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Chapter 5

NATURAL RESOURCES AND THE ENVIRONMENT

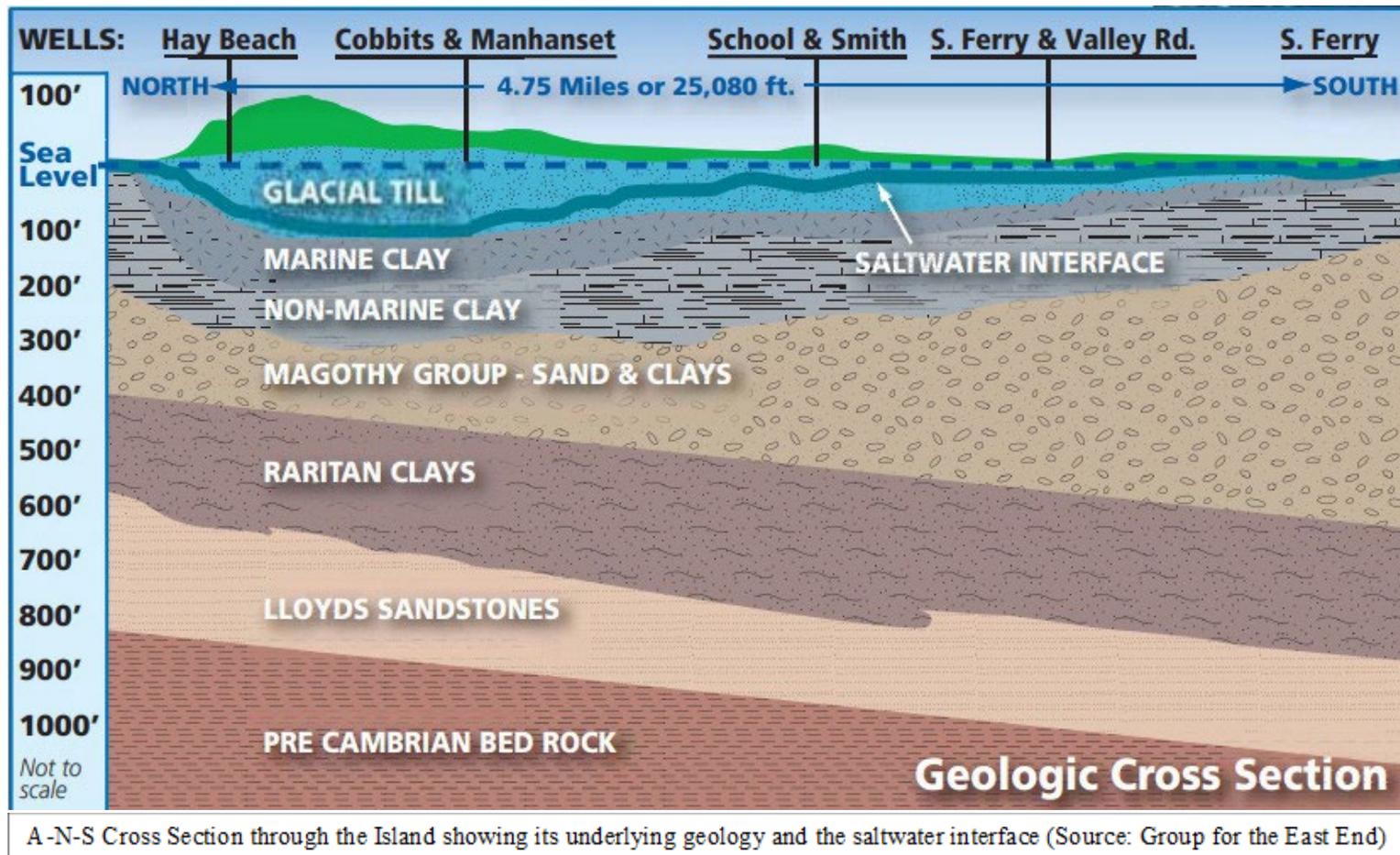
(02/17/2023 DRAFT) Version 1

GEOLOGY AND GEOGRAPHY OF SHELTER ISLAND

According to the Group for the East End, Shelter Island is composed of bedrock overlain with a sedimentary sand formation deposited at the end of the last ice age. Geologists have identified six geological units:

1. The deepest is crystalline bedrock found at an elevation 700 to 1000 feet below sea level (BSL) then on top of that;
2. Lloyds Sandstone, layers of coarse quartz sand, gravel, and sandy clay with isolated layers of clay dispersed throughout, lying 510 – 800 feet BSL.
3. Raritan Clay Layer - The overlying clay layer is encountered at an elevation of 400-625 feet BSL. It consists of gray clay to silty clay with some sandy layers.
4. Magothy formation – Found at elevation 300 feet BSL, with a thickness of 100-325 feet. It is comprised of fine to medium sand mixed with silt and clay and some beds of coarse sand and gravel.
5. Clay Layer overlying the Magothy – this is an overlying clay layer formed by two distinct units comprised of an upper unit of marine origin (60-100 feet BSL) and a lower unit of non-marine origin (160-180 feet BSL).
6. Upper Glacial – Surficial deposits at the land surface Mostly stratified and unstratified sand interspersed with clay and isolated beds of clay, all glacial till left as the glaciers retreated at the end of the ice age.

The soils that formed on top of this geological layer cake are composed entirely of the Montauk-Haven-Riverhead Association soils. These are characterized as deep, well-drained to moderately well-drained soils with a moderate texture. These supported agriculture on the island long before the first European settlement in the 17th Century.



Topography, Drainage and Hydrology

The hilly landscape shaped by the glaciers ranges from 180 feet above sea level on the bluffs in the northwestern part of the island to as much as 40 feet below sea level in isolated depressions found across the island. Water drains quickly into the gravelly soil, and there are few streams in the upland areas. The 2014 Watershed Management Plan identified 64 distinct sub watersheds on the island, ranging from less than 3 acres to over 240 acres in size.

The interior glaciation left a number of small kettlehole ponds. Water draining to these and other low areas on the interior of the island creates wetlands, including both open water and vegetated marsh and swamp, that are protected by state and federal law. The New York Department of Environmental Conservation has identified 70 freshwater wetlands totaling some 105 acres. There are likely other smaller seasonal wetland areas, and whether or not wetlands have been mapped previously, landowners must survey and protect wetlands on their property as part of most site improvements or construction projects.

The island is surrounded by marine surface waters: harbors, coves, sounds and bays, and there are several tidal creeks and estuarine marshes along the coastline. The Island's complex and dynamic coastline has a diverse collection of marine environments, ranging from wave-wracked rocky beaches at the base of bluffs to quiet inlets rich with plant and animal life. Continually shaped by tides, storms, and the movement of marine sediments, the beaches, mud flats and marshes shift and change over time.

Shelter Island & the Peconic Bay Environment

The Peconic Estuary was named an Estuary of National Significance by the US Environmental Protection Agency (EPA) in 1992. This inaugurated the Peconic Estuary Program (PEP), a coalition of local, state and federal agencies, governments, non-profit environmental groups, institutions and private citizens, supported by funding under the Federal Clean Water Act. Now known as the Peconic Estuary Partnership, the initiative prepared a new Comprehensive Conservation and Management Plan (CCMP) in 2020 and works to maintain and improve the health of the estuary (<https://www.peconicestuary.org/>).



The subject of all this attention is an estuary comprised of more than 158,000 acres of water formed into more than 100 distinct bays, harbors, coves, marshes, and tributaries. Draining into this rich marine environment is a watershed of some 125,000 acres of land, with a year-round population of 100,000 people; at the heart of all these lays Shelter Island.

The Peconic Estuary Partnership has identified threats to the ecosystem that start with the direct impacts of human activities such as dredging of navigational channels, hardening of shorelines with bulkheads and other structures to control erosion, and clearing of upland forests to build new roads, homes, and businesses. Specifically, ongoing changes in the environment that threaten the habitats of the estuary include:

- Development and land management activities that reduce, fragment, and degrade natural areas.
- Damming of streams flowing into the estuary that prevent the movement of diadromous fish from salt to freshwater.
- Invasive species of plant and animals, that outcompete native species and change the ecology of the estuary.
- The combination of rising seas and lack of sediment, which threaten to drown tidal wetlands and mudflats, especially if they cannot migrate inland because of topography or man-made barriers.
- Nitrogen pollution, increased water temperature, and human disturbance that contribute to the loss of eelgrass beds and decline of scallops and other shellfish.

The health and productivity of Shelter Island's shoreline and marine waters cannot be separated from that of the surrounding Peconic Bay. A series of harmful algae blooms in the 1980s and 1990s were part of the reason for creating the Peconic Estuary Partnership in the first place, and ongoing challenges to Shelter Island waters have already played out elsewhere. Perhaps most significant is the decline of eelgrass beds and tidal wetlands. Of more than 8,700 acres of eelgrass beds that thrived in 1930, fewer than 1,000 acres remain - much of it along the East side of Shelter Island. In addition to the algae blooms, nutrient enrichment and physical disturbance by boating and fishing practices, the major culprit may be warming water due to climate change.

Tidal wetlands have also declined in the estuary, losing about ten percent of their extent between 1974 and 2005 - with the greatest losses in East Hampton and Shelter Island, according the 2020 CCMP. This includes the drowning of some 25 percent of high marsh habitat during the same period. There are likely several forces at work, including sea level rise that seems to be outstripping the annual accumulation of sediments and organic matter, as well as the inability of many marshes to migrate inland due to shoreline hardening. What this means for Shelter Island is the loss of the extraordinary productivity of these ecosystems and the services they provide, including sediment retention, recycling of organic matter, and buffering of storm surge as well as irreplaceable feeding, breeding and nursery habitats for invertebrates, fish, and birds. Lost with them are the traditions of fishing and scalloping that long supported Shelter Island's baymen.

Shelter Island's Most Important Ecological Resources

The Island's diverse landscape supports a rich cross section of plant and animal communities, which is particularly vibrant in undisturbed areas such as the Mashomack Preserve, owned by the Nature Conservancy. The New York Natural Heritage Program has identified numerous rare species within four habitat types, as listed in the table below. The New York State Department of State has designated three Significant Coastal Fish & Wildlife Habitats on the island, including:

- Shell Beach, which has nesting sites for Least Tern and Piping Plover
- Shelter Island Eastern Shallows, which has eelgrass beds of state importance and supports bay scallops as well as populations of Atlantic Ridley and Loggerhead turtles.
- Mashomack Preserve, an undeveloped marine coastal ecosystem that is rare in New York State

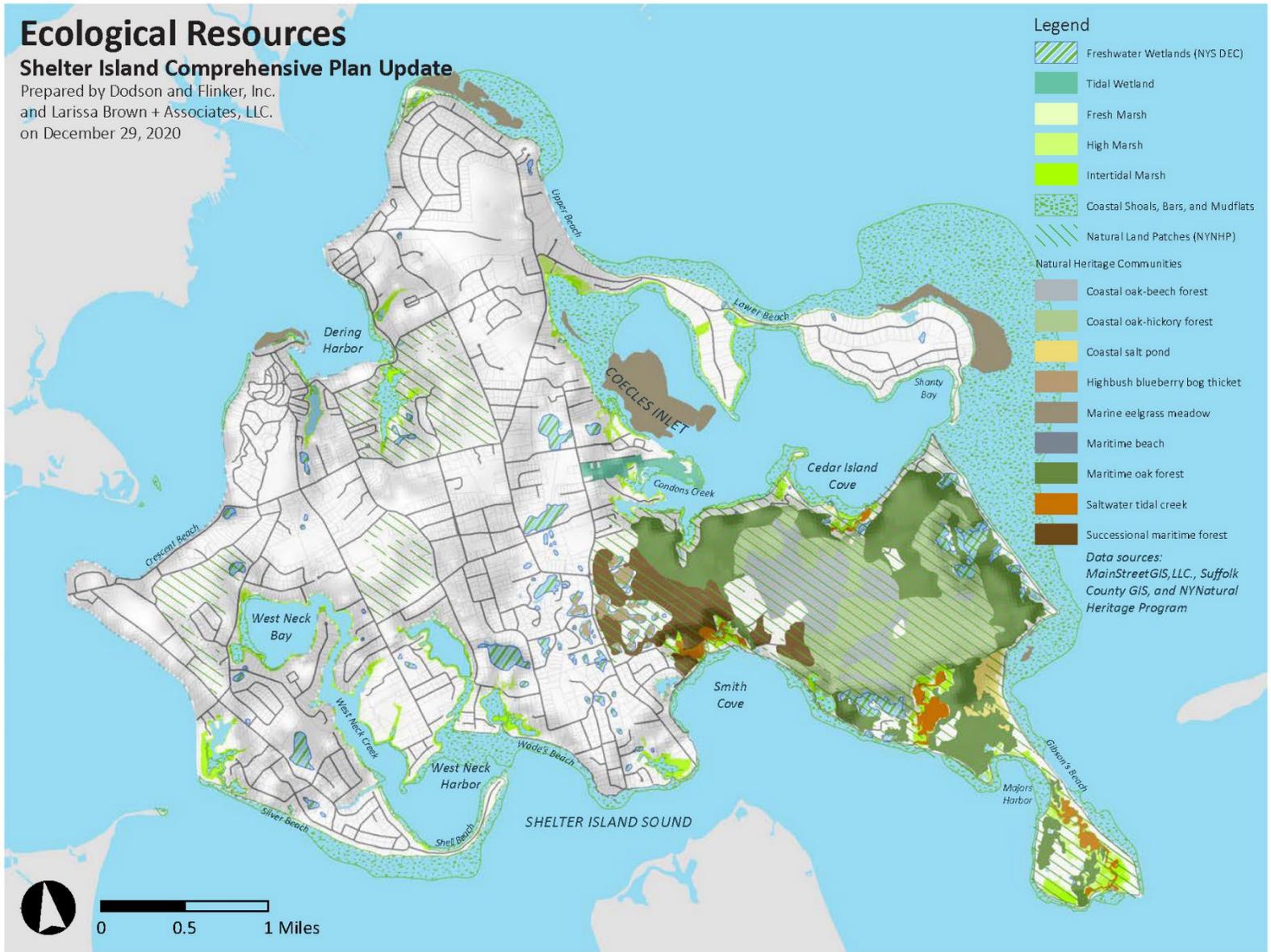
Finally, the NY Natural Heritage Program has identified nine Significant Natural Communities, all of which are associated with the Mashomack Preserve and nearby areas. Each of these, ranging from upland forests to tidal beaches and creeks, is significant due to its quality, age, or rarity within New York State. They include:

- Coastal Oak-Beech and Oak-Hickory Forest, covering 665 acres on a moraine landscape on the interior of the peninsula, unique for its size.
- Coastal Salt Ponds, including Cedar Cove Pond and Plum Pond, surrounded by undisturbed forest.
- Highbush Blueberry Bog, formed in old kettle hole ponds and other lowland areas within the Preserve.
- Marine Eelgrass Meadow, a critically important habitat type and shrinking resource within the Peconic Estuary.
- Maritime Beach, including 11.4 miles of gravel and sand formed between mean high water and eroding dunes and bluffs.
- Maritime Post Oak Forest, creating special habitat along the edge of creeks and marshes.
- Saltwater Tidal Creeks, including Fan Creek, Miss Annie's Creek, and Bass Creek, including low and high marsh habitats lined with oak forest.

The Mashomack preserve is particularly important because these habitats are found together in one large area of undisturbed open space, but other large, forested areas elsewhere on the island have been identified as potentially important by the State of New York. These "Natural Land Patches" include Sylvester Manor and adjacent forested areas along Gardiner's Creek; undeveloped land between North Menantic and Midway Road; and a large patch of forest on West Neck.

Rare Species Identified on Shelter Island by the New York State Natural Heritage Program

| Habitat Type | | NYS Legal Status (Endangered, Threatened, Rare, Special Concern) | Year Last Documented |
|----------------------------------------------|------------------------------------------|------------------------------------------------------------------------|----------------------|
| TIDAL RIVER | | -- | -- |
| Species Common Name | Species Scientific Name | -- | -- |
| Inland Silverside | <i>Menidia beryllina</i> | Unlisted | 1980 |
| Atlantic Silverside | <i>Menidia menidia</i> | Unlisted | 1980 |
| SUCCESSIONAL FIELD/GRASSLAND/CLEARING | | -- | -- |
| Species Common Name | Species Scientific Name | -- | -- |
| White Milkweed | <i>Asclepias variegata</i> | Endangered | 2010 |
| Little-leaf Tick-trefoil | <i>Desmodium ciliare</i> | Threatened | 1923 |
| Oakes' Evening-primrose | <i>Oenothera oakesiana</i> | Threatened | 1996 |
| Whip Nutrush | <i>Scleria triglomerata</i> | Threatened | 1996 |
| TIDAL WETLANDS/SALT MARSH | | -- | -- |
| Species Common Name | Species Scientific Name | -- | -- |
| Marsh Fimbry | <i>Fimbristylis castanea</i> | Threatened | 1996 |
| Rambur's Forktail | <i>Ischnura ramburii</i> | Unlisted | 1994 |
| Seaside Plantain | <i>Plantago maritima var. juncooides</i> | Threatened | 2010 |
| Seabeach Knotweed | <i>Polygonum glaucum</i> | Rare | 2005 |
| Dwarf Glasswort | <i>Salicornia bigelovii</i> | Threatened | 2010 |
| PINE BARRENS | | -- | -- |
| Species Common Name | Species Scientific Name | -- | -- |
| New Jersey Pine Barrens Tiger Beetle | <i>Cicindela patruela consentanea</i> | Unlisted | 1946 |



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Draft: 2/22/21

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Island's Ecology Changes Over Time

In addition to Mashomack and other areas with statewide ecological significance, Shelter Island is blessed with hundreds of acres of undeveloped land that support a more ordinary population of plants and animals. Ranging from household lawns and gardens to small patches of forest surrounded by house lots, to golf courses and farmland, these everyday landscapes support a community of plants and animals that have adapted to human disturbance and thrive in the diverse suburban landscape. In addition to the ubiquitous deer, there are rabbits, squirrels, chipmunks, mice, raccoons, opossums, woodchucks, and predators such as foxes. Also benefiting from

the diverse “edge landscape” common on the island are the typical backyard and edge-dwelling birds and a large number of turkeys. Some other once-common species, such as bobwhite quail, spadefoot/fowlers toads, muskrat, otters, and mink have declined with the reduction of grasslands and marshes that support them.

Centuries of land use change have permanently altered Shelter Island’s ecology, capped by the suburban-style development that has transformed much of the island since the 1950s. With relatively few predators and a decline in hunting, the common animal species have prospered on the Island, and can become pests under the wrong circumstances (at least from the affected homeowner’s perspective). Deer are probably the most problematic - damaging gardens, darting out in front of cars, and of course, serving as a vector for deer ticks and tick-borne diseases such as Lyme.

Control of the Deer Population

The Town of Shelter Island created a Deer and Tick Committee in 2005, which for some time pursued a three-pronged strategy of deer management through hunting, reduction of ticks through application of chemical acaricide at “4-poster” deer feeding stations, and public education. In 2016 the deer population was estimated to be more than 100 per square mile, a level too high to avoid continued negative impacts on native vegetation and human health and safety. The Committee’s goal, as stated in their 2019 Deer Management Plan, is to reduce the density of the deer population to less than 50 per square mile by 2022. Early in 2020, the NY Department of Environmental Conservation put new regulations in place that require that all homeowners within 745 feet of a “4-poster” station grant permission to use them. This resulted in the Town ending the program on Shelter Island in March, 2020.

Hunting has been the most successful method of reducing the deer population. The Shelter Island Police Department oversees hunting on Town-managed properties, working with neighbors to reduce problems and issuing permits to licensed hunters for three different seasons: recreational archery from October through January, recreational shotgun from January 6-31, and culling, from February 1 to March 31. Culling hunts are also pursued at Mashomack and Sylvester Manor during January. The hunting programs have resulted in the deer herd being culled by approximately 550 animals in both 2018 and 2019.

Ecological Impacts of Exotic and Invasive Plant Species

In addition to changing island fauna, land use change has brought with it a host of exotic and invasive plant species. This includes trees like Bradford Pear, Norway Maple and Mulberry, vines such as Asiatic Bittersweet, Wisteria and Mile-a-Minute, and shrubs like Autumn Olive, Japanese Barberry, Japanese Knotweed and Multiflora Rose. A long list of perennials, grasses and water plants threaten gardens, forest, and wetland habitats. Some of these were imported for use in landscaping or erosion control, while others have arrived by hurricane or accident. Collectively, they out-compete and sometimes literally choke out native species and the insects and birds that rely on them. Tim Purtell, Chair of the Green Options Committee and the Friends of Trees Organization, wrote in the Shelter Island Reporter on 7/13/2019: On Long Island, imports such as Asiatic bittersweet, multiflora rose, and Russian olive have caused havoc by overwhelming indigenous species. And while going native is a welcome trend, the black locust presents an example of a plant that can be as destructive as any introduced invasive.

Volunteers have for many years worked to clear invasives on town-owned properties and Mashomack Preserve, and Sylvester Manor staff pursue invasives control on their properties. The Town's Conservation Advisory Committee (CAC) maintains a list of recommended and prohibited plant species. While the CAC has no direct authority, they provide advice and technical support to the Town Board and meet regularly to review site planning and development proposals that involve changes to the Islands fresh and salt-water wetlands, aquifers, woodlands, and other open lands.

SHELTER ISLAND'S DRINKING WATER

The information in this section is a summary from the 2020 Ground and Surface Water Management Plan prepared by the Town of Shelter Island Water Advisory Committee (It can be found in its entirety at the end of this chapter for a more in depth look at the Island's aquifer and surface waters) and the Suffolk County Comprehensive Water Resources Management Plan (2015) and Suffolk County Subwatersheds Wastewater Management Plan (SWP)(2020), the guiding documents for water resource management in Suffolk County.

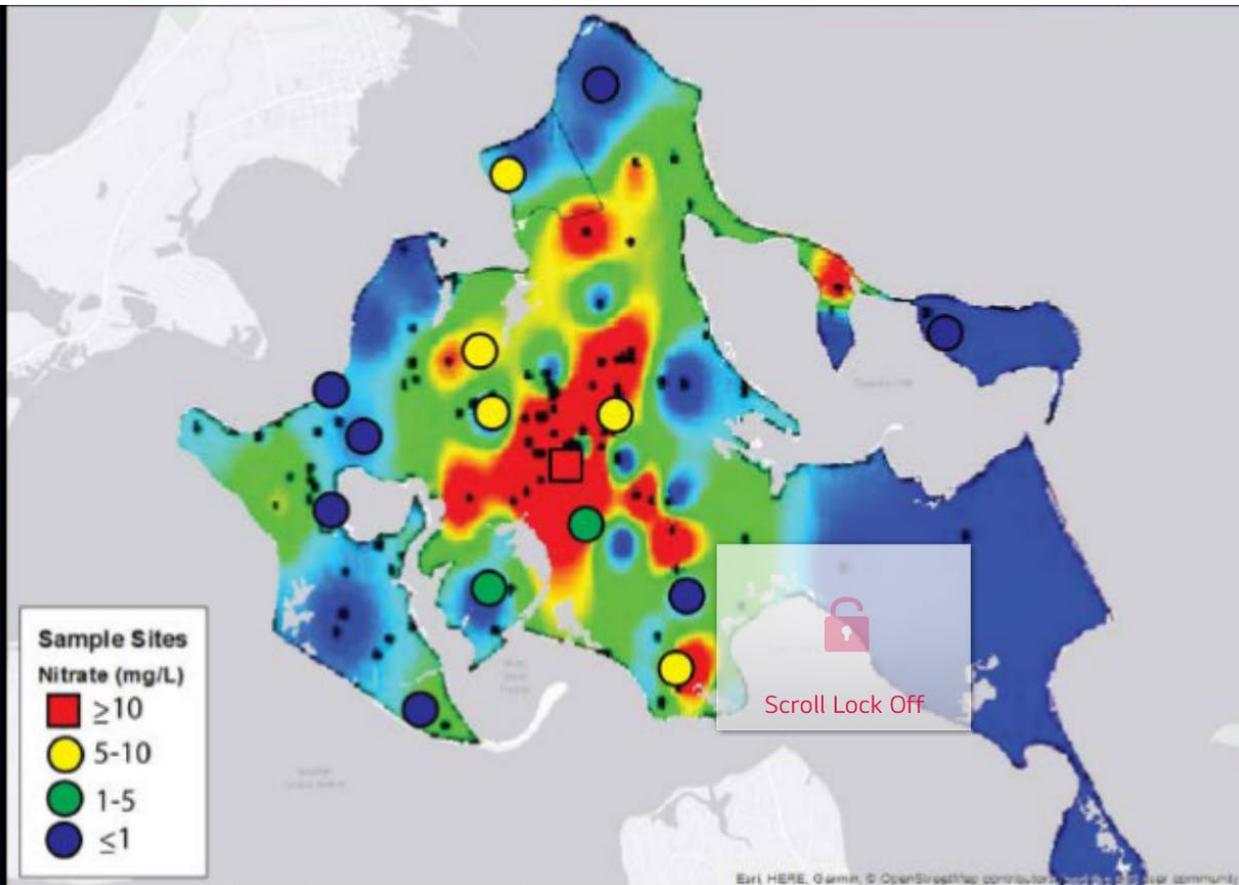
Shelter Island's groundwater resource consists of a single aquifer, isolated from groundwater aquifers on the mainland of Long Island's north and south forks. Unlike the hydrogeology of central and eastern Long Island where there are typically three relatively distinct aquifers – Upper Glacial, Magothy, and Lloyd - on Shelter Island only the Upper Glacial aquifer is potable. There is no potable water supplied to Shelter Island through pipelines from either the north or south fork, though some water is trucked in to fill cisterns in compliance with Town laws. There are three shared water supply systems on Shelter Island (Dering Harbor, Shelter Island Heights and West Neck Water Supply), but together they supply only 10% of the potable water need. The SWP notes that there are even smaller community supply wells on shelter Island than the 3 listed, but that they were not included in their study because they are too small and have minimal excess capacity. Those smaller community water supplies are each privately owned and only serve 1 individual parcel. The remaining 90% is supplied by private groundwater wells, (Approximately 2,366 private wells according to the SWP Table 3-6). All of the wells on the island together draw an estimated 260 million gallons each year, of which 95% is returned to the aquifer via onsite septic systems. Recharge through rain and snowfall is estimated to provide an additional 4.4 billion gallons to the aquifer; water not absorbed into the aquifer flows into surface water bodies or into surrounding salt-water bodies. While this suggests an abundance of fresh water, not all areas of the island are equally blessed. There are thinner aquifers in the peninsular areas like Montclair Colony and the Ram Islands. In addition, there is a seasonal pattern of aquifer drawdown during the summer months accompanied by 90% of the recharge happening between October and March.

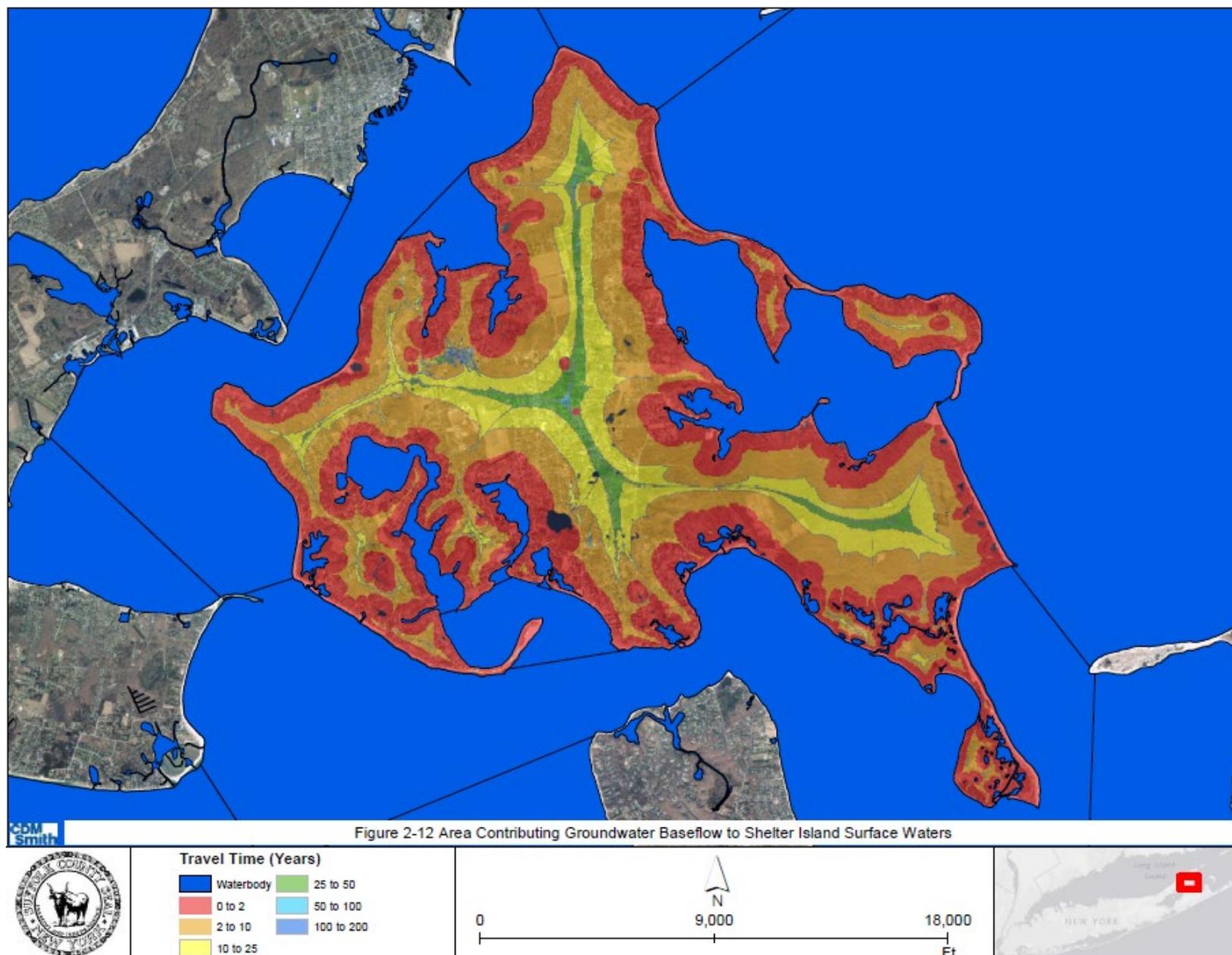
Of equal concern to the **quantity** of water is the **quality** of water drawn from the aquifer. Testing has shown that water quality has deteriorated as a result of wastewater discharge from residential treatment systems, fertilizer, herbicide, fungicide and pesticide applications, and other contaminants from various sources. Nitrate levels have been slowly but steadily increasing in the islands ground and surface waters and in some

areas are exceeding the state and federal Maximum Contaminant Level (MCL) of 10 mg/L. Recent studies suggest that drinking water below 10 mg/L *may not be as safe as widely perceived*. The 10mg/L standard set by the EPA was originally designed to protect infants from methemoglobinemia, or “Blue Baby Syndrome”, a condition that is caused by the conversion of hemoglobin to methemoglobin (which cannot carry oxygen) by consumption of nitrates in drinking water. The MCL was set to protect against infant methemoglobinemia, however other health effects including cancer and adverse reproductive outcomes were not considered. While many studies have linked nitrates in drinking water *above* the MCL to cancer in humans, and others have been inconclusive, several studies have found a link between prolonged exposure to nitrates in drinking water *below* the MCL and cancer in adults. A 2010 study found a 260% increase in the risk of thyroid cancer in post-menopausal women consuming water with nitrates above 5mg/L vs under 5mg/L. This same study identified a 160% increase in the risk of bladder cancer when consuming water above 5mg/L for four years. A link to colorectal cancer was reported in a 2018 study. More on these studies and their references can be found in the Ground and Surface Water Management Plan at the end of this document. According to the SWP nearly all of the precipitation that recharges Shelter Island will discharge to a coastal water body within 50 years, with most of the groundwater baseflow discharging in less than 25 years. This indicates that a reduction in the nitrogen introduced in this area will result in reduced nitrogen loading to Shelter Island surface waters relatively quickly, compared to areas in western Suffolk County where it may take decades to realize the benefit. Meaning that Shelter Island has the potential to stop and reverse the trend of increasing nitrogen in our aquifer relatively quickly if we make a concerted effort to upgrade antiquated septic systems.

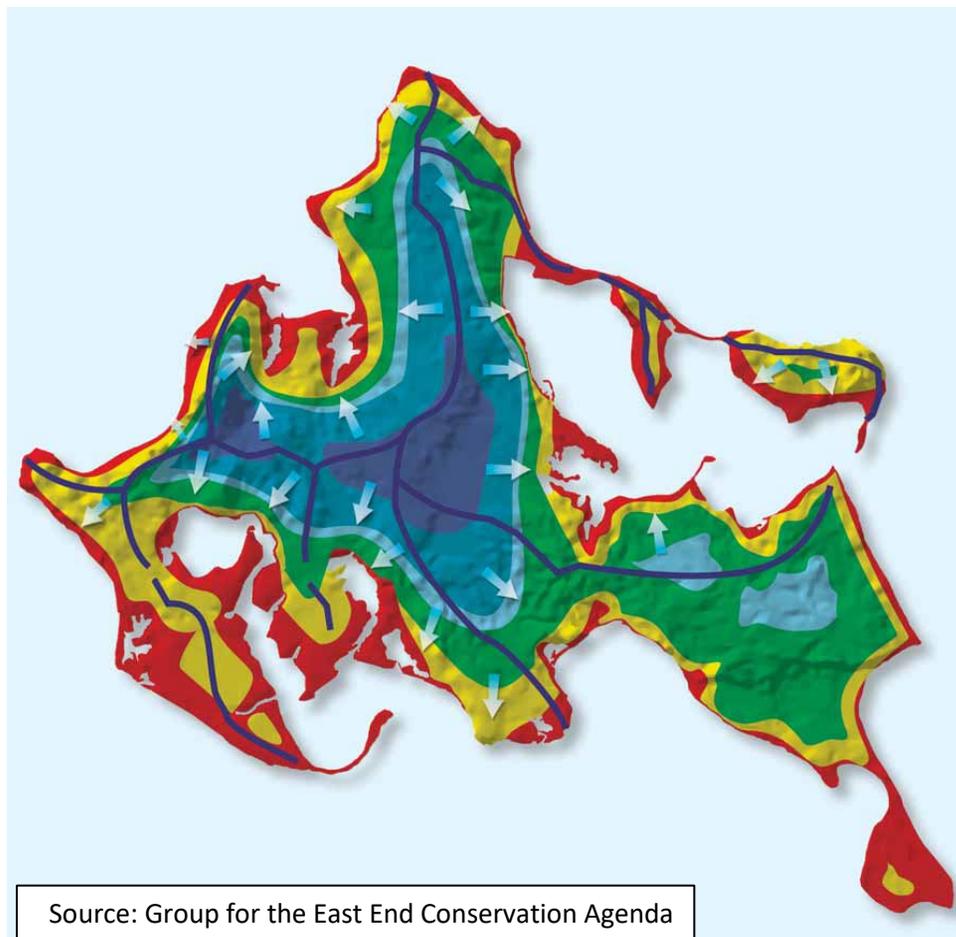
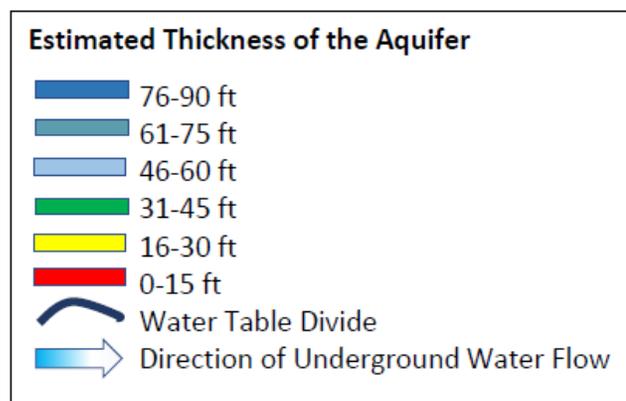
Recent nitrate concentrations plotted with NP&V nitrate model

Nitrate model data is from SCDHS, late 2000's





Recent groundwater monitoring has also detected volatile organic compounds, PFAS, PFOS, pesticides and pharmaceuticals in the Island's groundwater. Finally, saltwater intrusion is a significant threat, particularly in the peninsular areas on the south side of the Island. This will likely worsen with rising sea levels.



Protecting the island’s water supply and ensuring continued clean water for every home and business has been a focus of planning on the island going back to the 1994 comprehensive plan, which recommended better management of contamination sources and downzoning to reduce the density of development in sensitive areas. In 2005 the town commissioned a Water Supply Alternative Study, which took a comprehensive look at existing conditions, explored future growth scenarios, and estimated the costs and benefits of establishing an island wide water system. The study estimated a total cost of between \$25 million and \$38 million, and a capital cost per household of somewhere between \$8,500 and \$16,000 depending on the number of homes connected to the system. The SWP looked at the history of Shelter Island and drew the conclusion that because we lacked significant water infrastructure already that they made the assumption that the majority of the Island would remain on private wells. The 2020 One Island-One Water, Ground and Surface Water Management Plan took a fresh look at the subject and offered four goals or “key outcomes” to guide continued planning and implementation actions:

- Key Outcome 1: All Shelter Island residents have ready access to drinking water that meets all applicable local, state, and federal standards.

- Key Outcome 2: All wastewater effluent on Shelter Island discharged into the aquifer will be at a maximum of 19 mg/L in accordance with the new nitrogen-reducing septic system (I/A OWTS) standards set forth by Suffolk County.
- Key Outcome 3: As Shelter Island’s sole groundwater aquifer, the Upper Glacial Aquifers quality and quantity will continue to support the drinking water needs of residents without the need for “off-island” water.
- Key Outcome 4: Surface waters surrounding Shelter Island will not be negatively impacted by human activity on Shelter Island.

Suffolk County Comprehensive Water Resources Management Plan

In 2015 Suffolk County completed their Comprehensive Water Resources Management Plan, a 1040-page document analyzing the water quality, quantity, availability, and challenges faced by all of Suffolk County. The Water Resources Management Plan set goals in 4 significant categories: groundwater resource management, drinking water supply, surface water resource management, and wastewater management. The goals set by Suffolk County are as follows:

Groundwater resource management goals:

GOAL 1: All groundwater shall be in compliance with the stricter of New York State Ambient Groundwater standards and guidance values or Maximum Contaminant Level Goals (MCLGs) to the greatest extent feasible and practical. Water quality that is better than the existing standards should be preserved, to the greatest extent feasible and practical.

GOAL 2: Nitrogen loading should be reduced to the greatest extent feasible and practical for the protection of current and future drinking water supplies and to restore/maintain ecological functions of streams, lakes, estuaries and marine waters. Arrest and reverse the trend of increasing nitrogen concentrations in ground and surface waters to the greatest extent feasible and practical by decreasing the nitrogen loading from septic systems and fertilizers.

GOAL 3: Concentrations of other regulated and unregulated contaminants in groundwater should be minimized to the greatest extent feasible and practical, to protect current and future drinking water supplies and to restore/maintain ecological functions of streams, lakes, estuaries and marine waters. Reduce the discharge of volatile organic compounds and other regulated and unregulated contaminants to groundwater.

GOAL 4: Land use patterns should be consistent with the protection of the County’s groundwater and surface water resources, including the protection of existing and future drinking water supplies.

GOAL 5: Groundwater quality and quantity should be maintained to protect and preserve the County’s drinking water supply and natural resources.

GOAL 6: Groundwater levels should be maintained to protect and preserve the long-term sustainability and ecological functions of existing surface water resources.

GOAL 7: Existing programs to monitor, prevent contamination of, and manage Suffolk County groundwater resources should be enhanced and improved to provide the data and programs necessary to protect the groundwater resource that provides the County's drinking water supplies, and to provide the information necessary to develop a long-term approach to mitigate expected impacts of sea level rise upon existing infrastructure.

Drinking Water Supply Goals:

GOAL 1: All County residents should have access to safe potable water that is in compliance with drinking water MCLs, USEPA health advisories and New York State guidance levels.

GOAL 2: A community public water supply should be available to all Suffolk County residents.

GOAL 3: Residential and commercial irrigation should be managed to reduce peak demands on water supply infrastructure.

Surface Water Resource Management Goals:

GOAL 1: Surface water quality should be in compliance with New York State ambient water quality standards and guidance values for surface waters, and support human health, aquatic life and recreational and aesthetic values in accordance with their best usage classifications

GOAL 2: Groundwater nitrogen inputs to the County's surface waters should be reduced, consistent with the goals of the Long Island Sound Study (LISS), Peconic Estuary Program (PEP) and the South Shore Estuary Reserve (SSER) programs – to protect, preserve and restore the estuaries for long term sustainability of the resource.

GOAL 3: Ground and surface water nitrogen management plans and water quality management plans should be integrated to minimize the impacts of VOCs, pesticides, pathogens and inorganics on human health and the ecology of Suffolk County's wetlands and aquatic ecosystems.

GOAL 4: Harmful algal blooms resulting from water quality impairments from groundwater and storm water discharges should be identified and prevented, and monitored and managed to minimize impacts.

GOAL 5: Existing programs to monitor, prevent contamination of, and manage the County's surface water resources should continue to be strengthened to provide the information necessary to protect, preserve and restore the County's surface water features for long term sustainability.

Wastewater Management Goals:

GOAL 1: Improve groundwater quality to maintain a potable water supply to serve existing and future populations by reducing effluent nitrogen loads from existing and future onsite sewage disposal systems and sewage treatment plants.

GOAL 2: Improve surface water quality to increase coastal resiliency and rehabilitate and maintain a vibrant coastal ecosystem by improving dissolved oxygen levels, reducing harmful algal blooms, and controlling nutrient levels through the reduction of effluent wastewater nitrogen loads from existing and future onsite sewage disposal systems and sewage treatment plants.

GOAL 3: Reduce and/or eliminate the impacts of pharmaceuticals and personal care products from wastewater effluent for increased public health and marine life protection.

GOAL 4: Provide development opportunities for continued economic growth to support future population growth while limiting wastewater nitrogen discharge.

GOAL 5: Improve operations and maintenance of onsite sewage disposal systems and sewage treatment plants to maintain compliance with effluent nitrogen limit and achieve more stringent goals where feasible and appropriate to protect ground/surface waters.

GOAL 6: Provide funding sources to the residents of Suffolk County to permit affordable upgrades to existing onsite sewage disposal systems or connection to community sewers.

GOAL 7: Promote the reuse of effluent wastewater for irrigation and grey water uses to preserve the volume of potable groundwater water supply to serve anticipated future population growth.

The Suffolk County Subwatersheds Wastewater Plan (SWP) (July 2020) was developed in response to the Comprehensive Water Resources Management Plan as part of the Reclaim Our Water initiative. According to the SWP “Implementation of the recommendations of the Plan will support the arrest and reversal of the nutrient-related ecosystem degradation observed in Suffolk County which is primarily attributable to nitrogen over enrichment, with wastewater as the dominant nitrogen source. A reduction in nitrogen loading will establish the conditions necessary to support restored ecosystems, increased biodiversity and provide numerous economic benefits and protection of human health.” Wastewater management options and recommendations explored in the SWP include connection of parcels to community sewers by expanding existing sewer districts or creating new sewer districts where possible, upgrading cesspools or conventional onsite sewage disposal systems to I/A OWTS, and requiring nitrogen reducing technology on all new construction countywide. Based on the data collected the SWP notes that “There is little agriculture on Shelter Island, so groundwater nitrogen issues are due to onsite wastewater systems. Implementing I/A OWTS is the most viable alternative for water quality improvement to groundwater and private wells on Shelter Island (pg. 341). Suffolk County concluded that the success or failure of implementing many of these action items will be contingent upon securing necessary funding and cooperation from key stakeholders. This will be true for any efforts made by the Town of Shelter Island as well. Any success in

achieving cleaner drinking and surface waters will be the result of a cooperative effort of the Town, County, State and most importantly its local citizens and communities.

CLIMATE CHANGE AND SEA LEVEL RISE

New York State has prepared projections by region of climate change and sea level rise in three different scenarios (low, medium, high) for use in community resilience planning. In Region 4, which includes Shelter Island along with the rest of Long Island and New York City, the middle range climate change scenario suggests an increase in temperature average annual temperature of 4.1 to 5.7 degrees Fahrenheit by 2050. This has important implications for Shelter Island. In the ‘Middle Range’ scenario, Shelter Island can expect the following changes:

- Higher Average Temperature: over the next decade the average temperature is likely to rise anywhere from 2 to 3 degrees Fahrenheit. More Hot Days: twice as many days over 90 degrees F, and more than twice the number of heat waves by the 2050s.
- Fewer Cold Days: 14 fewer days below freezing by the 2050s.
- More Severe Storms: an increase in extreme precipitation events.
- Rising Sea Levels

The US National Oceanic and Atmospheric Administration (NOAA) maintains coastal stations that continuously monitor daily tides and long-term average sea levels. The Montauk Station, established in 1947, has documented a rise of 9.5 inches since that time. The New London, CT station has seen a rise of 8.6 inches since 1938. Of perhaps greater concern, the rate of sea level rise measured from 2005 to 2019 was double the rate during the 20th Century. Sea level rise is caused by the melting of glaciers and ice sheets, combined with thermal expansion of ocean water as it warms. NOAA, along with a host of scientists at universities and non-profit groups, has been modeling the potential for future sea level rise for many years. To provide a shared basis for planning and regulation in New York State, in 2014 Governor Cuomo signed into law the Community Risk and Resiliency Act, Chapter 355 of the Laws of 2014 (CRRA). The intent of the law is to ensure that state permits and expenditures consider climate risk, including sea-level rise, and that projections be based on the best available science. The result is 6 NYCRR Part 490, Projected Sea-level Rise, which establishes projections for sea level rise for three geographic regions. The resulting table of probabilities for sea level rise on Long Island is shown here.

| Time Interval | Low Projection | Low-Medium Projection | Medium Projection | High-Medium Projection | High Projection |
|---------------|----------------|-----------------------|-------------------|------------------------|-----------------|
| 2020s | 2 inches | 4 inches | 6 inches | 8 inches | 10 inches |
| 2050s | 8 inches | 11 inches | 16 inches | 21 inches | 30 inches |
| 2080s | 13 inches | 18 inches | 29 inches | 39 inches | 58 inches |

| | | | | | |
|--------------------------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|
| 2100 | 15 inches | 21 inches | 34 inches | 47 inches | 72 inches |
| Source: NYS Department of Environmental Conservation Sea-level Rise Projections for Long Island Region | | | | | |

Sea Level Rise Impact on Shelter Island

Low-lying areas are already subject to flooding, as shown by the map of **Existing Floodplains** on the following page, which is based on data from the Federal Emergency Management Agency (FEMA). The floodplains map displays data from FEMA’s National Flood Hazard Layer dataset, organized by recurrence interval. The “100 Year Floodplain,” an area with a 1% annual chance of flooding, is shown in blue. The FEMA Velocity Zone or Coastal High Hazard Area is shown in purple, an area with a 1% annual chance of flooding with damaging waves of 3 feet or greater. The “500 Year Floodplain, an area with a 0.2% annual chance of flooding, is shown in orange. Note that the greatest potential impact of flooding is around the bays and harbors, and along the low-lying coast of the Mashomack Preserve and the Ram Island Causeway. The high ground on the northwest side of the island is not as vulnerable, of course. The impact of sea-level rise will be most pronounced in areas that are already subject to flooding, as defined by FEMA. Sea level has already risen a foot in the last century and could rise another 1-2 feet in just the next twenty years. The projected floodplain maps shown on the following pages show how existing floodplains will change as sea-level rises over coming decades (additional scenarios using the same data may be explored at: <https://services.nysed.gov/SLRViewer/default>). The map of floodplains with 18 inches of sea level rise illustrates how areas already subject to flooding will be inundated more frequently, while the potential for flooding expands into adjacent areas. With 36 inches of flooding, possible sometime between 2060 and 2100, floodplains expand further inland. This will likely be felt most severely in areas where roads, docks and marinas are close to the water. Impact on existing homes and businesses will be concentrated in Dering Harbor, Coecles Harbor and West Neck Harbor, while most existing homes will remain safely above flood level. Ram Island will become a true island more frequently as flooding of the causeway becomes more common.

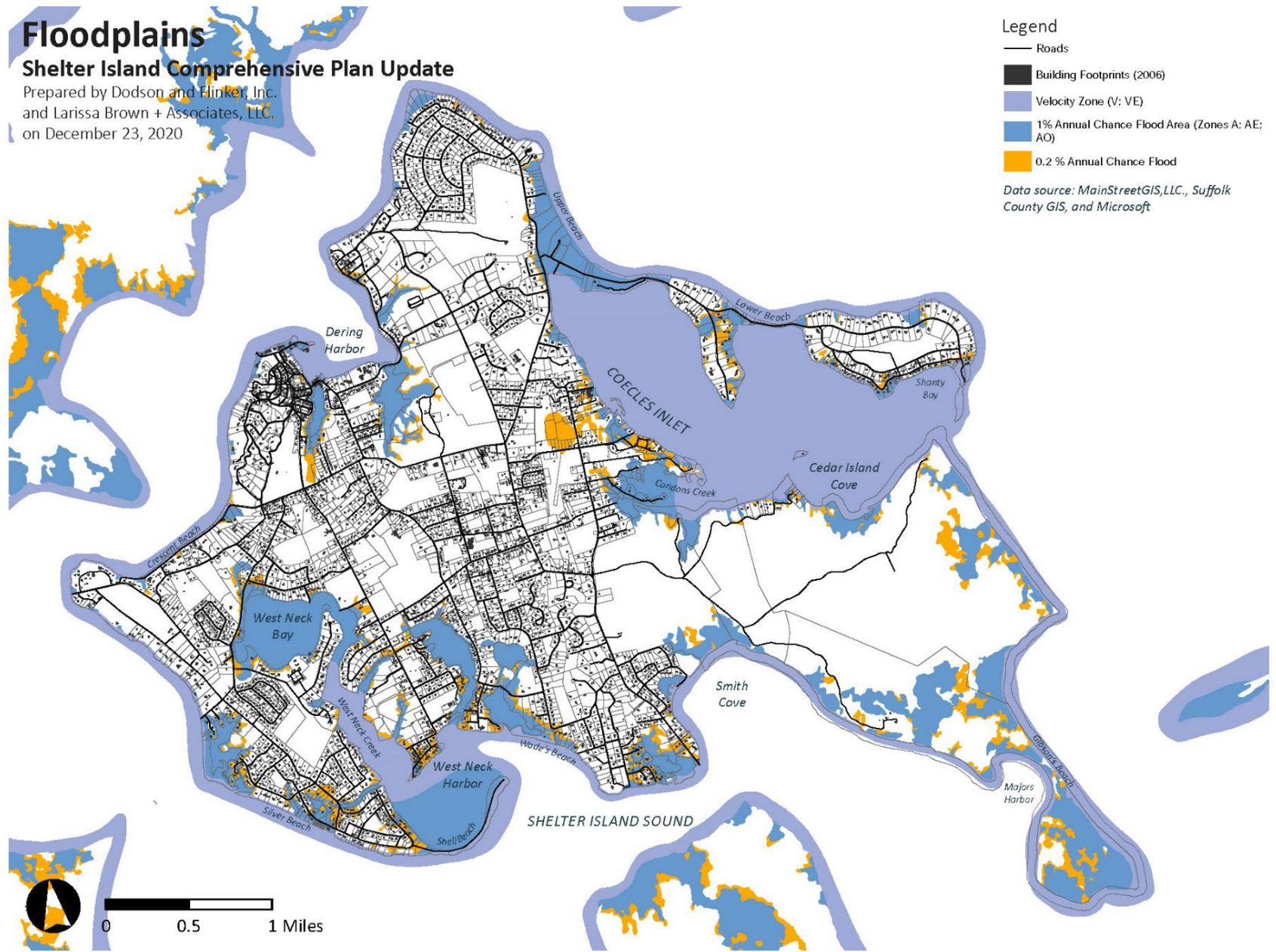
The particular impact on beaches, marshes and mud flats as sea level rises is expected because development of the adjacent upland areas leaves no room for them to shift inland. In an undeveloped shoreline environment, the beaches and dunes are in constant motion, reacting to wind, tide and changing sea levels.

Marshes form in the intertidal zone and normally shift inland gradually as sea level rises as they have for centuries. If the inland edge of the marsh is too steep, or has been hardened or otherwise bulkheaded, the marsh has no place to go and is permanently flooded – and the plant and animal communities that once thrived there will disappear.

Floodplains

Shelter Island Comprehensive Plan Update

Prepared by Dodson and Hinker, Inc.
and Larissa Brown + Associates, LLC,
on December 23, 2020



Town of Shelter Island, NY | Comprehensive Plan Update

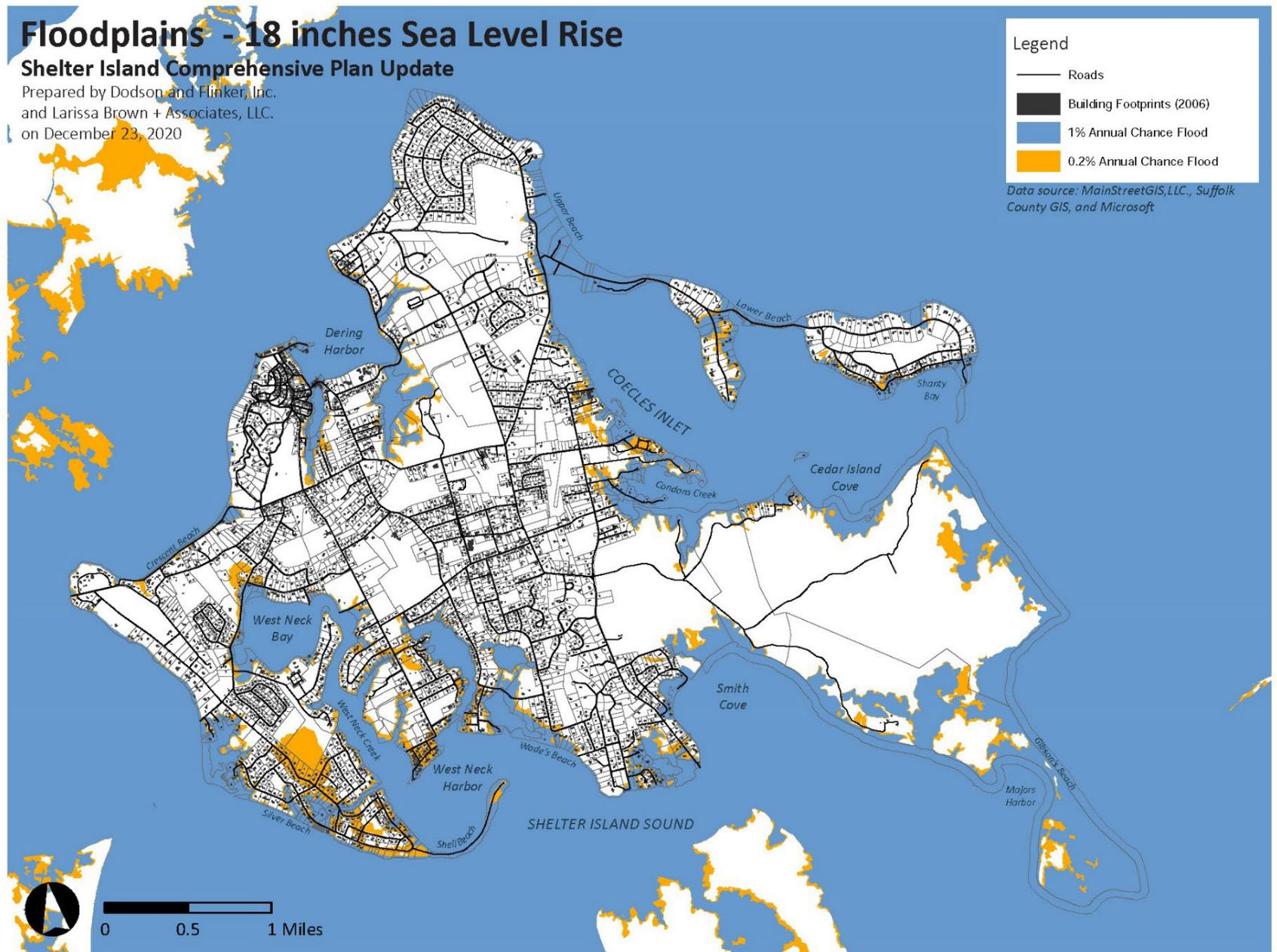
Draft: 2/22/21

Shelter Island 2020 | 1-53

Floodplains - 18 inches Sea Level Rise

Shelter Island Comprehensive Plan Update

Prepared by Dodson and Flinker, Inc.
and Larissa Brown + Associates, LLC.
on December 23, 2020



Town of Shelter Island, NY | Comprehensive Plan Update

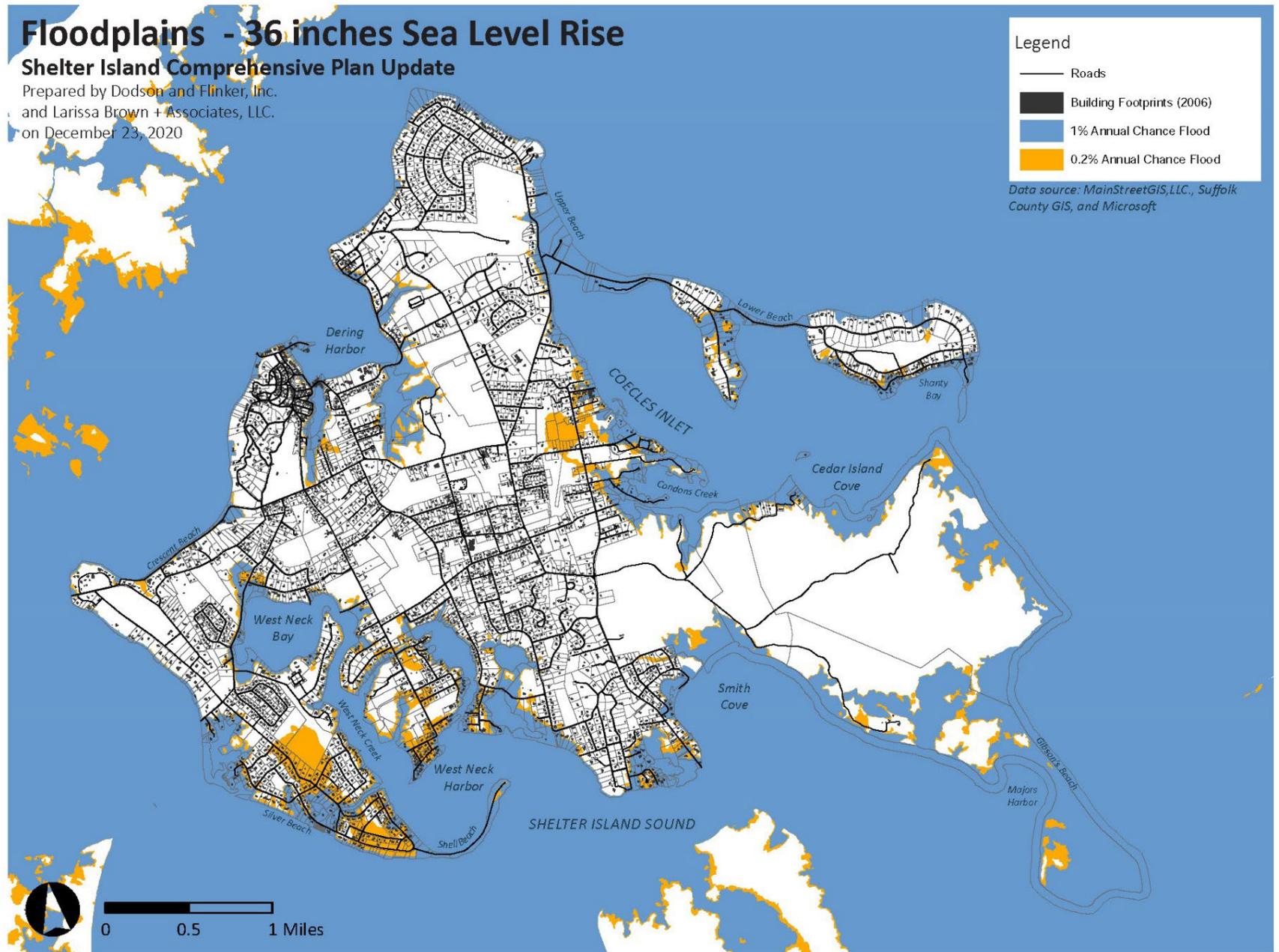
Draft: 2/22/21

Shelter Island 2020 | 1-55

Floodplains - 36 inches Sea Level Rise

Shelter Island Comprehensive Plan Update

Prepared by Dodson and Flinker, Inc.
and Larissa Brown + Associates, LLC.
on December 23, 2020



1-56 | Shelter Island 2020

Draft: 2/22/21

Dodson & Flinker, Inc. & Larissa Brown + Associates, LLC

Findings:

- Shelter Island’s Aquifer can supply the quantity of water needed, but the quality of that water varies, and depending on location, is threatened by nitrate contamination from septic systems, saltwater intrusion, and other pollutants.
- The Island retains ecological resources of statewide importance in Mashomack Preserve and other areas.
- Low-lying areas of the island are subject to flooding, but over the near-term impacts will remain focused on waterfront facilities, roads and natural areas along the coast.

Challenges:

- The decentralized nature of both the islands water supply and wastewater treatment make comprehensive solutions challenging– protecting the town’s water supply will require continual, diligent action at all levels.
- The recreational demand on natural areas needs to be balanced with protection of sensitive resources.
- Climate change will see rising temperatures and more frequent droughts, and an increase the number and severity of storms.
- Sea level rise will increase coastal flooding that will impact waterfront facilities and change the ecological function and visual character of coastal marshes and mudflats.
- Sea level rise will continue and it will exacerbate saltwater intrusion into the aquifer in low-lying coastal areas of the island

Goals & Objectives:

1. All wastewater effluent on Shelter Island discharged into the aquifer will be at a maximum of 19 mg/l
2. Ensure that all Shelter Island residents have ready access to drinking water that meets all applicable local state and federal standards.
3. Protect and monitor the upper glacial aquifers quality and quantity to support the drinking water needs of the Island residents without the need for “off island” water.
4. Protect surface waters surrounding Shelter Island from being negatively impacted by human activity

Action Items:

Ground Water Action Items:

1. Continue to monitor water table levels and implement water use restrictions as indicated.
2. Revise the irrigation law to prohibit irrigation as trucked in water just puts a strain on our neighboring towns’ supplies I think that there is the possibility of using roof runoff piped into cisterns (instead of drywells) for irrigation to avoid ground hardening in the summer months which reduces absorption and increases runoff.

3. Partner with the Shelter Island Heights Property Owners Corporation to upgrade the existing sewer plant in the Heights and explore alternative methods of disposing of the treated effluent.
4. Identify high-volume water users to target future education, funding, and support.
5. Include Suffolk County Local Law No. 41-2007 “A Local Law to reduce Nitrogen pollution by Reducing Use of Fertilizer in Suffolk County” in our Town Code. Provide Town oversight/enforcement of Suffolk County ban on the application of fertilizer between November 1st and April 1st
6. Reduce the discharge of volatile organic compounds and other regulated and unregulated contaminants to groundwater through education and Town Code modification.
7. Require businesses selling fertilizer to post fertilizer areas with the notice required by Suffolk County.
8. Explore the fertilizer, herbicide, pesticide, and fungicide regulations of other costal and island communities, see how they handle the issue, and adopt the most appropriate policy and practice for Shelter Island.
9. Educate on and encourage the proper use and disposal of lawn and other household chemicals
10. Revisit the requirement of permeable surface driveways in the nearshore overlay because people are more likely to use pesticide and weed killer on them. Consider allowing hard surface driveways with mandatory water capture and recharge via, trench drains and drywells, redirection into rain gardens and swales or other forms of water collection and recharge.
11. Issue regulations requiring the abandonment or removal of underground fuel oil storage tanks upon property transfer, with a voluntary compliance period of 2 years for tanks in water protection zones and 5 years for all other areas from the date the requirement takes effect. (Ref: Town Code Chapter 43-10.3)
12. Develop a rebate program and low/no-interest financing options for replacement of residential underground fuel oil storage tanks
13. Improve education regarding drought tolerant and native plants that require less water and provide a comprehensive guide to native plants that is easily accessible on the town website and in hard copy at Town Hall and the Building Department.
14. Coordinate with CPF and local landscape and lawn care businesses to convert one of the Town owned properties (possibly Dickerson Park) to an “environmental education center” with areas showing best environmental practices for landscaping, yard care and a section promoting plantings for pollinators.

Drinking Water Action Items:

15. Characterize (through sampling and analysis) and model the aquifer quality (Nitrates, Chlorides, PFOA/PFOS) to identify and prioritize the need for remediation of contaminants and development of additional water districts Island-wide.
16. Educate the public on the water quality in their area and encourage testing of private wells

17. Develop an incentive program for residents to test their well water and share the data with the Town for the purpose of establishing groundwater quality mapping.
18. Begin discussion with public water suppliers to understand the engineering and financial aspects of developing limited scope public water supply and distribution system(s) to provide drinking water to areas currently unable to reliably source potable water from residential wells (“currently challenged areas”).
19. Where public well exists, install public water supply and distribution system(s) to supply currently challenged areas and establish associated management and operating capability.
20. Develop a financial model and identify funding sources for drinking water supply improvements.
21. Consider establishing Water Quality Districts or an Island-Wide Water Management District.
22. Create a time-phased Master Plan for public water utility service to the remainder of Shelter Island.

Surface Water Action Items:

23. Develop a monitoring program (or participate in existing programs) for surface waters contained within and surrounding Shelter Island in conjunction with The Nature Conservancy, the Peconic Estuary Partnership and Cornell Cooperative Extension. The purpose is to develop a database of local surface water quality information that can be used to trend pollutant levels, assist in the groundwater modeling and management efforts, and assist with shellfish management and aquaculture activities.
24. Collect annual data from the commercial baymen about the quality and quantity of their catch to help monitor health of our waterways, shellfish, and marine life.
25. Continue to improve control of storm water runoff to reduce contamination of ground and surface waters by providing upland storm water catchment detention and recharge prior to stormwater reaching surface water bodies.
26. Consider roadside rain gardens or swales on town properties to ameliorate runoff in place of drywells.
27. Encourage coastal residents to create vegetative buffer zones on their properties to lessen runoff into the bays.
28. Continue to implement the Shelter Island Watershed Management Plan.

Wastewater Action Items:

29. All wastewater entering our aquifer should be at a max of 19mg/L of nitrates.
30. Consider establishing an Island-Wide Wastewater Management District, or local community districts. (This would facilitate single treatment systems serving multiple effluents).
31. Continue the plan to develop a centralized wastewater treatment plant to serve effluents from municipal buildings in Town Center. Design the treatment process (and purchase land if required) based on a modular approach that will enable expansion to service residences and other structures in the Center in the future.
32. Continue to closely monitor the Suffolk County Sub-Watersheds Wastewater Plan implementation, particularly the intent to identify a “reliable recurring funding source” for the implementation of the Plan.
33. Continue the Town grant program for I/A System installation.
34. Develop a low/no interest loan program for I/A system installation.
35. Designate “Water Protection Zones” (WPZs) where estimated effluent travel to surface water (fresh or salt) is less than 2 years (Based on 1 ft/day movement) and areas that are currently experiencing groundwater at or above 7mg/L of nitrates.
36. Develop a regulation that requires upgrading cesspool-only waste systems to add an I/A system upon property transfer (unless determined not to be feasible by a Professional Engineer). Suggest a “Voluntary Compliance Period” of 3 years for properties in WPZs (based on the permitting and grant application process duration) and 5 years for all other areas, prior to the requirement taking effect. [See Appendix C of Ground and Surface Water Management Plan]
37. Revisit the Towns I/A OWTS code and clarify the conditions for requiring an I/A system and develop a long-term plan that upgrades all sanitary systems over the next 10 years.

[Click Here to Submit Your Comments](#)

What follows is not for editing, it is a Final Document

Ground and Surface Water Management Plan

One Island - One Water



Prepared By:

Town of Shelter Island Water Advisory Committee

February 27, 2020

The Shelter Island Water Advisory Committee:

Michael J. Bebon, P.E.

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The members of the WAC wish to acknowledge:

The vision and leadership of the current and previous Town Boards and our Town Engineer, who have worked hard to protect our ground and surface water resources.

The USGS, New York State and Suffolk County agencies, Stony Brook University, and the Suffolk County Water Authority for their ongoing technical support.

The Nature Conservancy for their continued assistance and support of water resources protection, and those who participated in the Nature Conservancy's 2019 Water Leaders Training. Several of the recommendations in this report resulted from that training event.

The many people of Shelter Island who have volunteered their time and expertise over the years to protect our ground and surface water.

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1.0 Purpose and Scope

This Plan presents the current status of Shelter Island’s aquifer, the threats to it as a drinking water source for the Island in the short and long-term, and its impacts on surface waters contained within and adjacent to the Island. A vision for the future is embodied in four, strategic, “Key Outcomes” that describe desired future states. A series of recommendations for actions to be taken over period of 0-5 years, 6-10 years, and 11 years and beyond, to ultimately achieve each of the Key Outcomes is also included in this Plan.

While several of the recommendations can and should be acted on immediately, others need to be further developed through a robust stakeholder engagement process. This Plan is intended to be the primary resource document to support that process. Once modified by stakeholder input, this Plan is expected to serve as the Island’s Strategic Plan for Ground and Surface Water Management and to be incorporated into the Town’s Comprehensive Plan update.

An ongoing planning process is envisioned that will include an annual review of this Plan and the Key Outcomes and recommendations, and creation of an Annual Plan describing those specific actions that need to be taken in the given year to move toward the Key Outcomes. There are many external entities working on groundwater and surface water challenges and opportunities and it will be important to integrate their work into future revisions of this Plan. The Annual Plan will assist the Town Board in the planning, prioritizing, and budgeting processes and in assigning responsibilities for completion of the actions.

2.0 Background

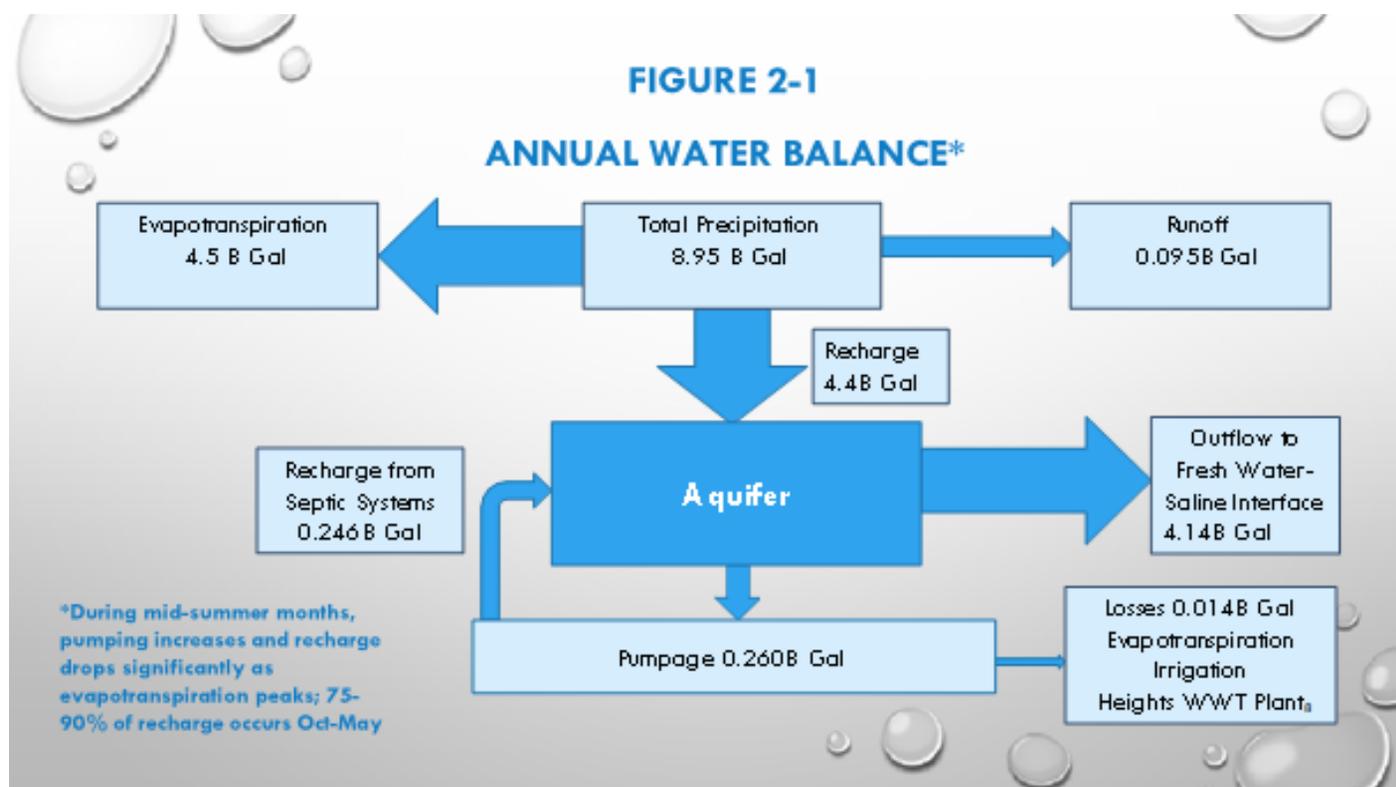
Shelter Island’s groundwater resource consists of a single aquifer, isolated from groundwater aquifers on the mainland of Long Island’s north and south forks. Unlike the typical hydrogeology of central and eastern Long Island where there are typically three relatively distinct aquifers – Upper Glacial, Magothy, and Lloyd - on Shelter Island only the Upper Glacial aquifer is potable⁽¹⁾; the Magothy has been found through sampling to be saline and studies suggest the Lloyd is also saline. ⁽¹⁾ There is no potable water supplied to Shelter Island through pipelines from either the north or south fork, though some water is trucked in to comply with Town laws. There are four potable water supply systems on Shelter Island, but together they supply only 13% of the potable water need. The remaining 87% is supplied by private groundwater wells. [See Appendix A].

(1) Geohydrology and Ground-Water Quality on Shelter Island, Suffolk County, New York, 1983-1984, Simmons; USGS Water Resources Investigations Report 85-4165, 1986)

The Shelter Island aquifer is supplied from recharged precipitation that exceeds the estimated volume pumped for potable use *by over a factor of 16 on an annual basis* (4.4 billion gallons recharged vs 260 Million gallons pumped). Of the 260 million gallons pumped, 95% is returned to the aquifer through wastewater treatment systems.

The excess recharge flows outward to the salt-water bodies surrounding the Island and to inland surface waters ⁽¹⁾. The annual water balance (by volume) is shown in Figure 2-1 below.

The majority of waste water generated on Shelter Island is treated and recharged to the aquifer through residential wastewater treatment systems – a mix of cesspools, septic tank/leaching field systems, and most recently several Innovative /Advanced Onsite Wastewater Treatment Systems (I/A Systems) that produce reduced nitrogen level effluent (10-19 mg/L). A small municipal sewer system serves Shelter Island Heights. This secondary treatment plant discharges to the Shelter Island Sound.



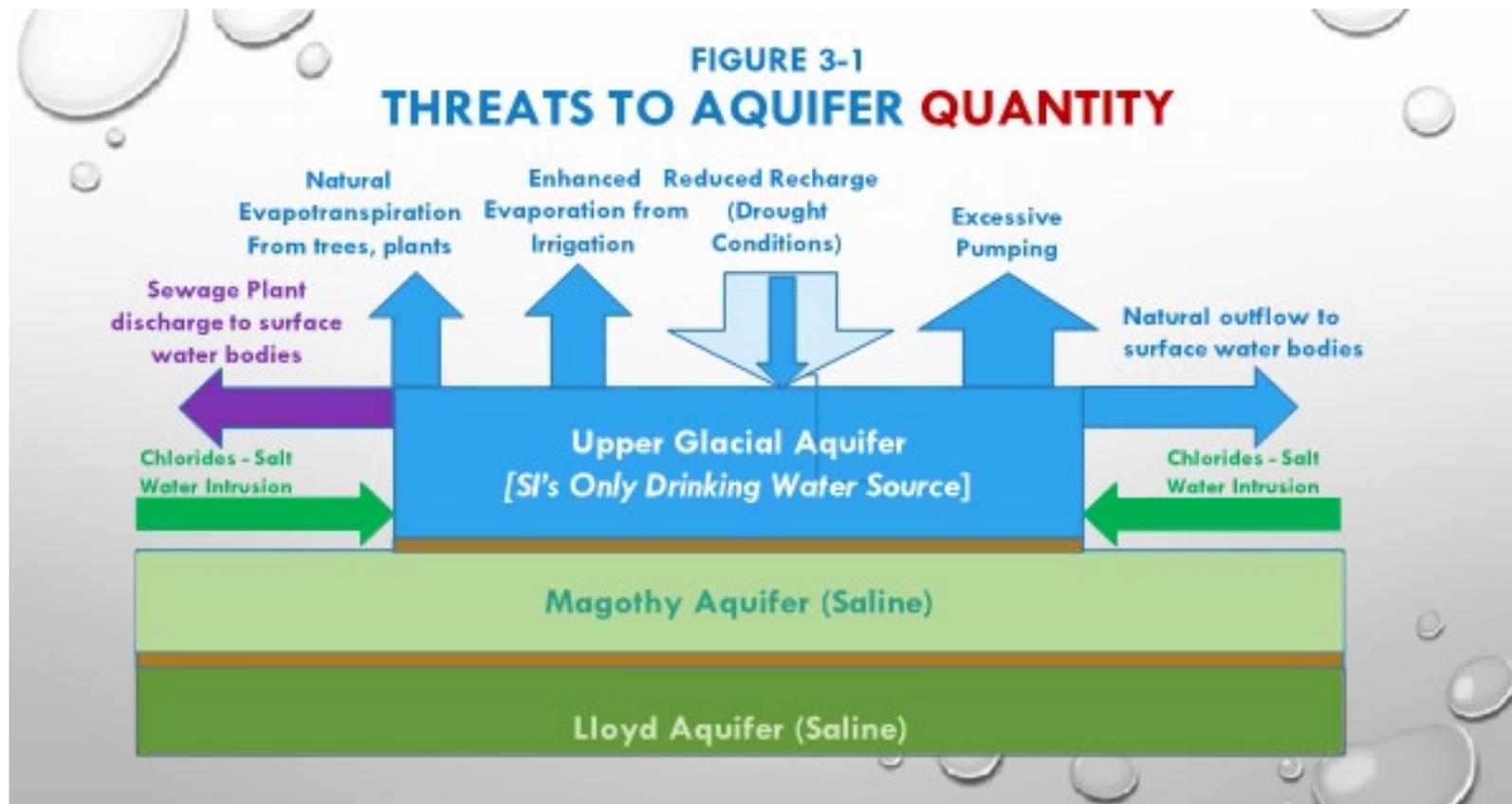
3.0 Groundwater Supply/Quantity

While the above annual mass balance suggests an abundant supply of ground water, there are both regional and seasonal variations that have raised concerns.

Regional variations in aquifer volume and contamination occur in the peninsular areas, where the topography is low, the aquifer thickness is minimal (estimated in some locations to be 20 ft or less) and salt-water intrusion is caused by periodic storms and spot over-pumping. Similar issues with salt-water intrusion exist at other shoreline locations such as the Ram islands.

Projections of continued sea level rise of between 8” and 30” by the 2050s⁽²⁾ will exacerbate the issue in these areas.

There are also seasonal variations. Maximum pumping occurs during the summer months when recharge is at its minimum and evapo-transpiration, irrigation, and pumping are peaking. About 90% of aquifer recharge occurs between October and March. This pattern, coupled with sporadic drought conditions, has led to continuous monitoring of groundwater levels and implementation of temporary water conservation measures when needed. Threats to aquifer *quantity* are shown in Figure 3-1 below.

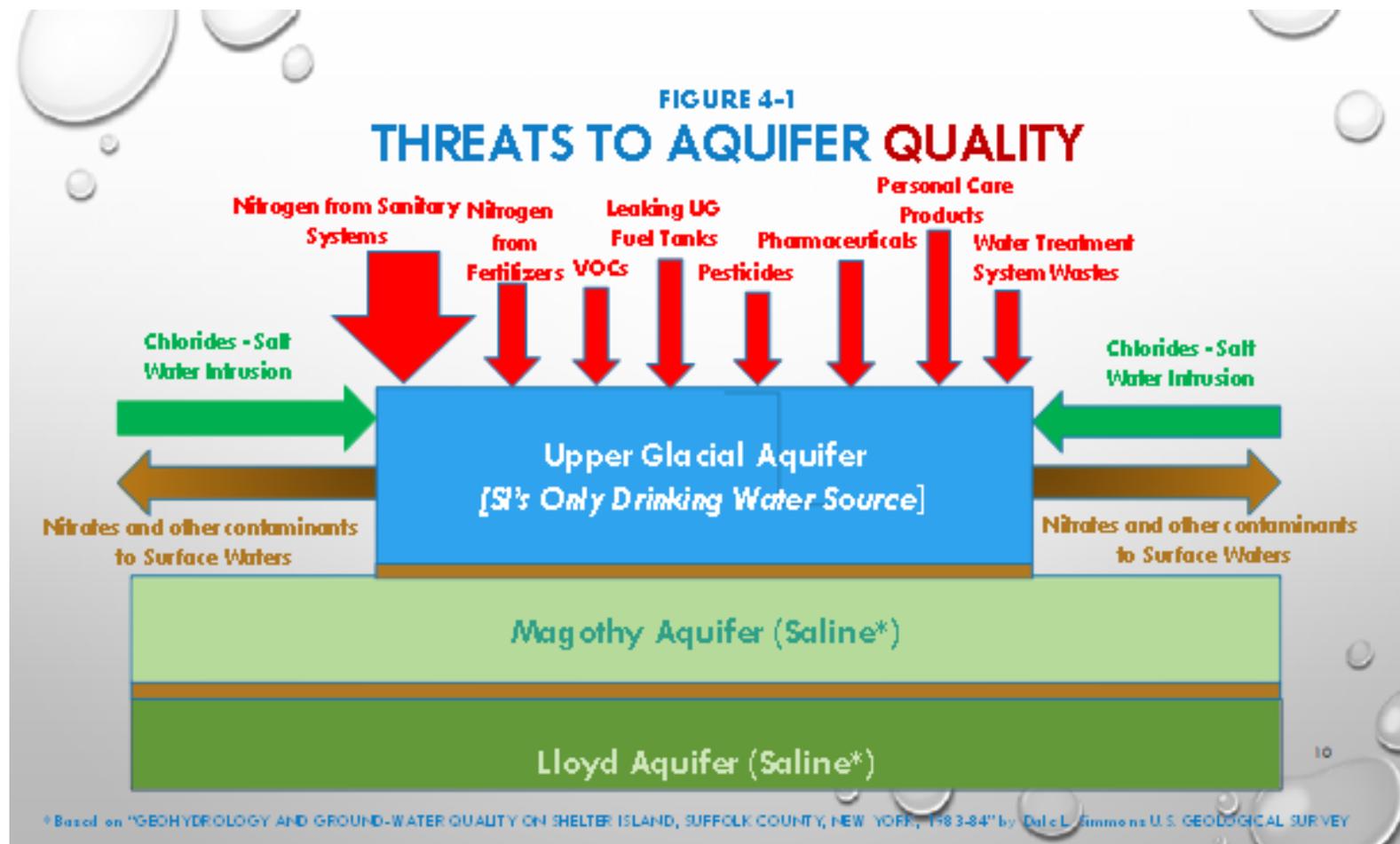


4.0 Ground Water and Surface Water Quality

As noted above, the Island's sole source of drinking water is the underlying Upper Glacial aquifer. Over the years aquifer quality has deteriorated as a result of wastewater discharge from residential treatment systems, fertilizer and pesticide applications, and introduction of other contaminants from various sources. Nitrate levels have slowly but steadily increased, and in some areas of the Island are approaching or exceed the EPA and NYS Maximum Contaminant Level (MCL) of 10mg/L (expressed as N-NO₃), suggesting that the continued nitrogen level of effluents being recharged *is not in balance* with the cyclical flushing and dilution from precipitation recharge.

(2) 6NYCRR, Part 490, Projected Sea-level Rise – Express Terms, Chapter IV Quality Services, Subchapter 1 Climate Change

Recent groundwater monitoring has also detected volatile organic compounds, PFAS, pesticides, and pharmaceuticals in groundwater. ⁽³⁾ As groundwater quality drops below potable limits, homeowners install residential water treatment systems, many of which recharge their concentrated waste streams back to the aquifer. Threats to aquifer quality are illustrated in Figure 4.1 below. With the outflow of excess recharge to surface water bodies, contaminants in the aquifer enter surface waters. High nitrogen levels in the outflow have been linked to toxic algal blooms. ⁽⁴⁾



5.0 Health Effects of Nitrates in Drinking Water

Much of the focus on groundwater quality on Shelter island has been on nitrate concentrations and, in particular, on areas where nitrate concentrations exceed or are approaching the MCL of 10 mg/L. However, recent studies suggest that drinking water below 10 mg/L *may not be as safe as widely perceived*.

(3) USGS Presentation June 25, 2019; Shallow Groundwater Quality of Shelter Island, 2016-2018; Irene Fischer and Shirley Chen, USGS NY Water Science center, June 25, 2019

(4) Christopher J. Gobler, Amanda Burson, Florian Koch, Yingzhong Tang, Margaret Mulholland; "The role of nitrogenous nutrients in the occurrence of harmful algal blooms caused by *Cochlodinium polykrikoides* in New York estuaries (USA)" 2012.

The EPA and NYS MCLs are approximately the same as the World Health Organization's guidance (11.3 mg/L as nitrate-nitrogen; 50mg/L as nitrate).⁽⁵⁾ Both were originally designed to protect infants from methemoglobinemia, or "Blue Baby Syndrome", a condition that is caused by the conversion of hemoglobin to methemoglobin (which cannot carry oxygen) by consumption of nitrates in drinking water. The MCL was set to protect against infant methemoglobinemia however other health effects including cancer and adverse reproductive outcomes were not considered. The conservatism of the EPA MCL and WHO guidance has come under question over the years. A 1977 report by the National Academy of Sciences⁽⁶⁾ concluded that *"...available evidence on the occurrence of methemoglobinemia in infants tends to confirm a value near 10mg/l nitrate as nitrogen as a maximum no-observed adverse-health- effect level, but there is little margin of safety in this value"*. Studies of infants in Europe have found that three to four percent of methemoglobinemia cases in infants occurred at doses *lower* than 10 ppm.⁽⁷⁾

While many studies have linked nitrates in drinking water **above** the MCL to cancer in humans, and others have been inconclusive, several studies have found a link between prolonged exposure to nitrates in drinking water **below** the MCL and cancer in adults. A 2010 study⁽⁸⁾ found a 260% increase in the risk of thyroid cancer in post-menopausal women consuming water with nitrates above 5mg/L vs under 5mg/L. This same study identified a 160% increase in the risk of bladder cancer when consuming water above 5mg/L for four years. A link *to* colorectal cancer was reported in a 2018 study.⁽⁹⁾ These adverse health effects are believed to be attributable to *N*-nitroso compounds (NOCs). NOCs are formed when nitrate is converted to nitrite after ingestion, and this nitrite reacts with both natural and synthetic organic compounds in the human stomach to produce *N*-Nitroso compounds. Many of these *N*-Nitroso compounds are carcinogenic in humans.⁽¹⁰⁾

6.0 Guiding Principles

The WAC used the following principles to guide development of the strategies and recommendations included in this Plan.

(5) World Health Organization "A global overview of national regulations and standards for drinking water quality" 2018 [License CC BY-NC-SA 3.0 IGO]

(6) National Academy of Sciences

(7) Sattelmacher 1964; Simon, 1962

(8) Ward M.H., Kilfoy B.A., Weyer P.J., Anderson K.E., Folsom A.R., Cerhan J.R. Nitrate intake and the risk of thyroid cancer and thyroid disease. *Epidemiology*. 2010;21:389–395.)

(9) Aarhus University. "Nitrate in drinking water increases the risk of colorectal cancer, study finds." *ScienceDaily*, 20 February 2018(10)

(10) International Agency for Research on Cancer (IARC) IARC Monographs on the Evaluation of Carcinogenic Risks to Humans: Ingested Nitrate and Nitrite and Cyanobacterial Peptide Toxins. IARC; Lyon, France: 2010.)

- Shelter Island should be a leader in water quantity and quality management on Long Island.
 - **Shelter Island should control and optimize the use of its own groundwater resources.**
 - o Since the volume of available groundwater substantially exceeds annual demand, importing water from off-island is not necessary at the current time and should be considered a “last resort” option.
- Protection of public health, safety, and the environment are key governmental responsibilities. Applicable actions, investments and initiatives include:
 - o Facilitating access to safe drinking water
 - o Protecting the quality of the aquifer
 - o Protecting surface water bodies within and adjacent to the Island’s shoreline

Note: Above principles assume compliance with all applicable local, state, and federal laws and regulations as a baseline.

7.0 Integrated Water Management Strategy

An integrated water management strategy is recommended based on a set of strategic “Key Outcomes” that will take many years to achieve. Achievement of each of these outcomes is likely to be on a decadal scale, similar to related water quality initiatives currently under discussion at the state and county ⁽¹¹⁾ level. Like the state and county initiatives, they will need to be approached with a carefully planned and continually evolving set of priorities since a significant investment of public and private funds will be needed.

7.1 Four Key Outcomes

1. *All Shelter Island residents have ready access to drinking water that meets all applicable local, state and federal standards.*
2. *All wastewater effluent on Shelter Island discharged into the aquifer or surface waters will be at a maximum of 19mg/L.*
3. *As Shelter Island’s sole groundwater aquifer, the Upper Glacial aquifer’s quality and quantity will continue to support the drinking water needs of residents without the need for “off-island” water.*
4. *Surface waters surrounding Shelter Island will not be negatively impacted by human activity on Shelter Island.*

(11) Suffolk County Sub-watersheds Wastewater Plan, July 30, 2019

Each of these Key Outcomes suggests policy, planning, and infrastructure development actions in the near and longer term. These actions should be captured in an Annual Planning process that identifies those that will need to be taken each year to move toward the Key Outcomes. This Plan and the Key Outcomes should be revisited annually to update as appropriate based on progress, evolving technology, and effectiveness of actions previously completed.

Recommendations for actions related to each of the Key Outcomes are presented below. The actions recommended are likely to change frequently as additional information becomes available, as state and county programs evolve, as climate change effects manifest faster or slower than projected, and as the impacts of early actions are realized.

Key Outcome 1: *All Shelter Island residents have ready access to drinking water that meets all applicable local, state and federal standards.*

Current Status: The Upper Glacial aquifer has not been characterized to a level adequate for detailed decision-making, and groundwater flow modeling capability and results are even more limited. However, there are known (and in some cases historical) issues with nitrogen levels exceeding or approaching the MCL at several areas on the Island and salt-water intrusion is an issue in several areas. Other contaminants of emerging concern (CECs) (e.g. VOCs, pharmaceuticals and PFAS) have also been identified. ⁽³⁾ Residential potable water point of use treatment systems have been installed to address these and other traditional contaminants such as iron and manganese.

Recommendations:

0-5 years

- Begin discussion with public water suppliers to understand the engineering and financial aspects of developing limited scope public water supply and distribution system(s) to provide drinking water to areas currently unable to reliably source potable water from residential wells (“currently challenged areas”).
- Develop a financial model and identify funding sources.
- Consider establishing Water Quality Districts or an Island-Wide Water Management District.
- Install public water supply and distribution system(s) to supply currently challenged areas and establish associated management and operating capability.
- Review Town Board oversight of the West Neck Water District and revise as appropriate.

6-10 years

- Characterize (through sampling and analysis) and model the aquifer to identify and prioritize the need for remediation of contaminants and development of additional water districts Island-wide.
- Create a time-phased Master Plan for public water utility service to the remainder of Shelter Island.

11+ years

- Complete the build-out of an Island-wide water supply utility system as required.
- Consider Integrating the Heights, Bridge Street Water Company, West Neck Water, and Dering Harbor water systems, as appropriate.

Key Outcome 2: All wastewater effluent on Shelter Island discharged into the aquifer will be at a maximum of 19mg/L.

Current Status: As noted above, there is one sewage treatment plant serving the Heights. The effluent from the Heights plant meets its State Pollution Discharge Elimination System (SPDES) permit levels and is being discharged to Shelter Island Sound. A project is being designed to recover the effluent for irrigation at the Goat Hill Golf Course. The Town is studying a small wastewater treatment system to service several municipal buildings located in the Town Center. All other wastewater is discharged to cesspools, septic/leaching pool systems (with system effluents approximately 65-70 mg/L nitrates) and a small (approx. 40) but growing number of I/A systems. The I/A systems that have been and are being installed typically reduce nitrate concentration in the effluent to 19 mg/L and have been approved by Suffolk County.

Suffolk County is currently evaluating systems capable of reducing effluent to 10mg/L. Suffolk County has also developed a multi-decadal Sub-Watersheds Wastewater Treatment Plan ⁽¹¹⁾. New York State, Suffolk County, and Shelter Island Town offer grants to support the installation of I/A systems. Several other east end towns have instituted programs including I/A grants, rebates, and other water protection programs. [Appendix B]. Recently, the IRS has issued a ruling that the I/A grants are taxable. Also, the continuity of grant funding at the County and State level has become uncertain.

Recommendations:

0-5 Years

- Continue to monitor developments affecting the I/A grant programs and adjust planning as appropriate.
- Consider establishing an Island-Wide Wastewater Management District, or local community districts. (This would facilitate single treatment systems serving multiple effluents).
- Continue the plan to develop a centralized wastewater treatment plant to serve effluents from municipal buildings in Town Center. Design the treatment process (and purchase required land) based on a modular approach that will enable expansion to service residences and other structures in the Center in the future.
- Continue to closely monitor the Suffolk County Sub-watersheds Wastewater Plan implementation, particularly the intent to identify a “reliable recurring funding source” for the implementation of the Plan.
- Adopt a set of criteria to prioritize allocation of Town grant funds for innovative/advanced wastewater treatment systems (I/A systems). [Note: The Water Quality Improvement Advisory Board is currently developing such a set of criteria].
- Continue the Town grant program for I/A System installation using the prioritized criteria.
- Develop a low/no interest loan program for I/A system installation.
- Designate “Water Protection Zones” (WPZs) where estimated effluent travel to surface water (fresh or salt) is less than 2 years (Based on 1 ft/day movement) and areas that are currently experiencing groundwater at or above 7mg/L of nitrates.

- Promulgate a regulation that requires upgrading cesspool-only waste systems to add an I/A system upon property transfer (unless determined not to be feasible by a Professional Engineer). Suggest a “Voluntary Compliance Period” of 3 years for properties in WPZs (based on the permitting and grant application process duration) and 5 years for all other areas, prior to the requirement taking effect. [See Appendix C]
- Eliminate the exemption for mandatory I/A system installation for new construction under 1,500sf; Create an exemption so that new construction < 1,500sf can qualify for a Town I/A grant.
- Complete construction and begin operations of Phase I of the Center Wastewater Treatment Facility.

6-10 Years

- Expand the Center wastewater treatment system (Phase II) to serve additional structures in the Center.

11+ Years

- Upgrade the property transfer regulations to require an I/A system upon transfer of *all*

properties, including those with septic systems

Key Outcome 3: *As Shelter Island’s sole groundwater aquifer, the Upper Glacial aquifer’s quality and quantity will continue to support the drinking water needs of residents without the need for “off-island” water.*

Current Status: The Town has a process in place to monitor water table fluctuations and to invoke temporary water use restrictions. At the present time, water table measurements indicate levels above historical averages. The Town does not have requirements for applicants proposing to construct structures in locations where the aquifer quality and/or quantity is challenged to provide engineering analyses of projected aquifer impacts including impacts on wells of surrounding residents. Application of fertilizers is regulated by Suffolk County⁽¹²⁾, but there appears to be little enforcement of these regulations on Shelter Island. The Town Code specifically exempts Landscaping from the requirement to obtain a Home Improvement Contractor license⁽¹³⁾. The Heights Sewage Treatment Plant discharges its effluent to Shelter Island Sound. There is little to no Town regulation affecting water use other than when temporary water use restrictions are invoked. Town regulations on underground fuel oil storage tanks are minimal.

Recommendations:

0-5 Years

- Continue to monitor water table levels and implement water use restrictions as indicated.
- Begin development of a groundwater model [Note: Grant request pending].
- Conduct a Historical Survey to identify areas of concern for further characterization.
- Complete the project to recycle Heights Wastewater Treatment Plant effluent through irrigation of Goat Hill while ensuring that Heights and West Neck Water wells are not negatively impacted.
- Identify high-volume water users to target future education, funding and support.

(12) Suffolk County Local Law No. 41-2007 “A Local Law to reduce Nitrogen pollution by Reducing Use of Fertilizer in Suffolk County”

(13) SI Town Code, Chapter 79 “Home Improvement Contractors”, Section 79-1

- Promulgate regulations requiring Hunter Curve demand analysis for any proposed new construction, reconstruction or renovation. and aquifer impact analyses for development in sensitive areas or large homes/buildings (over 5,000sf) and well relocation onto public property. Incorporate into Town Code [*Chapter 43 §43-6*] and Building Permit process.
- Provide Town oversight/enforcement of Suffolk County ban on application of fertilizer between November 1 and April 1.
- Require businesses selling fertilizer to post fertilizer areas with the notice required by Suffolk County. Provide periodic Town oversight of compliance.
- Require the use of 50% slow release fertilizers on Shelter Island.
- Develop a rebate program and low/no-interest financing options for replacement of residential underground fuel oil storage tanks.
- Issue regulations requiring abandonment or removal of underground fuel oil storage tanks upon property transfer, with a Voluntary Compliance period of 2 years for tanks in WPZs and 5 years for all other areas from the date the requirement takes effect. [*Ref: Town Code Chapter 43 §10.3*]
- Require Landscapers to obtain a Shelter Island license (eliminate current exemption for landscaping [*Ref: Town Code Chapter 79, §79-1*]) and to provide proof of Suffolk County License and staff training in Turf Management as required by Suffolk County.

6-10 Years

- Repeat the Baseline Study of Groundwater to identify trends and effectiveness of actions taken.
- Require a standard, remote-reading-capable water meter to be installed on all new construction.
- Require owners to connect to public water supply where available.
- Require enhanced rainfall capture systems.

11+ Years

- Complete full implementation of a groundwater model and integrate its use into Town decision-making and approval processes. (e.g. Building permits, Planning and Zoning Board review and approval processes).

Key Outcome #4: *Surface waters surrounding Shelter Island will not be negatively impacted by human activity on Shelter island.*

Current Status: Surface waters (adjacent salt-water bodies and contained fresh-water bodies) are being impacted by contaminants in addition to nitrates, introduced through the outflow of groundwater and storm-water runoff. Outflow of contaminated groundwater is also impacting surface waters. Insufficient surface water monitoring exists for most water bodies to assess impacts. The shell-fishing industry, particularly harvesting of scallops is important to the local economy and has been negatively impacted due to a parasite in the recent season and algal blooms in previous years. The Town has been proactive in improving infrastructure to control storm water runoff and has developed a Watershed Management Plan ⁽¹⁴⁾.

Recommendations:

0-5 Years

- Develop a monitoring program for surface waters contained within and surrounding Shelter Island in conjunction with The Nature Conservancy and the Peconic Estuary Partnership. The purpose is to develop a database of local surface water quality information that can be used to trend pollutant levels, assist in the groundwater modeling and management efforts, and assist with shellfish management and aquaculture activities.
- Participate in local actions to address the parasite-induced 2019 scallop die-off and implement appropriate preventive measures.
- Revisit the requirement for permeable driveways since it is common practice to apply pesticides to gravel and other permeable driveway materials. The pesticides enter runoff during storms.
- Continue to improve control of storm water runoff to reduce contamination of ground and surface waters.
- Continue to implement the Shelter Island Watershed Management Plan.

6-10 Years

- Achieve full compliance with the objectives of the Watershed Management Plan.

7.2 A Continuous Planning Process

Notwithstanding the analyses and recommendations above, the management of our ground and surface waters and implementation of protective measures must be an ongoing process. As we learn more from future studies, water sampling and analysis, and results from groundwater modeling, the outyear recommendations in this Plan are certain to change.

(14) Town of Shelter Island Watershed Management Plan; Nelson, Pope & Voorhis, June 2014

The Water Advisory Committee will continue to evaluate the results of water testing for both quantity and quality and provide periodic updates to this Plan. For example, additional assessment and evaluation is needed for contaminants of emerging concern (CECs) such as pharmaceuticals, PFAS/PFOS, 1,4-Dioxane, and others, as information on these pollutants evolves. We also believe an approach needs to be developed for the widespread practice of discharging wastes from residential Point-of-Use potable drinking water treatment systems to the groundwater.

7.3 Engagement and Outreach

While several of the above recommendations can be initiated rapidly, this Plan and many of the recommendations should be viewed as a source document for full community engagement on addressing the water issues facing Shelter Island. The community outreach ideas developed at the Nature Conservancy's November Water Leader's Training ⁽¹⁵⁾ are an excellent starting point for the development of such an engagement process. An organization outside the Town organization and committee structure should be engaged to assist the Town with its planning and implementation. The Nature Conservancy should be considered as a potential resource along with consultants experienced in this area.

Where advantageous, the stakeholder engagement for this Plan should be integrated with engagement activities associated with processes being planned for updating the Comprehensive Plan. ⁽¹⁶⁾

(15) Shelter Island Water Leaders Training Action Plan Notes (November 14-15, 2019)

(16) Shelter Island Town Comprehensive Plan, June 3, 1994

APPENDIX A CURRENT WATER SUPPLY MODEL

| Water supply Systems | Annual Pumpage (Million Gallons) | Comments |
|--------------------------|-------------------------------------|-------------------------------|
| Private wells | 226 | 87% of Island's total pumpage |
| Shelter Island Heights | 27 | |
| Bridge Street | <1 | |
| Dering Harbor/SCWA | 3 | |
| West Neck Water District | 4 | |
| Total | 260 | |

- CURRENT WATER UTILITIES SUPPLY ONLY **13%** OF ISLAND'S NEEDS
- SOME PRIVATE WELLS ALREADY REQUIRE TREATMENT SYSTEMS TO ACHIEVE DRINKING WATER STANDARDS

APPENDIX B 1/A OWTS: WHAT OTHERS HAVE DONE

| Actions | | Suffolk County | Brookhaven Town | Easthampton | Southampton |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sensitive Area Designated | Yes | | 500ft from body of water Nitrogen Protection Zones (NPZs) | Water Protection District | High Priority – 0-2yrs to surface water+ other factors Med priority – 0-10yrs [Areas designated in WQIPP] |
| 1/A OWTS Required | New construction in environmentally sensitive areas Failed cesspools cannot be replaced like in kind; must install septic; for certain commercial situations, SCDHS may require 1/A OWTS | | New residences or replacement construction in NPZs Residences built on or before 12/31/86: add BRs or increase floor area >10% Residences built on or after 1/1/87: add BRs or incr floor area >50% [Replacement construction due to natural disaster can apply for financial hardship waiver] | All properties in Town New buildings and structures Voluntary repl of existing sanitary system All substantial expansion of existing structures All EPA-required upgrades of large capacity cesspools All non-residential properties that require site plan reviews | All new residential construction in high priority area Any substantial septic upgrades required by SCDHS Increase > 25% of floor area New septic system or substantial Septic upgrade required by the Wetlands section of the Town Code SCDHS approval of 1/A OWTS required |
| Rabate Program | Yes | No; rely on SC program | | Properties in Water Protection District eligible Must qualify for Basic STAR or own non-residential property 100% of cost reimbursed | High and Medium Priority areas only Max \$20K Income <\$300K 100% of cost \$301-500K 50% \$500K - \$1M 25% >\$1M 0% |
| Treatment Level | 19mg/l residential | 19 mg/L | 19 mg/L | 19mg/L until SCDHS 10mg/L approved | 19 mg/L |

APPENDIX C NITROGEN LOADING FROM ONSITE WASTEWATER TREATMENT SYSTEMS

| Actions/ Requirements | Shelter Island Currently | Recommendations |
|-----------------------------|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sensitive Area Designations | None | Designate Water Protection Zones WPZs (e.g. Center; 500ft from bodies of water; watershed areas for water district supply wells) |
| I/A OWTS Required | All new and re- construction (regardless of location) 1,500sf and under exempt | Eliminate 1,500sf new construction exemption; allow I/A grant/rebate program eligibility for homes under 1,500SF Require I/A system installation for existing homes with cesspools (only) upon property transfer : Voluntary Compliance Period of 3 years in WPZs; 5 years for all other areas |
| Rebate Program | Maximum grant amount Supporting all applications equally No income limits | Apply approved prioritization criteria [currently under development by WQI] |
| Loan Program | None | Develop a need-based low/no interest loan program to cover I/A OWTS installations to supplement Suffolk County's program as needed |

APPENDIX D NITROGEN LOADING FROM FERTILIZERS

| CURRENT STATUS | RECOMMENDATIONS |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Suffolk County requires:</p> <ul style="list-style-type: none"> • Establishments selling fertilizers to post signage and make brochures available near fertilizer locations • Contractors applying fertilizers to be licensed and attend a SC approved Turf Management course <p>Shelter Island Town</p> <ul style="list-style-type: none"> • Excludes Landscaping from the requirement to obtain a Home Improvement Contractor's License | <p>Shelter Island should conduct periodic checks of establishments on the island to verify compliance</p> <ul style="list-style-type: none"> • Shelter Island should require Landscaping contractors working on the island to obtain a license and require evidence of SC license as a prerequisite • All contractor staff applying fertilizer must take approved SC Turf Management course • Develop local course for landscapers covering Water Protection Zone requirements |

APPENDIX E

UNDERGROUND FUEL TANKS

| Current Status | Recommendations |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Shelter Island Requires:</p> <ul style="list-style-type: none"> Removal or Abandonment of UG oil tank and replacement with AG tank for a building permit for reconstruction (as defined in Chapter 129) | <ul style="list-style-type: none"> Require removal or abandonment of UG oil tanks and replacement with compliant AG tank in all Water Protection Zones (WPZs) In WPZs, require tank removal or abandonment Certificate from a contractor licensed in Suffolk County upon property transfer – after 2 year voluntary compliance period Voluntary compliance period to be 5 years for all UG oil tanks in non WPZ areas |
| <p>No incentives offered to motivate removal/abandonment of UG oil tanks</p> | <p>Establish a rebate program for removal and abandonment of UG oil tanks with similar provisions and priorities to the rebate program for I/A OWTS installations</p> |

Appendix Documents:

Town of Shelter Island Watershed Management Plan June 2014

Hydrogeologic Data Review and Evaluation for Shelter Island NY June 2014

This Special Place: An Informational Guide to Practical Living on Shelter Island June 2020

Suffolk County Code Chapter 459 Fertilizer

Suffolk County Comprehensive Water Resources Management Plan