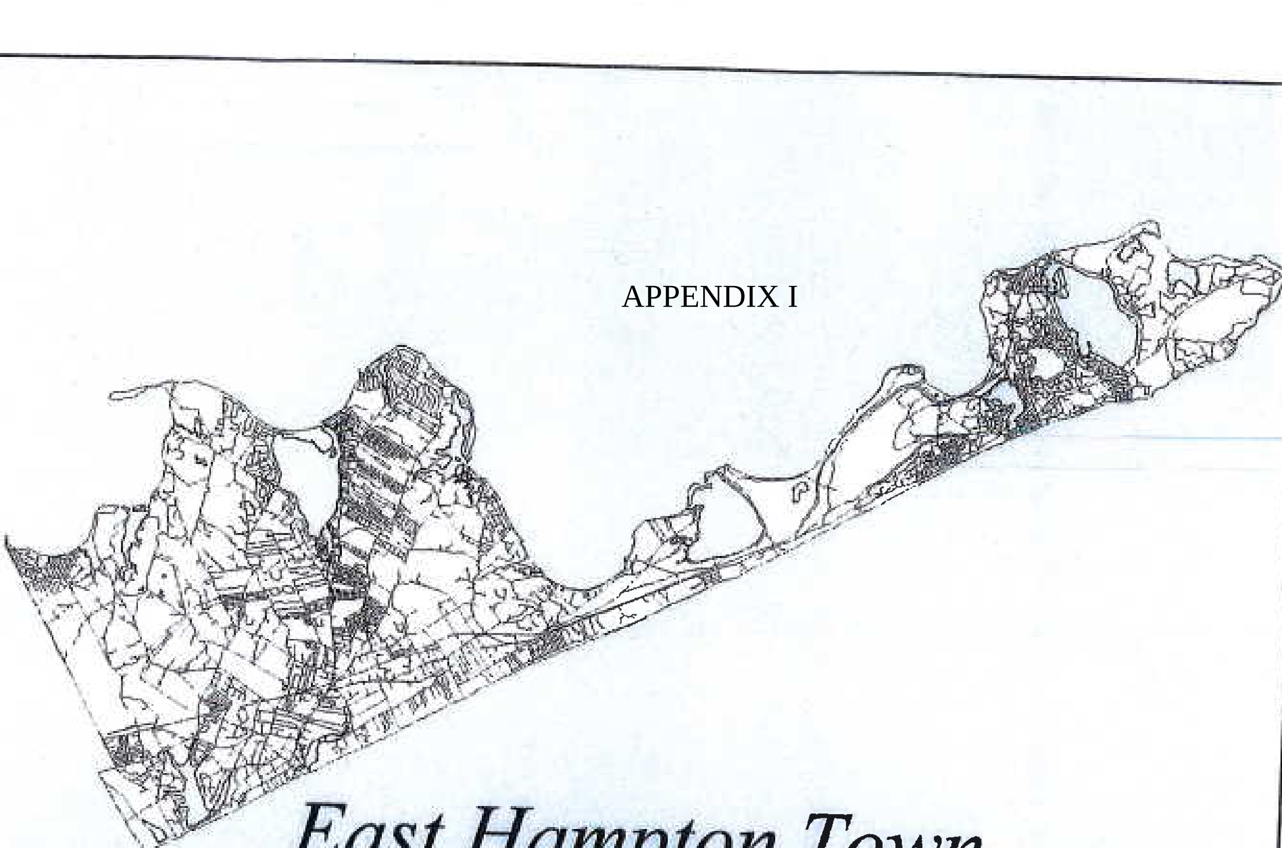
APPENDIX I



East Hampton Town

Water Resources Management Plan

Final Draft

3/8/04

EAST HAMPTON TOWN WATER RESOURCES MANAGEMENT PLAN

(Final Draft)

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EXECUTIVE SUMMARY

The Water Resources Management Plan for the Town of East Hampton was prepared for the purpose of evaluating fresh groundwater and surface water in the town. The issues to be addressed relate to both the quantity and quality of the water resources and their relation to potable water supplies at present and in the future. In addition, the relationship between water resources and ecology was also evaluated.

The town covers an area of 73.3 square miles and has an estimated population of 21,000 year-round residents. During the summer months, the population increases to approximately 65,000. Based on U.S. Census information, the year-round population increased by 22 percent in the period from 1990 to 2000. Expected future development to the point of buildout will increase the demands on the groundwater supply as well as increase pressure on surface water bodies.

The groundwater reservoir beneath the town is the source of all drinking water that is used to supply residents and businesses with potable water. Some of this water is provided by a network of public supply wells and distribution pipes that are operated by the Suffolk County Water Authority and the balance is provided by private wells.

The fresh groundwater exists in the interstitial spaces between sand grains and this reservoir "floats" on the saltwater portion of the groundwater that surrounds the fresh water on all sides as well as beneath the fresh water. The thickness of the fresh water lens ranges from zero or near zero feet in the vicinity of the coastlines and increases landward with a maximum thickness that is estimated to be 600 feet in the western portion of the town in the deep recharge area. The amount of rainfall in the town averages 45 inches per year, of which a minimum of half of this amount reaches and recharges the aquifer. Figures A, B and C show the average annual rainfall as measured at four different stations, Montauk's Ditch Plains, Springs's Wastewater Treatment Facility, Northwest Road and Northwest Creek from 1995 through 2003, and the annual and monthly rainfall in Springs (Wastewater Treatment Facility) since 1993.

Based on the "Master Water Supply Plan for the Town of East Hampton" prepared for the Suffolk County Water Authority by Leggette, Brashears & Graham (1997), the amount of precipitation that recharges the aquifer averages approximately 32 million gallons per day and this includes only the area above the five-foot water table elevation contour line (Napeague and Montauk do not contain groundwater elevations consistently over five feet and are, therefore, excluded from this calculation). The safe yield has been calculated to be 25 million gallons per day. The consumptive use in this area has been calculated to be 2.26 million gallons per day and, therefore, is well below the safe limit. It has been calculated that at the point of complete buildout, the consumptive use may rise as high as 11 million gallons per day, which would still be less than half of the safe yield even in a year of severe drought (where recharge drops to 15 million gallons per day).

Therefore, it can be concluded that there are no water quantity issues that the town will face, now or in the future based on the projected future buildout populations and consumptive use. However, it is important to recognize that these projections relate to the town's aquifer as a whole. Overpumpage in localized areas may have the impact of causing or exacerbating saltwater intrusion. In addition, many wetlands, streams, and ponds in the town exist as expressions of the water table. Therefore, localized overpumpage may reduce the water table elevation and this can reduce water levels in ponds, reduce or eliminate streamflows, and threaten wetlands. These impacts could threaten the populations of plants and animals and can also impact the surrounding marine ecosystems since changes in streamflow can impact the salinity of saltwater bodies that can impact marine flora and fauna.

It has been concluded in this report and in previous reports addressing groundwater issues that the focus of groundwater protection should be on preventing localized overpumpage and protecting and improving the quality of the groundwater.

With regard to the issue of water quality, this issue can be separated into surface water quality and groundwater quality. Surface water bodies in the town include the streams, ponds, tidal creeks, tidal embayments and wetlands. Ponds and streams that exist near the coastal areas such as Georgica Pond, Hook Pond, and Northwest Creek are hydraulically connected to the groundwater and owe their existence to the fact that the land surface elevation is below that of the water table. Therefore, these water bodies are susceptible to contamination that emanates from releases of contamination at the surface such as surface contamination spills within the water body or its drainage basin, or windblown contamination that settles in the water body. They are also susceptible to contamination that emanates from remote locations but is transported to, and discharges to, the water body. Other ponds and wetlands, generally in the central portion of the town and away from the coastline are likely to be perched water bodies, that is, they do not owe their existence to the water table that may be, in some locations, over one hundred feet below the perched water body. The perched body exists owing to the presence of a clay layer or other relatively impermeable geologic stratum that prevents the infiltration of precipitation to the water table. The precipitation then accumulates above this layer and forms a pond or wetland. Perched water bodies are, in general, only susceptible to contamination from surficial sources.

Generally, groundwater contamination occurs when contaminants are released to the surface of the land and are transported through the soil to the groundwater by gravity (in the case of liquids) or are transported downward by infiltrating precipitation. Sources of contamination in the town may include landfills; gas stations; underground storage tanks; pesticide and fertilizer applications in agricultural, residential, and commercial areas; septic systems; dry cleaners; and, stormwater runoff.

Two major landfills exist in the town: the Springs-Fireplace Road Landfill and the Montauk Landfill. Both landfills were in operation from the early 1960s until the 1990s. Both landfills have resulted in the presence of leachate in the groundwater that emanates from their putrescibles mounds and has migrated in accordance with groundwater flow. The leachate contamination associated with the Montauk Landfill is considered to be relatively minor and there are no known impacts to private or public supply wells. At the Springs-Fireplace Road Landfill, a contaminant plume is migrating north and northeast and the primary constituent of concern in the plume is tetrachloroethylene that is present in moderate concentrations in the groundwater. The plume is sufficiently wide and deep that current technologies to remediate the groundwater are not considered to be feasible (plume remediation may cost tens of millions of dollars and require 30 years or more to complete).

Gas stations represent significant sources of contamination due to leaking underground storage tanks, surface spillage that is carried by stormwater runoff to the subsurface, and, if the station performs auto repairs, there is the potential for waste oils, hydraulic fluids, and solvents to enter the subsurface and contaminate the groundwater. Although regulations regarding contaminant sources have become stricter over the years, the result has been to reduce but not eliminate new spills. In addition, it is not unusual for contamination from a gas station to remain undetected for decades. In general, it can be stated that gas stations that have operated at the same location for over 30 years are highly likely to have at least some contamination of the soil and groundwater related to its operations. Gasoline releases that have occurred since approximately 1979 are also likely to contain methyl tertiary butyl ether (MTBE). MTBE is considered to be the chemical that many feel creates the greatest potential environmental concern since it is a suspected carcinogen and it moves more rapidly in groundwater than any other gasoline constituent. It also resists natural biodegradation in the groundwater environment. Therefore, it contaminates significantly greater areas and remains for a longer period of time than any other gasoline constituent. Spills that involve MTBE will require longer periods of time and greater costs to remediate.

Residential and commercial underground storage tanks that are less than 1,100 gallons are not regulated in New York State and are, therefore, not required to perform periodic tightness testing or maintain inventory records. Therefore, an unregulated underground storage tank has a significantly greater probability of causing a release of petroleum that may remain undetected for years. It is estimated that there may be between 4,000 and 8,000 underground storage tanks that are unregulated in the town. Also, it was estimated by the U.S Environmental Protection Agency that at the age of 17 years, 50 percent of steel underground storage tanks contain leaks. Based on this information, it is estimated that there may be hundreds or thousands of underground storage tanks in the town that are leaking. This may represent the largest threat to the groundwater quality in the town for any category of contamination.

The use of pesticides, herbicides, and fertilizers for residential, commercial, recreational, and agricultural purposes has had an impact on the groundwater in the town. Past use of aldicarb starting in the late 1970s had a significant impact on groundwater. In addition, the Suffolk County Department of Health Services performed an investigation of the incidence of pesticides in groundwater wells within the town. The results of the investigation showed that numerous pesticides have been detected at various well locations throughout the town. The sources of these pesticide detections are believed to be related to residential applications for lawn care, farmland, and, possibly, golf courses, wineries, and plant nurseries. In residential areas, roof runoff from houses that do not contain gutters may cause excessive overland runoff over a relatively wide area. This may result in additional pesticides, herbicides, and fertilizers becoming entrained in the stormwater runoff as the water passes over a residential lawn.

Septic systems associated with residential and commercial properties have an impact on groundwater quality by adding nitrogen and in some cases, bacterial contamination to the groundwater. The majority of this contamination occurs as a result of the existence of poorly designed septic systems. Areas near the coastline often contain septic systems do not have the minimum required separation between the base of the septic pool and the water table. The Suffolk County Department of Health Services requires this separation to be at least three feet. There are more than 20,000 septic systems in the town, more than half, of which are concentrated in relatively high density residential areas.

Dry Cleaners are known to use tetrachloroethylene in the dry cleaning process. The dry cleaning machines contain this chemical and if the machine leaks, tetrachloroethylene is known to migrate downward, through solid concrete to contaminate the soil and groundwater. In addition, spills and discharges to leaching pools and sinks can enter the subsurface. Many dry cleaning businesses on Long Island that have had releases are now included on the Superfund list since tetrachloroethylene is considered to be a hazardous waste.

Stormwater runoff presents concerns since the runoff will incorporate contaminants it encounters and transports those contaminants to, primarily, surface water bodies (including Peconic Bay and the Atlantic Ocean). Nutrients, coliform bacteria, gasoline, and salts are common runoff contaminants.

In addition to the contaminants listed above, the Town of East Hampton Natural Resources Department has performed a sampling investigation to evaluate the issues of road salting and the issue of lead in drinking water.

The road salting issue was evaluated to determine if road-salting activities performed during winter months was having an impact on the quality of groundwater. Numerous samples were obtained from groundwater monitoring wells located adjacent to or near roads that are routinely salted during periods of snow or icing conditions. In addition, stormwater catch basin liquids were sampled following snow events. The results of the investigation show that, in general, the concentrations of chlorides (an indication of the use of salts) were significantly elevated in areas known to be salted on a regular basis during winter months. Therefore, it was concluded that there is a clear correlation between the use of road salts and the concentrations of chlorides in the groundwater.

The issue of lead in drinking water was evaluated to determine if residential tap water contained elevated concentrations of lead. Based on well sampling performed in the town, it is known that little or no lead is present in the native, unimpacted groundwater. However, it is also known that lead solder that has been used historically to connect and seal residential and commercial plumbing can enter the drinking water. This is known to occur most frequently as a result of standing water remaining in piping overnight. Lead solder leaches into the water and the first few gallons that are obtained from the tap in the morning may contain elevated concentrations of lead. It has long been a recommendation by various public health agencies to let tap water run for two minutes or so to clear the water that has been standing in pipes overnight. This recommendation has generally been applicable to older homes where the plumbing was installed during the period when lead solder was used. However, recent testing by the town at various residences has shown that elevated levels of lead were present in the first draw water even in houses that are relatively new and would not have been expected to contain lead in the solder.

Three other potential sources of groundwater and surface water contamination are swimming pools, laundromats and car washes. To date there is only one operating car wash, situated in Amaganset, two laundromats, one in Amagansett, one in Montauk, and thousands of swimming pools. Swimming pools for individual residences are not regulated and there is no way to tell to what degree they pollute the groundwaters below them and surface waters near by them. Community swimming pools are regulated by the

Suffolk County Health Services Department, but such regulation has to do more with the health of the swimmer than the quality of the water discharged to the ground via pool cleaning and pool maintenance.

With regard to the issue of surface water quality, the U.S. Geological Survey has recently completed an extensive study of the water quality in numerous ponds in the town. Samples were analyzed for pesticides and the results showed that low levels of pesticides were detected in many of the ponds throughout the town. In addition, samples were obtained for a group of chemicals that are known as "emerging contaminants" since the technical ability to sample for these chemicals has been, until recently, limited or non-existent. The chemicals include pharmaceutical drugs, hormones, steroids, and caffeine. Low concentrations of these compounds have been detected in the waters of the town. However, this area of investigation is in its early stages and the environmental impact of these chemicals is not generally known. It is also generally unknown what concentrations of these chemicals would be considered harmful. However, the town supports the efforts of the U.S. Geological Survey in this important research and we look forward to receiving additional information on this subject in the future.

In addition to the specific issues related to groundwater quality improvement, there are issues of land-use planning that are related to groundwater quality maintenance and improvement. The objectives of this plan are consistent with the applicable portions of the comprehensive plan for the town that has been prepared. Specifically, the comprehensive plan recommends the restoration and/or enhancement of the hamlet and village centers to maintain the rural and semi-rural character of the town. In addition to the quality of life issues addressed in the comprehensive plan, encouraging development

in or in the vicinity of areas already developed has the added benefit of leaving open space in the central portion of the town (which is the area of deep flow recharge and the most critical portion of the aquifer). Recharge that falls as precipitation in areas of open space creates higher volumes of recharge (when compared to developed areas) and higher quality water is recharged to the aquifer. Moreover, the hamlet and village centers such as Wainscott, the Village of East Hampton, and Amagansett are located, in general, on the southern portion of the South Fork. These areas are the most desirable for development from a hydrogeological standpoint since they are in a shallow groundwater flow area and the groundwater flow direction is to the south and towards the Atlantic Ocean (which is much less susceptible to contamination when compared to the comparatively diminutive Peconic Estuary). Were the Town of East Hampton divided into three general categories based on suitability for development based on water resource sensitivity, the least sensitive area would be the Atlantic coastal area for the reasons just described. The intermediate area would be the Peconic Bay coastal area since, although the Peconic Bay is more sensitive than the Atlantic and groundwater in this area will discharge to the bay, it is located in a shallow groundwater flow area (although the shallow flow area is thinner since it is a shorter distance landward from the bay as compared to the shallow zone on the Atlantic side of the town). The most sensitive area is the central deep-flow recharge area. This area is where, by far, the greatest reserves of fresh groundwater and the highest quality water exist. It is also the most sensitive to impacts since contamination that occurs in this area has the ability to move both laterally and vertically, i.e., in three dimensions, and, therefore, plumes in this area can be both long and deep and, thus, have the potential to impact a significantly greater volume of groundwater.

In terms of acting as subsurface receivers for septic effluents, road salts and other contaminants, it can be concluded that from a water resources management point of view, the Atlantic coastal area is significantly more desirable than the other two areas in the town, one of which discharges to the deepest flow recharge aquifers, the other, to tributaries of the Peconic Estuary.

SECTION 1.0
INTRODUCTION AND PURPOSE

The purpose of this Water Resources Management Plan for the Town of East Hampton is to evaluate the quantity and quality of fresh groundwater and surface water in the town. Issues addressed in this plan include an evaluation of the quantity of groundwater in the town with respect to both present and future needs as well as the potential impacts of overpumpage on surface water and wetland areas.

Water quality issues will also be addressed by evaluating the current quality of groundwater in the town and investigating known and potential issues that may have now, or in the future, the potential to adversely impact the ground and surface waters in the town.

1.1 Understanding the Groundwater System in the Town of East Hampton: A Primer

Since this document will discuss the various issues that effect the quality and quantity of groundwater in the town, it may be helpful to begin with a less technical, general discussion of how the groundwater system functions. This discussion is included to assist those with a limited understanding of groundwater issues.

To begin with, groundwater exists beneath the land surface throughout every square foot of land in the Town of East Hampton. This is the case not only in East Hampton, but also throughout Long Island. One can obtain evidence of this fact by visiting a beach and digging a hole in the sand above the high tide line. As many of us have done as children, creating a hole in the sand to a depth of a foot or two will result in encountering groundwater. We find that we cannot dig our hole any deeper than the level at which we encounter the water since the removal of our plastic bucketful of saturated sand and water is quickly infilled by more saturated sand and water. When we look into the hole and see the water level at the base of the hole, that water surface is known as the water table. In other words, the water table is the upper surface of the groundwater reservoir. As we move inland and the elevation of the land surface increases, the depth to the water table is greater and in some locations in the town, that depth is over 100 feet.

A large reservoir of groundwater that is used for drinking water and other purposes is known as an aquifer. The water that every resident in the town uses is derived from the aquifer beneath their feet. It should also be noted that the aquifer that exists below East Hampton is the same aquifer that exists beneath all of Suffolk County, and, for that matter, Nassau, Queens, and Brooklyn. It is, therefore, one large, interconnected reservoir of water that exists beneath the ground.

Many people have the mental image and perception of groundwater as existing in the form of underground streams (we have found over the years that many believe that this water somehow works its way over to Long Island from Connecticut). It is inaccurate to think of the groundwater as existing as underground streams or rivers. It is more accurate to picture our aquifer as a large lake that exists below all land areas on Long Island and is, therefore, essentially shaped exactly like Long Island. This "lake" exists in the otherwise empty spaces between the individual sand grains. This may be easier to visualize if one thinks of a glass aquarium with sand filled to its brim. Although it is not possible to add any more sand to the aquarium, it is possible to add a surprising amount of water to the aquarium. If a jug of water were slowly poured onto dry sand in a in an empty aquarium, the water would infiltrate and "disappear" below the sand's

surface. Gravity would cause this water to seep through the sand until it encountered the bottom of the aquarium. It would then begin to accumulate in the sand and one could see the level to which the water had reached by noting the wet and, therefore, darker sand. If the water level within the aquarium were filled halfway, this could act as a scale model of the aquifer that lies beneath the town. The surface of the sand at the top of the aquarium would represent the land surface, the dry sand in the upper portion of the aquarium would represent what is known as the unsaturated zone where the sand is not quite dry, it is moist since precipitation infiltrates through it during its downward journey to the water table. The lower wet portion of the aquarium represents the aquifer since water saturates the sand and exists in the space between each grain of sand. The upper surface of the wetted portion of the sand represents the water table.

Beneath the town, there is a bedrock surface over 1000 feet below the present ground surface. This bedrock is relatively flat and is also relatively impermeable. Therefore, it acts as the lower limit of the aquifer and over 1000 feet of sediments sits atop this bedrock surface. These sediments were deposited in layers during several different periods of glacial activity. During the latter history of the earth, primarily the last 100 million years or so, there have been several periods of glaciation, that is, the global temperature has varied sufficiently that during these cooler periods, the water that evaporated from the oceans fell as snow. This snow accumulated to the point that it would compact under its own weight and create a mass of ice. The addition of snow on this mass of ice caused it to expand and move southward. This is analogous to pouring pancake batter onto a griddle; the more batter that is poured in the center of the pancake, the more the pancake expands. Of course, the glacier did not advance at a constant rate.

There were warming periods when it backed up.. However, there would be a net advance of the glacier if, during a given year, the winter was cold enough to add enough snow to advance the glacier southward and the subsequent summer was not warm enough to melt away all of that winter's advance.

It is known that the mass of ice making up the glacier contains huge amounts of soil and rock derived from the terrain over which it has advanced. In addition, when the mass of snow and ice does not melt sufficiently to replenish the oceans, sea level drops and the water recedes. Therefore, in the area that was to become Long Island, the shores of the oceans were generally thousands of feet south and east of where they are at present.

As the glaciers began to melt, large amounts of meltwater started making its way toward the ocean. The soil and rock that had been incorporated into the glaciers was released and was transported to, and deposited upon, the bedrock surface where Long Island is at present. There were several periods of glaciation that were primarily responsible for the formation of Long Island. These glacial advances and retreats deposited sand onto Long Island like layers of a cake. The first two layers were added millions of years ago. The last layer, which is, obviously, the top layer, was deposited during the last glacial retreat, which occurred during the period from approximately 10,000 to 20,000 years ago. Each of the major sand layers has a name. They are, from top to bottom, the Upper Glacial Formation, the Magothy Formation, and the Lloyd Sand. Each of these sand layers is saturated with groundwater, however, only the lower portion of the Upper Glacial Formation is saturated with groundwater and the upper surface of the saturated portion, again, is known as the water table. The reservoir of groundwater within each of these sand layers is known as the Upper Glacial Aquifer, the Magothy Aquifer, and the Lloyd Aquifer. It should be noted that a portion of the Magothy Aquifer and all of the Lloyd Aquifer contain saltwater because these sand layers are so deep that they are below the bottom of the mass of fresh groundwater. Therefore, the Lloyd Aquifer is not considered to be a true aquifer on the South Fork since it contains no fresh water. The Lloyd Aquifer contains fresh water in most of the area west of the twin forks of the island.

As the glacier melted, the meltwaters ran off into the surrounding seas by way of meltwater channels, which are seen today as long north--south trending swales and coastal lagoons. The meltwater replenished the ocean and the sea level rose around Long Island as much as a hundred feet or more.. At the same time, rain and snow fell, infiltrated the sands, and accumulated above the bedrock. The fresh groundwater that accumulated met the seawater generally along the boundary of the land's edge. When they met at this boundary they did not mix appreciably owing to differences in density between fresh- and saltwater. The fresh water, being less dense, "floats" on atop the saltwater in much the same way that an iceberg floats in the ocean. It is analogous in that the fresh groundwater floats with a small portion of its mass riding above sea level with the bulk of its volume seated below sea level.

When the groundwater level reached a height that was in equilibrium with the sea level, excess rainwater that infiltrated into the groundwater seeped into the seawater. The continual infiltration of rainwater continually creates an excess of groundwater in the aquifer and this causes the groundwater to flow downhill towards the sea. This flow is extremely slow, generally less than one foot per day, or, a half and inch per hour.

Today, a droplet of water that falls to the ground in the center of the Town of East Hampton and sinks down through the soil and subsoils begins a journey that will one day end in its discharge to the sea. There is a groundwater divide line that runs east-west dividing the South Fork lengthwise. A groundwater divide is a line that marks the location at which the direction of groundwater flow changes. On Long Island's South Fork, a rain drop that infiltrates the soil and reaches the groundwater surface at a point to the north of the divide will flow down and northward, eventually discharging into the Peconic Estuary. A drop that impinges on the water table south of the divide will eventually discharge to the Atlantic Ocean.

Drinking water is obtained by installing wells in the aquifer. Wells are narrow vertically installed pipes that contain screens, or arrays of fine slits, in their lower portions. The screens allow water to enter the well pipe while preventing the surrounding sand and other sediments from entering it.. Submersible pumps are placed near the bottoms in the wells and the groundwater can then be pumped to the surface for storage, distribution and consumption.

Fresh surface waters in the Town of East Hampton falls into two categories, water table bodies and perched bodies. The first category includes effluent streams and water table ponds. An effluent stream is a stream with a streambed that exists below the level of the water table such as Tan Bark Creek, or Soak Hides Dreen, that empties into Three Mile Harbor. The groundwater, being at a higher level than the stream, will discharge to the stream through its bed and its banks.. Some effluent streams are so wide that they create ponds along their course. Water table ponds are nothing more than depressions, sometimes, kettlehole depressions that reach below the water table. The other type of surface water is a perched water body. A perched water body is a pond or small stream that is not connected to the aquifer but instead is a separate groundwater body that is created due to the presence of a clay layer. If a layer of clay is present at some location above the level of the water table, a droplet of water infiltrating the soil in this area will not be able to travel to the water table since its downward journey is blocked by the impermeable clay layer. Groundwater may accumulate above this clay layer and create a small groundwater system that is separate from the primary aquifer. If the clay layer is sufficiently close to the land surface and there is a depression in the land surface that reaches below the perched groundwater level, the groundwater will seep into the depression and create a pond. Such ponds are called vernal ponds because they have tendency to dry up in the summer. Also, at the edge of a clay layer, groundwater may cascade off the clay layer and infiltrate further downgradient and eventually reach the primary aquifer.

Further discussion of East Hampton's groundwater and surface water systems will be included in the main body of this report.

SECTION 2.0
A BRIEF HISTORY OF THE TOWN OF EAST HAMPTON AND ITS WATER USE

2.1 The Founding of East Hampton Town and Its Historical Water Needs

East Hampton Township was formally established in 1648 when the governing bodies of Connecticut and Massachusetts purchased 31,000 acres in East Hampton Town. The town was originally called Maidstone and was settled by a group of farmers and fishermen. At that time, the land was occupied by Montaukett Native Americans. (A map showing the location of East Hampton Town is shown in Figure 1.)

A source of potable water was supplied by freshwater springs such as those that still exist along the Springy Banks on the southwestern edge of Three Mile Harbor, the south end of Pussy's Pond in Springs, by streams such as Tan Bark Creek at the south end of Three Mile Harbor, Peter's Run on the west side of Lake Montauk, and freshwater ponds such as Scoy Pond in Northwest, and Fort Pond in Montauk. Potable water was plentiful and often pristine as there were few groundwater pollutants during the Colonial Period and the Montaukett and colonist populations were very small.

In the 1700s, brick-lined wells were constructed into the water table. The methodology for constructing shallow wells was similar to techniques used for well and cesspool construction on eastern Long Island until the mid-20th century. Bricks and, later, concrete tiles, were laid at the surface and proceeded down in level courses as the well or cesspool was advanced with shovels and pails. In the 1700s and 1800s water was drawn from wells using pail and rope. These primitive wells and cesspools can still be seen in some areas of the town today.

Before the modern septic system came into use, human wastes and wastewater were disposed of in various ways. The colonists built shallow pit latrines within outhouses. When a pit was full, another was dug, and the outhouse was moved. Water from bathing and washing clothes was disposed on the ground and was used to water gardens and landscapes. Such waste disposal systems, although primitive, resulted in less pollution of the groundwater than contemporary septic systems, which flush human wastes and water well down into the ground, enabling contaminants to percolate down to the groundwater.

In the early part of the 20th century, a small sewage collection and disposal system was built to service much of Sag Harbor Village, including the portion of Sag Harbor in East Hampton Town. Many outhouses existed up until the mid-20th century when they were replaced by modern plumbing that connected the indoor wastewater collection systems to cesspools through piping. In the early days of cesspool maintenance, the contents of clogged cesspools were pumped into tank trucks and removed from site. At first, the liquid wastes were pumped onto the ground to empty the truck. As the population increased and there were more cesspools pumped, the waste was placed in artificial ponds called lagoons. Prior to 1987, when the town's scavenger waste treatment plant began operation, the pumped liquid waste from non-working septic systems was deposited in two scavenger waste lagoons. One was located at the Montauk Landfill and the other at Springs-Fireplace Road Landfill in Springs.

East Hampton Town agricultural practices began with Native Americans using sticks and shovels to cultivate the soil. Horses and other farm animals were used by the colonists early on to pull plows until the arrival of tractors in the early 20th century. The principal sources of fertilizer were manures from chickens and livestock, and fish, most frequently, menhaden. It was not until the beginning of the 20th century that granular, highly soluble commercial fertilizers became available.

Pest control for orchards and row crops was also a primitive practice throughout the colonial and most of the post-colonial period. In the simplest sense, it consisted of picking off insects by hand and killing them. Arsenates were the first pesticides to be applied to fruit trees and row crops in large quantities. Lead arsenate was used as an herbicide. These heavy metal decoctions were widely used up until the end of World War II to control insect pests. As a result, arsenic, lead and other toxic heavy metals used to control insects, fungi and weeds agriculturally and in the garden can still be found in high concentrations in the town's soil today. Fortunately, heavy metals are generally not very soluble, thus not very mobile in water percolating down to the groundwater. Most of the arsenic remains in the uppermost soil layer. Arsenic and lead have been found only in trace concentrations in the town's drinking water.

Kerosene and fuel oil began to replace coal and wood in the 20th century, but coal was still widely used until the middle of the century. Soon after its introduction, fuel oil and to a lesser degree, natural gas, were the chief sources of home, school and commercial building heating fuels. Both home heating oil and gasoline were stored in steel tanks from the very first days of their use. These steel tanks were single walled, not protected from rust by zinc plates, and as often as not, buried underground. Before the turn of the last century, all of the gas tanks and about 40 percent of the fuel oil tanks were located underground. The other roughly 60 percent of the fuel oil tanks were either located outside next to the house, above grade, or in a basement or crawlspace. The buried fuel oil tanks installed over 20 years ago are by now likely to have rusted through to the point of leaking and have great potential to contaminate the groundwater.

Until recently, our knowledge of Long Island's and East Hampton Town's sole source aquifers, their volume and their quality, was relatively unknown. Today, East Hampton Town residents are more aware of, and knowledgeable about, the groundwater and the environment and are important partners in the protection of these resources.

SECTION 3.0
GEOLOGY AND HYDROGEOLOGY

3.1 Geology

The geology of the Town of East Hampton consists of a bedrock layer that is overlain by unconsolidated deposits of Cretaceous and Quarternary age. (Figure 2 shows a depiction of these vertically arranged geologic units.) The bedrock dips slightly to the south and consists of a layer of gneiss and schist that is of Precambrian age, i.e., more than 300 million years old.. Within the town, the shallowest bedrock is found in Sag Harbor and occurs at a depth of approximately 1000 feet below grade. The greatest depth to bedrock in the town occurs in Wainscott (1400 feet below grade). Overlying the bedrock are several layers of sand and other unconsolidated materials. Directly above the bedrock is the Raritan Formation that is of late Cretaceous age and is comprised of the Lloyd Sand and an overlying clay layer, sometimes referred to as the Raritan Clay. The Lloyd Sand has a thickness of approximately 200 to 300 feet and the Raritan Clay has a thickness of approximately 100 to 200 feet.

Overlying the Raritan Formation is the Magothy Formation that consists of sand with some silt and clay. It is of late Cretaceous age and has a thickness ranging from approximately 400 to 800 feet. Overlying the Magothy Formation is the Upper Glacial Formation which is the uppermost geologic unit in the town. These deposits consist primarily of sand and are of Pleistocene age. Maps showing these more recent and surficial deposits in the town are seen in Figures 3 and 3A. The soil types that comprise the uppermost layer are shown in Figure 4.

3.2 Hydrogeology

Groundwater within the town resides in the interstitial spaces between the sand grains that comprise the geological units beneath the town. The three geological units (the Upper Glacial, the Magothy, and the Lloyd Formations) are all either fully or partially saturated with water. Therefore, the three aquifers beneath the town are named according to the corresponding geologic formations and are referred to, from top to bottom, as the Upper Glacial Aquifer, the Magothy Aquifer, and the Lloyd Aquifer. The Magothy and Lloyd Aquifers are fully saturated and the Upper Glacial Aquifer is partially saturated since it is the uppermost aquifer and its unsaturated portion, or vadose zone, is the area vertical area between the ground surface and the water table.

The aquifers are vertically interconnected, however, the flow from one aquifer to another is generally limited due to differences in hydraulic conductivities. In addition, the presence of semi-permeable layers such as the Raritan Clay (which is present throughout the town between the Lloyd Aquifer and the Magothy Aquifer), and the Gardiners Clay (which is present in limited areas in the town between the Upper Glacial and Magothy Aquifers) reduces or eliminates the flow of groundwater from one aquifer to another. It should be noted that on the South Fork, the Lloyd Aquifer is not a true aquifer since it contains only salt water.

Other smaller areas of clay layers and lenses are present sporadically throughout the town. When these smaller clay units are present at elevations above the water table, the infiltrating precipitation that falls on the land surface and infiltrates the soil and percolates downward in accordance with gravity can be inhibited from reaching the regional water table. Instead, this water accumulates above these localized clay areas and creates "perched" water bodies. If the perched water body is sufficiently close to the land surface, the water may accumulate to a level that is higher than the land surface (for some, or part, of the year), the result may be the creation of a pond or wetland. Many of the ponds and wetlands in the town, especially in the areas away from the coastline, are perched water ponds and wetlands. These perched water bodies are indirectly connected to the regional groundwater since water that accumulates on these perched layers will eventually cascade off the edge of the clay ledge and then again move downward in accordance with gravity until it reaches the water table.

All groundwater that is present beneath the town is not potable (suitable for drinking purposes). Only those areas containing fresh (and uncontaminated) groundwater are considered potable. After the South Fork was formed by the advance and retreat of glaciers and the deposition of several layers of primarily sand that have a total thickness of over 1000 feet, the meltwater from receding glaciers worldwide caused the sea level to rise and saltwater surrounded the South Fork. At the same time, precipitation fell on the land and infiltrated the soil on the South Fork. Fresh water is less dense than saltwater and as the sea level continued to rise, the volume of fresh water also increased in response to the rising sea level. The density differences and the very slow movement of both fresh and salty groundwater prevent significant mixing of the fresh and saltwater bodies. Therefore, the areal extent of the fresh groundwater aquifer is approximately equal to the coastline of the South Fork. The vertical extent of the fresh groundwater varies, however, if viewed in cross-section, it would show that the thickness of the freshwater is greatest in the central portion of the town (along the long axis of the South

Fork) and thins towards the coastline. Figure 5 shows the water table elevation contours in the town and Suffolk County. The depth to the fresh-saltwater interface can be estimated using the Ghyben-Herzberg Ratio, which states that for every foot of freshwater that exists above sea level, there is 40 feet of freshwater below. Therefore, a comparison of the elevation of the water table in wells throughout the town to the elevation of sea level have shown that the elevation of the water table is greatest in the central-western portion of the town. This maximum elevation is approximately 15 feet above sea level and, therefore, the maximum thickness of the fresh water aquifer in the town is estimated to be 600 feet. This thickness is reduced both to the north and south as the coastline is approached until the point at or near the coastline when the thickness is little more than zero and all groundwater becomes saltwater. The amount of fresh groundwater stored on average from west to east in the Town of East Hampton is shown in Figure 5A.

The general groundwater flow directions are shown in Figure 6. In the horizontal plane, the groundwater flows generally to the north in the area north of the groundwater divide (which is the line which divides the area of northerly and southerly flow) and to the south in the area south of the divide. The rate of horizontal groundwater flow is, generally, approximately one foot per day. However, there is also a vertical component of flow. Theoretically, a drop of water that falls on the ground and reaches the water table at the groundwater divide will move straight down in the aquifer. At the bottom of the body of fresh groundwater, which is up to 600 feet deep, the drop will eventually begin to move laterally, either north or south, and will also begin to rise in the aquifer as it moves towards the coastline. Eventually, the drop will discharge to the ocean or bays (that is, if it is not intercepted by a drinking water or irrigation well and does not discharge into a stream first).

Using the knowledge of groundwater flow characteristics, the town has been divided into two primary areas; the deep flow recharge areas and the discharge areas. In deep flow areas, there is a downward component of flow and this is also the area where the aquifer is thickest. Such areas are present in the central portion of the South Fork along its east--west axis. The discharge areas are areas where there is an upward component of flow and the aquifer is considerably thinner. Recharge of the aquifer is abetted by soils covered by native vegetation. In addition, within these naturally vegetated areas, areas of topographical depressions, known as "recharge nodes," provide the greatest amount of recharge. Figures 6A and 6B show the town's dominant vegetative cover types and the areas with major recharge nodes. Figure 6C shows the cross-section of a typical recharge node. Figures 6D through 6G show examples of recharge areas of differing quality, from best to worst.

The distinction between deep flow recharge areas and discharge areas is crucial to groundwater protection plans. Contamination that enters the groundwater in deep flow recharge areas has the potential to contaminate both shallow and deep groundwater. Contamination in deeper portions of the aquifer has the added issue that it may be sufficiently deep such that existing groundwater remediation technologies may not be adequate to remove much of the contamination from the water. In discharge areas, the vertical component of flow is upward and the aquifer is thinner, therefore, contamination in these areas can remain in the shallow zone (in many cases) and, accordingly, the overall volume of groundwater contaminated in discharge areas is smaller than if an equal amount of contamination is released into deep recharge areas. It is, therefore, extremely important that future development in the town be confined to the extent maximum extent possible to areas outside the deep recharge zones.

3.3 The Issue of Groundwater Quantity

The first component of water resource planning is to determine the quantity of groundwater that is available for potable purposes now and in the future. This issue was evaluated in two ways. First, groundwater elevation maps were reviewed for various years over the past 25 years. In general, these maps show no significant differences in the elevations of the water table over time (see Figure 7). Although there are natural fluctuations in the water table elevations due to variations in precipitation from year to year, there is no indication that the rising population of the town and the corresponding water demands have impacted the water quantity as a whole. In fact, the water table elevation is believed to be not significantly different than it was 500 years ago.

The second evaluation was performed to determine the amount or recharge that falls on the land of the town and recharges the aquifer compared to the consumptive use. The town has an area of 73.3 square miles. For this analysis, we have reduced this area by 15 percent since the immediate coastal areas are not significant contributors to aquifer recharge. Therefore, the area of recharge is estimated to be 62.3 square miles. The amount of recharge has been estimated based on the average annual rainfall of 45 inches (recorded at Bridgehampton, NY). Evapotranspiration (the amount of rainfall that evaporates or is transpired through the leaves of trees) reduces the quantity of water by 50 percent on an annual basis, in general. However, it should be noted that evapotranspiration is highest in summer and has been estimated to be as high as 92 percent during the hottest month of the year (July), but can be as low as 16 percent in December when vegetation is generally dormant or dead and low temperatures inhibit evaporation. Using the average annual rainfall on the South Fork of 45 inches, the amount that infiltrates to the aquifer, after evapotranspiration, is estimated to be approximately 22.5 inches. During severe drought years, this amount may be as little as 10 inches per year (cf. Master Water-Supply Plan for the Town of East Hampton prepared by Leggette, Brashears & Graham for the Suffolk County Water Authority, 1997). Therefore, in a year of severe drought, the amount of precipitation in the town averaged to a daily recharge rate is approximately 29.5 million gallons per day. In addition, it should be recognized that, due to a slight easterly component of groundwater flow along border separating East Hampton from Southampton, approximately 0.9 million gallons of groundwater per day flows out of Southampton and into East Hampton. Therefore, the total input into the town's groundwater system in a severe drought year averages 30.4 million gallons per day.

According to the Suffolk County Water Authority, the average daily water use in residential areas is 100 gallons per day per customer (the average household is approximately 2.5 persons). For the purpose of calculating consumptive water use in the town, per capita water use has been conservatively estimated to be 100 gallons per day per person and a further conservative estimate is that none of the consumed water recharges the groundwater. The population of the town was reported to be 19,719 in the year 2000. Using the annual population growth rate of 2.2 percent in the period from 1990 to 2000, the estimated current population is 21,020. (See Figure 8 and Table 1 for population by town areas). In addition, there are an estimated 65,000 seasonal residents during one-third of the year. This water need is equivalent to having 43,000 year-round residents. Using this population value, it is estimated that residential consumptive water use is an average of approximately 4.4 million gallons per day. (See Table 2 for pumpage data for the town's public supply wells.)

In addition to this amount of water, golf courses and agricultural areas are large consumers of groundwater. Five golf courses exist in the town. Each of the courses is estimated to use 30 million gallons per year for irrigation and since irrigation applies relatively small amounts of water on a frequent basis, little or none of this water is expected to recharge the aquifer. Therefore, evapotranspiration is assumed to be 100 percent. As of 1994, the town zoning maps show that 1250 acres of agricultural land exist. The amount of irrigation in these areas has been estimated by the Suffolk County Cooperative Extension Service to be 140,000 gallons per acre per year (again, evapotranspiration is assumed to be 100 percent). Therefore, these additional water uses add 150 million gallons per year for golf courses and 175 million gallons per year for agricultural use. This is equivalent to an additional water need of 890,000 gallons per day, on average. Added to the residential use, the total consumptive use in the town is estimated to be 5.3 million gallons per day.

In comparison, the average daily consumptive groundwater use of 5.3 million gallons per day is well below recharge volume per day and, even, below the recharge rate during a severe drought year, which has been estimated to be 30.4 million gallons per day. Therefore, in the most conservative analysis, the recharge rate exceeds the consumptive use rate by a factor of approximately six. During a year of average rainfall, the recharge rate exceeds the consumptive use rate by a factor of greater than 12.

The Koppelman Comprehensive Plan states that at buildout, the year-round population will be approximately 36,000 (Figures 9 and 10 show the locations of vacant parcels in the town and the land use categories). Conservatively assuming that the seasonal population increases by a factor of three by that time, to 108,000, such size population would have a water use need equivalent to a year-round population of 72,000. Therefore, even in a severe drought year at buildout, the consumptive use would be 8.2 million gallons per day which would still be approximately four times less than the recharge during an average year.

It is concluded, then, that the quantity of water in the town is not an issue now, and given current projections of saturation population, there is no reason to expect that groundwater quantity will ever be an issue in the town. However, although groundwater is available in abundance, the majority of the water is located in the west-central portion of the town. Coastal areas and the Montauk area in general have already experienced problems from localized overpumpage of the aquifer, which has resulted in saltwater intrusion. In addition, localized overpumpage may impact the town's water table streams, ponds, and wetlands, especially in coastal areas. Therefore, management of the water resource to prevent localized overpumpage is a critical must for the town and the Water Authority..

It is important to recognize that although townwide the quantity of water is large relative to consumptive use, the largest volumes of groundwater are concentrated in the central-western portion of the town. This deep flow recharge area represents approximately only 15 percent of the town's total area, however, approximately half of all available groundwater in the town resides here. (See Figure 5 A)

3.4 Long Island and East Hampton Town Sole Source Aquifers

On geographical Long Island, only Brooklyn and a portion of Queens derive their potable water supply from the New York City reservoir system located to the north of the city. Nassau and Suffolk derive potable water from the aquifers residing beneath those counties. As with the town of East Hampton, Nassau and Suffolk Counties rely on groundwater for 100 percent of their potable water needs. The three aquifers that are present beneath the town (as discussed previously) are the same aquifers that exist throughout Nassau and Suffolk Counties. Therefore, the Long Island aquifer system is referred to as a sole source aquifer. In other words, the same aquifers that provides water to the residents of the town also provide water to the nearly three million residents of Nassau and Suffolk Counties.

Within the town, the area of the highest quality groundwater occurs in the central-western portion of the town where the groundwater mound has an elevation approaching 15 feet above sea level and, therefore, the aquifer thickness may approach 600 feet. This can be compared with areas such as Montauk where the thickest portion of the aquifer is much less than 200 feet, or Napeague, where the thickness is roughly 40 feet. In addition, since the west-central portion of the town is less populated than the coastal areas, there have been accordingly fewer harmful groundwater impacts to it.

The future quality of potable water within the town will be dependant upon the town's ability to successfully manage this deep flow recharge area and limit the presence of sources of pollution, including residential and commercial development.

SECTION 4.0
SPECIAL GROUNDWATER PROTECTION AREAS

In 1982, the town enacted legislation that created Water Recharge Overlay Districts (WRODs). Within these areas, clearing of vegetation in residential parcels was restricted so that roughly 75 percent or more of the natural vegetation is retained to promote recharge of the groundwater. Combined, the uncleared areas amount to thousands of acres of naturally vegetated open space dedicated to recharge (see Figures 11 and 12).

In addition to the WRODs, areas have been designated as Long Island Special Groundwater Protection Areas (SPGAs) because of their importance to recharge and groundwater storage. The areas of the SPGAs are similar to the WRODs. Also, Suffolk County's Sanitary Code Article 7 limits the quantities of toxic or hazardous chemicals that may be stored in commercial facilities located in deep recharge areas.

In central East Hampton, a portion of the new B&G eighteen-hole golf course is in a SPGA and WROD. Some commercial establishments are also in the central East Hampton SPGA and WROD. The western East Hampton WROD and SPGA are occupied by a commercial zone where the development of parcels restricts clearing to no more than 50 percent of the natural vegetation. Consequently, as much as 50% of the pine-oak woods, prime recharge vegetation, covering this area, may be removed. Goodfriend Park along NYS 114 is an example of commercial development in this SPGA and WROD. The Ross School private school with several buildings and a playing field are located in this development.

The Maidstone Gun Range is situated in the center of western East Hampton's WROD and SGPA and directly over the deepest flow recharge area in the town. The accumulation of lead from shot and bullets fired at the range over a twenty-plus year period is troublesome and has yet to be investigated.

A part of the town's WROD and/or SPGA areas have commercial or potentially polluting activities on them. The Montauk Downs golf course west of Lake Montauk is located in a WROD and SPGA. The course has initiated the use of Integrated Pest Management (IPM)and has achieved certification from Audubon, an organization that works with golf courses to make them more environmentally friendly. It has reduced its use of pesticides and fertilizers considerably. Extensive testing for pesticide residues in streams running out of the golf course in the mid-1990s as part of the Peconic Estuary Program failed to detect any. Also see the tests of monitoring wells in the vicinity of Montauk Downs carried out be Suffolk County's Health Services Department in the first years of this century which showed very little contamination by pesticides and fertilizers (Table 4).

The Montauk Landfill is located adjacent to the Hither Woods SPGA and WROD that are almost entirely in passive parkland. No leachate plume stemming from the landfill has ever been detected in monitoring wells installed nearby. The landfill was capped in 2000 and will no longer be able to pass leachate to the groundwater below.

SECTION 5.0
WATER BODIES, WETLANDS AND WATERSHEDS

There are more than 20 sizeable surface water bodies in the town. (See Figure 13 for a map of the major surface waters in the town, while Figure 6 shows the locations of the major watersheds feeding them.) Most of these water bodies are located along the north or south shores of the town and are groundwater fed. Groundwater seeps up from the underlying soil layers into depressions and low-lying areas where the land surface is situated below the water table. The elevation of a given water body's surface is generally slightly higher than the elevation of the water table.

Several groundwater coastal ponds are also intermittently connected to the surrounding seas. In Montauk, Oyster Pond west of Montauk Point is one such intermittently connected pond; most of the time the pond is shut off from the sea (Block Island Sound) by a spit of sand called a baymouth barrier. Georgica Pond in Wainscott is a coastal pond intermittently connected to the ocean; it is brackish, but its salinity varies widely according to the number and duration of the connections to the ocean each year. Wainscott pond, west of Georgica Pond, is the southwesternmost surface water body in East Hampton Town. Early in the geologic history of the South Fork, it was connected to the ocean, but is now blocked from it by a formidable primary dune, thus it is completely fresh. Hook Pond to the west in the Village of East Hampton was once intermittently connected to the ocean, but since at least 1930, it has been separated from it by sizeable primary dune fronting dune. Ca. 1931 an overflow-outflow pipe and weir system was installed to maintain the water surface at a constant level; the pond used to be brackish but is now nearly 100% fresh.

Ely Brook Pond in Northwest in Suffolk County's Cedar Point Park is more or less permanently connected to Northwest Harbor by a tidal creek. But it also receives water from two upgradient in the Grace Estate Town Park, Scoy and Little Scoy Ponds; these two glacial kettleholes are chronically filled with fresh groundwater and don't dry up, even in prolonged droughts. Consequently, Ely Brook Pond is brackish. Cedar Pond is a fresh groundwater pond, also in Cedar Point County Park. It is permanently isolated from Gardiner's Bay to the north by a baymouth barrier.

Fresh Pond in Montauk's Hither Hills State Park is a largish freshwater pond separated from Napeague Bay and Block Island Sound by a large dunefield. Fort Pond farther to the east in Montauk is the second largest freshwater pond on Long Island, but in the past was subject to intermittent openings to Fort Pond Bay. It is permanently isolated from the bay by the Long Island Railroad track and a dunefield north of it. Lake Montauk nearly 1000 acres large was once the largest freshwater pond on Long Island, was permanently opened to Block Island Sound in the 1920s. It's inlet to the sound is now protected by two jetties maintained by the US Corps of Engineers. Consequently, the lake is permanently tidal. However, the lake receives freshwater tributaries on the west, southwest, south, southeast, east and northeast. The southwest tributary is a freshish coastal pond, Stepping Stones Pond, while the tributary on the northeast is a salt pond, Little Reed Pond, once fresh like the lake, but now tidal. Little Reed Pond is connected to Big Reed Pond, a water table pond of some size, farther to the east by streamlets, which are not tidal. Big Reed Pond is permanently fresh. During the excursion of very high storm driven flood tides it is possible for salt water to reach Big Reed Pond.

The other large surface water bodies along the Peconic Estuary are have more or less permanent tidal inlets to adjacent outer bays. The two largest, after Lake Montauk, are Napeague Harbor, having two inlets to Napeague Bay, and Three Mile Harbor, with a single inlet to Gardiners Bay. Accabonac Harbor inleted to the western end of Napeague Bay is the next largest tidal embayment. Northwest Creek is not a creek, but a tidal embayment of modest size, which connects to Northwest Harbor, in actuality an outer bay, not a harbor. Hog Creek is more of a tidal creek than the last, it empties into Gardiner's Bay. Fresh Pond in Amagansett is a brackish pond with a very tenuous inlet to Napeague Bay; once every several years the inlet becomes blocked by sediments and has to be unclogged. Little Northwest Creek is the only classic tidal creek in the town. Its centerline demarcates the boundary between the town and Sag Harbor Village.

As of this writing, the west inlet and channel of Napeague Harbor is about to be maintenance dredged. Three Mile Harbor's inlet and channel were last dredged in 1999. Accabonac Harbor's inlet was partially dredged in 1995, Northwest Creek's inlet was last dredged in 1998 after a more thorough dredging in 1995. Lake Montauk's inlet was emergency dredged because of serious shoaling in 2001. Except for the last, which is a federal channel and was done under the aegis of the US Corps of Army Engineers, the others were dredged by Suffolk County. Hog Creek's inlet is dredged biennially by private associations based on each side of the inlet. The inlets to Little Northwest Crreek, Barne's Meadow Creek and Fresh Pond have never been dredged.

The inlets of Three Mile Harbor, Hog Creek and Fresh Pond are protected by jetties, while Accabonac Harbor's inlet is jettied on the north side. Northwest Creek's original inlet was filled and a new inlet dug farther to the west ca. 1959. Accabonac Harbor's inlet was moved several hundred yards to the north from its former position at about the same time. A new inlet is to be dug to the outer bay from the north end of Accabonac Harbor in 2004; this inlet will replace one in approximately the same spot that was filled in the early 1930s in order to install a road. Inasmuch as these inlets are the life blood connections to the Peconic Estuary, the town and the Town Trustees have instituted a policy to have them maintenance dredged regularly, not only for the purposes of safe navigation, but for environmental reasons, i.e., to make sure the tidal water bodies they serve are efficiently flushed of pollutants, including pathogenic microbes. The health of the biota and habitats of each of these inleted water bodies is dependent to a large degree on this tidal flushing.

All of the water bodies (freshwater ponds, streams, brackish ponds, tidal creeks and tidal embayments) discussed above are water table water bodies. In the hamlet of Montauk, in particular, there are many "perched" freshwater ponds and streamlets. Their bottoms are well above (in some cases more than 100 feet above) the true water table, which in Montauk resides slightly above sea level. These ponds and streams depend upon precipitation to feed them, but also on "perched" water or a virtual water table that resides on top of impervious aquacludes, almost all of which are tightly packed clays. During rainy years, the perched water table can be very thick and resides just below the surface of the land; during dry years it becomes very thin or disappears altogether. These perched ponds and streams have attendant freshwater wetlands of a multiple of types.

Several of their plants and wildlife are rare to the degree that they are listed as endangered or threatened on the state's Natural Heritage List and in state's environmental conservation code. However, there are no federally listed species in these wetlands, nor in any town wetlands or fresh water bodies as of this writing.

With few exceptions, such as Daniels Hole on Daniels Hole Road and Wolfie's Hole on the east side of NYS 114 in Wainscott, the freshwater wetlands in the town but not in Montauk are directly connected to the true water table. Those situated near the center or higher areas of the town are prone to dry up should the water table drop a few feet or so because of droughts; while those situated along the Atlantic Ocean or Peconic Estuary almost never dry up because the elevation of the water table only decreases by inches, not feet during droughts. These water table wetlands are of diverse types: red maple-tupelo swamps, shrub swamps, emergent marshes, subaquatic bottoms, cranberry bogs, interdunal swales, wet meadows and freshwater seeps and different combinations of two or more of these types. In East Hampton Town the latter two types are the rarest. These wetlands can change over time from one type to another, cycle through several types, or even become invaded by upland vegetation and lose most of their wetland qualities.

The quality of the groundwater feeding these wetlands is of utmost importance. For example, increasing the concentrations of nitrogen or metals in bog water, which, characteristically, is very low in nutrients (several sundew species get their nutrients and minerals from insects which they trap), drives the bogs towards becoming emergent marshes or woody deciduous wetlands. Several of the rarest species, many state listed as rare or endangered, can't tolerate excessive nutrients and are extremely susceptible to herbicides, even in the minutest quantities. The integrity and diversity of these water table wetlands is directly related to groundwater and surface water quality. Wetland plants and sediments can also remove noxious rainwater constituents and so polish the rainwater prior to it entering the ground.

Certain water table wetlands and ponds can be dewatered by pumping down the groundwater in their vicinity for human uses: consumption, clothes washing, irrigation and the like. Such close at hand wet habitats are especially vulnerable to pumping by large pumps (<100 gpm) day in day out. These pumps draw down the water table in a cone of depression around the well, tending to dewater the attendant wetlands and change their plant communities from wettish to dryish ones

Tidal wetland waters and species are more resilient with respect to groundwater quality, although they are affected by it, especially those tidal wetlands species that are beyond the reach of everyday tidal inundation. The biggest threat to tidal wetlands in East Hampton, however, is not polluted groundwater, but overtopping by phragmites, or ditch reed. Groundwater rich in nitrogenous chemicals encourages vigorous phragmites growth. Phragmites can similarly overtake all matter of freshwater wetlands and turn them into thick monoclonal impenetrable stands.

The town has two different kinds of watersheds, watersheds that border bodies of water such as tidal embayments and watersheds that overly deep recharge areas. The former contribute water from precipitation directly into the bodies of water by runoff and underflow. The latter only have a very indirect link with surface water bodies. The internal watersheds are often isolated from the watersheds that border tidal waters. (See Figure 6 B which maps several of these internal watersheds.) The coastal and low-lying watersheds contain small ponds and streams, expressions of the groundwater. The upland recharge watersheds occasionally contain vernal kettle ponds, but, in general, surface water and wetlands are uncommon in these areas. The watersheds around three of the town's largest embayments, Lake Montauk, Three Mile Harbor, and Accabonac Harbor, are largely developed. The watersheds around Napeague Harbor, a large tidal embayment located on the north side of the Napeague isthmus primarily contains passive parklands (Hither Hills and Napeague State Parks). Northwest Creek, a relatively small embayment west of Sag Harbor, is almost entirely bordered by passive parklands belonging to Suffolk County and New York State. Hog Creek is an even smaller tidal embayment between Three Mile Harbor and Accabonac Harbor in Springs. Its watershed is entirely occupied by houses and yet has the most extensive eelgrass beds of any tidal embayment in the Peconic Estuary.

On the Atlantic Ocean side of the town, four coastal ponds of ancient origin sit side by side behind the ocean dune line. The westernmost is Wainscott Pond and the easternmost is Hook Pond. The largest is Georgica Pond east of Wainscott Pond and the smallest is Lily Pond, between Hook and Georgica Ponds. These ponds sit behind a common baymouth barrier that has been retreating to the north at about a foot a year for the last several hundred years or more. It is evident that a few thousand years ago or more when the ocean shore was located a mile or more seaward than where it is today, these ponds were all part of the same coastal lagoon, or coastal embayment system. As the baymouth barriers and adjacent dunes retreat to the north, the arms of the parent system have become isolated into separate ponds. Georgica Pond is the only one that is regularly opened to the ocean so that it is able to tidally flush for two or three months a year and the only ones that regularly becomes saline. Hook Pond has an overflow pipe and has been connected to the ocean via a culvert since prior to 1930. The culvert has been replaced at least three times since then. Georgica and Hook Ponds have extensive watersheds, which extend all the way north to the groundwater divide. Contaminants enter them both by way of runoff and underflow. The main source of runoff is New York State Route 27, which borders the pond at its north end.

Fort Pond in Montauk is the second largest freshwater pond on Long Island. Its watershed is largely developed. Although it receives runoff through culverts from its perimeter roads, including NYS 27 at its south end, it has never experienced a serious algal bloom and remains relatively clean. However, the turbidity that is caused by the runoff from perimeter roads is likely responsible for the low degree of coverage of the pond bottom by aquatic vegetation. Of the two, Lake Montauk to the east has the largest watershed which extends west from the lake across the Montauk Downs State Park golf course until it meets the Fort Pond watershed, east to the top of the highlands on the east side of the lake and south all the way to the ocean. Lake Montauk was formerly fresh, thus the name, and the largest pond on Long Island until permanently opened to Block Island Sound in the 1920s. The groundwater divide on the Montauk Peninsula cuts across both bodies of water, closer to their south ends, than to their north ends.

5.1 Need for Protection

East Hampton's waterbodies, wetlands and watersheds provide protection against erosion and flooding, serve the livelihoods of fishermen and a host of other stakeholders, offer places of recreation, and aesthetic beauty, provide the major economic resources upon which tourism is based, and connect directly to, and feed, the sole source groundwater aquifer system that provides all of the town's potable, washing and sprinkling water needs. They are also home to many endangered and threatened species of plants, insects, amphibians, birds, and mammals listed in the state Environmental Conservation Code and in the state's Natural Heritage compilation, as well as recreationally and commercially important wildlife. The protection of East Hampton water bodies, wetlands and watersheds is as important to preserving the quality of its surface waters, as its groundwater. Monitoring and testing the quality of these water bodies, wetlands and watersheds is paramount to properly protecting them and the waters they feed, particularly the waters of the Peconic Estuary. The acquisition of additional critical open space, revising surface water, watershed and wetland protection legislation, sound planning, habitat remediation, and public education are the tools necessary to insuring their future quality, productivity and diversity.

The major water bodies serving East Hampton Town, in addition to the local ponds, streams, and embayments, are the Peconic Estuary and the Atlantic Ocean. Groundwater underflow north of the groundwater divide will eventually make its way to the Peconic Estuary. Groundwater flow south of the divide will make its way to the Atlantic Ocean. Runoff flowing from high to low elevations will either ultimately infiltrate to the groundwater or flow into these water bodies.

The most economically and recreationally valuable species found in the town's tidal embayments and creeks are shellfish and finfish. Shellfishing and finfishing provide a livelihood for many local baymen, who either fish full-time or part-time. Most shellfish and finfish landed in East Hampton are sold in local markets and restaurants. The Hamptons profit from its many seafood restaurants that sell fresh shellfish and finfish. If the quality of local waters decreases further and fishing is less productive, or precluded ,because of it, local baymen and fishermen will suffer economic losses, so will the markets and restaurants and so will the town's tourism base.

Shellfish are particularly susceptible to pollution because they are filter feeders and filter out small plankton, bacteria and other particles from the water column. Presently, whole tidal water bodies and portions of them are closed to shellfishing because of high concentrations of fecal coliforms and, presumably, pathgenic microbes. These coliforms and other microbes often originate in humans and turn up in wastewaters that can find their way into the water bodies where shellfish are found. Microbial pollution also comes from wildlife, especially, waterfowl, pets and livestock. Sections of Three Mile Harbor, Hog Creek, Accabonac Harbor, and Lake Montauk are closed to shellfishing either year round or during specific seasons. Alewife Brook Pond in Northwest, Fresh Pond in Amagansett, and Oyster Pond in Montauk are closed year round to shellfishing because of high fecal coliform concentrations. Most of Northwest Creek in Northwest is closed year round. The only tidal water body in East Hampton that has none of its waters closed to shellfishing is Napeague Harbor. (See Figure 13A for town waters closed to shellfishing due to high coliform levels.)

Many harbors and tidal creeks do not flush coliforms, other microbes, and nutrients out sufficiently during tidal exchange. Since groundwater slowly infiltrates into these areas, nutrients such as nitrates and other pollutants can build up. Groundwater feed, or "underflow" which entrains septic wastes can also contribute nitrates, other dissolved pollutants and microbes to a pond or harbor. Overland runoff also contributes to the build up of nutrients, especially nitrogen and phosphorous, microbes and turbidity particles in water bodies receiving it. Watersheds that include agricultural fields generally contribute large amounts of nutrients and other pollutants to their receiving waters. The application of the town's Harbor Protection Overlay District (HPOD) offers some degree of protection against these pollutants; however, it does not cover a large part of the Peconic Estuary.

Besides shellfish, finfish and waterfowl, East Hampton waters and their edges also host several endangered and threatened species listed by the state, federal government, or both. For example, there are four federally listed species situated at the water's edge or near the water in East Hampton Town. These are the roseate tern, piping plover, seabeach amaranth and sandplain gerardia. Additional, five species of marine turtles and several whales on the federal list regularly visit East Hampton waters. In addition There are about 50 species of state listed plants and animals in East Hampton, many of which are tied to coastal waters or wetlands.

5.2 Surface Water Quality

During 2001 through 2002, the US Geological Survey (USGS) sampled East Hampton and Southampton Town community ponds. The USGS was looking to identify possible contaminants in trace amounts that were entering ponds during storm events and during events of groundwater underflow. The USGS Water Division, located in Coram, N.Y., sampled six ponds during one storm event in June, 2002 and two non-storm events during August, 2001 and April, 2002. Overall quality of the ponds proved to be good. Most detections were in parts per trillion, which is generally considered to be several orders lower than most water quality detection ranges which are generally reported in parts per billion, parts per million, or even, parts per thousand. None of the test results exceed state or federal standards and guidelines (e.g., maximum contaminant levels, MCLs). They do indicate, however, the presence of pollutants, which need to be further tested for in the future. (Figure 13B shows an example of some of the results of these USGS samplings and tests.)

Nutrients, pesticides, volatile organic compounds and other wastewater and septic compounds were the types of contaminants for which the samples were analyzed. Nutrients consist of natural components found in soil and groundwater as "background" levels. Increases in nutrient levels over background levels can also result from development, septic wastewater, fertilization of residential, commercial and institutional landscapes, managed open spaces, such as golf courses, agricultural fields livestock feeding areas (e.g., pastures).

Pesticides are a group of naturally and synthetically formulated chemicals that are frequently used to rid plants, insects, or fungi from an area. Some already banned and presently used pesticides have been found to be toxic or carcinogenic to wildlife, livestock and humans. Some of the pesticides no longer used are known to be very resistant to biodegradation or highly insoluble in water (e.g., lead arsenate, DDT). This is why so many of these pesticides and their metabolites persist for so many years after application and are still detected today in soil and groundwater samples. Present day pesticides biodegrade more easily and have higher solubility. Because they are more soluble even though them may be not as toxic as poisons no longer in use, they can do just as much harm and still present a great risk where potable groundwaters and surface waters are concerned. Testing and analysis for such poisons in the environment these days includes assays not only for the parent compounds, but for their breakdown products as well. In many cases the breakdown products or "metabolites" present more of a risk than the parent compounds.

Volatile organic compounds are natural and synthetic chemical formulations. When found in groundwater or soil they have derived from spills and leaks at sites poorly maintained or from transporting vehicles such as tank trucks. Most of the time volatile organic chemical spills and leaks have to do with the production, transportation, distribution, and use of petroleum products such as gasoline and heating oil. (For a comprehensive listing of spills and leaks of volatile compounds in East Hampton Town from "Toxics Targeting" see Table 13.)

Wastewater compounds are of recent concern. Wastewater compounds can range from human and animal excretions to household cleaning products. Wastewater compounds found in groundwaters generally come from septic systems or sewage treatment plants that discharge to groundwater. They include medical residues, food and beverage derivatives and additives, products of diseases, cleaning and bleaching agents, cosmetics, and the like. Their long-term affects, either synergistically or independently, on human health even when ingested in low amounts, but chronically, as by drinking water, are only now being investigated.

5.3 Runoff and Groundwater Underflow Contributions of Household and Other Contaminants

Fort Pond and Hook Pond were sampled by the USGS during August, 2001 and April and June, 2002. Fort Pond is located in Montauk and is surrounded by residences to the south, west and east, as well as the Long Island Railroad and LIPA generating station to the north and Montauk Highway and commercial shops and businesses to the south. Hook Pond is located in East Hampton Village and is bounded by residences, Montauk Highway and adjunct village streets, and the Maidstone Golf Club. Upgradient to Hook Pond, on the west and north, is the commercial center of East Hampton Village. Both Hook and Fort Ponds are fed by groundwater and runoff, but can also be tidally influenced from time to time because of their close proximity to the Atlantic Ocean.

The results from the USGS sampling events showed that both Hook Pond and Fort Pond were affected by storm runoff and groundwater underflow contaminants. Fort Pond and Hook Pond nutrient detections show that the ponds were equally affected during storm and non-storm events. The largest detection was dissolved nitrite—nitrate at 1.8 mg N per liter in Hook Pond during the June, 2002 storm event. Five out of eight compounds found were detected in both ponds during storm and non-storm events. Nine volatile organic compounds were analyzed for during the non-storm and storm event in August, 2001 and June, 2002. Phenol was the only compound found during the non-storm event in April, 2002.

Results for Hook Pond during the June, 2002 storm event show that overland runoff is a contributing source of volatile organic compounds. All of the nine volatile organic compounds tested for during the June 2002 storm event were detected in Hook Pond. Three out of the nine were detected in Hook Pond during the August 2001 non-storm event, which shows that groundwater underflow contributes less in the way of volatile organics to the pond than runoff. The volatile organic compound detections during a non-storm event approximates the background quality of the groundwater in the area surrounding Hook Pond. Two out of nine volatile organic compounds were detected in Fort Pond during the June, 2002 storm event. None of the volatile organic compounds analyzed for during the August, 2001 non-storm event for Fort Pond were detected. These results show that there are not as many contributing sources of volatile organic compounds surrounding Fort Pond as there are around Hook

Seven wastewater compounds were analyzed for during the April, 2002 non-storm event and only one was analyzed for during the August, 2001 non-storm event and the June, 2002 storm event. Testing was limited during the storm event since most wastewater compound sources are transported through groundwater underflow from sewage treatment plants and septic tanks. Six out of seven and five out of seven wastewater compounds were detected in Fort Pond and Hook Pond, respectively. Caffeine (presumably, a metabolite in human urine) was the only wastewater compound that was found during the August, 2001 non-storm event and the June, 2002 storm event. Caffeine was detected in both ponds during the August, 2001 non-storm event, but was only detected in Hook Pond during the June 2002 storm event.

Ten pesticides were tested for in Hook and Fort Ponds. Two pesticides and one pesticide metabolite were detected in Hook Pond during the June, 2002 storm event. One pesticide and one metabolite were detected in Hook Pond during both non-storm events, but were not consecutive detections. One metabolite was consistently detected during both non-storm events and storm events for Fort Pond. Three pesticides and the one pesticide metabolite were detected in Fort Pond during the June, 2002 storm event. These results show that groundwater underflow is more of a contributing factor of pesticides and their metabolites than overland runoff is to Hook Pond. Fort Pond is more influenced by groundwater underflow as a source of pesticides and their metabolites than by overland runoff.

Hook Pond and Fort Pond are equally affected by nutrient sources located in their surrounding areas, transported by both overland runoff and groundwater underflow. Hook Pond and Fort Pond are both slightly affected by pesticide sources located in their surrounding areas, transported by both overland runoff and groundwater underflow for Hook Pond and groundwater underflow for Fort Pond. Hook Pond and Fort Pond are both equally affected by wastewater compound sources located in their surrounding areas, transported through groundwater underflow. Caffeine was also found during storm and non-storm events, indicating that at least some of the caffeine came from improperly disposed of caffeinated beverages containers. Hook Pond was more affected by volatile organic compounds than Fort Pond. Hook Pond is downgradient of a more densely populated and commercially developed area. The groundwater under the commercial area of Montauk at the south end of Fort Pond flows to the ocean, not towards the pond.

Methyl tert butyl ether (MTBE), a gasoline fuel additive and compound of much recent controversy, was detected in both Hook and Fort Ponds during the June, 2002 storm event, but was not detected in the ponds during the non-storm event testing. MTBE is quite water soluble and the detections show that MTBE is transported by rainwater runoff to the ponds, but has not them to a detectable degree via the groundwater.

5.4 Saltwater Intrusion in the Montauk And Napeague Areas

Since 2000 water pumped from SCWA wells in Amagansett has augmented Montauk's water supply. Such augmentation was precipitated by droughty conditions that lowered Montauk's water table and threatened to produce upconing of saltwater into

Montauk public supply wells, all of which are shallow and situated in the upper glacial aquifer.(The Magothy aquifer in Montauk is saline.)

When the drought conditions worsened throughout the years 2000, 2001, and most of 2002, mainland SCWA wells supplied the Montauk system with more and more water, much more than was previously anticipated. However, as far as can be shown, this increased pumping needed to export additional water to Montauk in no way threatened the aquifers proximate to the mainland wells pumping.

Three years ago the authority directionally drilled under the inlet to Lake Montauk and extended a water main under the inlet from a west side terminus at the end of Soundview Drive and Westlake Avenue to the east side of the lake. A new main was installed on East Lake Drive now provides Water Authority water from the west to provide potable water to the lakeside neighborhood that was previously served by a small private water company purchased by the Water Authority, the *in situ* well water from which was becoming increasingly salty.

5.5 Other Significant Public Water Extensions.

Seven years ago the Suffolk County Water Authority extended a water main from a terminus near the divide on Three Mile Harbor Road, three miles to the northwest to the North Woods—Hedges Banks community, because several private wells there had become contaminated with solvents, the source of which has never been elucidated. Three years later it extended a water main east from central Amagansett wells to Lazy Point on the isthmus of Napeague because the small community water supply system serving that residential area along the edge of Napeague Bay and Napeague Harbor experienced serious salt intrusion problems and was chronically beleaguered with other water quality problems as well.

Two years ago the Water Authority extended a Main through Sagaponack into Wainscott along Main Road, thence northward to ultimately connect to the water main that serves East Hampton Airport and Daniel's Hole Road. As a result of this connection, Bridgehampton well water is now mixed with East Hampton well water, and the water quality new combined zone is annually reported as such by the Water Authority. (See Figures, 14, 15 and 16.)

SECTION 6.0
WATER NEEDS

6.1 Prioritizing Public Water Needs

The locations of existing public water mains and public supply wells are shown in Figures 14, 15, and 16. If every home in the more densely populated hamlets of the town were eventually supplied with public water, which is what will most likely come to pass sometime around build-out, the noxious substances that collectively or individually reach the groundwater in the more populated areas of the town via septics, e.g., upper Springs, would not pose a problem to human health and pet health. However, such substances can still be injurious to organisms in nature, particularly where the groundwater carrying them reaches water table ponds (e.g., Scoy Pond in Northwest) or the tidal waters of Northwest Creek, Three Mile Harbor, Hog Creek, Accabonac Harbor, Fresh Pond, Napeague Harbor, and Lake Montauk. If such chemicals in significant concentrations were to find their way into the groundwater drawn upon by the town's public wells, however, it would cause a major problem. Remedying the problem (e.g., with activated carbon filtration) would prove to be very expensive.

6.2 Water Requirements for Fire Fighting

To address the issue of fire fighting water needs, an evaluation of the fire fighting capabilities was performed to determine if the current capabilities are adequate with respect to Springs and other communities. Presently in the town water for fighting fires is provided by four different water delivery systems: 1) forced water hydrants hooked up to SCWA mains which are always under high hydrostatic head pressure; 2) standpipe passive water wells into the water table; 3) electric pump fire wells which can be activated on demand; and 4) water tanker trucks which are owned by the towns various fire departments or privately. All of the fire wells, both the passive ones and the electrically driven ones, are shown in Figures 17 and 17a.

Springs is the most densest populated community in the town one of those that is the least served by public water. Current fire fighting capabilities include the water that can be provided by the Springs Fire Department. This includes a pumper truck with a capacity of approximately 3000 gallons of water and two engine trucks with a capacity of 500 gallons each. Therefore, the amount of water that can be brought quickly to a fire is at any one time is approximately 4000 gallons. Within the Spings area, there are many fire wells, either electrically drive wells or those pumped by a fire engine once hooked up, and on a few forced hydrants connected to water mains. Although there are many fire wells in the Springs area, a large portion of the Springs area does not have fire wells located within an acceptable distance to adequately assist in fire fighting. (See Figure 17 for the locations of fire wells in this area as well as the Northwest area, where public water and forced hydrants are also in short supply.)

Based on information provided by David DiSunno, the Chief Fire Marshal of the Town of East Hampton, the fire fighting capability in the Springs area is not as adequate as town communities supplied largely by forced mains, including East Hampton Village and part of Sag Harbor. Fire fighting requirements are calculated using the National Fire Protection Association Code 1142. The amount of water required for a fire in a typical Springs residence (a 2000 square-foot, two-story house) is a minimum of 10,000 gallons of water. In addition, if there are nearby residences, the water requirement increases by 50 percent to a minimum of 15,000 gallons. Code 1142 also requires that this water be delivered to the fire at a rate of at least 750 gallons per minute. It should also be noted that if a fire were to occur that involved a forest fire, the Springs area would be susceptible to severe damage since many houses are located within a forested area. In the event of a forest fire, the water demand would be many times greater than the demand for a single house and would easily exceed the ability of the three departments to provide adequate water to address the forest fire (see Figure 17A for photos of examples of local fire wells and other sources of water used for fighting fires).

In the Springs area, the Springs Fire Department has the capability of providing water onto a fire at 750 gallons per minute for less than six minutes and the quantity of water and the fire department may have less than one-third of the water that the NFPA requires. Fire wells, if appropriately located, will increase the volume of water but cannot provide the water at an acceptable rate. At present, if a significant fire were to occur in Springs, Chief DiSunno would contact the Amagansett and East Hampton Fire Departments. These departments could provide an additional 4,000 gallons each to a fire. However, due to travel times from these departments to the Springs area, this contingency is not considered adequate. In addition, with three fire departments responding, the amount of water available (12,000 gallons) may still be less than the NFPA requirements of a minimum of 15,000 gallons. Figure 18 shows the locations of the town's fire districts.

Therefore, it has been concluded that the current fire fighting capabilities are inadequate and represent an increased risk for the loss of life and property in the Springs area. To illustrate this point further, the Insurance Service Organization ranks areas, such as Springs, with regard to fire protection for the purpose of calculating fire insurance rates for a given area. Such factors as the density of the community, the availability of public water, and the capabilities of the fire department are considered. Each area is ranked from 0 to 9, where 0 represents the least potential for fire losses and 9 represents the greatest potential. Recently the Springs area received a 9, the lowest possible score. This compares poorly to other areas of the town such as Amagansett, East Hampton, and Montauk, which all received a rating of 5.

There no question that providing public water to Springs would greatly improve the capacity of the Springs Fire Department to fight fires and protect the lives and property of the residents of Springs. Public water distributed throughout Springs would also provide sufficient water to address fire risk and fire protection in accordance with NFPA standards and would also improve the area's insurance rating, which would very likely have the effect of reducing fire insurance rates in the area.

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SECTION 7.0
POTENTIAL CONTAMINATION ISSUES

7.1 Town Landfills

Two major landfills exist in the town: the Springs–Fireplace Road Landfill and the Montauk Landfill. Both landfills commenced operations in approximately 1960 and both landfills ceased accepting municipal waste in the 1990s. Both landfills now act as recycling and transfer facilities for municipal solid waste (see Figures 19A through 19D for photos of landfills in the town).

Both landfills contain a putrescibles lift (that is, a mounded area that contains household and commercial refuse) and a septage lagoon, now defunct and filled in. The septage lagoons were used to dispose of scavenger waste from septic tank and cesspool pumpouts in the town. The lagoons are no longer used for this purpose since scavenge wastes are now treated at the municipal sewage treatment plant on the Springs-Fireplace Landfill property.

The complete landfill closure process is underway at both landfills. The Montauk Landfill has been capped and the Springs-Fireplace Road Landfill will be either capped, reclaimed, or closed with a combination of these two methods. The purpose of capping the landfills is to prevent infiltrating precipitation from percolating into the landfill and through the waste where it incorporates contaminants from the waste that can be transported to the groundwater. This contamination is known as leachate. Leachate may be composed of inorganic parameters such as chlorides and metals as well as volatile and semi-volatile organic compounds.

Groundwater monitoring at the Springs-Fireplace Road Landfill has shown that the primary groundwater issue is the detection of tetrachloroethylene and related compounds in the groundwater on the north side of the landfill. Tetrachloroethylene has been detected at moderate concentrations in excess of the New York State Department of Environmental Conservation Class GA Standards since approximately 1991 when the groundwater-monitoring network was installed. More recently, additional wells were installed in the area to the north of the landfill to determine the extent of this contamination. The investigation showed that smaller concentrations, but still exceeding the drinking water standards, were discovered in the off-site wells. Monitoring of this plume will be continued. However, based on the width, length, and depth of the plume, it is not reasonable to expect that the plume will be actively remediated since any remediation (e.g., pump and strip) would likely need to be performed for a period as long as 30 years and the cost would be in the millions of dollars. Based on this information, the recommended course of action is to continue groundwater monitoring and to encourage residents living in the area downgradient of the plume to connect to public water as a precaution.

7.2 Petroleum Spills and Underground Storage Tanks

Almost all of the buried steel gasoline and diesel fuel tanks at the town's long-standing service stations began to leak by the 1970s and 1980s. Many of these leaks were serious, generating plumes of gasoline constituents (the so-called BTEX petrochemicals) that traveled away from the leaking tanks down-gradient to contaminate shallow private well systems (see Figures 19E through 19H for examples of petroleum-contaminated sites in the town). Of paramount significance have been the following leaks. The Mobile station tanks at the junction of School Street and Springs Fireplace Road in Springs leaked thousands of gallons into the soil and groundwater. It was partially cleaned up in the late 1980s by excavation and "farming" the excavated soil at the Springs Fireplace Landfill site. Harbor Heights station on NYS 114 in Sag Harbor's East Hampton Town northwest region leaked thousands of gallons over a span of approximately 20 years, constituents of which reached as far as a mile away to the north-northeast, to wit, all the way to Havens Beach on Northwest Harbor by the year 2000. The groundwater under Harbor Heights was pumped and stripped for eight years, from 1995 to 2003, before the contamination was removed to the satisfaction of the NYS Department of Environmental Conservation.

Sam's Auto on Three Mile Harbor Road south of Soak Hides Road in Springs suffered tank leakage for several years amounting to hundreds of gallons. The leaking BTEX constituents contaminated residential wells downgradient that were situated at the headwaters of Three Mile Harbor along Tan Bark Creek. A sparging unit was set up in the middle of the last decade and the BTEX components in the groundwater were sparged out until the groundwater met state standards. In the meantime the houses most afflicted were either provided with public water from the water main that had been extended to Hedges Banks well to the north because of solvent spill that occurred in the early 1990s or provided with new wells. As late as February 2004, at least one of the private wells down-gradient of the leaking tanks was still showing MTBE, albeit slight levels, in the well water.

Leaking fuel tanks at a now abandoned Texaco service station on the north side of NYS Route 27 in Montauk immediately south of For Pond were discovered ca. 2000.

In 2003 a remediation plan involving sparging the contaminated groundwater in the vicinity of the tanks was initiated and is in progress now. In the late 1990's petroleum products including were detected in a Suffolk County Water Authority well situated off Edgemere Avenue in Montauk north and east of the Montauk Firehouse. It turned out that a firehouse fuel tank was leaking. It was pumped out and the site remediated. In the last four named leaks, MTBE accompanied the BTEX constituents and traveled at a faster rate from the leaking tanks' sites than the other constituents. Such leaks brought into focus the troubling specter that MTBE would bode to the Town of East Hampton for years to come. (In 2003 the town initiated a law suit against the petroleum industry in an attempt to recoup damages to town groundwaters wrought by MTBE in the last decades.)

7.3 Contaminated Sites in the Town

In addition to the numerous sites mentioned above the town has experienced numerous releases of toxic or hazardous chemicals that have resulted in the contamination of soil and groundwater. (See Figure 19E for a mapping of actual and potential sources of environmental harm, including major spills and leaks of hazardous substances.). These incidents include industrial and commercial sites (primarily gas stations) at which chemicals were accidentally or intentionally disposed to the subsurface, but residential sites and roadsides, as well. The contaminants include liquid chemical solvents, petroleum products, heavy metals, and pesticides, to name a few.

In 2003 the town obtained a multi-volume database report from Toxics Targeting, Inc., which provides a detailed compilation of spills, leaks and other hazardous releases in East Hampton Town, from 1983 to 2002. Figure 20 shows the areas of the town covered by the study, while Table 13 summarizes the releases of hazardous materials in the town from 1983 through 2002, and Appendix A shows the entire list of spills and leak. The list shows that hundreds of spills, most involving petroleum, have occurred within the town. (See Figures 20A through 20D for examples of contaminated sites.)

When a release of liquid occurs, material that doesn't runoff or evaporate, infiltrates the soil and moves downward in accordance with gravity. Infiltrating precipitation will exacerbate this downward migration. The material will continue to move downward until the groundwater, i.e., the water table, is encountered. At this point, the contamination begins to move, primarily horizontally, in the aquifer in accordance with the rules of groundwater flow. Contamination that enters the ground from a specific, definable location (such as a leaking underground storage tank) is known as point source contamination. The contamination will spread in the aquifer since the contaminated soil will continue to provide a source for the contamination of the groundwater until all contamination in the soil is expended, which in many cases, takes decades. The constant, slow transfer of contamination from the soil to the groundwater, combined with the flow of the groundwater, itself, can create a long, relatively narrow swath of contaminated groundwater, or plume, over time. (Groundwater flows roughly at the rate of one foot per day depending on the gradient and the sediment composition.) Thus, depending upon the duration of the leak, plumes may be a few dozen feet long or more than a mile long.

There are numerous plumes known to exist in the town. Most are related to the leakage of petroleum products from underground storage tanks that have failed. Petroleum plumes are particularly troublesome since gasoline, as discussed above, has contained an additive known as MTBE (methyl tertiary butyl ether) since approximately

1979. (MTBE was added to gasoline as an octane enhancer to replace leaded gasoline and its use increased widely during the 1980s.) At present, MTBE can comprise up to 15 percent of the volume of gasoline distributed at the pump.

Although MTBE is considered a suspected carcinogen, it is not necessarily more toxic than many other constituents of gasoline. However, when released to the underground environment, MTBE behaves differently from the other gasoline constituents and these differences have resulted in probably making MTBE the most important primary point source contaminant of the town's groundwater.

Most of the other gasoline constituents move at a slow rate in groundwater. Although the groundwater flows at a rate of approximately one foot per day, the molecular structure of the other gasoline constituents retards and their velocity so that their flow rate is generally only a few inches per day. In addition, after these other constituents migrate a few hundred feet away from the source area, the concentrations are reduced sufficiently (by dilution with the uncontaminated water that the plume encounters) to the degree that naturally occurring soil bacteria will be able to biodegrade the BTEX contaminants at the plume's leading edge and prevent its further migration. As for MTBE, its rate of flow is generally not retarded because of its molecular structure, it is highly mobile, and it moves at the rate of groundwater flow or, even, faster. In addition, MTBE does not biodegrade appreciably in groundwater. Therefore, MTBE in groundwater travels faster, lasts longer and creates plumes that may be over a mile long.

It should also be noted that it only requires small amounts of MTBE to contaminate large volumes of groundwater. For example, one gallon of MTBE has the theoretical potential to create a groundwater plume 20 feet deep, 100 feet wide, and two miles long that exceeds the Maximum Contaminant Level (MCL) groundwater standards. In reality, one gallon of MTBE will vary rarely spread throughout the plume, but, nevertheless, very small amounts of MTBE can be responsible for the contamination of very large volumes of groundwater. For example, it is known that there is presently one active MTBE plume in the town that is several hundred feet long (and may prove to be longer when the investigation is complete). The source of this MTBE plume is known to be a leaking residential fuel oil tank. Home heating oil, *per se*, does not contain MTBE, but there are numerous instances of its presence in delivered heating oil as the result of the fuel oil delivery truck having also been used to make gasoline deliveries. The small gasoline residue left in the truck's tank in each such instance, though very little, is enough to severely contaminate the groundwater with MTBE via a leaking buried heating oil tank.

Although MTBE continues to be present in gasoline (and other petroleum products contaminated with MTBE), it has been banned for sale in New York State, January 1, 2004. (Alternative fuel additives, such as ethyl alcohol, which have the same function as MTBE, but which do not pose a threat to groundwater, are already readily available and in use in many states.)

When MTBE or any solvent or petroleum constituent contaminant enters the subsurface, in the large majority of cases, the responsible party is required by the New York State Department of Environmental Conservation to address the issue. Generally, this requires delineating the area of soil and groundwater contamination. This entails obtaining soil samples and performing appropriate laboratory analysis to determine the presence (or absence) and concentrations of contaminants. For groundwaters, monitoring wells are installed and sampled at various locations to determine the nature, extent and direction of the plume.

After the area of contamination is delineated, the source, e.g., a contaminated leaching pool or underground storage tank, is removed. Any contaminated soil is excavated and taken to a specially designated disposal area, none of which are situated in East Hampton Town. For groundwater, the remediation is often performed using a method known as "Air Sparging—Soil Vapor Extraction". The air sparging component consists of installing a line of several sparging wells perpendicular to the leading edge of the plume. Sparging wells are designed to blow air into the aquifer from a depth that is usually approximately 20 feet below the water table surface. As the air bubbles rise in the aquifer, they incorporate the volatile contamination within the air in the bubble and transport the contamination upward through the water table.

This process removes the contamination from the groundwater and transfers it to the soil above the water table. At this point, the soil vapor extraction system removes the contamination from the soil. Soil vapor extraction wells are perforated pipes that are installed in the ground above the water table. A vacuum blower is connected to the pipes and the contaminant vapors are removed from the soil and, either discharged to the air, if the concentrations are low enough, or treated by activated carbon adsorption prior to discharge to the atmosphere.

Most remediation projects of this type require 2 to 10 years to complete and the costs can range from $100,000 to well over a million dollars. It should be noted that the remediation process can significantly improve the quality of the groundwater, remediation does not generally restore the groundwater to pre-contamination conditions.

7.4 Golf Courses

Five golf courses are known to exist in the town (Figures 21 through 24). Golf courses provide the opportunity for recreation, however, they have been responsible for groundwater contamination at many locations on Long Island and the South Fork (See Tables 3 for some monitoring well test results in the vicinity of golf courses.)

To preclude contamination of important potable groundwater reserves, the best location for a golf course is along the south coast of the town, i.e., well south of the groundwater divide, since this is an area of shallow flow and discharges of contaminants to the Atlantic Ocean have less impact than releases to deep flow recharge areas or discharges to the Peconic Estuary. The Maidstone Golf Course situated south of NY State 27 just north of the Atlantic Ocean in East Hampton Village is an example of one that is very unlikely to significantly impact the environment. The state golf course on Barcelona, however, drains to the Northwest Creek and Northwest Harbor, tributaries to the Peconic Estuary. Fortunately, it's management practices are almost entire organic.

The three other golf courses in East Hampton Town, B and G, South Fork Country Club and Montauk Downs, are situated on or near the groundwater divide or upgradient of SCWA wells, in other words, in areas where pollutants from which are liable to impact private and/or public wells. These golf courses need to be managed as organically as possible in order to preclude such impacts. (The Montauk Downs golf course, upgradient to several public water wells and draining to Lake Montauk, has already made great strides to this end [Table 3A]) It is strongly recommended that groundwater monitoring be performed at all golf courses in the town to assure that pesticides and fertilizers are not impacting the groundwater (or downgradient surface waters) and the monitoring process also provides golf course owners with an incentive to reduce the uses of pesticides and chemicals applied. At present, monitoring wells are installed around the B & G Golf Course and part of the South Fork Country Club golf course and tested and reported on regularly. (The results of these tests covering more than two years of monitoring have yet to show any chemicals in contravention of state MCL levels.)

In addition, future golf courses should be sited well outside of the deep recharge area and, preferably, well south of the groundwater divide. Organic management practices should be encouraged for all golf courses since they use significantly lower amounts of chemicals which pose a threat to groundwater and, by extension, surface waters than traditional golf course management practices.

7.5 Dry Cleaners, Car Washes and Laundromats

Several dry cleaning facilities are known to exist in the town. Dry cleaners can be divided into two broad categories that relate to their potential for causing soil and groundwater contamination.

The two categories are known as "drop-offs" and "on-site" cleaners. Drop-off facilities can be considered to be relatively benign with respect to their potential to cause an environmental release of hazardous materials locally. At these facilities the clothes to be cleaned are dropped at the facility and the clothes are shipped by the facility to some other location, i.e., out of town, where the dry cleaning takes place. At on-site facilities, dry cleaning machines are located at the site and, therefore, dry cleaning solvents are used *in situ* thus having the potential to enter the subsurface sediments and, ultimately, the water table.

The overwhelming majority of dry cleaning machines use tetrachloroethylene (also known as perchloroethylene or "perc"). This chemical is a suspected carcinogen and has the potential to cause severe environmental damage if released into the environment. It is also considered a DNAPL (dense non-aqueous phase liquid) which means that it is more dense than water and if it reaches the groundwater in pure form, it has the ability to sink deep into the aquifer and leave a vertical column of pure perc globules from the water table to, potentially, hundreds of feet deep into the aquifer. Then, as the groundwater flows horizontally past the globules, they slowly dissolve and contaminate an area that may extend laterally two miles or more from the source area and hundreds of feet deep. Therefore, it is in the town's interest to reduce the potential for contamination at these facilities. Many dry cleaning facilities on Long Island have had releases and are now included on the Superfund list since, under these circumstances, the release of perc is considered to be a hazardous waste and is therefore included among the group of the most serious types of contaminated sites. None of these sites exist in East Hampton Town.

To address this issue, it is recommended that an inventory of all dry cleaning facilities be performed and those that perform on-site dry cleaning should be evaluated further. These facilities should be investigated to determine if perc is used and, if so, alternatives such as petroleum distillate solvents (which significantly reduce potential environmental impacts) should be encouraged or enforced. In addition, all dry cleaning machines in the town should contain secondary containment trays to prevent machine leakage since it is known that these solvents have the ability to migrate through solid concrete and reach the underlying soil and groundwater. (At present dry cleaning establishments are not regulated *per se* by the town, except by way of the Planning Board's site plan and special use permit review process; the Suffolk County Health Services Department regulates dry cleaners countywide.)

There is one commercial car wash and two commercial laundromats in the Town of East Hampton. The car wash is situated in Amagansett. It recycles its water and gets its water supply from a dedicated well, The laundromat in Montauk also recycles its water and gets its water supply from the Suffolk County Water Authority. The laundromat in Amagansett does not recycle most of its water. Laundromats and carwashes need to be closely monitored.

7.6 Swimming Pools and Spas

There are more than 4,500 residential swimming pools and several community swimming pools in the Town of East Hampton. (See Tables 12 A and B.) Residential swimming pools require a building permit for installation, but how they are used and maintained is completely unregulated. Since each residential swimming pool contains on average about 20,000 gallons of water, the 4,500 or so swimming pools hold approximately 90 million gallons at any one time during the summer. Water is continually added during the filtration process and to make up for loss by evaporation. At least 9 million gallons are used up in this manner each year, probably a very conservative estimate.

Swimming pools maintenance entails the addition of various chemicals, particularly chlorine to kill algae and bacteria, but also occasional herbicides, acidic washes and other harsh or toxic chemicals. Some of these chemicals reach the groundwater by way of the filtration and flushing process. Presently, we know very little about the extent to which swimming pools contaminate the groundwater and nearby surface waters by way of groundwater underflow. The potential pollution from swimming pools needs to be investigated and swimming pools (and spas) may have to be regulated based on that investigation in order to minimize their impacts on groundwater and surface waters.

7.7 Agricultural Areas and Nurseries

In the aftermath of World War II extremely toxic synthetic pesticides, namely chlorinated hydrocarbons and organophosphates, originally developed to control mosquitoes to reduce malaria and other mosquito-borne diseases, began to be commonly applied to all matter of farm and horticultural plants in East Hampton Town and elsewhere. These were much more effective than arsenates and the other pre-World War II insecticides and fungicides, such as copper sulfate; they were cheaper and easier to apply, and they were as persistent as the older ones. Hundreds of acres could be treated in less than an hour by spray planes, whereas, with the older tractor drawn spray rigs, it would take ten times as long or longer. The pilots of these planes were not subjected to clouds of dangerous aerosol spray the way the tractor drivers were. Crop production increased dramatically under the influence of these new pesticides, and, later, new herbicides.

However, not only were many of these synthetic pesticides more potent, they were readily mobile in water, especially when mixed with solvents, or "carriers" that were miscible in water. Unlike the heavy metals such as arsenic they and their solvents leached into the groundwater and contaminated it. The best example of such in the town is the widespread contamination of wells by aldicarb under the brand name Temik manufactured and distributed by Union Carbide in the 1970's after DDT, DDE and several other chlorinated hydrocarbons as well as several organophosphates were banned for use in the United States by the newly formed EPA. Aldicarb turned out to be highly soluble and very persistent and after only a few years of application, mainly to control the Colorado Potato beetle, poisoned hundreds of eastern Long Island wells, many of them in East Hampton, particularly in Wainscott, Northwest, and Amagansett.

The aldicarb contamination proved to be very instructive: not only were farm wells contaminated, non-farm wells, both residential, commercial, institutional (e.g., churches and schools), and even some public wells down-gradient of the fields where Temik was applied, were also contaminated. In the majority of cases the private wells contaminated by aldicarb were not situated proximate to a public water supply and so they were remediated on site by installing activated carbon filters paid for by Union Carbide as part of a settlement with Suffolk County. Said widespread contamination also spurred the Suffolk County Health Services Department's private well testing program into high gear. Under this program any homeowner can have his or her private well water tested from the tap for a nominal fee; said well test tests for a multitude of potential contaminants, including bacteria, nitrates, heavy metals, pesticides, herbicides, solvents, and petroleum derivatives, including MTBE.

Commercial agriculture is a laborious, yet profitable business. The various types of agriculture found in East Hampton Town contribute to the aesthetic qualities and rural character that attract vacationers and second-homers from the New York City area, New Jersey, Connecticut and Long Island's western suburbs. In today's extremely competitive world, everyone is looking for products that will boost productivity while lowering costs. For the agriculture business, those productivity-boosting products are fertilizers, pesticides and herbicides.

The most commonly used pesticides and herbicides are synthetically manufactured chemicals. There are two major types of agriculture found in East Hampton Town: fruit and vegetable farms and horticultural nurseries. Fruit and vegetables farms produce local apples, cucumbers, corn, leafy greens, potatoes, peaches, peppers, snap beans, strawberries, and tomatoes for farm stands, grocers and restaurants. Nursery farms produce ornamental shrubs, trees, flowers and plants used to landscape residential and commercial properties, most of which are sold and planted on commercial and residential properties in East Hampton Town.

Agricultural fields cover approximately 3.3% of East Hampton Town and are concentrated in Wainscott, south of Montauk Highway, along Long Lane in Northwest and Amagansett along Town Lane. Almost all of the agricultural fields in East Hampton Town are found south of the groundwater divide. Cancer studies performed by the New York State Department of Health during the years 1999 and 2000 with respect to a cluster of non-Hodgkins disease lipomas found in recent graduates of East Hampton High School (situated on Long Lane) reported elevated levels of pesticide-related arsenic and a host of other contaminants stemming from past agricultural practices in the soils on either side of Long Lane proximate to the high school. Studies showed that even though soil arsenic levels were elevated, cancer risks from exposure were only slightly elevated based on an approximately 70-year duration for a person living in that area. Private wells in the vicinity of the school tested relatively clean and the school, itself, is supplied by public water.

Although the studies were inconclusive, they did show that agricultural chemicals at relatively high levels can remain in the soil for very long times, in the study area, for more than 50 years. Since that time, the town's Natural Resources Department has sampled the dust blowing, and rain water running, off the field and has demonstrated that arsenic, lead and other contaminants contained in the dust and runoff have been transported to residential neighborhoods downgradient of these fields. Such contamination remains a serious problem and remains unremediated, yea, unaddressed.

During 2000 and 2001 the Suffolk County Department of Health Services (SCDHS) under the aegis of the state DEC sampled private and monitoring wells for pesticides in Nassau and Suffolk Counties. In this study 104 wells were sampled in East Hampton Town. Twenty-four pesticides were detected in the 104 wells sampled. Four wells had detections greater than the New York State MCLs for drinking water. Eighteen wells had multiple pesticide detections.(See Table 7.)

There are several commercial nurseries in East Hampton Town. The nursery landscaping business is much larger than the fruit and vegetable crop business. These nurseries are concentrated along Long Lane in Northwest and Town Lane in Amagansett, but also occur south of Montauk Highway in Amagansett. The conversion from row crop agriculture to nursery horticulture in the Town of East Hampton is quite recent, primarily since 1990. Such conversion is still in progress today. Consequently, while the impact of row crop pesticides on groundwaters have been fairly well studied, the impact of nursery pesticides has not been.

According to the Suffolk County Cornell Cooperative Extension, during 1990-2000, there were 15 registered major use pesticides used on nurseries. Forty percent of the 15 are herbicides, 40%, fungicides, and 20%, insecticides. Twenty-seven percent of the 15 nursery farm major use pesticides have a high leach ability rating (LAR). Of that 27 %, only one is regulated by the NYS DEC for levels found in groundwater as of 2003 (see Table 4).

Metalaxyl is one of the nursery farm major use pesticides with a high LAR that as of 2003 is not regulated by the NYSDEC with respect to groundwater drinking water levels or MCL's. Metalaxyl is also formulated under the names "Ridomi" and "Subdue". It is a fungicide sprayed on the leaves of plants and on soils to prevent fungus growth and reduce mildew. Metalaxyl has a low affinity for sandy soil, but a high affinity for organic material. Its biodegradation half-life is approximately 70 days. The biodegradation process is accelerated by photolysis. Since Metalaxyl has a high LAR and slow breakdown process, it has a great incidence of contaminating groundwater. Carcinogenic studies of metalaxyl have thus far been inconclusive. Laboratory studies on dogs have shown that ingestion of metalaxyl affects liver to brain weight ratios, and also increases liver concentrations of metalaxyl.

7.8 Fruit and Vegetable Farms

Fruit and vegetable farms use different pesticides to eliminate pests and to boost productivity. In January 2001, The Suffolk County Cornell Cooperative Extension drafted the "Pesticide Usage Report for Agricultural Crops in Suffolk County, 1975-2000." The report contained a table of registered pesticides used in Suffolk County during 1975-2000. The table listed the pesticide, pesticide class, and trade name, what type of crop it was used on during a 10-year period, a usage rating for each 10-year period, and an overall usage rating. High use pesticides with high LARs have a greater potential to reach and contaminate groundwaters (see Table 4).

According to the Suffolk County Cornell Cooperative Extension, during 1990-2000, there were 18 registered major use pesticides used on fruit and vegetable farms. Forty-four percent of the 18 major use pesticides are herbicides, 39 %, fungicides, and 17%, insecticides. Thirty-three percent of the 18 fruit and vegetable farm major use pesticides had high leach ability ratings. The New York State Department of Environmental Conservation applying the "New York State Ambient Water Quality Standards and Guidance Values" regulates 44 of the 18 major use pesticides. Of the six major use pesticides with high leach ability ratings, only half are regulated under the state's Ambient Water Quality Standards and Guidance Values as of 2003(Table 5).

Metolachlor is one of the fruit and vegetable farm major use herbicide with a high LAR that is not regulated by the NYS DEC with respect to groundwater. Metolachlor, also known as Dual, is used to control weeds for new fruit and vegetable plantings. Metolachlor is a "Class C" possible human carcinogen based on laboratory rat studies, which reported liver lesions in female rats after large exposures at 3,000 ppm. The risk of exposure to metolachlor is highest for applicators.

Metolachlor is a white to tan odorless liquid. The biodegradation of metolachlor is slow in the outside environment. It is also known to volatilize during hot climate conditions, at which time it can be inhaled as a vapor or dust. It can also precipitate out of the atmosphere and falls back down to the ground. This process increases metolachlor's mobility, its ability to move far from the point at which it is applied. Metolachlor biodegradation is enhanced by photolysis. Its average half-life in soil is 90 days. It has a low affinity to sandy soil, but a high affinity to organic material. Metolachlor's half-life in groundwater is between 548-1,074 days. Metolachlor has not been shown to be a problem for aquatic life as it is not absorbed through the external integuments of aquatic organisms.

Glyphosate is a compound that is a multi-spectrum herbicide. It is widely used in preparations sold under such brand names as Rodeo and RoundUp by homeowner, landscaper, farmer and pesticide applicator, alike. Because it kills all plant species, as well as aquatic plants and phytoplankton its use in wetlands and surface waters is questionable. It has also been linked to Hodgkins disease incidents in humans by researchers. In February, on the heels of a public hearing exploring the matter, the Trustees of the Town of East Hampton banned its use in all East Hampton waters under their jurisdiction. They are able to do this because they derive their powers from the Donegan Patent, which predates the creation of New York State and New York State law, and they own the bottoms of the lands under their jurisdiction.

No matter for what purposes pesticides are applied in East Hampton Town, whether for fruits and vegetables, nurseries, golf courses, landscapes, lawns and other vegetations, there are considerable amounts being used. The New York State Pesticide Registry states that in the year 2000, the last year for which accurate figures are available, more than 321 pesticides were used in East Hampton. The applications amounted to 10, 151 gallons or 393,734 pounds, about 0.2 gallons or 8 pounds per acre of land surface. About half of the town's land surface is in passive open space or vacant, thus the rates of application during that year were approximately twice that much. (See Table 6.) Thus the potential for groundwater and surface water contamination from pesticides in East Hampton is still great!

Pesticides such as Metolachlor and Metalaxyl need to be regulated and possibly banned from use in areas where there is a risk for groundwater contamination. Pesticides proven to be carcinogenic long after they were in use were ultimately banned. All pesticides, but especially those that have a tendency to leach to groundwater and which are slow to biodegrade, should be regulated by state and federal agencies with respect to potable water supplies and proven safe before applying them. None of them should be used around wetlands and surface waters where them can do damage to flora and fauna. In the State of New York, East Hampton Town and other municipalities are preempted from regulating the use of pesticides by state statute and state case law.

7.9 Continuing Monitoring Programs

The East Hampton Town Department of Natural Resources has continued to monitor the arsenic levels in agricultural soils where fine sediments are being transported off site by overland flow and then settled out in sediment fans downgradient. In 2003 after a three-inch spring rainfall, samples of runoff soils from the Northwest--Long Lane agricultural fields were collected and tested for heavy metals. One sample was from a sediment fan in the swale that crosses the north end of Long Lane; one sample came from a runoff soil site a quarter of a mile away, i.e., well down slope, on the north side of Stephan Hands Path, a major town thoroughfare. A third sample was taken from the north side of Stephan Hands Path along the route of a runoff stream that received sheet flow runoff from a non-agricultural nearby wooded area north of the agricultural swale.

Long Lane and the agricultural fields on either side of it are situated on an elevated piece of land formed by outwash fans during the melting of the last ice sheet to glaciate the South Fork about 20,000 years ago. Thus the topsoils are relatively fine in texture and deep. Stephens Hand Path cuts Long Lane north to south. Overland runoff travels across the agricultural fields in a southwesterly direction by way of five major swales of long standing. These swales cut across Long Lane as they move towards the ocean. One swale is largely intercepted by a recharge basin situated on the south side of Long Lane, the other four eventually reach NYS 114. Three cross Route 114 by culverts and overflow at the intersections of it with Stephan Hands Path (on the north), Harness Lane and Mane Lane (to the south). The southeasternmost swale is largely intercepted by a capacious state recharge basin situated on the east side of Route 114 just north of the Long Island Railroad R.O.W. Runoff from the swales running across 114 to Harness Lane and Mane Lane continues on into the subdivision known as Handsome Hills, where it has been a chronic problem and caused considerable damage over the years.

Test results from the sediment fan sample from the swale crossing northern portion of Long Lane showed that arsenic levels were elevated at 170 ppm. The New

York State soil background level for arsenic is between 3 and 12 ppm. Levels in the catchment basin were 14 times higher than the NYS background. The sample from the north side of Stephens Hand Path north of the Long Lane intersection, receiving sheet runoff from the wooded area, tested within range of the expected state background levels for arsenic at 6 ppm. The value for the sample from soil deposited on the north side of Stephens Hand Path west of Route 114 crossing, well downgradient and a the edge of a town-county nature preserve, was more than 4 times the NYS Background levels at 56 ppm. Thus, it was demonstrated that significantly large amounts of arsenic originating in the farm soils up gradient, were transported well off site where it may eventually pose a problem, particularly with respect to the Buckskill Nature Preserve's fauna residing there. (Arsenic is a heavy metal that is not only highly toxic, but bioaccumulated, as well; furthermore it is biomagnified as it passes up the food chain from vegetarian to top carnivore.)

Although the NYS DOH cancer studies demonstrated that arsenic levels in the areas surrounding Long Lane were only slightly elevated for carcinogenic risk when compared to background levels, these East Hampton neighborhoods continue to show higher-than-normal rates of cancer which ultimately may be at least partially attributable to the neighborhoods' agricultural past. Arsenic and other heavy metals are non-detectable in most public water well samples in Suffolk County, but the levels in certain South Fork public wells, particularly in those few that are downgradient of agricultural fields, are detectable and their presence is troublesome. The situation needs to be closely monitored.

As the only purveyor of public water in East Hampton Town, the Suffolk County Water Authority regularly monitors the quality of its well and main water and certifies that the water provided to residents is within all applicable drinking water standards. Table 5 shows some contaminants of concern as tested for and reported on by the SCWA.

7.10 Nitrate Loading From Septic Systems And Septic System Failure

The original septics or human wastewater disposal systems in East Hampton Town were little more than holes dug into the ground. When these holes were covered by sheds or canopies, they were called "outhouses." In the 19th and 20th centuries these unsightly and foul-smelling primitive systems were largely replaced by brick lined cylindrical holes called "cesspools" which received both human wastewater from toilets and gray wastewater from sinks and bathtubs. The wastewater solids were allowed to collect inside the cesspool where they were largely broken down by the digestive actions of various microbes, while the nitrate-rich water was allowed to leach into the ground surrounding the pools. Cesspools are still in use in many of East Hampton's older residences.

Newer residences have septic systems, which consist of a settling basin, or "septic tank" and a "leach field". The septic tank catches the solids, most of which are broken down by microbial action. Nowadays leach fields in East Hampton consists of precast concrete cylinders that have a large number of holes through which water leaches out into the surrounding subsoil layers. The concrete cylinders are bottomless and thus most of the wastewater leaches out through the bottom area. In time, the septic tanks fill with non-digestible solids and have to be pumped out into the tank of a scavenger waste, or "honey", truck which takes them to the town's scavenger waste treatment plant on Springs-Fireplace Road in Springs. If treated properly by the homeowner or business owner, the leaching rings clog up only very, very slowly and may last a hundred years or more before having to be replaced.

While many septic tank-less cesspools are still in existence, they clog up with grease and non-digestibles more readily than the modern septic systems and eventually have to be replaced. Others collapse producing "sinkholes" and have to be replaced. In the not so distant past, the life of a cesspool was extended by adding powerful solvents and acids to dissolve the grease and further digest the indigestibles. These chemicals leached into the groundwater along with the nitrates and added to the impacts resulting from such wastewater disposal units. Such practices are no longer permitted. Adding commercial bacteria preparations to revitalize the digestive capacity of the septic or cesspool system is permitted and does extend the life of the system. Notwithstanding this, all leaching septic systems still leach dissolved constituents, particularly nitrates, into the groundwater and that can cause major problems, especially where developmental density is high, more than one living unit per five acres, or where septic systems receive soluble substances, such as solvents or petroleum products, that are harmful to humans when they get into their drinking or bathing water by way of their wells.

Nitrogenous wastes derive primarily from urine, but also stem from feces, food waste, cleaning compounds and other liquids or solids that enter the septic system. Drinking water contaminated with nitrates can cause methemohemoglobinemia or "blue baby" syndrome. Infants that ingest water with nitrates greater than 10 mg/L begin to turn blue around the nose and ears and can also exhibit symptoms such as diarrhea, lethargy, and can also result in coma. Ingestion of groundwater with nitrate concentrations greater than 10 mg/L can also result in spontaneous abortion in pregnant women.

While several private wells in East Hampton Town have tested high for nitrates—6 to 7 ppm—especially in the denser residential areas such as in Springs, none have yet been found that exceeded the 10 ppm MCL. On the North Fork in Southold Town there are several instances of the 10 ppm standard being exceeded, even, by some public supply wells. Nitrate values for private wells in low density neighborhoods in East Hampton, especially those of forested areas in the Water Recharge Overlay District (WROD), are most frequently less than 1 ppm and just as often non-detectable, i.e., less than 0.02 ppm.

About 25% of U.S. households, including most of East Hampton Town, more than 21,000 homes and businesses, rely on septic systems to properly collect, treat and disperse domestic wastes below ground. If sited and designed properly septic systems can dispose of domestic wastes efficiently. As noted above, however, when used in densely populated communities that don't import potable water, but use the water from underneath those communities, septic systems may be efficient, but they can quickly render the groundwater unpotable. Residential septic systems are considered Class V injection wells, but are exempt from regulation by the Environmental Protection Agency.

Septic systems can be harmful to surface waters as well. They depend upon the availability of good leaching subsoils in order to work efficiently. In areas of the town where thick impervious clay lenses underlie leaching fields, the wastewater effluent will not penetrate the clay and will be shunted laterally along the top of the clay lens towards the nearest receiving area, most often a body of surface water. Such is the case in Montauk where septic effluents can end up in Lake Montauk or Fort Pond because they "perch" on top of the clay and move sidewise, rather than vertically down. Many leaching rings in Montauk have to be set on a column of clean sand that fills a passageway through the clay down to the true water table. There have been situations where such passageways, or holes, dug by crane, are more than 75' deep. If the column of sand should silt up to the degree that the wastewater no longer percolates through it, the entire system has to be abandoned, and a new one constructed.

If these holes are dug adjacent to ponds or wetlands that are dependent upon perched water for their habitat needs, these ponds and wetlands can be dewatered, significantly damaging them. In extremely prolonged rainy periods such as East Hampton experienced in the spring of 2003, and if such a column of sand is sufficiently downgradient from the perched water table, the groundwater under artesian pressure can move up through the column of sand and spill out over the ground bringing wastewater products with it, creating a serious health problem. (Leaching catchment basins set on columns of clean sand in similar situations can act the same way during such conditions; rather than leach water, they receive it from below and spill it out on to the road or shoulder, which was the case on Lincoln Road in Montauk in the spring of 2003 where the artesian phenomenon resulted major flooding.)

Septic systems that have their leaching rings in groundwater can also have injurious environmental impacts, especially when they are close to a body of water, particularly so, when the body of water is tidal. When the tide goes out it exerts a hydraulic pull, a suction as it were, on the septic effluent. It increases the degree to, and the speed with, which the septic effluent reaches the water. The town's Natural Resources Department and state DEC conducted coliform sampling experiments in the 1980s in test wells situated along the populated western shore of Three Mile Harbor in what is known locally as the "Springy Banks" region. Coliform values went up in the summer and stayed up until mid-fall. The coliform concentrations in the well samples were coincident with the degree of occupation of the homes, primarily, "second homes", immediately upgradient. The homes were maximally inhabited in the summer, minimally inhabited in the winter and spring.

Septic systems should not be used in areas with a high water table. Microbial degradation of pathogens and bacteria need sufficient distance to ensure proper breakdown before wastewaters meet the groundwater table. In the Harbor Protection Overlay District (HPOD) which comprises the first row of parcels, both developed and vacant, adjacent to the tidal creeks and tidal harbors in East Hampton that are tributary to the Peconic Estuary, as well as Fort Pond in Montauk, septic systems not meeting Suffolk County "Sanitary Code" standards have to be reconstructed whenever major improvements are made to those parcels under the aegis of the Zoning Board of Appeals and their natural resources special permit process. The required separation between the bottoms of the leaching devices (leaching ring, infiltrator, leaching pipes, etc.) has to be 4' above seasonally high groundwater. The 4' separation at installation further reduces the possibility of infiltration of the leaching device by a water table elevated hydraulically by flood tides.

In shallow aquifer situations septic systems need to be situated downgradient of water wells. A shallowly situated well pumping downgradient from a septic system can pull the wastewater away from usual groundwater flow and into the well, thereby contaminating it. For septic system placement in East Hampton Town with respect to private potable water wells including all private wells on neighboring parcels, the Suffolk County Sanitary Code requires a 100' separation between septic and well where the well has 40' or more of standing water, but 150' in situations where the well has less than 40' .In East Hampton Town the latter situation prevails in remote coastal areas such as Sammy's Beach and Lazy Point (now supplied with public water) and Cape Gerard and Louse Point where public water is not available.

For residences and businesses with conventional septic systems, the impacts from nitrogen can be reduced to a measurable degree by installing discharge infiltrators, which are installed in lieu of the usual concrete leaching rings receiving the wastewater effluent from the septic tanks. The overflow from the septic system is directed to the infiltrator, which is installed to a shallower depth (compared to leaching pools) and, therefore, increases the distance (and the residence time) between the point of discharge and the water table. Infiltrators also increase the area over which the wastewater is distributed and this increases the ability to achieve nitrogen reduction by natural processes. Nitrates are converted to nitrogen gas in a process call denitrification and the nitrogen gas passes out through the thin soil layer covering the infiltrator off into the atmosphere

Septic systems should only be installed by licensed professionals and should be inspected at least once a year. Education about septic system maintenance can play an important role in reducing septic system contamination and failure. Water conservation practices can also prevent septic systems from flooding. Septic tanks should be pumped of solids at least every two to five years. Restaurants and cooking establishments that use large amounts of cooking oils and lards need to have a "grease trap" installed between the earth pipe and the septic tank. The grease trap has to be cleaned regularly, or it will back up wastewater in the earth pipe and prevent it from reaching the septic tank. Rain water running off from roofs, driveways and parking areas should not be directed towards the leaching field as the leaching field can easily become overloaded.

For all new construction septic system installation is regulated by the Suffolk County Health Service Department according to the provisions of the Suffolk County Sanitary Code. For residential reinstallations in East Hampton Town septics are regulated by the town through the office of the Sanitation Inspector whose authority is codified in the towns local liquid waste septic sanitation law enacted in 1987. When new construction on vacant parcels cannot meet the Sanitary Code separation standards for well and septic outlined above, the construction is denied. However, the construction may be allowed to go forward if the Suffolk County Health Services Board of Review issues a waiver when petitioned to so by an applicant and after hearing the applicant's appeal.

7.11 Community Wastewater Disposal Systems

Wastewater generated from residences or businesses is directed to subsurface wastewater treatment systems. In areas where municipal sewage treatment is not available (as is the case for most of the Town of East Hampton with the exception of Sag Harbor Village), waste disposal options generally fall into two categories: conventional waste disposal systems, as discussed above, and sequencing batch reactors (SBRs) or "package treatment systems". Figure 25 shows a conventional waste disposal system and Figures 25A and 25B show photos of septic leaching fields.

Sequencing Batch Reactors (SBRs) are waste disposal systems that treat wastewater in an active manner which includes a fiberglass module vessel that contains chambers for treating batches of wastewater through aeration, settling, clarifying, and discharging the treated water. The advantage of these systems is that nitrogen concentrations in the effluent can be reduced up to 95 percent. The disadvantage is the cost especially when applied to single-family residences. Installation costs for a residential system, such as a Chromaglass reactor, may be in the vicinity of $10,000 to $13,000 for a single-family residence compared with $3,000 to $5,000 for a conventional system. In addition, there are electrical costs to operate the Chromaglass reactor that are estimated to be approximately $500 per year. However, encouraging the installation of these systems would have a significant, beneficial impact on the quality of groundwater in the town.

SBRs are required by the Suffolk County Department of Health Services in situations where the expected wastewater flows exceed allowable volumes per acre (which vary dependant upon the geographical area). Consideration should be given to increasing the use of SBRs for new residential construction, especially for multiple-residential construction, tight clusters of single-family residences and businesses and institutions which generate large amounts of wastes such as restaurants, health clinics and schools. The cost per treatment unit decreases as a function of the number of homes, condominiums, apartments, offices, classrooms and other buildings and structures treated by it increases. (See Figures 25C through 25G for photos of package sewage treatment plants, scavenger waste treatment plant, and denitrification systems.)

7.12 Wastewater Treatment Alternatives and Costs

One alternative to a community of septic systems is a sewage treatment plant (STP). There are four STPs operating within the greater limits of East Hampton Town. The Sag Harbor STP situated on Bay Street is the only long-standing STP on the South Fork, the only one serving a sizeable population (most of Sag Harbor Village), and the only one with an outfall pipe discharging treated effluent into a water body (Sag Harbor Bay). The East Hampton Scavenger Waste Treatment Plant on Springs-Fireplace Road in East Hampton treats septage from on-site subsurface septic treatment systems hauled to the site by scavenger waste trucks. It serves all of East Hampton and receives on the order of 10,000 gallons of septage from residential, commercial, and institutional sources daily. Summer haulage is about three times greater than off-season haulage and, consequently, cannot all be accommodated locally. Some is shipped out of town to the Bergen Point STP located in the southwestern corner of Suffolk County for disposal. The other two STPs are "package" treatment plants serving privately owned condominiums, Rough Riders on Fort Pond Bay in Montauk and Montauk Manor STP on Edgemere Avenue, also in Montauk. The latter three STPs provide tertiary treatment for nitrogen reduction and discharge their treated wastewaters underground via leaching fields.

Municipal sewage treatment plants collect raw domestic sewage by piping it from homes, commercial buildings or and institutions to a central collection location. At municipal STPs, raw sewage is treated before it is released. As solids enter the plant through pipes, grinders and screens decrease the size of solids and filter out nonhazardous materials that could be recycled or placed into a sanitary landfill. This step is known as primary treatment. Next, waste travels to a settling tank where solids settle to the bottom of the tank. Wastes in the tank are aerated to provide a constant level of oxygen for microbial degradation of pathogens and bacteria. This step is known as secondary treatment. Solids from the bottom of the tank are removed and are either recycled or disposed in a landfill. Finally, wastewater effluent from the settling and aeration tanks can either be drained into a large drainage field, similar to a septic system drainage field, where filtration of wastewater through sand layers promotes continued microbial degradation, or discharged to a surface water body where it is diluted.

Some STPs provide other forms of tertiary treatment to decrease the chances of releasing microbes into the aquatic environment. One form of tertiary treatment is the use of ultraviolet light passing through effluent wastewater to promote pathogen breakdown by photolysis. An older, less preferred form of tertiary treatment is the use of chlorination. The addition of chlorine gas to effluent wastewater also promotes pathogen breakdown. The former treatment is now in effect at the Sag Harbor treatment plant. It has replaced the latter treatment which charged the receiving surface water body with toxic chlorine which kills phytoplankton and zooplankton. Another form of add-on treatment is denitrification which can greatly reduce the amount of nitrates discharged into the receiving waters which can cause plankton blooms and the growth of red tide plankters that produce toxins which can be bioaccumulated in shellfish rendering them unfit for human consumption. It is believed that one of the causes of the "brown tide" phenomena that savaged the waters of the Peconic Estuary in the 1980s and early 1990s was the discharge of sewage effluent from outflow pipes coming from STPs.

Sewage treatment plants provide advantages and disadvantages to communities. Some of the advantages of STPs are that they are regulated by county and state and are more regularly monitored than septic systems. If tertiary treatment is used at a STP, pathogen and bacteria breakdown is improved when compared to septic systems. STPs are usually sited and designed better than septic systems, wastewater effluent originates and is disposed at one location rather than many locations, and the cost of a STP to the taxpayer to be installed and operated will pay for itself over and over again when compared to the cost of installing and maintaining individual septic systsems.

Disadvantages of STPs are that a few STPs having outfall pipes can dewater local streams and ponds and lower water tables because the wastewater effluent is not returned to the watersheds from which it originally came, thus the watershed's streams and underlying aquifer are starved for water. Sewage treatment plants can elevate nitrate levels in watersheds and their groundwaters or, in the case of those with outfalls, receiving surface waters. STPs can also produce offensive odors, noxious to surrounding households and businesses, and can be more costly to taxpayers than individual septic systems in areas thinly populated.

Package STPs are a more cost effective way to reduce nitrogen loading of groundwaters in a small community. Package STPs are designed to fit the needs of a specific neighborhood or multiresidential community. They are low maintenance, low cost, and do not require a full-time operator. Almost all package STPs on Long Island discharge effluent to groundwaters and, consequently, are required by state and county laws to denitrify the wastewater effluent before disposing of it.

There are several community septage collection and disposal systems in East Hampton that are technically not STPs because they do not treat the sewage except for removing settlable solids prior to disposing of the effluent. A few incorporate denitrification. The Camp Hero Wastewater Facility near Montauk Point services a senior center and 26 year-round residences that were once occupied by military personnel when Camp Hero was an active U.S. military base. It is a collection of pipes that join to mains that carry the raw sewage to a subsurface leaching field for discharge. Non-profit and quasi-governmental Town public-assisted housing facilities, such as Whalebone Apartments, Accabonac Apartments, Windmill 1 and 2 Apartments, and the Three Mile Harbor Trailer Park have combined sewer--leaching field systems. Avallone, on Fort Pond Bay, is another non-profit quasi-governmental apartment house in East Hampton Town. When the New York Ocean Science Laboratory (NYOSL) was in operation prior to 1981, Avallone served as a dormitory for lab workers and visiting scientists. When the NYOSL site was redeveloped as the Rough Rider condominiums, the package treatment plant that was constructed to handle the condominiums's wastewater had extra capacity; when the abandoned dormitory was converted to apartments in the late 1980s, their wastewater disposal needs were readily accomodated by the existing STP.

Another alternative to septic systems is the composting toilet system is not designed to treat "gray water" the wastewater generated by bathing, washing, showering and rinsing. Gray water does not contain potentially pathogenic microbes in high concentrations and it is generally much lower in nutrients. A composting toilet is an innovative way to treat human waste without leaching it into the ground. Unfortunately, most composting toilets are designed for use for short periods of time. These units are great for summer homes that are not rented continuously. If a home is only being used for a couple of months during a year, it is a good investment and helps protect the surrounding environment. Composting toilets are designed to be odorless and require little maintenance and cleaning. There are two different types: self-contained and central composting systems. The self-contained system is a single unit where the composting takes place with the help of some natural additives. Fans and heaters reduce odors and increase aerobic degradation. Wastes get churned approximately once a week, depending on the capacity of the model. Self-contained composting toilets provided by the Sun-Mar Company cost between $900 and $1,200, plus shipping.

Central composting systems collect the waste from no-water or low-water toilets located throughout a house. The system is usually located in an area below all the toilets and churns and aerates wastes on its own providing electricity. The cost of a central composting system, provided by the Sun-Mar Company, is between $900 and $1,650, plus shipping. Installation of composting toilet systems costs no more than the installation of conventional toilets that hook up to septic systems. There is only one composting toilet system functioning in East Hampton Town. The composting toilets are housed in a recently built comfort station maintained by the town's Parks and Recreation Department and is situated at the town beach located on the south end of Lake Montauk; its construction was partially funded by the US EPA and is one of the innovative water quality improvement projects sponsored by the Peconic Estuary Program.

7.13 Residential Underground Storage Tanks

There are three main types of home heating fuels that East Hampton Town. homeowners chose from: oil, natural gas, or propane. A good many houses are heated by electricity provided by LIPA and a few are heated by wood and coal. The reasons for choosing this or that type fuel are price and availability. Natural gas is provided by Key Span; it's distribution system in the town is limited to East Hampton Village and a few other communities. How clean a fuel burns, furnace maintenance costs and reliability of service and delivery are also considerations. Most houses and business within East Hampton Town are heated with oil. Fuel oil storage tanks situated on the home- or business owner's property are either located above ground outside, in the cellar or basement, or underground. The majority of tanks are situated underground.

In 1961 at the height of the conversion from coal furnaces to oil burners on eastern Long Island, the general recommendations for installation of fuel oil storage tanks were to have them installed where feasible on the property underground. (The filler pipe remained above ground.) This recommendation, of course, did not consider future environmental impact. Up until recently, home inspections or environmental audits carried out by professionals (e.g., engineers) did not include inspection of home heating storage tanks. Leaks in above-ground tanks are easy to detect by visual inspection Underground storage tanks are exceedingly difficult to inspect and can easily develop leaks that go unnoticed for long periods of time, even years. Storage tanks can develop leaks from the outside in or from the inside out. Underground storage tanks can rust and corrode relatively rapidly when buried in acidic soils. In East Hampton Town all most all soils are acidic. Water can collect inside a tank because of non-water tight connections or from condensation collecting on the inside during ambient temperature changes. Water on the inside of a storage tank can combine with sulphur in the heating oil forming sulfurous acid which eats away at the inner wall of the tank. Professionals can perform tank testing in order to assess the condition of the tank. Internal water can be detected relatively easy by using a specific test strip. Internal water can be removed with adehydrant. Finding a leak in an underground tank requires tank tightness test, which measures pressure retention inside the tank. Caution must be exercised in administering the test, however, because the pressure test can rupture a tank's wall if it has already been compromised and cause it to leak.

Tanks located on a single piece of property, that are 1,100 gallons or more need to be registered and are regulated by the NYS DEC. Most home heating tanks do not need to be registered with the NYS DEC because they are only 275 and or 550 gallons in capacity. Yet, if one of these tanks leaks or a spill occurs the NYS DEC has the right to regulate the spill and make the homeowner take responsibility for cleanup, which frequently entails removing the tank and the contaminated soil at no small expense.

Leaking underground storage tanks can impact the environment by way of the oil that percolates down through subsurface soils and eventually to groundwater. Leaking oil that impacts groundwater can create a plume from a continual point source. The plume, if not remediated, can impact potable water supplies and can also discharge into wetlands, ponds, rivers, streams and tidal water bodies.

Home heating oil is a petroleum product consisting of a mixture of hydrocarbons. When hydrocarbons enter the natural environment, they begin to breakdown through microbial degradation. Microbes that exist below ground use the available oxygen in soil or groundwater to breakdown hydrocarbons into smaller compounds, chiefly, carbon dioxide and water. If there is a continual point source of hydrocarbons creating a plume, over time degradation can slow down or even stop because of the limited amount of oxygen available for microbes to break them down. Some microbes are able to metabolize anaerobically, i.e., in the absence of oxygen. However, such anaerobic metabolic breakdown of hydrocarbons is much slower and much less complete than aerobic break down.

Homeowners that discover a leak in their storage tank should contact their home insurance agent immediately. Most homeowners will need to have the leaking tank evacuated and replaced with a new one; a monitoring well will probably need to be installed on the property so that the plume and its degradation can be monitored over time. Oil can also be removed from the plume by pumping out the top layer of oil and water from a monitoring well. The waste oil is carted off and can be separated and refined for later use, say, in the manufacture of asphalt for paving. Any new heating oil tank should be placed outside above ground or in a basement, crawlspace or garage. Whether outside or inside, the oil tank should be placed in a watertight catchment basin, which can catch any leakage and prevent it from getting into the ground.

7.14 Residential Lawn Maintenance

Lawn care became a major business in the years following World War II and not only included regular mowing, but also adding fertilizers, insecticides and herbicides. In the early 1950s 2,4-D was one of the first lawn care herbicides to become available in garden and hardware stores.. It was used to control broadleaved weeds, particularly, the common dandelion. Insecticides were used to control Japanese beetles and other root eating grubs. Fungicides were applied to kill fungi and mosses. Ultimately, manufacturers of lawn care products combined pesticides and fertilizers into one package (e.g., Scotts lawn supplements). These combo mixtures are convenient and easily applied; they are used in great quantity today on Long Island and elsewhere.

Landscapes became more and more elaborate and more expensive in the years following the war concomitant to an unprecedented surge in home building. Once confined to big estates, specimen trees and shrubs found their way into the landscapes of modest homeowners. Coincidentally, the pests that attacked lawns, flowers, trees and shrubs became more and more numerous belonging to more and more different species, the vast majority of which were exotic, they came in from the tropics, Europe or Asia, one way or another. In order to protect their valuable plants--very few of which were native--from predation and blight, homeowners were forced to resort to use more and stronger pesticides, as well as give them more and more nutrification.. Many of these pests such as the gypsy moth are never completely subdued, they come back and back, and with each new cycling require additional treatment. A good portion of these pesticides and fertilizers found their way into the groundwater.

The concern for agricultural and golf course pesticides as a possible groundwater or surface water contaminant is as valid a concern for residential lawn maintenance and landscape maintenance. Overland runoff to surface waters and infiltration to groundwater can occur for residential pesticides just as readily. Lawn maintenance pesticides of the wrong formulation or applied improperly can result in groundwater and surface water contamination. To have a healthy weed-free green lawn, homeowners need to add fertilizers, weedkillers, fungicides and insecticides, and lime if the pH of the soil is too acidic. In many cases, homeowners, or their gardeners and landscapers, are known to add more fertilizers and pesticides to their land than farmers do to their crops. Farmers and farm- workers are trained in the proper application of pesticides and advised to use best management practices, which saves them money; thus, they are advised to only apply pesticides when a problem arises and to use them sparingly, i.e., according to the label. Most homeowners are not trained in best management practices and can often overapply fertilizers and pesticides to be doubly assure that their lawns are green, and weed- and insect free. Homeowners also do not have to report to the state what registered pesticides and in what amounts they are using as applicators and farmers have to. Homeowners often have older pesticides (e.g., chlordane for aphids) that may have been banned from use by the US EPA and taken out of production..

Excess fertilizer and pesticides applied to lawns can leach into groundwater through filtration of subsurface soil and can contaminate near by wells. Excess lawn fertilizer and pesticides that originate upgradient of a pond, stream, lake, river, or watershed can runoff into these water bodies and contaminate them. Excess fertilizer running off into a stagnant water body can contribute to large blooms of algae. These algae respire at night using up the oxygen in the water causing hypoxia. The algae (both macrophytes and phytoplankton respond to increased nitrogen and phosphorous by reproducing cells and tissue at an accelerated rate, producing dense blankets of vegetation that compete for sunlight with rooted aquatics beneath them. The floating macrophytes and water column phytoplankton win.

Dead algae sink to the bottom and collect on the bottom of the water body where they consume large amounts of dissolved oxygen in aerobic decomposition. As the dissolved oxygen of the water body decreases, aquatic animals--zooplankters, fish, macroinvertebrate--suffer. This process is called eutrification.

A committee comprised of town officials, staff and informed community members within East Hampton Town has published a resource guide for Pesticide Use Reduction Education or PURE. The resource guide is readily in town offices Hampton and informs residents on how to reduce the use of pesticides and other amendments for lawn and landscape maintenance. Tips include how to create and care for a chemical free lawn, how to get rid of injurious insects "organically", how to create your own non-toxic pesticides, how to compost, how to talk to your landscaper about the use of environmentally safe products on your lawn, how to protect yourself, children and pets from pesticides, and also how to contact important numbers and websites for questions about lawn maintenance and the use of pesticides. The PURE committee also sends informative letters to the residents of East Hampton Town recommending that they look into more environmentally safe and natural products for their lawn and landscape care and provides PURE decals and PURE signs for lands and landscapes that are treated organically.

7.15 Community Wide Application of Insecticides

Pests that attack humans, pets and livestock are another cause for alarm. It turns out that the disease-carrying ticks of three local species thrive in the "ecotones" between house and forest. Consequently, many homeowners treat their property, or have it treated by licensed applicators, with pesticides to reduce the risk of getting lyme disease, babesiosis, erlichiosis or spotted tick fever. (See Tables 6 and 7 for the total amount of pesticides used in the town in the year 2000.) Some of the agents used to control ticks can ultimately get to the groundwater. However, the prevention might be worse than the cure. Mosquitoes are generally not controlled by the homeowner, but by licensed applicators and by Suffolk County's Office of Vector Control. In days past, that agency applied very strong pesticides such as DDT or spread oil over standing freshwater. Fortunately, in East Hampton, except in health emergencies, Vector Control now uses comparatively benign pesticides such as BT and metheprine. In the event of a health emergency involving mosquito borne disease pathogens such as West Nile or Equine Encephalitis, Vector Control may be called on to use stronger inorganic insecticides.

7.16 Roof Runoff

Stormwater runoff from roofs in residential and commercial areas has the potential to run off the property and over a wide area if rain gutters, leaders and catchment basins are not present. This runoff may entrain lawn pesticides, fertilizers and pet droppings and transport off site. It adds to the runoff in streets, which in turn can translate into more runoff directly entering water bodies or into storm drains overfillling them. In addition, the absence of roof water catchment systems may cause water damage to basements and foundations. Therefore, it is recommended that gutters, leaders and storm drains be required on all residences and commercial buildings within the town.

An average roof surface of 1200 square feet receives 100 cubic feet, or 750 gallons, of water in a one-inch rainfall event. The water from one thousand such buildings equipped with gutters, leaders and catchment basins would recharge 748,000 gallons of water to the aquifer, from 10,000 such buildings, 7,480,00 gallons. In other words, the rain falling on 10,000 average sized roofs in the town could recharge to the aquifer about 337 million gallons of water every year, by all means, no small amount..

7.17 Road Salting

Groundwater chloride contamination can affect the quality and taste of drinking water and can emanate from many sources. Point-source contamination of chlorides in groundwater supplies indicates the possibility of saltwater encroachment due to over pumping of an aquifer, impacts from excess road salting, or the leaching of stockpiled salts by highway departments. (See Figures 26A through 27B for photos of chloride contamination concerns and Table 8 for the quantities of salt used on town roads and highways.) Catchment basins not only recharge runoff but the contaminants contained in that runoff. (See Figures 28A through 28D for photos of leaching catchment basins and road runoff collection areas and Table 9 for the results of chloride sampling in catchment basins.) In areas where road salts and other contaminants can be leached directly into important groundwater recharge reserves, it is preferable to allow the runoff to collect in shallow depressions and swales (as in Figure 29.) In the latter situation salts and other contaminants are less likely to get to the groundwater.

The New York State Drinking Water Standard for chloride is 250 mg/L; and is enforced by the state Department of Environmental Conservation. For the purpose of this report, historical U. S. Geological Survey (USGS) and Suffolk County Department of Health Services (SCDHS) monitoring well data was collected to determine if chloride contamination was related to road salting and runoff. Data was collected from the USGS database for 13 monitoring wells and also from the SCDHS data files for 13 monitoring wells located in East Hampton Town. Most sampling events for the USGS and SCDHS occurred between the 1970s and 1980s, with some exceptions for a few wells that were sampled during the 1990s and 2000. The most current groundwater data source is from the Suffolk County Water Authority, which performs yearly sampling events on the public supply wells located in East Hampton Town. Chloride sampling was also performed on several shallow test wells installed around the local water bodies by the East Hampton Town Natural Resources Department. Samples were collected from test wells adjacent to major roads to see if excess road salting had impacted groundwater. (See Figures 30, 31, and 32 for the mapped results of said sampling.)

Ten areas located around catchment basins in East Hampton Town were sampled after a salting event on April 7, 2003. Sample locations and results are shown in Table 9. Sample locations were adjacent to heavily traveled roads, state Routes 27 and 114, which are regularly salted by the New York State Highway Department during snow events. Water located in and around the town catchment basins was sampled and hand delivered to a New York State Certified Laboratory, Ecotest Laboratories, Inc., in North Babylon, New York. Results of the town catchment basin sampling event on April 8, 2003 showed significantly elevated chloride levels. Nine out of ten catchment basin areas sampled resulted in a chloride level greater than the New York State Department of Environmental Conservation (NYSDEC) Standards and Guidance Values for chloride. Five out of ten catchment basin areas sampled contained greater than 500 mg/L of chloride. Although townspeople are not directly drinking this water from areas around and within the catchment basins, this is where much of the town's drinking water begins the journey from the surface of the ground to the underlying aquifers. High chloride amounts in highway runoff waters are being recharged into the local groundwater system, but because of the subsequent dispersion and mixing of this water with larger amounts of aquifer water, groundwater chloride concentrations are still considerably lower than the surficial runoff concentrations, but increasing in value.

The USGS monitoring well data indicates that none of the 13 monitoring wells contained chlorides above the N.Y. State Drinking Water Standard for its most recent sampling event. Four out of 13 SCDHS monitoring wells were above the N.Y. State Drinking Water Standard during the most recent sampling event.(See Figures 31 and 32.)

East Hampton Natural Resources sampled 20 test wells located around Three Mile Harbor, Accabonac Harbor, Georgica Pond, Fort Pond, Napeague Harbor, and Northwest Creek. The test wells that were chosen were located adjacent to or downgradient of major roads and highways that receive salt during snowstorms. One out of 20 test wells sampled tested above the New York State Drinking Water Standard of 250 mg/L. Chloride was detected in Accabonac Harbor Test Well 5 at 280 mg/L. Forty milligrams per liter of chloride is a conservative presumptive indicator of impacts to groundwater from road salting. Eleven out of 20 sampled test wells located along major roadways tested at 40 mg/L or greater for chloride. Five out of 20 wells sampled had detections above 100 mg/L. It is evident that road salts are raising the level of chlorides in the town's aquifers. (See Figure 30 and Table 10 for the sample test wells and the results of said sampling.)

7.17 Lead In Drinking Water

Residents of East Hampton Town are concerned whether lead could be a possible contaminant in their drinking water. Most contributions of lead to drinking water originate from the water pipes located within the house or in the connection pipe leading to the house from the well or water main. The natural concentrations of lead in the groundwater are generally very low and are not considered a significant contributor to homes that show high lead concentrations in their tap water. Exposure is greatest for those living in older houses, almost all of which have lead soldered plumbing connections

Lead has the potential to accumulate in the body and cause adverse health effects. Children and infants are more susceptible to the affects of lead poisoning, which can affect detrimentally developmental processes and growth, than adults. Therefore, it is recommended that residents in the town be aware of the possibility of having lead in their tap water and take steps to minimize it's concentration.

In the interests of those East Hampton Town homeowners provided with public water by the Suffolk County Water Authority (SCWA), a yearly report is published and widely circulated by the Authority; it shows the results of regular water quality testing for the well and water main water provided to each service community. This report is usually bundled with a newspaper (e.g., Suffolk Life) for distribution to the general public. It can also be viewed on the Internet. The water serving the five existing public water-supply communities (or service zones) in East Hampton Town was tested several times during the year and the test results are incorporated into the SCWA's 2002 Annual Drinking Water Quality Report. With respect to lead every zone in East Hampton Town in East Hampton had an average value below detection and the highest single value was 4.7 g/L in Sag Harbor. The federal Maximum Contaminant Level (MCL) for lead in drinking water is 15 g/L. The SCWA attributed lead in drinking water to lead leaching from the homeowner's pipes.

The latest monitoring well data provided by the SCDHS shows that lead in drinking water is not a contaminant of concern for East Hampton Town. (See Figures 33 and 34 for the locations and results of lead sampling in the town.)

East Hampton Town recently had some local homeowners sample their drinking water for lead. Homeowners were given preprepared sample bottles and instructed on how to properly sample their tap water for lead. Before the first sample was taken, the aerator on the faucet was removed. Cold water was allowed to run for a few seconds to drain approximately two cups. After two cups had drained from the pipes, the first sample was taken. Water continued to flow out of the cold faucet for approximately five minutes, after which time, a second sample was taken. The second sample when compared to the first sample shows whether or not lead is continually leaching out of the homeowner's pipes or if the lead detected results from water sitting in pipes for an extended period of time, say overnight. In this way, private well water in three houses was tested for lead. Two out of three houses had detections of lead in the drinking water for the first sample taken. One out of three houses had detections of lead in drinking water for the second sample. One out three houses had lead detections above the NYSDEC Ambient Water Quality Standard for lead.(See Table 11.)

In East Hampton all well water is acidic. Acidic water leaches lead from plumbing joints at a comparatively high rate. The State Building Code and East Hampton Town Building Department have not allowed the use of lead solder for water supply pipe joints in new construction since approximately 1986. Houses plumbed before that time are likely to contain lead solder joints and, so, leach lead into the water supply lines.

State and federal governments regulate lead levels in drinking water. The federal EPA protects drinking water from elevated lead levels nationwide under the Safe Drinking Water Act. The EPA provides recommendations to limit exposure to lead even if the risk is high. The EPA suggests that homeowners flush their water through the pipes in the morning for two minutes before using the water for household needs. The EPA also suggests using cold water for consumptive uses and to have drinking water tested by a state certified laboratory if there is a suspicion of lead in it. [The private well water testing service provided for a nominal cost by the Suffolk County Health Services Department tests for in tap water, but, inasmuch, as the tap water is run for three minutes before taking a sample, the chances of finding any are not good.]

7.19 Summary of the Source Water Assessment Program (SWAP) Report

A recently completed report entitled "Long Island Source Water Assessment Summary Report (from the Source Water Assessment Program" (or SWAP) was prepared by the New York State Department of Health with the assistance of other local regulatory agencies and a private contractor.

The purpose of the SWAP report was to evaluate the locations of all public drinking water wells on Long Island and perform a computer modeling study to evaluate the contributing areas of recharge water for these wells. It was found that these contributing areas, or capture zones, are irregularly shaped due to the complexities of the geology of Long Island and the interaction of pumpage rate and the aquifer at each of the wells. In addition, the travel times for water in the capture zones were also evaluated to determine the duration of time necessary for a molecule of water to travel from some point within the capture zone to the well.

The purpose of determining the capture zones and travel times is to evaluate current land usage in these areas so that it can be determined whether there are high risk land uses (such as gas stations, farms, golf courses, or dry cleaners) situated within the capture zones for a given public well.

It was found that for the South Fork, the capture zones for the public supply wells have travel times that range from near zero to 100 years (Figure 35). Also, based on known areas of contamination with respect to the locations of public supply wells, it was found that East Hampton town well areas, primarily, in Montauk, are judged to have wells with a medium susceptibility to pesticides and a medium to high susceptibility to volatile organic chemicals, VOCs (Figures 36 and 37). This information should be considered for future land use planning in the town.

The SCWA public well stations in East Hampton are protected to this and that degree from surface contamination by the degree of passive open space surrounding them. The various wells and the degree of vacant lands in around them within radii of 0.1, 0.25 and 0.5 miles are shown in Figures 38 A through P. Figure 38 Q shows the same circles for a SCWA water supply well under construction in Amagansett. From an examination of these figures it can be shown that certain well fields, e.g., Sag Harbor Turnpike/NYS 114 (Figure 38 B), are largely surrounded by open space, while others, e.g., Bridgehampton Road on Montauk Highway in East Hampton Village (Figure 38 C) are situated in relatively densely developed areas. The town in concert with the county, state, and SCWA should seek to further maximize the vacant land around each well station to insure the protection of each from contamination in the future.

It doesn't take much of this or that substance to make water unfit for drinking or bathing. Table 14 lists different common chemical contaminants showing up in Long Island groundwaters and how little of each it takes to exceed the state MCL. For example, only 4.2 pounds of carbon tetrachloride, less than a gallon, will render one billion gallons of water unpotable and unfit for bathing!

SECTION 8.0
RECOMMENDATIONS

(Editor's Note: numeral before each recommendation is not meant to be taken as the priority ranking of said recommendation)

Based on the findings of this report, we offer the following recommendations:

1. Extend public water mains throughout the Springs to provide a higher quality, safer, and more reliable source of potable water. In addition, the presence of public water will greatly improve the ability of the town to address fires in this area. Also, public water mains should be extended along the entirety or NYS 114 to connect the Sag Harbor and Wainscott distribution zones. Additionally, public water mains should be extended into all other residential areas, which are susceptible to groundwater contamination from contaminant sources nearby, e.g., the residential area west of NYS 114 and south of Stephan Hands Path not now served by public water.
2. In the not too distant future extend public water along Daniel's Hole Road, Two Holes of Water Road, Bull Path, Old Northwest Road, Swamp Road, and Stephan Hands Path, to enhance fire-fighting capabilities and to provide potable water distribution for this area when the need arises.
3. Consider establishing a moratorium on building permits for new residences on vacant parcels in Springs and other groundwater poor areas, now served solely by private wells. The moratorium would be rescinded as soon as public water becomes available.
4. Locate apartment-type/high-density "affordable" units south of the groundwater divide, where accessible to public water provide them with

sequential batch sewage treatment plants having advanced (e.g., tertiary) treatment capabilities.

5. Revisit the boundaries of the Water Recharge Overlay District (WROD) and reconcile them with the boundaries of the Special Groundwater Protection Areas (SPGA). Consider expanding the zones in some areas where it makes hydrogeological sense.. Extend Harbor Protection Overlay District (HPOD) and its WROD-like clearing restrictions to cover all parcels, unimproved and improved, situated along the shores of the Peconic Estuary, to wit, Northwest Harbor, Gardiners Bay, Napeague Bay, Fort Pond Bay and Block Island Sound.

6. Carefully control the use of road salt on roads in the SGPA and WROD zones. Evaluate the potential for the use of alternative substances to be used in the future to reduce or eliminate the use of chloride-containing road salts.

7. Impose clearing restrictions for all unimproved parcels not in WROD, but within the five-foot water budget contour (two foot contour in Montauk) as formulated by the Environmental Subcommittee of the Comprehensive Plan Program. The added clearing restrictions will address almost all of the "Old File Map" subdivisions that are not presently located in Water Recharge Overlay District or Special Groundwater Protection Area. (The extended clearing boundaries will be adjacent to existing roads, in the way that the boundaries for the WRODs have been defined).

8. Create hydrologist-technician position for addressing water issues. The position will include the duties of the sanitary inspector governing septic and well rebuilds and replacements in the town.

9. Provide increased wellhead protection by closely controlling and monitoring activities upgradient of public supply wells, in areas mapped by the Source Water Assessment Program (SWAP). Maximize the amount of vacant land, i.e., passive open space, around each well station, especially around those well stations situated in the deeper flow recharge zones.

10. Create a state-of-the-art Town wide groundwater monitoring system in cooperation with the USGS, SCDHS, and SCWA, that would share participation, data collection, and oversight equally.

11. Lawfully abandon all underground fuel oil tanks on all parcels, except for those already in compliance with state and county laws and rules and regulations applicable to underground tanks 1100 gallons and larger. All new fuel tank installations for heating oil tanks should be above ground with secondary containment dikes, or placed in basements, garages or crawl spaces provided with concrete flooring. Work to provide incentives for such abandonment, e.g., tax credit, low interest loans.

12. Encourage the distribution of natural gas lines to provide an alternative source of clean non-polluting fuel for heating and other residential and commercial needs.

13. Use swales and natural depressions instead of catch basins to accommodate road runoff where possible and feasible.

14. Contain runoff from agricultural fields on site as it has been recently shown that runoff migrating off of town agricultural fields contain toxic chemicals. Every agricultural and nursery operation, and especially any one owned and/or controlled by the town, should demonstrate, either by the use of berms, swales, or other runoff controlling features, that it is keeping all runoff on site.

15. Contain runoff from golf courses and playing fields on site.

16. Dry cleaners in the Town should be inventoried and a determination made as to whether dry cleaning is performed on site or whether the business operates as a "drop-off facility." For those that perform on-site dry cleaning, the town should encourage the use of new generation dry cleaning machines that have secondary containment trays at their base to prevent solvents from migrating through the concrete. In addition, dry cleaners should be encouraged to use new generation dry cleaning solvents and the use of tetrachloroethylene should be eliminated as soon as possible. Leaching pools at dry cleaning facilities should be sampled to determine if there have been any illegal subsurface discharges.

17. New laundromats and car washes permitted and constructed in the Town should use recycled-water and should not be located in SGPAs or WRODs.

18. Only dry businesses and businesses that do not use solvents, strippers, paint thinners, petrochemicals, and other chemicals listed as hazardous, flammable, or toxic by the USEPA, NYS Health Department and/or the Suffolk County Department of Health Services should be permitted in SGPAs and WRODs.

19. Regulate swimming pool and spa cleaning and maintenance; use HPOD type standards in the WORD and SGPA zones to decrease the potential for toxic chemicals entering the groundwater.

20. Regulate the installation of automatic sprinkling and irrigation systems in WRODs, SGPAs and groundwater deficient areas (e.g., Gerard Drive) and require a building permit and review prior to their installation.

21. Encourage the use of indigenous vegetation for landscaping in WRODs, SGPAs, HPODs and natural habitat areas. Native species are more resistant to pests and pathogens and require less care and water.

22. The issue of lead solder in older plumbing systems can be addressed by encouraging the water users in the town to flush the individual tap for a period of at least two minutes prior to use for drinking or cooking in the morning. This flushing should occur whenever the tap has been unused for at least six hours. This recommendation applies to all structures within the Town, regardless of age. Rebuilds of residences and commercial buildings should require the elimination of all lead-soldered joints, and require recertification of plumbing.

23. Use zoning powers, where possible, to monitor and regulate the use of chemical pesticides in the town by enacting and/or amending local laws that indirectly or directly pertain.

24. Continue to have special days (STOP) days on a regular basis for collecting toxic chemicals from homeowners who might otherwise discard them improperly.

25. Create a town-sponsored groundwater/drinking water education program for homeowners, renters, and business operators and a water conservation curriculum for local schools. Encourage participation in existing water quality and water conservation programs.

26. All new construction should have gutters and drainpipes to drywells to recharge all roof water on site. Preexisting buildings should be retrofitted wherever and whenever possible with gutters, leaders and drywells.

27. All plumbing fixtures for new construction and any reconstruction requiring a building permit should be of the "water-saver" type. For all replumbs and rebuilds, non-lead solder required by the Building Code should be used and all lead solder joints existing in the old plumbing should be removed so that the plumbing can be recertified.

28. Having a single water purveyor to pump and distribute all public water throughout the town is the best way to control and monitor water use and the quality of the water used.

29. Work with representatives in the county, state, and federal legislatures to improve the protection of the town's sole source water supplies. This is especially important with respect to having a law passed at the state level banning the use of chemical pesticides in the town, where such chemicals are used solely for cosmetic purposes. Pursue the adoption of SCDHS "Watershed Rules and Regulations" (as already implemented for Fisher's Island in Southold Town) and pursue the adoption of the recommendations of the

Peconic Estuary Management Plan having to do with surface waters and their watersheds.

30. Implement a townwide pest management program for town waters and lands that employs natural pest control measures, e.g., using mosquito fish to eliminate mosquitoes in backwater areas.

31. Become part of the Peconic Maritime Reserve Council. The subsidiary Central Pine Barrens intergovernmental agency is proving that it can protect groundwater supplies and the forest ecology efficiently, judiciously and cooperatively.

32. Draft a townwide Stormwater Runoff Management Plan and revise local laws governing runoff and the protection of surface waters.

33. Although some groundwater monitoring wells exist in the town, consideration should be given to expanding the network over time to more closely monitor groundwater contamination. An integrated network of groundwater monitoring wells would be helpful to determine the quality of water in the deep flow recharge area over time, evaluate trends in nitrogen concentrations associated with highly developed areas and coastal areas, better determine the impacts of road salting, and stormwater runoff, septics, wet businesses, landscapes, golf courses, and pesticides on freshwater aquifers.

34. Additionally, it has already been amply demonstrated that pesticide residues, solvents and petroleum chemicals are already present in the groundwater in many areas and in a few areas, the concentrations are elevated and a cause for concern. However, there is no current townwide program to evaluate the

concentrations of pesticides and herbicides emanating from agricultural fields, golf courses, and nurseries. An evaluation of potential risks to the drinking water of residents in the area of these sites should be performed and groundwater monitoring wells should be installed to determine if these sites are or are not impacting the drinking water of nearby residents. For areas of known contamination such as gas stations and landfills, groundwater monitoring should be on-going. Although the groundwater monitoring at town landfills is on-going, monitoring at other sites should be performed by the site owner with oversight from the New York State Department of Environmental Conservation. Finally, in water poor areas such as the Gerard Drive area, monitoring wells can be used to measure the thickness of the fresh water aquifer in this area and this well network can be used to determine the fluctuations in the water table so that it can be known if the aquifer in this area is or is not critically low so that water restrictions can be enforced before hand to prevent a crises situation from arising. Such a comprehensive on-going monitoring program is very much in need.

35. Recharge nodes with vegetated pass-through bottoms are the most important points for recharging water the to aquifer. They should be protected from disturbance throughout their extent, including the entire slope of their watershed.

36. Enact a comprehensive "Groundwater Protection and Conservation" local Town law to codify the recommendations herein.

37. Enforce to the limit of the law all of the provisions of the Town Code pursuant to the protection of groundwaters, watersheds and surface waters, both those presently existing and those to be enacted in the future. Work with regulators in the county, state and national government to see that all laws governing the protection of town groundwaters, watersheds and surface waters are applied to the fullest extent possible.

38. Constitute a townwide groundwater-watershed oversight committee to advise the Town Board, its appointed boards and its offices on groundwater and watershed matters. Such a committee should have official standing in the way that the Town Nature Preserve committee and Environmental Health committee have.

39. Reduce buildout density, especially in areas north of the groundwater divide and proximate to the Peconic Estuary by way of a continued program of acquisition, large lot easements, purchase or development rights and other measures.

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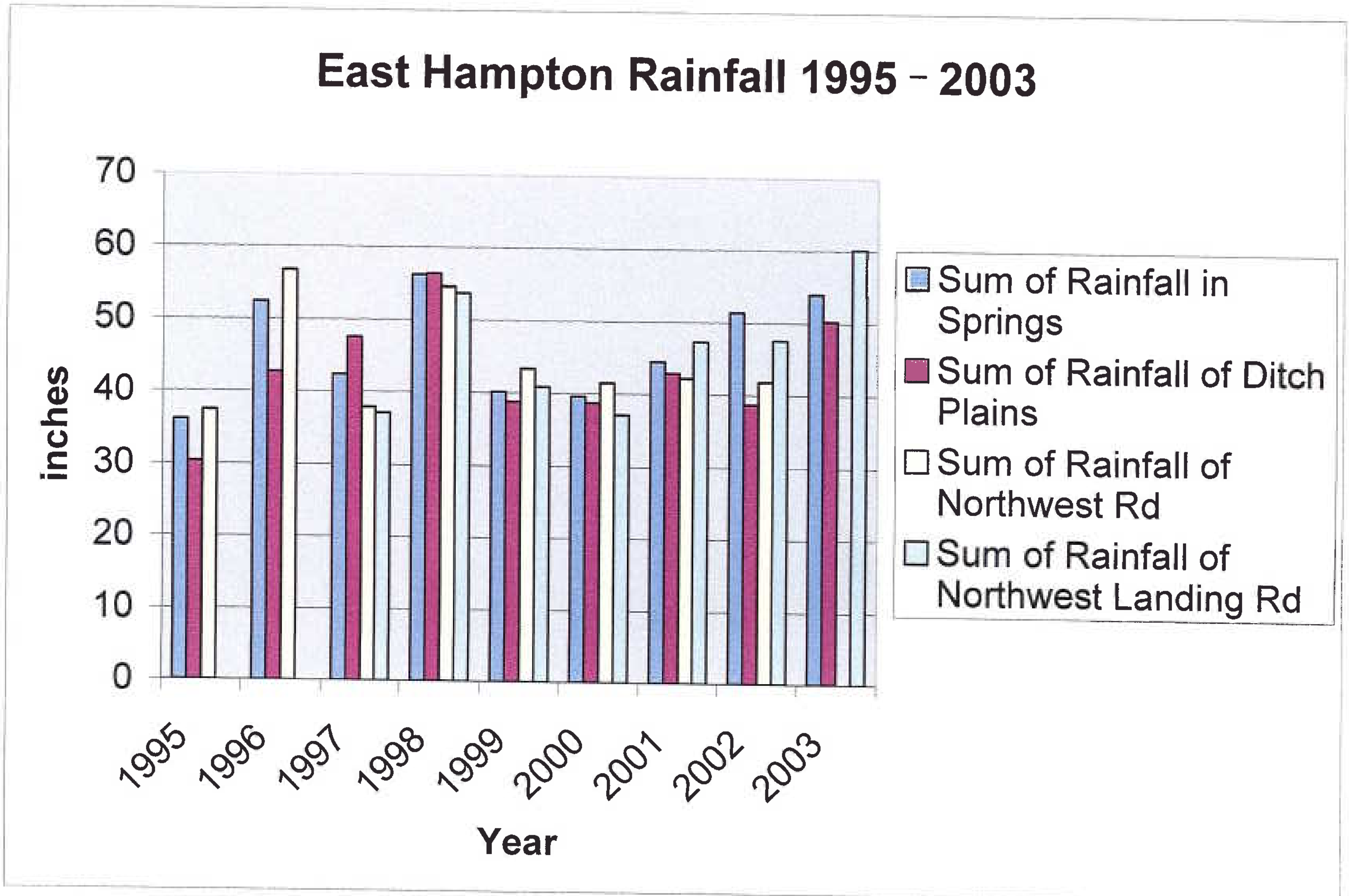


Figure A. Annual Rainfall in East Hampton Town at Four Stations

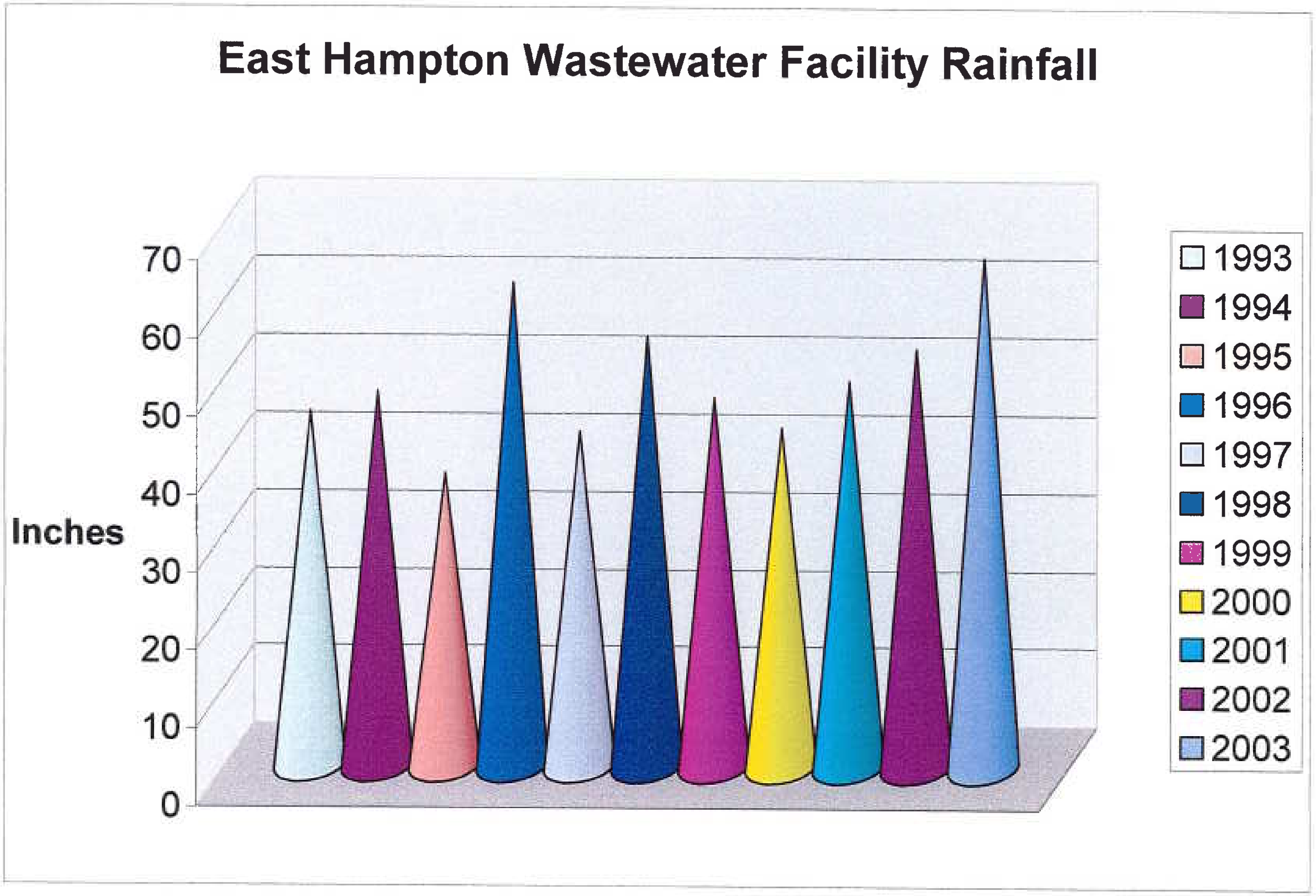


Figure B. Annual Rainfall at East Hampton Wastewater Facility

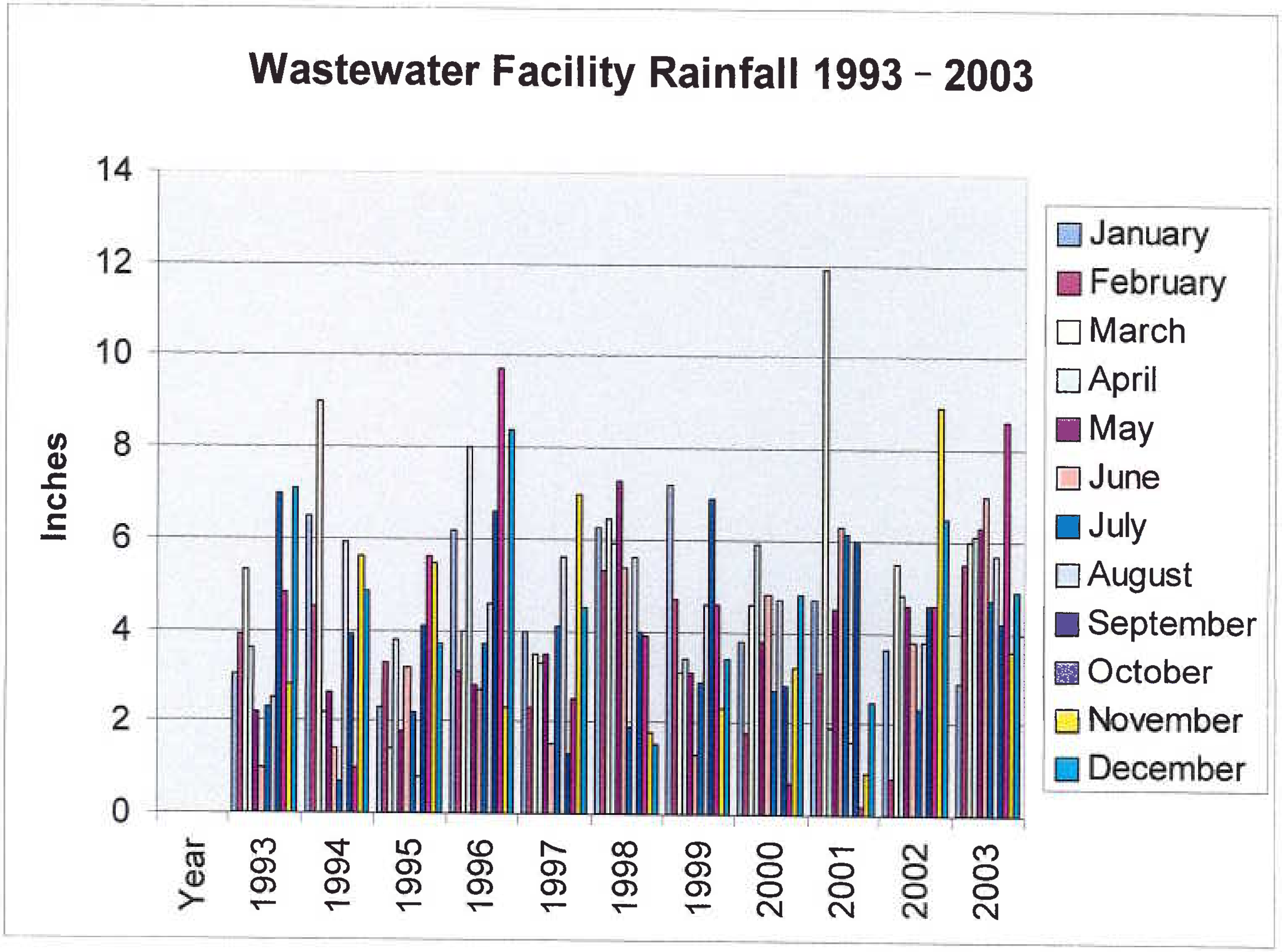


Figure C. Monthly Account of Annual Rainfall at East Hampton Wastewater Facility

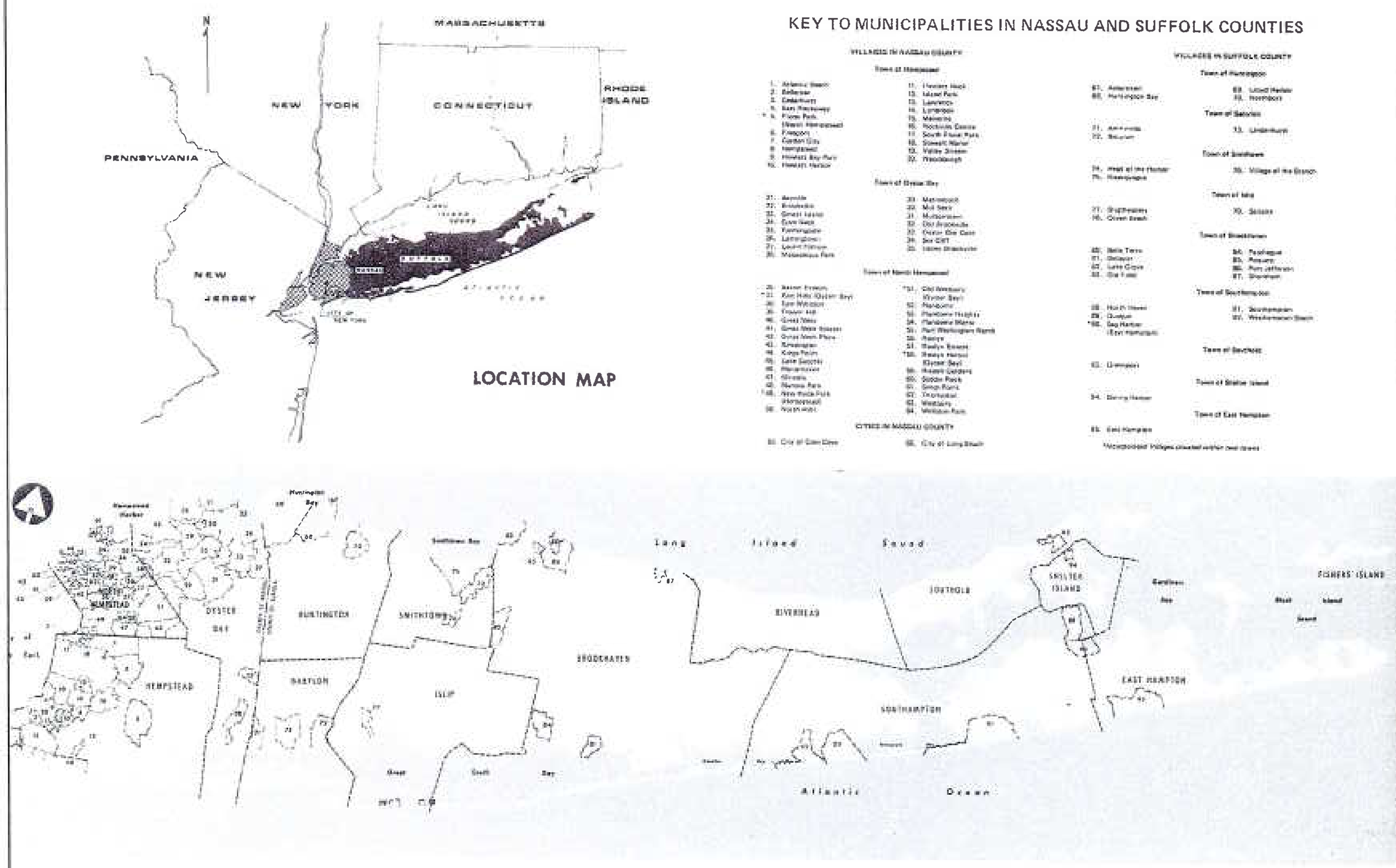
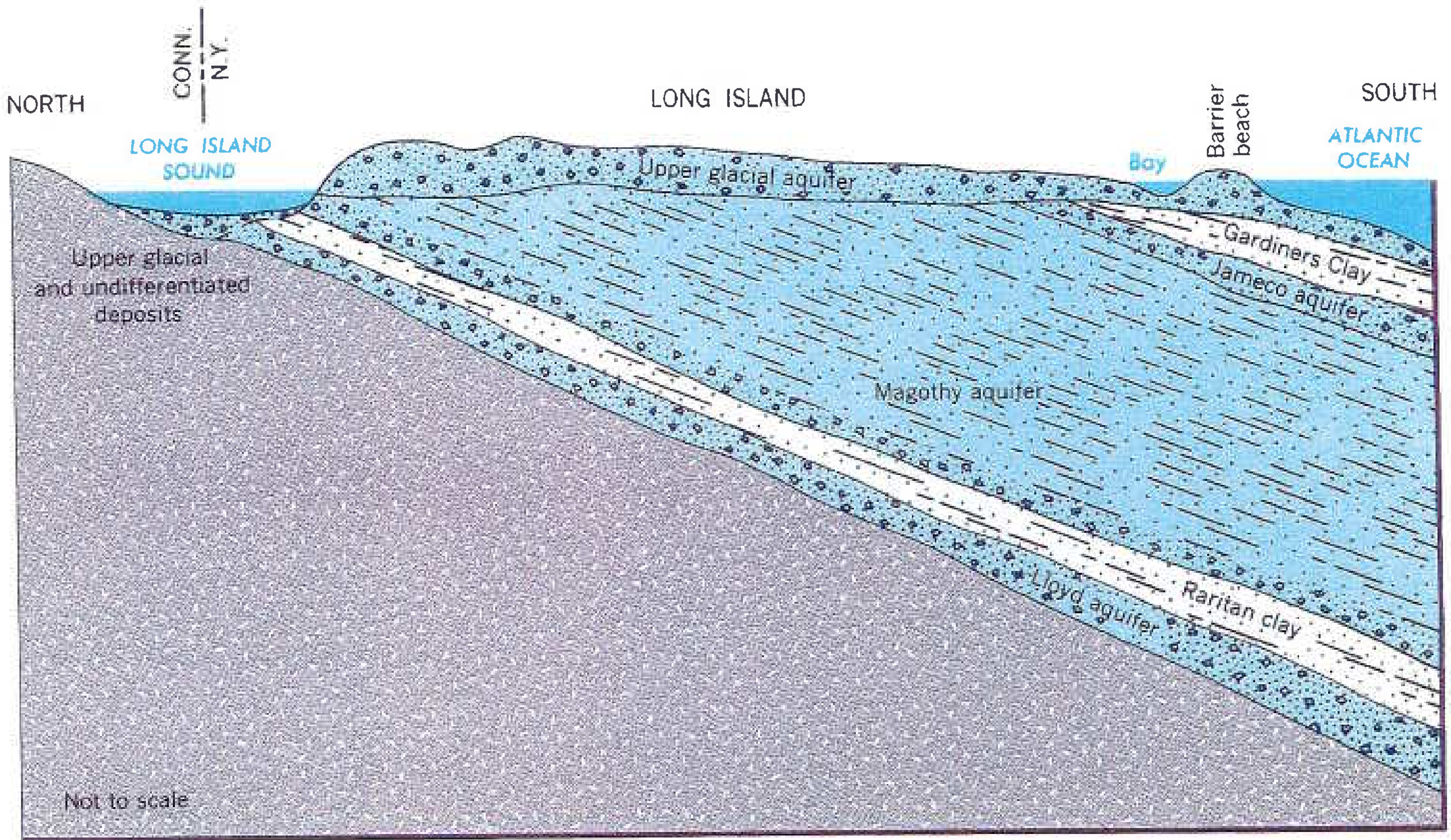


FIGURE 1–1 *Nassau and Suffolk Counties–Municipal Boundaries*

2

Source: LI 208 Study

Figure 1. Map of Long Island Towns



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EXPLANATION

Figure 2 . Geologic and Hydrogeologic units in the Town of East Hampton

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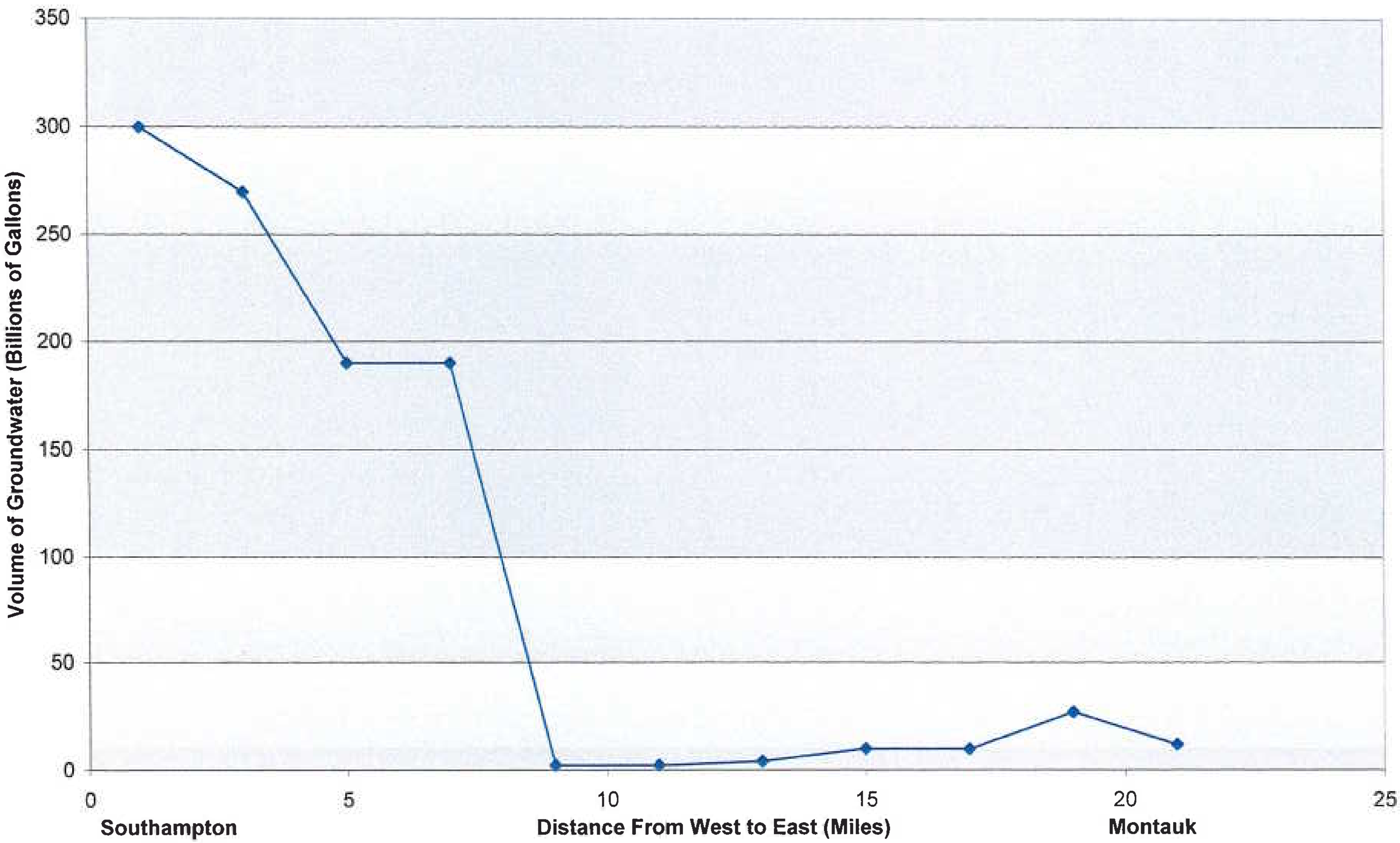

Figure 5A . Volume of Groundwater vs. Distance

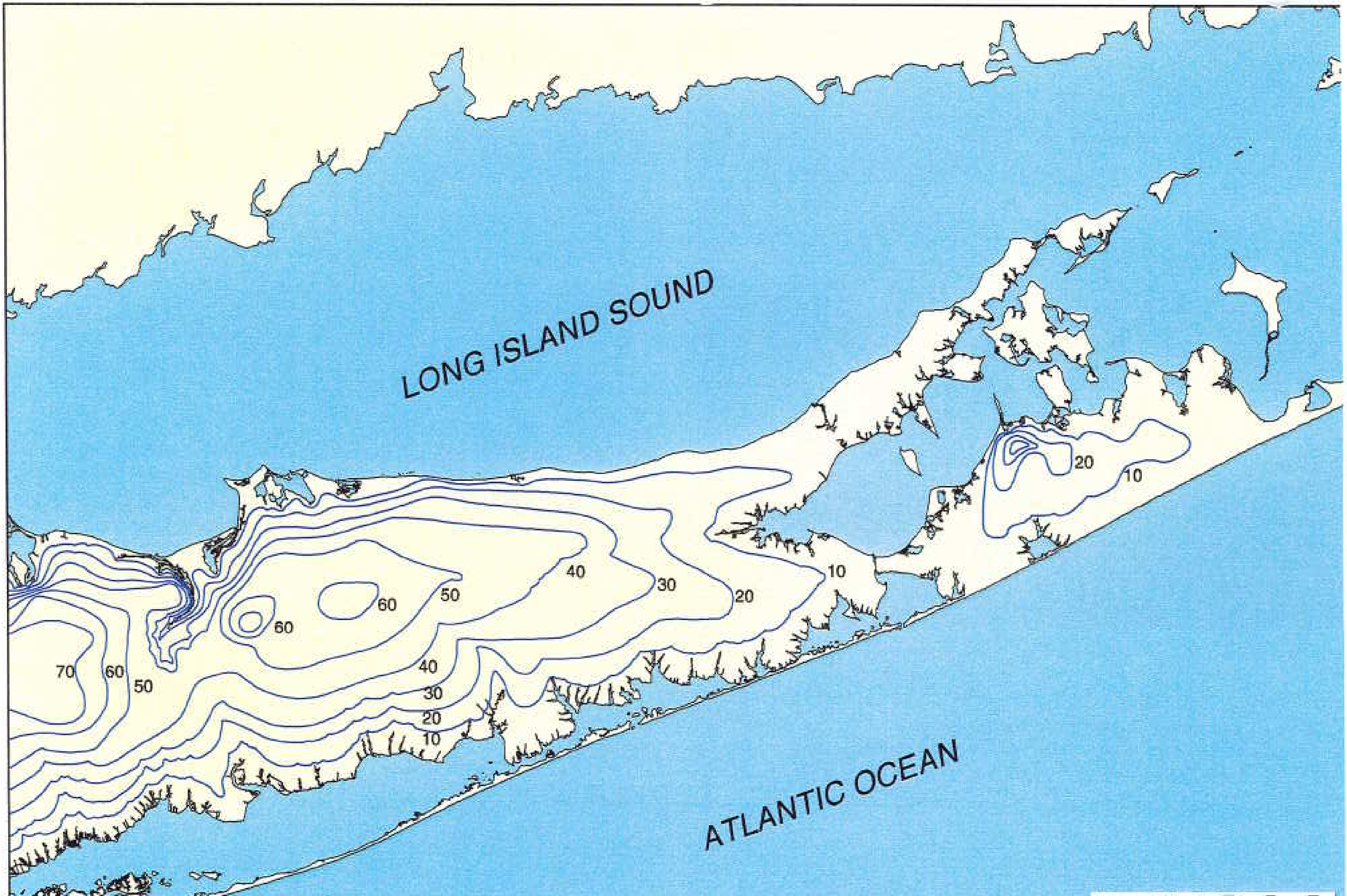

Figure 5. Groundwater elevation contours for the Town of East Hampton and Suffolk County

Source: USGS