PLANNING COMMISSION EXHIBIT #67

January 13, 2011

Mr. Robert McIntyre
Planning Commission
Old Saybrook Town Hall
302 Main Street
Old Saybrook, CT 06475

Dear Mr. McIntyre and Members of the Planning Commission:

I would like to submit to the Planning Commission and for the record the two (2) enclosed documents: a) Herpetological Survey and Vernal Pool Analysis with Conservation Planning Recommendations and Strategies "The Preserve", and; b) Ecological Connectivity Vernal Pool Stepping Stones Into Upland Habitat, Distribution Map 28 Revised.

These documents will assist the Members by providing important information that is of import to the Commission's work of shaping the plans for the three (3) proposed pods. This information was requested by Mr. Aresco at the last meeting, and was deemed reasonable by Attorney Branse.

I would like to talk for 10 -15 minutes at the January 19th meeting and discuss how the decisions made by the IWWC regarding the Preliminary Plan should be taken into consideration by the Planning Commission when deliberating on the Phase I , three-pod plans. Thank you for your consideration.

Sincerely,

Chris Cryder

Chris Cryder, 70 Chalker Beach Road

Herpetological Survey and Vernal Pool Analysis with Conservation Planning Recommendations and Strategies

"The Preserve"

Old Saybrook, Westbrook, and Essex, Connecticut

Michael W. Klemens, LLC
68 Purchase Street, 3rd Floor, Suite 2
Rye, NY 10580

October 26, 2004

Executive Summary

Michael W. Klemens, LLC was retained to conduct a herpetological reconnaissance and vernal pool analysis of the ±1000-acre tract of land known as The Preserve in Old Saybrook, Westbrook, and Essex, CT. Between 14 Oct 2002 and 3 June 2004, a total of 391 person hours (over a 20-day period) were spent in the field on the site. Michael W. Klemens, PhD was present on site supervising this research the entire period. Two herpetological technicians, Brandon M. Ruhe and Kevin J. Ryan assisted him. Both of these technicians have been trained by Dr. Klemens and have experience working on various herpetological projects in the tri-state area. Eric Davison of Environmental Planning Services (EPS) as well as Michael Klein, the principal of EPS, also assisted the team.

A total of fourteen species of amphibians and a total of eleven species of reptiles were documented on the site for a total of 25 species. This represents slightly more than half of the 45 species of terrestrial and freshwater amphibians and reptiles reported from Connecticut (Klemens, 1993; 2000). No endangered or threatened species of amphibians and reptiles were documented. Two State-listed Special Concern Species were found, the eastern box turtle (*Terrapene c. carolina*) and the eastern ribbon snake (*Thamnophis s. sauritus*); both were found at several locations on the site.

Twenty-nine vernal pools were documented on the site, confirmed by the presence of one or more obligate vernal pool species. Two additional vernal pools were found on the Pianta site bringing the total number of pools to 31. Of these pools, more than a third (n=12) were considered to be of exceptional conservation importance and the design of the development was modified to protect these significant vernal pool resources using the standards set forth in Calhoun and Klemens (2002).

Introduction

This report documents the results of biological surveys conducted at a site of a residential and golf course development proposed by River Sound Development, LLC, on a ±1000-acre site known as The Preserve. The site is located west of Bokum Road and East of CT Route 153 in Old Saybrook, Westbrook and Essex, CT. Michael W. Klemens, LLC was retained to complete and ecological inventory and assessment and vernal pool analysis of this site. Michael W. Klemens, LLC worked closely with EPS during these inventories, our respective teams of biologists shared information with each other and assisted each other whenever possible to maximize the opportunities for data collection of wildlife and plant species on this site. At the recommendation of Michael W. Klemens, LLC, Stuart Z. Cohen ,PhD, principal of Environmental Turf Services, Inc. was retained by the development team to address specific issues of amphibian conservation as it relates to golf course design, turf management, and IPM issues. Michael W. Klemens, LLC is an independently owned sole proprietary, limited liability corporation. There is no connection, implicit or implied between Michael W. Klemens and the various professional appointments and/or employments of Dr. Michael W. Klemens.

Materials and Methods

The documentation of amphibians and reptiles is a labor-intensive and highly specialized activity. Although many common species are readily found, secretive species often require specialized search and detection methods accompanied by an in-depth understanding of each species' predicted activity patterns and movements over both daily and seasonal activity cycles. This requires the deployment of a variety of different capture techniques and strategically spaced field investigations at different times of year and different times of the day. In addition, one must be prepared to maximize field activity and unique moments of weather opportunity, particularly during spring and early summer nocturnal rainstorms.

A variety of capture techniques for amphibians were used; these are outlined in Klemens (1993: 11-13 [appended to this report]). Hand-collection was an important method of capture. This type of collection is most successful during early and mid-morning hours when reptiles are basking. However, during early spring and early autumn days or during cool and damp weather, specimens could be found throughout the day. Logs, rocks, and debris were lifted and carefully replaced. Debris turning was the principal method of detection for adult and subadult marbled salamanders and many of the small snakes found on The Preserve. Depending on the size of objects, the team of three herpetologists turned and replaced between 100 and 175 cover objects per hour. This means that on an average day of fieldwork on The Preserve, as many as 1000 cover objects had been moved and replaced. The level of intensity of work represents a level of effort rarely expended on most studies of this type and is directly responsible for the rich dataset of species occurrences.

Turning of moss and rocks in streams and seepage areas yielded salamanders and their larvae. These were often captured with the aid of a small net or scoop. Driving slowly or walking along roads in wet nighttime weather yielded large numbers of amphibians, especially during the spring or autumn. Unusual or secretive species were often observed in numbers on wet roads. Although there are no paved roads within The Preserve, we extensively sampled the paved roads that bordered the site. Roads bordering wooded swampland were particularly productive.

Dip nets of various sizes were employed in a variety of ways – turtles and frogs were captured by placing the net in front of fleeing animals, or by scooping up mud or aquatic vegetation into which these animals had retreated. Sweeping a dip net through the water while standing at the edge of a vernal pool or pond captured larval amphibians and newts. Unbaited minnow traps were used to collect newts and Ambystomid salamanders. Baited turtle traps consisting of metal hoops covered with one-inch nylon mesh with a single funnel opening, were very effective in sampling aquatic turtles particularly in the detection of spotted turtles (*Clemmys guttata*) in vernal pools. Road kills were an important source of reptile information. The site's database for ribbon snake (*Thamnophis sauritus*), black rat snake (*Elaphe obsoleta*) and spotted turtle were augmented by road kill specimens.

Voucher specimens of amphibians and reptiles were collected during this study. These collections were made under a scientific collecting permit issued to Dr. Michael W. Klemens by the CT Department of Environmental Protection. Preserved specimens of amphibians and reptiles, deposited in a nationally recognized museum collection have several important functions. A specimen with complete data, including the place, date, and collector, in a well-curated museum collection, provides incontrovertible proof of the occurrence of a certain species at a certain locality and a given point in time. Such data will stand the test of time in a manner that GIS databases and photographic collections cannot. In addition, study of preserved specimens provides information on morphometric and pattern variations, reproductive cycles, food habits, hybridization, as well as some forms of environmental pollution. The collection of such voucher specimens if done judiciously and with respect to the environment and to the populations of these animals will not adversely impact the survival of the species. Certain species, however, are dependent upon the survival of long-lived adults. These include many turtles and some large snakes. Such sensitive species were not collected as voucher specimens unless found dead.

A GIS database of species occurrences of reptiles and amphibians was created with technical assistance of BL Companies. All occurrences of amphibians and reptiles were mapped by hand by Michael W. Klemens, LLC and then input into BL's GIS system. Each species was entered as a GIS layer; in addition, separate layers were created to distinguish between breeding sites versus terrestrial observations of the following vernal pool obligate/facultative amphibians: spotted salamander, marbled salamander, red-spotted newt, and wood frog. Once the GIS maps were created, they were re-checked dot-by-dot against the original hand-drawn maps to ensure the accuracy of the transferred data. The complete data set is shown on Map 1.

The primary data source was the field investigations that we conducted from 14 October 2002 to 3 June 2004. Some additional information was also incorporated from the report prepared by Mr. Ron Gautreau of Evans Associates (1999) for the previous applicant. I have worked with Mr. Gautreau on several projects and am confident of his ability to properly identify reptiles and amphibians in the field. Mr. Ed Pawlak of Connecticut Ecosystems LLC provided additional unpublished data. Mr. Pawlak had collected these data on behalf of River Sound Development, LLC during field season 2002. The bulk of Mr. Pawlak's data included amphibian egg mass counts at vernal pools plus several additional spotted turtle records. However, in excess of 95 percent of the herpetological data presented in this report was collected by Michael W. Klemens, LLC. These data include all the occurrences of State-listed Special Concern reptile species.

To evaluate the vernal pool resources, I followed the methodology outlined by Calhoun and Klemens (2002) that assesses vernal pools on their biological components and landscape integrity. Using this methodology, the pools with the highest biological values and intact landscape rate as Tier One and those that have reduced biological values and a degraded landscape rate as Tier Three. Those pools that are intermediate between these

two conditions were rated as Tier Two. Calhoun and Klemens (2002) uses an objective, scientifically determined scoring system to arrive at the Tier level.

Results I: Herpetofaunal Analyses

SALAMANDERS

Spotted Salamander (*Ambystoma maculatum*) – Map 3

The spotted salamander is Connecticut's most common mole salamander, widely distributed throughout the State. None-the-less, it is declining in many areas because of the loss of upland habitat surrounding its breeding habitats (Klemens, 2000). Vernal pool species such as the spotted salamander require that 75% of the upland habitat (defined as 750 feet from the high water level of the vernal pool) remain intact (Calhoun and Klemens, 2002). Spotted salamanders breed in March and April. The distribution of the spotted salamander is shown on Map 3. Breeding pools, confirmed by the presence of eggs and/or larvae are indicated as diamonds. This species breeds in the southern end of Pequot Swamp Pond. Terrestrial observations of spotted salamanders are shown as circles. One should note that the majority of terrestrial observations fall within the outer red lines encircling the breeding (= vernal pools). This outer line corresponds to the 750-foot limit around the pool, supporting the need to conserve upland habitat as described in Calhoun and Klemens (2002).

Marbled Salamander (*Ambystoma opacum*) – Map 4

The marbled salamander is widespread in Connecticut, but most commonly encountered in low-lying areas of the coast and Central Connecticut lowland. It is scarce/absent from areas above 900 feet in elevation. It is much less frequently encountered than the spotted salamander. This is due to its more limited geographic distribution, but also its reliance on long-hydroperiod vernal pools. Marbled salamanders are quite widespread on The Preserve; in fact the concentrations of this species are quite unique to the site. This is because of a convergence of factors including its geographic location, forest cover, and dry, friable soils. However, the most important attribute of The Preserve for marbled salamanders is the abundance of long-hydroperiod vernal pools on the site. This is because almost all of the vernal pools at The Preserve are of the type Calhoun and Klemens (2002) classified as cryptic vernal pools. These are pools imbedded in larger swamp systems, and as such, tend to hold water for longer periods of time than do classic vernal pools, which are stand-alone depressional basins in the forest. Map 4 illustrates the distribution of marbled salamander breeding sites, confirmed by congregating adults, larvae, or metamorphs with diamonds. Marbled salamanders also breed in the southern end of Pequot Swamp Pond. Circles indicate terrestrial observation. Unlike spotted salamanders, marbled salamander return to dry vernal pools to breed from, September to October. As with the spotted salamander, most of the terrestrial observations fall within the 750-foot upland habitat zone of a breeding pool. A cluster of terrestrial observations on the western portion of the site, near the Essex/Old Saybrook/and Westbrook town lines, are likely attributable to a vernal pool that lies just off of The Preserve property.

Northern Dusky Salamander (*Desmognathus fuscus*) – Map 5

The northern dusky salamander requires clean, cool seepage areas for its survival. Statewide it is declining because of the loss of habitat due to urbanization (Klemens, 1993; 2000). Evans Associates (1999) reported a single site for dusky salamanders on The Preserve. Our subsequent field investigation has determined that this species is quite widespread on the site, as illustrated on Map 5.

Northern Two Lined Salamander (*Eurycea bislineata*) – Map 6

The northern two-lined salamander is secure within Connecticut. Klemens (1993) hypothesized that this species may be expanding into the niche vacated by dusky salamanders in urban and suburban sections of the State. At The Preserve, there are slightly more records of this species than the dusky, however, the populations of both species appear to be in equilibrium, indicative of the quality and unfragmented nature of the habitat on the site.

Four-Toed Salamander (*Hemidactylium scutatum*) – Map 7

The four-toed salamander had not previously been reported on the site. We made eleven collections of this species during our surveys, associated with wooded swamp ecosystems. Although secretive, the four-toed salamander, Connecticut's smallest salamander, is actually quite widespread. It seems to favor acidic, friable soils such as found at The Preserve.

Redback Salamander (*Plethodon cinereus*) – Map 8

The red back salamander is Connecticut's most widespread and abundant salamander, comprising a significant amount of the terrestrial biomass of the deciduous forest biome. The sites illustrated on Map 8 are those where we actually collected voucher specimens, however the redback salamander was found throughout the site.

Red Spotted Newt (*Notophthalamus viridescens*) – Map 9

The red-spotted newt, once thought to be common, is now recognized as a declining species in Connecticut (Klemens, 2000). This is in part due to its extensive terrestrial upland habitat use, which occurs during the juvenile "eft" stage. Therefore, newts have many of the same constraints on their ecology and life history, as do vernal pool species such as mole salamanders and wood frogs. A large breeding population of red-spotted newts occurs in Pequot Swamp Pond. Map 9 illustrates both the breeding sites (confirmed by larvae or aquatic adult salamanders) as diamonds, while the terrestrial occurrences of the juvenile eft state are shown by circle. The red-spotted newt appears far more abundant on the western portions of the site.

FROGS

American Toad (*Bufo americanus*) – Map 10

The American toad, while very common throughout the State, appears to be quite localized and scarce on The Preserve. Breeding sites were located in the ruts and puddles under the powerline right of way. Such shallow and disturbed edge habitats are this species preferred breeding sites. The American toad is one of several ubiquitous species that are surprisingly uncommon at The Preserve.

Northern Spring Peeper (*Pseudacris crucifer*) – Map 11

The northern spring peeper is widely distributed within Connecticut. It breeds in a wide variety of wetlands on The Preserve, including vernal pools, wooded swamps, and wet meadow habitats on the power-line-right of way. Non-breeding adults and juveniles were found in woods and shrubby habitats throughout the site.

Gray Treefrog (*Hyla versicolor*) – Map 12

The gray tree frog is a declining species in Connecticut. It requires open shrubby habitats for breeding, avoiding more densely forested wetlands. It appeared to be most abundant on the eastern side of the site, but also breeds in Pequot Swamp Pond.

Bullfrog (*Rana catesbeiana*) – Map 13

The bullfrog is a ubiquitous species in Connecticut, reaching high densities in disturbed and altered wetlands. It is one of a group of common species of amphibians and reptiles that are strikingly rare at this site. In the case of the bullfrog, the rarity is likely a synergistic effect between the lack of disturbed wetland habitats and the overall scarcity of open water habitats that are favored by this species. It may be that it is habitat limited, as its distribution on the site is almost identical to the gray treefrog, another species requiring open wetland habitat types.

Green Frog (*Rana clamitans melanota*) – Map 14

The green frog is another common frog species widely distributed on The Preserve. It is able to exploit a wide variety of wetland habitats, including vernal pools and forested wetlands, reflected in its distribution on Map 14.

Pickerel Frog (*Rana palustris*) – Map 15

The pickerel frog is another common species, found in grassy habitats associated with a variety of wetland systems. It was concentrated on the seasonally damp, flooded woods roads and logging trails on the site. These logging roads were often in the early stages of re-vegetation, and the pioneer species were often grasses, sedges, and ferns, providing important habitat for this species.

Wood Frog (*Rana sylvatica*) – Map 16

The wood frog is widely distributed throughout the State. None-the-less, it is declining in many areas because of the loss of upland habitat surrounding its breeding habitats (Klemens, 2000). Vernal pool species such as the wood frog require that 75% of the upland habitat (defined as 750 feet from the high water level of the vernal pool) remain intact (Calhoun and Klemens, 2002). Wood frogs breed in March and early April. The distribution of the wood frog is shown on Map 16. Breeding pools, confirmed by the presence of eggs and/or tadpoles are indicated as diamonds. This species breeds in the southern end of Pequot Swamp Pond. Terrestrial observations of wood frogs are shown as circles. One should note that the majority of terrestrial observations fall within the outer red lines encircling their breeding (= vernal) pools. This outer line corresponds to the 750-foot limit around the pool, supporting the need to conserve upland habitat as described in Calhoun and Klemens (2002).

TURTLES

Snapping Turtle (*Chelydra serpentina*) – Map 17

The snapping turtle is another ubiquitous species, widespread in Connecticut, especially abundant in disturbed habitats, that is strikingly rare on The Preserve. A single snapping turtle was found the site. Although live turtle trapping captured both painted and spotted turtles, snapping turtles were not found in any of the traps, even in habitats such as Pequot Swamp Pond, where they would be expected to occur.

Painted Turtle (*Chrysemys picta*) – Map 18

Painted turtles were concentrated in areas of open water and shrubby swamp-riparian corridors. A large population occurs in Pequot Swamp Pond and in the southeastern corner of the site in the Oyster River headwaters. Another concentration was found in the large beaver impoundment south of Ingham Hill Road in Essex. The painted turtle is a common species, though open water habitat to support this species on the site is quite limited

Spotted Turtle (*Clemmys guttata*) – Map 19

Spotted turtles are vernal pool facultative species (Calhoun and Klemens, 2002) that are declining throughout Connecticut (Klemens, 2000). A vernal facultative species is often associated with, but not dependent upon, vernal pools. Spotted turtles were found in low numbers throughout the site, which is consistent with their life history strategy. The maximum number of turtles observed or captured in any one wetland was two individuals. Spotted turtles were observed with binoculars basking in pools, and were live trapped and released using baited hoop nets. A gravid female spotted turtle was found dead on Rte. 153, immediately west of the project site.

Eastern Box Turtle (*Terrapene carolina carolina*) – Map 20

The eastern box turtle is a Connecticut Species of Special Concern. It is declining in most sections of the State (Klemens, 2000) due to habitat fragmentation and loss of long-

lived adult to roads mortality and collection. Its distribution within the State is centered along the coast and in the Central Connecticut Lowland northward into Massachusetts. It is absent from the western and eastern hills and highlands (Klemens, 1993). Box turtles are long-lived vertebrates, approaching over 100 years, and usually occur in small populations. A total of five box turtles were found on The Preserve. These were measured, tagged, and released. Two turtles were found associated with a stream corridor in Westbrook, two turtles were found in a seasonally wet, cleared log landing in Essex, and a single turtle was found southeast of Pequot Swamp Pond above a vernal pool near Ingham Hill Road in Old Saybrook.

Turtle Mark No.	Sex	Carapace Length	Weight	Age (Years)
L-1	Male	156.0 mm	630 gm	over 25
L-2	Male	154.5 mm	645 gm	25-35
L-3	Male	126.5 mm	335 gm	13
R-1	Female	151.5 mm	640 gm	18
R-2	Female	141.0 mm	530 gm	15

SNAKES

Eastern Worm Snake (*Carphophis amoenus*) – Map 21

The eastern worm snake is a secretive, fossorial species most commonly found in the low-lying sandy areas of the State. Its status is uncertain, but appears to be secure in Connecticut (Klemens, 2000). My research on The Preserve resulted in six stations for this species. Its distribution correlated with areas of ledges and sandy, dry soils. No worm snakes were found in the southeastern portion of the site, though that may be an artifact of collection, rather than a distributional phenomena.

Northern Black Racer (*Coluber constrictor constrictor*) – Map 22

All but one record of this large, active diurnal black snake occurred on the powerline right-of-way, where the management regimes geared toward managing up-growth of woody vegetation regimes create optimal habitat for this open meadow and field species. A single black racer was found at the edge of a mowed field adjacent to the assisted living facility in Essex. Although widely distributed in Connecticut (except the most upland areas), the black racer has become scarce in many areas due to road mortality and habitat fragmentation, and the succession of open habitats to second growth forest. A major den area for this species was identified just to the northeast of Vernal Pool No.1.

Northern Ringneck Snake (*Diadophis punctatus edwarsii*) – Map 23

The small, secretive ringneck snake was widely distributed on the site often associated with forested, mesic slopes above swamps, vernal pools, and other wetlands. Records were concentrated on the western portions of the site (W of Pequot Swamp Pond) and in the northeast section of the site along the Essex and Old Saybrook town lines, but other occurrences were scattered across the site. This species is secure within Connecticut.

Black Rat Snake (*Elaphe obsoleta obsoleta*) – Map 24

The black rat snake is a common species in Middlesex County where is occurs both at the edges of human habitation, and in second growth forest, especially of the type that occurs on the site, i.e., dry oak dominated forest with ledges and grassy balds. It was not as common, however, as I would have anticipated given the abundance of suitable habitat on the site. A pair of snakes, including a gravid female was found at the snake den site above Vernal Pool No.1, cohabiting with a large population of black racers. Shed skins of other snakes were found around Vernal Pool No. 1 and at the snake den area. A very large snake (at least six feet in length) was found on a grassy bald in the southwest portion of the site, and a juvenile was found in the southeastern corner of the site. A dead-on-road snake was found on Ingham Hill Road, near the junction of Rte. 153.

Northern Water Snake (*Nerodia sipedon sipedon*) – Map 25

The northern water snake is a very common species in Connecticut, yet like the bullfrog and snapping turtle, it was rarely encountered on the site as shown on Map 25. One water snake was found on the site proper, in the wetlands on the powerline right-of-way at the CL&P in-holding. Two water snakes were found on Ingham Hill Road in Essex, at the northeastern portion of the site, and a water snake was found off site in a flooded gravel pit associated with the headwaters of the Oyster River.

Eastern Ribbon Snake (*Thamnophis sauritus sauritus*) – Map 26

The eastern ribbon snake is a Connecticut State-listed Special Concern Species, which is quite widely distributed on the site. This is consistent with its distribution in Connecticut (see Klemens, 1993) where is tends to occur in clusters. Scattered occurrences were found through out the site, though the major occurrence of these snakes occurred under the wet powerline right-of-way along the Essex/Old Saybrook town line. Young ribbon snakes were observed at the snake den area, above Vernal Pool No. 1, microsympatric with black rat snakes and black racers.

Eastern Garter Snake (*Thamnophis sirtalis sirtalis*) – Map 27

The eastern garter snake, like the bullfrog, snapping turtle, and water snake is a ubiquitous species in Connecticut that is, however, very uncommon on the site. Four specimens were found at widely scattered location on The Preserve.

RESULTS II: VERNAL POOL ANALYSES

Thirty-one vernal pools were documented on the site. These are illustrated on Map 2A. Twenty-eight of these were on the original parcel and were studied by Pawlak in 2002 as well as by me in 2003. Two additional pools (29 and 30) were documented on the land purchased between the Valley Railroad tracks and Bokum Road (a.k.a. the Pianta tract). One additional vernal pool (No. 31) was documented by me in 2003 on the main portion

of the site. As the majority of these pools were contained within a larger wetland system (i.e., cryptic vernal pools *sensu* Calhoun and Klemens, 2002), a separate numbering system was devised for these specialized wetland areas. These are illustrated on Map 2A and discussed on Tables 1 and 2.

Almost all vernal pools with the site can be classified as Tier One pools based on the criteria developed by Calhoun and Klemens (2002).

> These are pools of the highest quality with several obligate species breeding in them, with intact vernal pool envelopes (the zone from the high water mark of the pool up to 100 feet from the pool edge) AND with more than 50% of the associated critical upland habitat intact. One should note that to be rated Tier One the threshold is 50% development or less, however, as design standards for *de novo* development, these authors recommend no more than 25% development within that zone. The difference is between what parameters are required to rate of pool of conservation quality/concern, versus what the best science shows is optimal for the amount of development to be allowed.

However, upon close observation it became clear that it was important to identify priorities among these pools—so that protecting the most productive and diverse pools as part of the site design process would allow them to remain interconnected as stepping stones of biological diversity in the post-development landscape.

These key priority pools are the most important ecological determinant for preservation of the site. The criteria used to define were therefore based on two categories of information: the relative diversity and productivity of species occurring within and around individual pools.

In terms of VERNAL POOL OBLIGATE SPECIES DIVERSITY, even though there are three obligate species found in The Preserve (spotted salamander, marbled salamander, and wood frog), not all species were present in all the vernal pools. Those pools containing all three obligate species were therefore more important.

In terms of VERNAL POOL OBLIGATE SPECIES PRODUCTIVITY, the egg mass counts of spotted and wood frogs in certain pools numbered in the hundreds. These egg mass count data were collected in 2002 (Pawlak, unpublished data). These productivity levels were reconfirmed in 2003. By sheer numbers of breeding adults, larval amphibians, and productivity, such pools were very important to the maintenance of vernal pool amphibians on the landscape, as well as being important to the production of food and energy cycling within the deciduous forest on The Preserve.

The PRESENCE OF VERNAL POOL FACULATIVE SPECIES, such as spotted turtles and four-toed salamanders within a vernal pool ecosystem was also considered to be important and/or the PRESENCE OF STATE-LISTED SPECIAL CONCERN SPECIES, i.e., the ribbon snake and box turtle was also considered to add value to a pool.

Of the twelve highest priority pools—those qualified on the basis of having the maximum obligate species diversity and productivity, as well as the presence of facultative and/or special concern special concern species—all were conserved through the use of stringent standards applied to the adjacent development. These standards include a maximum of 25% development with the 100-750 foot critical upland habitat zone, the exclusion of development in the vernal pool envelope, the 0-100 foot zone, and mitigating measures, such as special designed wildlife underpasses or roadway barrier to exclude animals from the road surface, thereby encouraging maximum wildlife habitat connectivity, as well as application of strict turf management guidelines to golf course development and maintenance, and mitigating measures to avoid stormwater management impacts to vernal pools.

Following is a description of the rankings of each vernal pool, grouped into terms of the highest, intermediate, and lowest priority pools. As a result of this ranking, all of the highest priority pools were conserved. In addition, two intermediate and one low priority pool were conserved, bringing to 15 the number of pools conserved by this scientifically-informed site design process.

High Priority Pools (N=12)

Vernal Pool No. 18: This is considered to be the most important vernal pool on The Preserve, producing over 1200 spotted salamander egg masses, and large rafts of wood frog egg masses, as well as a population of marbled salamanders. I found brooding marbled salamanders in this pool in October 2002. Marbled salamanders were found on land surrounding this pool in 2003. I considered this the most important vernal pool on The Preserve, based on its exceptional productivity.

Vernal Pool No. 20: One of the few classic long-hydroperiod vernal pools on the site. Calhoun and Klemens (2002) defined the classic vernal pool as a depression in the forest floor. In the case of classic vernal pools the wetland depression equals the vernal pool. In the case of the cryptic vernal pool, the pool area is a much smaller subset of a larger wetland. As stated previously the majority of vernal pools on The Preserve are of the cryptic type, therefore I considered it important to conserve this pool based on its ecological distinctiveness, but also because it contained approximately 500 spotted salamander eggs masses, and also served as breeding habitat for both wood frogs and marbled salamanders. I found brooding marbled salamanders in this pool in 2003. Pool No. 20 also contained fairy shrimp.

Vernal Pool 16: Contains robust populations of all three obligate vernal pool amphibians, including more than 230 spotted salamander eggs masses and large rafts of wood frog eggs. Marbled salamander larvae were dip netted in this pool in 2003 and spotted turtles, a vernal pool facultative species were live trapped in this pool in 2003. Marbled salamanders were found on land surrounding this pool in 2003.

Vernal Pool 31: Contains populations of all three vernal pool obligate species. A single eastern box turtle (State-listed Special Concern Species) was found twice within the vernal pool envelope of Vernal Pool 31.

Vernal Pool 7: Contains robust populations of all three obligate vernal pool amphibians, including approximately 342 spotted salamander egg masses and approximately 43 wood frog egg masses. Marbled salamanders and fairy shrimp were confirmed breeding in this pool in 2002.

The following five vernal pools (Nos. 6, 10, 12, 15, 25) rank as "high priority" in terms of wood frog and spotted salamander production. However, marbled salamanders have not been confirmed in these wetlands, though it is likely that this species may also occur is some of these wetlands.

Vernal Pool No. 15: Also contains a population of eastern ribbon snakes (*Thamnophis s. sauritus*) and eastern box turtles (*Terrapene c. carolina*) were found nearby. Both these are State-listed Special Concern Species. More than 205 spotted salamander eggs masses, and more than 105 wood frog egg masses were found in this pool.

Vernal Pool No. 6: This pool contains a breeding population of wood frogs and spotted salamanders as well as spotted turtles. Approximately 110 spotted salamander egg masses and approximately 125 wood frog eggs masses were present in this pool in 2002.

Vernal Pool No. 10; Vernal Pool No. 12; Vernal Pool 25: These pools contain significant documented breeding populations of both wood frogs and spotted salamanders, Marbled salamanders may also be found In Pool 10 based upon the presence of several terrestrial records within the 750-foot upland habitat zone surrounding the pool. Egg mass counts in 2002 were: Pool 10: more than 355 spotted salamanders and 125 wood frogs; Pool 12: 152 spotted salamanders, approximately 75 wood frogs; Pool 25: 139 spotted salamanders, approximately 100 wood frogs.

The following two vernal pools (Nos. 1, 17) are important for spotted salamander production only. However, they have other important attributes that make them high priority conservation areas.

Vernal Pool No. 17: This is a classic short hydroperiod vernal pool. It contains a large population of spotted salamanders (more than 289 egg masses in 2002). Wood frog production was very low in this pool in 2002 and 2003. A spotted turtle was observed basking in this pool in 2003. It is probably the only example of a short hydroperiod classic vernal pool on The Preserve.

Vernal Pool No. 1: This pool contains a large population of spotted salamanders (approximately 330 egg masse in 2002), but is also part of the critical habitat zone encompassing Wetland 17 (of which this pool is part of) and Wetland 16. The ridge between Wetlands 17 and 16 contains a snake den used by black racers, black rat snakes,

ringneck snakes, as well as by ribbon snakes, the latter are a State-listed Special Concern Species.

Intermediate Priority Pools (N=6)

The following data are from pools that were studied in 2002 and/or 2003. These were defined as a lower level of priority based either on productivity and/or diversity of vernal pool obligate species and the absence of key facultative species, including State-listed Special Concern Species. However, the presence of significant numbers of spotted salamanders resulted in these being ranked as "intermediate priority." Of these six pools, we were able to conserve two, No. 8 and No. 11, as part of the design process.

Pool No.	Spotted Sal. Eggs	Wood Frog Eggs	Marbled Sal.	Fairy Shrimp
5	70	2	Y	N
8	129	25	N	N
9	70	1	N	N
11	77	102	N	N
19	131	0	N	N
23	103	0	N	N

Low Priority Pools (N=13)

The following data are from pools that were studied in 2002 and/or 2003. These were defined as lowest priority based either on productivity and/or diversity of vernal pool obligate species and the absence of key facultative species, including State-listed Special Concern Species. Of these pools, Pool 28 has been conserved in the design process.

Pool No.	Spotted Sal. Eggs	Wood Frog Eggs	Marbled Sal.	Fairy Shrimp
2	0	2	N	N
3	22	0	Y	Y
4	2	1	Y	Y
13	19	5	N	N
14	29	81	Y	Y
21	20	4	Y	N
22	31	4	N	Y
24	7	13	Y	Y
26	Present	0	Y	N
27	Present (?1)	1 metamorph	N	N
28	19	1	Y	Y
29	25	15	N	N
30	?	metamorphs	metamorph	N

(Note about No. 30: The presence of metamorph wood frogs, a single metamorph marbled salamander, and a young spotted turtle on the Valley Rail Road tracks near this pool may have come from this pool, or from the larger swamp on the west side of the RR

tracks. An additional wetland located to the southeast of this wetland, partially off site was not studied. It may also have some vernal pool functions.)

Discussion

The Preserve is distinguished not so much by the diversity of species that occur on site, but rather by the number of sites where many of these species are found or were documented breeding. Therefore, while The Preserve may be only moderately diverse, it has high levels of biomass of individual species. The number of vernal pools and vernal pool obligate species is noteworthy, and presented special challenges in the site design. As a conservationist, I recognize that the best conservation solution for the site would be its protection, but equally important, if the site is to be developed, it must be developed using the best available science to make informed decisions about the location of development and the design and placement of infrastructure. My goal here was to work on the premise that development was going to occur on site, and that it was going to occur using a PRD (Planned Residential Development) and/or conservation subdivision that would allow for significant open space protection.

Under those premises, the Applicant made a commitment to voluntarily design the project using vernal pool data, and to site the open space and protected areas in a manner that was ecologically meaningful. Percent open space is just a number, but my goal was to make that open space part of an ecologically functional system--using best available science both to call out those areas most in need of protection and stewardship, and to ensure that these critical areas were assembled in the landscape in interconnected habitat blocs. And again, those blocs of habitat needed to be connected using animal movement and occurrence data, not some educated guess of where animals may move and what habitats they might use. The site plan presented by the Applicant is a result of that design process, which involved no fewer than 15 design team meetings at BL in which my data was worked through the site design process.

The resulting proposed development protects all documented occurrences of State-listed Special Concern reptiles (i.e., box turtle and ribbon snake). It protects the snake den, all twelve of the highest priority vernal pools, two intermediate vernal pools, and one of the lowest priority vernal pools. In total fifteen vernal pools are conserved (see Map 2B) protecting representative populations of all other amphibians and reptiles that occur on the site. Therefore, although the biomass of amphibians and reptiles will be reduced by the development, viable populations of amphibians and reptiles will continue to flourish on the site in the post-development phase.

The vernal pool conservation plan is the centerpiece of the biodiversity conservation strategy for The Preserve. This plan has created an interconnected area of habitat, with the vernal pool protection zones functioning as stepping stones for wildlife to use to move throughout the open space areas of The Preserve. Development within the 750-foot conservation zone around each of the 15 conserved pools follow the design guidelines set

out in Calhoun and Klemens (2002). The vernal pool envelope is protected (the zone from 0-100 from the pool). In some instances, specifically pools No. 16 and 31, the development shown in the vernal pool envelope is a pre-existing off-site condition. The critical upland habitat zone is protected by allowing no more than 25% development, and that development follows the design standards set forth in Calhoun and Klemens (2002). Golf course development is calculated to the same standards as paved surfaces and houses, although the golf course has been designed to allow amphibians to traverse it without becoming trapped in drains and other man-made structure, nor being exposed to harmful levels of pesticides or fertilizers (see Environmental Turf Services report). The golf course areas of the site, while not providing habitat, will allow for movement of amphibians between vernal pools and between individual pools and their associated upland terrestrial habitats.

In order to facilitate movement of amphibians and other wildlife through the site, wildlife underpasses have been created at key road/habitat junctures. Map 28 shows the location of these underpasses and the connectivity between the vernal pools that wildlife will use as in a stepping stone fashion to move through the protected open space areas of The Preserve. Detail 1 illustrates the design standards to which these wildlife underpasses will be built, allowing light penetration and high clearance over the habitat linkage. In short, these are not dark tunnels, which discourage most species movements, even at night, but rather structures that give the animals the sense that they are moving to something lit and visible, not down a dark hole.

In order to avoid road mortality, within the designated critical upland habitat zones of the conserved vernal pools, the curbs have been designed to either deflect animals off of high-traffic road surfaces into wildlife underpasses OR to facilitate their unimpeded movements across low-traffic road surfaces (see Detail 2). Within the vernal pool critical upland habitat zones, great care has been given to stormwater management, to avoid the creation of decoy wetlands and the capture and mortality of animals in stormwater BMPs such as hydrodynamic separators (see Calhoun and Klemens, 2002). Road management standards and lighting standards will also follow Calhoun and Klemens (2002). Detail on the inter-digitation of vernal pools with the roadway design and stormwater management can be found in the engineering reports prepared by BL Companies which are part of the Applicant's submission.

In summary, the site plan has been designed to accommodate wildlife needs. This has occurred over the last half year as data became available, through a series of design charettes with all team members. The final product is a development that has been adapted to and redesigned to accommodate wildlife and to conserve the site's biological diversity. While falling short of a totally protected area, what we have accomplished is the protection of the site's amphibians, reptiles, and vernal pool ecosystems, by making intelligent choices about where to and where not to develop.

From a conservation perspective (and from an ecological function perspective) it is better to intensify protection in certain areas, well in excess of the required standards, and designate other parts of the site for development, rather than attempt to do a little

protection everywhere. From a biological perspective, a little protection does nothing to secure the long-term values of the site. What is needed, and what was done by this Applicant, is to focus development in certain areas, thereby allowing an ecologically resonant, interconnected system of wetlands and forest to remain on site, with sufficient upland habitat intact to allow animals to function in this vernal pool landscape as they have for centuries.

Literature Cited

Calhoun, A. J. K. and M. W. Klemens. 2002. Best development practices: Conserving pool-breeding amphibians in residential and commercial development in the northeastern United States. MCA Technical Paper No. 5, Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, New York.

Evans Associates. 1999. Herpetological survey report for The Preserve site: Towns of Old Saybrook and Essex, Middlesex County, Connecticut.

Klemens, M. W. 1993. Amphibians and reptiles of Connecticut and adjacent regions. State Geological and Natural History Survey of Connecticut, Bulletin 112. Connecticut Department of Environmental Protection, Hartford, CT.

Klemens, M. W. 2000. Amphibians and reptiles in Connecticut: A checklist with notes on conservation status, identification, and distribution. Connecticut Department of Environmental Protection, DEP Bulletin No. 32, Hartford, CT

TOWN	SITE AREA
OLD SAYBROOK	893.2 ± AC.
ESSEX	70.8± AC.
WESTBROOK	3.7± AC.
TOTAL	967.5± AC.

LEGEND

- CL & P EASEMENT
- WETLANDS
- 100 FT. WETLAND BUFFER
- CONSERVED VERNAL POOLS
- NON-CONSERVED VERNAL POOLS
- 750 FT. VERNAL POOL BUFFER (CONSERVED)

OBSERVATIONS LEGEND:
PRIORITY CONSERVATION SPECIES

CONNECTICUT LISTED SPECIAL CONCERN SPECIES
- BOX TURTLE
- RIBBON SNAKE

VERNAL POOL OBLIGATE SPECIES
- SPOTTED SALAMANDER BREEDING POOL
- SPOTTED SALAMANDER TERRESTRIAL
- MARBLED SALAMANDER BREEDING POOL
- MARBLED SALAMANDER TERRESTRIAL
- WOOD FROG BREEDING POOL
- WOOD FROG TERRESTRIAL

VERNAL POOL FACULTATIVE SPECIES
- FOUR TOED SALAMANDER
- RED SPOTTED NEWT BREEDING POOL
- RED SPOTTED NEWT TERRESTRIAL
- GRAY TREEFROG
- SPOTTED TURTLE

ESSEX
WESTBROOK
ESSEX
OLD SAYBROOK
153
CONNECTICUT ROUTE
TOWN LINE
WESTBROOK
CL&P EASEMENT
BOKUM ROAD
CONNECTICUT VALLEY RAILROAD (VALLEY BRANCH)
SCHOOL HOUSE ROAD
HOLLOW ROAD
PEPPERIDGE TRAIL
DEER RUN
LEADA WOODS ROAD
INGHAM HILL ROAD
WILD APPLE LANE
PHEASANT HILL ROAD
FOX HILL ROAD
BARLEY HILL ROAD

GRAPHIC SCALE
400 200 0 400
SCALE IN FEET

PLANNING COMMISSION EXHIBIT #676

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355 Research Parkway
Meriden, CT 06450
(203) 630-1406
(203) 630-2515 Fax

MICHAEL W. KLEMENS, LLC
Data Collected and Mapped By
Michael W. Klemens PhD
68 Purchase St.
3 rd Floor Suite 2
Rye, NY 10580

THE PRESERVE
OLD SAYBROOK, WESTBROOK, ESSEX
MIDDLESEX COUNTY, CONNECTICUT

REVISIONS		
No.	Date	Desc.
1	6/9/05	SUPPLEMENTAL FIELD WORK
2	8/23/05	SUPPLEMENTAL FIELD WORK

Designed	X.X.X.
Drawn	K.T.
Checked	
Approved	
Scale	1"=400'
Project No.	01C955-F
Date	XX/XX/XX
CAD File	AMC95509-rev

Title
ECOLOGICAL CONNECTIVITY VERNAL POOL STEPPING STONES INTO UPLAND HABITAT

Sheet No.

DISTRIBUTION MAP 28
REVISED

Jan 05, 2006 10:45am gwmuer F:\ACAD\01c955-F\dwg\Habitat\AMC95509-rev.dwg
Layout: 11x17 OVERALL