.** Without proper safeguards, the placement of fill in concert with land disturbances associated with golf course construction may introduce suspended sediments to nearby watercourses. If not properly controlled, suspended sediments may cause stream degradation in downstream areas. All drainage from this property is eventually conveyed to West Branch Fawn Brook, a high quality coldwater fisheries resource. Excessive sediment deposition could damage the downstream aquatic ecosystem in the following ways:

    1. Sediment reduces the survival of resident fish eggs and hinders the emergence of newly hatched fry. Adequate water flow, free of excess sediment particles is required for fish egg respiration and successful hatching.
    2. Sediment reduces the survival of aquatic macroinvertebrates. Since aquatic insects are important food items in fish diets, reduced insect populations levels in turn will adversely affect fish growth and survival. Fish require an excessive output of energy to locate preferred prey when aquatic insect levels decrease.

3. Sediment reduces the amount of usable habitat required for spawning purposes. Excessive fines can clog and even cement gravels and other desirable substrate together. Resident fish may be forced to disperse to other areas not impacted by siltation.
4. Sediment reduces stream pool depth. Pools are invaluable stream components since they provide necessary cover, shelter, and resting areas for resident fish. A reduction of usable fish habitat can effectively limit fish population levels.
5. Turbid waters impair gill functions of fish and normal feeding activities of fish. High concentrations of sediment can cause mortality in adult fish by clogging the opercular cavity and gill filaments.
6. Sediment encourages the growth of filamentous algae and nuisance proportions of aquatic macrophytes. Eroded soils contain plant nutrients such as phosphorous and nitrogen. Once introduced into aquatic habitats, these nutrients function as fertilizers resulting in accelerated plant growth.
7. Sediment contributes to the depletion of dissolved oxygen. Organic matter associated with soil particles is readily decomposed by microorganisms thereby effectively reducing oxygen levels.

Recommendations

The following recommendations are provided to assure protection of aquatic resources.

- **Develop an aggressive and effective erosion and sediment control plan.** Proper installation and maintenance of erosion/sediment controls is critical to environmental well being. This includes such mitigative measures as filter fabric barrier fences, staked hay bales, and sediment basins. Land disturbance and clearing should be kept to a minimum and all disturbed areas should be restabilized as soon as possible. Exposed, unvegetated areas should be protected from storm events. The applicant and the local wetland enforcement officer should be responsible for checking this development on a periodic basis to ensure that all soil erosion and sediment controls are being maintained. In addition, the applicant should post a performance bond with the town to protect against future soil erosion violations. Past stream siltation disturbances in Connecticut have occurred when individual

contractors either improperly deployed mitigation devices or failed to maintain these devices on a regular basis.

- **All instream work and land grading/filling near watercourses should take place during low flow periods.** This will help minimize the impact to the aquatic resources. Reduced streamflows and rainfall during the summer and early fall provide the least hazardous conditions in which to work near sensitive aquatic environments.

Planning Comments

Golf courses are allowed as a Special Permit Use in the R-1 and R-2 zones in Hebron. Therefore, no zone change would be required for this proposed land use. Existing abutting land uses include a golf course (across the street) and single family residential uses. Both uses are considered compatible with this proposal for an additional nine holes of golf.

Golf courses provide the community with open space which might otherwise be converted to a more intensive use such as a residential subdivision. Golf courses also provide the community with an additional recreational option for those who choose to afford it. Visually and aesthetically, a golf course is preferable to a residential "cookie-cutter" subdivision. Golf courses are "good neighbors" for residential lot owners, frequently raising property values of homes in their proximity.

Buffering between existing residential lots and this golf course is an important issue to address. A landscaping plan should be devised to maximize privacy of the existing homes. To the extent possible, the existing tree cover should be preserved.

Lighting- if provided- should not interfere with abutting lots. Suitable screening should be provided to maintain a rural residential atmosphere.

It does not appear that parking for golfers is provided on this site, but on the existing golf course across the street. Since this is an expansion, parking spaces should be added across the street to the existing lot to serve this expansion.

Proposed access off West Street appears to be adequate.

Archaeological Review

A review of the State of Connecticut Archaeological Site Files and Maps shows no known archaeological site on the project area. In addition, no known archaeological sites are located in close proximity to the project area. Field review suggests that the property possess a low-to-moderate sensitivity for archaeological resources. This assessment is based on the lack of significant wetlands in which the great majority of sites are located.

The Office of State Archaeology suggests that this new development proposal should have no adverse effect on the State's archaeological resources.

Appendix

For Appendix Information Please Contact the
ERT Office at 860-345-3977