East Guilford
Natural Resource Inventory
Guilford, Connecticut

King's Mark
Environmental Review Team
Report

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

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Environmental Review Team Report

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

For the

First Selectman, Inland Wetland Commission,
Planning & Zoning Commission and the Conservation Commission
Guilford, Connecticut

Report # 332

November 2005

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Acknowledgments

This report is an outgrowth of a request from the Guilford First Selectman, and the Inland Wetland, Planning and Zoning and Conservation Commissions to the Southwest Conservation District (SWCD) and the King's Mark Resource Conservation and Development Area (RC&D) Council for their consideration and approval. The request was approved and the measure reviewed by the King's Mark Environmental Review Team (ERT).

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

The field review took place on Wednesday, June 29, 2005.

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I would also like to thank Leslie Kane, environmental planner, Charles Bishop, first selectman, and the chairmen of the inland wetland, planning and zoning, and conservation commissions for their cooperation and assistance during this environmental review.

Prior to the review day, each Team member received a summary of the proposed project with location and soils maps. During the field review Team members were given additional information and maps. Some Team members conducted a map review only and others made additional site visits. Following the review, reports from each Team member were submitted to the ERT coordinator for compilation and editing into this final report.

This report represents the Team's findings. It is not meant to compete with private consultants by providing site plans or detailed solutions to development problems. The Team does not recommend what final action should be taken on a proposed project - all final decisions rest with the town and landowners. This report identifies the existing resource base and evaluates its significance to the proposed use, and also suggests considerations that

should be of concern to the town. The results of this Team action are oriented toward the development of better environmental quality and the long term economics of land use.

The King's Mark RC&D Executive Council hopes you will find this report of value and assistance in the review and management of this area of the Town of Guilford.

If you require additional information please contact:

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Meeting with Team members prior to the field walk.

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Introduction

Introduction

The Guilford First Selectman, Inland Wetland, Planning and Zoning and Conservation Commissions have requested Environmental Review Team (ERT) assistance in reviewing an area they are calling “East Guilford” for a natural resource inventory and assessment.

The area is defined as that portion of town between Tanner Marsh and Nut Plains Roads on the west, North Madison Road on the north, Podunk Road on the east and I-95 on the south. The area is estimated to be in excess of 3000 acres (the outline boundary was digitized and the area was calculated to be 3,312 acres).There has been significant recent development in this area as well as acquisition of large tracts of dedicated open space. A large +400 acre parcel in the center portion of the study area is currently being considered for subdivision development (Goss Property, Bearhouse Hill Road and Podunk Road). The southern portion of the study area is tidal and is being considered for designation as a Globally Important Bird Area by the National Audubon Society.

Objectives of the ERT Study

The town has requested the ERT to review this area because of concerns with the development in this section of town and they want some documentation of the area and assessment of the impacts to important resources to be found in East Guilford. The property owners of the large subdivision being proposed are not interested in participating directly in the ERT study, but the Guilford town officials feel that this ERT study of a much larger area will assist them in determining the appropriate level of development in this region with regard to natural resource opportunities and limitations. This report is not a detailed study but will be used as a guide to assist Guilford in planning how to best manage its natural and cultural resources while accommodating growth in this area. Areas of information requested include: geology, soils, watershed perspective, water quality, wetlands and watercourses, wildlife habitat, fisheries, recreation, land use, traffic and access and archaeological and historic significance.

The ERT Process

Through the efforts of the Guilford Selectman, the Inland Wetland, Planning and Zoning and Conservation Commissions this environmental review and report was prepared for the Town of Guilford.

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

The review process consisted of four phases:

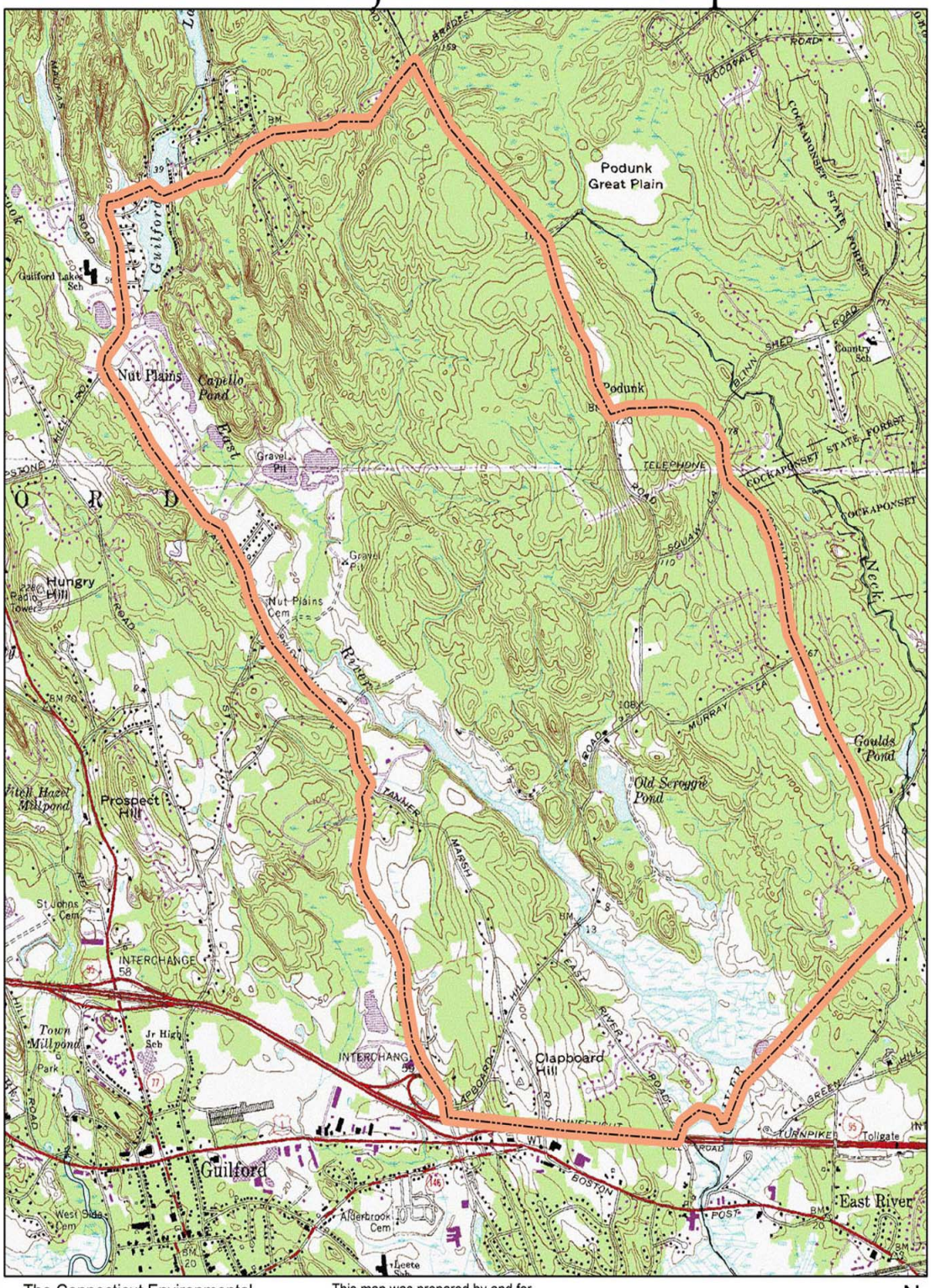
1. Inventory of the site's natural resources;
2. Assessment of these resources;
3. Identification of resource areas and review of plans; and
4. Presentation of education, management and land use guidelines.

The data collection phase involved both literature and field research. The field review was conducted Wednesday, June 29, 2005. The emphasis of the field review was on the exchange of ideas, concerns and recommendations. Being on site allowed Team members to verify information and to identify other resources.

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

East River

ERT Project Location Map



The Connecticut Environmental Review Team

This map was prepared by and for the Connecticut Environmental Review Team. This map is for educational use only. It contains no authoritative data. November 2005.

Topography and Geology

Topography

The East Guilford Natural Resource inventory area is located within the Coastal Slope landscape region (Bell, 1985) in Eastern Connecticut. In this region, the elevations of the highest hills decrease from north to south at a rate of about 50 feet/mile. Maximum hilltop elevations in the northern portion of the inventory area are about 250 feet above sea level whereas hilltop elevations along the southeastern boundary of the area are only about 130 feet.

The east and northern parts of the inventory area are occupied by rolling hills that have between 50-100 feet of relief. Several of the hills are oval shaped in map view, suggesting glacial sculpting during the last Ice Age.

The valley of the East River forms the western boundary of much of the area except along the southern-most region where the boundary diverges away from the river valley. The East River flows south-southeasterly from an elevation near forty feet above sea level in the north to near sea level in the south where it is tidal. The gradient of the East River is 20-25 feet/mile. Banks of gravel (technically called kame terraces) line both sides of most of the river valley in the inventory area. The banks stand 20-40 feet higher than the river. The banks were deposited by Ice Age melt-water streams and present a relatively flat surface that may be several hundred feet in width.

Bedrock Geology

The inventory area is on the southwestern flank of the Killingworth Dome and on the northeastern limb of the West River Syncline (Bernold, 1976; Rodgers, 1985). Two similar looking gneisses are exposed in the inventory area: the Monson Gneiss (Omo on the following Bedrock Materials Map) forms the core of the Dome and crops out in the northeast part of the inventory area. It is mantled by the overlying Middleton Gneiss (Omi on the following Bedrock Materials Map). Both were initially formed during the Ordovician Period (approximately 500-450 million years ago). They are thought to have been part of an ancient island arc system of volcanoes that were subsequently deformed and metamorphosed during several plate tectonic events in the mid and late Paleozoic Era.

The Monson Gneiss is a granitic gneiss in its lower part (not seen on the ERT field trip) and a light gray-colored plagioclase-quartz-biotite/hornblend gneiss and dark-gray amphibolite in its upper part.

The Middletown Gneiss is an anthophyllite bearing plagioclase-quartz-hornblende gneiss. The gneiss is distinguished from the Monson Gneiss by the presence of anthophyllite: the boundary between the two similar gneisses is placed on the map at the lowest anthophyllite bearing unit. Anthophyllite bearing units are distinctive in the field because they weather variegated yellow, red and purple and are thus easy to spot (Bernold, 1962). The anthophyllite mineral is harder to spot in the field and this reviewer was not aware of it until reading about the area. Anthophyllite forms in aggregates of parallel or radiating clusters of asbestiform fibers and indeed in places where it is abundant anthophyllite-bearing rocks have been mined for asbestos.

Surficial Geology

The town of Guilford was buried by a glacier during the last Ice Age, but was near the southern terminus of the ice sheet (see Flint, 1971; Bell, 1985, p.122-126; Stone and others, 1992). The Ice began melting about 20,000 years ago and Guilford melted free of the ice about 17,000 years ago (B.D. Stone *in* McHone, 2004). Glacial ice is a very efficient erosional agent and thus the ice carried abundant sediment in a variety of grain-sizes. When the ice melted all the debris frozen within the ice was left plastered over the land, on top of hills and in valleys, and formed the rocky soil that we see today. It is called glacial till. But the melting ice formed torrents that washed southward through the valleys to the sea. Streams of melt-water eroded some of the till and deposited the coarsest particles in the bottoms of the valleys through which the streams flowed. In many valleys, left over chunks of ice remained and were buried by the stream sediment. When the left-over ice melted the sand covering them collapsed forming the lowest part of the valley floor into which the streams flowed, leaving higher terraces along the valley sides. We refer to these terraces as kame terraces. They are a valuable natural resource and are mined in many places in Connecticut and adjacent states for sand and gravel. They also are excellent shallow aquifers from which abundant yields of groundwater may be extracted.

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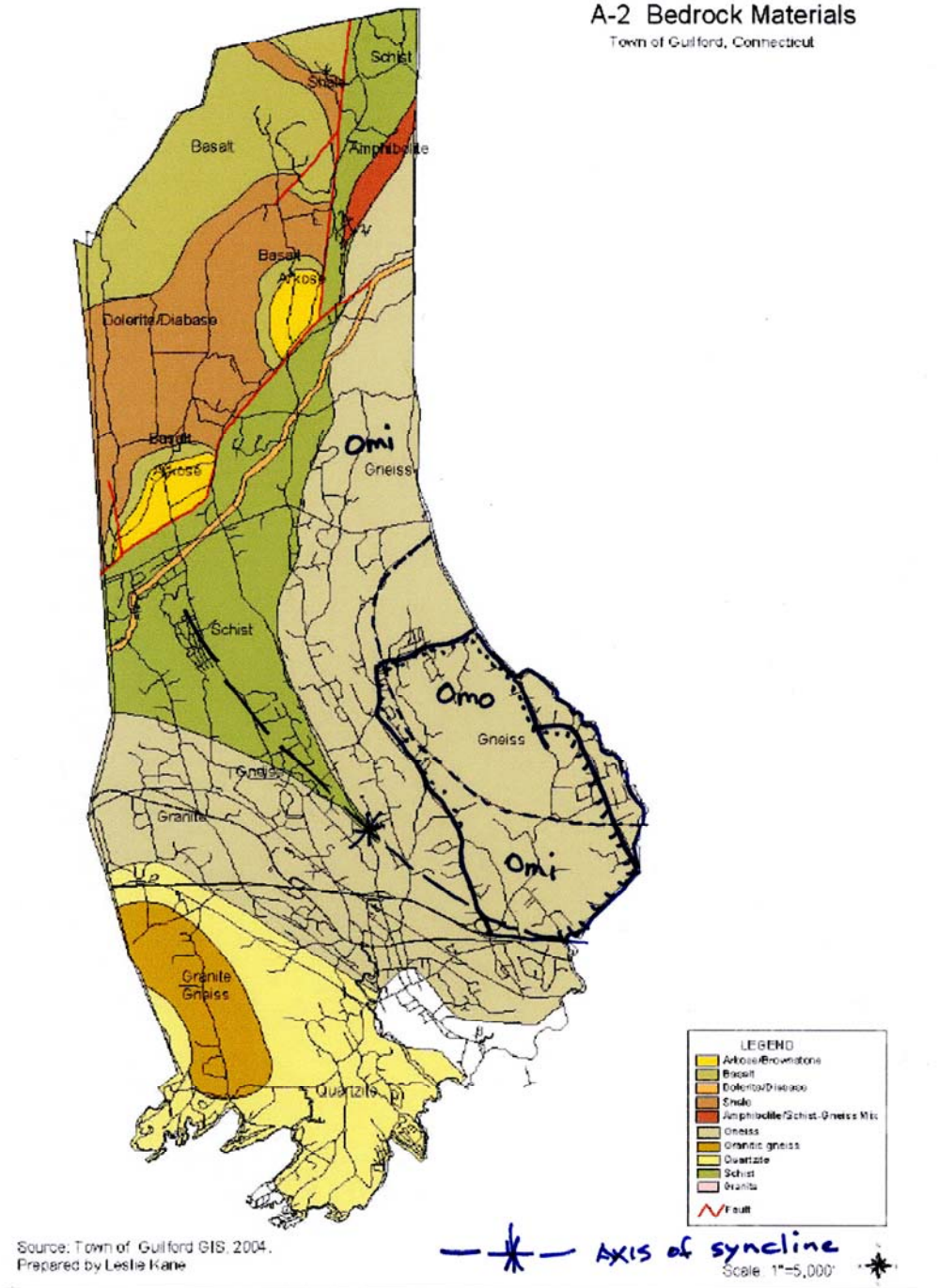
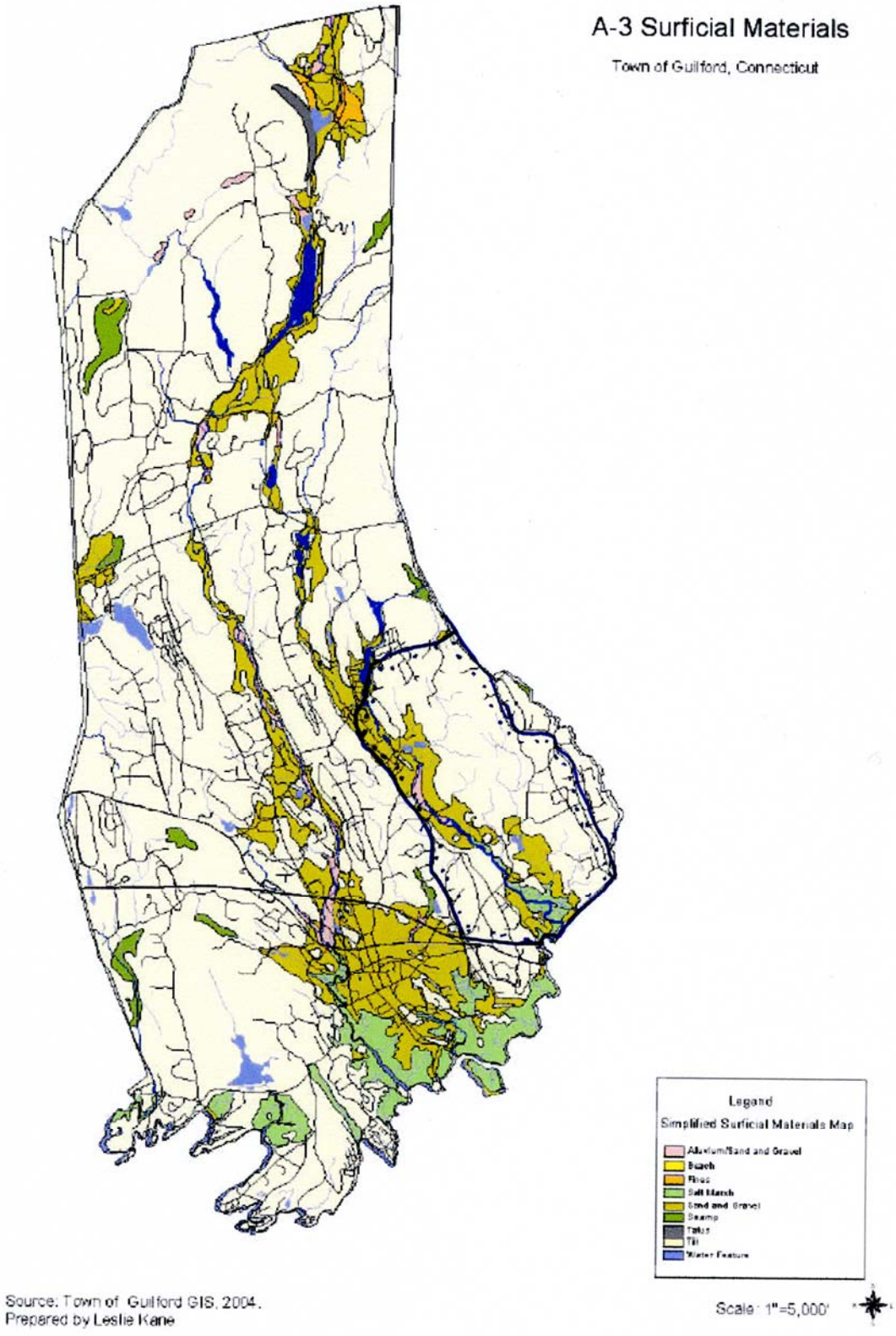


Omo MONSON GNEISS

Omi MIDDLETOWN GNEISS


A-3 Surficial Materials
Town of Guilford, Connecticut
Legend
Simplified Surficial Materials Map
Alluvium/Sand and Gravel
Beach
Fines
Salt Marsh
Sand and Gravel
Swamp
Talus
Till
Water Feature
Source: Town of Guilford GIS, 2004.
Prepared by Leslie Kane
Scale: 1"=5,000'

A Watershed Perspective

These recommendations to the Town of Guilford are given from the perspective of improving water quality and maintaining and supporting designated uses of the waters of the State in accordance with Connecticut's Water Quality Standards[1]. These recommendations also reflect the Department of Environmental Protection's (DEP) growing commitment to address water quality concerns from a watershed perspective, taking into account the cumulative impact of numerous activities within a given watershed that may affect water quality.
A

Opening Remarks

Watersheds are natural drainage divides that vary in size from drainage for backyard ponds to headwaters and tributaries of lakes and rivers. It is an easily identifiable landscape unit that ties together terrestrial, aquatic, geologic, and atmospheric processes. Land use planning at the watershed scale is an effective way to guide future development so as to minimize impact on both water quality and natural resources; direct available technical and financial resources to restoration and enhancement needs; facilitate partnerships to promote land and water resource stewardship; and develop actions to measure progress. Management decisions involving river resources must be made comprehensively and from an overall basin perspective. Integrated water use, water quality, land use data, and the instream biotic resource and habitat needs must be considered in river management decisions.[2]

The project area is located within the lower third of the East River Subregional Drainage Basin (#5108) of the South Central Eastern Regional Complex that drains to Long Island Sound. Various sources indicate that this is a richly diverse, intact and distinctive community that features extensive mixed, unfragmented forest, enveloping a network of wetlands, open water marsh and small streams tributary to the East River. A significant portion of the East River within this area is tidal.

The East River Marsh Forest System has been identified as a Significant Natural Resource Area that supports a wildlife management corridor.[3] There are numerous listed state-endangered, threatened or Species of Special Concern within the area. Additionally, a portion falls within a Resource Protection Focus Area. This is a large, relatively undisturbed geographic area that CTDEP identified as having multiple natural resources or natural resource uses which would be appropriate for future resource protection. This area lies north

[1] State of Connecticut, Department of Environmental Protection. Effective 1996 & 2002. Water Quality Standards. Bureau of Water Management – Planning and Standards Division. Hartford, CT.
[2] State of Connecticut, Office of Policy and Management. 2005. Conservation and Development Policies Plan for Connecticut 2005-2010. Intergovernmental Policy Division. Hartford, CT.
[3] Natural Resource Inventory Committee, Subcommittee of the Guilford Conservation Commission. January 2005. Natural Resource Inventory and Assessment, Town of Guilford, CT.

of the Audubon Guilford Salt Meadows Sanctuary and the Falkner Island Unit of the Stewart B. McKinney National Wildlife Refuge, which has recently been designated as a Globally Important Bird Area by National Audubon.

Review of the Conservation and Development Policies Plan for Connecticut 2004-2009 Locational Guide Map (June 2005), depicts the areas along Goose Lane, Tanner Marsh Road and Nut Plains Road as future growth areas. Within the undeveloped portion of the subject area, rural lands are denoted. A goal of the Plan is to preserve diverse landscapes that offer outdoor recreation, preserve fragile natural communities, agricultural lands, and habitats for plants and animals, protect and enhance water resources, and offer green spaces accessible to residents both in the country and in the cities. These natural, scenic, recreational, and historic areas of the state are essential to the quality of life, are important economic assets in Connecticut, and must be maintained and protected from adverse effects. Future development must occur in careful balance with the protection of these resources.

While this particular area has not been linked to a trail or greenway, there are 3 that pass through the Town of Guilford. The Shoreline Trail from Lighthouse Point in New Haven runs along the shoreline through East Haven, Branford, Guilford, and Madison to Hammonasset Park, a distance of approximately 25 miles. It will connect to the proposed New Haven Harbor Trail which will eventually connect to the East Coast Greenway, a major project that spans from Maine to Florida. To the north passes the Metacomet-Monadnock-Mattabesett Trail which is currently under study for designation as a National Scenic Trail by the National Park Service.

There is strong scientific evidence that providing access to places for physical activity increases the level of physical activity in a community, which is good for one's health. A trail may be constructed simply for pedestrian access or multiple uses, such as equestrians, bicyclists, roller bladers, baby strollers, joggers/runners, etc., but the trail design and route should be conducive to the natural terrain. Trail designs vary from at-grade stone dust paths to pavement of various widths and raised boardwalk crossings over wetlands and watercourses or as viewing platforms. With regard to promoting public access, it may be appropriate to construct a trail system that provides for scenic vistas, lakeside access, and wildlife viewing, besides merely pedestrian/bicyclist/equestrian use, provided that the terrain and habitat are suitable. Complementing nature trails with educational kiosks for animal tracks and sign, bird watching, and valuable/grand trees and shrubs, and natural geologic features offer additional attractions that may increase usage by individuals and educational groups. If the town is limited in its resources to construct a trail system, it may be prudent to establish a main loop initially off which future spurs could later be constructed. Additionally, the concern for public safety and illegal dumping may be reduced by limiting access to isolated areas until such time as popular use of the trail system would provide enough traffic and visibility to discourage prospective law-breakers. Future trail expansion off-site is encouraged, but this may require lengthy and costly negotiations with adjacent property owners.

Establishing a greenway may also preserve the area. A greenway is a corridor of open space that (1) may protect natural resources, preserve scenic landscape and historical resources or

offer opportunities for recreation or nonmotorized transportation, (2) may connect existing protected areas and provide access to the outdoors, (3) may be located along a defining natural feature, such as a waterway, along a man-made corridor, including an unused right-of-way, traditional trail routes or historic barge canals or (4) may be greenspace along a highway or around a village.

Adoption of a greenway in this region may provide additional opportunities for public access to "satellite" treks; however, these uses may necessarily be limited to minimize impacts on natural resources. For further guidance on establishing a greenway, contact the Connecticut Greenways Council, DEP Greenways Assistance Center, Leslie Lewis at telephone (860) 424-3578, e-mail: leslie.lewis@po.state.ct.us.

Water Quality Classification

The surface water classification for the streams and inland wetlands within the area is Class A. The Class A designated uses are: habitat for fish and other aquatic life and wildlife; potential drinking water supplies; recreation; navigation; and water supply for industry and agriculture. Whereas the East River is designated as Class SB/SA; the "S" denotes coastal waters. The designated uses for Class SA are: habitat for marine fish, other aquatic life and wildlife; shellfish harvesting for direct human consumption; recreation; industrial water supply; and navigation. Class SB/SA means that the waters presently may not be meeting Class SA criteria (the chemical, physical, or biological parameters and their concentrations or levels, or narrative statements that represent the quality of water that supports a particular use) for one or more designated uses, but the water quality goal is achievement of Class SA Criteria and attainment of Class SA designated uses.

The ground water classification for the area is Class GA. Designated uses for Class GA are: existing private and potential public or private supplies of water suitable for drinking without treatment; baseflow for hydraulically connected surface water bodies.

As a consequence of the surface and ground waters associated with this area being designated as high quality, any proposed development merits further consideration of available, practical measures which can be taken to ensure the protection of these resources from development-related impacts and nonpoint source pollution - a growing nationwide concern.

Stormwater Runoff

By itself, the effect of stormwater runoff from a proposed subdivision or roadway system may not seem significant. But the input of collected stormwater runoff to an estuarine system can have a tremendous impact. Besides the common effects associated with nonpoint source pollution, in a saltwater or brackish environment fresh water, which is collected and discharged as runoff from precipitation events, can dilute the receiving waterbody's salinity, thereby causing degradation of the estuarine habitat.

The contribution of stormwater from development within the Coastal Boundary that surrounds the East River may be regulated or otherwise require that the CTDEP review and

approve the proposed activities. Generally speaking, within coastal areas the first one-inch of stormwater runoff must be retained and infiltrated into the ground to avoid dilution of the receiving water. Other concerns related to stormwater runoff are:

- Increased runoff volume (as a result of less infiltration)
- Increased peak discharges (relating to the timing and magnitude of the runoff occurring from a specific storm event) and velocity
- Reduced groundwater recharge
    - reduced stream baseflow
- Increased frequency of bankfull and overbank floods
    - channel scour, widening, and downcutting of the receiving stream
    - streambank erosion and increased sediment loads
    - loss of pool/riffle structure within streams (important habitat areas)
- Destruction of wetlands, riparian buffers and springs, and burying of stream substrate
    - settling of suspended sediments carried or eroded by stormwater discharges can destroy benthic habitat, thus impacting the food chain
- Reduction in the diversity, richness, and abundance of the stream community (aquatic insects, fish, amphibians)
    - discharge of excess nutrients from lawn fertilizers, detergents, grass clippings, leaves, pet wastes, and atmospheric deposition can cause excessive algal growth, depleting oxygen from the water and stressing or suffocating aquatic life
    - discharge of other contaminants such as automobile oils and fluids, vehicle and tire wear, pesticides, and atmospheric deposition of air-borne pollutants can adversely affect the aquatic ecosystem
    - impacts to the aquatic biota due to stress caused by the increased temperature of stormwater runoff

Development of this area should be viewed with regard to the collective impact of all other land use activities within the watershed.

CTDEP's new guidance document, the 2004 Connecticut Stormwater Quality Manual[4], discusses in detail the "what's, "why's, "how's, and "where's" of stormwater management. As development occurs, impervious area increases and new sources of stormwater pollutants are introduced, accumulating pollutants between storm events. As it rains and snowmelt rolls over the ground surface, it picks up pollutants and contaminants (even thermal effects), which may then subsequently be collected by a stormwater conveyance system and quickly discharged to receiving waters, causing environmental pollution and adverse impacts to fish and wildlife and their habitats. Impervious areas, such as roadways, rooftops, paved driveways, and sidewalks, decrease the amount of precipitation that percolates through the ground to recharge aquifers, thus allowing for their slow release as base flow in streams during low flow periods. By contrast, in undeveloped areas, natural processes such as infiltration, interception, depression storage, filtration by vegetation, and evaporation, reduce the quantity of stormwater runoff, and act to remove pollutants. The increased volume and

[4] Connecticut Department of Environmental Protection. 2004. 2004 Connecticut Stormwater Quality Manual. Hartford, CT.

velocity of stormwater runoff often exceeds the physical ability of the receiving water body to handle such flows, thereby causing flooding, erosion and sedimentation, and physically altering the aquatic habitat.

From this perspective, treating and reducing runoff from all developed sites throughout the region will help to minimize surface water pollution and flooding problems caused by storm events. Therefore, it is generally recommended to minimize the use of impervious surfaces where possible. Steps to increase groundwater infiltration include: eliminating road curbing and allowing for sheet flow, construction of vegetated drainage swales, reducing road widths, minimizing sidewalk coverage, designing cul-de-sacs with a pervious center, and promoting pervious driveways.

Stormwater Management

Stormwater treatment practices remove pollutants from stormwater through various physical, chemical, and biological mechanisms. Since many pollutants in stormwater runoff are attached to solid particles, treatment practices designed to remove suspended solids from runoff will remove other pollutants as well. Exceptions to this rule include nutrients, which are often in a dissolved form, soluble metals and organics, and extremely fine particulates that can only be removed by treatment practices other than traditional separation methods. It is generally recommended that reducing and treating runoff from all developed sites and reducing the amount of impervious surfaces, where feasible, is the best way to manage stormwater runoff. By promoting infiltration, the volume is reduced and impacts to water quality and quantity are minimized. Thus, stormwater must be addressed with appropriate Best Management Practices.

The new 2004 Connecticut Stormwater Quality Manual describes both primary treatment practices, which provide demonstrated, acceptable levels of water quality treatment, and secondary treatment practices which are not suitable as stand-alone treatment facilities but can be used for pretreatment or as supplemental practices. The five major categories of primary stormwater treatment practices are:

- Stormwater ponds
- Stormwater wetlands
- Infiltration practices
- Filtering practices
- Water quality swales

Examples of secondary stormwater treatment practices described include traditional practices such as dry detention ponds, vegetated filter strips and level spreaders, oil/particle separators, and deep sump catch basins.

This Manual provides guidance on the measures necessary to protect the waters of the state from the adverse impacts of post-construction stormwater runoff. The manual focuses on site planning, source control and pollution prevention, and stormwater treatment practices, and is intended for use as a planning tool and design guidance document by the regulated and

regulatory communities involved in stormwater quality management. It also includes innovative and emerging technologies as secondary treatment practices. For more information on how to control stormwater, the new 2004 Connecticut Stormwater Quality Manual is now available on DEP's website at: http://www.dep.state.ct.us/wtr/stormwater/strmwtrman.htm.

Depending on where the proposed site is situated in the watershed, stormwater detention may or may not be necessary to protect downstream receiving waters from flooding or streambank erosion as a result of coinciding or cumulative peak flows from a stormwater event. When considering the use of detention measures, the following concept can be applied:

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

Given the exceptionally high value of the local ecosystem, it would be prudent to consider on-site stormwater management to ensure that the volume of stormwater runoff does not overwhelm the natural drainage system.

Stormwater Quality

Percolated through the ground, stormwater is filtered by the soil, stored, and gradually released to surface waters via the hydraulic connection through the stream/lake bed. This slow rate of release benefits the riverine system by moderating fluctuations in the water surface elevation of the stream as well as stream temperatures. However, infiltration is not always practical or preferable. For example, infiltration practices should not be placed over fill materials and should be located at least 75 feet away from wells, septic systems, surface water bodies, and building foundations (at least 100 feet upgradient and at least 25 feet downgradient from building foundations).

Although stormwater basins are designed to control stormwater runoff and reduce peak flows, they offer limited water quality benefits. As a pre-treatment practice, it cannot be emphasized enough that infiltration should be utilized to the greatest practical extent to reduce water quantity and improve water quality. Specific recommendations include:

- Maximizing overland sheet flow
- Increasing and lengthening drainage flow paths
- Lengthening and flattening site and lot slopes (although may conflict with goal of minimizing grading and disturbance)
- Maximizing use of vegetated swales

Various other treatment methods for renovating stormwater runoff include: nutrient uptake by hydrophytic vegetation, biodegradation of pollutants by microbial activity, and sediment trapping and filtration by organic or synthetic materials and vegetation. Note that due to the predominance of Charlton-Chatfield soil complex, very rocky and ranging between 3-45% slope, infiltration techniques must be approached cautiously. For example, roof runoff may

be directly to the ground provided that the discharge is located away from the septic system (consult a professional civil engineer, the USDA Natural Resources Conservation Service, or the Southwest Conservation District). Dry wells may also be used to receive rooftop runoff. These are small, excavated pits or trenches filled with aggregate that receive clean stormwater runoff primarily from rooftops, functioning as infiltration systems to reduce the quantity of runoff. Dry wells treat stormwater runoff through soil infiltration, adsorption, trapping, filtering, and bacterial degradation (Prince George's County, Maryland, 1999). The use of dry wells is applicable for small drainage areas with low sediment or pollutant loadings, and where soils are sufficiently permeable to allow reasonable rates of infiltration and the groundwater table is low enough to allow infiltration. For more information about infiltration practices and drywells, consult Chapters 4 and 11 of the 2004 Stormwater Quality Manual.

As for the proposed stormwater detention basins, "wet" versus "dry" systems provide increased water quality benefits in addition to hydraulic control. Chapter 8 of the 2004 Stormwater Quality Manual indicates that stormwater ponds, specifically micropool extended detention ponds and wet extended detention ponds, would be the best choices for providing water quantity and water quality benefits for this situation. Stormwater ponds are vegetated ponds with sediment forebays that retain a permanent pool of water and are constructed to provide both treatment and attenuation of stormwater flows. Treatment is primarily achieved by the sedimentation process where suspended particles and pollutants settle to the bottom of the pond. Stormwater ponds can also potentially reduce soluble pollutants in stormwater discharges by adsorption to sediment, bacterial decomposition, and the biological processes of aquatic and fringe wetland vegetation (although anoxic conditions may actually cause pollutants to be released). The key to maximizing the pollutant removal effectiveness of stormwater ponds is maintaining a permanent pool. To achieve this, wet ponds typically require a large contributing watershed with either an impermeable liner or an elevated water table without a liner. The pool typically operates on the instantaneously mixed reservoir principle where incoming water mixes with the existing pool and undergoes treatment through sedimentation and the other processes. When the existing pool is at or near the pond outlet or when the primary flow path through the pond is highly linear, the pond may act as a plug flow system in which incoming water displaces the permanent pool, which is then discharged from the pond. The value provided by this process is that a portion of the "new," polluted runoff is retained as the "old," treated water is discharged from the pond, thereby allowing extended treatment of the water quality volume. When properly designed, the permanent pool reduces the velocity of incoming water to prevent resuspension of particles and promote settling of newly introduced suspended solids. The energy dissipating and treatment properties of the permanent pool are enhanced by aquatic vegetation, which is an essential part of the stormwater pond design. In contrast, dry detention ponds, or dry extended detention ponds that have no permanent pool, are not considered an acceptable option for treating the water quality volume due to the potential for resuspension of accumulated sediment by incoming storm flows during the early portion of a storm event when the pond is empty.

Wet ponds typically consist of two general components - a forebay and a permanent wet pool. The forebay provides pretreatment by capturing coarse sediment particles in order to

minimize the need to remove the sediments from the primary wet pool. The wet pool serves as the primary treatment mechanism and where much of the retention capacity exists. Wet ponds can be sized for a wide range of watershed sizes, if adequate space exists. For example, a variation on the conventional wet pond, sometimes referred to as a "pocket pond", is intended to serve relatively small drainage areas (between one and five acres). Because of these smaller drainage areas and the resulting lower hydraulic loads of pocket ponds, outlet structures can be simplified and often do not have safety features such as emergency spillways and low level drains. Micropool extended detention basins are primarily used for peak runoff control and utilize a smaller permanent pool than conventional wet ponds. While micropool extended detention ponds are not as efficient as wet ponds for the removal of pollutants, they should be considered when a large open pool might be undesirable or unacceptable. Undesirable conditions could include thermal impacts to receiving streams from a large open pool, safety concerns in residential areas, or where maintaining a large open pool of water would be difficult due to a limited drainage area or deep groundwater. Micropool extended detention ponds are also efficient as a stormwater retrofit to improve the treatment performance of existing detention basins. Wet Extended Detention Ponds are very similar to wet ponds with the exception that their design is more focused on attenuating peak runoff flows. As a result, more storage volume is committed to managing peak flows as opposed to maximizing the wet pool depth. The configuration of the outfall structure may also differ from typical wet pond designs to provide additional storage volume above the level of the permanent pool. For additional construction details, limitations, and factors for consideration of wet ponds, see Chapter 11 of the Manual.

Conservation Practices

In order to protect and preserve the water quality, wildlife habitat, character and scenic value this area provides, it would be prudent to evaluate alternative development strategies, such as conservation or "cluster" subdivisions. Consider implementation of subdivision design standards which are density- based to help manage growth in impervious cover. In other words, instead of spreading the number of developable lots across the area, which increases the amount of impervious surface and consequently, increases the amount of stormwater runoff and promotes expansive lawn maintenance applications of fertilizers and pesticides, low impact development can typically accommodate the same number of homes on smaller lots while providing large, communal open space that may then be used as a playground, park, or walking/hiking trail, etc., resulting in less stormwater runoff, reduced roadway and stormwater basin maintenance, minimal lawn maintenance, preservation of wildlife habitat and open space, as well as retaining groundwater infiltration, thereby further reducing the impacts associated with stormwater runoff.

Stormwater detention allows settling of fine sediments as well as infiltration, as does *filtration* through grassed swales and stone berms. Catch basins with sumps are a first line of defense in stormwater drainage collection systems, but will not likely trap a significant fraction of sediment. Therefore, it is recommended, wherever possible, that road curbing be eliminated and drainage directed to sheet flow over grassy surfaces and ultimately into vegetated drainage swales utilizing the permeable soils on site to promote infiltration, and reducing the amount of stormwater runoff that requires treatment; thereby replenishing

groundwater supplies and reducing the cost of road construction and maintenance, including seasonal street sweeping, catch basin cleaning, and maintenance for the stormwater basin. Other strategies to reduce imperviousness include: reducing roadway widths, minimizing sidewalk coverage, reducing front yard setbacks to minimize driveway length and area, designing cul-de-sacs with a pervious center, and promoting pervious driveways. Porous asphalt or concrete, also known as porous pavement, is similar to conventional asphalt but formulated to have more void space for greater water passage through the material. Traditionally, porous pavement has had limited application in cold climates such as Connecticut due to the potential for clogging as a result of sand application, although porous pavement has been successfully used for some parking lot applications in New England where the underlying soils are sufficiently permeable. For additional information, view UCONN - Cooperative Extension System's NEMO (Nonpoint Education for Municipal Officials) website at: http://www.canr.uconn.edu/ces/nemo/.

The Town of Guilford has already reduced the roadway widths to 24' and 22", but this could be pared down even further to 18' to 20', depending on the roadway layout. It is not necessary to have sidewalks on both sides of the street, or even at all, unless there is an attraction nearby such as a school, playing fields, or park. However, if selected, sidewalk widths should be reduced and they should be separated from the street with a vegetated area; grading the sidewalks away from rather than towards the road to reduce impervious area, increase on-site infiltration, and decrease stormwater runoff.

Additionally, it may not be necessary to completely pave the interior of the cul-de-sacs. Where impervious surface reduction is difficult, cul-de-sacs can be designed to incorporate landscaped areas in between to help maintain natural recharge. It is not necessary to have a fully paved 50-foot radius cul-de sac. Reducing the radius of a typical cul-de-sac turnaround from 40 to 30 feet can reduce impervious coverage by nearly 50 percent (Schueler, 1995). A 30-foot radius will accommodate most vehicles and reduce pavement. Emergency vehicles and snow removal equipment turning radii have been adequately addressed in other communities with modified cul-de-sacs designed with a depressed and pervious (unpaved) center. The center of the cul-de-sac can then serve as an effective bioretention treatment or "island" for stormwater runoff before percolating into the ground. Bioretention is a practice to manage and treat stormwater runoff by using a specially designed planting soil bed and planting materials to filter runoff stored in a shallow depression (Prince George's County, Maryland, 1999). Bioretention areas are composed of a mix of functional elements, each designed to perform different functions in the removal of pollutants and attenuation of stormwater runoff. Bioretention removes stormwater pollutants through physical and biological processes, including adsorption, filtration, plant uptake, microbial activity, decomposition, sedimentation, and volatilization (U.S. EPA, 2000). These areas can be landscaped with low maintenance perennials or shrubs appropriate for the soil and moisture conditions. If a cul-de-sac island is used, the cul-de-sac radius should allow for a minimum 20-foot wide road. To make turning easier, the pavement at the rear center of the island may be wider (Metropolitan Council, 2001).

Similarly, smaller bioretention areas or "rain gardens" can be used as a functional landscape element, which can be incorporated into residential yards, street median strips, roadway

shoulder rights-of-way, and under roof downspouts; combining shrubs, grasses, and flowering perennials in depressions that allow water to pool for only a few days after a rain (Metropolitan Council, 2001). The soil absorbs and stores the rainwater and nourishes the garden vegetation. Rain gardens are an effective, low cost method for reducing runoff volume, recharging groundwater, and removing pollutants. These bioretention facilities are most effective if they receive runoff as close as possible to the source and are incorporated throughout the site (Pennsylvania Association of Conservation Districts et al., 1998). A demonstration of these bioretention practices can be viewed at the Glen Brook Green Subdivision, located in the Jordan Brook subwatershed in Waterford, CT.

Buffers

CTDEP supports and recommends the use of buffers to protect surface water resources from environmental impacts. Leaving a vegetated strip helps protect surface and groundwater quality, and fish and wildlife habitats from nonpoint source pollution. Buffers can trap road sands, contaminants and other pollutants contained in stormwater runoff generated from roadways, parking lots, roof tops, and other impervious surfaces, as well as eroded sediments occurring from natural scour or land moving activities such as site development and other soil disturbances, including farming activities. A 50 foot vegetated buffer is typical, but widths can vary depending on such factors as topography, the erosivity of the soil, and the value or sensitivity of the water resource.

The riparian corridor is the area immediately adjacent to a watercourse that typically contains wetlands and acts as a buffer to the watercourse. In addition to the benefits described above, riparian buffers help moderate the temperature of stormwater runoff before it enters the watercourse, thereby reducing thermal impacts on aquatic wildlife. Riparian wetlands may additionally provide valuable wildlife habitat, flood attenuation, water quality renovation, and groundwater recharge, so it is important to protect these areas from degradation.

To protect riparian buffers from noise, human encroachment, and other development impacts, including stormwater runoff, the CT DEP Fisheries Division recommends a 100-foot buffer zone along perennial streams, and a 50-foot buffer zone along intermittent streams[5] measured from the outer edge of any riparian wetlands. DEP Fisheries further recommends that this buffer zone remain in a naturally vegetated and undisturbed condition. Should future homeowners be required to provide a conservation easement, besides being shown on the subdivision plans or within the land deeds, it is suggested that signage be posted long the residential edge of the conservation easement as a reminder to help minimize encroachment.

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

Soil Erosion and Sediment Control

The 2002 revision of the Connecticut Guidelines for Soil Erosion and Sediment Control[6] contains detailed technical guidance on specific erosion and sediment control practices and recommended procedures for developing an effective soil erosion and sediment control plan.

In order to minimize erosion and sedimentation during and after construction, use of an appropriate seed mix specifically selected based on the site's soil moisture conditions, and adequate amounts of mulch are recommended. Application rates for seed and mulch are prescribed by the Connecticut Guidelines for Soil Erosion and Sediment Control, but the Soil and Water Conservation District or the USDA Natural Resources Conservation Service (formerly the Soil Conservation Service) may have more current information on the various seed mixes and mulches that are now available. Note: avoid seed mixes containing Reed Canary grass, an invasive species. Temporary sedimentation basins and other stormwater control structures (i.e. siltation fence and staked hay or straw bales) should be inspected and maintained weekly, and within 24 hours of receiving a 0.1" or greater rainfall event. Note that proposed stormwater basins should not be used as temporary sedimentation basins during construction.

[6] The Connecticut Council on Soil and Water Conservation. January 1985 (Revised January 1988). Connecticut Guidelines for Soil Erosion and Sediment Control.

Wetland Review

The review area the Team was asked to comment on is quite large. It is vast, encompassing about 3,300 acres, or, in excess of five square miles. Typically, the Team walks over most of the parcel it has been requested to review. But because of the size of the area, and the nature of this investigation, the Team participated in a driving tour that included five stops. For these reasons, only general comments can be made, though this reviewer, like other Team members, does feel that the Team observed a good representative overview of the land and the land use in question. The driving tour went as follows:

1. First stop: Field walk along Tannery Brook to its confluence with the East River. Observation: The East River was at low tide; very cobbly, silty/muddy. Observed deer tracks and a dead eel.

2. Second stop: former septage lagoons used until 2 - 4 years ago. Observation: It is now a municipal leaf compost area, with various mulches stored on site. Road sand and gravel are also stored here. In addition, construction debris, such as used pipes, broken road pavement (asphalt), and a stump dump are piled at this location.

3. Third stop: the Team toured various subdivisions in the northern part of the review area to view the current state of development and construction typical to the area. Observation: subdivisions feature large houses with 4-5 bedrooms, manicured lawns, some with long driveways. Much blasted rock for road construction and many streets ending in cul-de-sacs.

4. Forth stop: intersection of Squaw Road and Podunk Road. Observation: to view the proposed new east-west artery location projected to carry bypass traffic to Nut Plains Road relieving traffic to the south and east from the current heavy traffic counts.

5. Fifth stop: The Foote wooden bridge. Observation: The East River enjoys a well vegetated riparian area. Some alewives were present in this low tide situation.

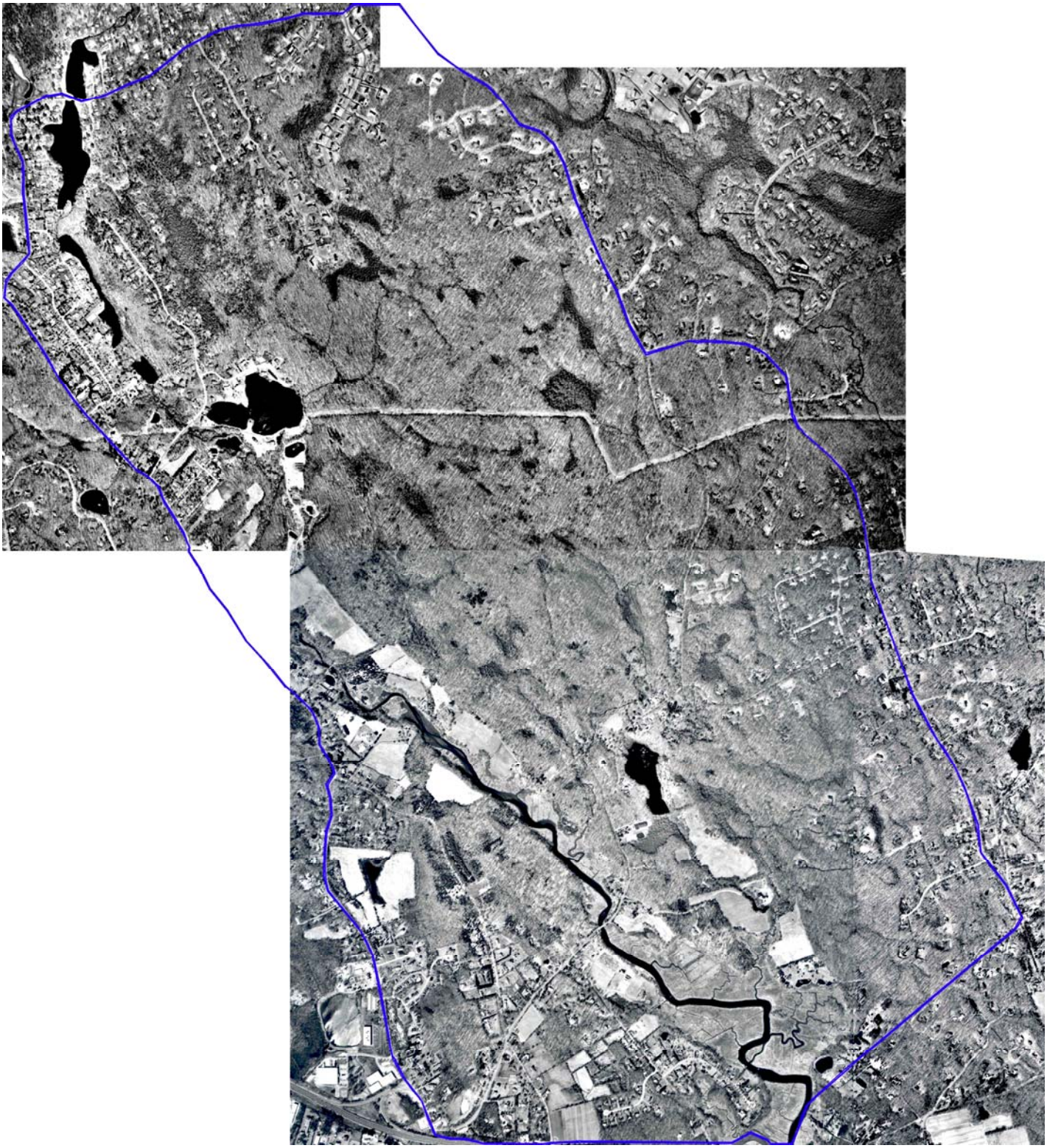
Description

The Goss Site wetlands are described in detail in the report prepared by CLA Engineers for Ralph Waldo & Associates. The Team was asked to provide a broader perspective of the 3,300 acres.

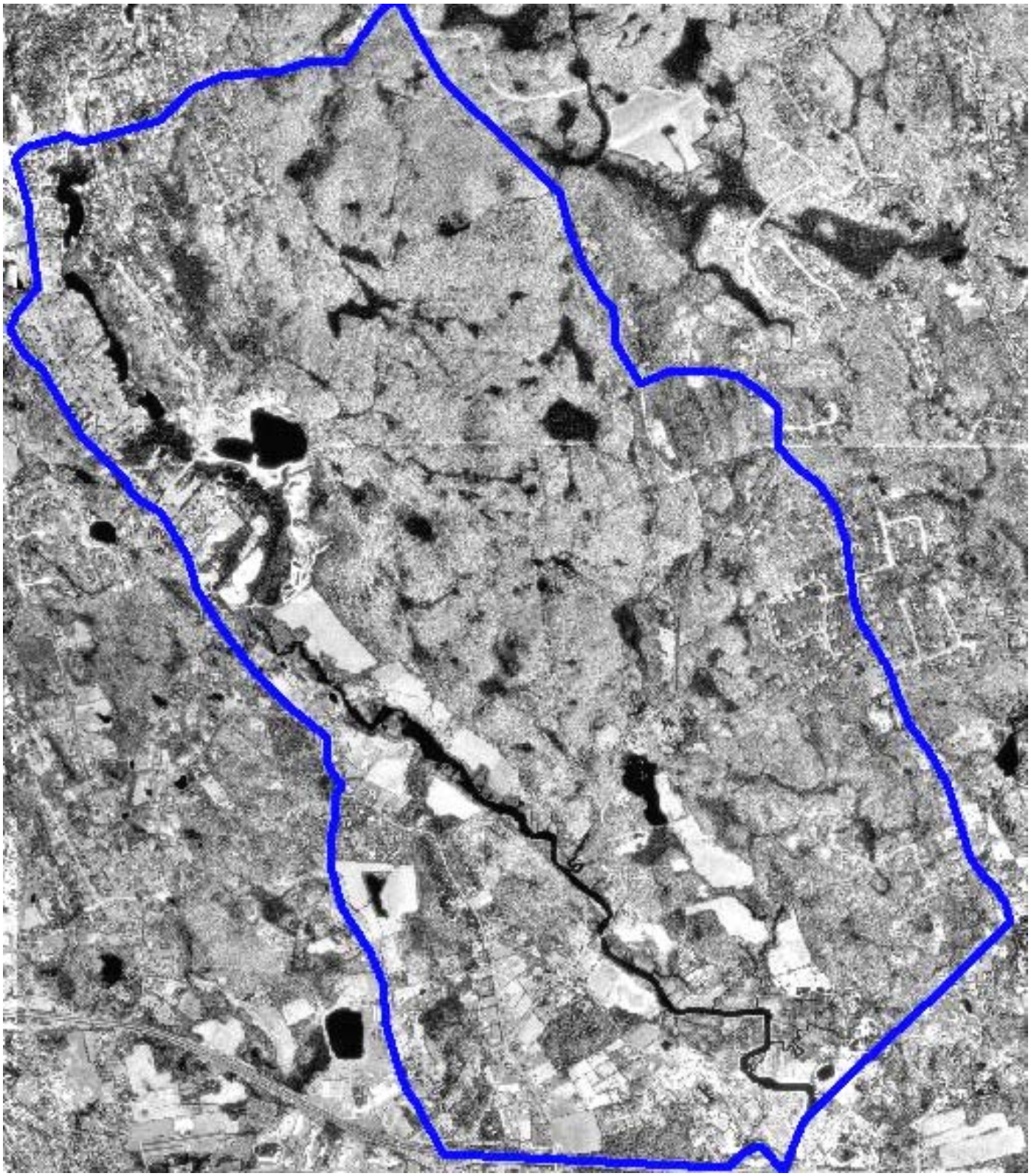
Overall, much of the area is forested. Many of the older, existing subdivisions, being low density, appear wooded when viewed from the air. (This is readily apparent in the following aerial photograph.)

The dominant visual wetlands on the aerial photograph are the watercourses and swamps. These show up as dark (black) areas on the aerial image. The East River dominates the southwestern portion of the study area as it flows to the protected tidal area 1.8 miles to the south.

The East River



This is the 2004 aerial photograph of the 3,330 review area. Wet areas show up in this image as dark or black. Road cul-de-sacs, open fields, subdivisions and the zigzagging power line clearing can all be easily identified.



This is the study areas as it appeared in 1990. In comparing the two aerial shots, the viewer will notice the increase in development especially in the northeast and the southeast.

Poorly drained glacial till and thick glacial till (southwest corner) underlies most of the study area. This results in wetlands that are often extensive in low lying areas and typically wooded. A swath of sand and gravel 1,500 to 2,500 feet wide underlies the East River on its course from the northwest corner to the south central boundary where salt marshes buffer it on each side. Many hundreds of acres of wetland soils are mapped as is readily apparent on the town's GIS mapping.

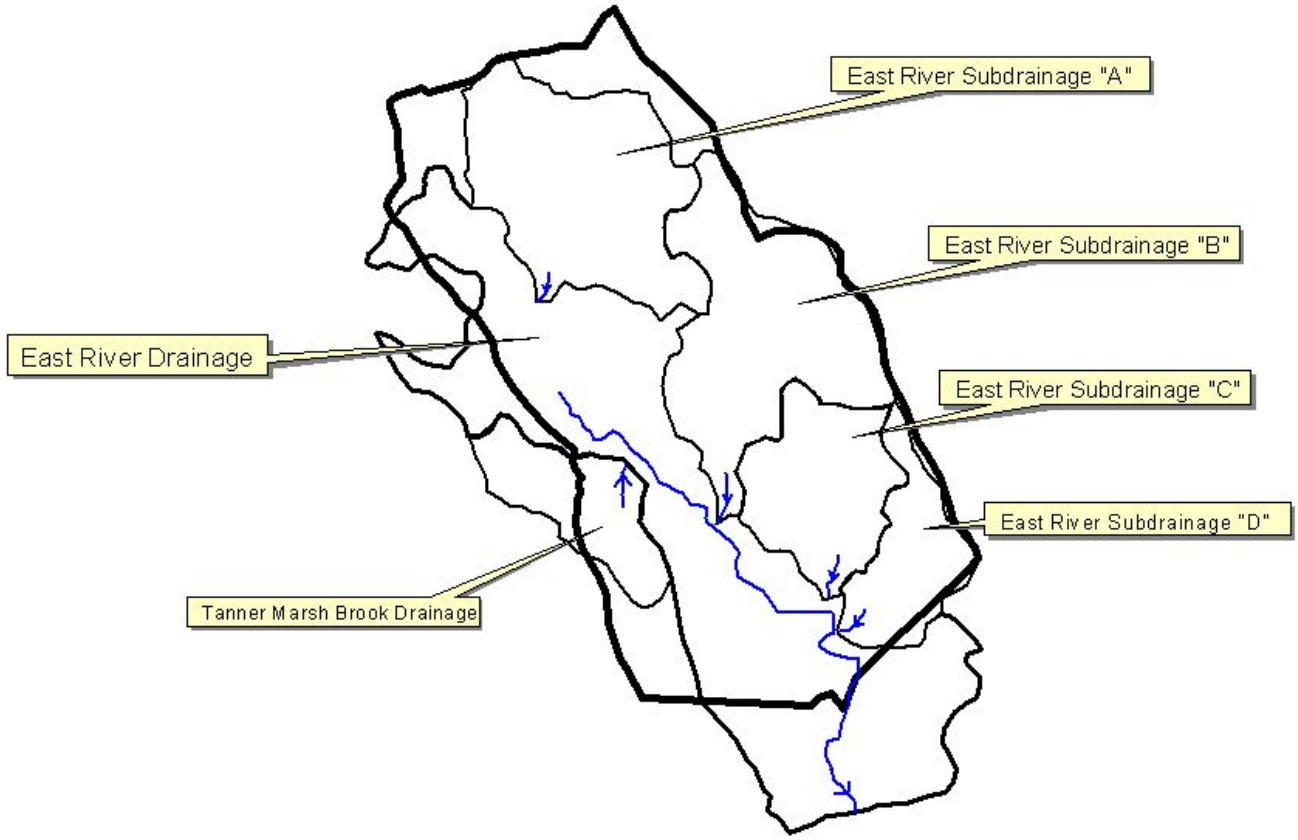
The DEP Water Quality mapping for surface waters shows these drainages rated as "A" on a scale of AA, A, B, C, D with AA being the best. The water quality mapping contains assumptions of water quality since not all of the waters in the state can be field checked. With further investigation it is likely that many of these waters, especially the headwater streams, would yield the AA rating.

The Goss Property

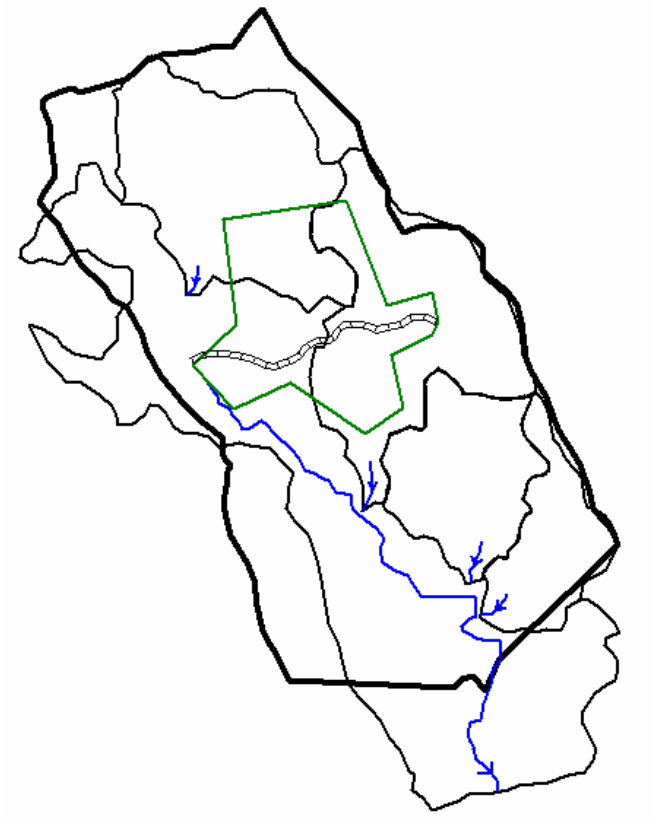
This property sits at the top of three adjoining local drainage divides. Its runoff will directly affect no less than five headwater streams. The drainages have been delineated, measured for size and named on the graphic below.

Subdrainage "A" is about 610 acres, Subdrainage "B" about 625 acres,
Subdrainage "C" about 335 acres, and Subdrainage "D" about 240 acres.
Subdrainage Tanner Marsh Brook is about 245 acres.

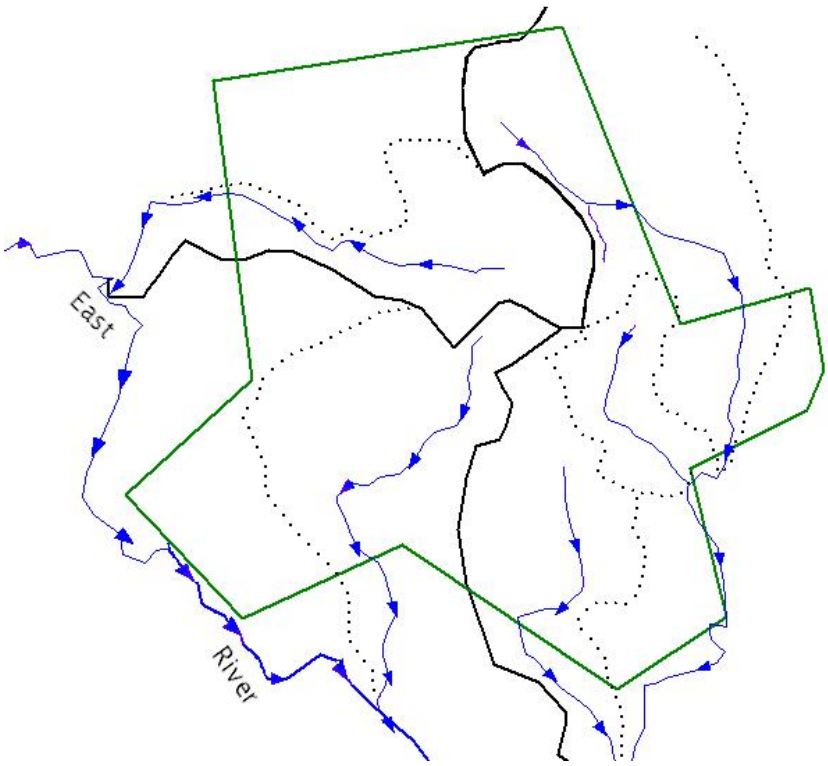
The portion of the East River drainage depicted here, exclusive of the sub drainages, is 1,570 acres.



The heaviest black line in the graphic above depicts the 3,300 acre area the ERT was requested to review. The other lighter weight black lines depict the drainage basin boundaries of the water courses that feed into (are tributaries to) the East River. The blue arrow/line shows the mouth, or emptying out point, of the basins into the East River drainage. By inference, the highest elevations in each drainage are those areas furthest away from the outlet of the stream.



This graphic shows the above drainage divides with the approximate location of the proposed Goss Property and one of the possible locations of the proposed new road.



The graphic above shows the approximate boundaries f the Goss property. The black lines, both solid and dashed, follow the hill tops that separate the drainage areas of the stream. The streams are depicted in blue with arrows showing direction of flow. These are considered first order streams and are the most vulnerable to land use and toxicity changes. It is apparent from this graphic that any proposed development would sit right at the headwaters of these five streams which flow directly into, and directly impact, the water quality of the East River.

Proposed/Future Activity

The ERT Team was asked to review the area even as proposals for subdivision construction of single family homes continues. It is clear from comparing the aerial photographs from 1990 and 2004 that this 3,300 acre tract has been under heavy developmental pressure, especially in the northeast section. For a long time the dominant land use and growth areas were along the existing travel corridors, roughly paralleling Nut Plains Road to the east, Bradley Corners Road to the north, and Podunk/Nortontown roads to the west. Now, subdivision roads make their way further into the interior of this review area and a bisecting road is proposed.

Except for the properties that are currently held as open space, it would appear that between future new development and road penetration, the impacts from growth to these 3,300 acres will continue until there is no private land remaining to develop.

Plusses

- Though the fringes of the study area have been developed, the interior has not. This has allowed the several headwaters streams that feed the East River to continue to freely add quality water to its flow.

- The Department of Environmental Protection has officially mapped reported leachate and wastewater discharges across the state. Within the study area only two are mapped. One is the former municipally owned septage lagoons in the East River Drainage. The other is a series of now-inactive failed septic systems in the area of the Guilford Lakes. (For comparative purposes, an area of the same size, when outlined to the southwest of this study area, embraces no less than 15 officially reported leachate and wastewater discharge locations.)

- The East River, especially to the south, is distinguished locally and by the DEP as a vital natural resource. As its value has come to be known, this tidal area has been recognized and preserved by the State of Connecticut and the National Audubon Society as an important part of Connecticut's coastal wetlands. These wetlands support specialized salt marsh vegetation and animal life. They are also a way-station and nesting stop for thousands of migratory birds along the Atlantic flyway.

  Beginning about 1.5 miles below the study area the DEP has set aside 114 acres as the East River Wildlife Management Area. The DEP funded a $110,000 project to restore degraded East River salt marshes as a function of the department's efforts to restore and improve the health of the state's coastal wetlands. The National Audubon's Guilford Salt Meadow Sanctuary is in excess of 212 acres and within the bounds of the study area.

Minuses

The town has challenges to deal with in the face of increased developmental pressures. Many questions need to be answered as environmental planning continues:

- Deleterious land use: Are there long term ground and/or surface ramifications due to runoff from the stump dump, asphalt dumps, and the other construction debris areas? Is there an elevated salt content in the uncovered road sand piles?

- How will the continued addition of impervious surfaces to the East River tributary watersheds affect the health (water quality) of the river and its estuary?

- Regarding the Goss property, it is likely wetlands will be impacted by at least three road crossings. How will these be dealt with to preserve the nature and integrity of the wetlands in which they occur?

Summary/Recommendations

When looking at land use from a wetland and watercourse point of view, each of the local and sub- local watersheds is its own study area.

- In general, whenever a subdivision is built, a sub-surface system is constructed to remove water, mostly in the form of precipitation or storm water, from the area and pass it down gradient and off the site. To avoid as many impacts to the wetland systems as possible, plans should minimize runoff from impervious surfaces, obtain as much open space as possible and work towards an orderly open space accumulation in the largest contiguous parcels possible. The long term maintenance of every storm water system will be preeminent in the future health of the wetland resources.

- Continued development will further segment the open space and woodlands and alter the natural drainage patterns. Larger, contiguous pieces of land have increased values for many environmental functions versus the same amount of land broken into many small pieces.

- Planning for growth areas through a town-wide, build-out analysis will provide the opportunity to protect water resource assets before they are threatened. The factors that allow for good water quality, including the forest cover and the existing wetland buffers, combine to maintain overall wetland health at an elevated level. Roads and subdivisions should be constructed to preserve these merits.

- The entire area, excepting those parcels already set aside, will continue to come under pressure from development of housing and infrastructure. Open space subdivisions and the best storm water management practices will help in the preservation of the assets.

- While it is sometimes easier to say than to do, the task of the wetland commissioners is the understanding that reasonable and prudent alternatives is their decision and not the applicant’s.

- How the town deals with its wetlands and watercourses as it continues to grow will shape much of the ecological integrity of the area for future generations. One telltale sign of older

subdivisions is the amount and quality of buffer area allowed for the water resources. Planning now for the protection of the water resources will help ensure their integrity as the town grows around them.

- Road sand - as the length and width of road surface miles per watershed increase so does the amount of road sand applied during the winter months. Some things to keep in mind:

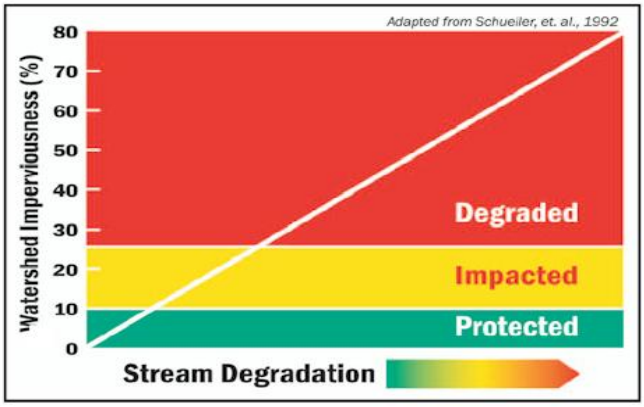
  Connecticut has a "no tolerance" level for snow and ice on its roads. As a result, large quantities of road sand are applied every winter to keep the travel ways safe. The DEP estimates that on average in urban settings more than 40,000 pounds (20 1/4 tons) of sand is applied per road mile every year. Of that total, approximately 30-50% is collected in the spring through street sweeping. Thus, ~12 tons of sand is left on every mile of road annually. (The proposed east-west road through the study area will be about 1.3 miles in length. At the above application rates, the town will introduce 27+ tons of road sand, pick up 13 tons and leave 14 tons of sand *every year* in the watersheds the road passes through.)

  Because of the nature of the Connecticut's hill and valley topography, roads are often in close proximity to wetlands and watercourses. This aspect of the landscape makes it highly likely that over time most of the uncollected sand will move downslope into the wetlands and watercourses. These sediments can destroy aquatic habitat and fill in water bodies. The impact of sand deposition (typically in combination with elevated salt levels) on spawning streams and wetlands with close proximity to roads is well documented. Road sand can be a major pollutant source by carrying nutrients, oil, and metals with it to the rivers, streams, and lakes. In the springtime, after the danger of icing, if the road sands are swept/collected later than sooner, the impacts are worse. This is because the constant grinding of automobile tires reduces sand particle size. These finer particles are held in suspension longer and thus carried further downstream.

As a result of these impacts towns are urged to sweep the roads as soon as possible in the spring and maintain their catch-basin clean out schedule.

* (DEP road sand documentation is on the Web at http://dep.state.ct.us/wst/solidw/street_sweepings.pdf)

- A rule of thumb for any given drainage: the water quality decreases as impervious surface in the watershed increases. (Impervious surfaces are generally thought of as roads, driveways, roof tops, sidewalks, etc.) Often referred to are the numbers/ranges seen in the following graphic:



This graphic is taken from NEMO Fact Sheet Number 3 entitled: Impacts of Development on Waterways. *The fact sheet and this graphic are available on line at: http://nemo.uconn.edu/publications/fact_sheets/nemo_fact_sheet_3_s.pdf*

The graph above depicts the water quality of the stream as being generally well protected when the imperviousness in the watershed is 0-10 percent of the total land cover. The numbers show that from that 10 percent to about 26 percent imperviousness, impacts compromise the water quality. After ~26 per cent definite degradation is taking place. As with many studies, the numbers are not absolute for every scenario, but the concept is sound.

Finally, the East River is Guilford's foremost natural resource. Both its function and value as a coastal natural area, and its importance for recreational commerce, are important to the town. The preservation and continued improvement of this asset will focus around the protection of the water quality that feeds it. The area the Team was asked to review is totally within the bounds of the East River drainage.

The connection between the East River and the upstream components that make it "work" well are inseparable. This 3,300 acre review area represents 26% of the entire East River drainage. Careful management of the watershed's land use, especially areas that impact headwater streams, will be a key to the continued maintenance of the water quality for the East River.

Soils Resources

This soils report applies to the +3,300 acre parcel referred to as the East Guilford region, which is bounded by Tanner Marsh, Nut Plains Roads on the West, North Madison Road to the North, Podunk Road to the East and the coastal resources on the South. The information in this report is based on the historical soils series descriptions and the new digital mapping unit descriptions as presented in the Soil Survey of Connecticut, remote survey interpretations plus field observations. In an effort to inventory and assess the natural resources within this region, this section looks at three (3) separate areas and issues related to the soils, their physical attributes and their ability to affect water quality.

The historical reference for soils regarding this region can be found in sheet numbers 56, 62, 63 and 71 of the 1979 New Haven County Survey. See Exhibit #1 Soils Map with Sectors A1 – A3.

Exhibit #2 (CT Soils Mapping) & Exhibit #3 (CT Hydric Soils Mapping) are derived from the new digital survey (Soil Survey of Connecticut). The soil survey utilizes recent aerial photographic base with one soil legend, which employs the numbering convention used by the USDA.

Mapping Units

Wetland Soils – Exhibit #3

1) Map Unit AA – Adrian & Palm soils – USDA Soil #17

This map unit consists primarily of Adrian and Palm soils on 0 to 3 percent slopes. Adrian soils are very deep and very poorly drained. Typically, these soils have an organic layer 16 to 51 inches thick. The underlying layer is of a sandy or loamy texture to a depth of 60 inches or more. These soils have a watertable within 12 inches of the soil surface.

2) Map Unit Ce – Carlisle – USDA Soil # 18

This unit consists primarily of Carlisle soils on 0 to 3 percent slopes. Carlisle soils are very deep, very poorly drained muck soils formed in organic deposits in bogs and low-lying depressional areas. The muck is at least 51 inches deep and ranges depth to 30 feet or more. Carlisle soils have a watertable at or near the surface throughout the year, and in wetter periods are often ponded.

3) Map Unit Ra – Raynham – USDA Soil # 10

The Ra map unit is composed of Raynham soils on 0 to 3 percent slopes. These soils are very deep and poorly drained. They formed in silty lacustrine deposits. Raynham soils are composed of stratified silt loam materials to a depth of 60 inches or more. These soils have a seasonal high watertable within 20 inches of the soil surface during the months of November through May.

4) Map Unit Rb – Raypol – USDA Soil # 12

This map unit consists primarily of Raypol soils on 0 to 3 percent slopes. Raypol soils are very deep, poorly drained soils, formed in loamy over sandy and gravelly glacial outwash deposits. These soils have a watertable within 1.5 feet of the surface much of the year. Typically, they have a silt loam, very fine sandy loam surface layer and subsoil over a stratified and gravel substratum that extends to a depth of 60 inches or more.

5) Map Unit Ro – Rippowam (formerly named Rumney - Ru) – USDA Soil # 103

These soils are very deep and poorly drained. They formed in alluvial sediments. Typically, these soils have fine sandy loam textures overlying stratified sand and gravel to a depth of 60 inches or more. Rippowam soils are subject to flooding and typically flood annually, usually in the spring.

This soil constitutes 1% of the total soils in this region and is found along the East River Corridor between Lisa Ct. and Bearhouse Hill Rd. The composition and profile of this soil creates an unconsolidated aquifer that is capable of yielding moderate to very large amounts of water (50 – 500 gallons per minute) to individual wells.

Concerns

5a) Streambank Stabilization – Increased, direct runoff discharges to tributaries and the river from development has increased velocities and volume, which entrain and transport solids and organic materials. Evidence of eroding banks have introduced sediments downstream, advances the aggrading of the stream, which causes the river to go out of bank more often.

5b) Aquifer Protection – Consideration should be given to potential high yield areas for preservation and protection for municipal and private consumption. **See Exhibit #4, "Ground-water Availability in CT."**

5c) Residential Development Threat to Water Quality– Sprawl from residential development, their associated manicured landscapes, impervious surfaces and stormwater

infrastructures are introducing excessive amounts of nutrients and pesticides into surface waterbodies, watercourses and ground water.

6) Map Unit Rd – Ridgebury. USDA Soil #2

This is a nearly level poorly drained soil in drainageways and depressions on glacial uplands. They formed in compact glacial till derived from gneiss and schist. Typically, they have friable loam or sandy loam surface layer and subsoil over a firm fine sandy loam or sandy loam dense till substratum. Ridgebury soils have a perched watertable within 1.5 feet of the surface much of the year.

This soil has poor potential for development, which is limited by its high water table and its slowly permeable substratum.

Note: This soil is located south of Clapboard Hill Rd. and between Tanner Marsh and East River Roads.

7) Map Unit RN – Ridgebury, Leicester and Whitman extremely stony fine sandy loams. USDA Soil #3

Consists of nearly level to gently sloping, poorly drained soils in drainageways and depressions on glacial uplands. Ridgebury soils are very deep and derived mainly from gneiss and schist. Typically, they have a friable loam or fine sandy loam surface layer and subsoil over a firm fine sandy loam or sandy loam dense till substratum. Ridgebury soils have a perched watertable within 1.5 feet of the surface much of the year.

This soil constitutes 15% of the total soils in this region and is found throughout this +3,300 acre sector of East Guilford. This soil type develops in the drainageways, which act as a conduit to the East River hydrologic unit 5108 of the South Central Eastern Regional Complex.

Concerns

6A) Land Use - In the upper region east of Guilford Lakes and the southern portion of this region, these wetlands have been encroached upon by agricultural influences and residential development, which has filled and utilized them as environmental sinks to perform convenient stormwater conveyance, served as raw-water renovation and have been the recipient of an array of NPS pollutants directly related to land use and the impervious roadways which bisect them.

6B1) Sprawl - Proposed development of a 600 acre section with approx.160 residential units will reduce wetlands and their related permanent and seasonal habitats.

6B2) Loss of Wetlands - The interruption of drainage patterns due to the proximity of proposed roadways, dwellings and their expansive landscapes will have an adverse impact to water quality and wildlife dependent on these wetlands.

6B3) Marginal Land Use - The limitations imposed by these wetland soils and the physical attributes associated with the upland soils should require a higher level of scrutiny by Guilford's Inland Wetlands Commission, Health Dept. and their Planning & Zoning Commissions. Thorough reviews of all plans of development are necessary to assess and evaluate potential threats to natural resources, minimize land disturbance, reduce fragmentation of habitats and qualify suitable building lots that limit encroachment regarding these resources.

6B4) Buffering of Wetlands – Most of the upland soils in close proximity to these wetlands have **moderate to severe erosion hazards** that relate to their composition and their topographic relief. Establishing well defined limits of disturbance and preserving the majority of the natural landscape reduces the risk of erosion and siltation on and off-site.

7) Wa map unit - Walpole sandy loam. Slopes 0 to 3 percent. USDA Soil # 13

Walpole soils are nearly level, poorly drained soils that formed in depressions on broad outwash terraces. Typically, they have a fine sandy loam or sandy loam surface layer and subsoil over a substratum of stratified loamy sand and gravel. Walpole soils have a watertable within 1 foot of the surface from late fall to late spring.

8) Map Unit We – Westbrook mucky peat – USDA Soil # 98

The Westbrook soils are very deep and very poorly drained. They are on tidal flats subject to inundation by salt water twice daily. Typically, Westbrook soils have organic materials 16 to 51 inches thick overlying loamy mineral deposits to a depth of 60 inches or more. These soils have a watertable at their surface as they are subject to tidal waters.

This soil constitutes 4% of the total soils in this region and is located in the southern portion East River Corridor south of Bearhouse Hill Rd. trending southeast to the Interstate-95 crossing. The composition and profile of this soil creates an unconsolidated aquifer that is capable of yielding moderate to very large amounts of water (50 – 2,000 gallons per minute) to individual wells.

a) Aquifer Protection – Consideration should be given to potential high yield areas for preservation and protection for municipal and private consumption. **See Exhibit #4, "Ground-water Availability in CT."**

b) Habitat Protection – There is evidence of breeding habit for several unique species, which would benefit from the expansion or creation of sanctuaries in this area. One such species was the "Diamond back Terrapin," which occupies areas with brackish waters.

Non-wetland Soils – Exhibit #2

9) AfA – Agawan fine sandy loam, (A, 0-3 & B, 3-8 percent slopes. USDA Soil # 29A & B

This map unit consists of Agawam soils. These soils are very deep, well drained soils formed in loamy over sandy and gravelly glacial outwash deposits. Typically, they have a fine sandy loam surface layer and subsoil over a stratified sand and gravel substratum that extends to a depth of 60 inches or more.

This soil has **good potential for development**. Permeability is moderately rapid in the surface layer and subsoil and **rapid in the substratum**. Runoff is medium. Conservation measures are needed to prevent excessive runoff, erosion and siltation during construction.

Concern

- The rapid permeability in the substratum requires that caution be taken to prevent ground water contamination.

- These soils have been developed residentially and many acres are currently in agricultural use with orchards.

- The aforementioned land uses employ a wide array of fertilizers and pesticides, which can be introduced to the hydrologic regime of the area. The substratum can act as a conduit to the riverine environment and ultimately LIS.

Note: **These soils range south of Bearhouse Hill Rd. on both sides of the East River.**

10) CfB – Charlton fine sandy loam, 3 to 8 percent slopes. USDA Soil # 60B

This mapping unit is a well drained soil on the side of slopes of hills and ridges and at the foot slopes of steep slopes. Permeability is moderate or moderately rapid. Runoff is medium to rapid. This soil has **fair potential for community development.** It is limited mainly by the steepness of slopes. However, it does have a **severe erosion hazard**.

Intensive conservation measures are needed to prevent excessive runoff, erosion and siltation during construction.

11) CfD – Charlton fine sandy loam, 8 to 15 percent slopes. USDA Soil # 60C

Located on the sides of hills and ridges and at the foot slopes of steep hills that have been influenced by underlying bedrock. This soil has a **poor potential for community development**. It is limited mainly by steepness of slopes. The steepness of slopes causes additional expense in building structures, roads and the installation of water and sewer lines. This soil is fairly easy to excavate, but it commonly contains stones and boulders.

This soil has a **severe erosion hazard**. Permeability is moderate to moderately rapid. Runoff is rapid. Intensive conservation measures are needed to prevent excessive runoff, erosion and siltation during construction projects.

12) ChB – Charlton very stony fine sandy loam, 3 to 8 percent slopes. USDA Soil #61B

ChC – Charlton very stony fine sandy loam, 8 to 15 percent slopes. USDA Soil #61C

This map unit consists primarily of Charlton soils, which are very deep, well-drained soils formed in glacial till, derived mainly from granite, gneiss and schist. Typically, they have a fine sandy loam surface layer and subsoil over a friable fine sandy loam or sandy loam substratum that extends to a depth of 60 inches or more.

This soil has a fair potential for development. Permeability is moderate or moderately rapid. Runoff is medium. . Stones and boulders may interfere with the installation.

Concerns

- Waste disposal systems generally function satisfactorily with careful design and installation to ensure that effluent does not seep to the surface downslope from the system.

- Both soils have a **moderate erosion hazard** associated with them and enhanced conservation measures are needed with the increase in steepness of slope as in the ChC soil type.

13) CnC – Charlton extremely stony sandy loam, 3 to 15 percent slopes. USDA Soil #62C

Charlton soils are very deep, well-drained soils formed in glacial till, derived mainly from granite, gneiss and schist. Typically, they have a fine sandy loam surface layer and subsoil over a friable fine sandy loam or sandy loam substratum that extends to a depth of 60 inches or more. **This soil has fair potential for development.**

This soil is limited by stoniness and steepness of slope. Permeability is moderate to moderately rapid. Runoff is medium to rapid. **The hazard of erosion is moderate to severe.** The steepness of slope attribute is significant during any proposed construction activity that is in such close proximity to wetlands and watercourses. Careful attention should be given in minimizing disturbances, employing enhanced erosion and sedimentation controls and maintaining adequate vegetated buffering of sensitive areas.

14) CnD – Charlton extremely stony fine sandy loam, 15 to 35 percent slopes.

USDA Soil #62D.

This moderately steep to steep, well drained soil is on the sides of hills, ridges and steep valleys where the relief is affected by the underlying bedrock. This soil has moderate or moderately rapid permeability. Runoff is rapid. When disturbed, this soil has a **severe erosion hazard.** This soil has **poor potential for development** because of its steepness of slopes and stoniness.

15) CrC – Charlton-Hollis soil 3 to 15 percent slopes. USDA Soil #73C.

This complex consists of well drained soils located on uplands where the relief is affected by underlying bedrock. The Charlton component has moderate or moderately rapid permeability. Runoff is medium to rapid. The Hollis component has moderate to moderately rapid permeability above the bedrock.

This complex has **fair to poor potential** for community development. **The Charlton component has fair potential** for development and the **Hollis has poor potential** for development due to its shallowness to bedrock.

Intensive enhanced conservation measures such as temporary vegetation and siltation basins are frequently needed to prevent excessive runoff, erosion and siltation.

Concerns

The included Paxton and Hollis soils are even less suitable for development:

- Paxton soils have slow permeability in the substratum. A dense lense of Paxton soils within the Charlton soil can cause down slope seeps and affect the structural integrity of proposed service infrastructures and dwellings.

- Hollis soils are limited by their shallowness to bedrock, which is approx. 10 to 20 inches in depth.

- The fine particulates of schist and gneiss associated with these soils stay in suspension for extended periods. This characteristic demands adequately sized temporary and permanent sedimentation basins to assure runoff pretreatment and minimize the potential for transport of solids and turbid water off-site.

- All of the aforementioned non-wetland soils (10-15) are easily suspended and transported by surface runoff. The minimization of land disturbance, avoiding or limiting exposure of steep slopes is important during all phases of construction.

16) Map Unit Eh – Ellington. USDA Soil #20A.

The Eh map unit consists primarily of Ellington soils on 0 to 3 percent slopes. Ellington soils are very deep, moderately well drained, formed in loamy over sandy and gravelly glacial outwash deposits. These soils have a seasonally high watertable at 1.5 to 2.5 feet in late fall to early spring. Typically, Ellington soils have a silt loam, very fine sandy loam or fine sandy loam surface layer and subsoil over a stratified sand and gravel substratum that extends to a depth of 60 inches or more. Ellington soils demonstrate redoxamorphic features within a 24 inch depth.

17) Map Unit GLC – Gloucester gravelly sandy loam 8 to 15 percent slopes. USDA Soil #58C

These very deep excessively drained soils formed in sandy glacial till derived mainly from granite, gneiss and schist. Gloucester soils contain more than 35 percent by volume of rock fragments. Typically, they have a fine sandy loam to gravelly sandy loam surface layer, a gravelly or very gravelly fine sandy loam or sandy loam upper subsoil and substratum. The substratum extends to a depth of 60 inches or more.

Note: This soil unit is not prevalent on the landscape and constitutes less than 1% of the landscape identified.

18) **Map Unit HcA – Haven silt loam 0 to 3 percent slopes**.
Map Unit HcB – Haven silt loam 3 to 8 percent slopes.

These very deep well drained soils formed in loamy over sandy and gravelly glacial fluvial deposits. Typically, they have a silt loam, loam or very fine sandy loam surface layer and subsoil over a stratified sand and gravel substratum.

This soil has a good potential for community development. The hazard of erosion is moderate. Permeability is moderate in the surface layer and subsoil and very rapid in the substratum. Runoff is medium

Note:

- The very rapid substratum raises concerns of ground water contamination from septic, construction activities.

19) Map Unit HkA – Hinckley gravelly sandy loam, 0 to 3 percent slopes. USDA Soil #38A.

HkC – Hinckley gravelly sandy loam, 8 to 15 percent slopes. USDA Soil #38C.

These very deep excessively drained soils formed in sandy and gravelly glacial fluvial deposits derived mainly from granite, gneiss or schist. Typically, Hinckley soils have a gravelly sandy loam or gravelly fine sandy loam surface layer over a stratified gravelly to extremely gravelly loamy sand-to-sand subsoil and substratum. The substratum extends to a depth of 60 inches or more.

21) Map Unit HME - Hinckley and Manchester 15 to 35 percent slopes. USDA Soil # 38E

This map unit consists of moderately steep to very steep, excessively drained soils on outwash terraces. The Hinckley and Manchester soils have rapid permeability in the surface layer and subsoil and very rapid permeability in the substratum. Runoff is rapid. Mainly the steep slopes limit soils. **Waste disposal systems, such as septic tank absorption fields, need very careful and often unusual design and installation to insure that effluent does not seep to the surface in areas downslope from the leaching system. Due to the very permeable substratum, particular attention to the systems design is required to prevent contamination of the groundwater.**

The hazard of erosion is severe. Intensive conservation measures are needed to prevent excessive runoff, erosion and siltation during periods of construction.

22) HpE – Hollis-Charlton-Rock Outcrop complex, 15 to 35 percent slopes. USDA Soil #73E

This complex has a **poor potential for development**. One soil is named Hollis. Hollis soils are shallow and well drained. They have fine sandy loam textures overlying consolidated bedrock at a depth of 10 – 20 inches. The other soil is named Charlton. Charlton soils are very deep well drained soils formed in loose glacial till. Typically, they have fine sandy loam textures to a depth of 60 inches or more.

The rock outcrop consists of exposures of crystalline bedrock located on knobs and ledges. The Hollis soil dominates the area, followed by the Charlton and rock outcrop components. **Runoff is rapid** in both the Hollis and Charlton type soils. Both are limited by steepness of

slopes and shallowness to bedrock, rock outcrops and stoniness. **There is a hazard of effluent seeping into cracks in the bedrock and polluting groundwater.**

These highly erodable slopes must employ intensive conservation measures such as the use of diversions, vegetative cover, mulching and siltation basins, which are needed to prevent excessive runoff, erosion and siltation.

23) Map Unit HrC – Hollis-Rock outcrop complex, 3 to 15 percent slopes. USDA Soil # 75C

Hollis soils are shallow and somewhat to well drained soils. Typically, they have fine sandy loam textures overlying consolidated bedrock at a depth of 10 to 20 inches. These soils do not have a watertable within their 20-inch depth.

24) Map Unit HSE – Hollis-Rock outcrop complex, 15 to 25percent slopes. USDA Soil # 75E

The map unit is limited mainly by steep-to-steep slopes, shallowness to bedrock and rock outcrops. This map unit has poor potential for development. **Onsite waste disposal systems will require very unusual design and installation. There is a hazard of system failure or that effluent may seep into the cracks in the bedrock and pollute the groundwater.**

Erosion hazard is severe. If these soils are disturbed for construction, intensive conservation measures, such as mulching, re-establish vegetative cover and siltation basins are needed to diffuse surface runoff to control excessive runoff, erosion and siltation.

25) Map Unit Nn – Ninegret fine sandy loam. USDA Soil #21A

These soils are very deep and moderately well drained. Ninegret soils formed in glacial outwash. Typically, they have a fine sandy loam surface and subsoil layer, overlying sand and gravel to a depth of 60 inches or more. They exhibit redoxamorphic features within a depth of 24 inches. These soils have a seasonally high watertable at 1.5 to 2.5 feet from late fall to early spring.

The soil has poor to fair potential for community development. Permeability is moderately rapid in the surface layer and subsoil and rapid in the substratum.

Concerns:

- Waste disposal system will not function properly due to the seasonally high watertable.

- Foundations and basements need to be properly designed and constructed to insure a stable foundation and prevent wet basements.

- Waste effluents have the potential to pollute ground water.

26) Map Unit PbB – Paxton fine sandy loam, 3-8 percent slopes. USDA Soil # 84B
Map Unit PbC – Paxton fine sandy loam, 8-15 percent slopes. USDA Soil # 84C

Map Unit PbD – Paxton fine sandy loam, 15-25 percent slopes. USDA Soil # 84D

This PbB map unit consists primarily of Paxton soils that are very deep, well drained soils formed in compact glacial till, derived mainly from gneiss and schist. Typically, they have a friable fine sandy loam or loam surface layer and subsoil over a firm fine sandy loam or sandy loam dense till substratum. Commonly referred to as hardpan.

This soil has **fair potential** for community development. Permeability is moderate in the surface layer and subsoil and slow in the substratum. It is limited mainly by the slowly permeable substratum and the steepness of slopes. **Runoff is rapid**. **Erosion hazard is severe** and fairly intensive conservation measures are needed to prevent excessive runoff, erosion and siltation during periods of construction.

"D" Slope Designations

- The steeper slope designations have a moderate to severe erosion hazard and waste disposal systems have the potential of effluent breakouts at mid-slope.

- These soils have a poor potential for development as steeper slopes increase the erosion hazard and dense subsoil layers perched watertables that form mid-slope seeps and may give rise to effluent breakouts from waste disposal systems.

- Careful design and installation of footing drains are needed to insure the integrity of the structures basement and utilities.

- The majority of these soils occur in the southern portion of this region, which has a majority of` low to medium density residential land use.

27) Map Unit PdB–Paxton very stony fine sandy loam, 3 to 8 % slopes. USDA Soil # 85B

Map Unit PdC–Paxton very stony fine sandy loam, 8 to 15 % slopes. USDA Soil # 85C

These map units are sloping, well drained soils on the sides of drumlins, ridges and hills of glacial uplands. The soils composition and description is similar to the aforementioned

Paxton soils except for the excess of stone in the matrix. The hardpan lenses that develop in these soils are a limiting factor regarding drainage and the optimal performance of any system on site.

28) Map Unit SvB - Sutton fine sandy loam, 3 to 8 percent slopes. USDA Soil # 50B

These soils are very deep and moderately well-drained. Typically, Sutton soils have fine sandy loam textures to a depth of 60 inches or more. Depths to the seasonally high watertable range from 1.5 to 2.5 feet during the months of November through April. Redoxamorphic features occur within a depth of 24 inches.

29) SxC – Sutton extremely stony fine sandy loam, 3 to 15 percent slopes. USDA Soil #52C

These soils are very deep and moderately well drained. They have developed in slight depressions on glacial till plains and near the base of slopes on glacial uplands where the relief is affected by underlying bedrock. Typically, Sutton soils have fine sandy loam textures to a depth of 60 inches or more. Depths to the seasonal high watertable range from 1.5 to 2.5 feet during the months of November to April. Redoxamorphic (mottles) features occur within a depth of 24 inches.

This soil has a **fair potential** for community development. Proposed structures with basements require careful design due to the basements being below the depth of the watertable. If not constructed properly, the structures integrity can be compromised. Waste disposal systems, such as on-site septic systems generally will not function satisfactorily with normal design and installation because of the seasonal high watertable. This soil will remain wet and soggy for several days after moderate to heavy rain events.

30) Map Unit UD - Udorthent Map Unit. USDA Soil #306 & 308

This mapping unit is comprised of cut and borrows areas where the surface layer and subsoil has been modified or removed. In many places, the landscape has been smoothed, and the cut and fill areas occur in a complex pattern. While this soil type is modified, the existing partial subsoil and substratum exhibit attributes linked to the **Agawam soil type (AfB).**

31) Map Unit WkC – Wethersfield loam, 8 to 15 percent slopes. USDA Soil # 87C

These sloping,, well drained soil is on the side slopes of drumlins, ridges and hills on glacial uplands. They formed in compact glacial till, derived mainly from red Triassic rocks. Typically they have a friable loam or silt loam surface layer and subsoil over firm loam, silt loam, or fine sandy loam, dense basal till substratum.

Permeability is moderate in the surface layer and subsoil and slow or very slow in the substratum. Runoff is medium. This soil has **fair potential** for development. The hazard of erosion is moderate. The slow permeability in the substratum affects the function of any

waste disposal system. During construction, conservation measures are necessary to prevent runoff, erosion and siltation.

- Proposed development of parcels with these soils should prompt closer investigation, due to influence of the physical attributes of the Wethersfield soils plus surface runoff and ground water effects. These soils are marginal and careful consideration should be given to not developing these soils.

32) Map Unit WxA – Woodbridge fine sandy loam, 0 to 3 percent slopes. USDA Soil #45A

This nearly level, moderately well drained soil is on the top of drumlins and in slight depressions on hill and ridges of glacial uplands. Woodbridge soils are very deep, moderately well drained soils that formed in compact glacial till, derived mainly from gneiss and schist. Typically, they have a friable fine sandy loam or loam surface layer and subsoil over a firm fine sandy loam or sandy loam dense till substratum. Woodbridge soils have a perched seasonal watertable at 1.5 to 2.5 feet from late fall to early spring.

Permeability is moderate in the surface layer and subsoil and slow in the substratum. Runoff is slow. This soil has fair potential for development. **It is limited mainly by the seasonally high watertable and its slowly permeable substratum.** Onsite septic systems will not function satisfactorily without careful and costly design and installation. This soil is subject to ponding at times.

During construction conservation measures are needed to prevent excessive runoff, erosion and siltation.

33) Map Unit WxB – Woodbridge fine sandy loam, 3 to 8 percent slopes. USDA Soil #46B

This gently sloping, moderately well drained soil is on the top of drumlins and in slight depressions and at the base of drumlins on glacial uplands. Woodbridge soils are very deep, moderately well drained soils that formed in compact glacial till, derived mainly from gneiss and schist. The substratum, described to a depth of 60 inches, is olive, mottled, very firm gravelly fine sandy loam. From late fall to early spring, Woodbridge soils have a watertable at a depth of 1.5 to 2.5 feet.

Permeability is moderate in the surface layer and subsoil and slow in the substratum. Runoff is medium. This soil has **fair potential** for development. **It is limited mainly by the high watertable and its slowly permeable substratum.** Onsite septic systems will not function satisfactorily without careful and costly design and installation.

- Siting buildings and their associated facilities require well-designed drainage around the footings, basements and fields to insure performance and maintain the integrity of the dwelling.

- Effluent breakouts from waste disposal systems are a possibility. These systems require careful design and installation in order to perform satisfactorily.

33) Map Unit WyC – Woodbridge fine sandy loam, 3 to 15 percent slopes. USDA Soil #47C

This gently sloping and sloping, moderately well drained soil is on the top and sides of ridges and hills of glacial uplands. Woodbridge soils are very deep, moderately well drained soils that formed in compact glacial till, derived mainly from gneiss and schist. The substratum, described to a depth of 60 inches, is olive, mottled, very firm gravelly fine sandy loam. From late fall to early spring, Woodbridge soils have a watertable at a depth of 20 inches.

Permeability is moderate in the surface layer and subsoil and slow in the substratum. Runoff is medium. This soil has fair potential for development. **It is limited mainly by the high watertable and its slowly permeable substratum.** Onsite septic systems will not function satisfactorily without careful and costly design and installation.

- Most construction will intercept or go below the watertable of 20 inches. Siting buildings and their associated facilities require well-designed drainage around the footings, basements and fields to insure performance and maintain the integrity of the dwelling.

- Particular attention needs to be given to insure that effluent does not seep to the surface downslope from the system, especially when the system is installed on steeper slopes.

- Erosion hazard is severe and requires enhanced conservation measures are needed to control runoff, erosion and sedimentation.

Note:

Soils 31 thru 33 are found in the southerly portion of this region near Clapboard Hill and Nortontown Rd. Agricultural, some industrial and commercial uses are sited within these soils along with medium concentrations of residential uses.

A1 – Exhibit #1

This upper section of the East Guilford Region has minor agricultural and moderate residential uses plus commercial ventures that modified the landscape from earth resource extraction operations. Along the lake and riverine environments to the east, the nonpoint threats to water quality are related to the aforementioned land uses. The soils in this area play a major part in cleansing and draining these lands towards the East River corridor. They act as a conduit for the transport of relatively high water quality through the Town of Guilford and ultimately into the sound.

The residential activities and roadways pose the greatest risk to surface and ground waters. The use of commercial pesticides and fertilizers plus the disposal of organic materials into the wetlands, watercourses and surface waterbodies collectively drive down water quality and have the potential to affect shallow wells and aquifers. Educating the public in an effort to curtail encroachment on wetlands, watercourses and surface waterbodies by private landowners needs to be addressed. This should include a program to provide guidance on lawn care and septic system maintenance strategies for Guilford.

A2

Generally, the middle section of the East Guilford region is undeveloped. Its size is approx. 700-800 acres of the 3,300-acre region. Singly, this may be the best opportunity to preserve contiguous open space and limit the fragmentation of forested habitat. The potential development of 160 residential units and roadway will add to the current problem of sprawl, which is plaguing many Connecticut communities.

The conceptual drawings and layout for development have not explored the limitations of the soils and water resources in this area. A project of this size requires a comprehensive review of this area to assess and evaluate all natural resources and limit the destruction of aquatic and terrestrial habitats. Foresight in planning dramatically reduces or eliminates unnecessary risks to the environment. This proposal falls quite short of smart growth planning.

A3

This area has a higher degree of development from all levels of land use and possesses a wide array of fresh water and tidal environments, which are in jeopardy of non-point source contaminants. Developing strategies to modify state, municipal and private landowner land use should be explored in order to preserve and protect Guilford's natural resources and those of Long Island Sound.

Should the town require any additional information or wish to have the Southwest Conservation District review the proposed site plan please contact the District office.

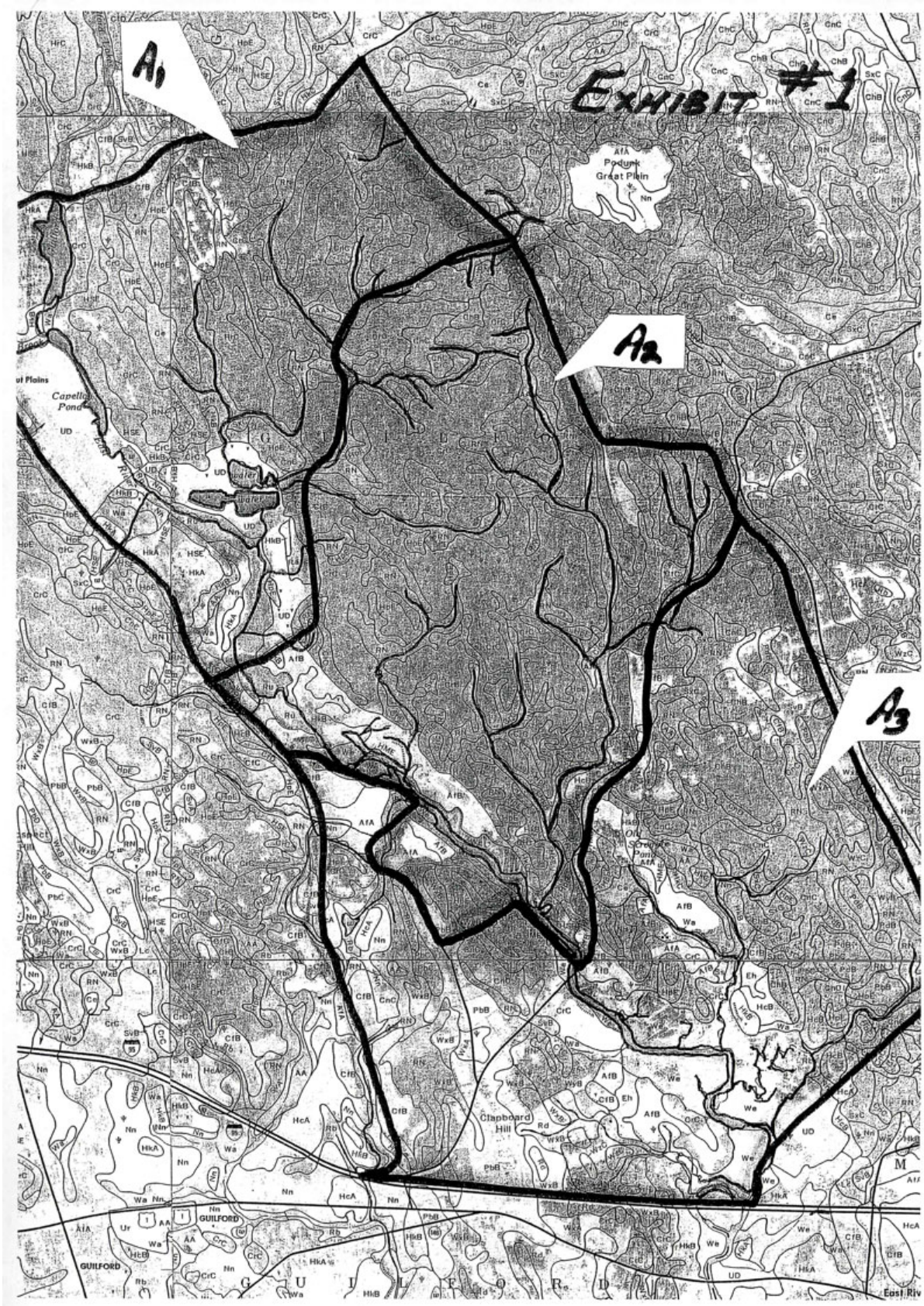

A1
EXHIBIT #1
A2
A3
Potunk
Great Plain
Capella
Pond
Clapboard
Hill
GUILFORD
GUILFORD

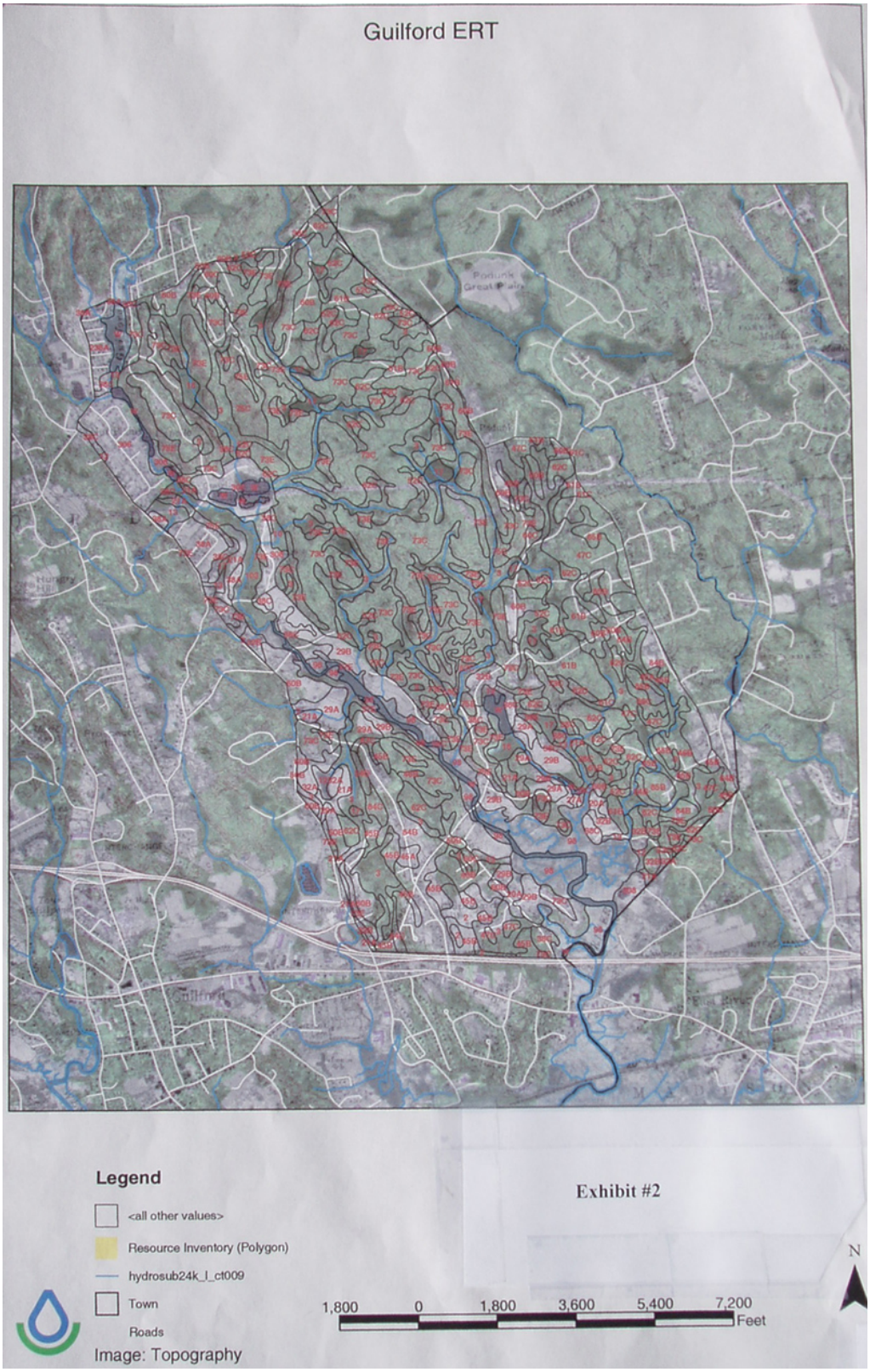
Exhibit #1

Soils Inventory Report

Map Unit Symbol	Map Unit Name	Acres	Percent
10	RAYNHAM SILT LOAM	5.2	0%
103	RIPPOWAM FINE SANDY LOAM	43.5	1%
12	RAYPOL SILT LOAM	11.1	0%
13	WALPOLE SANDY LOAM	32.9	1%
17	ADRIAN AND PALMS SOILS	34.7	1%
18	CARLISLE MUCK	14.2	0%
2	RIDGEBURY FINE SANDY LOAM	20.6	1%
20A	ELLINGTON SILT LOAM, 0 TO 5 PERCENT SLOPES	9.5	0%
21A	NINIGRET AND TISBURY SOILS, 0 TO 5 PERCENT SLOPES	33	1%
238A	HINCKLEY-URBAN LAND COMPLEX, 0 TO 3 PERCENT SLOPES	21.7	1%
27A	BELGRADE SILT LOAM, 0 TO 5 PERCENT SLOPES	1	0%
29A	AGAWAM FINE SANDY LOAM, 0 TO 3 PERCENT SLOPES	36.9	1%
29B	AGAWAM FINE SANDY LOAM, 3 TO 8 PERCENT SLOPES	118	4%
3	RIDGEBURY, LEICESTER AND WHITMAN SOILS, EXTREMELY STONY	482.6	15%
306	UDORTHENTS-URBAN LAND COMPLEX	92.8	3%
308	UDORTHENTS, SMOOTHED	31.2	1%
32A	HAVEN AND ENFIELD SOILS, 0 TO 3 PERCENT SLOPES	14.6	0%
32B	HAVEN AND ENFIELD SOILS, 3 TO 8 PERCENT SLOPES	35.1	1%
37E	MANCHESTER GRAVELLY SANDY LOAM, 15 TO 45 PERCENT SLOPES	18	1%
38A	HINCKLEY GRAVELLY SANDY LOAM, 0 TO 3 PERCENT SLOPES	30	1%
38C	HINCKLEY GRAVELLY SANDY LOAM, 3 TO 15 PERCENT SLOPES	72.8	2%
38E	HINCKLEY GRAVELLY SANDY LOAM, 15 TO 45 PERCENT SLOPES	2.2	0%
45A	WOODBRIDGE FINE SANDY LOAM, 0 TO 3 PERCENT SLOPES	7.4	0%

45B	WOODBRIDGE FINE SANDY LOAM, 3 TO 8 PERCENT SLOPES	59.3	2%
46B	WOODBRIDGE FINE SANDY LOAM, 2 TO 8 PERCENT SLOPES, VERY STONY	46.3	1%
47C	WOODBRIDGE FINE SANDY LOAM, 2 TO 15 PERCENT SLOPES, EXTREMELY STONY	67.1	2%
SOB	SUTTON FINE SANDY LOAM, 3 TO 8 PERCENT SLOPES	24.9	1%
52C	SUTTON FINE SANDY LOAM, 2 TO 15 PERCENT SLOPES, EXTREMELY STONY	53.8	2%
58C	GLOUCESTER GRAVELLY SANDY LOAM, 8 TO 15 PERCENT SLOPES, VERY STONY	2.2	0%
60B	CANTON AND CHARLTON SOILS, 3 TO 8 PERCENT SLOPES	126.3	4%
60C	CANTON AND CHARLTON SOILS, 8 TO 15 PERCENT SLOPES	14.2	0%
61B	CANTON AND CHARLTON SOILS, 3 TO 8 PERCENT SLOPES, VERY STONY	69.3	2%
61C	CANTON AND CHARLTON SOILS, 8 TO 15 PERCENT SLOPES, VERY STONY	2	0%
62C	CANTON AND CHARLTON SOILS, 3 TO 15 PERCENT SLOPES, EXTREMELY STONY	174.6	5%
62D	CANTON AND CHARLTON SOILS, 15 TO 35 PERCENT SLOPES, EXTREMELY STONY	3.4	0%
73C	CHARLTON-CHATFIELD COMPLEX, 3 TO 15 PERCENT SLOPES, VERY ROCKY	679.8	21%
73E	CHARLTON-CHATFIELD COMPLEX, 15 TO 45 PERCENT SLOPES, VERY ROCKY	278.3	8%
75C	HOLLIS-CHATFIELD ROCK OUTCROP COMPLEX, 3 TO 15 PERCENT SLOPES	36.2	1%
75E	HOLLIS-CHATFIELD ROCK OUTCROP COMPLEX, 15 TO 45 PERCENT SLOPES	62.9	2%
84B	PAXTON AND MONTAUK SOILS, 3 TO 8 PERCENT SLOPES	133.9	4%
84C	PAXTON AND MONTAUK SOILS, 8 TO 15 PERCENT SLOPES	10.1	0%
84D	PAXTON AND MONTAUK SOILS, 15 TO 25 PERCENT SLOPES	4.2	0%
85B	PAXTON AND MONTAUK SOILS, 3 TO 8 PERCENT SLOPES, VERY STONY	58.4	2%

	PAXTON AND MONTAUK SOILS, 3 TO		
86C	15 PERCENT SLOPES, EXTREMELY STONY	7.3	0%
87C	WETHERSFIELD LOAM, 8 TO 15 PERCENT SLOPES	3.2	0%
98	WESTBROOK MUCKY PEAT	145.8	4%
W	WATER	71.3	2%
	Total:	3303.8	


Guilford ERT
Legend
<all other values>
Resource Inventory (Polygon)
hydrosub24k_l_ct009
Town
Roads
Image: Topography
Exhibit #2
N
1,800 0 1,800 3,600 5,400 7,200
Feet

Exhibit#2

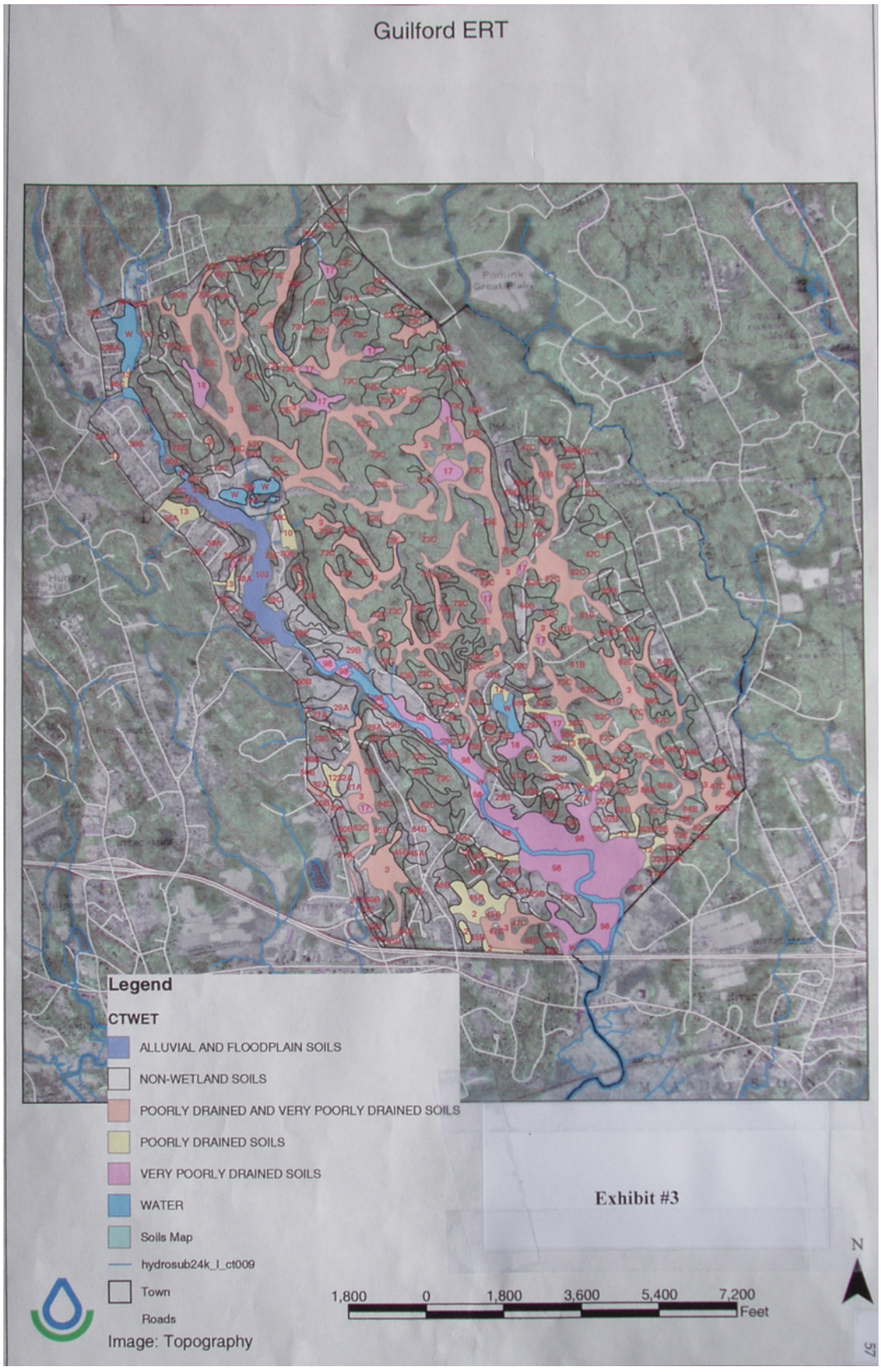

Guilford ERT
Legend
CTWET
ALLUVIAL AND FLOODPLAIN SOILS
NON-WETLAND SOILS
POORLY DRAINED AND VERY POORLY DRAINED SOILS
POORLY DRAINED SOILS
VERY POORLY DRAINED SOILS
WATER
Soils Map
hydrosub24k_l_ct009
Town
Roads
Image: Topography
Exhibit #3
1,800 0 1,800 3,600 5,400 7,200
Feet
N
57

Exhibit #3

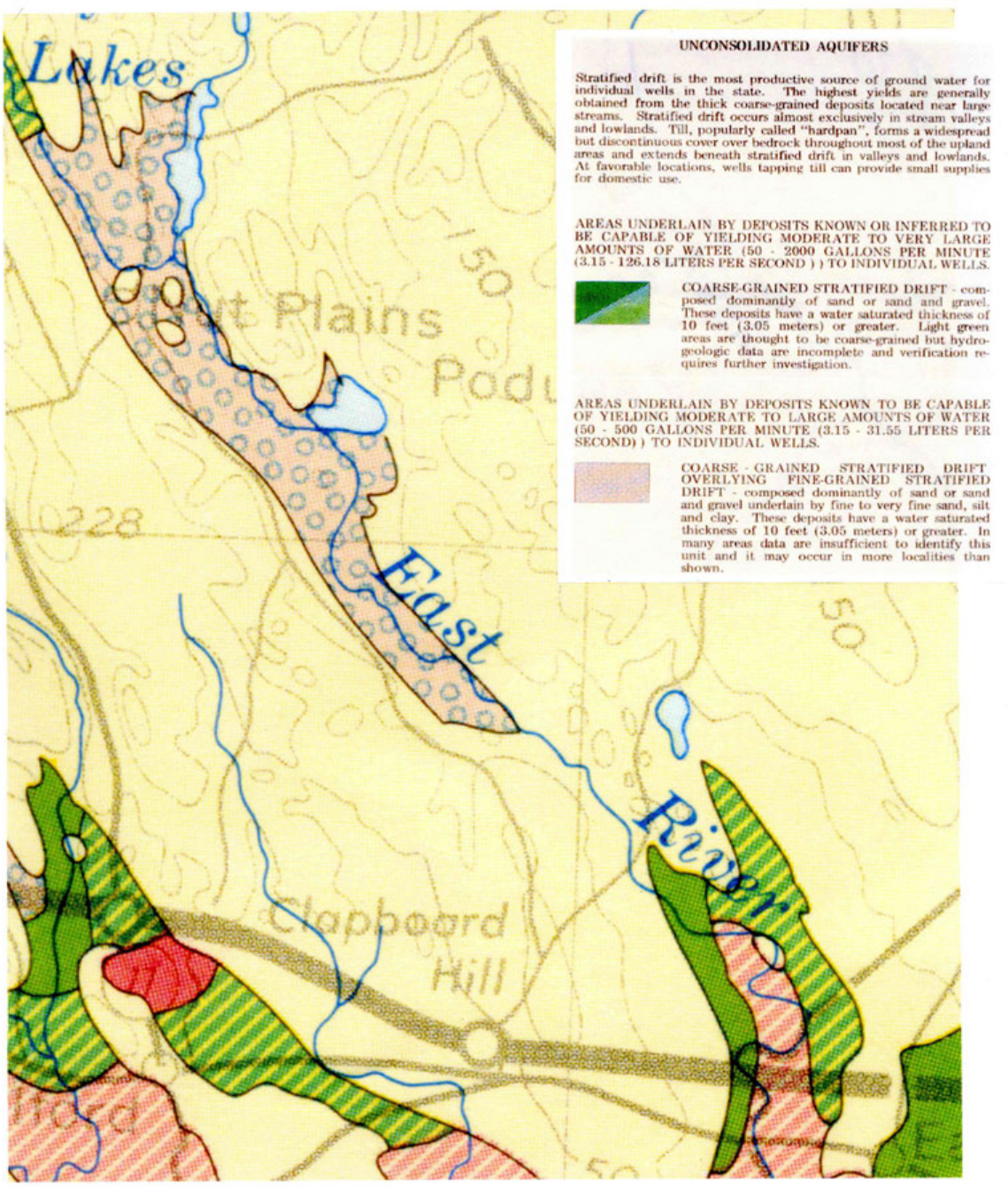

Lakes
Plains
228
East
River
Clapboard
Hill
UNCONSOLIDATED AQUIFERS
Stratified drift is the most productive source of ground water for individual wells in the state. The highest yields are generally obtained from the thick coarse-grained deposits located near large streams. Stratified drift occurs almost exclusively in stream valleys and lowlands. Till, popularly called "hardpan", forms a widespread but discontinuous cover over bedrock throughout most of the upland areas and extends beneath stratified drift in valleys and lowlands. At favorable locations, wells tapping till can provide small supplies for domestic use.
AREAS UNDERLAIN BY DEPOSITS KNOWN OR INFERRED TO BE CAPABLE OF YIELDING MODERATE TO VERY LARGE AMOUNTS OF WATER (50 - 2000 GALLONS PER MINUTE (3.15 - 126.18 LITERS PER SECOND)) TO INDIVIDUAL WELLS.
COARSE-GRAINED STRATIFIED DRIFT - composed dominantly of sand or sand and gravel. These deposits have a water saturated thickness of 10 feet (3.05 meters) or greater. Light green areas are thought to be coarse-grained but hydrogeologic data are incomplete and verification requires further investigation.
AREAS UNDERLAIN BY DEPOSITS KNOWN TO BE CAPABLE OF YIELDING MODERATE TO LARGE AMOUNTS OF WATER (50 - 500 GALLONS PER MINUTE (3.15 - 31.55 LITERS PER SECOND)) TO INDIVIDUAL WELLS.
COARSE - GRAINED STRATIFIED DRIFT OVERLYING FINE-GRAINED STRATIFIED DRIFT - composed dominantly of sand or sand and gravel underlain by fine to very fine sand, silt and clay. These deposits have a water saturated thickness of 10 feet (3.05 meters) or greater. In many areas data are insufficient to identify this unit and it may occur in more localities than shown.

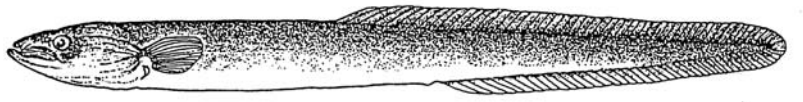
Exhibit #4

Fisheries Resources

East River

The East River is a locally important recreational resource, which supports a mixed coldwater/warmwater fish community. It is annually stocked with over 500 adult (9-12") brown trout in the Town of Guilford. There are several stocking locations on the river where there is public access, extending from below Guilford Lakes downstream to Foote Bridge Road. The river also supports a very diverse assemblage of resident finfish. The river was last surveyed within a tidal zone on 7/11/1990 downstream of a town access road off of Nut Plain Road. Fish community assemblage listed in descending order of abundance was as follows: American eel, fourspine stickleback, fallfish, banded killifish, sea lamprey, redbreast sunfish, white sucker, hogchoker, striped killifish, brown bullhead, white catfish, yellow perch, golden shiner, largemouth bass and ninespine stickleback.

Relative to diadromous fish, the East River also supports strong runs of river herring (alewife, blueback herring), sea lamprey and supports the catadromous American eel. It is also known to support a sea-run brown trout population. The first dam on the system is Capello Pond Dam, which has a well functioning Denil fishway. The second dam is Lower Guilford Lakes Dam that has a hybrid fishway: bypass channel, rocky ramp, and steeppass. This fishway while only a couple of years old has passed alewife, sea lamprey, American eel and resident fish including trout.



American eel (*Anguilla rostrata*), from Freshwater Fishes of Connecticut, 1996, Fig.20.

Potential Impacts from Future Residential Development

The Town of Guilford requested that Team members provide some general advice as to potential impacts of the proposed Bearhouse Hills development (Goss Property) to be located on a 440 acre parcel with an estimated 110 residential house lots.

- **Stream Sedimentation**

Sediment runoff could negatively impact watercourses that support fisheries resources. The negative impacts of sediment runoff have been well documented by researchers. Sediment will reduce populations of aquatic insects and fish by eliminating physical habitat while suspended sediments will reduce dissolved oxygen levels (Cordone and Kelley 1961). Suspended sediments may prevent successful nest development of trout (Bell 1986). As

reported by Meehan (1991), sediment deposition can severely impact spawning substrate abundance and quality. Reductions in egg survival are caused by smothering, insufficient oxygen supply and lack of proper removal of catabolic products (Bell 1986). Meehan (1991) indicated that erosion and sedimentation of instream habitat could alter channel morphology by increasing the stream width-depth ratio, incidence and severity of stream bank erosion, channel braiding, and reduce pool volume and frequency.

- ***Stormwater Pollution***

Stormwaters that outlet to wetlands, ponds and watercourses can contain a variety of pollutants that degrade downstream water quality to the detriment of aquatic organisms (Klein 1979). Pollutants commonly found in stormwaters include hydrocarbons (gasoline and oil), herbicides, heavy metals, road salt, fine silts, and coarse sediment. Nutrients, total phosphorous and total nitrogen in stormwater runoff fertilize stream waters causing water quality degradation. Additionally, fine silts in stormwaters that remain in suspension for prolonged periods often cannot be effectively removed from engineered stormwater detention basins and/or roadway catch basins. Accidentally spilled petroleum based chemicals or other toxicants cause partial or complete fishkills if introduced in high concentrations. Klein (1979) and Booth (1991) document that fish and aquatic community health declines significantly when impervious cover exceeds 10% in a watershed. Impervious cover greater than 25% represents extensive urbanization within a watershed such to the extent that stream water quality and fish community health precipitously decline after that point of development.

- **Thermal Loading**

Thermal loading or increases in ambient surface water temperatures during the summer is a serious concern with any development that results in the increase in the amount of impervious surfaces. Impervious areas act as a heat collector, with heat being imparted to stormwaters as they pass over impervious surfaces. In addition, stormwater temperatures can be elevated from solar radiation as they as collected and stored in detention basins that may be constructed as part of any development. Surface water temperatures of downstream areas of streams are greatly influenced by temperatures of upstream headwaters.

- **Percolation of septic effluent**

A failure of septic systems to operate properly can be potentially dangerous to the environmental health of nearby riverine resources. Nutrients, especially phosphorous and assorted chemicals that may be placed in septic systems could possibly enter wetlands and streams in the event of a system failure or infiltrate the groundwater during the spring when water tables are close to the surface. Failure of the systems to operate properly could threaten fish habitat, public health, and overall water quality conditions.

Recommendations

- **Erosion and Sediment Control Plan**

It is recommended that any future subdivision development develop an aggressive and effective erosion and sediment control plan that utilizes guidance as described in the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control. Proper installation and

maintenance of erosion/sediment controls is critical to environmental well being. This includes such mitigative measures as filter fabric barrier fences, staked hay bales, and sediment basins. Land disturbance and clearing should be kept to a minimum and completed in phases. All disturbed areas should be restabilized as soon as possible. Exposed, unvegetated areas should be protected from storm events. The applicant and the local wetland enforcement officer should be responsible for checking this development on a periodic basis to ensure that all soil erosion and sediment controls are being maintained.

- **Stormwater Management**

The effective management of stormwaters and roadway runoff can be accomplished through proper design, location, and maintenance of stormwater detention and catch basins. It is recommended that future developments utilize the latest technology as described in the DEP 2004 Connecticut Stormwater Quality Manual and with the goal of minimizing thermal impacts to receiving water bodies. Particular attention should be made to stormwater discharges that outlet to wetlands and watercourses to ensure that instream erosion is not accelerated. Maintenance is very critical. Catch basins should be regularly maintained to minimize eventual adverse impacts to aquatic resources. The use of sand and sodium chloride road salt to de-ice paved surfaces should be minimized.

- **Lawn Chemicals/Fertilizer**

Property owners should consider having the soil in lawns tested to identify which nutrients are sufficiently abundant and which nutrients are not. This information tells you which nutrients you need and don't need to put on your lawn. Whenever possible, landowners should use fertilizers with little or no phosphorus. The use of low or non-phosphorous fertilizers can provide nutrients while avoiding threats to water quality.

- **Properly design and locate septic systems**

It is critical that all septic systems be placed in areas that will effectively limit septic effluent. Systems should not be placed adjacent to sensitive wetland and stream ecosystems. All septic systems should be maintained on a regular basis. Prevent the disposal of harmful chemicals into septic systems, which may negatively effect operation and possibly result in system failure.

- **Riparian Zone Protection**

It is highly recommended that a riparian buffer zone be maintained along the East River and its tributaries. A riparian buffer is one of the most natural mitigation measures to protect water quality and fisheries resources. It is the policy of the Connecticut Department of Environmental Protection, Inland Fisheries Division that riparian corridors along perennial streams be protected with an undisturbed 100-foot wide riparian buffer zone whereas intermittent streams should be protected with a 50-foot wide undisturbed riparian buffer. A copy of this policy is available upon request from the Team's fisheries biologist. No construction and alteration of existing habitat should be allowed in this zone.

- **Stream Crossing Guidelines**

The following is a copy of the Inland Fisheries Division policy relative to stream crossing best management practices.

The Inland Fisheries Division (the "Division") routinely recommends the installation of span bridges or arch culverts for the crossing of **perennial watercourses**. *These structures best preserve physical aquatic habitat and do not create barriers to fish migration. In certain select situations, the Division has accepted the installation of culverts for stream crossings. However, a certain amount of modification to a culvert is required to assure the efficacy of maintaining aquatic habitat and resource integrity. The modifications recommended are:*

- The invert of a box culvert should be set no less than 1 foot below the existing streambed elevation. The invert of a round culvert less than 10 feet in diameter should be set 1 to 2 feet below the existing streambed elevation. For round pipe greater than 10 feet in diameter, the culvert invert should be set one-fifth of the pipe diameter below the streambed elevation.

- For multiple culvert situations, one or more of the culverts should be installed as per the guidelines for single culverts. Deflectors may need to be installed in the stream to concentrate low streamflows into and through the recessed culvert.

- The culvert gradient should be no steeper than the streambed gradient upstream or downstream of the culvert.

- The culvert alignment should be similar to that of the stream and the culvert kept at a short a length as possible. Vertical headwalls rather than fill slopes should be installed at the culvert inlet and outlet to reduce the total culvert length.

- Corrugated metal culverts rather than concrete culverts are preferred. The corrugations create a roughness, which aids in the retention of streambed material.

- Streambed material excavated for the culvert placement should be stockpiled and be replaced within the culvert following its installation. The streambed material should be replaced in a manner replicating the original stream cross section with a well-defined low flow channel contiguous with that existing in the stream.

Culverts installed on ***intermittent watercourses*** are evaluated based upon the potential for seasonal utilization of the watercourses by fish.

In addition to offering recommendations for structure design, the Division has developed the following measures to enhance and/or protect aquatic habitats and resources during instream and near-stream construction activities.

- The placement of scour protection measures should be minimized to the fullest extent possible. Native stone should be utilized rather than quarried rip-rap.

- Unconfined instream activities should be allowed only during the time period of June 1 through September 30.

- Retaining walls should be utilized in lieu of fill slopes along roadway approaches to stream crossing structures to minimize riparian habitat loss.

- Riparian vegetation disturbed during construction should be re-established in a timely manner upon the project completion. The species of vegetation selected for reestablishment should be native to the immediate watershed and be non-invasive.

- All appropriate erosion and sediment controls should be established prior to and be maintained through all phases of construction.

Literature Cited

Bell, M.C. 1986. Fisheries handbook of engineering requirements and biological criteria. U.S. Army Corps of Engineers. Fish Passage Development and Evaluation Program. North Pacific Division, Portland, OR. 290 pp.

Booth, D. 1991. Urbanization and the natural drainage system-impacts, solutions and prognoses. Northwest Environmental Journal. 7(1): 93-118

Cordone, A. J., and D. W. Kelley. 1961. The influences of inorganic sediment on the aquatic life of streams. California Fish and Game 47:189-228.

Klein, R, D. (1979) Urbanization and Stream Quality Impairment. Water Resources Bulletin 15(4) 948- 963.

Meehan, W.R. 1991. Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society Special Publication 19, Bethesda, MD. 751 pp.

Wildlife Resources

Wildlife Habitats

One major, direct impact of additional development in the project area will be loss of wildlife habitat. As more and more acres are lost to development, native wildlife species that are dependent on the habitat found in those acres are displaced. Only those species that are highly adaptable to living around human populations (including raccoons, blue jays, and non-native house sparrows and starlings) can be expected to thrive. While it is unknown what types of habitats are found in the area of the large proposed development site (Goss Property), it is likely that there are species present that will not be able to make use of a residential area. Additionally, there may be species present that require multiple habitat types, such as those that require both wetland and upland habitat. Although there may be an effect on only one of those habitat types, these species will be negatively impacted because of their need for both habitat types in close proximity to one another.

Other types of impacts include degradation of habitat due to increased traffic and roads around the developments, and isolation and fragmentation of habitat patches as more land is developed, leaving only 'islands' of habitat with no access to or from other open space areas.

Reducing Impacts

Although steps that can be recommended to reduce impacts to wildlife are generally site-specific, some general guidelines can be provided. One step that can be taken is to provide corridors to open space areas. This involves leaving areas of open space within the development that are connected to other areas of open space (parks, etc.) outside the development. This can facilitate movement by providing food and cover and reduces the risks (vehicular, etc.) to wildlife traveling for foraging and breeding purposes.

Another step that can be taken is to consider the placement of open space areas within subdivisions and placement of subdivisions in relation to each other. In most cases, one or more large areas of open space are preferable to many small areas. If the proposed development includes a minimum open space requirement, it should be situated to maximize the contiguous acreage and should be placed near an area of particular wildlife value (this, of course, is site-specific). Unique or special habitat features of a proposed development site should not be surrounded by houses, essentially creating an island of habitat that is inaccessible without crossing a road. Instead, open space should be planned in such a way so that these features are accessible from surrounding areas, even if these areas are also developed.

Additionally, placement of the subdivisions and open spaces within them should also be considered in relation to each other. For example, if an existing subdivision contains open space that has a vernal pool, it would benefit wildlife to maintain any upland habitat found near that pool as open space when considering open space issues in surrounding subdivisions.

Please note that this wildlife section does not specifically address any particular subdivision in the town of Guilford, but is being provided as a very general guideline regarding issues to consider in development. As the amount of development or habitat conversion to highly disturbed construction area increases, the value for wildlife proportionally decreases. More specific information can only be provided by visiting the locations of the proposed developments, determining what habitats are present, and the requirements of the wildlife species found in those habitats.

The Natural Diversity Data Base

The Natural diversity Data Base maps and files regarding the project area have been reviewed. According to our information there are several records for state-listed species that occur within the project boundaries.

Species Name	Common Name	State Status
Progne subis	Purple Martin	Threatened
Aristida purpurascens	Arrowfeather	Special Concern
Scirpus sylindricus	Salt Marsh Bulrush	Special concern
Aristolochia serpentaria	Virginia Snakeroot	Special Concern
Brackish Tidal Marsh	Significant Natural Community	N/A

The purple martin is a colonial nesting bird that relies entirely on man-made structures (martin houses, hollow gourds, etc.) for nesting habitat. This species forages over open areas in close proximity to large bodies of water and human dwellings. Installation and annual maintenance of the purple martin house in this area might benefit this species.

The Wildlife Division has not made a detailed on-site inspection of the project area. Consultation with this office should not be substituted for site-specific surveys that may be required for environmental assessments. This is a preliminary site review and is not a final determination. A more detailed review may be conducted as part of any subsequent environmental permit applications submitted to the DEP for the proposed site. Please be advised that should state involvement occur in some other fashion, specific restrictions or conditions relating to the species discussed above may apply. In this situation, additional evaluation of the proposal by the DEP Wildlife Division should be requested and species-specific surveys may be required.

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

Archaeological and Historical Review

Review of the state of Connecticut's archaeological site files and maps show two known archaeological sites in the inventory area. In addition, the project area is located in a highly sensitive area for prehistoric archaeological sites. The project area contains a number of highly sensitive areas for undiscovered archaeological sites, including the drainage area of the East River. Archaeological sites in the area and in close proximity suggest that the topographic and environmental characteristics of the project area should contain Native American camp and village sites. These potential sites would be adjacent to the wetland areas and represent the seasonal occupations of Native American hunters-gatherers utilizing the natural resources of the area.

In addition, historic sites including extant industrial stone mill ruins and colonial house foundations have a high potential of yielding important information on Guilford's history. We strongly suggest that the town work with their municipal historian, Joel Hylander, in identifying any historic features that may exist, in the inventory area.

The Office of State Archaeology (OSA) recommends that the town consider a cultural resource archaeological survey of the inventory area to identify, evaluate and manage all cultural resources that may be there. The recommended archaeological survey should be conducted in accordance with the State Historic Preservation Office's *Environmental Review Primer for Connecticut's Archaeological Resources.* Funding may be available in the near future from the state of Connecticut to conduct the recommended survey.

The OSA is prepared to offer technical assistance in conducting the archaeological survey and they look forward to working with the Town of Guilford in the conservation and preservation of its cultural resources.

Recreation Planning Review

The purpose of the ERT reportedly is to provide the Town of Guilford guidance on how to help shape the future of the southeastern portion of the community, now undergoing great development pressure. The major theme is to seek an appropriate balance between development and preservation, a secondary and related issue involves the perceived need for a new east-west road, and both for fire and rescue purposes and to lesson I-95 bound traffic on Podunk and Clapboard Hill Roads. Such a road would begin at the Podunk Road/Squaw Lane intersection, incidentally requiring considerable blasting, and extend west to Nut Plains Road at either the Foote Bridge or Stump Dump access road locations.

This once large rural area has already experienced much subdivision development in its northern half and a roughly 400 acre property is now proposed for development, encompassing much of the rest of it. Thus the time for decision making has arrived, with resulting actions likely to have a major impact through the proposed 110 lot subdivision in this area.

Review of the town's new natural resource inventory and assessment provides an excellent overview of the area's physical character and any significant resources which it possesses. Basically it consists of a wooded, gneiss-based upland east of the East River and a riverine corridor of floodplain and marsh bordered by glacial terraces along the East River itself. The upland segment is significant as a sizeable unbroken forest but also in containing a network of stream corridors feeding and thus impacting the quality of the East River. As such it is considered part of the Lower Connecticut River focus area in the CT DEP Resource Protection Project Focus Area Program. The neighboring river corridor has its own important values including a significant 100 year flood zone, the East River Marsh Complex listed by the National Audubon Society as a globally-significant bird area, and the recreation and habitat values of the river and adjoining lands.

When one overlays such attributes as significant forestry, significant river system, natural diversity data base sites, plus the area's value as a wildlife migration corridor, it is clear that it is a significant natural resource area as recognized in the Natural Resource Inventory and Assessment. Therefore any development proposal within this environmentally sensitive should minimize any negative impacts to the extent possible within existing zoning and property rights constraints.

Ideally the entire 400 acre property proposed for development should be maintained as permanent open space, but this reviewer recognizes the difficulties of this occurring. The base guidelines of any plan to be approved should contain the following elements:

1. Maximizing the permanent open space component of the subdivision,
2. Provision of continuous open space corridors for hiking trail and wildlife migration corridor purposes and specifically to help provide a proposed routing for the

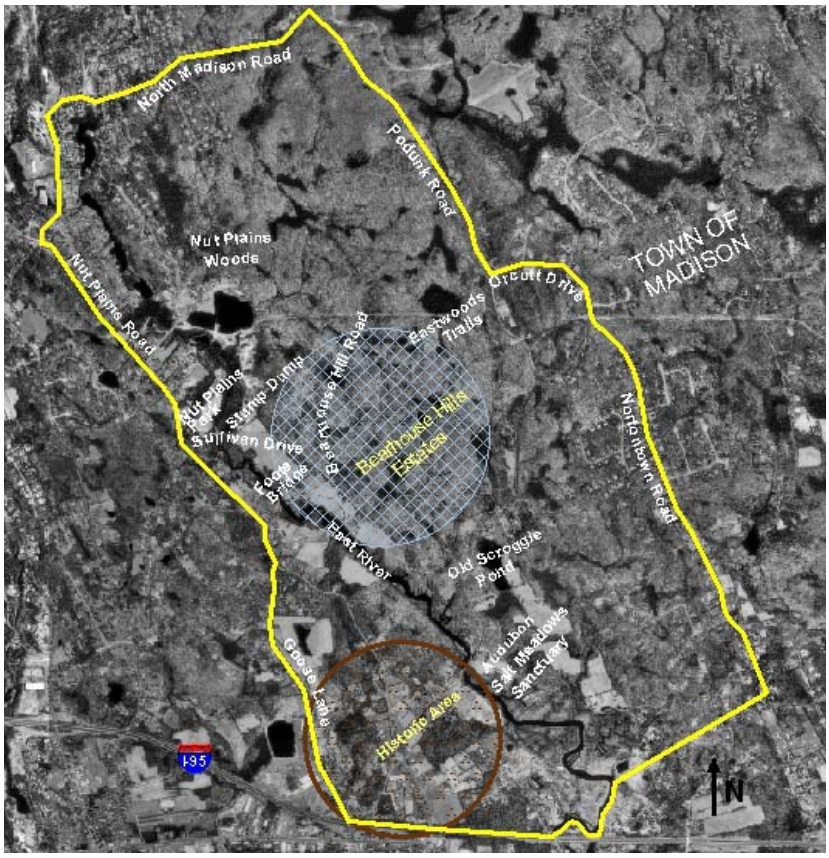
Metacomet/MMM Trail south from the Town's Timberland Property toward Long Island Sound.

3. Minimizing impact of wetlands corridors within the upland area caused either by subdivision activity or construction of the proposed east-west road to prevent impact on the water quality of the East River.
4. Maintaining the meadow habitat along the river corridor as rare grassland bird habitat.

Land Use Planning Considerations

Site Location

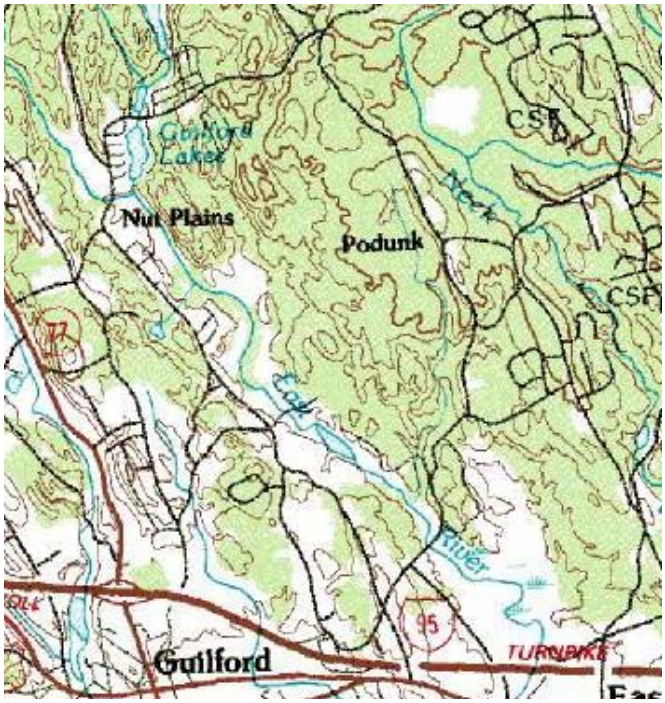
The Town of Guilford has requested a review of the area known as East Guilford for a natural resource inventory and assessment. This area has previously been identified as a predominantly vacant area that could potentially be residentially developed in Guilford's Growth Management Strategies, August 9, 2004.



Site Characteristics

The site area is bounded by the Town of Madison to the East, I-95 and the municipal Boundary to the south/southeast, Goose Lane and Nut Plains Road to the west and North Madison Road to the north. Housing is developed along the perimeter streets of this area and mostly to the west of the East River as seen on the above map. The undeveloped areas are mostly forested with gradual topography and the site includes many wetland areas and

waterbodies including the East River, Old Scroggle Pond, and a portion of Guilford Lakes to the north.



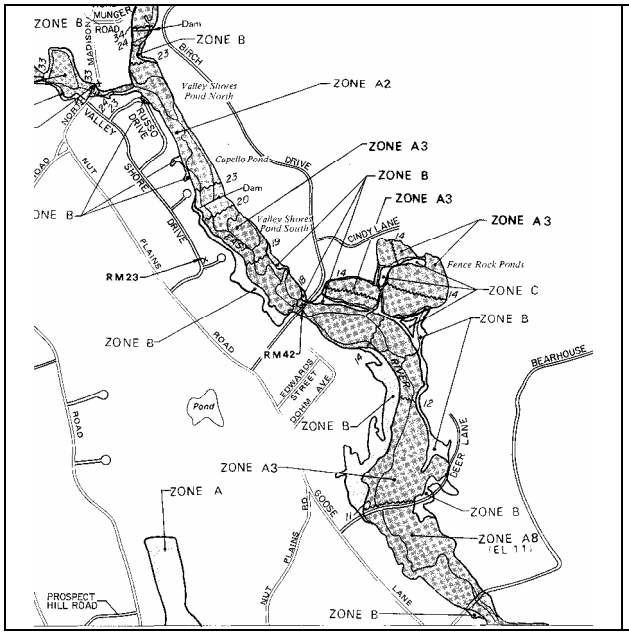
The Town of Guilford currently does not provide any sewer service and has limited public water supply that does not extend to this area, so proposed developments in this area need to be served by private septic and well systems. (Water service is provided to developments to the north of Guilford Lakes.) Otherwise Guilford is serviced by Southern Connecticut Gas, Connecticut Light and Power and SBC.

Several homes within the vicinity are listed by the Guilford Preservation Alliance as Historic homes (circa 1738 – mid 1840s) and are located in a historic district in the southwesterly area of the site on Clapboard Hill Road (15), East River Road (3), Goose Lane (9), and Tanner Marsh Road (2). Other streets within this area with historic homes include Nut Plains Road (10), Podunk Road (3), and Nortontown Road (3). The Historic Foote Family Cemetery is located off of Bearhouse Hill Road. The road is also historic for its status as an original Native American route and as an early "Post Road" before it was rerouted closer to the shore. Much of the area has historically been used for agricultural purposes including a cranberry bog off of Bearhouse Hill Road.

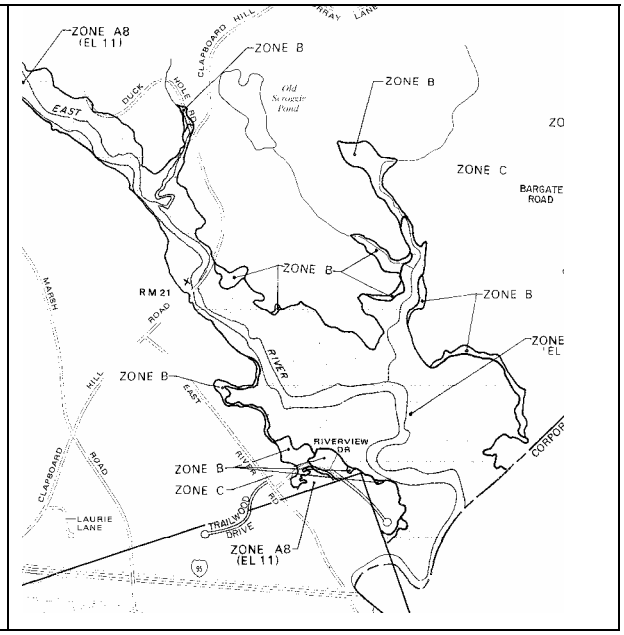
A 491± acre site within East Guilford is proposed for an open space subdivision, known as Bearhouse Hill Estates, to the south and north of Bearhouse Hill Road. The development proposes 110 single family homes with individual septic systems, wells and drainage systems on 185± acres with 306± acres to be preserved as open space. The open space areas include wetlands, watercourses, and some areas of steep slopes.

Watershed issues

Guilford currently has pending Stormwater Management regulations for both its zoning codes and its subdivision codes that would require best management practices to be utilized in the design of the stormwater management system to protect water quality and renovate stormwater prior to discharge. The East River, which drains into Long Island Sound, flows along the westerly portion of the site is tidal until about 1 mile north of the Audubon Salt Meadows Sanctuary and includes many adjacent tidal wetlands.



Northwesterly East Guilford
FIRM Map - August 19, 1986



Southwesterly East Guilford,
FIRM Map - August 19, 1986

Areas directly adjacent to the East River and Neck River are within Zone A, the 100 year flood hazard plain, or within Zone B, the 500 year flood hazard plain, including a portion of the Audubon's Guilford Salt Meadows Sanctuary (Southerly East Guilford). In addition, the East River Marsh/Forest System and an area bounded by Tanner Marsh Road, Clapboard Hill Road, and East River Road have both been identified in Guilford's *Growth Management Strategies* (August 9, 2004, p. 52) as a Significant Natural Resource Area (SNRA). This designation is made by the Connecticut Department of Environmental Protection (A map showing this area can be accessed at the CT DEP's website at http://dep.state.ct.us/cgnhs/nddb/nddbpdfs.asp) to identify habitat areas with state and federal listed endangered species or areas of significant natural communities.

State Endangered and Threatened species are protected by the Connecticut Endangered Species Act (Connecticut General Statutes Sec. 26-303 to Sec. 26-315). The purpose of the Act is to conserve, protect, restore and enhance any endangered or threatened species but only for state agency actions that may endanger these species or individual sale or transport of these species. These acts do no prevent a property owner from legally developing their property that may damage or remove species habitat. In addition, no local overlay Zone has

yet been implemented that would require any additional site assessment studies or regulations.

A portion of East Guilford is also within the Coastal Boundary (as defined by Connecticut's Coastal Area Management Act) and includes the tidal waters of the East River and the Audubon Salt Meadows Sanctuary and a 1,000 foot setback from these areas. (Guilford's Natural Resource Inventory and Assessment, Jan 2005, p. B1) Properties within the Coastal Boundary require local Coastal Site Plan Review and must follow regulations dictated by this section of the Zoning Code and other applicable state regulations.

Traffic Circulation/Site Access

East Guilford's primary circulation is via Goose Lane and Nut Plains Road to the west, North Madison Road to the north, and Podunk Road and Nortontown Road to the east forming a perimeter street network. The area is centrally traversed by only two streets, Bearhouse Hill Road (unpaved) through the central portion and Clapboard Hill Road (paved) through the southerly area. Goose Lane/Nut Plains Road, Clapboard Hill Road, and North Madison Road are major collectors that serve as important routes that provide direct access to I-95 for Guilford and Madison residents respectively. Minor collectors within this area include: Tanner Marsh Road, Podunk/Squaw Road, Nortontown Road, and Murray Lane.

As new residential communities are proposed in the remaining developable land holdings of East Guilford, circulation and site access issues become more prominent. The Town of Guilford's Transportation Plan recommends a new roadway connection with an east/west connector road between Podunk Road and Goose Lane (2002, p. 23). The roads are "desirable in order to improve public safety by facilitating the movement of emergency vehicles when time is critical, and to allow better connections between various parts of town"(p. 23) and would connect with Guilford's primary road system that runs north/south.

Currently the Bearhouse Hills Estates application proposes a new east/west road to extend the existing Sullivan Road across the East River through the proposed development and eventually connecting with Podunk Road directly across from Squaw Lane. The proposed development plans show two Nut Plains Road improvement alternatives: the first aligns the existing Nut Plains Road to Sullivan Road to create a more traditional 4-way intersection and the second which softens the curve from Nut Plains Road to Goose Lane. Private property abuts both of these alternatives, so it is unclear which proposal will go forward.

A majority of the proposed homes would be located off this proposed street and three proposed cul-de-sac extensions off Sullivan Road. A new north/south road would extend the existing East Bearhouse Hill Road south to the proposed Sullivan Road. Eleven (11) homes would be accessed by access ways/private driveways off of the proposed roadway system.

Recreational Opportunities – Public Access and Open Space Priorities

Guilford is a community with many active and passive recreational activities and East Guilford is no different. The study area includes the Town's Nut Plains Park (16 acres, originally purchased for a potential school site) and three significant community open space amenities that provide public access for hiking trails. These natural resources include the Nut Plans Woods Preserve (45 acres), the Eastwoods (95 acres), and the Audubon Guilford Salt Meadows Sanctuary (235 acres). Nut Plains Wood and Eastwoods are owned and maintained by the Guilford Land Conservation Trust. The Town-owned Timberland Trail system (600 forested acres), although not part of the study area, is directly north of the East Guilford area surrounding the Guilford Lakes. The Town also owns a 60 acre site adjacent to Nut Plains Park that is currently used by the Department of Public Works for a stump dump/mulching site and contains closed sewage sludge pits. This site may be used in the future for a Public Works satellite office.

Bearhouse Hill Road was recently designated as part of the Shoreline Greenways Trail, part of a larger regional shoreline trail network proposed from New Haven Harbor to Hammonassett State Park in Madison, CT. This current trail is approximately 5± miles from the shore. Full development of the Shoreline Greenways Trail is still under development and the current trail location may need to be revised to connect to trails in the Town of Branford and the Town of Madison. At its current location, Bearhouse Hill Road/the Shoreline Greenways Trail is located within the larger site of the proposed Bearhouse Hills Estate subdivision that is pending with the Town of Guilford and is not clearly delineated on the proposed plans. In order to protect this important regional trail resource, continued coordination should occur with adjacent towns to finalize the route (or redirect the route if Bearhouse Hill Road is proposed as a permanent roadway). Should the Greenways Trail continue to be located within the proposed development, a more permanent legal easement and trail access map should be recorded against the land records. As this remaining area is developed, it is likely due to the sensitive wetland areas of East Guilford, that open space subdivisions such as the Bearhouse Hill Estates will be proposed. This type of development ensures a smaller development footprint so that large open space areas can remain largely undisturbed and be preserved.

Zoning Regulations, Municipal Plans and Regional Plan for the Area

East Guilford is predominantly residentially zoned with a small area on Clapboard Hill Road north of I-95 zoned C-2. Most of the site is zoned R-8 which requires approximately 4 acre sites. The three smaller residential zones include: the northwesterly corner south of North Madison Road down to Cindy Lane zoned R-6, the area directly around the Guilford Lakes zoned R-3, and the area between Nut Plains Road/ Goose Lane and the East River zoned R-5. The area also includes one Planned Residential Development (PRD) site located between Goose Lane and Tanner Marsh Road south midway between where the two streets intersect and north of Clapboard Hill Road. These residential zones permit the following:

	R-3	R-5	R-6	R-8
Minimum Lot Size	20,000 SF/ .46 acres	40,000 SF/ .92 acres	60,000 SF/ 1.37 acres	160,000 SF/ 3.67 acres
Minimum Square (each side)	100 ft.	125 ft.	150 ft.	300 ft.
Minimum Frontage	100 ft.	125 ft.	150 ft.	200 ft.
Setback from Street	20 ft.	30 ft.	30 ft.	30 ft.
Setback from centerline (local)	45 ft.	55 ft.	55 ft.	55 ft.
Rear Setback	20 ft.	50 ft.	50 ft.	50 ft.
Side Setback	12 ft.	20 ft.	20 ft.	20 ft.
Interior Setback from driveways	10 ft.	20 ft.	20 ft.	20 ft.
Lot Coverage	20%	20%	15%	5%
Total Floor Area	40%	40%	30%	10%

The Town of Guilford has issued a Growth Management Strategies document (dated August 9, 2004) that specifically addresses the type of development that may be more appropriate for remaining large pieces of land such the areas within East Guilford. Specifically, the easiest land to develop has already been developed for housing long ago. The remaining available land may have topographic or wetland challenges such as most of the East Guilford area. The Bearhouse Hills Estates application follows an open space subdivision plan and as a result is able to set aside 300 acres of open space for the 110 house development. The Growth Management Strategy also outlines a "flexible development" that concept would allow for maximum density for a particular area (maximum units per acre), but these concepts have not yet been enacted into the Zoning Regulations. Additional open space revisions to the Zoning Ordinance are pending as of this report.

The Guilford Plan of Conservation and Development outlines seven primary policies. Three policies help define Guilford's expectations and goals for the East Guilford area. One of the policies encourages a diverse housing supply, including new development; however the construction of affordable housing suggested is not likely to be the preferred new development in this area by either existing residents or developers. The other two policies focus on 1) preserving Guilford's character and cultural landscape (i.e. it's sense of place) and 2) conserving the Town's open space and environmental resource and habitats. The East River and Clapboard Hill Road areas in East Guilford are specifically identified as "Countryside" areas that "are quintessentially rural New England in character and feeling" and that are "low-density, a combination of forest and field, narrow roads, stone walks, mature roadside landscapes, stone bridges and drainage structures, and historic buildings including dwellings, barns and other accessory structures." (Guilford Plan of Conservation and Development, p. 21)

An overall objective of the Plan is to protect and preserve these areas, through allowing balanced development that retains the rural character of the area by allowing construction within the capacity of the existing infrastructure (i.e., retaining local windy, narrow roads and adequate soils for septic) and topography (avoiding significant grading that would alter existing vistas, negatively affect connections to existing homes, roads, etc.) and ensuring

retention of as much open space area as possible. The second policy suggests careful identification and protection of natural resources (including steep slopes, wetlands, and vernal pools), habitat areas, and scenic corridors, particularly where also identified as an area of state and regional importance. Open space acquisition and easements are the ideal form of preservation, but where development does occur, open space subdivisions or Planned Residential Developments (PRD) with large open space dedications can at least preserve contiguous tracts of habitat and natural resources. In all potential development areas in East Guilford, the town has strong policies for sanitary and storm water management (pending) that should continue to protect local water resources. It should be noted that as a transportation policy, the Plan suggests that the Board of Selectman and Town Engineer should, "consider constructing Bearhouse Hill Road to connect Podunk Road to Goose Lane." (p. 59)

Guilford is located within the 15 town South Central Regional Council of Governments (SCRCOG). SCRCOG's *Vision for the Future, a Regional Plan of Development* recommends development be guided to major transportation corridors within areas of adequate infrastructure in order to protect open space areas and retain developed Town and City centers. This area of East Guilford is not serviced by any state roads, but abuts I-95 to the south. Proposed residential development, as evidenced by the pending Bearhouse Hill Estates application, is benefited by the close proximity of I-95, but is also limited by the strict north/south nature of the existing roadway system. The *Plan* also recommends the protection of environmentally sensitive land and encourages clustering in moderate to low-density areas in order to preserve more open space.

Summary

East Guilford is a largely undeveloped area rich in natural resources with many private land holdings. In the near future it is likely that this area will be developed (such as the pending Bearhouse Hill Estates). Distinct ecological areas of East Guilford have been identified, particularly along the East River, but other natural resources and smaller wetlands on private property will not likely be identified except through required development processes. Barring Guilford Conservation Land Trust or Town of Guilford purchase of the remaining private land holdings in the future, development of large tracts of land should be recommended as conservation or open space subdivisions (as recommended by Guilford's Growth Management Strategies and Plan of Conservation and Development) to preserve as many large open space areas as possible.

Traffic Analysis

The subject 110 home open-spaced development is bordered by Goose Lane/Nut Plains Road to the west, Podunk Road to the east, and Clapboard Hill Road/Tanner Marsh Road to the south (See Figure).

A traffic study was prepared by Barken and Mess Associates, Inc. to evaluate the traffic impacts of the development on surrounding roadways. Traffic from three proposed access locations for a subdivision roadway was evaluated. The proposed access location on the western side of the development is Sullivan Drive, which is located south of the intersection of Goose Lane and Nut Plains Road. The other two proposed access locations on the eastern side of the development are from Podunk Road, at the Squaw Lane and East Bearhouse Hill Road intersections.

Site traffic was generated based on a journey-to-work analysis, which yielded a 70-30 split distribution of potentially 100 vehicles from the development on an average day. Approximately 70 percent of the site traffic would exit at Sullivan Drive and travel south to Interstate 95, Interchange 59. Of the remaining 30 percent, 15 percent would travel south down Nut Plains Road towards the Guilford Center. The other 15 percent would travel north.

The study also reviewed the safety of the proposed access locations and surrounding roadways. It was reported that the intersection sight line at proposed access locations were adequate, except for the Sullivan Drive/Goose Lane intersection. Vehicles travel on Goose Lane, near this intersection, at an average speed of 45 miles per hour (mph). Existing vegetation would have to be cleared along Goose Lane at this intersection to provide adequate sightline for vehicles exiting Sullivan Drive. In addition, Goose Lane intersects Nut Plains Road at an acute angle, where Goose Lane is only controlled by a yield sign. Therefore, vehicles find it difficult to make a left turn from Goose Lane onto Nut Plains Road.

Overall, it was reported that the vehicles generated by the development could be accommodated on the surrounding roadways. However, the study recommended some improvements at the intersection of Goose Lane and Nut Plains Road. One improvement would involve realigning Goose Lane with Nut Plains Road, within the Towns' right-of-way, to develop a more standard “T” intersection. Another improvement would require realignment of Nut Plains Road, which would require the taking an existing house located opposite of Sullivan Drive.
Access - East/West Connector Road

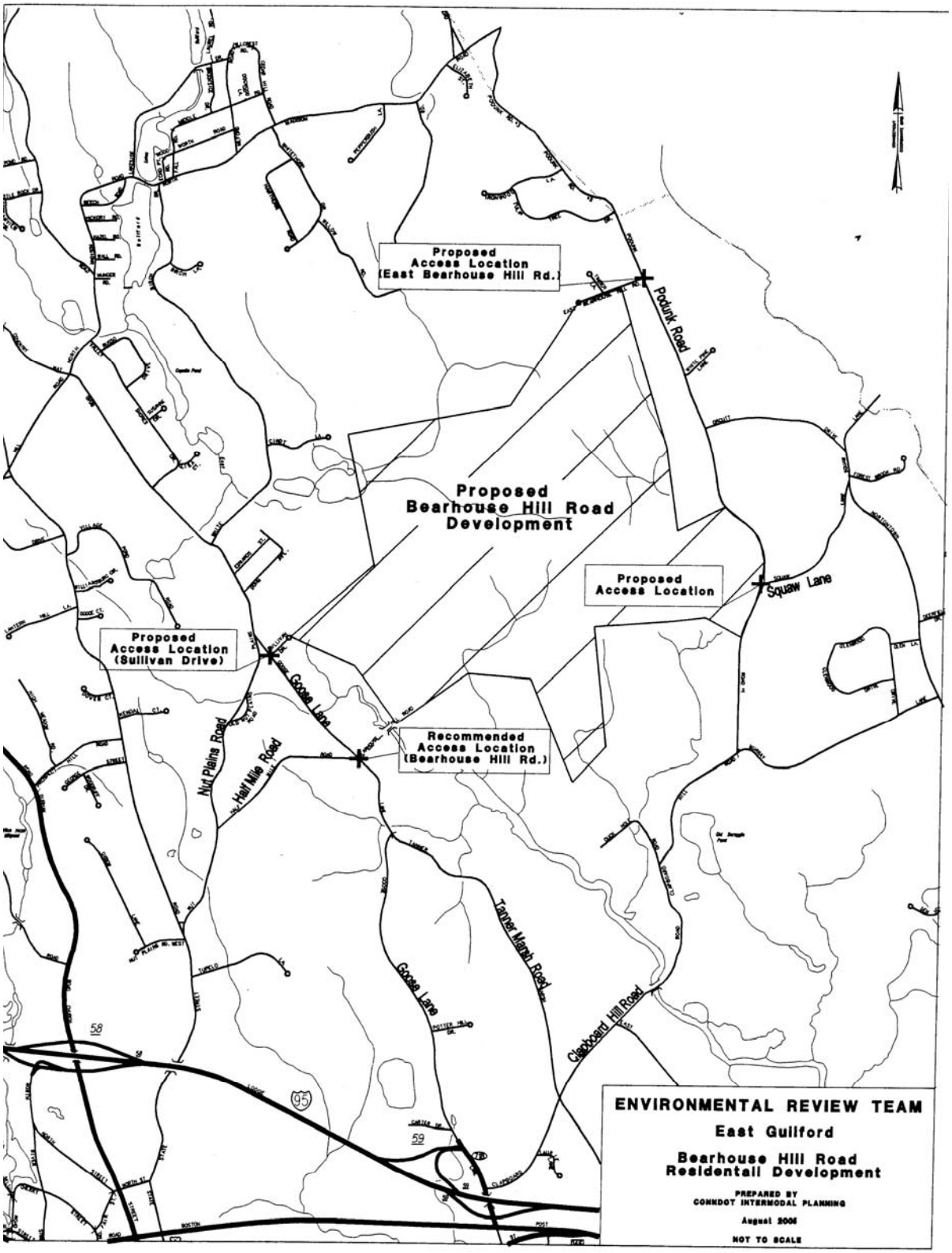
The surrounding roadways in the area of the development are basically north-south collector routes (Podunk Road and Goose Lane) that channel traffic to arterial roadways, such as Route 80 to the north and Route 1 to the south, as well as Interstate 95.

Based on review of plans of the proposed development, a 24-foot wide, bidirectional roadway through the development has been designed at the Towns' standards for a local residential street. The location of this roadway would form a link between the two collector roads, Podunk Road and Goose Lane.

Sullivan Drive was investigated as a main access location for the subdivision roadway. Improvements at the intersection of Goose Lane and Nut Plains Road were recommended to accommodate the proposed development.

An alternative access location to Sullivan Drive is the Bearhouse Hill Road/Goose Lane intersection, which is located south of Sullivan Drive. The existing Bearhouse Hill Road is a private, gravel roadway that provides access to Goose Lane from adjacent property driveways. The existing roadway would have to be widened, along with an existing small bridge, located west of the intersection, to be an accommodating residential street. This access location would provide a safer route for vehicles wanting to head south on Nut Plains Road, by way of Half-Mile Road, as opposed to Goose Lane (See Figure). From field observation, it appeared that adequate sightline is available at this intersection. However, an engineering analysis would need to be performed on this access location to determine if adequate sight line is available.

Inland wetland permitting would be required at a minimum for roadway construction. The use of Best Management Practices to minimize impacts during construction would be required. Detention/retention basins and specialized drainage structures may be required to minimize impacts on wetlands and groundwater quality.


Proposed
Access Location
(East Bearhouse Hill Rd.)
Podunk Road
Proposed
Bearhouse Hill Road
Development
Proposed
Access Location
Squaw Lane
Proposed
Access Location
(Sullivan Drive)
Goose Lane
Nut Plains Road
Hall Mills Road
Recommended
Access Location
(Bearhouse Hill Rd.)
Tanner Marsh Road
Goose Lane
Clapboard Hill Road
58
95
59
ENVIRONMENTAL REVIEW TEAM
East Guilford
Bearhouse Hill Road
Residentail Development
PREPARED BY
CONNDOT INTERMODAL PLANNING
August 2006
NOT TO SCALE

About the Team

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

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

Purpose of the Environmental Review Team

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

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

Requesting an Environmental Review

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

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