Chris Cuzzi

ENVIRONMENTAL REVIEW
of
PROPOSED INLAND WETLAND AND WATERCOURSE ACTIVITIES

"THE PRESERVE"

Old Saybrook, Connecticut

NLJA # 0719-0012

October 17, 2005

Prepared by:

Geoffrey L. Jacobson, PE
Wade M. Thomas, CPESC, CPSWQ
Kati L. Drzewianowski, EIT
Nathan L. Jacobson & Associates, Inc.
86 Main Street
P.O. Box 337
Chester, Connecticut 06412

Penelope C. Sharp, PWS
225 Reeds Gap Road East
Northford, CT 06475

R. Richard Snarski, Certified Soil Scientist, PWS, CPESC
New England Environmental Services
155 Jerry Daniels Road
Marlborough, CT 06447

Jacobson

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

ac	acres
BMPs	Best Management Practices
CB	Catch Basin
cf	cubic feet
CNs	Curve Numbers
DEP	Department of Environmental Protection
FB	Filter Basin
GPD	gallons per day
IWWC	Inland Wetlands and Watercourses Commission
MAC	Maximum Allowable Concentration
mg/L	milligrams per liter
MH	Manhole
lbs/d	pounds per day
MAC	maximum allowable concentration
MR	Mud River
NDDB	Natural Diversity Data Base
NRCS	Natural Resources Conservation Service
OR	Oyster River
SC	scupper
sf	square feet
SSAS	subsurface soil absorption system
TB	Trout Brook
Tc	Time of Concentration
TRM	turf reinforcement mat
TSS	Total Suspended Solids
TST	Temporary Sediment Trap
UG	Underground Gallery
USGS	United States Geological Survey

1.0 Introduction

This review has been prepared for the Town of Old Saybrook Inland Wetlands and Watercourses Commission. The purpose of this document is to assess the potential environmental impacts upon wetland and watercourse habitats that will result from the proposed development of property in Old Saybrook, Essex, and Westbrook known as "The Preserve".

The Preserve is a 999 acre parcel, with approximately 926 acres located within Old Saybrook. With the exception of a short section of access road to Route 153 in Westbrook, all of the proposed development activities will occur within Old Saybrook. The entire property is currently undeveloped, and can generally be characterized as having rugged topography with large unbroken tracts of forest land and extensive wetland systems.

The Preserve is unique for a variety of reasons. It is the largest, privately owned unbroken tract of forested land still extant within the communities of its location. Important wetland resources on the property include Pequot Swamp, a bog-like wetland of local significance, and numerous viable vernal pools. At least four state-listed plant species and three wildlife species are also known to occur on or adjacent to the site.

The proposed project is a residential and recreational community which, upon completion, would include 221 residential units, a network of roadways to provide access to the lots, a private eighteen-hole golf course with club house and other amenities, a golf course maintenance building, a fire house, an above ground water storage tank, an onsite wastewater treatment facility, a network of trails, a nature center and four athletic fields.

In preparation of the review provided in this report, field visits to the site were conducted and the information identified in Appendix A was reviewed.

1.1 Prior Inland Wetland and Watercourse Permit Application

The current "Inland Wetlands and Watercourses Permit Application" is identified by the Applicant as Alternative #12. Of the twelve development alternatives considered, the first two were the only ones which were previously submitted to the Commission as formal permit applications.

1.1.1 Alternative #1: October 21, 1999 Review

The first wetland application, which was submitted on April 28, 1999 and withdrawn in October 1999, was for a proposed development which included 308 residential building lots, a network of roadways to provide access to the lots, an eighteen hole golf course with clubhouse and recreational amenities, a maintenance building, guest cottages, and a wastewater treatment facility.

This prior application was the subject of a similar review, which was prepared by the same peer review team, and presented in a bound report, dated October 21, 1999, entitled "Environmental Review of Proposed Wetland and Watercourse Activities, 'The Preserve – Phase I', Old Saybrook, Connecticut". This report will be referenced hereinafter as the "first review", and the associated application as the "first application".

1.1.2 Alternative #2: March 15, 2000 Review

Alternative #2, which included both the second and third wetlands applications were simultaneously submitted to the Commission in January 2000. The second application, which was subsequently denied, included the roadway infrastructure and twenty-four Phase I single family residential lots. While only Phase I of the residential development was included in the application, it should be noted that the overall layout for the residential component of the development was scaled back to a new total of 283 single family residential building lots. Other notable modifications included individual subsurface sewage disposal systems for each lot (instead of a centralized community system) and a reduction in the length of roadways. The third application, which was eventually approved, included the country club and golf course. This component of the project also included some modifications to that which was presented in the first application, including adjustments to the layout of the golf course and maintenance facility to reduce the area of activity within the wetlands and the one hundred foot (100') regulated upland review area.

The second and third applications were the subject of a similar review effort, prepared by the same peer review team, and presented in a bound report, dated March 15, 2000, entitled "Environmental Review of Proposed Wetland and Watercourse Activities, 'The Preserve – Phase IA', Residential Subdivision & Golf Course Lot and 'The Preserve Golf Course', Old Saybrook, Connecticut". This report will be referenced hereinafter as the "second and third review", and the associated application as the "second and third application".

1.2 Alternative #12

As compared to the second and third applications, the current application has been further modified to reduce the number of proposed residential units from 283, to a total of 221 (as directed by the Planning Commission), consisting of 67 single family residential lots and 154 clustered residential units. Accordingly, the network of roadways necessary to provide access to building lots has also been reduced. The potential impact to inland wetlands and watercourses, resulting from the development of the residential component of this project will be associated with three proposed roadway crossings of watercourses and roadway construction work located within the one hundred foot (100') regulated upland review area. In addition, site work associated with the development of four of the proposed single family residential building lots and a portion of the central village also occurs within the one hundred foot (100') regulated upland review area.

While the recreational elements included in the current application are similar to those proposed in the previous applications, adjustments to the layout of the golf course and maintenance facility have been made to reduce the area of clearing within wetlands and to improve the connectivity between some of the adjacent vernal pools. In this regard, based on the information prepared by the Applicant, the area of tree clearing in wetlands and at golf play-over areas has been reduced from 5.5 acres to 4.0 acres. However, tree clearing and grading within the one hundred foot (100') regulated upland review area has been increased from 25.6 acres to 32.6 acres.

1.3 Alternatives Analysis

Throughout our review, the very basic issue of the analysis of prudent and feasible alternatives has been paramount. In our first review, we noted that the two alternatives presented ("no build" and "conventional subdivision") were inadequate, and that "...the total or cumulative impact of the proposed project raises the question of whether a fresh look should be given to the overall layout with an emphasis on preservation of wetland buffers, and vernal pools." The second and third application, while somewhat of an improvement, still failed to adequately address alternatives to the proposed design.

In our opinion, while the current application is much improved, it does not explore or discuss the feasibility of what would appear to us to be some basic alternatives, such as reducing the length of the golf course, or conversion of some of the proposed single family residential estate lots to clustered residential units. The latter alternative could have the potential to free up an area of sufficient size that would allow for the relocation of at least a portion of the golf course to non-regulated areas, thus retaining more natural buffers adjacent to the wetlands.

In making this observation, we note that The Preserve property contains approximately 1,000 acres of land, with a sizable portion located within uplands, beyond regulated areas. In Section 10.2 (Criteria for Decision) of the Inland Wetlands and Watercourses Regulations of the Town of Old Saybrook, the Commission must take into consideration "...feasible and prudent alternatives to, the proposed regulated activity which alternatives would cause less or no environmental impact to wetlands." The same section further states that "such activities should include, but not necessarily limited to, requiring actions of different nature which would provide similar benefits with different location for activity."

In short, while the current golf course layout is an improvement from previous applications, and has reduced the area of play-over clearing, it is still located in and around sensitive regulated wetland systems.

1.4 General Comments and Concerns

Based on a review of the design drawings, the following apparent omissions and/or errors were found in the "Summary of Regulated Activities" presented in Engineering Report Volume I entitled "Project Information and IWWC Application":

1.4.1 Roadways

- While it has been stated that there will be no dredging or filling of wetlands, Sheet GDP-20 shows a riprap plunge pool to be constructed in wetlands at the drainage discharge from Road "F."
- The summary does not show, or appear to include, work within the one hundred foot (100') regulated area that is associated with proposed off-site road improvements at the intersection of Road "B" and Bokum Road (Sheet GDP-17) and the intersection of Bokum Road and Route 154 (Sheet PLN-29).

1.4.2 Housing

- While it has been stated that no residential unit is located within a regulated area, Sheet GDP-20 shows small portions of proposed houses on Lots #31, #32, and #34 to be located within the one hundred foot (100') regulated area.
- The summary does not show, or appear to include, a small area of clearing within the one hundred foot (100') regulated area on Lot #6 that is associated with a proposed footing drain.
- The summary does not show, or appear to include, a small area of clearing within the one hundred foot (100') regulated area on Lot #25 (Sheet GDP-26) and Lot #27 (Sheet ESC-26).

1.4.3 Golf Course

- While it has been stated that there will be no dredging or filling of wetlands, the "GRA" plates entitled "Summary of Regulated Activities" included in Engineering Report Volume I shows the main irrigation lines crossing through wetlands on Holes #2, #8, #13, #14, and #16.
- While it is stated that seven temporary wetland crossings are proposed, we counted thirteen temporary crossings including eight on the front nine and five on the back nine as shown on the "Golf-Erosion Control Plans."
- The summary does not show, or appear to include, the stormwater discharge and associated clearing within the one hundred foot (100') regulated area on the west side of the golf cart wetland crossing located between the green on Hole #2 and the tees on Hole #3.
- The summary does not show, or appear to include, the stormwater discharge and associated clearing within the one hundred foot (100') regulated area located to the southwest of the green on Hole #11.

2.0 Wildlife Habitat

The Applicant has provided a detailed wildlife study that includes special surveys for both bird species and bats. These studies were both completed by outside consultants and the bird study prepared in conjunction with a previous application. The Applicant's biologist has listed the mammals observed and/or expected to utilize the site and has included descriptions of each of the mammal species. A separate and comprehensive herpetological study has also been provided.

As can be expected for a site of this size, The Preserve is rich in faunal life. A total of twenty-one species of mammals were directly observed with the potential for eleven additional species using the site. Four of the observed mammals are bat species that were netted during the bat survey. Of these, one is the Eastern red bat (*Lasiurus borealis*), a State Species of Special Concern. The breeding bird survey identified forty-nine avian species on The Preserve with an additional eight species nearby and likely to be utilizing the site. Amphibians and reptiles found on site include two State-listed species, the Eastern box turtle (*Terrapene carolina carolina*) and the Eastern ribbon snake (*Thamnophis sauritus*), both of which are State Species of Special Concern. The site boasts a "Snake Den" in which Black rat snakes (*Elaphe o. obsoleta*) and Northern black racers (*Coluber c. constrictor*) are breeding.

There can be no doubt that this species richness will be impacted by the proposed project due to the fact that development of any type has negative consequences for wildlife species. This development which includes several types of housing units, a roadway network, and a golf course will result in shifts in animal populations. There is some information regarding the avian species post-development; however, projections regarding other faunal species have not been provided. The author of the bat study recommends that, for the Eastern red bat, additional data should be collected to determine the degree to which this species uses the site in terms of roosting and foraging, and how the population may be affected by habitat modification. It is not clear that this has been done. Four of the five locations that this bat was observed appear to be directly within either the golf course development or the village complex. It therefore seems possible that the Eastern red bat population will decline or possibly disappear.

We recommend that predictions be made concerning the other State-listed species on the site and that consultations with the Connecticut Department of Environmental Protection Natural Diversity Data Base (NDDB) be held in order to develop strategies to protect all of the State-listed faunal species. It would also be helpful to have one list of all of the species observed or presumed to utilize the site in its current undeveloped state and a comparative list of species expected to be on site following development. With this information consolidated, it will be easier to analyze the impacts upon overall biodiversity.

3.0 Buffers

The importance of wetland buffers has been well documented. A natural buffer around inland wetlands will maintain water quality within inland wetlands by filtering sediments and other pollutants. The buffer may act as a sink for nutrients, particularly nitrogen, which can be taken up by plants within the buffer area. Naturally vegetated buffers will protect wetland dependent and other species of wildlife from direct and indirect disturbance. The buffer can reduce noise levels, resulting from development, which might interfere with courtship, mating, prey location, and predator detection. The buffer can also minimize parasitism and predation of avian (forest interior) broods and nests by forest edge species such as brown-headed cowbird, crow, starling, or grackle. Wide buffers may also aid in maintaining populations of interior species.

Buffers also preserve the integrity and functioning of riparian systems as corridors for the movement of wildlife. This is particularly important during times of flooding. Please note that the Connecticut Department of Environmental Protection Fisheries Bureau recommends a minimum one hundred foot (100') buffer to all watercourses. In addition, on page 51 in the *Eastern Connecticut Environmental Review Team Report* for the first application, it was stated that, "a minimum of 100 feet of undisturbed vegetation left between any stream/wetland and any development or disturbance is recommended. Although this is a minimum standard recommendation, the buffer will preserve at least some measure of habitat value, help to filter sediments and excess nutrients, and reduce disturbance within the wetlands." Likewise, the 2004 Connecticut Stormwater Quality Manual states "as a general rule one hundred feet (100') of undisturbed upland along a wetland boundary or on either side of a watercourse is recommended as a minimum buffer width depending on the slope and sensitivity of the wetland or watercourses."

We recognize that strict adherence to a one hundred foot (100') buffer would essentially eliminate much of the golf course. As such, if it is the Town's desire to maintain the golf course as an element of this plan and to permit construction, we would recommend a **minimum twenty-five foot (25') buffer** with a larger buffer preferable, particularly adjacent to large contiguous wetland systems and vernal pools, in order to preserve the functions and values of the wetlands. Most wetland biologists recognize that buffers to wetlands play a critical role in protecting the quality and quantity of surface waters and providing habitat for aquatic and/or wetland dependent terrestrial species of wildlife. Ideally, buffer widths should be determined on a case-by-case basis depending upon the protection goals. Because it is not always practical to determine buffer widths for each individual situation, a generally recognized buffer width of one hundred foot (100') is supported in the literature as providing necessary wetland protection for most situations. We wish to make it clear that our recommendation for a minimum twenty-five foot (25') buffer is viewed by our Peer Review Team as an absolute minimum, "better than nothing" criterion and neither supported by the scientific community nor what we would recommend under most circumstances. As indicated above, a wider upland review area would only be achievable with the elimination of the proposed championship 18-hole golf course.

The golf course design includes 32.6 acres of tree clearing, regrading, fairway and green construction, and cart path construction within the one hundred foot (100') regulated upland review area. The magnitude of this disturbance will alter wetland ecology.

4.0 Vernal Pools

As noted in the Herpetological Survey and Vernal Pool Analysis with Conservation Planning Recommendation and Strategies, the majority of the thirty eight vernal pools identified on the property are ranked "Tier I" pools based upon the methodology provided in *Best Development Practices, Conserving Pool-Breeding Amphibians in Residential and Commercial Developments in the Northeast United States* (2002) by Calhoun and Klemens. As noted in Calhoun and Klemens (2002), Tier I pools are exemplary pools and the Management Recommendations detailed in the Best Development Practices manual should be applied for the Vernal Pool Depression, Envelope, and Critical Terrestrial Habitat.

The Applicant's consultant has taken an approach which "conserves" eighteen of the thirty-eight pools, slightly less than half, in order to promote long term vernal pool conservation, and, as claimed in his report, the conservation of seventy-six percent (76%) of the biological productivity of the vernal pools on the site. This claim is not substantiated by an impact assessment related to the proposed development. The conserved pools exhibited high spotted salamander egg mass counts; however, many of the nonconserved pools contained high egg mass counts and in another context (i.e. traditional development proposal) would be afforded maximum protection due to the fact that they are Tier I pools.

As specified by Calhoun and Klemens (2002): "The Critical Terrestrial Habitat extends 650 feet beyond the upland edge of the vernal pool envelope (i.e. 750 feet beyond the edge of the pool). This area provides habitat for amphibians during the non-breeding season for foraging, dispersing, and hibernating. During the breeding season, adults migrate to pools through this zone."

The same document spells out the desired management for this area as follows (with emphasis added):

- "Maintain or restore a minimum of 75% of the zone in **contiguous (i.e., unfragmented) forest** with undisturbed ground cover.
- Maintain or restore forested corridors connecting wetlands or vernal pools.
- Provide suitable terrestrial habitat for pool-breeding amphibian populations by maintaining or encouraging at least a partially closed-canopy stand that will provide shade, deep litter, and woody debris.
- Minimize disturbance to the forest floor.
- Where possible, maintain native understory vegetation (e.g. shrubs and herbs)."

The document further states that "roads (and associated development) within this zone limit the amount of terrestrial habitat available to amphibian populations, fragment and isolate remaining pieces of habitat, facilitate further development, and directly result in mortality of individuals."

Most of the conserved pools are in and near the golf course. Even though approximately seventy-five percent (75%) of these pools Critical Terrestrial Habitat will not be developed, the remaining undeveloped area is in most cases fragmented by golf course fairways. For example, Vernal Pool #7 has a roadway to the east and a golf hole to the west. We believe that fragmentation of Critical Terrestrial Habitat by golf course fairways and roadways will negatively impact the population of pool-breeding amphibians and the ecological integrity of the site's natural resources. The migration of metamorphs (juvenile salamanders) across fairways will be impeded with the additional potential for increased predation and desiccation. We ask the Applicant to provide documentation attesting to the fact that amphibians, specifically juveniles will **not be impeded** by golf course fairways and that mortality will **not be increased.**

A recent peer-reviewed study by Betsie B. Rothermel (Ecological Applications 14(5):1535-1546) referenced in the REMA review dated January 7, 2005, demonstrated that migrating juvenile spotted salamanders are impeded by open pasture. The study found that an average of only nine percent (9%) of juveniles survived traveling across 165 feet of pasture to a forested edge. This is most likely due to the pasture's physical characteristic, which is drier and offers less protection from desiccation than forested habitat. It is important to note that fairways shown on sheets MP-1 through MP-4, that are within the vernal pool Critical Terrestrial Habitat, are commonly two hundred to three hundred feet (200' to 300') across. We expect that these mowed fairways will have less cover than a pasture, and will therefore impact the success of migrating juvenile amphibians. In addition, in the study juveniles migrating across pastures were not able to selectively orient themselves towards the nearest forest edge. This suggests that once on a fairway, some of the juveniles will not find the shortest path (or perhaps any path) across the fairway.

Spotted salamander larvae have been observed to remain in vernal pools well into August and sometimes later. Therefore maintaining vernal pool hydrology throughout the summer months is critical to their survival. A pumping test was conducted by the Applicant of the proposed golf course irrigation wells with two of the three proposed wells located in the vicinity of Wetland #19. The test showed impacts to the hydrology of several "conserved" vernal pools. These pools are all highly productive containing between 211 to 462 egg masses in 2005. The Applicant's herpetologist considers these pools to be "conserved." However, if water levels are drawn down and larval amphibians fail to develop as a result, we question whether or not they will be truly conserved. Since this pumping test was impacted by an early significant rainfall event, there is the potential that larger impacts to the vernal pools surface and ground water hydrology would occur.

The Applicant's consultant has conducted thorough studies of the vernal pools on site and has collected at least two years of data on the pools. However, no analysis of potential impacts upon either the conserved or the nonconserved pools has been provided. For example, in respect to a nonconserved pool such as Vernal Pool #25, with 159 spotted salamander egg masses, will amphibian use of the pool cease entirely, dwindle over time, or continue with reduced numbers. **We believe the Commission should be provided with an impact evaluation for all vernal pools on site in order to be able to**

thoroughly assess the consequences of the proposed development and to arrive at an informed decision regarding this project.

4.1 Vernal Pool Guidelines

It is recommended that the following general guidelines be implemented by the Applicant for the protection of vernal pools:

- Hydrology is a key element in the functioning of a vernal pool. It is imperative that the hydrology, both ground water and surface water, not be altered. It is therefore critical that **no point source stormwater discharges be directed into or towards a vernal pool.**

- The pumping test for golf course water supply wells showed hydrologic impacts to Vernal Pools #7, #9, and #12. Even a small drawdown within a vernal pool can have a major impact upon the survival rates of amphibian larvae. **We strongly recommend that no drawdown of surface water occur within vernal pools.**

- **No contaminants from either the road system or the golf course should be directed toward vernal pools.** In particular, fine sediments entering a vernal pool during the breeding season can coat egg masses of salamanders and wood frogs and can harm vertebrate and invertebrate species.

- **We recommend a minimum one hundred foot (100') buffer surrounding all vernal pools.** However, it is our understanding that the roadway system may be difficult to realign due to other roadway design considerations. As such, it is recognized that maintenance of the one hundred foot (100') buffer in these specific circumstances may not be reasonably attainable. In addition, Vernal Pool #27 is so compromised by surrounding development that it is the peer review team's opinion that this will cease to function as a vernal pool and therefore maintaining the one hundred foot (100') buffer at this location will serve no useful purpose.

5.0 Mitigation

In contrast to previous plans for The Preserve, the current plan (Alternative #12) has reduced the area of tree clearing in wetlands from 5.5 to 4.0 acres. Three vehicular road crossings are proposed, which will be accomplished by the use of bridges and footings that will be placed outside of wetland limits. The golf course, as designed, entails considerable disturbance within the one hundred foot (100') regulated upland review area including construction of tees, greens, fairways, roughs, and bio-basins. Additionally, at four of the proposed "estate" houses, the central village, and the proposed roads, grading will occur within the one hundred foot (100') upland review area. According to the Applicant's calculations, 32.6 acres of upland review area will be disturbed.

Clearing of wetlands often invites the colonization of invasive species such as Purple Loosestrife (*Lythrum salicaria*) or Common Reed (*Phragmites australis*). There is already a seed source for these species on site and these and other undesirable species such as Common Cattail (*Typha latifolia*) frequently colonize in cleared wetlands. As such, there is no guarantee that clearing the wetlands will promote growth of desirable plant species and improve habitat diversity. In fact, observations made at other golf courses by the peer review team show that the colonization of invasive species in cleared wetland areas is common. The Applicant's Biologist has recognized this possibility and recommends that these areas be monitored for the colonization of invasives, although no time period appears to have been specified. **We recommend that the cleared wetlands be monitored for a minimum period of five (5) years.**

For The Preserve golf course, intrusion into regulated areas will result in a total disturbance of 32.6 acres, as calculated by the Applicant. One of the results of the disturbance is fragmentation of the existing habitat. Fragmentation will disrupt migration patterns, drive out forest interior species, and negatively affect obligate vernal pool species. Although the Applicant's intent is to preserve approximately seventy-six percent (76%) of the biological productivity of the pools, it is not clear that this will in fact be the final outcome once the golf course and 221 residential units occupy what is now an undeveloped contiguous forested habitat. There will be considerable fragmentation of the land, and amphibians and other fauna may not respond as predicted. The Applicant's herpetologist states that "53% of the vernal pools on the site are being lost" (page 8-6 of Klemens report). The Peer Review Team asks how the Applicant proposes to mitigate the loss of these wetlands. We do not believe that the conservation of eighteen (18) pools provides mitigation for the lost pools.

Another potential impact relates to water quality. On any site with this extent of disturbance, there is the possibility of failure of erosion control measures. Severe storm events may occur, and result in sedimentation of wetlands, despite state-of-the-art soil erosion and sediment control measures and good maintenance.

The Applicant proposes some simple mitigation strategies including placement of bluebird boxes and bat houses. The other recommended strategy is the replanting of many acres of buffer areas with seed and/or shrub species. This reflects a philosophy that

differs from ours regarding mitigation. In our opinion, we prefer that areas requiring clearing adjacent to fairways be cut and allowed to re-vegetate with the natural woodland plants and then be maintained at heights suitable for play. This is particularly important for any area to be cleared within the upland review area. Trees when cut typically sprout with multiple stems and become "bushy," thus these areas would eventually grow to resemble the "edge" habitat that is desirable. We do not recommend the planting of these areas with nursery stock, due to the fact that such action can introduce new genotypes into the landscape. Deer are likely to browse new plantings and they will also require water, at least initially, for survival. Furthermore, the preparation required for planting multiple shrubs would require grubbing out existing stumps, regrading, disturbance and compaction of natural soils. We concur with the Applicant's biologist that avoidance of impacts is the preferred mitigation and believe that additional efforts can be made by the Applicant to further reduce potential disturbance to the habitats at The Preserve.

As a final point, the Applicant's biologist discusses the removal of Common reed (*Phragmites australis*) from Pequot Swamp and outlines a two-step process. Herbicidal treatment is recommended. According to the narrative, healthy grasses will be able to flourish once competition from Common reed is eliminated. The Applicant's biologist also recommends removal of localized patches of Tree-of heaven (*Ailanthus altissima*) and Common reed in Wetlands #16, #35, and the tip of Wetland #18. It is not clear from the Applicant's submitted application whether these recommendations will be implemented. As part of the routine maintenance of the golf course we recommend that any non-native invasive species as well as Cattail species (*Typha* spp) be eradicated from all wetlands.

6.0 Surface Water & Groundwater Quality

The potential adverse impacts to surface and groundwater quality resulting from the application of pesticides, herbicides and fertilizers utilized for landscape maintenance on both the proposed golf course and residential lots has been an issue of considerable concern to area residents.

Since the evaluation of these concerns extends beyond the technical expertise of this peer review team, additional technical assistance was obtained from Leggette, Brashears & Graham, Inc., Professional Groundwater and Environmental Engineering Services; and A. Martin Petrovic, Professor of Turfgrass Science, Cornell University School of Agronomy. A copy of their review and recommendations regarding this issue will be found under separate cover.

From a wetland perspective, any seasonal drawdown to the water levels in the vernal pools throughout breeding and larval development, which extends into August and occasionally later, is considered a significant physical impact to the vernal pools because it will affect the survival of the developing amphibians. Due to this potential impact, we recommend additional surface water monitoring locations be incorporated into the Applicant's monitoring plan, specifically, Vernal Pools #21 and #22 and two locations on the eastern edge of Pequot Swamp down-gradient of the easterly subsurface soil absorption system.

7.0 Stormwater Management

The review of the stormwater management system for The Preserve is based on the documents which have been submitted to the Old Saybrook Inland Wetlands and Watercourses Commission as part of the current Application for Permit.

The Regulations of the Town of Old Saybrook do not contain specific requirements for the preparation of hydrologic studies or the design of stormwater detention or stormwater quality basins. Therefore, for the purposes of this review, we have assumed that the requirements contained in the Connecticut Guidelines for Soil Erosion and Sediment Control (2002), the Connecticut Department of Transportation Drainage Manual (October 2000 as amended through 2003), the 2004 Connecticut Stormwater Quality Manual and current commonly accepted standards of practice for hydrologic studies and hydraulic design for stormwater management systems would apply to this project.

7.1 Site Characteristics

As identified on the USGS Essex Quadrangle, and as described in the documents provided by the Applicant, the parcels topography is dominated by four ridgelines on the site and the lower valley areas between them. Ground surface slopes are relatively steep in the vicinity of these ridges and the valley areas contain extensive inland wetlands. An 18± acre (as planimetered from the USGS Essex Quadrangle) inland wetland known as Pequot Swamp is located in the valley between the central and easternmost ridge on the property.

The documents provided by the Applicant indicate that the dominant upland soil type classifications on the property are Hollis-Charlton series, and that the surficial geology is characterized by a thin depth of glacial till (generally less than ten to fifteen feet thick) over bedrock. In addition, the documents indicate that numerous bedrock outcrop areas occur throughout the site. We note that Sheet SA-5 listing the soil types is not consistent and describes HpE (73E) as Charlton-Chatfield complex and not Hollis-Charlton in the Soil Survey of Middlesex County.

7.2 Drainage Basins

The property straddles the upper watersheds of three watercourses. The northern section drains toward the Mud River in Essex; the central and western sections drain west towards the Trout Brook in Westbrook; and the south and eastern sections drain south toward the Oyster River in Old Saybrook.

The divide between the Connecticut Major Basin and the South Central Coast Major Basin is located in the northern portion of the project site. The portion of the property within the Connecticut Major Basin is also within the Falls River Sub Regional Basin.

The sub regional basin divide between the Oyster River and the Patchogue River Basin of the South Central Coast Major Basin is also located within the west portion of the property.

Based on the topographic mapping prepared for the project by the Applicant and site inspections made of the property for previous reviews, it would appear that the "Atlas of Public Water Supply Sources and Drainage Basins of Connecticut" (CTDEP, 1982) incorrectly identifies the sub regional drainage basin divide between the Oyster River and Patchogue River Basins. This sub regional basin divide is actually located to the east of Pequot Swamp, identified on the Essex Quadrangle, and the project drawings and includes the watershed area tributary to this wetland. Watershed areas within The Preserve property included in the three sub regional drainage basins are as follows:

Sub Regional	Regional	Major	Total Drainage Basin (acres)	Existing: Area in The Preserve (acres)	Developed: Area in The Preserve (acres)
Falls River ("Mud River")	Connecticut Main Stem	Connecticut	11,348	255	251
Oyster River	South Central Eastern	South Central Coast	3,668	471	479
Patchogue River ("Trout Brook")	South Central Eastern	South Central Coast	5,062	273	269

Locally, the portion of The Preserve property within the Falls River ("Mud River") Sub Regional Basin drains to a large inland wetland area located in Essex to the northeast of the property which is associated with the Mud River and through a series of ponds located on the east side of Connecticut Route 153 in Essex which outlet to the Mud River. The Mud River flows northeasterly to its confluence with the Falls River which outlets to the Connecticut River in the North Cove area of Essex.

The major portion of The Preserve property is located within the Oyster River Sub Regional Basin which drains to the south through extensive inland wetland areas that are associated with Crystal Lake. The outlet from Crystal Lake flows southerly to its confluence with Fishing Brook which flows easterly to the Oyster River. A smaller portion of the property within this sub regional basin drains to an inland wetland area in the southeast corner of the property adjacent to the Valley Shore Railroad embankment. This wetland is associated with the Ingham Ponds which outlet southeasterly to Chalkers Mill Pond. The outlet from Chalkers Mill Pond flows southerly to its confluence with the Oyster River south of Interstate Route 95. The Oyster River outlets to Long Island Sound at Indiantown Harbor in Old Saybrook.

The portion of The Preserve property within the Patchogue River Sub Regional Basin drains to the west to Trout Brook, on the west side of Connecticut Route 153 in Westbrook, which flows southerly through a series of ponds before its confluence with the Patchogue River. The Patchogue River Sub Regional Basin includes Pequot Swamp. The Patchogue River flows southeasterly to its outlet to Long Island Sound near Grove Beach Point.

7.3 Stormwater Management System Design

Correct watershed delineation, hydrologic soil groups, runoff curve numbers, times of concentration and rainfall data are all key components in accurate modeling of how the hydrology of a watershed will be affected due to development. The goal of stormwater management is to control proposed peak flow rates to less than or equal to existing conditions for the 2, 10, 25, 50, and 100-year design storms. Based on our review of the project documentation this has not been done.

7.3.1 Methodologies and Computer Models

This report indicates that the Natural Resources Conservation Service (NRCS) Technical Release (TR-20) methodology was used to analyze the proposed development's stormwater runoff impacts by creating runoff hydrographs and reservoir route them. The report also indicates that the computer model utilized to develop the stormwater runoff models was HydroCAD, as developed by Applied Microcomputer Systems, Chocorua New Hampshire. Both programs are commonly utilized hydrologic models.

7.3.2 Watershed Delineation

In general the major drainage basin delineations and significant subbasin delineations were checked, and we are in substantial agreement with only minor discrepancies. In this regard, we note that watershed lines should, in all cases, run perpendicular to topographic contours.

Topography for off-site watersheds should be provided (USGS Topography is acceptable) to verify the watershed delineations. This comment specifically applies to Oyster River Drainage Areas OR-A1, OR-A2 and OR-A3.

7.3.3 Soil Types

The majority of the soils are glacial tills with a seasonal high water table. The delineation of soil types shown on the Existing Conditions Watershed Plan, Sheet SA-8, and the soil types listed on Sheet SA-5 were checked against the published soil types for the project area in the US Department of Agriculture Soil Survey of Middlesex County, Connecticut and were found to be correctly identified. It should be noted that the soil types do not appear to match up exactly with the inland wetlands, topographic slopes, and physical features. Discrepancies of up to one-hundred-fifty feet (150') were noted. For example, the wetland boundaries should match the associated wetland soil types, the sloped areas

match a sloped soil type (designated by the last letter of the soil abbreviation) and water bodies should match. However, our experience has been that such discrepancies are commonly due to diminished accuracies inherent when enlarging the 1"=1320' soil survey maps.

7.3.4 Runoff Curve Numbers

We question the methodology for reducing the runoff curve numbers based on provision of rain gardens for residential lots. While a reduction in runoff curve number may be appropriate for the first flush or one inch (1") design storm, it would not appear to be justifiable for larger design storms (i.e. 2-year design storm and above). A NRCS or other authoritative reference should be provided to justify the runoff curve number reduction, as the runoff curve number reduction decreases the runoff volume.

Although the curve numbers associated with any given soil type and associated cover type have been identified correctly, we are unable to fully review the use of these numbers throughout the calculations, due to the following:

- **Cover types should be listed for all subbasins in the Drainage Areas and Curve Number tables in the Engineering Report Volume IIIb so that they may be verified.**
- **Calculations appear to be missing for the Engineering Report Volume IIIb for the existing basin OR-E and as such were not able to be reviewed.**
- For existing watershed boundaries; the areas listed on SA-8; in the Engineering Report figures; in the Engineering Report overview tables of each subbasin; on the Drainage Basin & Curve Numbers table; in the Basin Area Analysis table; and, in the calculations **should all be the same value for each watershed.**
- For proposed watershed boundaries; the areas listed on PDA-0; in the Engineering Report overview tables for each subbasin; on the Drainage Basin & Curve Numbers table; on the Basin Area Analysis table; and, in the calculations, **should all be the same value for each watershed basin.**
- We question if TB-B1B should be included with the MR-DP calculations.
- We question if TB-C1a and TB-C1b should be included with the TB-BP calculations.
- The percent change on the tables in the Engineering Report stating the summary of the peak flow rates for the Oyster River, Mud River, and Trout brook should be shown on all of the drainage points. (Note: Some of the tables appear to have information different than that shown in the HydroCAD calculations, along with some mathematical errors in percent difference calculations.)
- The computations of composite **curve numbers were checked and are noted to have multiple mathematical errors. All discrepancies should be resolved to facilitate review.** These errors are listed in Section 14.1 "General Apparent Errors."

7.3.5 Times of Concentration

The time of concentration (T_c) calculations do not appear to be included in the report other than the total T_c values and as such could not be verified.

It is expected when this information is submitted that it will contain the lengths and Manning's "n" values utilized in the sheet flow, shallow concentrated flow and channel flow computations. The Connecticut State NRCS office has for some time recommended that sheet flow lengths of fifty to one hundred feet (50' to 100') be utilized in Connecticut in the computation of T_c for hydrologic studies.

The shallow concentrated flow component of the Tc should use Figure 3.1 of the NRCS Technical Release 55 (TR-55) Manual.

The delineation of the flow paths for times of concentration should be shown for all subbasins.

7.3.6 Rainfall Data

The hydrologic models included in the report were developed for the 2, 10, 25, and 100 year recurrence interval design rainfall events. The input data to the computer models indicates that the correct 24-hour precipitation depths for Middlesex County as taken from TP 40 and listed in the Connecticut Guidelines for Soil Erosion and Sediment Control were utilized.

The report indicates that the 24-hour duration NRCS Type III rainfall distribution was utilized in the computer models, which is the correct distribution pattern.

7.3.7 Ponds and Routes

General Comments:

- Data sheets available from the HydroCAD program showing the **input data should be provided for ALL PONDS AND REACHES** so that they may be checked for accuracy which could result in a difference in the existing versus proposed peak flow rates in the various watersheds.
- On Water Surface Elevation vs. Storage Volume the column labeled "Delta Area" should read "Average Area".
- Column widths on Flowmaster should be adjusted to show all the data.
- We question the use of pond storage in the wetlands. The HydroCAD website (http://www.hydrocad.net/) states "For flow through swamps or wetlands without a specific outlet control, use a standard reach routing."

OR-A:

- Topographic information should be provided to verify the stage storage relationship contained in Engineering Report Volume IIIb for the water storage capacity computed easterly of Bokum Road.
- We question the methodology for delineating the watersheds relative to cross culverts located on Bokum Road. Oyster River Drainage Area OR-A1 has two cross culverts (Culvert #8 and Culvert #9) which, based on USGS topography would appear to be in two separate watersheds with unconnected storage areas. In this instance we would typically consider each cross culvert as a subbasin unless a large contiguous swamp was connecting the two culverts. A similar method was utilized for Oyster River Drainage Area OR-A2 where Culvert #6 appears to be draining a separate watershed than Culvert #5 and Culvert #4. Each culvert should have a separate drainage area unless it is hydraulically connected.
- Topographic information should be provided to verify the stage storage relationship contained in Engineering Report Volume IIIb for the water storage capacity computed easterly of Bokum Road. Specifically the culverts associated with OR-A1-P, OR-A2-P, OR-A3-P, and OR-A4-P to confirm the assumptions made in the Water Surface Elevation vs. Storage Volume tables.
- In the OR-AP HydroCAD output, we question the peak outflow rates being larger than the peak inflow rates on Pond BR-GP for the 25, 50, and 100-year design storms; and Pond UG-14 for the 25 and 100-year design storms.
- In the OR-AP HydroCAD output, we question UG-14 having a higher peak elevation and/or a higher storage capacity than that calculated in Engineering Report Volume IIIa, for the 10, 25, 50, and 100-year design storms. Likewise, FB-10 and FB-7 both have a higher storage capacity than those listed in the Engineering Report Volume IIIa for the 2, 10, 25, 50, and 100-year design storms. The Applicant should check to determine if similar discrepancies occur in any of the other basins.
- On the Water Surface Elevation vs. Storage Volume table for OR-A1-P, the depth associated with elevation 63.5 should be 3.5 ft.
- On the Water Surface Elevation vs. Storage Volume table for OR-A2-P, the average area between 172,000 sf and 175,000 sf should be 173,500 sf.
- On the Water Surface Elevation vs. Storage Volume table for OR-A3-P, we question the input data when the culvert was not found and therefore has unknown storage.
- On the Water Surface Elevation vs. Storage Volume table for OR-A4-P, we question the 2,852,000 sf area associated with elevation 36.5. It appears that each one foot elevation change results in approximately a 30,000 sf change, and therefore it would appear that the area associated with elevation 36.5 would be approximately 2,837,000 sf.

- The delineation used to calculate the areas associated with the Water Surface Elevation vs. Storage Volume tables for OR-A6, OR-A8 should be provided.

OR-B:

- The delineation used to calculate the areas associated with the Water Surface Elevation vs. Storage Volume tables for OR-B1, OR-B2, OR-B3, OR-B4, OR-B5, OR-B9, OR-B10, and OR-B11 should be provided.
- In the OR-B HydroCAD output, we question the peak outflow rates being larger than the peak inflow rates on Pond B1P for the 50 and 100-year design storms
- In the OR-BP HydroCAD output, we question the peak outflow rates being larger than the peak inflow rates on Pond B4P for the 2, 10, and 50-year design storms; DB-3 for the 100-year design storm; G1-CP for the 100-year design storm; G6-BP for the 100-year design storm; UG-10 for the 50-year design storm; UG-18 for the 100-year design storm; UG-21 for the 100-year design storm; UG-9 for the 100-year design storm; and UG-X for the 100-year design storm.
- We question the apparent over sizing of the golf course bio-basins. For example, G1D has a maximum storage capacity of 13,571 cf according to Engineering Report Volume IIIa; however, according to the HydroCAD computations the 100-year design storm only requires 111 cf of storage. Likewise, the following bio-basins appear to be oversized by more than 50%: G1B, G2A, G2E, G3A, G3B, G4D, G5A, G5C, G7B, G8C, G8D, G8E, G8F, and G9B. (Similar oversizing throughout the remaining basins may occur and should be investigated.) It should be noted that while there is nothing wrong with oversizing these basins, many of them are located in regulated areas and as such, disturbance should be limited.
- In the OR-BP HydroCAD output, we question the zero storage for UG-17.
- The Flowmaster Rating Table for OR-B1 is inaccurate above elevation 98.74, since the natural channel points entered do not extend up to elevation 115.00 on one side. Likewise, OR-B2 is inaccurate above elevation 103.91, since the natural channel points entered do not extend up to elevation 106.33 on one side; OR-B3 is inaccurate above elevation 108.08, since the natural channel points entered do not extend up to elevation 115.00 on one side; OR-B4 is inaccurate above elevation 87.89, since the natural channel points entered do not extend up to elevation 88.00 on one side; OR-B5 is inaccurate above elevation 67.32, since the natural channel points entered do not extend up to elevation 71.00 on one side; OR-B9 is inaccurate above elevation 61.56, since the natural channel points entered do not extend up to elevation 62.00 on one side; OR-B10 is inaccurate above elevation 122.56, since the natural channel points entered do not extend up to elevation 122.70 on one side; and OR-B11 is inaccurate above elevation 60.56, since the natural channel points entered do not extend up to elevation 61.00 on one side.
- We question why there are two Water Surface Elevation vs. Storage Volume tables provided for OR-B11.

- The plans provided for OR-B1, OR-B3, OR-B5, and OR-B11 are illegible. Clear plans should be prepared and submitted.

OR-C:

- We question the 0 cf of storage in UG-22 for the 2 and 10-year design storms.
- The delineation used to calculate the areas associated with the Water Surface Elevation vs. Storage Volume tables OR-C8 and OR-C9 should be provided.
- On the Water Surface Elevation vs. Storage Volume table for OR-C9, the depth associated with elevation 68 should be 5.29 ft and the depth associated with elevation 70 should be 7.29 ft.
- The plans provided for OR-C8 and OR-C9 are illegible. Clear plans should be prepared and submitted.

OR-E:

- The delineation used to calculate the areas associated with the Water Surface Elevation vs. Storage Volume tables OR-E2, OR-E6, and OR-E7 should be provided.
- The Flowmaster Rating Table for OR-E2 is inaccurate above elevation 44.00, since the natural channel points entered do not extend up to elevation 45.00 on one side. Likewise, OR-E7 is inaccurate above elevation 38.00, since the natural channel points entered do not extend up to elevation 44.00 on one side.

MR-A:

- The delineation used to calculate the areas associated with the Water Surface Elevation vs. Storage Volume tables MR-A2, MR-A3, MR-A4, MR-A5, MR-A7, and MR-A8 should be provided.
- In the MR-A HydroCAD output, we question the peak outflow rates being larger than the peak inflow rates on Pond A7P for the 2 and 10-year design storms.
- In the MR-AP HydroCAD output, we question the peak outflow rates being larger than the peak inflow rates on Pond A7P for the 25-year design storm.
- The Flowmaster Rating Table for MR-A2 is inaccurate above elevation 104.00, since the natural channel points entered do not extend up to elevation 106.00 on one side. Likewise, MR-A3 is inaccurate above elevation 102.00, since the natural channel points entered do not extend up to elevation 104.00 on one side; and MR-A5 is inaccurate above elevation 152.00, since the natural channel points entered do not extend up to elevation 154.00 on one side.

MR-D:

- In the MR-D HydroCAD output, we question the peak outflow rates being larger than the peak inflow rates on Pond D2P for the 2-year design storm.
- In the MR-DP HydroCAD output, we question the peak outflow rates being larger than the peak inflow rates on Pond BR-FP for the 50-year design storm; D2P for the 10, 25, and 50-year design storms; D4P for the 10, 25, and 50-year design

storms; D8P for the 10-year design storm; and MR-UG1 for the 25, 50, and 100-year design storms.

MR-F:

- The delineation used to calculate the areas associated with the Water Surface Elevation vs. Storage Volume tables MR-F1 should be provided.

MR-G:

- The delineation used to calculate the areas associated with the Water Surface Elevation vs. Storage Volume tables MR-G1 should be provided.
- On the Water Surface Elevation vs. Storage Volume table for MR-G1, the depth associated with elevation 48 should be 9.47 ft and the depth associated with elevation 50 should be 11.47 ft.
- The Flowmaster Rating Table for MR-G1 is inaccurate above elevation 40.61, since the natural channel points entered do not extend up to elevation 49.00 on one side.

TB-B:

- In the TB-B HydroCAD output, we question the peak outflow rates being larger than the peak inflow rates on Pond B5CP for the 2 and 25-year design storms; B6P for the 100-year design storm; and B8P for the 10 and 25-year design storms.
- We question why the multiple errors shown for the 100-year design storm of TB-B were not addressed.
- In the TB-BP HydroCAD output, we question the peak outflow rates being larger than the peak inflow rates on Pond B5BP for the 25-year design storm; B5CP for the 10 and 100-year design storms; B8P for the 2 and 10-year design storms; G13EP for the 25 and 50-year design storms; G18DP for the 25, 50, and 100-year design storms; UG-1A for the 50 and 100-year design storms; and UG-4 for the 10-year design storm.
- We question the zero storage in UG-6A.
- We question the Manning's "n" values of 0.000 for the reaches.
- The Flowmaster Project Description sheet showing the input data for TB-B2P, TB-B4P, TB-B5CP, TB-6P, and TB-B7P should be included so that it may be reviewed.

7.4 Stormwater Collection and Conveyance System

The stormwater collection and conveyance system for the project includes standard catch basin inlet structures with two foot deep sumps and high density polyethylene (HDPE) pipe storm sewers. In addition to the storm sewer system, grass lined drainage channels located on the road shoulders are proposed along some of the subdivision roads.

7.4.1 Storm Sewer Systems

Although the storm drainage system could change due to other comments, the layout of the storm drainage system impacts the flows that will be seen in the bioretention areas. Based on our review of the Storm Drainage Analysis provided in the Engineering Report Volume II, it would appear that the storm sewer systems have been design to convey the runoff generated from the contributing roadway pavement and shoulder areas (as well as any associated contributing areas located beyond the limits of the road right of way). It also appears that runoff generated from overland contributing areas outside the roadway is to be intercepted by the roadside channels shown on the drawings.

As such, we have the following comments:

- Drainage area delineations provided appear to have minor errors. For example, Road A Station 26+00 to Station 31+00, swale at top of hill to the north of the road should match with the basin delineations.
- The time of concentrations used for the storm sewer systems are either five, seven, or ten minutes which provides a conservative calculation with respect to peak discharge and pipe sizing. When the runoff occurred over an impervious surface, five (5) minutes was used. When the runoff occurred over a pervious surface, ten (10) minutes was used. When the runoff occurred over a combination of pervious and impervious surface, seven (7) minutes was used.
- There are several instances where the storm sewer design computations, the pipe size, the top of structure frame, the slopes, the bypass locations, and pipe invert elevations shown on the plans, are not in agreement with the same information shown on the roadway profile sheets. In addition there are instances where some of this information is missing on the drawings. Multiple discrepancies between the drawings and the calculations, as listed in Section 14.0 "Design Drawing Inconsistencies" of this report should be resolved in order to complete our review of the storm sewer system.
- It is our understanding that all proposed subdivision roadways are to be accepted by the Town. From a Public Works Department maintenance standpoint, we would recommend that the depths of some of the structures be considered. Catch basins should have a maximum depth of twelve feet (12'), and where a deeper structure is absolutely necessary a manhole should be utilized with a locking cover, and drop manholes should be utilized.
- It is unclear as to which catch basins are singles, doubles, Type "C", Type "C-L", Type "C-G" in the calculations as well as the drawings. Catch basins should be labeled as to the type and size or a table should be provided.
- Complete storm drainage information (catch basin numbers, catch basin top of frame elevations, invert elevations, pipe lengths, and pipe sizes) and calculations have not been provided for the Central Village, East Village, Athletic Fields, or in the vicinity of the maintenance and fire station buildings. This information should be provided.

- Per the ConnDOT Drainage Manual Section 11.7, gutter spread for the 10-year design storm should be less than half of the lane width. The following catch basins currently appear to exceed the half of the lane width design criteria:

  CB-C2, CB-D3, CB-D6, CB-A38, CB-A40, CB-A41, CB-A42, CB-A44, CB-B12, CB-B13, CB-B24, CB-G3, CB-G5, CB-G16, CB-G17, CB-G18, CB-G19, CB-H1, CB-H2, CB-B43, CB-B44, CB-G7, CB-G9, CB-G13, CB-G23, CB-H7, CB-G26, CB-G28, CB-G31, CB-G32, CB-G38, CB-G40, CB-G41, CB-G43, CB-G47, CB-H26, CB-H27, CB-G54, CB-H

- Per the Old Saybrook Road Regulations, all pipes should have a slope greater than or equal to 0.5%. Pipe rungs P-A1, P-A39, P-A47, P-A54, P-F6, and P-B67 are less than 0.5%.
- Per the ConnDOT Drainage Manual Section 11.8, "at sag vertical curves of expressways where curbing is not used, a type "C-L" catch basin shall be placed at the outer edge of the shoulder and within the shoulder. This inlet will collect rain and snow-melt which cannot reach the actual sag location due to the dam created by snow plowing operations." This specifically pertains to Station A99+75.00. Particularly given the fact that the existing driveway is now located at the proposed roadway low point.
- The Old Saybrook Road Regulations require three feet (3') of cover; however, we would have no objection to providing a minimum of two feet (2') of cover, provided that a formal waiver is obtained.
- It is unclear from the calculations what elements the outlets labeled "O-x", where "x" is a number, are referring to on the drawings, as well as the lengths, slopes and inverts of the associated pipe sections.
- It should be confirmed that all catch basins have a two foot sump as specified in the details, for example the profile for Road B Sta. 18+50 to 21+25 in the Roadway Drainage Analysis in the Engineering Report Volume II, shows catch basin CB-B13 with a sump elevation higher than the invert out elevation.
- Multiple discrepancies between the drawings and the calculations, as listed in Section 14.0 "Design Drawing Inconsistencies" of this report should be resolved in order to complete a full review of the storm sewer system.
- We question the outlets from underground gallery UG-4 into Vernal Pool #7, filter basin FB-14 into Vernal Pool #31, FB-4 into Vernal Pool #6, and FB-8 into Vernal Pool #26.
- Catch basin CB-A106 is shown with a discharge extending fifty feet (50') into property not owned by The Preserve.
- It is not clear as to why some outfalls to inland wetlands or watercourses have Vortechs™ stormwater treatment structures (Road A Sta. 16+40± R and Sta. 20+90± R for example) and others do not (Sta. 38+20± L and Sta. 40+25± R for example).

- With regard to stormwater treatment structures, it has been our experience that engineers typically specify the Vortechs™ units to obtain land use commission approval and when the project is constructed an alternate unit is typically installed due to the marginal cost savings in the stormwater treatment structure. It is our opinion that if a stormwater treatment structure is to be utilized then the Vortechs™ stormwater treatment structures should be provided since they are currently the most efficient units available. We would recommend that utilization of Vortechs™ stormwater treatment structures be made a condition of approval, if the commission is so inclined.

7.4.2 Stormwater Pump Station

It is not clear where the storm pump station, located on Road A at Sta. 6+75 L will be pumping the stormwater to. The invert into the pump station is approximately 32' feet below existing ground surface and it is assumed that stormwater storage would exist beneath this invert elevation. More design details, design flows and discharge information need to be provided on the storm pump station. Unless absolutely necessary, we would discourage the use of stormwater pumping systems, as they can be maintenance intensive.

7.4.3 Roadside Drainage Channels

The vegetated swales should utilize turf reinforcement mats (TRMs) instead of the specified temporary straw matting on the channel bed to prevent erosion. The flow in the swales should be collected with Type "C-G" and Type "C-G" Double Type II catch basins instead of the specified Type "C-L" and Type "C-L" Double Type II catch basins. As it has been our experience that Type "C-L" structures are much more susceptible to closing and therefore require more maintenance. Computations should also be provided.

7.4.4 Culverts and Bridges

There are four main bridge and culvert sites on The Preserve property.

- **Bridge Site #1**

The Bridge Site #1 is located on Road "A" at approximately Station 39+06 to Station 39+88. The bridge spans 78'-4" over a portion of Wetland #16. Our concerns include the following:

- The method of construction should be such that the wetland is not affected in any way. Sheet S-101 appears to show that there is a ten foot clearance between the eight foot deep bridge footing toe and the wetland boundary at the southerly abutment and a nine foot clearance between the eight foot deep bridge heel and the wetland boundary at the northerly abutment. In order to perform such excavations, it would appear to require the use of a cofferdam which should be shown on the plan.

- The bridge abutment footing toe appears shorter than what would typically be used on a bridge abutment. It is our understanding that the shortened toe is utilized in order to minimize distance to the wetlands; however, provisions should be made to assure that the toe length will not be lengthened during final design.
- A detail of the bridge scuppers (a stormwater handling device) do not appear to be provided.
- The drawing identifies the use of four inch (4") PVC from scuppers to the adjoining catch basins, however, the Drainage Analysis calculations in the Engineering Report Volume II indicates the use of an eight inch (8") PVC. Per the Connecticut Department of Transportation Bridge Design Manual (2003) Section 11.2.2, drainage piping should have a minimum diameter of eight inches (8").
- We question if the Drainage Analysis calculations take into account the geometry of a scupper and if the scuppers will be able to handle the stormwater without causing stormwater gutter spread at the bridge location.
- We question the low point of the road being located at the mid-span of the bridge. We understand that this was most likely done in order to avoid water ponding at the location of the abutments/bridge joints; however it appears that the use of four inch (4") PVC from the scuppers to the adjoining catch basins will still cause ponding water to occur on the bridge, potentially causing dangerous icing conditions in the winter.
- The 100-year design storm water surface elevation should be shown on the bridge elevations on the drawings. In addition, a table of hydraulic data showing drainage area, design discharge, and base flood elevation should be provided on the Bridge General Plan sheet.
- The proposed contour for elevation 84 at the northeast side of the bridge should be shown.

- **Bridge Site #2**

The Bridge Site #2 is located on Road "A" at approximately Station 44+92 to Station 46+34. The bridge spans 139'-5" over a portion of Wetland #16. Our concerns include the following:

- The method of construction should be such that the wetland is not affected in any way. Sheet S-201 appears to show that there is an eight foot clearance between the six foot deep bridge footing toe and the wetland boundary at the southerly abutment and a ten foot clearance between the six foot deep bridge toe and the wetland boundary at the northerly abutment. In order to perform such excavations, it would appear to require the use of a cofferdam which should be shown on the plan.

- The bridge abutment footing toe appears shorter than what would typically be used on a bridge abutment. It is our understanding that the shortened toe is utilized in order to minimize distance to the wetlands; however, provisions should be made to assure that the toe length will not be lengthened during final design.
- The 100-year design storm water surface elevation should be shown on the bridge elevations on the drawings. In addition, a table of hydraulic data showing drainage area, design discharge, and base flood elevation should be provided on the Bridge General Plan sheet.

- **Bridge Site #3**

The Bridge Site #3 is located on Road "B" at approximately Station 22+90 to Station 23+23. The precast three-sided culvert spans 24'-0" over a portion of an intermittent watercourse that connects Wetland #30 to Wetland #18. Our concerns include the following:

- The approximate finish grade in-between the abutments as shown on the "Out" Elevation on Sheet S-301, appears to show that water in the intermittent watercourse would be collecting against the westerly abutment.
- The method of construction should be such that the intermittent watercourse is not affected in any way. Sheet S-301 does not show the width of the intermittent watercourse; however, the footings are approximately six feet from the centerline of the intermittent watercourse. In order to perform such excavations, it would appear to require the use of a cofferdam which should be shown on the plans.
- The 100-year design storm water surface elevation should be shown on the bridge elevations on the drawings. In addition, a table of hydraulic data showing drainage area, design discharge, and base flood elevation should be provided on the Bridge General Plan sheet.

- **Bridge Site #4**

The Bridge Site #4 is located on Road "B" at approximately Station 49+66 to Station 50+09. The precast arch spans 42'-0" over a portion of the existing railroad track. No impacts to wetlands are anticipated.

7.5 Stormwater Detention and Retention Basins

Detention is described as the short-term storage of stormwater. The objective of a detention facility is to regulate the runoff from a given rainfall event and to control discharge rates to reduce the impact on downstream stormwater systems. **Retention is the permanent storing of stormwater indefinitely** until the water is lost through percolation, taken in by plants, or through evaporation.

For this reason it is our team's opinion that many of the "bio**retention**" areas that the Applicant is proposing are predominately "bio**detention**"

7.5.1 Golf Bioretention Basins

Every golf hole and the driving range include from one to five bioretention areas. As detailed by the Applicant, the bio-basins will consist of a two foot (2') bed of sandy loam covered with a six inch (6") layer of composted peat. Based on current research, underdrains should be included to maintain aerobic conditions, and appropriate plantings provided.

The golf course bio-retention basin water quality volume computations, while conservative with respect to the provided volume, are not consistent with the method contained in the 2004 Connecticut Stormwater Quality Manual. The method utilized assumed a 1" depth of water over the entire drainage area whereas the method contained in the 2004 Connecticut Stormwater Quality Manual is based on percentage of impervious surface relative to the entire drainage area in the post-development condition. In the latter method, the only increase in the impervious area would be the golf cart path which represents a relative minor area relative to each drainage area. It is our opinion that the method contained in the 2004 Connecticut Stormwater Quality Manual would provide sufficient water quality volume treatment and would greatly reduce inland wetland and vernal pool regulated area encroachment.

We would also recommend that, other than the underdrains, pipe outfalls be eliminated due to the point source discharge to the down-gradient inland wetland, vernal pool or watercourse, and be replaced by the lower berm constructed with turf reinforcement matt or flexible channel liner to function as a broad crested weir in larger storm events. The modification would provide the necessary water quality volume treatment while minimizing ponded water encroachment on course playability.

7.5.2 Rain Gardens

All of the ¾ acre and the Estate lots have one or more rain gardens and/or recharge galleries that are sized to take runoff from the roof, drives, and other impervious areas on the lots. As detailed by the Applicant, the rain gardens (a small version of the bioretention facilities used on the golf course) will consist of a two foot (2') bed of sandy loam covered with a six inch (6") layer of compost peat. There will be a berm around the rain garden to promote six inches (6") of infiltration. Various grasses, shrubs, and small trees are established to promote evapotranspiration, maintain soil porosity, encourage biological activity, and promote uptake of some pollutants. Stormwater runoff is directed into the facility, allowed to pool, and infiltrates through the plant/mulch/soil environment, providing the treatment. The intention is to create an engineered terrestrial ecosystem which has aesthetic value through the use of plants and landscaping, along with a constructed soil/media profile. The Applicant has noted in Engineering Report Volume IIIA that "rain gardens may have under drains in areas of shallow depth to bedrock or groundwater."

We have the following comments regarding the rain gardens:

- Rain gardens should be located close to the source of runoff, but at least 10 feet from the house, and preferably down-gradient, so infiltrating water doesn't seep into the foundation. We question the rationale for locating rain gardens in remote wooded areas.
- We question the long term functioning of the residential rain gardens in low permeability upland till environment due to the potential for clogging by the natural soil subsoil and substratum which contain 25 - 60 percent by weight passing the No. 200 sieve. Based on current research, rain gardens should include underdrains.
- A mechanism for long term maintenance of the residential rain gardens needs to be implemented and wording stating such should be included in the deeds.
- As stated in Section 7.3.4 "Runoff Curve Numbers," we question the methodology of reducing the runoff curve numbers based on provision of rain gardens for residential lots. While a reduction in runoff curve number may be appropriate for the first flush or 1" design storm, it would not appear justifiable for larger design storms (i.e. 2-year design storm and above). A NRCS or other authoritative reference should be provided to justify the runoff curve number reduction as the runoff curve reduction reduces the runoff volume.
- Several team members have observed other rain gardens on other projects in Connecticut in which water remained ponded for several weeks from late winter through early spring. When this occurs, anaerobic conditions develop, and the rain gardens cease to provide their intended functions. In addition, they may also function as decoy vernal pools.
- We would recommend that the foundation drain outfall not be directed to the proposed rain gardens as this is clean groundwater that does not require treatment.

The following items should be included in individual deeds and the Homeowner's Association Documents:

- No obstructions to water flow in a swale or a rain garden shall be permitted.
- No filling of swale or rain garden shall be permitted.
- No additional impervious surfaces shall be permitted except additions and accessory buildings
- No disturbance of rain garden plants shall be permitted.
- In the rain garden, leave the dead or dormant plants standing over the winter to provide wildlife cover and a food source for animals such as birds. Once spring arrives and new growth is 4-6-inches tall, cut all tattered plants back. If the growth is really thick, hand-cut the largest plants and then use a weed whacker or pruning sheers to cut the planting back to a height of six to eight inches. Dead plant material can also be removed with a weed whacker or pruning sheers and

composted or disposed of as appropriate. A lawn mower shall not be utilized for maintenance of rain gardens.

7.5.3 Road Bioretention Areas

Bioretention areas similar to those in the golf course and in the residential community will also be utilized in three locations on the roads. Roads D, F, and G, as well as the access drive for the ball fields will have a depressed landscaped island in the center of the cul-de-sac, similar to a large rain garden. The bioretention area will be a dry landscaped area between storms and during storms will collect water to retain and will also have detention capabilities.

The comments we have for the road bioretention areas comments are the same as those previously listed for the rain gardens.

7.5.4 Underground Galleries

There are multiple systems of underground galleries and crushed stone beds proposed around the site that are designed to promote groundwater recharge and provide stormwater detention.

We have the following comments regarding the underground galleries:

- Inlet and outlets should be separated by the maximum length possible.
- A manhole should be present on all underground galleries for inspection purposes.
- Effort should be made to maintain minimum earth cover.
- Level spreaders should be used in lieu of riprap pads.
- Invert elevations should be added to the gallery details.
- Drop manholes should be provided for all outfalls to minimize pipe slopes and exit velocities.

7.5.5 Filter Basins

In general, filter basins are located at the storm outfalls from the underground galleries.

We have the following comments regarding the filter basins:

- The hydrology of the filter basins should be determined, particularly when located proximal to inland wetlands.
- We question the water quality benefits of the filter basins where they encroach on the inland wetlands. It may be more beneficial to the receiving wetlands to maintain an undisturbed natural ground cover.

7.5.6 Detention Basins

There are six surface detention basins located throughout the property. Two of these detention basins are designed as "wet" ponds which will be used for irrigation. Irrigation Pond #1 is located behind the Maintenance Facility and Irrigation Pond #2 is located at Hole #9. The remaining four detention ponds are designed to be "dry" detention basins between storms.

We have the following comments in regards to the typical irrigation ponds and detention basins:

- Cross sections should be provided.
- Computations should be provided to confirm that there is at least one foot (1') of freeboard above the 100-year design storm with the emergency spillways flowing full with the outlet structure blocked.
- Emergency spillways should be in undisturbed earth and not embankments.
- The bottom of the basin should have a 2% slope towards the outlet.
- We question if the hydrology of the dry detention basins has been determined to substantiate the dry detention ponds proposed.

8.0 Sediment & Erosion Control

Information contained in the Soil Survey of Middlesex County indicates that the majority of soil types on this site are Hollis-Charlton and Charlton-Hollis, with the subsoil and substratum having moderate to severe erosion factors (K = 0.43), and from 25 to 60 percent of the soil mass passing the No. 200 sieve (silt or finer particles). These types of soils are easily conveyed by stormwater runoff and can remain suspended in ponded water for days or even weeks after a storm event. As such, careful development, implementation and monitoring of a comprehensive sediment and erosion control program will be critical to the success of this project. We have the following general comments in this regard:

- We would recommend that they Applicant be required to employ an individual with considerable experience in environmental compliance issues on large scale construction projects to monitor this project on a continuous basis throughout construction and the "grow-in" period. This person should have sole responsibility, and the authority, to direct the installation, field medication, maintenance and emergency repairs of erosion control measures. In addition, this person should be responsible for maintaining required records, reporting to, and communicating with the Wetland Enforcement Officer.
- A Connecticut Department of Environmental Protection "General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities" will be required for this project. As a condition of approval, we would recommend that copies of the registration form and stormwater pollution prevention plan be submitted to the Town prior to the start of construction.
- Temporary sediment traps should be lengthened and aligned with the existing contours as much as possible to promote sheet flow and avoid point source loadings.
- We would recommend that wood chips be used to the maximum extent possible. In this regard, wood chip berms should be installed down-gradient of all temporary sediment traps and permanent water quality basins. Returns, or wings, should be utilized at fifty foot (50') intervals wherever the wood chip berms traverse topography.
- Reverse slope benches, designed in accordance with criteria contained in the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control should be added to all cut and fill slopes exceeding fifteen feet (15') in height. Up-gradient diversion channels should be utilized as much as possible to minimize slope stormwater run on to the cuts or fills.
- We would recommend that EcoAegis, and the appropriate seed mixture, be considered for temporary and permanent seeding (i.e. perennial rye for topsoil stockpiles) throughout the project.

- Wherever silt fence or hay bales are not placed parallel to existing contours, wings should be placed at fifty foot (50') intervals to prevent the concentration of runoff along the silt fence to the low point.

- Outlet protection computations prepared in accordance with criteria contained in the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control should be provided for all drainage outfalls.

Specific comments regarding the sediment and erosion control aspects of the golf course can be found in Section 9.0. Comments regarding the roadways can be found in Section 12.2.

9.0 Golf Course

As previously stated the golf course has been laid out in and around the inland wetlands on the project site, with fifteen holes involving activities located within the one hundred foot (100') regulated upland review area. Note that while the "Summary of Regulated Activities" states that there are "No regulated activities for Hole #11", Plate GRA-11 shows a small area of clearing and a stormwater discharge located within the regulated area. The cumulative impacts of these activities within and around the wetlands have the potential to degrade wetland systems that, at present, are largely undisturbed and surrounded by areas of forested cover. This will result in adverse impacts upon wetland resources including the loss of wildlife habitat; the loss of wetland buffers and related functions; and, the degradation of vernal pools.

In order to address potential impacts, we have prepared detailed comments regarding the golf course layout as presented by the Applicant. The intent in providing these comments should not be construed as an overall endorsement of the Applicant's layout by the peer review team, even if all of the comments are addressed. The purpose in providing these specific comments is to reduce the intrusion upon, and impacts to, the wetland system without significant alteration of the Applicant's basic design concept, should the Commission find the layout as presented is the most prudent and feasible layout. **The individual summaries for each hole include specific recommendations regarding alternatives to be considered and mitigation measures to minimize adverse impacts.**

These comments, which follow the General Comments in this report section, should be reviewed in conjunction with the table on page 29 of the Engineering Report Volume I provided by the Applicant. This table summarizes the quantitative impacts, as well as changes that the Applicant has made to each hole since the last application.

9.1 General Comments

We have the following general comments regarding development of the golf course:

- We recommend that a **twenty-five foot (25') minimum "no disturbance" buffer** be maintained to all wetlands throughout the golf course, as previously stated in Section 3.0 "Buffers".

- The clearing of trees and vegetation from large wetland areas and regulated areas by hand methods can still be expected to result in some disturbance and mucking up of the wetlands. In this regard, we do not recommend replanting the wetlands if the wetland soil becomes exposed during the tree clearing process. Instead, all exposed soil areas should be hand raked and upland woodland leaves placed over the exposed soil to allow for natural revegetation to occur.

- Justification should be provided for the proposed interception, collection, and point source discharges of surface runoff from tees, greens and fairways. These point source discharges have the potential to transmit pollutants directly to the

wetlands. Alternatives should be explored to eliminate point source discharges wherever feasible even if just utilized for larger storms.

- Where point source discharges are unavoidable, a determination should be made on a case-by-case basis if the exit velocities will exceed the allowable velocity for the soil type (ref. Sec. 8G in the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control), and if outlet protection or other measures to disperse the discharge will be necessary.

- Outlets from temporary sediment traps should be carefully reevaluated so as to maximize the travel time to wetlands and watercourses.

- Monitoring of the drainage outlet pipes should be conducted for a three-year period to determine if erosion or gullying occurs. In this regard, a Remediation Plan should be developed which outlines various corrective measures to be taken. We recommend that bioengineering techniques be utilized, whenever possible, such as turf reinforcement mats or flexible channel liners, in lieu of structural measures such as riprap.

- Profiles should be provided for each hole where removal of vegetation within wetlands is proposed so as to justify the proposed height of clearing and the maximum height that vegetation will be permitted to re-grow. It should be noted that the proposed clearing heights shown on the drawing plates (GRA's) in Engineering Report Volume I, identified as "Summary of Regulated Activities," do not correspond with the required play-over heights listed in Table 2 of the "Biological Supplement" included in Engineering Report Volume IV.

- A common element in the design of each of the holes is a series of bioretention areas. In many instances, their creation requires grading directly adjacent to wetlands and vernal pools with point source discharges to the wetlands and vernal pools. The required disturbance and the potential for erosion at these discharge points raises a question whether it would be preferable, and less environmentally damaging, to instead maintain the existing forest litter and herbaceous growth where clearing would not otherwise be necessary (see Section 7.5.1 "Golf Bioretention Basins" for further comments).

- It is our recommendation that where clearing is required within the regulated area for golf course play, or for air circulation, that trees and shrubs be hand cut and removed (i.e. no machinery) with stumps and root structures left intact and the natural forest ground cover and litter retained. The goal is to preserve the natural forest friable soils and litter in order to infiltrate and renovate the stormwater from the golf course.

- A detail should be provided for the temporary diversion channels. Given the size of some of the watersheds to be directed around work areas, we are concerned that these concentrated discharges may result in erosion of the channels and outlets.

- In general, woodchip berms should be used throughout the property in lieu of sedimentation fences and hay bales as they are more effective in removing sediment and allow for migration of wildlife. In areas where wildlife migration is not an issue sedimentation fences and hay bales can be considered on a case-by-case basis.

- Woodchip piles should be retained on site in stable upland areas for emergency use during construction of the golf course.

- Tree clearing should be prohibited during the prime avian breeding season (April 30 – June 30).

- Temporary signs and/or barriers should be posted stating "No machinery to enter this area" in all areas where trees are to be removed by hand only.

- Where haul roads cross over wetlands and watercourses, crushed stone ant-tracking pads and mountable crushed stone diversion berms should be provided on both sides.

- We would question how the size and number of stockpile areas were determined as they would appear to be insufficient in relation to the areas of disturbance (i.e. why does Hole #13 show the location of only one small stockpile).

- Prior to any clearing, a licensed land surveyor should be required to flag the limits of clearing for approval by a Town representative.

- Prior to any grubbing of stumps or earthwork activities, sediment and erosion control measures should be installed as shown on the drawings and, based on actual field conditions encountered, at supplemental locations required by the Town.

9.2 Construction Logistics

- A general note appears on the Golf - Erosion Control Plans indicating that the golf cart path locations are to be used as haul roads during construction. In this regard, it would seem reasonable to assume that a clearing at least twenty feet (20') in width would be required to allow triaxles and other construction equipment to pass in either direction. It is our understanding that where cart paths are located in wooded areas, they are to be threaded around trees so as to keep disturbance to a minimum. This approach would appear to be inconsistent with their use as haul roads.

- Some of the slopes traversed by the golf cart paths are steep, with grades approaching thirty percent (30%). We question if triaxles and other wheeled construction equipment can safely negotiate such slopes during golf course construction.

- The haul roads and temporary wetland crossings shown in the GEC sheet set do not correspond to those shown on the Golf Course and Housing Phase Construction Sequence sheets provided in Engineering Report Volume I.

- A detail has been prepared which proposes utilization of attached tires as the temporary wetland crossing. We would recommend that corduroy timbers similar to wetlands crossings utilized by logging operations be considered.

- We question what precautions are proposed for equipment refueling (i.e. a bermed concrete or bituminous concrete pad).

- Given the magnitude of the project; the numbers of heavy construction equipment required; and, given the sensitive environmental surroundings, we question where the equipment will be regularly parked and maintained. We question if this will occur at the staging area located at the clubhouse site.

9.3 Construction Phasing

- Phasing of the golf course construction should be further refined and broken down into smaller more manageable sub-phases taking into account both hole locations and earthwork volumes (note that the golf course construction is only one part of the overall Phase I development).

- While a time line has been presented for construction of the golf course, we note that it shows the entire course to have been cleared and grubbed by mid-July with placement of topsoil not beginning until mid-September, and completion of topsoil placement extending out to mid-December. This raises obvious site stabilization and revegetation concerns. (Entire course open and disturbed for a two-month period during the summer, and topsoil placement continuing beyond seasonal seeding dates.)

- The "General Construction Sequence For The Golf Course" outlined in Engineering Report Volume I, Section 1.3.1.1, is idealized and over simplified, as well as being inconsistent with the overall construction timeline and the realities of earthwork interrelationships (i.e. Hole #1 is indicated as requiring import from Holes #4, #5, #7, and #8).

- The "Construction of a Typical Golf Hole (Hole #8, Par 5)" outlined in Engineering Report Volume I, we would question the necessity for two temporary wetland crossings, as there is no apparent need for the temporary crossing at the tees. It should also be noted that this second crossing is inconsistent with other design drawings for Hole #8 which do not show a crossing at the tees. In addition, while this section also states "All irrigation lines will cross wetlands at the bridges by hangers...," Sheet GRA-8 shows these lines cutting through wetlands where a bridge is not proposed.

9.4 Driving Range

Based on the Applicant's computations, the driving range disturbs 0.24+ acres located within the one hundred foot (100') regulated upland review area which includes rough, a portion of one bio-basin, and a stormwater discharge.

These proposed regulated activities will require clearing and grading within the upland review area as close as forty feet (40') to the edge of wetlands.

9.4.1 Driving Range Recommendations

- Relocate the haul road to Hole #9 outside of the regulated area.

9.5 Hole #1

Based on the Applicant's computations, Hole #1 disturbs 2.0± acres located within the one hundred foot (100') upland review area which includes some of the fairway, a bunker, rough, naturalized areas, three bio-basins, stormwater discharges, 150 feet of retaining wall, 597 feet of golf cart path, and a ninety-four foot (94') long wetland crossing. In addition, this hole also involves the clearing of 0.12± acres of wetlands for play-over, with the vegetation to be cut and maintained at a height of approximately two to four feet (2' to 4').

These proposed regulated activities will require clearing and grading within the upland review area as close as five feet (5') to the edge of wetlands. Clearing is also proposed as close as thirty feet (30') of the edge of Vernal Pool #21, which does not comply with the minimum fifty foot (50') undisturbed zone established as a condition of the Section 56 Planning Commission Approval.

Grading for the fairway within twenty feet (20') of an intermittent watercourse, with stormwater discharges located within ten feet (10') may result in sediment deposition within, and suspended fines (silts and clays) entering, the watercourse. Since fine sediments entering a vernal pool during the breeding season can coat egg masses of salamander and wood frogs, and can harm vertebrate and invertebrate species, we are concerned with these discharges into an intermittent water course that drains into Vernal Pool #22.

9.5.1 Hole #1 Recommendations

- Maintain the required fifty foot (50') undisturbed buffer to Vernal Pool #21 established by the Planning Commission.
- Shift the cart path further to the northeast away from Wetland #22 in the area where it is now five feet (5') or less.
- Shift the retaining wall so that it provides a twenty-five foot (25') undisturbed buffer along the intermittent watercourse.

- Adjust the clearing and grading limits to provide a twenty-five foot (25') undisturbed buffer along all wetland areas.
- Eliminate the point source discharges to the intermittent water course.
- Relocate the northwestern haul road from Hole #1 to Hole #2 outside of the regulated area.
- Eliminate the temporary crossing of the wetland (use the haul road across the intermittent watercourse on Hole #2).
- Relocate the discharge from temporary sediment trap, TST-1B away from the stockpile area on Hole #2.
- Eliminate the discharge from TST-1C and TST-1D to the intermittent watercourse that drains to Vernal Pool #27.
- Eliminate the "Fairway Wetland Buffer Supplemental Understory Plantings" proposed within the existing forested area that is proposed to remain.

9.6 Hole #2

Based on the Applicant's computations, Hole #2 disturbs 4.1± acres located within the one hundred foot (100') regulated upland review area which includes a tee, fairway, bunker, rough, naturalized areas, five bio-basins, stormwater discharges, 320 feet of golf cart path, and a thirty-five foot (35') long watercourse crossing. In addition, this hole also involves the clearing of 0.12± acres of wetlands, for play-over, with the vegetation to be cut and maintained at a height of approximately one to four feet (1' to 4').

These proposed regulated activities will require clearing and grading within the upland review area as close as five feet (5') to the edge of the wetlands. Grading for the fairway within fifteen feet (15') of an intermittent watercourse, with stormwater discharges located within five feet (5') may result in sediment deposition within, and suspended fines (silts and clays) entering, the watercourse. Since fine sediments entering a vernal pool during the breeding season can coat egg masses of salamanders and wood frogs, and can harm vertebrate and invertebrate species, we are concerned with these discharges into the intermittent water course that drains into Vernal Pool #22.

9.6.1 Hole #2 Recommendations

- Adjust the grading limits to provide a twenty-five foot (25') undisturbed buffer along the intermittent watercourse.
- Adjust the clearing and grading limits to provide a twenty-five foot (25') undisturbed buffer along all wetland areas.

- Eliminate point source discharges to the intermittent watercourse.
- Eliminate the point source discharges from bio-basins FB-2B and FB-2C (also identified as temporary sediment traps TST-2B and TST-2C) to Vernal Pool #22.
- Relocate the stockpile area blocking the haul road route to Hole #3 (also move outside of the one hundred foot (100') regulated upland review area).
- The outlet from temporary sediment trap TST-2A should not discharge into and down a haul road with a grade of ten percent (10%).
- Eliminate the "Fairway Wetland Buffer Supplemental Understory Plantings" proposed within the existing forested area that is proposed to remain.
- Eliminate the grading and reseeding of the area to the northeast of tees and treat in the same manner as wetland play-over areas (cut and maintain at an appropriate height).

9.7 Hole #3

Based on the Applicant's computations, Hole #3 disturbs 2.6± acres located within the one hundred foot (100') regulated upland review area which includes some of the tees, fairway, bunker, rough, naturalized areas, two bio-basins, stormwater discharges, over one thousand feet (1,000'+) of retaining wall, 463 feet of golf cart path, and two wetland crossings of eighty-four feet (84') and fifty-seven feet (57') each. (Note: plate GRA-3 only references one crossing, however there is a second crossing between Hole #2 and Hole #3 which does not appear to be accounted for). In addition, this hole also involves the clearing of 0.47± acres of wetlands, for play-over, with the vegetation to be cut and maintained at a height of approximately seven to nine feet (7' to 9').

These proposed regulated activities will require clearing and grading within the upland review area right up to the edge of the wetlands. Stormwater discharges located within the five feet (5') of wetlands may result in sediment deposition within, and suspended fines (silts and clays) entering the wetlands.

9.7.1 Hole #3 Recommendations

- Shift the retaining walls so that they provide a twenty-five foot (25') undisturbed buffer along the wetlands.
- Adjust the clearing and grading limits to provide a twenty-five foot (25') undisturbed buffer along all wetland areas.
- Eliminate the temporary crossing of the wetland between Hole #2 and Hole #3 (use the haul road between Hole #2 and Hole #3).

- Relocate the stockpile area blocking the haul road route to Hole #4 (also move outside of the one hundred foot (100') regulated upland review area).

- Eliminate the grading and reseeding of the area to the northeast of tees and treat in the same manner as wetland play-over areas (cut and maintain at an appropriate height).

9.8 Hole #4

Based on the Applicant's computations, Hole #4 disturbs 4.5± acres located within the one hundred foot (100') regulated upland review area which includes two tees, fairway, a bunker, rough, naturalized areas, six bio-basins, stormwater discharges, an underground gallery, over eight hundred feet (800'+) of retaining wall, 860 feet of golf cart path, and two wetland crossings of ninety-four feet (94') and eighty feet (80') each. In addition, this hole also involves the clearing of 0.83± acres of wetlands, for play-over, with the vegetation to be cut and maintained at a height of approximately one to six feet (1' to 6').

The proposed regulated activities will require clearing and grading within the upland review area right up to the edge of the wetlands. Stormwater discharges located within ten feet (10') of wetlands may result in sediment deposition within, and suspended fines (silts and clays) entering the wetlands.

9.8.1 Hole #4 Recommendations

- The clearing height of Wetland # 40 is not stated on plate GRA-4.

- Shift the retaining wall so that it provides a twenty-five foot (25') undisturbed buffer along the wetlands.

- Adjust the clearing and grading limits to provide a twenty-five foot (25') undisturbed buffer along the wetland areas.

- Eliminate the point source discharge from bio-basins FB-4A (also identified as temporary sediment trap TST-4A) to Vernal Pool #19.

- Adjust the location of the western stockpile area so that it is located within the proposed clearing limits and move it outside of the one hundred foot (100') regulated upland review area.

- Eliminate the "Fairway Wetland Buffer Supplemental Understory Plantings" proposed within the existing forested area that is proposed to remain.

- Eliminate the grading and reseeding of the area to the northeast of tees and treat in the same manner as wetland play-over areas (cut and maintain at an appropriate height).

9.9 Hole #5

Based on the Applicant's computations, Hole #5 disturbs 2.5± acres located within the one hundred foot (100') regulated upland review area which includes most of the fairway, some of the green, rough, naturalized areas, two bio-basins, stormwater discharges, over four hundred feet (400'+) of retaining wall, 507 feet of golf cart path, and a ninety-one foot (91') long wetland crossing. In addition, this hole also involves the clearing of 0.37± acres of wetlands, for play-over, with the vegetation to be cut and maintained at a height of approximately three to five feet (3' to 5').

Proposed regulated activities will require clearing and grading within the upland review area right up to the edge of the wetlands. Clearing is also proposed as close as fifteen feet (15') from the edge of Vernal Pool #23, which does not comply with the minimum fifty foot (50') undisturbed zone established as a condition of the Section 56 Planning Commission approval. Stormwater discharges located within twenty feet (20') of wetlands, and twenty-five feet (25') of Vernal Pool #23, may result in sediment deposition within, and suspended fines (silts and clays) entering the wetlands. Since fine sediments entering a vernal pool during the breeding season can coat egg masses of salamanders and wood frogs, and can harm vertebrate and invertebrate species, we are concerned with this discharge to Vernal Pool #23.

9.9.1 Hole #5 Recommendations

- Maintain the required fifty foot (50') undisturbed buffer to Vernal Pool #21 as established by the Planning Commission.
- Shift the retaining walls so that they provide a twenty-five foot (25') undisturbed buffer along the wetlands.
- Adjust the clearing and grading limits to provide a twenty-five foot (25') undisturbed buffer along all wetland areas.
- Eliminate the point source discharge from bio-basins FB-5B (also identified as temporary sediment trap TST-5B) to Vernal Pool #23.
- Adjust the location of the stockpile areas so that they are outside of the one hundred foot (100') regulated upland review area.
- Eliminate the "Fairway Wetland Buffer Supplemental Understory Plantings" proposed within the existing forested area that is proposed to remain.

9.10 Hole #6

Based on the Applicant's computations, Hole #6 disturbs 2.4± acres located within the one hundred foot (100') regulated upland review area which includes all of the tees, some of the fairway, some of the green, rough, naturalized areas, two bio-basins, stormwater discharges, over three hundred feet (300'+) of retaining wall, and 430 feet

of golf cart path. In addition, this hole also involves the clearing of 0.13± acres of wetlands, for play-over, with the vegetation to be cut and maintained at a height of approximately two to seven feet (2' to 7').

These proposed regulated activities will require clearing and grading within the upland review area right up to the edge of wetlands, including construction of an earth berm over five hundred feet (500'+) in length adjacent to the wetlands. Stormwater discharges located within ten feet (10') of wetlands may result in sediment deposition within, and suspended fines (silts and clays) entering the wetlands.

9.10.1 Hole #6 Recommendations

- Shift the retaining walls so that they provide a twenty-five foot (25') undisturbed buffer along the wetlands.
- Adjust the clearing and grading limits to provide a twenty-five foot (25') undisturbed buffer along all wetland areas.
- Adjust the location of the western stockpile area so that it is located outside of the one hundred foot (100') regulated upland review area.
- Eliminate the "Fairway Wetland Buffer Supplemental Understory Plantings" proposed within the existing forested area that is proposed to remain.
- Eliminate the grading and reseeding of the area to the northeast of tees and treat in the same manner as wetland play-over areas (cut and maintain at an appropriate height).

9.11 Hole #7

Based on the Applicant's computations, Hole #7 disturbs 0.1± acres located within the one hundred foot (100') regulated upland review area which includes small areas of rough, naturalized areas, stormwater discharges, 185 feet of golf cart path, and a one hundred-ninety foot (190') long wetland crossing.

These proposed regulated activities will require clearing and grading within the upland review area as close as sixty feet (60') from the edge of wetlands, with stormwater discharges located within seventy-five feet (75').

9.11.1 Hole #7 Recommendations

- Relocate the discharge from bio-basin FB-7A (also identified as temporary sediment trap TST-7A) to the southwest end of the basin to reduce the area of clearing within the regulated area and to discharge on to a flatter existing slope.

9.12 Hole #8

Based on the Applicant's computations, Hole #8 disturbs 3.6± acres located within the one hundred foot (100') regulated upland review area which includes all of the tees, some of the fairway, a bunker, rough, naturalized areas, six bio-basins, stormwater discharges, over five hundred feet (500'+) of retaining wall, 1,226 feet of golf cart path, and two wetland crossings of one hundred twenty feet (120') and sixty-two feet (62') each. In addition, this hole also involves the clearing of 1.24± acres of wetlands, for play-over, with the vegetation to be cut and maintained at a height of approximately two to six feet (2' to 6').

These proposed regulated activities will require clearing and grading within the upland review area right up to the edge of the wetlands, including construction of an earthen berm over three hundred feet (300'+) in length adjacent to the wetlands. Clearing is also proposed as close as twenty-five feet (25') from the edge of Vernal Pool #23, which does not comply with the minimum fifty foot (50') undisturbed zone established as a condition of the Section 56 Planning Commission approval. Stormwater discharges located within five feet (5') of wetlands may result in sediment deposition within, and suspended fines (silts and clays) entering, the wetlands. Since fine sediments entering a vernal pool during the breeding season can coat egg masses of salamander and wood frogs, and can harm vertebrate and invertebrate species, we are concerned with this discharge to Vernal Pool #23.

9.12.1 Hole #8 Recommendations

- Maintain the required fifty foot (50') undisturbed buffer to Vernal Pool #23 as established by the Planning Commission.
- Relocate the middle tee to the south side of the wetlands and adjust all of the remaining tees further to the south of the wetlands so as to reduce the area of wetland clearing.
- Shift the cart path in the area of the tees further to the south of Wetland #18.
- Shift the retaining walls so that a twenty-five foot (25') undisturbed buffer is provided along the edge of wetlands.
- Adjust the clearing and grading limits to provide a twenty-five foot (25') undisturbed buffer is provided along the edge of wetlands. .
- Eliminate the point source discharge from bio-basin FB-8F (also identified as temporary sediment trap TST-8F) to Vernal Pool #23.
- Adjust the location of the eastern stockpile area so that it is located outside of the on hundred foot (100') regulated upland review area.

- Eliminate the "Fairway Wetland Buffer Supplemental Understory Plantings" proposed within the existing forested area that is proposed to remain.

- "Butterfly Habitat Plantings" should not be proposed within the wetlands where native vegetation is to be maintained.

9.13 Hole #9

Based on the Applicant's computations, Hole #9 disturbs 1.3± acres located within the one hundred foot (100') regulated upland review area which includes some of the fairway, the green, rough, naturalized areas, two bio-basins, stormwater discharges, over two hundred feet (200'+) of retaining wall, and 563 feet of golf cart path. This hole also involves the clearing of 0.04± acres of wetlands, for play-over with the vegetation to be cut and maintained at a height of approximately one to three feet (1' to 3').

These proposed regulated activities will require clearing and grading within the upland review area as close as three feet (3') from the edge of the wetlands, with stormwater discharges located within fifty-five feet (55') to the wetlands.

9.13.1 Hole #9 Recommendations

- The clearing height of Wetland # 29 to the southwest of the green is not stated on plate GRA-9.

- Shift the retaining wall so that it provides a twenty-five foot (25') undisturbed buffer along the wetlands.

- Adjust the clearing and grading limits to provide a twenty-five foot (25') undisturbed buffer along all wetland areas.

- Eliminate the point source discharge from bio-basins FB-9A (also identified as temporary sediment trap TST-9A) to Vernal Pool #21.

- Consider eliminating the haul road along the wetlands at the northwest end of the hole, and connecting into the haul road on Hole #1.

9.14 Hole #10

Based on the Applicant's computations, Hole #10 does not disturb any area located within the one hundred foot (100') regulated upland review area.

9.14.1 Hole #10 Recommendations

- Adjust the location of the discharge from bio-basin FB-10A (also identified as temporary sediment trap TST-10A) so that it does not discharge down a 50% slope into the regulated area.

- The cut in excess of twenty feet (20') up-gradient of the bio-basin FB-10C (also identified as temporary sediment trap TST-10C) raises a concern regarding the control of groundwater and the potential for a continuous flow into the temporary sediment trap and the transport of fines towards Pequot Swamp.

9.15 Hole #11

Based on the Applicant's computations, Hole #11 does not disturb any area located within the one hundred foot (100') regulated upland review area. However, the drawings do show a small area of clearing and a stormwater discharge located to the southwest of the green within the upland review area.

9.15.1 Hole #11 Recommendations

- Relocate the discharge from bio-basin FB-11B (also identified as temporary sediment trap TST-11B) to the south, outside of the regulated area, where existing slopes are much flatter.

- Relocate the cart path, beginning at the west end of the green, to the east around the north side of the existing knoll and then to the south through the existing draw in the contours.

- The proposed haul road location should be identified.

- Eliminate the grading and replanting along the south side of the fairway and treat in the same manner as wetland play-over areas (cut and maintain at an appropriate height).

9.16 Hole #12

Based on the Applicant's computations, the only disturbance located within the one hundred foot (100') regulated upland review area is 723 feet of golf cart path between Hole #11 and Hole #12.

9.16.1 Hole #12 Recommendations

- Consider alternatives to the proposed point source discharges from bio-basin FB-12A and FB-12B (also identified as temporary sediment traps TST-12A and TST-12B) due to existing slopes in excess of 25% and the potential for erosion.

- Adjust the location of the construction limit lines and silt fence to the east of the tees, to match the proposed tree line.

- Eliminate the grading and replanting along the north and south sides of the tees and treat in the same manner as wetland play-over areas (cut and maintain at an appropriate height).

9.17 Hole #13

Based on the Applicant's computations, Hole #13 disturbs 2.7± acres located within the one hundred foot (100') regulated upland review area which includes a tee, some of the fairway, most of the green, bunkers, rough, naturalized areas, five bio-basins, over six hundred feet (600'+) of retaining wall, 1382 feet of golf cart path, and four wetland crossings of eighty feet (80'), fifty-seven feet (57'), forty-four feet (44'), and twenty-nine feet (29') each. In addition, this hole also involves the clearing of 0.23± acres of wetlands, for playover, with the vegetation to be cut and maintained at a height of approximately five to seven feet (5' to 7').

The proposed regulated activities will require clearing and grading within the upland review area right up to the edge of the wetlands. Stormwater discharges located within ten feet (10') of wetlands may result in sediment deposition within, and suspended fines (silts and clays) entering the wetlands.

9.17.1 Hole #13 Recommendations

- The clearing height of Wetland # 19 to the southeast of the green is not stated on plate GRA-13.
- Shift the cart path located near the midpoint of the hole further to the southwest away from the wetlands.
- Shift the retaining wall in the vicinity of the green so that it provides a twenty-five foot (25') undisturbed buffer along the wetlands.
- Adjust the clearing and grading limits to provide a twenty-five foot (25') undisturbed buffer along all wetland areas.
- Eliminate the three temporary wetland crossings located on the north side of the hole.
- Adjust the location of the stockpile area so that it is located outside of the one hundred foot (100') regulated upland review area.
- Eliminate the "Fairway Wetland Buffer Supplemental Understory Plantings" proposed within the existing forested area that is proposed to remain.
- Eliminate the grading and replanting along the north and south sides of the tees and treat in the same manner as wetland play-over areas (cut and maintain at an appropriate height).

9.18 Hole #14

Based on the Applicant's computations, Hole #14 disturbs 2.6± acres located within the one hundred foot (100') regulated upland review area which includes tees, some

of the fairway, rough, naturalized areas, two bio-basins, stormwater discharges, over four hundred feet (400'+) of retaining wall, 529 feet of golf cart path, and a sixty-eight foot wetland crossing. In addition, this hole also involves the clearing of 0.19+ acres of wetlands, for play-over, with the vegetation to be cut and maintained at a height of approximately two to ten feet (2' to 10').

The proposed regulated activities will require clearing and grading within the upland review area as close as ten feet (10') to the edge of wetlands, with stormwater discharges located within thirty feet (30').

9.18.1 Hole #14 Recommendations

- Relocate the discharge from bio-basin FB-14B (also identified as temporary sediment trap TST-14B) to the north end of the basin so that it does not drain towards Vernal Pool #8.
- Shift the retaining wall so that it provides a twenty-five foot (25') undisturbed buffer along the wetlands.
- Adjust the clearing and grading limits to provide a twenty-five foot (25') undisturbed buffer along all wetland areas.

9.19 Hole #15

Based on the Applicant's computations, Hole #15 does not disturb any area located within the one hundred foot (100') regulated upland review area.

9.19.1 Hole #15 Recommendations

- Consider alternatives to the proposed point source discharges from bio-basins FB-15B and FB-15C (also identified as temporary sediment traps TST-15B and TST-15C) due to existing slopes ranging up to 40% and 25% respectively, with discharges into Vernal Pool #7.
- The location of the temporary haul road crossing to the southeast of Hole #15 needs clarification.
- Eliminate the grading and reseeding of the area to the west of the tees and treat in the same manner as wetland playover areas (cut and maintain at an appropriate height).

9.20 Hole #16

Based on the Applicant's computations, Hole #16 disturbs 2.0± acres located within the one hundred foot (100') regulated upland review area which includes some of the tees, some of the fairway, rough, naturalized areas, two bio-basins, stormwater discharges, over two hundred feet (200'+) of retaining wall, 746 feet of golf cart path,

and two wetland crossings of sixty-seven feet (67') and thirty-five feet (35') each. In addition, this hole also involves the clearing of 0.19± acres of wetlands, for play-over, with the vegetation to be cut and maintained at a height of approximately three to five feet (3' to 5').

The proposed regulated activities will require clearing and grading within the upland review area right up to the edge of wetlands, with stormwater discharges located within thirty feet (30').

9.20.1 Hole #16 Recommendations

- Adjust the clearing and grading limits to provide a twenty-five foot (25') undisturbed buffer along all wetland areas.
- Adjust the location of the discharge from bio-basin FB-16C (also identified as temporary sediment trap TST-16C) so that it does not discharge down a 65% slope into the wetlands.
- Eliminate the temporary crossing of wetland on the northeast side of the hole (use the haul road on the southwest side).
- Eliminate the "Fairway Wetland Buffer Supplemental Understory Plantings" proposed within the existing forested area that is proposed to remain.
- Eliminate the grading and reseeding to the east of the tees and between the tees and the fairway and treat in the same manner as wetland play-over areas (cut and maintain at an appropriate height).

9.21 Hole #17

Based on the Applicant's computations, Hole #17 disturbs 0.3± acres located within the one hundred foot (100') regulated upland review area which includes rough, naturalized areas, a bio-basin, stormwater discharges, and 327 feet of golf cart path.

The proposed regulated activities will require clearing and grading within the upland review area as close as twenty-five feet (25') to the edge of wetlands, with a stormwater discharge located within thirty feet (30'). Clearing is also proposed as close as forty feet (40') from the edge of Vernal Pool #3, and construction of a cart path and installation of the main irrigation line will occur within five feet (5') and twenty feet (20') respectively of Vernal Pool #36. These activities do not comply with the minimum fifty foot (50') undisturbed zone established as a condition of the Section 56 Planning Commission approval. In addition, the stormwater discharge that drains to Vernal Pool #3 may result in sediment deposition within, and suspended fines (silts and clays) entering, the watercourse. Since fine sediments entering a vernal pool during the breeding season can coat egg masses of salamander and wood frogs, and can harm vertebrate and invertebrate species, we are concerned with this discharge.

9.21.1 Hole #17 Recommendations

- Maintain the required fifty foot (50') undisturbed buffers to Vernal Pools #3 and #36, established by the Planning Commission.
- Eliminate the point source discharge from bio-basin FB-17A (also identified as temporary sediment trap TST-17A) to Vernal Pool #3.
- Eliminate the grading and reseeding of the areas on the northeast and southwest sides of the tees and treat in the same manner as wetland play-over areas (cut and maintain at an appropriate height).

9.22 Hole #18

Based on the Applicant's computations, Hole #18 does not disturb any area located within the one hundred foot (100') regulated upland review area.

9.22.1 Hole #18 Recommendations

- Consider alternatives to the proposed point source discharge from bio-basins FB-18C and FB-18D (also identified as temporary sediment traps TST-18C and TST-18D) due to slopes in the range of 40% to 50% and the potential for erosion.

10.0 Maintenance Facility

The maintenance facility is located on 1.1 acres, along with a wastewater treatment plant, a firehouse, and an irrigation pond. The site will include a stormwater management system as well as a closed loop equipment wash system that is independent of the stormwater drainage system. The facility will also include a fuel storage and pump/fill area, a pesticide and fertilizer storage area, a mixing/loading area, storage bins, and vehicle and mechanical equipment storage. An emergency spill management plan is proposed for the operations to be conducted at this facility.

10.1 Maintenance Facility General Recommendations

- Waste oil and solvent storage tanks are proposed to be located at the fuel storage area; however, there has been no indication as to whether secondary containment will be provided. This should be addressed.

- The Accidental Spill Response Procedure makes reference to the community of "Jackson". This document should reference the Town of Old Saybrook. In addition, the reference to the county sheriff departments should be deleted.

10.2 Maintenance Facility Stormwater Drainage System and Irrigation Pond, IR-1

- As previously discussed, management procedures should be provided for the proposed lined irrigation pond located to the east of the proposed maintenance facility with regard to preventing overflows that would discharge towards Pequot Swamp. This would be particularly important during cold weather periods when the irrigation system is not utilized.

- Stormwater drainage information and calculations should be provided for this facility as requested in Section 7.4 "Stormwater Collection and Conveyance System." Information should also be provided regarding the retention system at the northeast corner of the maintenance facility with an outlet to the stormwater system. In addition, clarification should be made on the plans as to which catch basins will require petroleum absorbent 'pillows' and Snout® vertical traps, or an equivalent.

- We would recommend that the dry-water quality swale, which receives the discharge from the stormwater drainage system have an impermeable liner to prevent infiltration. In this regard, we would suggest that the liner be covered with a permeable material with an under drain discharging to the irrigation pond. A geotextile separation fabric should be placed on top of the permeable material, and covered with two feet (2') of a top soil/compost mixture to allow it to enhance its capability to renovate stormwater.

- An explanation should be provided for the pipe that is shown extending through the embankment, from the bottom of the irrigation pond, with an apparent uncontrolled discharge towards Pequot Swamp.

- No irrigation lines have been shown connecting to the irrigation pond.

11.0 Residential and Recreation

The proposed development includes a total of 221 residential units that include village homes and single-family home sites. These include 37 single family lots (½+ ac), 30 single family estate lots (2+ ac), 70 detached clustered village units, and 84 attached clustered village units. The development will also include trails, a nature center and four athletic fields, all open for public use.

11.1 General Comments

- Reverse slope benches, designed in accordance with the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control, should be provided for all slopes steeper than three horizontal to one vertical (3H:1V) which exceed fifteen feet (15') in height.

11.2 Sheets GD-4 and EC-4

- Redirect discharge from filter basin FB-1 located at the northeast corner of the proposed basketball court to the south side of the natural drainage divide so that it does not discharge to Vernal Pool #28.

- Erosion control blanket should be placed on the southeast side of the filter basin FB-1.

11.3 Sheets GD-9 and EC-9

- Within the one hundred foot (100') buffer to Vernal Pool #6 there is biobasin FB-4, two rain gardens, a footing drain, a storm drainage discharge from road F, a portion of a driveway, and clearing and grading. This vernal pool is identified as a "conserved pool," which is inconsistent with Klemen's report which shows zero percent (0%) disturbance within the one hundred foot (100') regulated upland review area. We recommend no clearing, grading, or stormwater discharge within this review area.

- We question the viability of proposed Lot #34 given the roadway embankment which extends to the south side of the house with the one hundred foot (100') regulated upland review area against the rear corner of the house and no room for a reasonable yard.

- Given the above noted comments, we would question the feasibility of locating five (5) lots at the end of Road "F".

11.4 Sheets GD-13 and, EC-13

- As stated previously in Section 4.1, Vernal Pool #27 is so compromised by surrounding development that it is the peer review team's opinion that this will

cease to function as a vernal pool and therefore maintaining the one hundred foot (100') buffer at this location will serve no useful purpose.

11.5 Sheets GD-24 and EC-24

- We question the practicality of development of proposed Lots #21 and #25 due to the limited useable area located outside of the one hundred foot (100') buffer from Vernal Pool #26. We recommend the one hundred foot (100') buffer as shown on the plans be maintained with a conservation easement provided for protection.

11.6 Sheets GD-28, EC-28, and LL-28

- Activities associated with Lots #14 and #15 should be located outside of the one hundred foot (100') buffer. In this regard, Sheet EC-28 is inconsistent with GD-28 and LL-28.

12.0 Roadway Network

The Preserve includes nine roads, described as Roads "A" through "I." Drainage comments are included in Section 7.0 "Stormwater Management."

12.1 General Comments

- The topsoil stockpiles and construction staging areas depicted on the Soil Erosion and Sediment Control Plans appear to be significantly undersized based on the magnitude of the project.

- The Applicant's Engineers have indicated that roadway fills will be constructed of crushed stone. Given the volume of crushed stone to be utilized, and the amount of apparent rock cut based on field observations and test pit data, a processing area should also be added to the plans. An area for topsoil screening and stockpiling should be added to the plans. Both areas, if applicable, should be located in topographically flat areas and as far away from inland wetlands, and more importantly vernal pools within inland wetlands.

- A detail showing the amphibian barrier does not appear to be provided.

12.2 Erosion and Sediment Control Comments

- We would recommend turf reinforcement mats (TRMs) or three-dimensional flexible channel liners be utilized in all roadside channels where appropriate.

- We would recommend that all temporary sediment traps be located at road cut/fill transitions to the maximum extent possible.

- Temporary sediment trap storage volumes were checked and appear to be properly sized according to the 134 cubic yards of water storage per acre drained criteria contained in the General Permit for the Discharge of Stormwater and Dewatering Wastewaters Associated with Construction Activities. We note however that while the drainage areas draining to the temporary sediment traps have been called out, delineations were not provided to confirm the drainage areas.

- We would recommend utilization of silt sacks in lieu of hay bales at all catch basins.

- We would recommend that all topsoil stockpiles and construction staging areas be located at least one-hundred feet (100') from inland wetlands and that they be surrounded with wood chip berms. In this regard, some of the construction staging areas are shown in areas with questionable access. The construction staging areas should be located proximal to cut fill transitions to the maximum extent possible.

- We would recommend that all construction entrances on the roadway project be at least one hundred feet (100') in length (denoted as anti tracking pads on the plans). While the detail on Volume IIA, Sheet MDS-13 calls out the length as one hundred feet (100') minimum on roads; it has been our experience that contractors typically install soil erosion and sediment control measures based on the Site Plans and not the Details.

- We would recommend that the pipe outfall structure located within basins located down-gradient of all underground galleries be eliminated; that all basins be reconfigured and lengthened along existing contours to the maximum extent possible; and, that the down-gradient berm be designed as a level spreader with utilization of turf reinforcement mats (TRMs) to disperse and allow the forest litter filter the runoff as much as possible prior to flowing in to a receiving wetland.

- The Applicant's Engineers have indicated that underground galleries in roadway fills will be constructed of crushed stone and will located above existing ground as much as possible to promote infiltration. In that some of the underground galleries are proximal to roadways and it is assumed the slopes will be topsoiled seeded, we have reservations regarding surcharging the fill surrounding the underground galleries and slope stability or soil erosion.

- In that the roadway fills would appear to be droughty given utilization of crushed stone we would recommend that consideration be given to utilizing warm season grass mixes.

- Erosion and Sediment Control measures do not appear to be shown in the vicinity of the bridge sites which span wetlands.

12.3 Road A

- We question the amphibian barrier connecting to the mid point of the wing wall to the southeast of Station A36+50. Case studies and/or documentation should be provided in regards to the effectiveness of the proposed amphibian crossings.

- The amphibian barrier in this location is twelve hundred feet (1,200') long; we question whether amphibians will travel this distance along a barrier to reach the man-made eight foot (8') wide crossing or will they become disoriented and utilize nearby rain gardens instead of the vernal pools. Documentation should also be provided in regards to the effectiveness of amphibians following along the amphibian barrier for these lengths.

- Reverse slope benches should be provided at the following locations:

  Sta. 6+50 R to Sta. 9+25 R, Sta. 13+00 L to Sta. 14+00 L, Sta. 20+00 R to Sta. 21+00 R, Sta. 22+00 L to Sta. 24+50 L, Sta. 26+50 L to Sta. 30+00 L, Sta. 29+00 R to Sta. 30+25 R, Sta. 33+50 L to Sta. 35+25 L, Sta. 42+25 L

to Sta. 43+25 L, Sta. 6+50 R to Sta. 9+25 R, Sta. 44+00 R to Sta. 44+75 R, Sta. 46+50 L to Sta. 48+50 L, Sta. 47+50 R to Sta. 49+00 R, and Sta. 108+00 L to Sta. 109+75 L

- Discharge from the underground gallery UG-4 is within the one hundred foot (100') regulated upland review area and has a discharge directly into Vernal Pool #7, a "conserved pool".

- The geotextile silt fence (or woodchip berms as applicable) delineation to the east of Station 40+50 should extend around the discharge from underground gallery UG-6.

- Geotextile silt fence (or woodchip berms as applicable) should be shown to the west of Road "A" from approximately Station 81+00 to Station 95+50.

- Geotextile silt fence (or woodchip berms as applicable) should be shown along the clearing limit line down-gradient of filter basin FB-14 and from approximately Station 99+00 to Station 100+25.

- Geotextile silt fence (or woodchip berms as applicable) should be shown along the clearing limit line on the south side of Road "A" from approximately Station 104+50 to 106+00.

- Discharge from the filter basin FB-14 is within the one hundred foot (100') upland review area and has a discharge directly into Vernal Pool #31.

- For comments regarding Bridge Site #1 and #2, please see Section 7.4.4 "Culverts and Bridges."

12.4 Road B

- Proposed grading at the crossing at Station B23+00 should be corrected so that the full extent of clearing and grading adjacent to the wetland and watercourse can be evaluated.

- Amphibians from Vernal Pool #20, the second most productive vernal pool on the site, may be crossing Road B in search of upland habitat; we question why amphibian barriers are not being utilized in the area of Station B23+00 + to direct the amphibians to the proposed crossing and reduce road kill.

- Reverse slope benches should be provided at the following locations:

  Sta. 14+00 L to Sta. 18+50 L, Sta. 14+50 R to Sta. 22+00 R, Sta. 6+50 R to Sta. 9+25 R, Sta. 33+75 L to Sta. 35+50 L, Sta. 38+75 R to Sta. 41+00 R, Sta. 39+50 L to Sta. 42+25 L, Railroad Crossing Approaches, Sta. 55+25 L to Sta. 57+25 L and Sta. 66+25 L to Sta. 69+00 L

- We would recommend relocating the following temporary sediment traps outside of the upland review zone:

  TST-B3 (Sheet ESC-12), TST B13 (Sheet ESC-17) we would recommend relocating northerly, TST B12 (Sheet ESC-16)

- Geotextile silt fence (or woodchip berms as applicable) should be shown to the north of Road "B" from approximately Station 44+75 to Station 45+75.

- Geotextile silt fence (or woodchip berms as applicable) should be shown to the east of Road "B" from approximately Station 62+00 to Station 62+50.

- For comments regarding Bridge Site #3 and #4, please see Section 7.4.4 "Culverts and Bridges."

12.5 Road F

- Reverse slope benches should be provided at the following locations:

  Sta. 1+25 L to Intersecting Road

- We would recommend relocating the temporary sediment trap, TST-E1 (Sheet ESC-20), outside of the upland review zone.

- Discharge from the filter basin FB-4 is within the one hundred foot (100') regulated upland review area and has a discharge directly into Vernal Pool #6, a "conserved pool", with riprap shown within the wetlands on Sheet GDP-20.

12.6 Road G

- Reverse slop benches should be provided at the following locations:

  Sta. 23+25 L to Sta. 24+50 L, Sta. 23+50 R to Sta. 25+25 R, and Sta. 39+50 R to Sta. 40+25 R

- Diversion ditch should be shown to the south of Road "G" at the top of the slope from approximately Station 23+25 R to Station 25+50 R.

12.7 Road H

- Discharge from the filter basin FB-8 is within the one hundred foot (100') regulated upland review area and has a discharge directly into Vernal Pool #26.

- Reverse slop benches should be provided at the following locations:

  Sta. 11+00 R to Sta. 12+50 R, and Sta. 13+90 L to Sta. 15+75 L

- We would recommend relocating the temporary sediment trap, TST-G1 (Sheets ESC-26 to ESC-27), outside of the upland review zone.

- Geotextile silt fence (or woodchip berms as applicable) should be shown to the south of Road "H" from approximately Station 14+50 to Station 16+75.

13.0 Wastewater Treatment and Disposal

The community septic system includes two subsurface soil absorption systems (SSAS) each 1,600 feet in length located on the east and west sides of the Central Village on either side of a topographic divide. The westerly SSAS discharges to Pequot Swamp which forms a portion of the Trout Brook watershed. The easterly SSAS discharges towards an interconnected system of wetlands, watercourses and vernal pools located within the Oyster River Watershed. It should be noted that the design of these systems are such that effluent flows from the base of the leaching fill, or in this instance crushed stone beds, onto existing slopes located up-gradient of the previously mentioned wetland environments. The effluent will then flow overland, with the potential to re-concentrate on steeply sloping hillsides.

Based on long term groundwater monitoring results obtained down-gradient of similar systems, approximately 5.9 mg/L of total nitrogen (approximately 5.0 mg/L of nitrate) and 1/5 mg/L of phosphorus can be anticipated to discharge to down-gradient watercourses, wetlands, and vernal pools.

The total waste water design flow rate for the subject project, based on DEP design criteria, is 135,650 gallons per day (GPD). It has been our experience that wastewater design flow rates based on this criteria are extremely conservative and incorporate a large factor of safety. Assuming an actual flow rate of fifty percent (50%) of the wastewater design flow rate, mass loadings down-gradient of each subsurface soil absorption system are anticipated to be approximately 1.7 lbs/d (606 lbs per year) of total nitrogen and approximately 0.4 lb/d (150 lbs per year) phosphorus. These mass loadings are based on data in our files from two similar type projects consisting of a waste water treatment plant and fill subsurface soil absorption systems constructed in the early 1990s (and monitored continuously since then). In that nitrates comprise approximately eighty-one to ninety-one percent (81% to 91%) of the total nitrogen mass, the total nitrogen loading to Pequot Swamp would be approximately 515 lbs per year of nitrate. We note that newer technology may be utilized in the subject project which could result in lower nitrate, total nitrogen, and phosphorus discharges to the subsurface soil absorption systems.

According to *Pesticides and Fertilizers at The Preserve: Risk Assessment, Risk Management, and Water Quality Monitoring* prepared by Cohen, Barnes, O'Connor, Reid and Rosenthal, which was submitted by the Applicant, the maximum allowable concentration (MAC) of nitrates is 2 mg/L for amphibians. We would therefore question the impacts from anticipated concentrations from the SSAS on the amphibian population.

Pequot Swamp Pond Analysis data indicates that nitrates were not detected in any of the seven (7) samplings taken by the Applicant on June 14, 2005. This raises concerns regarding the impact on the vegetative community in Pequot Swamp as a result of the nitrogen rich effluent entering it. Many of the acid-loving plants such as Sundews (*Drosera* spp), Twig rush (*Cladium manscoides*), Cranberry (*Vaccinium macrocarpon*), and Yellow-eyed grass (*Xyris caroliniana*) could decline due to competition from plants

that respond positively to increased nutrient loading. Long term change in species composition would therefore appear to be possible result.

Based on the Pequot Swamp Pond Analysis data provided by the Applicant, pH levels ranging from 8.00 to 8.28 were found in the seven samplings. The peer review team found these values interesting as they were quite high for the Eastern Highlands of Connecticut which are composed of acidic, igneous and metamorphic bedrock. Additionally, a number of acid-loving plant species are present in Pequot Swamp which generally grow in low pH aquatic environments. Based on these observations and discrepancies, a field evaluation was conducted by our office on September 29, 2005 at which time Pequot Swamp was tested for pH at two locations by an environmental analyst with significant field testing experience. The first area tested was along the eastern edge of the pond, where a hole was made in the vegetative mat and the pH found to be approximately 5.0. The second area tested was in the open water, near the marker assumed to identify WQ-4, where a pH reading of approximately 5.9 was determined. These pH readings would be more consistent with what we would expect in bog-like water bodies. These results would also be consistent with observed pH readings contained in other information submitted by the Applicant (Table 5, Engineering Report Volume IV Supplemental Report) for the thirty-eight vernal pools, with values ranging from 4.5 to 6.6.

We would recommend that the Applicant retain the professional services of a limnologist, or other similar professional, to assess nitrogen loading effects of Community Leachfield No. 1 on Pequot Swamp and Community Leachfield No. 2 on Wetland # 18.

In addition to the nutrient mass loading impacts on Pequot Swamp, other inland wetlands and vernal pools, we are concerned about reconcentration of the effluent subsequent to breakout from the SSAS, as it will tend to reconcentrate in topographic lows and pose soil erosion and sedimentation effects.

We would also recommend low permeability trapezoidal side containment berms and a toe drain on each end of the leachfield to reduce or eliminate the potential for slope failure due to excess seepage pressure.

It should be noted that two underground galleries (UG-X and UG-22) are proposed for stormwater infiltration in the area of the easterly SSAS. The SSAS design should be adjusted as may be necessary to compensate for this additional flow.

The base of leaching fill and down-gradient crushed stone blanket from which the treated effluent exits onto the proposed grades should be added to the plans wherever the community leach fields are depicted.

We note that Engineering Report Volume I, states that "other than limited areas of the collection system no portion of the leaching field, or treatment facility is located within the 100' upland review area." We note that the one foot (1') thick bed of broken washed stone encroaches approximately twenty-five feet (25') into the one hundred foot (100')

undisturbed zone around Pequot Swamp that was required as a condition of the Planning Commission Section 56 approval (see Volume IC drawing set, Sheet SS-5F, Station 111+44.78 Cross Section).

14.0 Design Drawing Inconsistencies

During the course of our review, the following inconsistencies were noted in the documents submitted for review. The Applicant should therefore be required to reconcile these apparent inconsistencies.

14.1 General Apparent Errors

We have the following comments:

- Show intersection grading for Road "A" to Road "B", Road "G" to Road "H" (at Station G38+00 and Station H28+00), Road "H" to Road "I", and Road "G" to Road "I".
- On Sheet ESC-6, match line ESC-20 is incorrectly labeled as match line ESC-21.
- On Sheet ESC-21, match line ESC-22 is incorrectly labeled as match line ESC-23.
- The Engineering Report Volume IIIb should be updated with the most recent watershed boundary drawings for existing and present scenarios (currently the Existing drawings are dated 8/1/04 and there are no Proposed drawings.)
- Engineering Report Volume I mentions that the roughs will be sodded but also mentions that they will be seeded. This discrepancy should be clarified.
- Table of Contents for Trout Brook should state Figure 4: Trout Brook Watershed in the Engineering Report Volume IIIb.
- Table of Contents for Oyster River should state Figure 2: Oyster River Watershed in the Engineering Report Volume IIIb.
- Sheet GCL-4 is mistitled as "Hole 1", it should be identified as Hole #4.
- The "Golf-Erosion Control Plans" and the "Golf Course Mitigation Plans" for Hole #14 should be revised to reflect the new layout shown on the "Golf-Grading and Drainage Plans."

14.2 Runoff Curve Number Apparent Errors

The computations of composite curve numbers were checked and are noted to have multiple mathematical errors. All discrepancies should be resolved to facilitate review. These errors include the following:

- The total areas shown in the calculations versus the total areas shown on Sheet PDA-0 and SA-8 do not match for the following basins:

  OR-A, OR-AP, OR-B, OR-BP, OR-C, OR-CP, OR-D, OR-DP, OR-E, OR-EP, MR-A, MR-AP, MR-D, MR-DP, MR-G, MR-GP, MR-HP, MR-IP, TB-B, TB-BP, TB-CP, and TB-DP.

- The following subbasins appear to have a substantially incorrect area (more than a 2% difference and/or 1 acre in area as delineated on the plans than those shown in the Drainage Areas & Curve Numbers tables in Engineering Report Volume IIIb):

  Existing: OR-A1, OR-A2, OR-A3, OR-A6, OR-B5, OR-B6, OR-B7, OR-B8, OR-C7, OR-C9, OR-D1, OR-E1, OR-E4, OR-E7, MR-D1, MR-G7, TB-A1, and TB-B3;

  Proposed: OR-A2, OR-A4a, OR-A5e, OR-A5g, OR-B1b, OR-B1d, OR-B1g, OR-B1-GC-2f, OR-B2-GC-1c, OR-B2-GC-9b, OR-B3-GC-4a, OR-B4, OR-B4b, OR-B4c, OR-B4d, OR-B4-GC-4b, OR-B4-GC-2a, OR-B4-GC-1c, OR-B4-GC-1d, OR-B4-GC-2c, OR-B4-GC-1a, OR-B5, OR-B5-GC-6a, OR-C1a, OR-C1d, MR-A3-GC-17a, MR-A4B, MR-D2, MR-D2B, MR-D2C, MR-D3c, MR-D9, MR-G1b, MR-G1c, MR-G1e, MR-G6, MR-H1a, MR-H1h, TB-B1A, TB-B1-GC-10a, TB-B1-GC-10b, TB-B1-GC-10d, TB-B1-GC-18b, TB-B1-GC-18c, TB-B1C, TB-B1B, TB-B4, TB-B6A, TB-B6-GC-15b, TB-B7-GC-13a, TB-B7-GC-13b, TB-B7-GC-13c, TB-B7-GC-14a, TB-B8-GC-13e, TB-C1d, and TB-D1.

- The following subbasins were listed in the Drainage Areas & Curve Numbers tables in Engineering Report Volume IIIb but were not located on the plans or had unclear delineations:

  Proposed: OR-B1i, OR-B1-DR-A, OR-B1-DR-B, OR-B1-DR-C, OR-B1-DR-D, OR-B1-DR-E, OR-B3b, OR-B4g, OR-B4-GC-3a, OR-B4-GC-2e, OR-B4-GC-3e, OR-B4-DR-F, OR-C1-GC-9a, and MR-I1.

- The following subbasins were listed in the HydroCAD input data but were not located on the plans or had unclear delineations:

  Proposed: OR-B-G1D, OR-B1i, OR-B1-DR-A, OR-B1-DR-B, OR-B1-DR-C, OR-B1-DR-D, OR-B1-DR-E, OR-B3b, OR-B4-GC-3a, OR-B4-GC-2h, OR-B4-GC-2e, OR-B4-DR-F, OR-B2a (in OR-C calculations), MR-A3-GC-17c, TB-B1B (in MR-D calculations), and MR-I1.

- There are two areas labeled as TB-B1D Sheet PDA-0.
- The labels on the plans for TB-B7-GC-13b and TB-B7-GC-13c appear to be switched on Sheet PDA-0.
- OR-A4a appears to be a portion of OR-A4 and the areas are inclusive instead of exclusive.
- The following subbasins appear to have a mathematical error resulting in an incorrect CN calculated in the Drainage Areas & Curve Numbers tables in Engineering Report Volume IIIb:

  Existing: OR-A1, OR-A2, OR-A3, and OR-A4;

  Proposed: OR-C6, TB-B1-GC-18b, TB-B5A-GC-16c, GC-15b, and TB-B8d.

- The following subbasin appears to have an addition error resulting in an incorrect area calculated in the Drainage Areas & Curve Numbers tables in Engineering Report Volume IIIb:

  Proposed: OR-A5d.

- The following subbasins appear to utilize different CN values in the Drainage Areas & Curve Numbers tables in Engineering Report Volume IIIb than in the HydroCAD input data:

  Existing: OR-A1, OR-A2, OR-A3, OR-A4, MR-D1, MR-D10, TB-B1B, and TB-B6;

  Proposed: OR-A5f, OR-B1a, OR-B1e, OR-B1f, OR-B1g, OR-B2-GC-9b, OR-B5, OR-B9a, OR-C1b, OR-C1d, OR-C1e, OR-C7c, OR-D2a, OR-E2b, MR-A4D, MR-D2A, MR-D2B, MR-D4a, MR-D4b, M-D10, M-D13, MR-G1C, TB-A1, TB-B1-GC-18b, TB-B1-GC-18c, TB-B6A, TB-B8a, and TB-B9.

- The following subbasins appear to utilize different areas in the Drainage Areas & Curve Numbers tables in Engineering Report Volume IIIb than in the HydroCAD input data:

  Existing: OR-A5, OR-A6, OR-A7, OR-A8, OR-A9, OR-A10, OR-B5, OR-C7, MR-D1, MR-H1, TB-B3, and TB-B7;

  Proposed: OR-A5d, OR-B1e, OR-B1g, OR-B2-GC-9b, OR-B4d, OR-B4-GC-1d, OR-B5, OR-B9a, OR-C1a, OR-C1d, MR-D10, MR-G1C, TB-B1A, TB-B1-GC-10b, TB-B1-GC-18a, TB-B1-GC-18b, TB-B1-GC-18c, and TB-B6A.

- The following subbasins appear to be in the Drainage Areas & Curve Numbers tables in Engineering Report Volume IIIb and not in the HydroCAD input data:

  Existing: OR-E1, OR-E2, OR-E3, OR-E4, OR-E5, OR-E6, OR-E7, and OR-E8;

  Proposed: OR-A5g, OR-A5h, OR-B2-GC-1c, OR-B4-GC-3e, OR-B4g, OR-B4-GC-3e, OR-C1-GC-9a, MR-A3-GC-17a, MR-D2, TB-B8-GC-13e, TB-C1a, and TB-C1b.

- The following subbasin(s) appear to be in the HydroCAD input data but not in the Drainage Areas & Curve Numbers tables in Engineering Report Volume IIIb:

  Existing: OR-C2, OR-C3, OR-D2, and MR-D13;

  Proposed: G1D (on OR-BP calculations), OR-B4-GC-1c, OR-B4-GC-2h, OR-B2a (on OR-CP calculations NOTE: different "OR-B2a" in OR-BP calculations), OR-C1-GC-9c, MR-A3-GC-17c, TB-B1B (on MR-DP calculations NOTE: also used in TB-BP calculations), MR-D2C, MR-G1e, TB-C1a (on TB-BP calculations), TB-C1b (on TB-BP calculations), and TB-B9-GC-13E.

14.3 GDP Sheet Apparent Errors

There appear to be the following errors and omissions on the GDP drawing sheets:

- GDP-1:
  - The "Storm Pipe Chart" refers to the incorrect structures for pipes P-A17, P-A18, and P-A19.
  - The slope of pipe P-A18 appears to be 3.01% based on the invert elevations and pipe length.
  - We question the proposed contours near catch basin CB-A15.
  - The top of frame elevations listed and that shown on the plans according to the contours do not appear to be the same for catch basins CB-A1, CB-A2, CB-A8, CB-A14, CB-A15.
- GDP-2:
  - The pipes P-A32A and P-A29A appear to be incorrectly labeled on the drawing.
  - The invert in elevation for catch basin CB-D1 is contradictory between the drawing and the calculations.
  - Pipe P-C4 is incorrectly labeled on the drawings as P-C1.
  - The top of frame elevations listed and that shown on the plans according to the contours do not appear to be the same for catch basins CB-A21, CB-C3.
- GDP-3:
  - Catch basin CB-A27 should be centered in the swale.
- GDP-4:
  - The invert in elevations from scuppers, SC-A1 and SC-A2 into catch basins, CB-39 and CB-40, respectively, are not labeled.
  - The inverts out from scuppers SC-A1 and SC-A2 are to the east, the drawings list them as coming out of the south side of the scuppers.
  - The top of frame elevations listed and that shown on the plans according to the contours do not appear to be the same for catch basins CB-A36, CB-A39.
  - We question the grading outside the limits of clearing along the east side of the road in the vicinity of underground gallery UG-4.
  - The proposed contour for elevation 84 at the northeast side of the bridge should be shown.
- GDP-5:
  - Contour 108 appears to be missing.

- GDP-6:
  - Match line GDP-20 is incorrectly labeled as match line GDP-21.
  - The top of frame elevations listed and that shown on the plans according to the contours do not appear to be the same for catch basin CB-A58.
- GDP-7:
  - The order of where the structures are flowing from and to in the "Storm Pipe Chart" appear to be in backwards order (i.e. chart reads that water flows from structure "B" to structure "A", whereas water actually flows from structure "A" to structure "B").
  - It appears that water will collect in the depression at the northwest corner of Road "A" and Road "B," an additional catch basin should be added at this location.
  - The top of frame elevations listed and that shown on the plans according to the contours do not appear to be the same for catch basin CB-B3.
- GDP-9:
  - The order of where the structures are flowing from and to in the "Storm Pipe Chart" appear to be in backwards order (i.e. chart reads that water flows from structure "B" to structure "A", whereas water actually flows from structure "A" to structure "B").
  - Relocate manhole MH-A10 off of the slope of the swale and into the center of the swale.
- GDP-10:
  - The order of where the structures are flowing from and to in the "Storm Pipe Chart" appear to be in backwards order (i.e. chart reads that water flows from structure "B" to structure "A", whereas water actually flows from structure "A" to structure "B").
  - We question the curve data present on this sheet but no other GDP sheets.
  - The top of frame elevations listed and that shown on the plans according to the contours do not appear to be the same for catch basins CB-A96, CB-A101, and CB-A102, and manhole MH-A11.
- GDP-11:
  - The order of where the structures are flowing from and to in the "Storm Pipe Chart" appear to be in backwards order (i.e. chart reads that water flows from structure "B" to structure "A", whereas water actually flows from structure "A" to structure "B").
  - The catch basins CB-A105 and CB-A106, and outlet O-A5 appear to be incorrectly labeled on the drawing.

- Pipe P-A123 and outlet O-A5 are recognized differently on Sheet MDS-31 as 57'-15" HDPE s=6.14% and O-A8 respectively.
- Catch basin CB-A103 is not labeled.
- The top of frame elevations listed and that shown on the plans according to the contours do not appear to be the same for catch basin CB-A106.

- GDP-12:
  - The order of where the structures are flowing from and to in the "Storm Pipe Chart" appear to be in backwards order (i.e. chart reads that water flows from structure "B" to structure "A", whereas water actually flows from structure "A" to structure "B").
  - Catch basin CB-B6 is not labeled.
  - The top of frame elevations listed and that shown on the plans according to the contours do not appear to be the same for catch basin CB-B12, manhole MH-B3.
- GDP-13:
  - The order of where the structures are flowing from and to in the "Storm Pipe Chart" appear to be in backwards order (i.e. chart reads that water flows from structure "B" to structure "A", whereas water actually flows from structure "A" to structure "B").
  - Pipe P-G2 information is missing from the "Storm Pipe Chart".
  - Match line GDP-21 is incorrectly labeled as match line GDP-22.
  - The top of frame elevations listed and that shown on the plans according to the contours do not appear to be the same for catch basin CB-G1, CB-G2.
- GDP-14:
  - The order of where the structures are flowing from and to in the "Storm Pipe Chart" appear to be in backwards order (i.e. chart reads that water flows from structure "B" to structure "A", whereas water actually flows from structure "A" to structure "B").
  - The top of frame elevations listed and that shown on the plans according to the contours do not appear to be the same for catch basin CB-B35.
- GDP-15:
  - The order of where the structures are flowing from and to in the "Storm Pipe Chart" appear to be in backwards order (i.e. chart reads that water flows from structure "B" to structure "A", whereas water actually flows from structure "A" to structure "B").
  - Match line GDP-22 is incorrectly labeled as match line GDP-23.

- The top of frame elevations listed and that shown on the plans according to the contours do not appear to be the same for manhole MH-B5, and catch basins CB-B45, CB-B38, and CB-B41.
- It appears that water will collect in the depression to the southeast of catch basin CB-B42; an additional catch basin should be added at this location.
- We question the grading to the east of Station B52+00. As shown it appears that a wall is being proposed at this location although it is not shown.

- GDP-16:
  - The order of where the structures are flowing from and to in the "Storm Pipe Chart" appear to be in backwards order (i.e. chart reads that water flows from structure "B" to structure "A", whereas water actually flows from structure "A" to structure "B").
  - The invert out for catch basin CB-B48 is contradictory between the drawing and the Drainage Analysis calculations.
  - The east edge of the road is missing between Stations 53+80 and 54+40, and between Stations 55+00 and 55+60.
- GDP-17:
  - The order of where the structures are flowing from and to in the "Storm Pipe Chart" appear to be in backwards order (i.e. chart reads that water flows from structure "B" to structure "A", whereas water actually flows from structure "A" to structure "B").
  - Underground gallery UG-15 is not labeled.
  - The bypass flow from catch basin CB-B57 appears to flow into a depression at the east side of station 67+50. An additional catch basin should be provided at this location.
  - The inverts out from catch basin CB-H5 to the east, the drawings list them as coming out of the west side of the catch basin.
- GDP-18:
  - The order of where the structures are flowing from and to in the "Storm Pipe Chart" appear to be in backwards order (i.e. chart reads that water flows from structure "B" to structure "A", whereas water actually flows from structure "A" to structure "B").
  - We question the location of catch basin CB-C4.
  - The top of frame elevations listed and that shown on the plans according to the contours do not appear to be the same for catch basin CB-C4.

- GDP-19:
  - The order of where the structures are flowing from and to in the "Storm Pipe Chart" appear to be in backwards order (i.e. chart reads that water flows from structure "B" to structure "A", whereas water actually flows from structure "A" to structure "B").
  - Catch basins CB-D17 and CB-D16, and pipes P-D5 and P-D6 are not labeled.
  - Pipe P-D19 is incorrectly labeled on the drawings as P-19.
  - We question the proposed contours in the area of Lot #16.
- GDP-20:
  - The order of where the structures are flowing from and to in the "Storm Pipe Chart" appear to be in backwards order (i.e. chart reads that water flows from structure "B" to structure "A", whereas water actually flows from structure "A" to structure "B").
  - The pipe length listed for P-F7 is not the same as the pipe length shown.
  - The top of frame elevations listed and that shown on the plans according to the contours do not appear to be the same for manhole MH-F2.
- GDP-21:
  - The order of where the structures are flowing from and to in the "Storm Pipe Chart" appear to be in backwards order (i.e. chart reads that water flows from structure "B" to structure "A", whereas water actually flows from structure "A" to structure "B").
  - Catch basins CB-G6 and CB-G5, and pipe P-G6 are not labeled.
- GDP-22:
  - The order of where the structures are flowing from and to in the "Storm Pipe Chart" appear to be in backwards order (i.e. chart reads that water flows from structure "B" to structure "A", whereas water actually flows from structure "A" to structure "B").
  - Catch basin CB-G16 is not labeled.
  - Show the full Detention Basin 3.
  - Flow arrows on pipes P-G15, P-G16, and P-H8 appear to be pointing the wrong direction.
  - The top of frame elevations listed and that shown on the plans according to the contours do not appear to be the same for catch basins CB-G16, CB-G17, CB-G19, and CB-H5.

- GDP-23:
    - The order of where the structures are flowing from and to in the "Storm Pipe Chart" appear to be in backwards order (i.e. chart reads that water flows from structure "B" to structure "A", whereas water actually flows from structure "A" to structure "B").
    - The top of frame elevations listed and that shown on the plans according to the contours do not appear to be the same for manhole MH-G4.
- GDP-24:
    - The order of where the structures are flowing from and to in the "Storm Pipe Chart" appear to be in backwards order (i.e. chart reads that water flows from structure "B" to structure "A", whereas water actually flows from structure "A" to structure "B").
    - The top of frame elevations listed and that shown on the plans according to the contours do not appear to be the same for catch basin CB-H28.
- GDP-25:
    - The order of where the structures are flowing from and to in the "Storm Pipe Chart" appear to be in backwards order (i.e. chart reads that water flows from structure "B" to structure "A", whereas water actually flows from structure "A" to structure "B").
    - The top of frame elevations listed and that shown on the plans according to the contours do not appear to be the same for catch basins CB-G56 and CB-G57, and manhole MH-G6.
- GDP-26:
    - The order of where the structures are flowing from and to in the "Storm Pipe Chart" appear to be in backwards order (i.e. chart reads that water flows from structure "B" to structure "A", whereas water actually flows from structure "A" to structure "B").
- GDP-27:
    - The order of where the structures are flowing from and to in the "Storm Pipe Chart" appear to be in backwards order (i.e. chart reads that water flows from structure "B" to structure "A", whereas water actually flows from structure "A" to structure "B").
    - Pipe P-H34 is not labeled.
    - The top of frame elevations listed and that shown on the plans according to the contours do not appear to be the same for catch basins CB-H26, CB-H27

14.4 MDS Sheet Apparent Errors

There appear to be the following errors and omissions on the MDS drawing sheets:

- MDS-19:
  - The slope value is cut off for one of the Underground Gallery 3 / Micropool pipes.
- MDS-20:
  - The title should correctly read "Underground Gallery 5 / Filter Basin 2".
- MDS-21:
  - The title should correctly read "Underground Gallery 7 / Filter Basin 3".
- MDS-22:
  - The title should correctly read "Underground Gallery 8A-D / Filter Basin 5".
  - The title should refer to Road "B".
- MDS-23:
  - Both titles should refer to Road "B".
- MDS-24:
  - The slope value is cut off for one of the Underground Gallery 11 pipes.
  - The title should correctly read "Underground Gallery 12 / Filter Basin 9".
- MDS-25:
  - Both titles should refer to Road "B".
- MDS-29:
  - The Underground Gallery 16a and the adjoining structures as well as CB-G44 should all be shown.
  - The title should correctly read "Underground Gallery 16A – 16B / Filter Basin 7".
- MDS-31:
  - The 57'-15" HDPE s=6.14% and O-A8 are recognized differently on Sheet GDP-11 as P-A123 and O-A5 respectively.

14.5 Drainage Analysis Apparent Errors

There appear to be the following errors and omissions in the Drainage Analysis calculations in the Engineering Report Volume II:

- It does not appear that catch basins CB-A1 and CB-A2 have 100% capture efficiency and will cause water to bypass onto the adjoining road off of The Preserve property. Please provide intersection grading at the start of construction.
- Longitudinal slopes appear shallow for many of the bypasses.
- We question the bypass path over the sidewalk near catch basin CB-A10.
- It is unclear from the proposed grading whether catch basin CB-C5 bypasses to CB-A18 as used in the calculations or CB-C1 on Sheet GDP-18.
- It is unclear from the proposed grading whether catch basin CB-A24 bypasses to CB-A22 as used in the calculations or CB-D3 on Sheet GDP-2.
- It appears that bypass from CB-D3 would flow to CB-A22, currently the calculations show that CB-D3 does not bypass to any catch basin. (GDP-2)
- It is unclear from the proposed grading if catch basin CB-A24 bypasses to another structure on Sheet GDP-4.
- It is unclear from the proposed grading whether catch basin CB-A54 bypasses to CB-A51 as used in the calculations or CB-A53 on Sheet GDP-6.
- The pipe that flows from catch basin CB-A64 to CB-A66 appears to be P-A81 on the drawings but P-A77 in the calculations.
- It appears that bypass from CB-B18 would flow to CB-B17, currently the calculations show that CB-B18 does not bypass to any catch basin. (Sheet GDP-13)
- It appears that bypass from CB-B21 would flow to CB-B19, currently the calculations show that CB-B21 bypasses to CB-B17. (Sheet GDP-13)
- It is unclear from the proposed grading where catch basin CB-B23 would bypass to on Sheet GDP-13.
- It appears that bypass from catch basin CB-G15 would flow to CB-H3, currently the calculations show that CB-G15 does not bypass to any catch basin. (Sheet GDP-22)
- It appears that bypass from catch basin CB-G17 would flow to CB-H4, currently the calculations show that CB-G17 does not bypass to any catch basin. (Sheet GDP-22)
- It appears that bypass from catch basin CB-G19 would flow to CB-H4, currently the calculations show that CB-G19 bypasses to CB-G17. (Sheet GDP-22)
- It is unclear from the proposed grading whether catch basin CB-H5 bypasses to CB-G15 as used in the calculations or CB-H3 on Sheet GDP-22.

- It is unclear from the proposed grading whether catch basin CB-B39 bypasses to CB-B41 as used in the calculations since CB-B41 appears to be raised on Sheet GDP-15.
- It is unclear from the proposed grading where catch basin CB-B41 would bypass to on Sheet GDP-15.
- It appears that bypass from catch basin CB-B53 would flow to CB-B55, currently the calculations show that CB-B53 bypasses to CB-CB-B56. (Sheet GDP-17)
- It appears that bypass from catch basin CB-B55 would flow to CB-B56, currently the calculations show that CB-B55 does not bypass to any catch basin. (Sheet GDP-17)
- It is unclear from the proposed grading where catch basin CB-B57 would bypasses to on Sheet GDP-17.
- It appears that bypass from catch basin CB-G35 would flow to CB-G37, currently the calculations show that CB-G35 bypasses to CB-H17. (Sheets GDP-23 and 26)
- It appears that bypass from catch basin CB-H28 would flow to CB-G47, currently the calculations show that CB-H28 does not bypass to any catch basin. (Sheet GDP-24)
- It appears that bypass from catch basin CB-H16 would flow to CB-H17, currently the calculations show that CB-H16 does not bypass to any catch basin. (Sheet GDP-26)
- It appears that bypass from catch basin CB-H15 would flow to CB-H17, currently the calculations show that CB-H15 bypasses to CB-H16. (Sheets GDP-23 and 26)

Appendix A List of Applicant's Submittal Materials

The environmental review for this project was based on the following materials submitted by the Applicant:

Item 1: Old Saybrook Inland Wetland & Watercourses Commission Application to Conduct a Regulated Activity, pages 1-6 of 6, dated August 11, 2005, signed by Martin Malin and David M. Royston, and including:

A) A letter to the Connecticut Water Company from Dzialo, Pickett & Allen, P.C., dated August 11, 2005.
B) A letter to Old Saybrook Inland Wetlands and Watercourses Commission from Dzialo, Pickett & Allen, P.C., dated August 11, 2005.
C) Connecticut Department of Environmental Protection Statewide Inland Wetlands & Watercourses Activity Reporting Form

Item 2: A set of drawings entitled "Volume IA, Site Development Plans, Inland Wetlands and Watercourse Application – Town of Old Saybrook, CT, The Preserve, An Open Space and Recreation Community; Ingham Hill Road – Bokum Road, Old Saybrook, Westbrook, Connecticut", sheets as noted; scales as noted, dated August 11, 2005, prepared by BL Companies, and including:

ID	Drawing Index
SA-1	Key Map
SA-2	Site Analysis-Existing Conditions Overview
SA-3A	Site Analysis-Wetland and Watercourses
SA-3B	Site Analysis-Vernal Pools
SA-4	Site Analysis-Soils Map
SA-5	Site Analysis-Soils Map Descriptions
SA-6	Site Analysis-Landforms
SA-7	Site Analysis-Slope Analysis
SA-8	Site Analysis-Existing Drainage and Watersheds
SA-9	Site Analysis-Site Features and Vegetation
MP-0	Overall Master Plan
MP-1 to MP-4	Master Plans
OW-1 to OW-4	Master Plan/Existing Watershed Overlay
ON-1 to ON-4	Master Plan/Natural Resources Overlay
OS-0	Overall Master Open Space Plan
OS-1	Preservation and Master Open Space Plans
ATL-2 to ATL-11	Alternate Plans
GN-1 to GN-3	General Notes
PH-1	General Phasing Plan
CL-1 to CL-4	Site Preparation and Clearing Plan

Item 3: A set of drawings entitled "Volume IB, Site Development Plans, Inland Wetlands and Watercourse Application – Town of Old Saybrook, CT, The Preserve, An Open Space and Recreation Community; Ingham Hill Road – Bokum Road, Old Saybrook, Westbrook, Connecticut", sheets as noted; scales as noted, dated August 11, 2005, prepared by BL Companies, and including:

ID	Drawing Index
PDA-0	Proposed Drainage Basins
IP-2	Index Plan-Subdivision
GD-1 to GD-31	Grading and Drainage Plans-Subdivision
GD-32 to GD-35	Grading and Drainage Details and Notes-Subdivision
EC-1 to EC-31	Erosion Control Plans-Subdivision
EC-32	Erosion Control Details and Notes-Subdivision
LL-1 to LL-31	Landscaping Plans
LL-32	Landscaping Details and Notes
SP-1	Site Plans-Nature Center and Maintenance Facility/Fire Substation
SP-2 to SP-4	Site Plans-Central Village
SP-5 to SP-6	Site Plans-East Village
SP-7 to SP-8	Site Plans-Athletic Fields
SP-9	Site Plans-Recreation Area
SP-10 to SP-12	Site Details and Notes
SP-13	Typical Lot Design and Layout
SU-1	Site Utility Plans-Nature Center and Maintenance Facility/Fire Substation
SU-2 to SU-4	Site Utility Plans-Central Village
SU-5 to SU-6	Site Utility Plans-East Village
SU-7 to SU-8	Site Utility Plans-Athletic Fields
A6.02	Architecturals-Maintenance Building Floor Plan
GCC-0 to GCC-18	Golf-Layout and Clearing Plans
GCC-19	Golf-Layout and Clearing Details and Notes

Item 4: A set of drawings entitled "Volume IC, Site Development Plans, Inland Wetlands and Watercourse Application – Town of Old Saybrook, CT, August 11, 2005, The Preserve, An Open Space and Recreation Community, Ingham Hill Road – Bokum Road, Old Saybrook, Westbrook, Connecticut", sheets as noted; scales as noted, dated August 11, 2005, prepared by BL Companies, and including:

ID	Drawing Index
GGD-0 to GGD-18	Golf-Grading and Drainage Plans
GGD-19 to GGD-20	Golf-Grading and Drainage Details and Notes
GDA-1 to GDA-6	Golf-Drainage Area Plans
GEC-0 to GEC-18	Golf-Erosion Control Plans
GEC-19	Golf-Erosion Control Details and Notes
GCL-1 to GCL-18	Golf Course Mitigation Plans
GCL-19	Golf Course Mitigation Notes
SS-1A	Overall Septic System Plan
SS-1B	Septic System Plan-Golf Course Layout
SS-2A	Subsurface Disposal Plan-Area #1

SS-2B	Subsurface Disposal Plan-Area #2
SS-3A	Distribution Plan-Area #1
SS-3B	Distribution Plan-Area #2
SS-4A	Transverse Section-Area #1
SS-4B	Transverse Section-Area #2
SS-5A to SS-5I	Cross Sections-Area #1
SS-6A to SS-6H	Cross Sections-Area #2
SS-7	Sanitary Sewer Collection System
SS-8	Wastewater Treatment Plant Schematic
SS-9	Wastewater Treatment Plant Layout
SS-10	Septic System Details
SS-11A to SS-11G	Community Septic Test Pit Logs
SS-12	Groundwater Contour Plan
BL-1 to BL-35	Boring Logs

Item 5: A set of drawings entitled "Volume IIA, Roadway Plans, Inland Wetlands and Watercourse Application – Town of Old Saybrook, CT, The Preserve, An Open Space and Recreation Community; Ingham Hill Road – Bokum Road, Old Saybrook, Westbrook, Connecticut", sheets as noted; scales as noted, dated August 11, 2005, prepared by BL Companies, and including:

ID	Drawing Index
IND-1	Index Plan-Roadway
RDS-1	Roadway Design Standards
TYP-1 to TYP-6	Typical Cross Sections
GRA-1 and GRA-2	Intersection Grading
MDS-1 to MDS-13	Roadway Details and Notes
MDS-14 to MDS-31	Roadway Drainage Details
PLN-1 to PLN-27	Roadway Layout Plans
PLN-28 and PLN-29	Offsite Roadway Layout Plans
PRO-1 to PRO-31	Roadway Profiles
GDP-1 to GDP-27	Roadway Grading and Drainage Plans

Item 6: A set of drawings entitled "Volume IIB, Roadway Plans, Inland Wetlands and Watercourse Application – Town of Old Saybrook, CT, August 11, 2005, The Preserve, An Open Space and Recreation Community, Ingham Hill Road – Bokum Road, Old Saybrook, Westbrook, Connecticut", sheets as noted; scales as noted, dated August 11, 2005, prepared by BL Companies, and including:

ID	Drawing Index
IND-1	Index Plan-Roadway
UTL-1 to UTL-27	Roadway Utility Plans
ESC-1 to ESC-27	Roadway Erosion Control Plans
SPM-1 to SPM-9	Roadway Signing and Pavement Marking
SPM-10	Roadway Signing and Pavement Marking Details
S-101 to S-105	Bridge Site 1
S-201 to S-205	Bridge Site 2
S-301 to S-304	Bridge Site 3
S-401 to S-404	Bridge Site 4

S-501	Misc. Amphibian Crossing Details
RWL-1 to RWL-5	Roadway Mitigation Plan
RWL-6	Roadway Mitigation Notes

Item 7: A report entitled "Engineering Report, Volume I: Project Information & IWWC Application," dated August 11, 2005, prepared by BL Companies.

Item 8: A report entitled "Engineering Report, Volume II: Roadway Drainage," dated August 11, 2005, prepared by BL Companies.

Item 9: A report entitled "Engineering Report, Volume IIIa: Site Stormwater Management," dated August 11, 2005, prepared by BL Companies.

Item 10: A report entitled "Engineering Report, Volume IIIb: Site Stormwater Management," dated August 11, 2005, prepared by BL Companies.

Item 11: A report entitled "Engineering Report, Volume IV: Environmental Reports," dated August 11, 2005, prepared by BL Companies.

Item 12: A report entitled "Engineering Report, Volume V: ITPMP / Ground and Surface Water Monitoring Program," dated August 11, 2005, prepared by BL Companies.

Item 13: A report entitled "Engineering Report, Volume IV: Environmental Reports; Supplemental Report," dated September 11, 2005, prepared by BL Companies.

Item 14: A set of drawings entitled "Master Plan, The Preserve, Old Saybrook, Connecticut", sheets 1-2 of 2; Scale: 1"=100', dated September 13, 2005, prepared by BL Companies, received September 14, 2005.

Item 15: A packet of information from Terrance Gallagher of BL Companies, entitled "Infiltration Tests for Storm," dated September 26, 2005, including:

A) Photos of testing, pages 1-2 of 2, entitled "01C955; The Preserve".
B) A spreadsheet entitled "Calculated Permeability Rates for Unsaturated Soils Using a Double Ring Infiltrometer; The Preserve, Westbrook, Old Saybrook, Essex, CT", undated.
C) Infiltrometer Test Data sheets, prepared by BL Companies, dated September 14, 2005, for the following locations: IT-UG-1, IT-UG-2, IT-UG-2f, IT-FB-5, IT-HOLE15, and IT-UG-8.

Item 16: A letter to Michael Klein from BL Companies, dated August 25, 2005, pages 1-3 of 4, received September 29, 2005, including:

A) A fax to Amy Pond from Michael Klein, showing a sketch entitled "Pequot Swamp Water Sampling, dated May 25, 2005.
B) A spreadsheet entitled "Pequot Swamp Pond Analysis", undated, prepared by BL Companies.