Executive Summary

Introduction

Water is the single most significant resource for which Suffolk County bears responsibility. As the impact of Superstorm Sandy underscored, more than at any time in our history, we are obliged to come to terms, in every sense, with the water that surrounds us. Suffolk County's water quality is at a tipping point. We face an alarming trend in the quality of the water our families drink, compounded by impairment of many bodies of water in which our families play. Moreover, the source of these impairments has demonstrably degraded the wetlands that serve as our last line of natural defense against storm surge.

While today our drinking water generally meets quality standards, elevating levels of contaminants raise serious concern. Many of our rivers, estuaries and bays are impaired as result of eutrophication. Nitrogen, which primarily spews from residential septics and cesspools, as well as fertilizer, are the principal culprits that spur hypoxia, harmful algal blooms, diminution of sea and shellfisheries, and degradation of our protective natural infrastructure– wetlands and seagrass beds that act as wave and storm surge buffers [1] [2]. Sea level rise, which also contributes to marshland degradation, is projected to raise groundwater levels, increasing vulnerability to saltwater infiltration, and further compromising on-site wastewater treatment infrastructure largely composed of cesspools and septic tanks.

Perhaps nowhere have we seen the impact of nitrogen pollution in more stark terms than the Great South Bay. At one time, this bay produced more than half the clams eaten in our country. However, over the past quarter-century, the clam harvest in the Great South Bay has fallen by 93 percent, destroying an entire industry which once accounted for 6,000 jobs. While clams were once over-harvested, they have largely failed to recover due to recurrent brown tides fed primarily from nitrogen from septic systems and cesspools. We must

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[1] Deegan LA, Johnson DS, Warren RS, Peterson BJ, Fleeger JW, Fagherazzi S, and Wollheim WM (18 Oct 2012) "Coastal Eutrophication as a Driver of Salt Marsh Loss" *Nature* : doi:10.1038

[2] Anderson ME, McKee Smith J, Bryant DB, and McComas, RGW. (Sept 2013), "Laboratory Studies of Wave Attenuation through Artificial and Real Vegetation" USACE, "It is generally acknowledged that vegetated coastal features such as wetlands can reduce the effects of surge, waves, and tsunami propagation."

decide if this type of impaired surface water body will be our region's future or if we can restore our bays to health.

In advance of the release of the 2015 Suffolk County Comprehensive Water Resources Management Plan ("Comp Plan"), this Executive Summary Update is spotlighting the Comp Plan's critical findings, and relevant post-Superstorm Sandy considerations, in order to spur a critical public dialogue about the scope of the problem and begin to frame near-term solutions. While many environmental issues related to groundwater and surface waters have arisen since the previous Plan (1987), one elemental condition has remained constant: the vast majority of Suffolk residents rely on on-site wastewater disposal systems that discharge to groundwater. In addition, fertilizer use, industrial and commercial solvents, petroleum products, pesticides and a host of other manmade contaminants have had profound and long-lasting impacts on groundwater quality, as well as on fresh surface waters and coastal marine waters into which groundwater and stormwater runoff discharge.

In the face of sea-level rise and extreme weather events, Suffolk County is compelled to devise the means and methods to live and thrive with the water beneath, by and around us.

Critical Findings

*"We have a million and a half people, **approximately 74%,** or roughly a million people, who are **not sewered**. This is probably the only place in the world with that large a density in this tight a space where the waste is going into a sole source aquifer immediately beneath us that we're drinking, and this is **a big concern**."*[3]

Downward Trajectory in Groundwater Quality:

1. Nitrogen is public water enemy #1, as **nitrate contamination** from unsewered housing and fertilizer use poses a threat to both drinking water supplies and coastal marine habitat and resources. Nitrogen-induced nutrient loading and eutrophication can lead to many negative impacts on estuarine environments including harmful algal blooms (HABs), hypoxia [little or…], and even anoxia [no oxygen];

2. Volatile organic chemicals (VOCs), another **priority contaminant group**, derived from commercial, industrial, and consumer use,

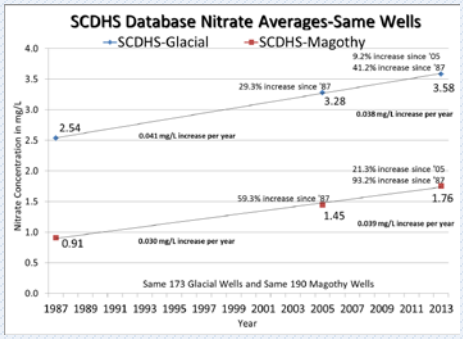
[3] Dawydiak, Walter, Acting Director Environmental Quality, Suffolk County Department of Health Services. Testimony to Health Committee of SC Legislature, March 6, 2012

impacting large portions of the aquifer, public water supply and private wells;

3. Pesticides pose a threat, especially to private wells in agricultural areas; and,

4. Pharmaceuticals and personal care products are an **emerging concern**.

Public Water Supply Well Nitrate Trends (1987-2013)



- Nitrogen pollution continues to worsen
- The rate of degradation has not declined; it appears to have accelerated in the Magothy aquifer
- Nitrogen levels in public supply wells are still generally good for drinking water, but unacceptable for surface waters

Surface Water Impairments:

5. Due to excess coliform bacteria and nitrogen, **many of the water bodies surrounding Suffolk County have been designated as impaired by the New York State Department of Environmental Conservation** (NYSDEC). In fact, the vast majority of Long Island's 60-mile long South Shore Estuary Reserve was declared impaired by the NYSDEC in 2010.

6. **Brown tide** algae invasions have been plaguing Long Island estuaries for nearly a quarter of a century, according to Dr. Chris Gobler of Stony Brook's School of Marine & Atmospheric Sciences (SoMAS), **obliterating a shellfish habitat** that once provided one half of all hard clams for the nation.

7. There was an 18-36% **loss of tidal wetlands** between 1974 and 2001 according to NYSDEC.[4]

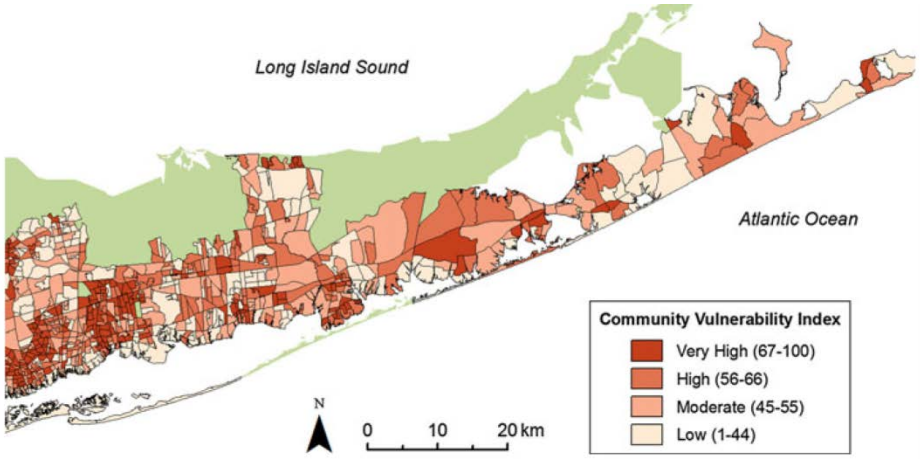
8. The NYS Seagrass Taskforce estimates that the 200,000 acres of seagrass in Long Island's bays and harbors in 1930 have shrunk by nearly 90% to 22,000 acres.

9. The Forge River in Moriches is "the worst case of anoxia (absence of oxygen) I have seen," states Dr. Larry Swanson, Associate Dean of SoMAS.

*The costs of redressing water-related issues are significant; the economic consequences of not doing so are **potentially devastating in property values alone**. Then there is Long Island tourism, producing revenues of $4.7B/yr, with approximately 28% of visitors – 5.1M/yr – visiting parks and beaches.*[5] *"Coastal habitats shield people and property from sea-level rise and storms," reducing*

[4] Discrete marsh trends show even higher rates of loss in other areas (TNC).
[5] Trust for Public Land, "The Economic Benefits and Fiscal Impact of Parks and Open Space in Nassau and Suffolk Counties, New York," 2010 accessed at http://cloud.tpl.org/pubs/ccpe--nassau-county-park-benefits.pdf

their exposure by half, according to marine ecologists at Stanford Woods Institute for the Environment.[6, 7]



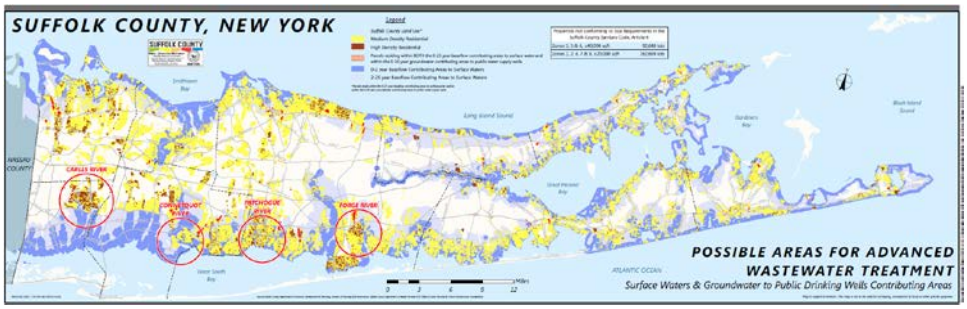
The Community Vulnerability Assessment Tool (NOAA) identifies block groups that are at most risk, assessing damages resulting from a category 3 hurricane (gray) compounded 0.5m sea-level rise (black), + values of tidal marshes.[6]

Nitrogen from Unsewered Areas

Suffolk County, with a population larger than 11 states and a region that derives its drinking water from the ground, must pay particular attention to the 360,000 sub and non-performing septic/cesspools in Suffolk, accounting for well over 74% of the homes. They are particularly problematic in areas with high water tables and in close proximity to surface waters. When flooded or submerged in groundwater, septic systems do not function as designed and they fail to adequately treat pathogens. Excess nitrogen from sewage threatens our valuable natural resources, coastal defenses, and human health.

[6] Arkema, K, "Coastal habitats shield people and property from sea-level rise and storms," Nature Climate Change, July 2013

[7] Shepard, C, et al, "Assessing future risk: quantifying the effects of sea level rise on storm surge risk for the southern shores of Long Island, New York," Nat Hazard 2011: 727-745.



Map of 0-25 Year Baseflow Contributing Areas to Surface Waters

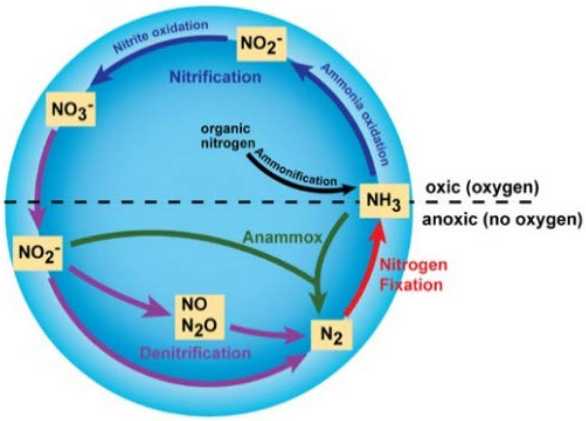
Characteristics of Unsewered Areas in Suffolk County, N.Y.			
	Unsewered Residential Parcels		
	Total	Medium Density (> 1 to < 5 d.u./acre)	High Density *(≥ 5 d.u./acre)*
0-25 Year Baseflow Contributing Areas to Surface Waters	155,939	121,843	34,096
0-50 Year Estimated Groundwater Travel Time to Public Water Supply Wells	55,169	43,967	11,202
≤ 10 Feet Depth to Groundwater	38,143	25,914	3,288
≤ 10 Feet Depth to Groundwater AND either 0-25 Surface Water or 0-50 Groundwater Public Wells Contributing Areas	30,250	21,309	8,941

Suffolk County has identified priority high density (greater than 5 homes per acre) and medium density (1 to 5 homes per acre) residential subregions within the contributing areas with the following characteristics:

1. With a depth to groundwater of 10 feet or less; and/or
2. Contribute to an area that is listed as a 303(d) impaired water body.

Contaminant	Manmade Sources
Nitrogen pollution is increasing in our groundwater	**360,000 septic and cesspools**
• While 83% of all community supply wells had nitrogen concentrations less than or equal to 6 mg/L in 2013, there were large changes in nitrogen levels in all of Suffolk County's groundwater aquifers. Nitrate concentrations in the Upper Glacial aquifer **rose by over 40%** between 1987 and 2013 while levels in the Magothy aquifer, a deeper aquifer, **rose by over 80%.** The observed rate of increasing nitrates was generally linear in the Upper Glacial aquifer between 1987 to 2005 and 2005 to 2013, but the trend increased slightly in the Magothy aquifer between 2005 to 2013 as compared to the rate of increase observed between 1987 and 2005 in the same subset of public supply wells.	30,250 homes with septic systems or cesspools are within the 0-25 year contributing area to surface water and have less than 10 feet separating their systems from the water table
• Nitrate levels in nearly 25 percent of the private wells sampled between 2007 and 2013 exceeded groundwater management zone target levels of 4 and 6 mg/L. Nitrate levels in approximately 7 percent of the samples collected from 2007 through 2013 exceeded 10 mg/L. In some agricultural areas, nitrate levels in private wells can still exceed 20 mg/L.	
• Parts of Suffolk County's groundwater exceeds maximum containment levels caused by unsewered, subsized lots, especially in Huntington, Smithtown and northern Brookhaven, with nitrate levels ranging from 8 mg/L to 12 mg/L in Magothy wells in Northport and East Northport.	
• All 3 major estuaries in Suffolk County are suffering from dissolved oxygen impairments as well as recurring Harmful Algal Blooms, some toxic to humans, diminishing the County's wetlands, which act as a second line of defense for storms.	**80% of all fertilizer purchased in Suffolk is for non-farm, residential uses**
• Wetlands have been scientifically proven to reduce vulnerability from storm surge, reducing wave height by 80% over short distances. Waves lose energy as they travel through vegetation.	
• Losses of healthy salt marsh have accelerated in recent decades. The NYSDEC estimates that an 18-36% loss in tidal wetlands in the Great South Bay occurred between 1974 and 2001. In 2010 the NYSDEC declared the vast majority of Long Island's South Shore Estuary Reserve system, stretching more than 60 miles, an "impaired water body" (under section 303(d) of the Clean Water Act). NYSDEC identifies nitrogen from wastewater as a reason for this unfortunate designation and states that cesspools, septic systems, and sewage treatment plants cause eutrophication, resulting in lower water oxygen levels and persistent algal blooms. According to researchers Kinney and Valiela[1], **69% of the total nitrogen load for the Great South Bay is from septic systems and cesspools**.	25,905 tons of fertilizer were purchased as non-farm uses in 2012, representing 16% of all fertilizer purchased statewide
• Excessive nitrogen has been shown to have a direct effect on seagrass by promoting growth of microalgae which shade it and macroalgae which out-compete it. Thousands of acres have died off in Long Island's Eastern and South Shore estuaries. According to the NYS Seagrass Taskforce, historic photography and records indicate that there may have been as much as 200,000 acres of seagrass in 1930 in Long Island bays and harbors; only about 22,000 acres remain.	
• A few decades ago, half the clams eaten in this country came from Great South Bay. However, in the past 25 years, the hard clam harvest in Great South Bay has fallen by more than 93% to record lows, resulting in a loss of more than 6,000 jobs[1]. In the 1970s, bay-scallop fishery on Eastern Long Island and hard-clam fishery in the South Shore bays were the two largest in the U.S. The bay-scallop collapse was almost entirely due to the nitrogen-caused algal blooms. While hard clams were over-harvested in the 1970s and 1980s, they have failed to recover largely due to recurrent brown tides.	

Contaminant	Manmade Sources
Volatile Organic Compounds (PCE, TCE, TCA, and MTBE) • Approximately **22% of public water supply wells are treated** to remove low-level VOCs prior to delivery to customers. • The gasoline additive MTBE, banned in 2004, was detected in 5% of all public supply wells tested in 2013, down from 16% with detections in 2005. • Concentrations of dry cleaning and metal finishing solvents **doubled in a 25-year period**, impacting between three (PCE) and five (TCE) times the number of wells. • 70% of community supply wells are rated as high or very high for VOC contamination, due to the widespread use of VOCs.	Illegal discharges & spills, leaking underground storage tanks, septic systems, household cleaners, and banned chemicals travelling through the aquifer
Pesticides • Past agricultural practices have significantly impacted private wells on the East End, with **6.5% exceeding pesticide maximum contaminant levels.** • Pesticides were detected in approximately 16% of the public supply wells sampled between 1997 and 2014. • **Over 100 pesticide-related compounds** have been detected in Suffolk's groundwater. • 20% of drinking water wells tested between 1997 and 2012 had at least one pesticide detection.	Agricultural sector and homeowners
Pharmaceuticals and Personal Care Products • Detection of pharmaceuticals and personal care products, like ibuprofen, phthalates, and caffeine, have been found in about **2.5% of community public supply well samples**, and 5 to 10% of (shallower) non-community public supply and private well samples. • The presence of **1,4-dioxane**, an industrial solvent stabilizer and byproduct in personal care products, has been found in over 40% of the Suffolk County Water Authority's public supply wells. This **emerging contaminant** is likely a human carcinogen and is not removed with conventional treatment technologies.	Industry and homeowners



Nitrogen Bomb in Our Bays

Nitrogen is one of the primary nutrients critical for the survival of all living organisms. Since the mid-1900s, the impact of humans on the global nitrogen cycle via manufacture of fertilizers and burning of fossil fuels has substantially altered the amount of fixed nitrogen in the Earth's ecosystems. Some predict that by 2030, the amount of nitrogen fixed by human activities will exceed that fixed by microbial processes.[8] Nitrogen is arguably the most important nutrient in regulating primary productivity and species diversity in aquatic and terrestrial ecosystems.[9]

Much of the nitrogen applied to agricultural and urban areas ultimately enters rivers and coastal systems. In nearshore marine systems, elevated nitrogen can lead to anoxia or hypoxia (no or low oxygen), altered biodiversity, alterations in the food-web, and habitat degradation. One common consequence of increased nitrogen is proliferation of harmful algal blooms.[10] Toxic blooms of certain types of dinoflagellates have been associated with high fish and shellfish mortality. Absent such economically catastrophic impacts, elevated nitrogen can lead to changes in biodiversity, species composition and overall ecosystem function. It has also been suggested that alterations to the nitrogen cycle may lead to increased risk of parasitic and infectious diseases among humans and wildlife.[11] Moreover, increases in nitrogen in aquatic systems can lead to increased acidification in freshwater ecosystems.

- Nitrogen is released when microorganisms break down sewage, manures, decaying plants or fertilizers, millions of pounds of nitrogen are generated on Long Island each year. As Chris Gobler of the Marine Science Research Center at Stony Brook University points out, "and unfortunately most of that, as we all know, is not going to sewage treatment plants, but is going to septic tanks" and eventually seeping into groundwater and surface water, Gobler said. "**We do expect these numbers to rise.**"

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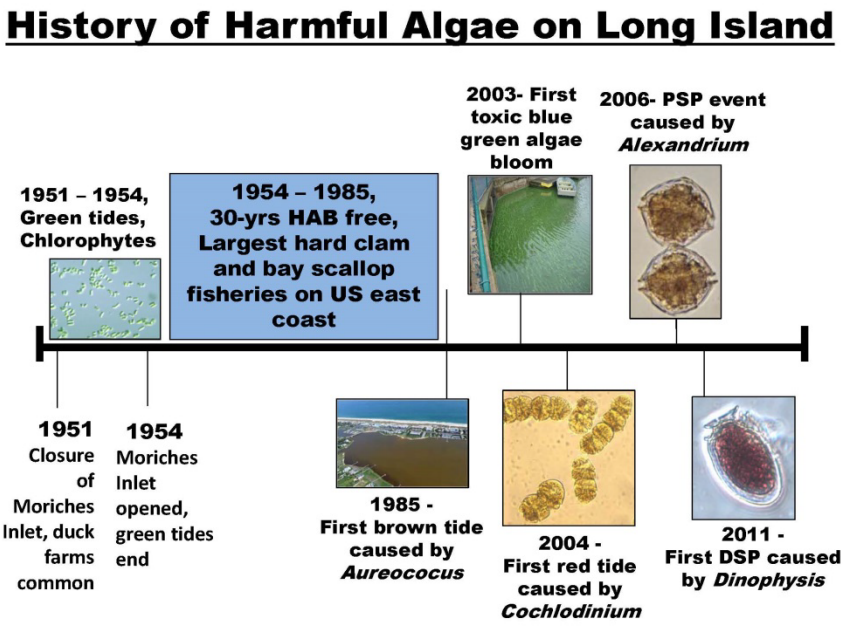
[8] Vitousek, P. M. *et al.* Human alteration of the global nitrogen cycle: sources and consequences. *Ecological Applications* **7**, 737–750 (1997).

[9] Vitousek, P. M. *et al.* Towards an ecological understanding of biological nitrogen fixation. *Biogeochemistry* **57**, 1–45 (2002).
[10] Howarth, R. W. Coastal nitrogen pollution: a review of sources and trends globally and regionally. *Harmful Algae* **8**, 14–20. (2008).
[11] Johnson, P. T. J. *et al.* Linking environmental nutrient enrichment and disease emergence in humans and wildlife. *Ecological Applications* **20**, 16–29 (2010).

- "The math, via nutrient budgets, that's been done – quantifying the precise amount of nitrogen in pounds per day from different sources including the atmosphere, fertilizers, septic tanks, cesspools, sewage treatment plants – clearly shows that the large majority is from cesspools and septic tanks, going from land into these **South Shore estuaries**," says Gobler. "The groundwater travels through the aquifer, it's going towards the bay. Tainted groundwater flows only a couple of feet a day. So, ironically, the bays may just now be getting hit with the effects of explosive development of the 1960s and '70s."



- Though submerged septic systems have not been thoroughly evaluated, such systems may very well diminish treatment of potentially pathogenic bacteria. "Excess nutrients (nitrogen and phosphorous) from both point and non-point sources from wastewater inputs can significantly impact surface water quality causing anoxia, hypoxia, eutrophication, nuisance algal blooms, dieback of seagrass and corals and reduced populations of fish and shellfish."[12]

[12] Paul, J.H., et al, "Rapid movement of wastewater from on-site disposal systems into surface waters in the Lower Florida Keys," Estuaries, Oct 2000, Vol23, Iss5, pp662-668.

	Suffolk County			New York State		
Year	Total Fertilizer	Farm	Non-Farm	Total Fertilizer	Farm	Non-Farm
2011	34,710.71	20.9%	79.1%	596,891.67	70.1%	29.9%
2012	32,432.19	20.1%	79.9%	590,819.23	72.7%	27.3%

2008-2012 Suffolk County non-farm fertilizer sales was 17.5% of NYS/Agriculture & Markets

- Though the element occurs naturally and is necessary for human health and plant growth, when ingested in high levels, it can deprive bodies of oxygen in blood. In infants, excess nitrogen in water used for formula preparation can lead to "blue baby syndrome," where the lack of oxygen turns the skin blue. In adults, high nitrogen levels, in severe cases, can lead to brain damage.

- Excess nitrogen is also harmful to coastal ecosystems. One important impact of nitrogen loading to coastal systems is low dissolved oxygen, or hypoxia. This occurs when decomposition processes outpace oxygen production and consume dissolved oxygen in the water column. Hypoxia can lead to fish kills and displace marine organisms, cause odors, alter sediment chemistry, and impact the food web.

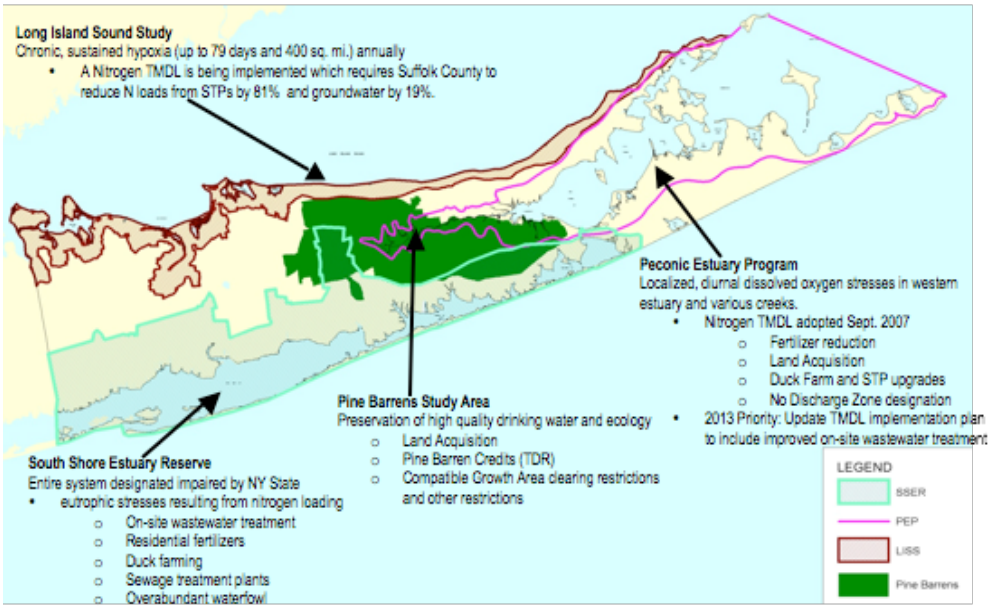
- In 2010 the NYSDEC declared the vast majority of Long Island's South Shore Estuary Reserve system, stretching more than 60 miles, an "impaired water body" (under section 303(d) of the Clean Water Act). NYSDEC identifies nitrogen from wastewater as a reason for this unfortunate designation and states that cesspools, septic systems, and sewage treatment plants cause eutrophication, resulting in lower water oxygen levels and persistent algal blooms throughout this important ecosystem.

- Note: Under the Clean Water Act, states, territories, and authorized tribes are required to develop lists of impaired waters. These are waters that are too polluted or otherwise degraded to meet water quality standards. The law requires that these jurisdictions establish priority rankings for waters on the lists and develop TMDLs for these waters. A Total Maximum Daily Load, or TMDL, is a calculation of the maximum amount of a pollutant that a waterbody can receive and still safely meet water quality standards.

Waterbodies that are designated as impaired will remain on the list until a TMDL has been developed. Waterbodies that are designated as impaired but no longer require a TMDL (usually because a TMDL has been developed) will be listed on the All Impaired Waters List.

- Drinking water safety and prevention of hypoxia are only two reasons Long Islanders are concerned about nitrogen loading. Other important impacts include harmful algal blooms (HABs), declining populations of recreationally and commercially important fish and shellfish, and degradation of wetlands and seagrass - important natural defenses against storms.

- The recurrence of nitrogen-caused low oxygen conditions, are the reason many of Long Islands bays are considered "impaired" (under section 303(d) of the Clean Water Act). For this reason alone, federal and state policies have mandated that nitrogen loads be reduced in the Long Island Sound and Peconic Estuary.



The Tides Are Turning on Us[13]

- October 15, 2013 – Brown tide algae, the color of coffee, has returned to Long Island's South Shore with concentration 20x what is harmful to shellfish in central Great South Bay and is 4x in other parts of the Great South Bay. Chris Gobler says such algal blooms have been forming in South Shore bays for at least the past 25 years.

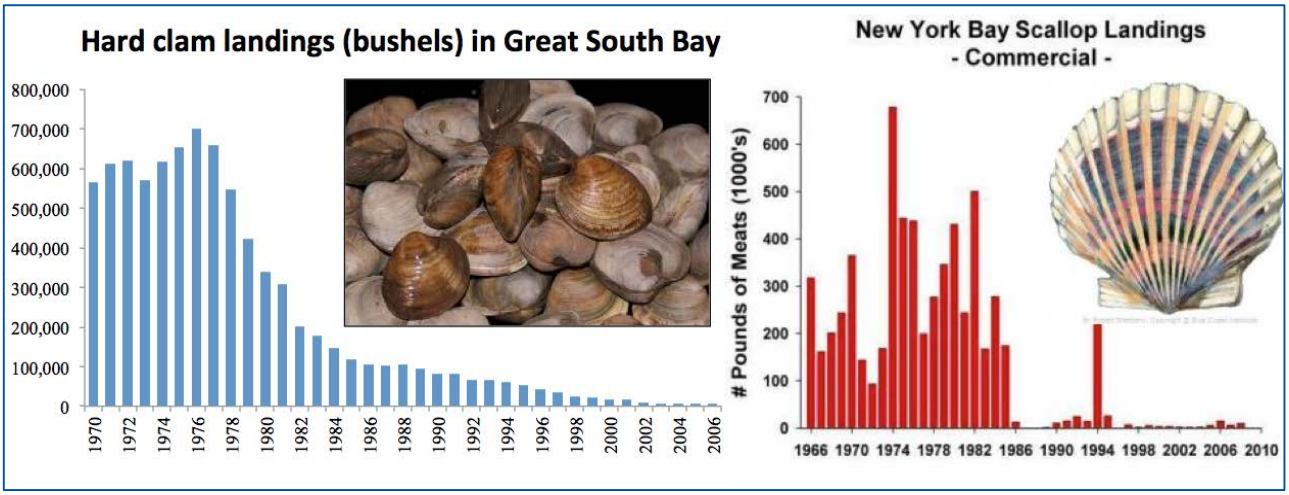
- Since the 1980s, the Brown Tide causing algae A. anophagefferens has plagued Long Island Estuaries, and has been implicated in the crash of the hard clam population in Great South Bay and the iconic bay scallop population in the Peconic Estuary. In effect, the fate of the shellfish population is forewarning for the surrounding ecosystem of eel grass and marsh, like the proverbial canary in the coal mine.

- Since this particular strain of algae, A. anophagefferens, can exploit either inorganic or organic nutrients, it can potentially out-compete other co-occurring phytoplankton under some circumstances. As A. anophagefferens is adapted to grow under low light conditions and can utilize the available dissolved organic nutrients, it proliferates as the waning algal bloom uses up the inorganic nutrients and shades the water column with its biomass.

- Note that the **primary source of dissolved inorganic nitrogen** to many of Long Island estuaries is in fact **groundwater underflow**.

[13] http://www.seagrant.sunysb.edu/articles/t/brown-tide-research-initiative-what-s-new is the source for all material in this section

Reduced groundwater underflow combined with an organically enriched environment provide ideal conditions for the brown tide, allowing it to out-compete other species that rely on inorganic nutrients alone and higher light levels for photosynthesis.



- When hard clam populations were at their peak in Great South Bay in the 1970s, it has been estimated that the entire volume of Great South Bay was "filtered" through the benthic shellfish once every three days. With the dramatic decline in the hard clam population of Great South Bay, by 1993 the estimated time to filter the bay increased to once every 25 days. Field and laboratory results confirm the importance of these benthic filter feeders in helping to control *A. anophagefferens* populations. In tank experiments, under certain conditions, water filtration by hard clams prevented *A. anophagefferens* from blooming. These results suggest that the reduction in benthic filter feeders, such as hard clams, has caused a shift of the dominant grazers on phytoplankton from benthic filter feeders to the zooplankton grazers in the water column. Accordingly, a combination of a healthy population of benthic filter feeders and pelagic grazers could potentially control *A. anophagefferens* abundance and help prevent a brown tide.

- The red-tide, or **rust tide** organism ***Cochlodinium*** has appeared in Long Island waters every year since 2004, with an earlier than usual appearance in 2013. The Department of Environmental Conservation reported a fish kill at Cases Creek in Aquebogue on Aug. 2, finding killifish, snappers, and black sea bass, all with a coating of "orange slime." Gobler said, "Prior research in my lab has

demonstrated that these blooms are made worse by increased nitrogen into these bays."

- The **red-tide** algae, *Alexandrium*, produces saxitoxin, which causes *Paralytic Shellfish Poisoning,* resulting in numbness and tingling in the face and extremities, followed by headache, dizziness, nausea and a loss of coordination; more severe paralysis, respiratory failure and death can occur (NYSDEC). Saxitoxin accumulates in the tissues of molluscan shellfish, posing a human health threat which causes shellfish beds to be closed to fishing, and income to be lost. Blooms of this species began to occur annually in north shore bays on Long Island, but now regularly impact eastern and south shore bays including Mattituck Creek, Sag Harbor Creek, and Shinnecock Bay as well.

- The algae *Dinophysis* produces okadaic acid, which causes *Diarrhetic Shellfish Poisoning* resulting in gastro-intestinal symptoms which can be dangerous or even lethal in high-risk populations. This algae has also expanded its range on Long Island in recent years and has occurred in record concentrations in western Peconic tributaries.

- Another group of harmful algae, Cyanobacteria, have created harmful blooms with increasing frequency and extent in Suffolk County's fresh waters.

Why Are Protective Salt Marshes Falling Apart?

Too Many Nutrients[14]

- NYS 2100 Commission's report: **"Tidal wetlands can protect coastal communities** from storm damage by reducing wave energy and amplitude, slowing water velocity, and stabilizing the shoreline through sediment deposition."

- A 2013 report by the US Army Corps of Engineers concluded that **vegetated coastal features** such as marshlands **can reduce the effects of surge, waves**, and tsunami propagation.[15] Researchers have concluded that coastal wetland vegetation serves as a natural defense system against storm surges and waves along coastal regions, reducing wave height by 80% over short distances. Waves lose energy as they travel through vegetation.[16,17]

- Salt marshes are among the most biologically productive ecosystems on Earth and they perform many ecosystem services that are highly valued by society. "Salt marshes are a critical interface between the land and sea," Woods Hole scientist Linda Deegan says. "They provide habitat for fish, birds, and shellfish; protect coastal cities from storms; and they take nutrients out of the water coming from upland areas, which protects coastal bays from over-pollution."

- Losses of healthy salt marsh have accelerated in recent decades, with some losses caused by sea-level rise and development. The NYSDEC estimates that there was an **18-36% loss in tidal wetlands** in the Great South Bay between 1974 and 2001.[18] As the only South Shore bay with major riverine input, Great South Bay's living resources have been significantly affected by diminished tributary water quality.

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[14] Deegan LA, Johnson DS, Warren RS, Peterson BJ, Fleeger JW, Fagherazzi S, and Wollheim WM (18 Oct 2012) "Coastal Eutrophication as a Driver of Salt Marsh Loss" *Nature*: doi:10.1038.

[15] Anderson ME, McKee Smith J, Bryant DB, and McComas, RGW. (Sept 2013), "Laboratory Studies of Wave Attenuation through Artificial and Real Vegetation" USACE, "It is generally acknowledged that vegetated coastal features such as wetlands can reduce the effects of surge, waves, and tsunami propagation."

[16] Jadhav, Ranjit and Chen, Qin, "Field Investigation of Wave Dissipation Over Salt Marsh Vegetation During Tropical Cyclone" Coastal Engineering, 2012

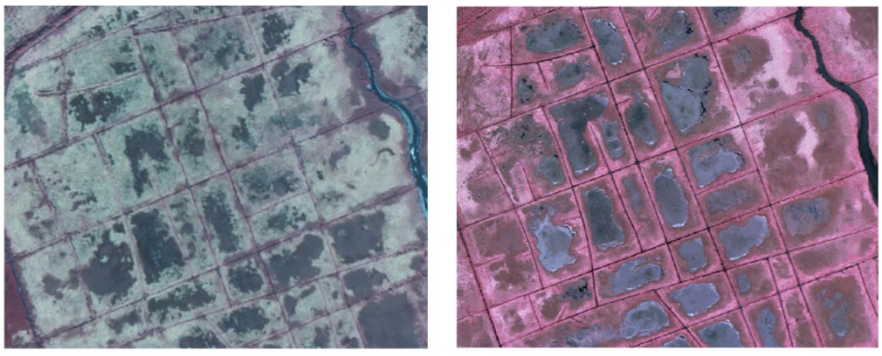
[17] Ysebaert, T, Yang, S.,Zhang, L., He, Q., Bouma, T., Herman, P. "Wave Attenuation by Two Contrasting Ecosystem Engineering Salt Marsh Macrophytes in the Intertidal Pioneer Zone" Society of Wetland Scientists 20 Sept 2011

[18] http://www.dec.ny.gov/lands/31989.html

- Based upon 36 years of nutrient enrichment in replicated field experiments, a team of scientists from Louisiana State University's Department of Oceanography and Coastal Sciences, the Coastal Systems Program at the University of Massachusetts-Dartmouth, and the Woods Hole Oceanographic Institution drew the following conclusions: "Enrichment reduces organic matter belowground and may result in a significant loss in marsh elevation equivalent to about half the average global sea level rise rates. Sustaining and restoring coastal emergent marshes is more likely if they receive less, not more, nutrient loading.... The salt marshes most vulnerable to changes in elevation will be those organic-rich salt marshes at the low end of their elevation range and exposed to relatively high nutrient loading.... An example of this situation might be in [neighboring] Jamaica Bay, New York, an estuary that has lost much of its salt marsh to fragmentation, and has had significant marsh dieback (near complete loss of vegetation in salt marsh parcels, with subsequent erosion and down-estuary transport of sediment away from the marsh platform).[19,20]

- Marsh loss through expansion of unvegetated pannes is a widespread phenomenon especially prevalent in northeast estuaries. As these unvegetated areas expand, the vegetated area of marsh and the delivery of ecosystem services from these marshes, like coastal protection from storm surges, are also lost.

Smith's Point North



1974 2008

[19] Turner, R. E. et al. Salt marshes and eutrophication: an unsustainable outcome. Limnol. Oceanogr. 54, 1634–1642 (2009).
[20] Hartig, E. K., et al. Anthropogenic and climate-change impacts on salt marshes of Jamaica Bay, New York City. Wetlands 22: 13–31. (2002)

- According to Coastal Resilience 2.0, a project of The Nature Conservancy, from '74-'08 Smith's Point marsh diminished by 28.31% and Gardiner Park by 33.67%.

- Excessive nitrogen has been shown to have a direct effect on seagrass by promoting growth of microalgae which shade it and macroalgae which out-compete it. Thousands of acres have died off in Long Island's Eastern and South Shore estuaries. According to the NYS Seagrass Taskforce, historic photography and records indicate that there may have been as much as **200,000 acres of seagrass in 1930** in Long Island bays and harbors; only about **22,000 acres remain**.

- Global decrease in estuarine and coastal ecosystems (ECEs) is known to affect at least three critical ecosystem services (Worm et al. 2006): the number of viable (non-collapsed) fisheries (33% decline); the provision of nursery habitats such as oyster reefs, seagrass beds, and wetlands (69% decline); and filtering and detoxification services provided by suspension feeders, submerged vegetation, and wetlands (63% decline). The loss of biodiversity, ecosystem functions, and coastal vegetation in ECEs may have contributed to biological invasions, declining water quality, and decreased coastal protection from flooding and storm events.[21]

- Like wetland systems, seagrass beds dampen wave energy and stabilize sediment, protecting Long Island's coastal communities from the impact of storms and flooding. "Larger seagrass bed width in the direction of wave propagation results in higher wave attenuation, and relative wave attenuation increases as incoming wave height increases…. A few authors have postulated that seagrass beds could reduce the energy that reaches shorelines, and potentially protect shorelines from being eroded"[22]

- Wetlands and seagrass beds are also critical to the resiliency of Long Island's marine food web to the impacts of storms and climate change, and ecological threats like eutrophication and harmful algal blooms. By providing the nursery habitat necessary for reproduction of key species at the base of the food web, these habitats are essential to the success of recreationally and commercially important finfish and shellfish.

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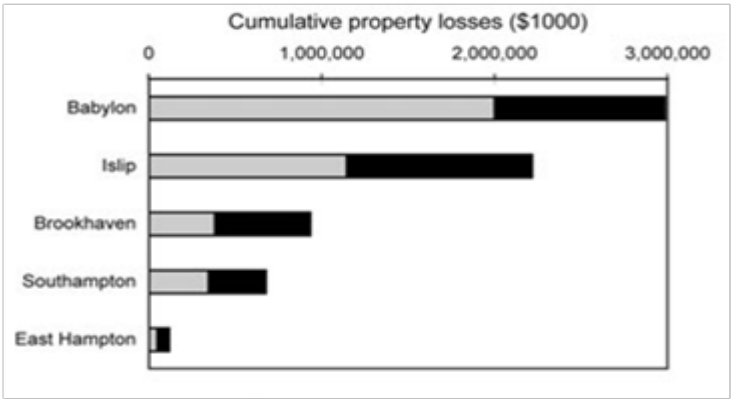
[21] Barbier EB, et al. "The value of estuarine and coastal ecosystem services." Ecol Monogr 2011;81:169–193.
[22] Chen S-N,et al. "A nearshore model to investigate the effects of seagrass bed geometry on wave attenuation and suspended sediment transport." Estuaries Coasts 2007;30:296–310.

- Coastal wetlands reduce the damaging effects of hurricanes on coastal communities by absorbing storm energy in ways that neither solid land nor open water can. The mechanisms involved include decreasing the area of open water (fetch) for wind to form waves, increasing drag on water motion and hence the amplitude of a storm surge, reducing direct wind effect on the water surface, and directly absorbing wave energy. Since marsh plants hold and accrete sediments, often reduce sediment resuspension, and consequently maintain shallow water depths, the presence of vegetation contributes in two ways: first by actually decreasing surges and waves, and also by maintaining the shallow depths that have the same effect.[23]

- "Coastal habitats – such as seagrasses, kelp forests, coral reefs, mangroves, wetlands, and dunes – can provide protection from erosion and inundation due to storm surge. Loss of these nearshore habitats can have dire implications, including damage to coastal infrastructure, private property, and loss of human life.... Existing coastal habitat protection laws aimed at reducing eutrophication of receiving waters also keeps in check those same biophysical processes that exacerbate ocean acidification." [24]

- "The number of people, poor families, elderly and total value of residential property {exclusive commercial} that are most exposed to hazards can be reduced by half if existing coastal habitats remain fully intact. Coastal habitats defend the greatest number of people and total property value in Florida, New York and California.... Large expanses of coastal forests and wetlands, oyster and coral reefs, dunes and seagrass beds (Supplementary Fig. S4) are critical for protecting the eastern seaboard.... Variation among counties in the value of property now protected by coastal habitats is substantial, ranging from US$0 (for example, Jefferson, Florida), to more than US$20 billion in ***Suffolk*** and Kings, New York." - Arkema, Katie K, et al, "Coastal habitats shield people and property from sea-level rise and storms," Nature Climate Change, July, 14, 2013.

[23] Costanza R, et al. "The valueofcoastalwetlandsforhurricaneprotection." Ambio 2008;37:241–248.
[24] Ruckelhaus, M, et al, "Securing ocean benefits for society in the face of climate change," Marine Policy, Jan 6, 2013



The Community Vulnerability Assessment Tool (NOAA) identifies block groups that are at most risk, assessing damages resulting from a category 3 hurricane (gray) compounded .5m sea-level rise (black),[25] + values of tidal marshes.[26]

Case #1: The Forge River

"It's the worst case of anoxia [absence of oxygen] I have seen."

-Larry Swanson, coastal oceanographer, Marine Science Research Center, (New York Times, 2/28/08)

"The **Forge River** has been a distressed estuary since the early part of the 20th century. Extensive duck farming in the 20th century along the banks of the Forge River and high density residential development contributed to the high-nitrogen sediment load that remains. Residential development booms in the Mastic Beach area in the early 20th century and on the peninsula in the mid-20th century added thousands of onsite wastewater treatment systems (cesspools and septic

"Assessing future risk: quantifying the effects of sea level rise on storm surge risk for the southern shores of Long Island, New York," Nat Hazard 2011: 727-745.

[26] Bromberg, K, et al, "Centuries of human driven change in salt marsh ecosystems," AnnRvw Mar Sci 2009; 1-117-141.

systems) inside the Forge River watershed. Residents of the Forge River watershed continue to report **malodorous conditions and fish kills** while local scientists report hypoxic and anoxic conditions that are inhospitable to aquatic life.

"Nitrogen loading, in order of quantity delivered to the estuary, is from residential septic systems, the duck farm, private treatment plants, release from the sediments, residential and agricultural fertilizer use, and to a lesser extent atmospheric deposition and stormwater. The Characterization report concludes that the severe dissolved oxygen depletion in the Forge River is primarily due to algal blooms fed by exceptionally high nitrogen. The majority of the nitrogen entering the estuary is from groundwater that is years or tens of years old and therefore reflects historic inputs. Groundwater continues to receive nitrogen from septic systems and fertilizer use. Dense algal blooms will recur annually, particularly during the summer, as long as new and historic nitrogen loading and circulation remains unchanged…. The **Forge River has a history of water quality impairments** and has experienced chronic hypoxia and fish kills. In 2006, using methodology established by the Federal Clean Water Act, the river was categorized as a waterbody that did not meet water quality standards, and was placed on **New York State's "303(d) list**." – Cameron Engineering & Associates, LLP & CH2MHill, Forge River Watershed Management Plan, March 2012.

"The sheer volume of groundwater that feeds the Forge River and its tributaries, especially in high-density areas, delivers a tremendous nitrogen load, likely far more than, say, a concentrated amount from a point-source discharge" -Robert Waters, supervisor, Suffolk County Department of Health Services' Bureau of Marine Resources (2/28/08).

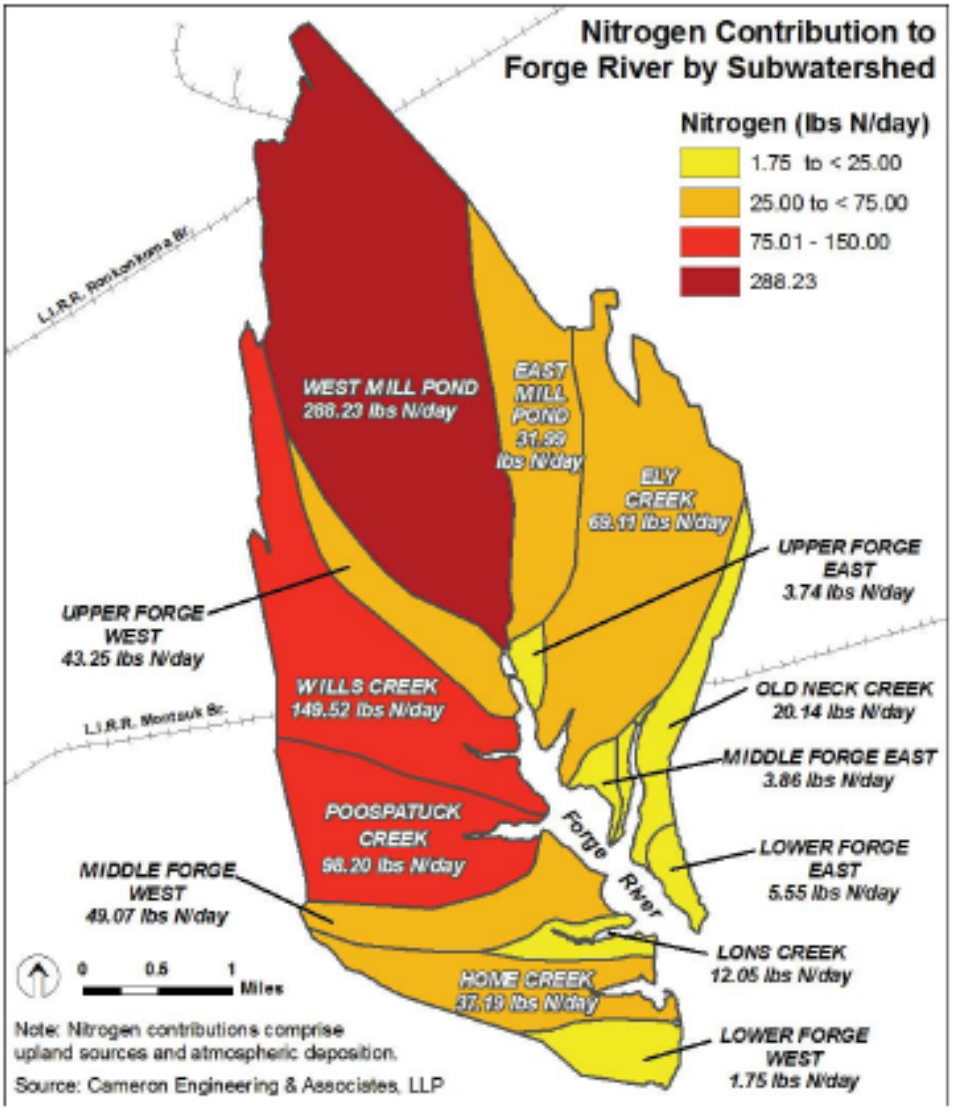
"The eastern boundary of the study area consists of the Forge River and its tributaries. The River is an estuary that has been identified as an impaired water body and is included in the New York State Department of Environmental Conservation (NYSDEC) 303 (d) list for pathogens, nitrogen and dissolved oxygen/oxygen demand. Incorporation of the densely developed residential area in the western part of the Forge River watershed to **the potential Sewer District boundary provides a significant environmental benefit** which helps to satisfy the stakeholder goals associated with improving the water quality of the Forge River."

"Many homes close to the estuary are at elevations so low that there is little unsaturated soil between the on-site system and groundwater. Here there is no opportunity for soil bacteria or roots to act on the nitrogen prior to its release to groundwater and then the estuary. Several hundred homes are less than nine feet

above groundwater, the minimum currently required by the County for on-site wastewater treatment systems (p. 11-54).

"If groundwater nitrogen were significantly reduced, algal blooms would be less frequent and less intense. Less intense and fewer algal blooms would reduce the deposition of organic matter to the sediments. Activity by aerobic sediment bacteria would slow, releasing less nitrogen back to the water table. Anaerobic bacteria located deeper in the sediment where oxygen is depleted, would denitrify remaining organic material and release nitrogen to the atmosphere. Reducing groundwater nitrogen inputs to the estuary is one of the most effective ways to improve water quality in the Forge River (p. 11-57)."

Figure 11-40. Nitrogen Contributions by Subwatershed



Note: The Jurgielewicz Duck Farm ceased operations just prior to the publication of this report. Nitrogen loading will be re-calculated as part of the formulation of the TMDL without the input from the duck farm.

Water Resource Management Plan Goals

The goals and objectives summarized on **Table ES-1** are targeted to protect and improve ground and surface water quality in the coming years, recognizing that maintenance of these invaluable resources is vital to the health and economic well-being of Suffolk County residents, and to enable provision of a healthy and safe supply of potable water to County residents through 2030. Although it is acknowledged that full achievement of these goals within the next twenty years may not be realized, the recommendations presented in this document provide the framework for continued improvement of the County's water resources and provision of a reliable, high quality potable supply for future generations.

The goals and objectives are consistent with County policy declarations that are articulated in the Suffolk County Sanitary Code:

...§760-701: *" The designated best use of all groundwaters of Suffolk County is for public and private water supply, and of most surface waters for food production, bathing and recreation .... it is hereby declared to be the policy of the County of Suffolk to maintain its water resources as near to their natural condition of purity as reasonably possible for the safeguarding of the public health, and to that end, to require the use of all available practical methods of preventing and controlling water pollution from sewage, industrial and other wastes, toxic or hazardous materials, and stormwater runoff" and*

760-401: " the policy of the County of Suffolk is to protect the groundwater to insure the availability of an adequate and safe source of water supply for generations to come by: enforcing the local, state and federal laws regulating water supply; promoting the extension of public water supply to all areas of the County; maintaining a process of groundwater planning; carrying out research and development in the field of alternatives to community water supply; and by promoting education and acceptance of the importance of groundwater management and protection."

Table ES-1
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.*

Source Water Assessments

Recognizing that activities in a water supply's source water area have a significant potential to affect quality of the potable supply, the New York State Department of Health (NYSDOH) directed the development of Source Water Assessments for all public supply wells that existed in Suffolk County in 2003.

As part of this project, updated source water assessments were completed for all existing and planned community supply wells identified by Suffolk County water suppliers. The source water assessments have three major components:

- *Use of three dimensional groundwater flow and contaminant transport models to delineate the area contributing recharge to each well (source water area), and to estimate the time of travel from the water table to the well screen;*
- *Use of GIS and extensive databases to identify the prevalence of each contaminant category within the source water area, based upon land uses and the presence of potential point sources of contamination;*
- *Evaluation of the susceptibility of each well to potential contamination, based upon contaminant prevalence, contaminant fate and transport characteristics, and travel time to the well screen.*

Groundwater Quality

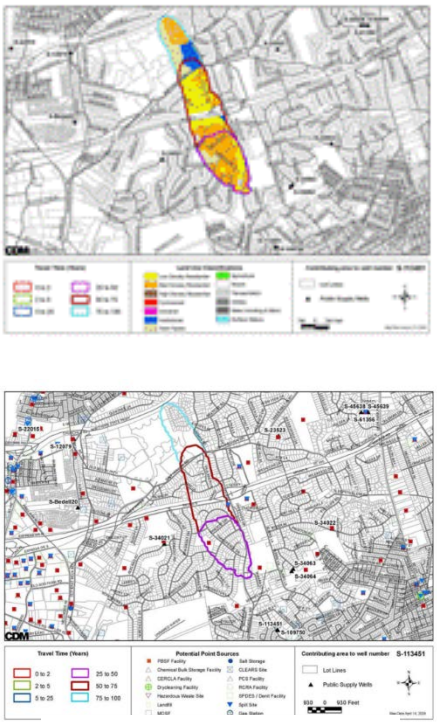
Groundwater throughout most of the County is of generally very high quality In fact, the ***1987 Comp Plan*** identified only four inorganic constituents chlorides, sulfate, iron and manganese – that exceed drinking water standards in native groundwater in some parts of the aquifer system. Although Suffolk County's 1.5 million residents live directly above the sole source aquifer, the quality of the County's groundwater remains remarkably good due to the concerted efforts of water resource managers. Nevertheless, review of water quality data reveals that concentrations of many contaminants introduced to the groundwater by human activity have increased over the past 25 years since the ***1987 Comp Plan*** was completed.

Suffolk County has long recognized that land uses and activities occurring above ground can have a direct impact upon groundwater quality, as recharging precipitation can transport dissolved contaminants from materials used, stored or disposed of at the ground surface down through the unsaturated zone to the underlying aquifer. The sands, silts, gravels and clays that make up the unsaturated zone and the aquifer system function as a large sand filter that has helped to limit the impact of many of these contaminants on groundwater quality. While implementation of regulations and management activities protecting groundwater quality have been effective in reducing the impacts of human development, the continued effects of overlying land uses on groundwater quality in the County are evident.

New York State Department of Environmental Conservation (NYSDEC) has established groundwater quality criteria for over one hundred contaminants, and improved analytical capabilities allow detection of hundreds of additional contaminants, at increasingly lower concentrations. This study focused on contaminants that have been identified in Suffolk County groundwater – nitrate, which has long been identified as the inorganic parameter causing the most widespread concern; volatile organic compounds (VOCs) and pesticides, which have previously been identified as a serious threat to groundwater quality, and additional contaminants of concern, whose occurrence and health impacts are still being studied, such as perchlorate and pharmaceuticals and personal care products (PPCPs).

A comparison of water quality data collected from community supply wells that were sampled in both 1987 and in 2013 reveals that concentrations of nitrate are increasing in all three aquifers, as a result of sanitary wastewater discharges and fertilization practices. A comparison of average nitrate concentrations from all community supply wells that existed in 1987 and in February 2013 shows that nitrate concentrations, on average, have increased

more than 1 mg/L in the Upper Glacial aquifer and about 0.76 mg/L in the Magothy 6 mg/L in 83 percent of all community supply wells in 2013. Less than one percent of all raw water samples collected from community supply wells exceeded the 10 mg/L drinking water Maximum Contaminant Level (MCL). Private well sample results showed that almost one third of the private wells tested contained less than 1 mg/L nitrate, approaching native groundwater quality, and nitrate concentrations in nearly 75 percent of the private wells were less than or equal to 6 mg/L. However, nitrate levels in nearly ten percent of the 9,473 private wells sampled between 1997 and 2013 exceeded the 10 mg/L MCL; these impacted wells were primarily located in agricultural areas of the north and south forks and in pockets of the more densely developed unsewered areas of the north and south shores. In summary, while groundwater throughout most of the County continues to comply with the nitrate MCL, the data indicates that the quality of the aquifer has been particularly evident in the shallow zones of the aquifer that are utilized by private wells.

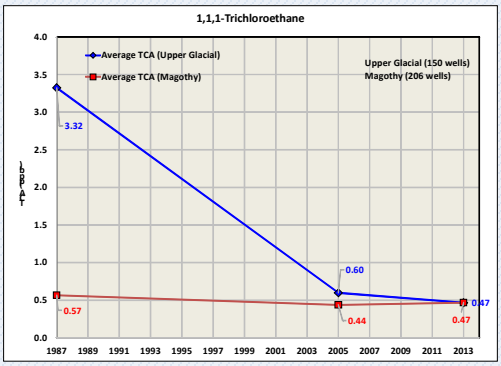


SCDHS routinely tests groundwater for over 90 VOCs including four of some of the most commonly detected in the County (tetrachloroethene or PCE; trichloroethene or TCE; 1,1,1-trichloroethane or TCA, and MTBE). Increased detections of VOCs throughout the County, albeit at low concentrations, indicate widespread use and release to the environment. Isolated areas of higher levels of VOC contamination are associated with industrial, commercial, transportation or institutional land uses.

The data shows that PCE has not been detected in about 92 percent of the supply wells sampled from 2009 through 2013, and PCE levels in raw water samples collected from over 98 percent of the supply wells tested remain below the drinking water standard of 5 µg/L. However, a comparison of PCE levels in wells that were sampled in both years indicates that PCE was detected in over three times as many wells in 2013 as in 1987 and average PCE concentrations doubled in the same set of Upper Glacial and Magothy wells.

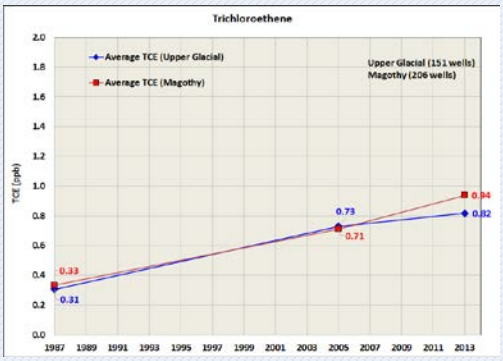
Source Water Assessments Used Computer Models, Land Use Data, Potential Point Source Locations, and Contaminant Fate and Transport Characteristics to Assess the Susceptibility of Each Community Supply Well to Contamination.

1,1,1-TCA Concentrations in Public Supply Wells 1987-2013



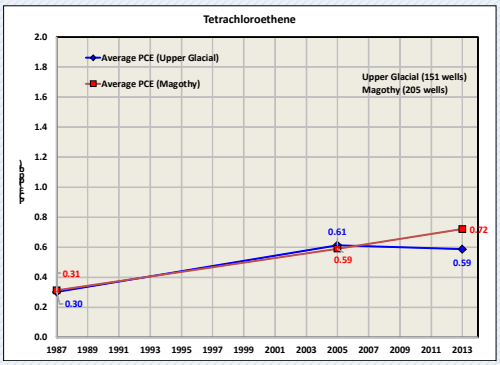
- 1980:Banned as cesspool additive
- 1996:US manufacturing ban
- Concentrations and the # of impacted wells have decreased in both aquifers

TCE Concentrations in Public Supply Wells 1987-2013



- # of impacted wells more than doubled
- Average TCE concentrations have nearly tripled in both aquifers

PCE Concentrations in Public Supply Wells 1987-2013



- The # of impacted wells doubled
- Average PCE concentrations approximately doubled in both aquifers

The analysis of TCE identifies a similar trend of increasing detections. Although TCE was not detected in over 90 percent of the wells tested in 2013, and concentrations in over 98 percent of supply wells remained below the drinking water standard of 5 µg/L, TCE was detected in more wells – and at higher average concentrations – in 2013 than in 1987. Average TCE concentrations nearly tripled from 0.31 µg/L to 0.80 µg/L in the 160 upper glacial public supply wells that were sampled in both 1987 and 2013. Average TCE concentrations also nearly tripled from 0.33 µg/L to 0.93 µg/L in the same 211 Magothy wells sampled in both 1987 and 2013.

A completely different trend was observed for 1,1,1-TCA, a chemical previously used as an additive in cesspool cleaners prior to a 1980 ban in Suffolk County, and a chemical which also received a domestic manufacturing ban under the United Nations Montreal Protocol in 1996. Resultant reductions in the release of this contaminant from the bans resulted in marked improvement in water quality for this contaminant. Although very low levels of TCA were reported in all aquifers; TCA levels and the number of impacted wells have declined since the last assessment was performed in 2005. All but two public supply wells, one Upper Glacial and one Magothy, met the drinking water standard of 5 µg/L based on testing in 2013. Average TCA concentrations decreased from 3.16 µg/L to 0.47 µg/L in the 159 public supply wells screened in the upper glacial aquifer that were tested in both 1987 and 2013. Average TCA concentrations in the Magothy supply wells tested from both years also decreased, although not as dramatically, from 0.57 µg/L to 0.47 µg/L.

The former gasoline additive MTBE, which has been banned in New York State since 2004, also experienced fewer detections in public and private supply wells. In 2005, MTBE was detected in 16% of the public supply wells sampled and in 2013 the number of detections dropped to only 49 public wells or about 5% of the wells sampled. The presence of MTBE was detected in almost 10 percent of the private wells SCDHS tested from 1997 through 2007, and 1.4% exceeded the drinking water standard of 10 ppb. In 2013, MTBE was detected in less than 5% of raw groundwater samples collected from all supply wells, marking a significant improvement.

Pesticides also continued to be detected in groundwater downgradient of agricultural areas. In recent years, extensive investigations conducted by SCDHS, including sampling of public, private and monitoring wells, have identified the presence of over 100

Suffolk County Public & Environmental Health Laboratory Highlights

Types of Samples Analyzed:

- Public & private drinking water
- Groundwater monitoring wells
- Bottled water
- Creeks, lakes, etc.
- Bathing beaches, bays, etc.
- Sewage
- Hazardous waste (contaminant investigations & clean-ups)

Major Accomplishments:

- Approximately 60,000 tests performed annually
- The only lab on Long Island approved to test drinking water for radionuclides
- First lab to detect the gasoline additive MTBE in potable water
- Developed an analytical method for the analysis of the herbicide Dacthal
- Nationally known as first lab to detect carbamate pesticides in drinking water on Long Island
- The only lab on Long Island analyzing for Brown Tide using an approved method
- Analytical capability to test for 150 pesticides and metabolites, more than any other laboratory on Long Island

Goals:

- Increase drinking water analytical capability from 298 to ~380 contaminants
- Contaminants of interest include: PPCP's, pesticides, radionuclides, and 1,4-dioxane

pesticide-related compounds in Suffolk's groundwater. SCDHS found at least 141 community supply wells (approximately 16 percent of the wells sampled) were impacted by pesticide-related contaminants during the period from 1997 through July 2014.

Emerging Environmental Issues

New, more sophisticated analytical techniques have enabled the County to detect the presence of contaminants at parts per trillion levels, much lower concentrations than could previously have been identified. SCDHS has closely monitored available information on emerging contaminants and has analyzed thousands of samples from community, non-community and private wells over the last decade. SCDHS monitoring has identified the presence of trace levels of PPCPs in about 2.5 percent of the samples collected from community supply wells and in an average of 6 to 10 percent of the samples collected from the shallower non-community and private wells. As new information on the detection, fate and transport characteristics, or potential effects of PPCPs is published nearly every day, SCDHS continues to monitor the literature and regulatory initiatives to assess the need to respond to any potential public health concerns. SCDHS must continue to monitor and prepare for emerging and evolving environmental issues such as Unregulated Contaminant Monitoring Rule compounds including 1,4-dioxane and pharmaceuticals and personal care products, soil vapor intrusion, composting, microplastics, and septage management.

Most PPCPs are not currently monitored – and in fact, cannot be monitored at this time. There are potentially hundreds, if not thousands of PPCPs and their metabolites and breakdown products that may be released to the environment. It should not be necessary to monitor for all of these parameters, however the subset of compounds with potential human-health impacts that ultimately should be monitored has not yet been identified. In addition, analytical methods to detect the extremely low levels of some PPCPs and their metabolites that may exist in the environment are not yet available. While analytical protocols to detect some PPCPs have been developed, cost effective methods to rapidly detect the presence of many of the other compounds that may be present have not.

SCDHS is currently in the process of developing the analytical capability to test for 1,4-dioxane in anticipation of a specific federal and/or state drinking water standard. This is considered an emerging contaminant of concern and the chemical is currently regulated as an Unspecified Organic Contaminant in drinking water at 50 µg/L in New York State. 1,4-dioxane has been used as a solvent stabilizer and is present as a byproduct in personal care products such as shampoos and cosmetics. Based on a preliminary evaluation, 1,4-dioxane

appears to be of particular concern in Suffolk County due to the presence of historic sources, groundwater plumes, and the nature of the sandy, sole source aquifer. As of the October 2014 United States Environmental Protection Agency (USEPA) data release from nationwide public water supply monitoring in 2013 and 2014, 31 out of the 40 public water suppliers in New York State with detections of 1,4-dioxane were on Long Island. The highest concentration thus far of 1,4-dioxane in a public water supply throughout the nation was also on Long Island. Suffolk County's largest water supplier, SCWA, has detected this contaminant in approximately 40% of their public supply wells at concentrations of up to 15.2 µg/L.

Microplastics are another emerging contaminant being studied by SCDHS. These are plastic particles, usually made of polyethylene or polypropylene, and less than 5 millimeters in any one direction. Microplastics or microbeads are commonly found in personal care products such as toothpaste, creams, lotions and cosmetics. They have been in use by manufacturers of these products for approximately 10 years. Microplastics can be released to the environment by sewage treatment plants which discharge to surface waters. These tiny plastic particles can then adhere to toxic chemicals such as poly aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), etc. and bioaccumulate in animals upon ingestion. There are many alternatives available to manufacturers including rice, seeds, salt, sugar, bark, cornmeal, oats and shells.

Groundwater Quality and Land Use

Compared to many sources of water supply throughout the country, Suffolk County's groundwater supply remains for the most part, a high quality source of potable water, despite the impacts of the 1.5 million people who live in the watershed. The combined efforts of programs to protect the aquifer system at the federal, state, county and town levels have been very successful in controlling the impacts of development on groundwater - although the continual gradual decline of groundwater quality indicates that additional efforts are required.

As part of this study, the County's calibrated groundwater models were used to delineate the ground surface area contributing recharge or source water for each of the County's 704 existing and planned community supply wells, shown on **Figure ES-1**. The contributing area maps are used frequently by SCDHS as a water resource management tool in evaluating potential receptors from known or suspected contamination, during the review of applications for wastewater management systems, and during evaluation of the transfer of development rights. Using Geographic Information Systems (GIS), these contributing areas were overlain upon land use mappings provided by the SCDEDP as well as

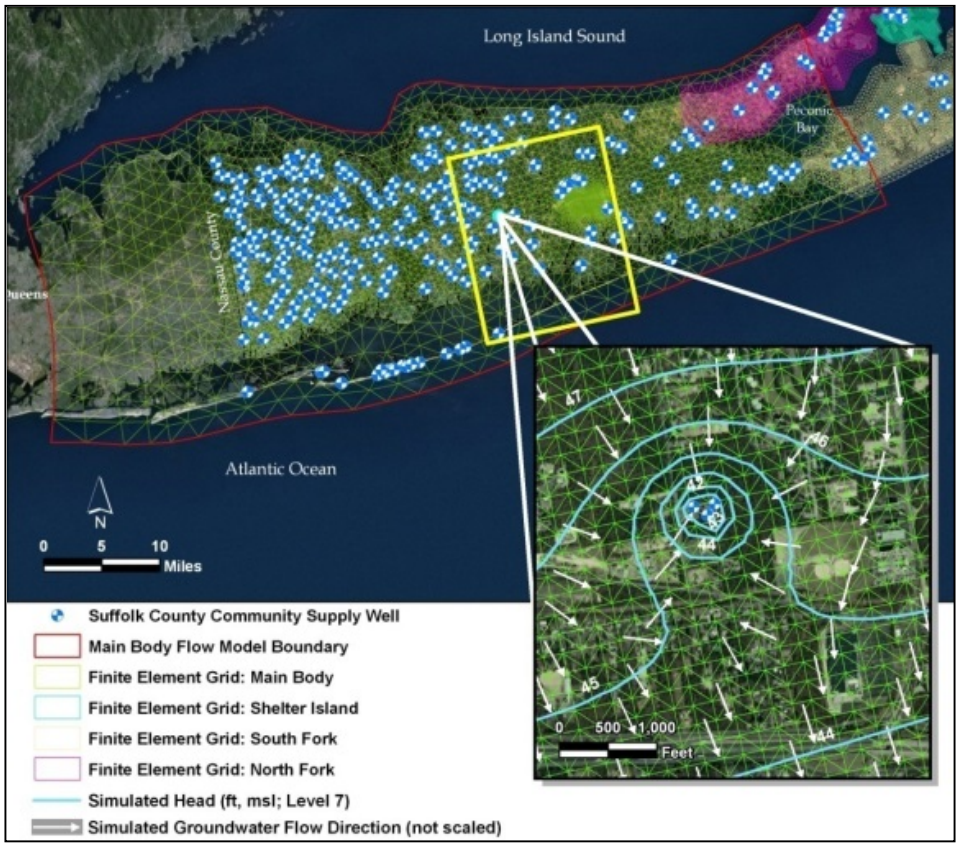


Figure ES-1 Calibrated three-dimensional groundwater and salt water intrusion models were used to develop source water assessments for each community supply well, to help to understand the relationships between land use and groundwater quality and groundwater and surface water resources.

mappings of potential point sources of contamination developed from databases maintained by SCDHS, NYSDEC and the United States Environmental Protection Agency (USEPA). These potential point sources are facilities or properties that have the potential to release contamination to groundwater based on knowledge of the materials used, stored, or disposed of on-site. Based upon the fate and transport characteristics of contaminants commonly associated with the land use types and facilities present within each well's contributing area, and the simulated time of travel from the water table to the supply well's screen, each public supply well's susceptibility to contamination by microbials, nitrates, VOCs and pesticides was assessed and documented.

Historical land uses within a community supply well's contributing area and travel times from the water table to the well screen were used to relate land use to groundwater quality.

The susceptibility ratings resulting from the updated source water assessment analyses show that the majority of Suffolk County community supply wells are vulnerable to nitrate contamination; this demonstrates a need for additional groundwater protection measures. Due to the widespread use of VOCs in the County, the susceptibility of nearly seventy percent of community supply wells is rated as high or very high for contamination by VOCs. Susceptibility to pesticides is rated at low to medium throughout most of the County, except on the North Fork, where community supply wells are highly or very highly susceptible to pesticide contamination introduced to the aquifer by the agricultural lands present. Because it takes years – or decades in some cases – for recharging groundwater to reach a supply well screen, historical land uses can also have a significant impact upon water quality at a well. The relationship between historical land use types within supply well contributing areas and well water quality was also evaluated as part of this study.

On a County-wide basis, sanitary wastewater disposal and fertilization are the two most significant sources of nitrogen loading to the groundwater system. Sanitary wastewater management is one of the most important groundwater resource protection issues facing Suffolk County in both existing developed areas and in currently undeveloped areas. Prior to extensive development, private wells were used to withdraw potable supply from the aquifer; most of the water withdrawn was returned to the aquifer system via on-site cesspools or septic systems. The recharging sanitary wastewater introduced nitrogen and bacteria to the aquifer system, but this was successfully diluted by the greater volume of recharging precipitation and did not cause widespread impacts. Eventually, the sanitary wastewater recharged by more and more residents exceeded the assimilative capacity of the resource in densely developed areas, causing noticeable impacts to the aquifer, drinking water supply, and surface water ecology, and prompting implementation of wastewater collection and treatment systems.

Recognizing the impacts that densely developed unsewered areas have on groundwater and surface water quality, Suffolk County has implemented sanitary sewering programs, and through Article 6 of the County Sanitary Code, established maximum allowable residential densities of one acre in Groundwater Management Zones (GMZ) III, V and VI and ½ acre in GMZs I, II, IV, VII and VIII for new developments that do not include wastewater treatment and disposal facilities. Water quality data and groundwater model simulations show that unsewered areas where property sizes are smaller than one acre are likely to cause groundwater nitrogen concentrations that exceed GMZ target levels of 6 mg/L. Water quality data and groundwater modeling also show that property sizes of ¼ acre or smaller significantly increase the risk of exceeding the 10 mg/L nitrate MCL as shown by **Figure ES-2**. These model

An evaluation of the impacts of historical land use and nitrate concentrations revealed that:

- *Nitrate levels were lowest in wells with contributing areas comprised primarily of open space.*
- *Nitrate levels in wells with sewered contributing areas were lower than nitrate levels in unsewered areas.*
- *Groundwater nitrogen levels increase in unsewered areas as housing density increases.*
- *Wells with contributing areas that comply with the density requirements established by Article 6 of the County Sanitary Code complied with target nitrate concentrations.*
- *Agriculture remains a major source of nitrate contamination, particularly on the North Fork; nitrogen loadings are crop-specific.*

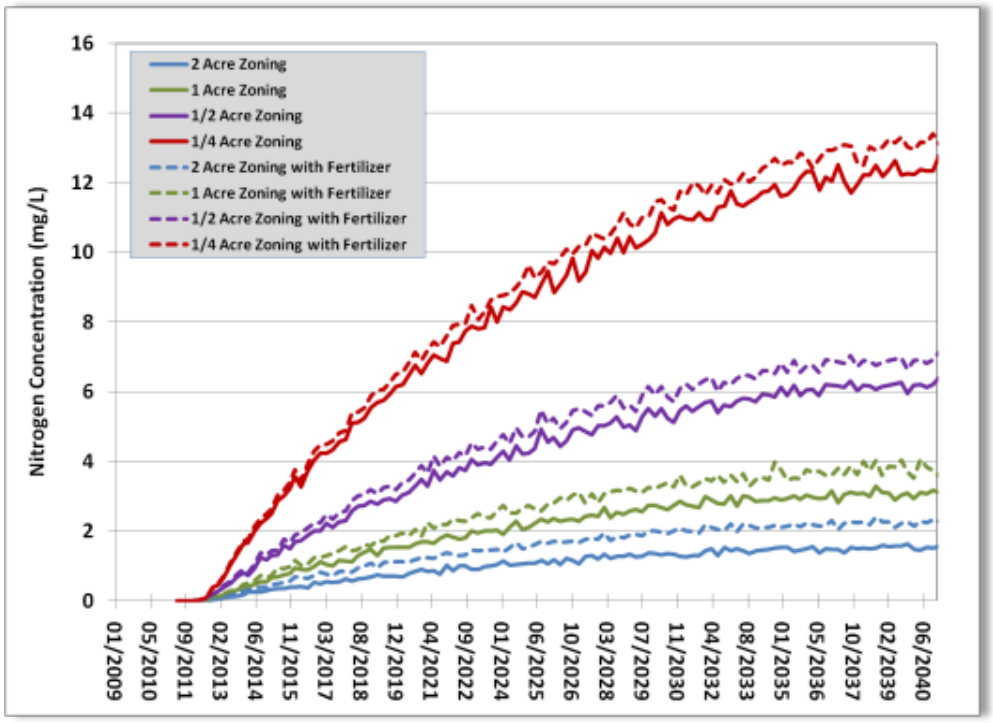


Figure ES-2 Groundwater models were used to assess the impacts of hypothetical unsewered residential areas of various densities upon nitrate concentrations in downgradient groundwater.

simulations of nitrogen levels are higher than previously planning studies because roadways (which would have covered twenty to twenty-five percent of the land area) were not incorporated into the evaluation. Incorporation of roadways would have reduced the overall nitrogen load included in the model, as well as the resulting nitrate concentration.

Data provided by the SCDEDP shows that over sixty percent of residential parcels in the County are less than or equal to the minimum ½ acre size required by Article 6, and indeed, many existing residences with on-site wastewater disposal systems had already been constructed on smaller parcels prior to 1980 when Article 6 was enacted. The observed nitrogen levels in groundwater, which have continued to increase since the ***1987 Comp Plan***, result from a combination of the Article 6-compliant and the older non-compliant parcels.

Sources of VOC contamination can include both point sources, such as leaking underground storage tanks, illegal discharges and spills, and non-point sources such as septic system discharges. Relating the presence of VOCs in groundwater to overlying land use is not straightforward, given the widespread

Prior to extensive development, precipitation infiltrating down through the ground surface travelled through the aquifer system to discharge to one of the County's streams, or to one of the surrounding salt water bodies. In fact, approximately 95 percent of stream baseflow was derived from groundwater.

Although water supply pumping, sanitary wastewater management and stormwater management have all modified the County's predevelopment water budget, groundwater continues to be a significant source of baseflow to streams and wetlands, and discharges millions of gallons to coastal waters each day. Consequently, groundwater quality can have a significant impact upon surface water quality.

use of VOCs, the detections of low levels of VOCs in shallow groundwater throughout the County, and the myriad of potential pathways by which low levels of the contaminants can be introduced to the aquifer system. Water quality data has revealed that the highest levels of VOCs are found in wells with industrial, commercial, transportation or institutional uses within their source water areas. Nevertheless, low levels of VOCs were widely detected in groundwater throughout the County, indicating a more widespread low-level source of the observed contaminants, such as residential septic systems. Before targeted recommendations to reduce the release of VOCs to the County's groundwater can be developed, a better understanding of the potential sources of the observed contamination is required.

SCDHS has been a pioneer in the investigation of pesticide impacts to ground and surface waters. The results of their early investigations led to expanded pesticides monitoring in Suffolk County and throughout the nation, to the ban of some pesticides found to leach to groundwater, and to changes in the federal and state pesticide registration processes to prevent similar contamination from occurring. Pesticide contamination in Suffolk County is primarily associated with agricultural land use.

The public health implications of low concentrations of PPCPs in water are only now being studied and are not yet well understood. PPCPs in groundwater are of most concern in densely developed unsewered areas where sanitary wastewater is discharged directly to the ground via on-site septic systems, cesspools or leaching fields. SCDHS continues to assess the potential presence of PPCPs in groundwater, and monitors literature and regulatory initiatives pertaining to potential public health implications.

Surface Water Quality

Suffolk County's surface waters are renowned for their beauty and their ecological, recreational and economic significance. Both the Long Island Sound and the Peconic Estuary have been federally designated as estuaries of national significance; two of the County's south shore beaches were included on Dr. Stephen P. Leatherman's (a.k.a. Dr. Beach) 2010 list of the "Top 10" beaches in the United States, and the County's streams, harbors and estuaries have great ecological value and significance. The Long Island Sound (LIS), Peconic Estuary and South Shore Estuary Reserve (SSER) have been the subjects of focused studies for years; the LIS Comprehensive Conservation and Management Plan (CCMP), the Peconic Estuary Program (PEP) CCMP and the SSER Comprehensive Management Plan (CMP) all identify a number of strategies and recommendations to improve water quality, reduce use

impairments, and protect and restore habitat and ecosystems in the marine systems and the fresh surface waters that feed them.

This Plan focused on the water quality of the County's fresh surface water features, particularly as they are impacted by the quality of groundwater baseflow. **Figure ES-3** below illustrates the relationship between groundwater and stream baseflow.

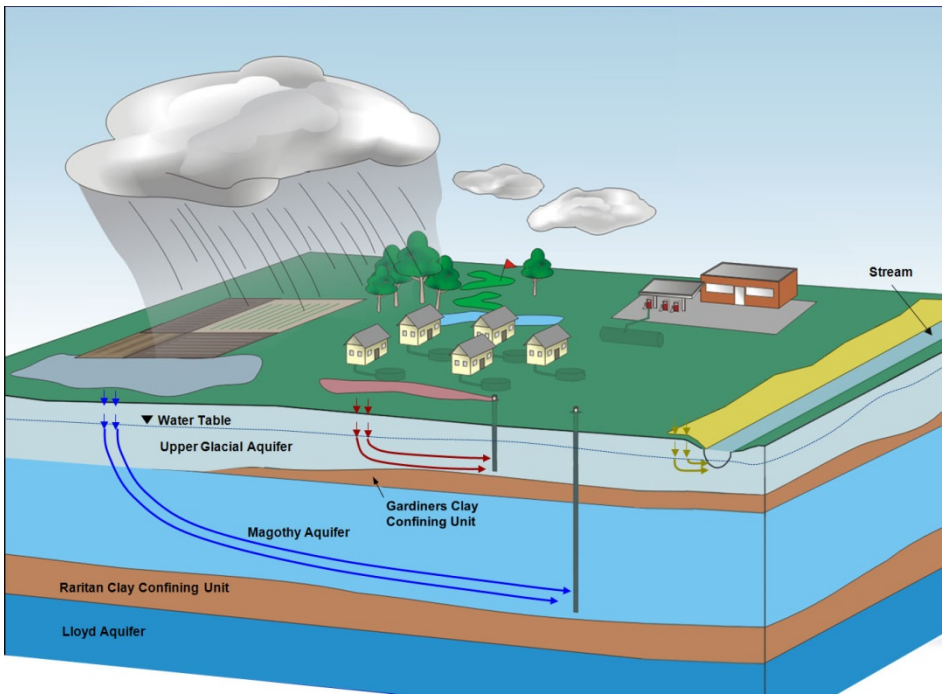
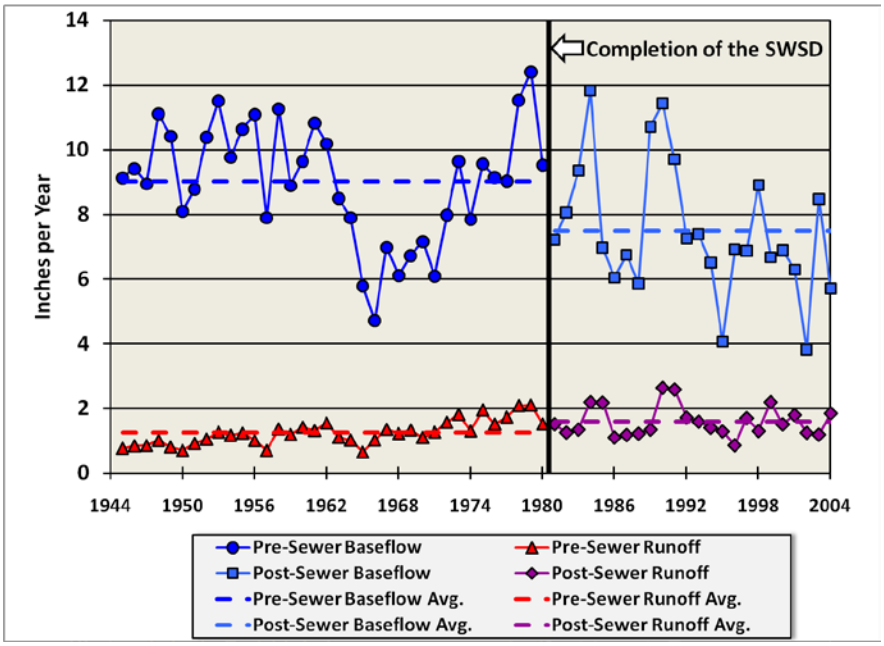


Figure ES-3 Hypothetical watershed showing how land use can affect groundwater and surface water quality

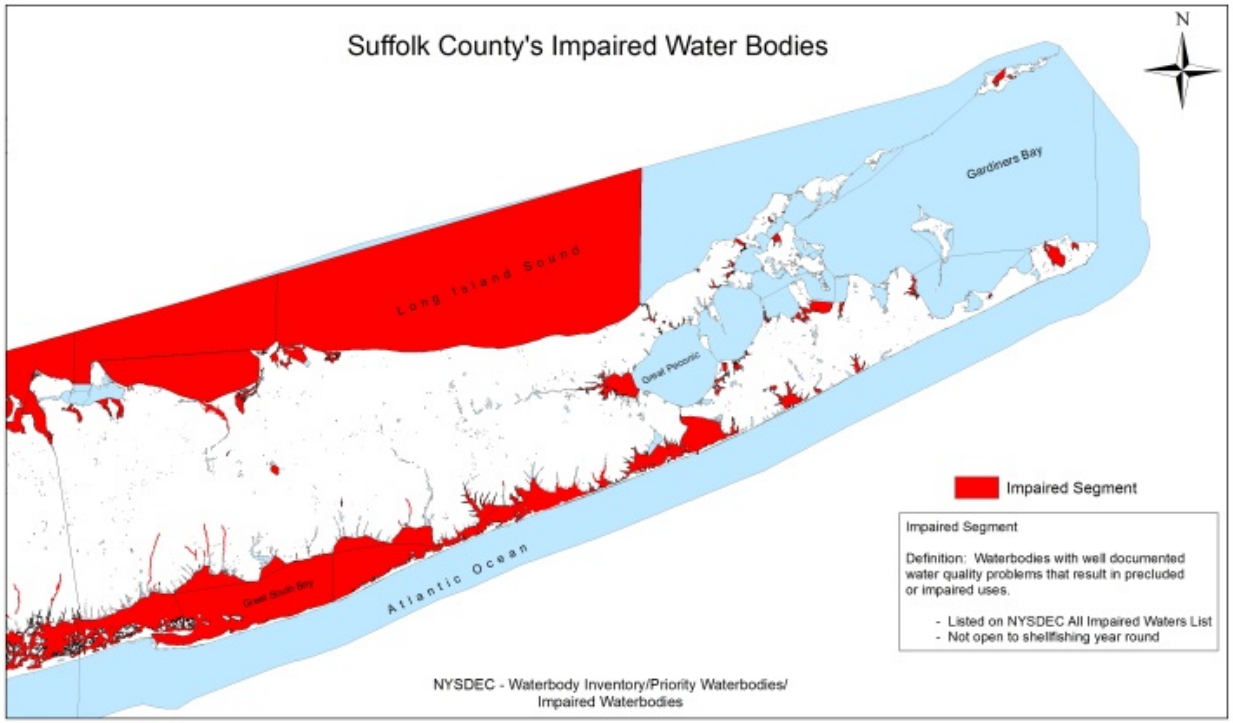
Within Suffolk County, New York State has classified more than 200 freshwater streams and ponds, identified over 50 coastal plain ponds distinguished by ecological communities that support rare and unusual plant species, and regulates over 1,050 freshwater wetlands covering nearly 24,000 acres (NYSDEC, 2006). Only 31 of the fresh water bodies are included on the NYSDEC *All Impaired Waters List*– although this is an indication that the quality of most streams, lakes, and ponds supports their best use, Suffolk County's largest lake (Lake Ronkonkoma) is designated as impaired. NYSDEC has identified pathogens, metals, dissolved oxygen, phosphorus, ammonia, pesticides and silt/sediment as the primary contaminants causing impairment of the fresh surface waters, and storm water runoff as the source of these

contaminants. A review of water quality data characterizing twelve of the larger fresh streams in the County revealed that streams in the more densely developed western part of the County showed higher levels of VOCs than streams located further to the east, and that pesticides were primarily detected in streams in the agricultural eastern areas of the County. In general, as would be expected based upon their properties, VOCs have a lower rate of detection, and lower reported concentrations, in surface waters than in groundwater. Levels of MTBE, the most frequently detected VOC, appeared to be declining in recent years, probably because sale of gasoline containing MTBE as an additive has been prohibited in New York State since 2004.



Even after sanitary sewering was completed in the County's Southwest Sewer District, groundwater baseflow is the major source of streamflow.

The coastal waters bordering Suffolk County are impacted to varying degrees by contaminants introduced by point and primarily, non-point sources. Of the 38 classified saline waters in Suffolk County including the Long Island Sound and those that discharge to the Long Island Sound, 19 are identified as impaired according to the NYSDEC's *All Impaired Waters List*. This includes a large portion of the Long Island Sound as well as all of the county's north shore harbors (Huntington Harbor, Centerport Harbor, Northport Harbor, Nissequogue River, Stony Brook Harbor, Port Jefferson Harbor, Mt. Sinai Harbor and Mattituck Creek). Of the 120 classified saline waters included in



Quick Facts:

- *The SCDHS's Bureau of Marine Resources has been conducting water quality monitoring of the County's estuaries since the 1970's.*
- *Presently, routine monitoring is performed at over 200 stations from all 3 main estuaries (SSER, LIS, Peconic Estuary).*
- *Approximately 10,000 water quality samples are collected annually.*
- *Over 190 Bathing Beaches are monitored under §6-2 of the NYS Sanitary Code to ensure compliance with water quality standards.*

the Peconic Estuary, 41 are identified as impaired the largest of which include Flanders Bay and Reeves Bay. Of the 73 classified saline waters along the south shore including Great South Bay, the Atlantic Ocean, and those that drain to either of these waters, 33 are considered to be impaired. This includes, but is not limited to, the large bays along the south shore of the County (all of Great South Bay, Moriches Bay and Shinnecock Bay). The estuary programs have demonstrated that nutrients (particularly nitrogen) and pathogens are primarily responsible for use impairments and for stressing the living marine resources.

Within the Suffolk County watershed area, nonpoint sources are the major contributors of nutrients and pathogens. Recommendations identified by each of the estuary programs focus on reducing nitrogen loading from sanitary wastewater and fertilization, implementation of best management practices (BMPS) to improve stormwater quality, and open space preservation to improve water quality and reduce impacts on the ecology of Suffolk County's coastal waters. The cumulative impacts of these stresses on the overall health of the aquatic ecosystem are not well understood. Little is also known about the impact of emerging contaminants such as PPCPs on the marine resources; the cumulative impacts of pesticides and PPCPs on the aquatic ecosystems have not yet been well defined, and are currently under study.

Non-point source contributions of nutrients, pathogens and other contaminants have been identified as the primary causes of surface water quality impairments in Suffolk County. Groundwater continues to provide close to ninety percent of baseflow to most streams in the County, and groundwater discharge is one primary source of nutrient loading to fresh and coastal surface waters. The groundwater models were used to delineate the land surface area contributing groundwater baseflow to the County's streams and coastal waters at time of travel intervals ranging from less than one year to fifty years as shown by **Figure ES-4.** Understanding the land use types within

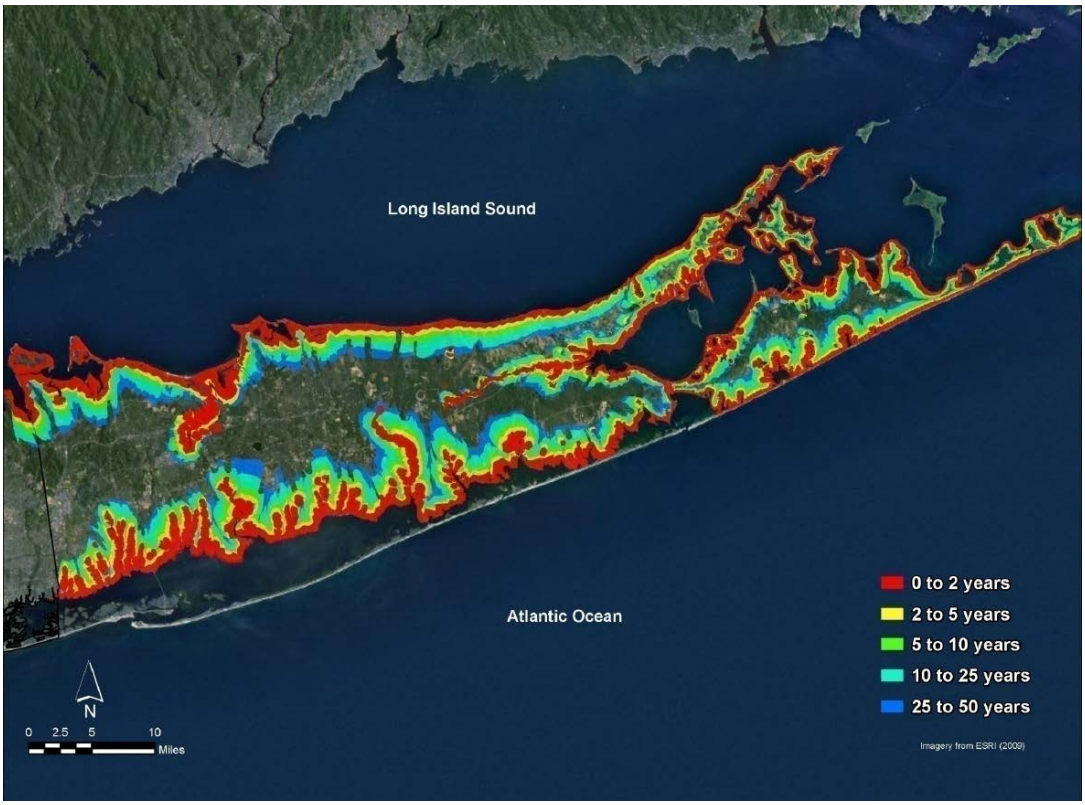


Figure ES-4 Precipitation falling upon the ground surface in the highlghted areas travels through the aquifer system to discharge to County streams, harbors, and other coastal waters. The time that it takes the water to travel from the water table to surface water discharge provides an indication of the time it will take for the effects of management actions to be reflected in the surface water quality.

the groundwater contributing areas to a stream can help to identify the sources of any observed contamination and to guide identification and evaluation of management options to improve water quality, as illustrated by **Figure ES-5.**

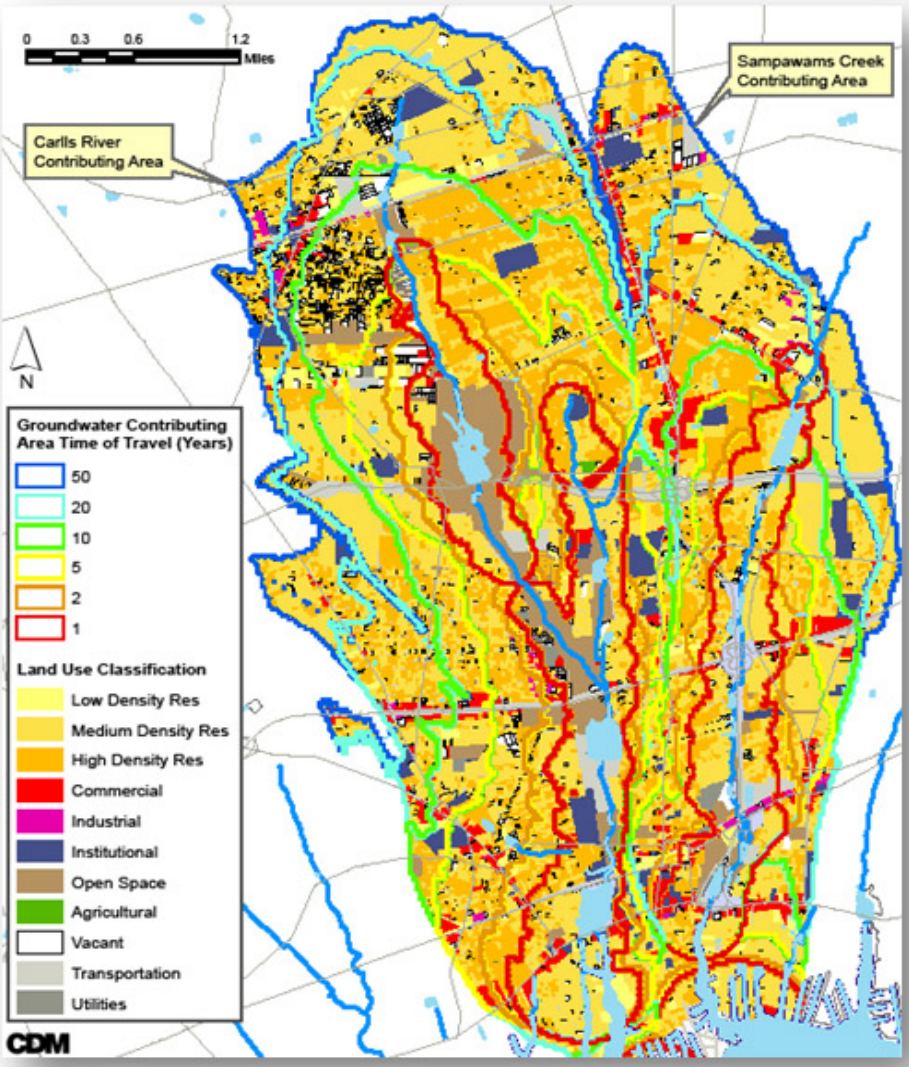


Figure ES-5 *The delineation of groundwater contributing areas to the County's surface waters has aided in the understanding of the impact of land use types on surface water quality and will help select and prioritize management and protection alternatives.*

Management actions implemented to reduce nutrient and contaminant loads to groundwater within the areas contributing to the County's surface water features will reduce these non-point source loads to the surface waters. Protecting the quality of recharge in these areas will help to protect and improve surface water quality. Based on estimated travel time from the water table to surface water discharge, it may take years for the benefits of improved water quality to be fully realized.

Groundwater Quantity

Suffolk County's extensive and productive aquifer system that provides the sole source of potable water supply for the County's 1.5 million residents has been studied for decades. All of the County's groundwater originates as precipitation that recharges the island - the County is fortunate to receive an annual average of approximately 48 inches of precipitation, relatively evenly distributed throughout the year. While the amount of precipitation that recharges the aquifer varies by season and location, on average, it is estimated that approximately 50 percent of the precipitation recharges the aquifers to provide an annual average of approximately 1367 million gallons each day of recharge to the aquifer system. The calibrated Main Body, North Fork, South Fork and Shelter Island groundwater models were used to develop water balances to better understand the County's aquifer system and to begin to assess the magnitude of the impacts that could result from predicted increases in sea level for long term planning purposes.

The water balances compared aquifer conditions that would have existed at the turn of the century prior to extensive development to current conditions, including contemporary levels of public water supply pumping and the operation of stormwater and wastewater management facilities. Long term average recharge rates were based on precipitation records obtained from gages at Mineola, Brookhaven National Laboratory, Riverhead and Bridgehampton. Recent levels of public water supply pumping assigned in the model simulations were based on the average annual pumping rates used for the Long Island Source Water Assessment Program evaluations (SWAP, 2003).

The predevelopment and present day water balances are summarized by **Figure ES-6**.

Under predevelopment conditions, precipitation, the only source of recharge to the groundwater system, traveled down through the aquifer system, until it was ultimately discharged to surrounding coastal waters, either as stream baseflow or as underflow. Construction and operation of sanitary sewering systems that discharge to surface waters results in a net loss of groundwater from the aquifer system, and a potential reduction in the local water table elevation. Because groundwater provides the baseflow for the County's fresh surface water features, sanitary sewering with surface water discharge can also result in a loss of stream baseflow.

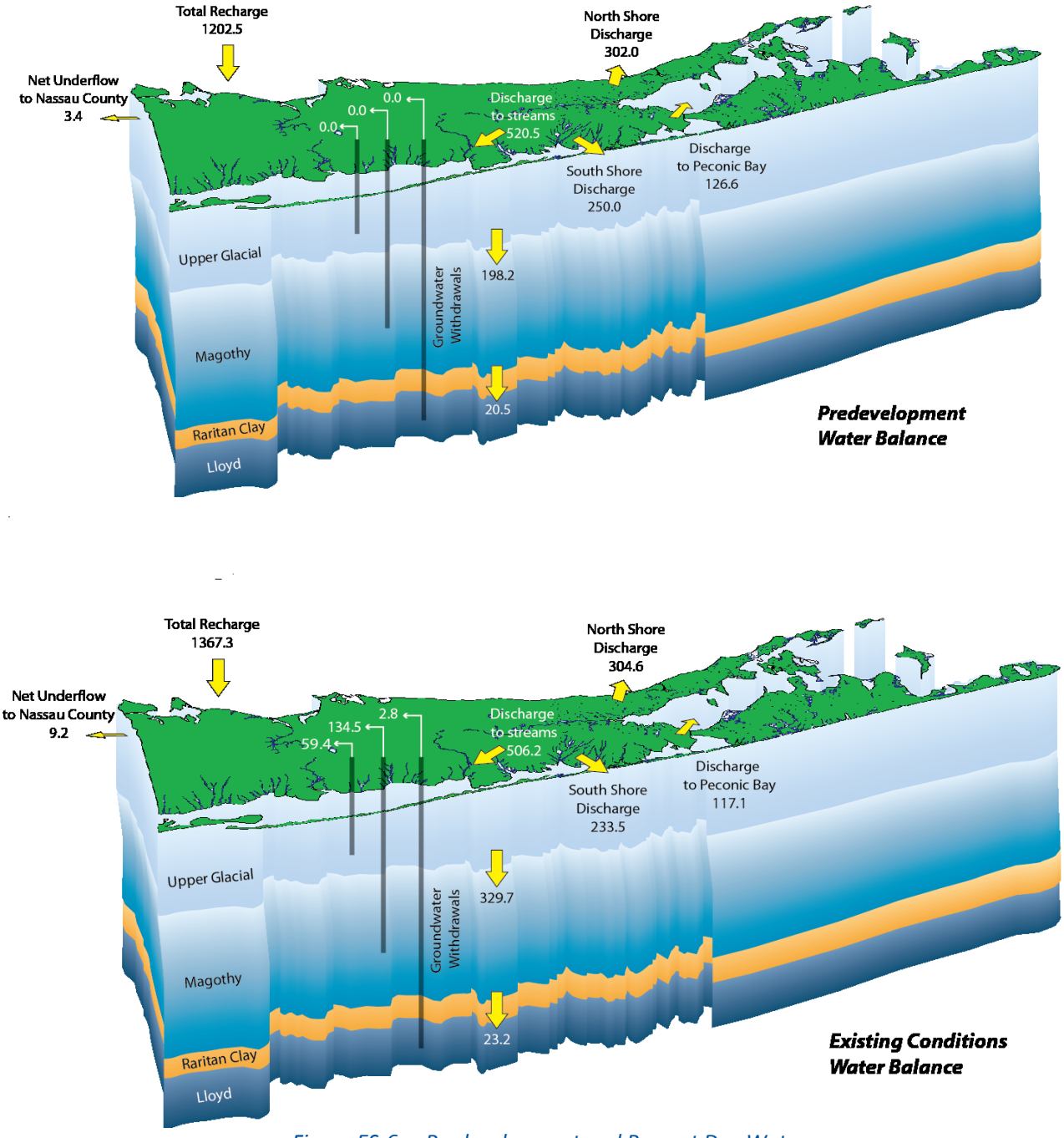


Figure ES-6 – Predevelopment and Present Day Water Balances (All flows in million gallons per day)

The construction of stormwater recharge basins in many parts of the County has increased recharge during the growing season, so that on an annual basis, recharge to the aquifer is actually slightly higher than during pre-development conditions.

The water balances confirm that on a County-wide basis, the aquifer system can sustain current and projected rates of water supply pumping. A comparison of pre-development and current water balances also identifies a net loss of baseflow to area streams and to coastal areas in those parts of the County where water supply pumping is not returned to the aquifer via on-site septic systems or small sewage treatment plants discharging to recharge beds. Suffolk County has evaluated the impacts of sanitary sewering in the Southwest Sewer District (SWSD) on streams and wetlands areas within that district. Potential impacts of development on streams, ponds, wetlands and inter-tidal areas are best considered on a localized basis, considering area water supply pumping, development, and stormwater and sanitary wastewater management approaches.

Sea Level Rise

Sea level rise will compromise over 82,000 unsewered parcels in Suffolk County within this century

- *Almost 25% of the 360,000 currently unsewered parcels in Suffolk*
- *They comprise the majority of the 150,000 sensitive, unsewered parcels in the 25-year travel time to surface waters*
- *This estimate is more than double the previously identified number of potentially compromised parcels (~40,000)*

In the past, sea level had been rising along the East Coast at a reported rate of between 0.34 and 0.43 inches per decade (**Climate Risk Information**, 2009). Over the past century, the rate of sea level rise has been increasing, with the average rate since 1900 now at 1.2 inches/decade. Global warming is predicted to further accelerate the rate of rising sea level, both as a result of the expansion of the warming oceans, and as a result of ice melt. Rapid ice melt scenarios incorporated into other model simulations predict even more significant increases in sea level in the coming years.

The Main Body flow model, and the North Fork, Shelter Island and South Fork salt water intrusion models were used to project the impacts of sea level rise of 34 inches from 2014 to 2100 on the groundwater table. This estimate was selected as the mid-range of "business as usual" (e.g., no reduction in greenhouse gas emissions) projections by Stony Brook University researchers Minghua Zhang, et al in 2014 for the New York Resiliency Institute for Storms and Emergencies. Projections of climate change models vary widely – predicting sea level increases of 12 inches (based on greenhouse gas mitigation) to as much as 75 inches by the end of the century.

The Plan depicts the projected groundwater table elevation depicted in 2035, 2050 and 2100 assuming a linear rise in sea level from present day to 2100. The models show that the impacts of sea level rise on the groundwater table are moderated on the south shore where groundwater baseflow to the numerous

streams and wetland areas is anticipated to increase in response to the rising groundwater table. The exception is on the Barrier Island where groundwater discharges at the surface in many areas.

The impacts of rising sea level are predicted to be more significant on the forks and Shelter Island. For example, over most of the South Fork, the projected increase in water level elevation varies from 1 to 2.5 feet, and the impact is markedly more extensive than projected for the main body of the County. Similar results were projected by the North Fork and Shelter Island models. The simulated rise in the freshwater/saltwater interface position was also assessed for the North and South Forks and Shelter Island; localized increases in the elevation of the saltwater interface will result in a reduction in the thickness of the freshwater aquifer systems.

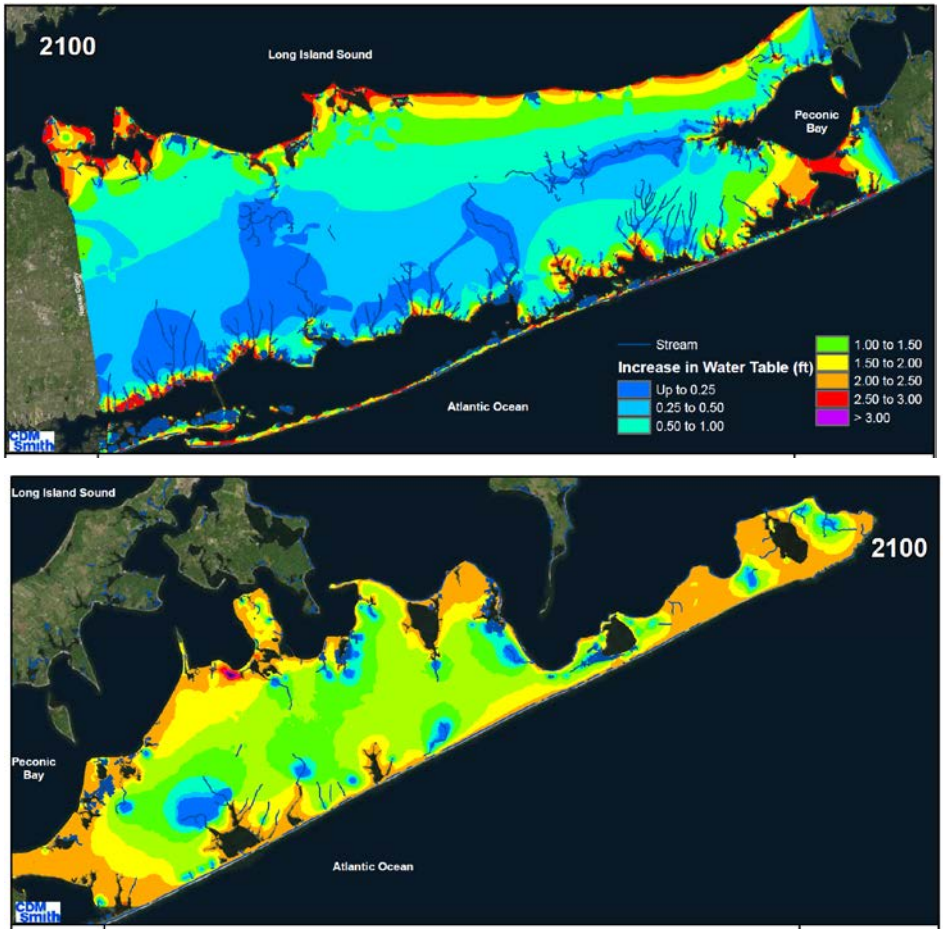


Figure ES-7 The predicted impacts of a 34" rise in sea level on the groundwater table on the main body of Suffolk County and on the South Fork

In the coming decades, Suffolk County will need to address the impacts of projected increases in sea level elevation. Over 56,000 parcels, over fifteen percent al or potentially compromised on-site septic systems. This will only be exacerbated by sea level rise when substantially all of these parcels will be affected by a 1 to 2 foot rise in groundwater. In addition, it is projected that another 26,000 unsewered parcels will be impacted by the end of the century based on the modeled 34" sea level rise.

While there are many uncertainties associated with the impacts of climate change, published research and the results of Global Climate Models consistently indicate that sea level will continue to rise at an accelerated pace. Additional evidence indicates that precipitation is increasing in this part of the world, and that the number of extreme precipitation events is also increasing in the northeastern United States, including Suffolk County. Sea level rise may have profound impacts on low lying coastal areas, particularly along the south shore and on the forks, with significant implications for infrastructure such as stormwater and wastewater collection and disposal systems and water supply. The impacts of sea level rise and more frequent extreme precipitation events should be monitored so that wastewater and stormwater runoff management strategies can be developed if required. The impacts of sea level rise on the location of the saltwater interface must also be monitored and addressed from a water supply perspective. Extreme precipitation events will exacerbate existing drainage problems; reliable solutions can only be developed based upon data characterizing the magnitude of increased water levels and flows.

Drinking Water Supply

From a County-wide water quantity perspective, Suffolk County's aquifers can readily provide the average annual 292 million gallons per day (mgd) required to satisfy projected future (2030) water supply demands. However, as additional wells are sited to meet projected future needs, the effects of water supply pumping on groundwater-fed streams, ponds and wetlands must be considered, and in localized coastal areas, projected water supply demands may exceed the capacity of the limited shallow fresh water aquifer. From a water quality perspective, most untreated groundwater in the County continues to comply with existing drinking water quality criteria, and community supplies are treated to remove the low levels of VOCs or other contaminants that source water monitoring may identify. Community supplies currently provide potable water to more than 87 percent of Suffolk County residents; approximately 72 percent of the population is served by the SCWA. Community supplies are generally the best means of providing a reliable supply of potable water that complies with all applicable drinking water criteria or MCLs.

Several potential issues of concern that affect some residents' access to a reliable and safe supply of water have been identified. These concerns result both from the ability of the aquifer resource to supply sufficient water that complies with all applicable drinking water criteria, and the ability of existing infrastructure to meet water supply demands, now and in the future.

Resource Constraints

Two areas of the County where existing groundwater quality has affected the ability to utilize the existing groundwater supply have been identified during this study:

- Northport and East Northport, where nitrate levels measured in untreated water from existing SCWA Magothy wells have ranged from 8 mg/L to 12 mg/L, and
- Southold, where the extent of the shallow aquifer is limited by underlying and surrounding salt water, and where agricultural contaminants such as nitrates and pesticides have caused widespread groundwater contamination.

Infrastructure Limitations

Infrastructure limitations also affect the reliable provision of potable supply. Customers of some smaller, aging community and non-community supply systems would be served more reliably by a larger community supplier such as the SCWA. A GIS analysis completed as part of this study concluded that approximately 45,000 private wells continue to provide potable supply to Suffolk County residents. Shallow private wells are more susceptible to contamination from near surface activities and are not tested with the same frequency as community supply wells; in fact less than 2 percent of private wells are tested by the SCDHS each year. A sampling effort conducted by the SCDHS between 1997 and 2006 found that almost 10 percent of the samples collected from private wells exceeded the drinking water standard for nitrate and approximately seven percent showed VOCs above 5 µg/L.

While there are adequate supplies to meet all existing and projected potable water needs on a Countywide basis, existing infrastructure in some parts of the County is not adequate to respond to the increased water supply demand resulting from the early morning use of automatic irrigation systems during hot, dry summer periods, as illustrated during the summer of 2010. Community supply pumping during the winter months has only increased by approximately 15 mgd since 1987, while pumping during the summer has increased by 100 mgd or more. Much of this increase is attributed to the installation and use of automatic irrigation systems.

Wastewater Management Quick Facts:

Onsite Sewage Disposal Systems (OSSDS)

- *The #1 pollutant affecting Suffolk County's water resources is wastewater nitrogen*
- *Approximately 74% of SC is unsewered utilizing OSSDS*
- *There are an estimated 360,000 OSSDS located in SC*
- *Prior to 1972, block cesspools were the minimum required method of OSSDS for single-family homes*
- *After 1972, basic OSSDS for single-family homes, consisting of a 900 gallon septic tank and precast leaching pools*
- *An estimated 252,530 existing OSSDS pre-date the requirement for a septic tank*
- *Approximately 209,000 existing OSSDS are located in identified priority areas*
- *SC is evaluating the effectiveness of innovative alternative onsite wastewater treatment systems (I/A OWTS) for single-family dwellings to reduce wastewater nitrogen to 19mg/l through a County Sponsored demonstration project*
- *4 manufacturers (Norweco, Busse, Orenco Systems, and Hydro-Action) have agreed to install a total of 19 I/A OWTS within SC for the demonstration project (Systems to be installed in 2015)*

Projected water supply demands for the year 2030 were based on population projections provided by the SCDEDP and provision of community supply to all residents currently using private wells. Considering peak water supply pumping demands that are based on existing observed peak demand factors, the 2030 projections indicate that additional wells will be required in most Towns in the County. In fact, over one hundred new supply wells would be required in the County based upon projection of current peak water demand patterns. Alternatives to provide potable water to County residents, considering treatment, conveyance from the Pine Barrens, and conservation were identified and evaluated.

Wastewater Management

An estimated 69 percent of the total nitrogen affecting our ground and surface water supplies emanates from wastewater, specifically onsite sewage disposal systems.[27] Approximately 74 percent of Suffolk County is unsewered utilizing onsite sewage disposal systems with limited ability to reduce wastewater nitrogen.[28] There are approximately 360,000 onsite sewage disposal systems located in Suffolk County with approximately 209,000 of these systems located in identified priority areas meeting the following criteria[28]:

- Areas in the 0-50 year contributing zone to public drinking water wells fields
- Areas in the 0-25 year contributing zone to surface waters
- Unsewered parcels with densities greater than what is permitted in Article 6 of the Suffolk County Sanitary Code
- Areas located in an area where groundwater is less than 10 ft below grade

In 1958 the first SCDHS onsite sewage disposal Standards went into effect, requiring block cesspools for single-family homes. Up until 1972 these cesspools (AKA leaching pools) were permitted to be installed without a septic tank.

[27] [27]IBM Smarter Cities Challenge Report. Suffolk County, NY, United States. August 2014

[28] [28] SCDEDP, 2014

Wastewater Management Quick Facts Continued:

Wastewater Treatment Plants and Sewering

- *As of 2013, Suffolk County has 197 operational wastewater or sewage treatment plants (STPs)*
- *171 of the STPs are designed to remove nitrogen from the wastewater (Effluent Total Nitrogen 10 mg/l or less)*
- *14 STPs discharge directly to surface waters*
- *The 2013 average effluent total nitrogen for the tertiary plants in Suffolk County was 8.7 mg/l*
- *The last major expansion of sewers in Suffolk County was the creation of the Southwest Sewer District completed in the early 1980's*
- *There hasn't been a sewer expansion project similar to the magnitude of the Southwest Sewer District in Suffolk County in over 30 years.*
- *In 2014, Suffolk County received a $383 million funding award from New York State to install sewers and connect approximately 10,000 properties to sewers*

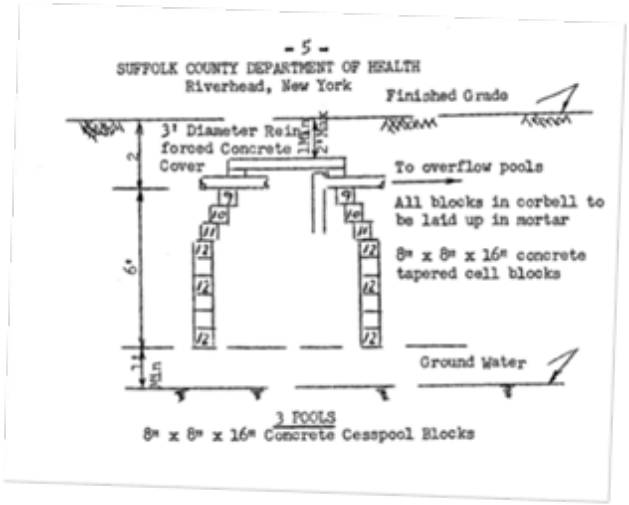


Figure ES-8 Block Leaching Pool Detail from SCDHS Residential Standards Prior to 1972

It has been estimated 252,530[28] of the 360,000 existing onsite sewage disposal systems pre-date the requirement for a septic tank. In 1972, the standards were revised to require basic treatment for single-family homes, consisting of a 900 gallon septic tank and precast leaching pools. The addition of septic tanks provides a small degree of wastewater nitrogen removal.

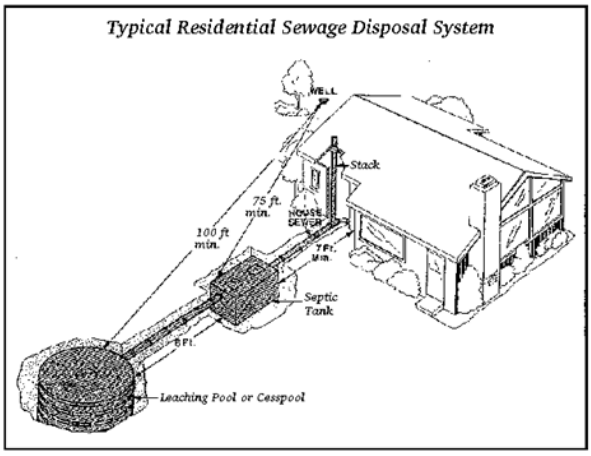


Figure ES-9 Typical Onsite Sewage Disposal

Currently, nitrogen discharge from onsite wastewater treatment systems is regulated by lot size through the implementation of the Suffolk County Sanitary Code Article 6. Based on differences in regional hydrogeological and groundwater quality conditions, Article 6 delineated boundaries of the eight Groundwater Management Zones (GWMZ) for protection of groundwater quality. The Goal of creating the GWMZ was to limit groundwater nitrogen to

Wastewater Management Quick Facts Continued:

Emerging Contaminants of Concern in Wastewater

- *A variety of Contaminants of Emerging Concern (CECs), including pharmaceuticals and personal care products (PPCPs) have been detected in wastewater*
- *Many CECs can be removed from wastewater*
- *The primary mechanisms of removal/transformation of CECs are sorption and biodegradation*
- *The aerobic conditions that exist in most wastewater treatment processes are required for degradation of most PPCPs*
- *Minimal PPCP degradation occurs under anaerobic (e.g., septic tank) conditions*
- *Some PPCPs have breakdown products that are more harmful than the original compounds.*
- *Removal of PPCPs in the tertiary wastewater treatment process that remove nitrogen are more efficient than secondary treatment*
- *Removal of PPCPs by I/A OWTS has been found to be comparable to the removal in an activated sludge wastewater treatment process*

4 mg/l in GWMZ III, V, and VI and to 6 mg/l in the remaining zones. Many areas of Suffolk County were built before the Article 6 density restrictions or prior to conventional treatment system requirements. It is these many homes and businesses that are contributing to the pollution of groundwater in Suffolk County as well as the surface waters and ecosystems of the County.

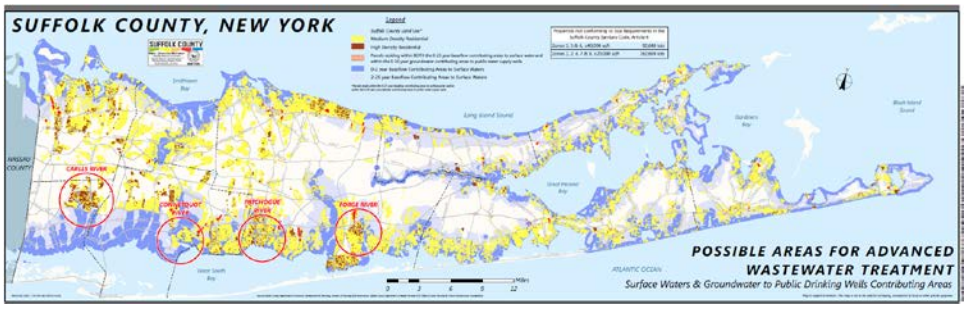


Figure ES-10 Map of Possible Priority Areas for Advanced Wastewater

Alternatively to meeting the density requirement of Article 6 of the Suffolk County Sanitary Code to protect water resources, connection to community wastewater treatment systems is an acceptable method of reducing nitrogen. Unfortunately only 26 percent of Suffolk County is connected to sewer systems. The last major expansion of sewers was the creation of the Southwest Sewer District and extension of sewers to existing homes and commercial buildings located within the district. This project was completed in the early 1980s and there has not been a sewer project of its kind in Suffolk County in over 30 years. Since the expansion of the Southwest Sewer District, most of the sewering that has taken place in Suffolk County is for the connection of new development. Evidence has shown that sewering can help reduce nitrogen loads to surface waters; for example the average nitrogen in the Carlls River located by the SWSD was 3.2 mg/l in the 1970s and in the 2000s dropped to 1.8 mg/l. After Super Storm Sandy impacted structures along our coastline in 2012, the need for increased wastewater treatment to reduce nitrogen was realized to improve our valuable water resources. Nitrogen from residential septic systems and cesspools, as well as fertilizer, are the principle culprits that spur hypoxia, harmful algal blooms, diminution of sea and shellfisheries, and degradation of our protective natural infrastructure – wetlands and seagrass beds that act as wave and storm surge buffers.[29,30] By reducing wastewater nitrogen through the use of increased wastewater treatment via sewering or

[29] Deegan LA, Johnson DS, Warren RS, Peterson BJ, Fleeger JW, Fagherazzi S, and Wollheim WM (18 Oct 2012) "Coastal Eutrophication as a Driver of Salt Marsh Loss" Nature : doi:10.1038

[30] Anderson ME, McKee Smith J, Bryant DB, and McComas, RGW. (Sept 2013), "Laboratory Studies of Wave Attenuation through Artificial and Real Vegetation" USACE, "It is generally acknowledged that vegetated coastal features such as wetlands can reduce the effects of surge, waves, and tsunami propagation."

Wastewater Management Recommendations:

Develop a Wastewater Management Plan to set nitrogen load reduction targets to meet water quality goals

Identify the means of sewage disposal on a parcel-by parcel basis to meet water quality goals

Revise Sanitary Code and sewage disposal construction standards to permit the use of I/A OWTS

Continue to investigate and implement new I/A OWTS technologies and STP technologies for increased removal of nitrogen and CEC's

Create a wastewater management district and responsible management entity to provide funding sources for upgrading and/or repairs of I/A OWTS and STP's, O&M tracking, performance tracking, education and outreach

Continue to perform sewering feasibility studies, and find funding sources to implement the sewering in the areas studied

Implement SPDES permit action limits that specify advanced treatment for new STPs located in sensitive areas such as 25-year travel times to surface waters and 50- year contributing areas to public supply wells to reduce nitrogen loading as compared with OSSDS at Article 6 allowable density

installation of innovative/advanced onsite wastewater treatment systems, Suffolk County predicts improvement of our wetlands and seagrass beds to increase coastal resiliency during future storm surge events.

The first major sewer expansion in Suffolk County will occur through a funding reward of $383 million from New York State to install sewers and connect approximately 10,000 existing, developed properties to sanitary sewer systems. This will be the first major sewering based project within Suffolk County in more than 30 years. The goal of the project is to reduce nitrogen pollution to ground and surface waters to improve coastal resiliency against future storm events. The areas to be sewered will be:

(1) Mastic: Parcels in the Forge River area will be connected to a new sewer collection system that will flow to a new wastewater treatment plant located on municipal property near the Brookhaven Town Airport.

(2) North Babylon and West Babylon: Parcels in the Carlls River area will be connected to the SWSD.

(3) Great River: Parcels in the Connetquot River and Nicolls Bay area will be connected to the SWSD.

(4) Patchogue: Parcels in the Patchogue River area will be connected to the Patchogue sewer system within the Patchogue Sewer District.

An alternative means of combating wastewater nitrogen discharging from residential lots that do not have access to community sewers are Innovative/alternative onsite sewage disposal systems (I/A OWTS), which have been proven in other jurisdictions to reduce wastewater nitrogen to 19 mg/l or less. These types of systems are currently being evaluated by the County to reduce nitrogen discharges from on-site wastewater treatment systems. These types of systems would replace conventional onsite sewage disposal systems. In 2014, Suffolk County began its first demonstration project for I/A OWTS and anticipates implementing a program permitting the use of I/A OWTS by the end of 2015. The demonstration project is intended to provide field-testing and technology verification to determine if a particular I/A OWTS can function effectively in Suffolk County. Four (4) manufacturers (Norweco, Busse, Orenco Systems, and Hydro-Action) have agreed to install a total of nineteen (19) systems within Suffolk County for the demonstration project.

Another means of treating wastewater to reduce nitrogen in areas where centralized sewers are not feasible is the creation of decentralized community

sewer systems. Decentralized community sewer systems normally serve small communities. Suffolk County is evaluating and promoting the creation of decentralized community systems for communities that utilize wastewater treatment systems approved for use under the SCDHS Commercial Standards Appendix A for flows up to 15,000 gpd (30,000 gpd with modifications to SCDHS Commercial Standards Appendix A or an SCDHS variance). These systems are normally package wastewater treatment plants which are substantially or entirely below grade, with enclosed process tanks that qualify for reduced separation distances of 75' to property lines and habitable structures when an aerosol emissions and odor removal system is installed. Currently, SCDHS has approved seven (7) Appendix A treatment technologies for use in Suffolk County. Suffolk County plans on funding a pilot program to determine the feasibility of retrofitting pre-existing communities served by onsite sewage disposal systems with decentralized community sewer systems to reduce existing wastewater nitrogen loads to improve water quality.

In addition to nitrogen removal, anticipated rising groundwater and sea level elevation are of concern. Leaching pools are required at a minimum to be 2 feet above the groundwater table. Updated sea level rise projections indicate sea level will rise approximately 24 to 34 inches by the end of the century. Therefore, Suffolk County should evaluate the minimum required separation distance between the bottom of leaching structures and groundwater by investigating alternative shallow leaching systems, which may also provide additional nitrogen removal.

Pharmaceuticals and personal care products (PPCPs) are becoming additional contaminants of concern in wastewater discharges based on their potential impacts to ground and surface water resources. In recent years, very low levels of PPCPs, also sometimes referred to as pharmaceutically-active compounds (PhACs) or organic wastewater contaminants (OWC), have been detected in the environment. As most pharmaceuticals are designed to be water soluble, and to be persistent long enough to serve their designated therapeutic purposes, they can be present in dissolved form in receiving ground and surface waters. PPCPs are continuously introduced into the environment by sewage treatment plants and by on-site wastewater disposal systems (e.g., septic tanks and leach fields) in unsewered areas. Advanced treatment units, whether sewage treatment plants or I/A OWTS, have shown evidence of removing emerging contaminates of concern but further research is required.

The implementation and creation of a wastewater management plan will help address Suffolk County's wastewater nitrogen problem by setting required nitrogen load reduction targets and/or ambient water quality nitrogen concentration targets to meet water quality goals. In addition, the plan shall

identify the means of sewage disposal on a parcel by parcel basis to meet nitrogen reduction targets. Possible treatment options are connection to an STP to meet wastewater effluent total nitrogen (TN) of < 10 mg/l, installation of an I/A OWTS to meet TN <19 mg/l, or installation of a conventional system to meet TN>19 mg/l. The County anticipates issuing an RFP in 2015 to select a consultant to assist the County in establishing watershed-specific nitrogen discharge standards and determining the means of sewage disposal on a parcel by parcel basis to meet water quality goals. To meet the nitrogen reduction requirements and permit I/A OWTS to be installed in areas where sewers are not available, the current Suffolk County Sanitary Code and SCDHS Onsite Sewage Disposal System Construction Standards must be revised in cooperation with NYSDEC and NYSDOH. These codes and standards will be revised to include the formation of an RME to oversee I/A OWTS and decentralized privately owned STP's, permit the installation of I/A OWTS, provide standard construction requirements for I/A OWTS, require property owners to certify their system at the time of transfer if feasible, etc. A wastewater management district and responsible management entity (RME) should be established per the revised Sanitary Code to provide funding sources for the upgrading and/or repairs of I/A OWTS, education and outreach, performance tracking, and O&M tracking. Education and outreach performed by the RME will target contractors, design professionals, and property owners. The wastewater management plan shall define when sewers should be extended in lieu of onsite sewage disposal systems.

Implementation*

The success or failure of implementing many of the action items identified in the attached table is contingent upon securing the necessary funding and the cooperation of many of the key stakeholders. Responsibilities for many of the management activities identified are currently shared by a number of agencies and partners on the federal, state, county, town and local levels. While Suffolk County may have the ability to exercise authority and implement many of the recommendations, it will be critical to develop and maintain a network of cooperative and willing partners to participate in the resource management efforts.

* A table of the Comprehensive Water Resources Management Plan key recommendations, action items, prospective owners and likely collaborators follows at the end of this section

Management Strategies

The following is a list of the key management strategies, tools, options, and rate determiners that must be considered before addressing some of the recommendations identified in the attached table:

- To assess the effectiveness of implementing management strategies it is critical to develop a comprehensive database and monitoring programs
- Engaging a diverse group of stakeholders and communities will play an important role in developing effective implementation strategies
- Establishing a responsible management entity (RME) and a County-wide wastewater management district is the recommended management model for oversight of advanced wastewater system infrastructure
- Identification of financial incentives and financing mechanisms are a rate determiner in implementing many of the recommendations
- Appropriate staffing levels to implement and oversee key programs must be identified and prioritized as resources allow

Recent Actions

Key action items that have already been implemented by the County as outlined in the attached table include:

- Selected innovative wastewater treatment companies and homeowners to participate in a septic demonstration program
- Initiated pharmaceutical and personal care product health care management and take back programs
- Implemented volatile organic chemical action plan including the hiring and training of dedicated staff to focus on inspecting and sampling priority sites
- Reestablished the stream and groundwater monitoring well network programs
- Joined forces and committed funding along with the east end towns, villages and the Peconic Estuary Program in an Inter-Municipal Agreement to implement water quality initiatives

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Water Resources Management Plan Framework

Area	Recommendation	Priority	Owner	Collaborators	Key Milestones and Actions	Action Status and Time Range	Funding Status	Variables
1.0 Nitrogen	1.1 As a result of Superstorm Sandy in an effort to promote resilience create and/or expand sewer districts for existing communities identified as priority areas and upgrade current wastewater infrastructure	1	SCDPW	SCDEDP, SCDHS	a. Continue to undertake subregional sewer feasibility studies	Short term - On schedule	CP8134 Forge River; CP8139 Carll's River; CP8153 Smithtown/Kings Park; CP8156 Ronkonkoma Hub; CP8157 Connetquot River; CP8191 Center Moriches;CP8192 Flanders/Riverside	
			SCDPW	SCDEDP, SCDHS	b. Advance sewer expansion projects as funding becomes available	Continuous	$383 Million announced as of 2014	
			SCDPW	SCDHS, SCDEDP	c. Plan/Construct Bergen Point outfall replacement	Ongoing	CP8108 $207 million with a $12.5 million grant and $37.5 million loan from SRF	
	1.2 Develop a range of approvable advanced alternative on-site wastewater treatment options available for residential and non-residential applicants in Suffolk County. Gain acceptance and encourage participation	1	SCDHS and SCDPW	SCDEDP, NYSDOH, NYSDEC, USEPA, Towns	a. Assess innovative technologies in nearby states to initiate a County septic demonstration program	Completed; report available online		
					b. Select innovative wastewater treatment companies to participate in a septic demonstration program	Completed		
					c. Select homeowners to participate in a Septic Demonstration Program	Completed		
					d. Install 19 advanced on-site demonstration septic systems	Short term - On schedule	Manufacturers are funding system purchase, installation and maintenance	
					e. Develop demonstration program to evaluate efficacy of shallow narrow drainfields and vegetated wetlands.	Short term - On schedule	Suffolk County Septic/Cesspool Upgrade Program Grant Request	
					f. Monitor effectiveness of on-site demonstration septic systems	Short term - On schedule	SCDHS and SCDPW will perform sampling and analysis, respectively	Effluent nitrogen results
					g. Encourage the use of non-proprietary wastewater treatment systems through demonstration programs	Short term - On schedule	To be determined - could include Watershed Improvement Districts, State Revolving Loan Fund, NYS Water Quality Improvement Program, the Suffolk County Water Quality Protection and Restoration Program, a proposed Aquifer Protection Fee by the public water suppliers, and the Community Preservation Fund for the East End, if supported at the local and state levels	
					h. Develop SCDHS process to approve and permit I/A OWTS systems. Mandate maintenance contracts on all I/A OWTS	Short term - On schedule		
					i. Modify Sanitary Code and establish construction standards for I/A OWTS systems	Short term - On schedule		Results of pilot program
					j. Provide guidelines and train municipalities and private industry to install and maintain advanced onsite systems	Short term - On schedule		Results of pilot program, funding source
					k. Familiarize homeowners and towns on the operations and maintenance of advanced septic systems in comparison to existing septic systems with the goal of providing rationale for an RME.	Short term - On schedule		Public participation, funding
					l. Promote the installation of I/A OWTS systems (Appendix A) for commercial and multi-family development by providing financial incentives	Short term - On schedule		Funding
					m. Establish a database of onsite systems (current and new) to track installation, maintenance, inspection, and performance and use to guide identification of approvable technologies; in coordination with EPA	Short term, On schedule	Integrate with Capital Project 4081, Environmental Health Information Management System	County Funding of Capital Project, see data management below

Water Resources Management Plan Framework

Area	Recommendation	Priority	Owner	Collaborators	Key Milestones and Actions	Action Status and Time Range	Funding Status	Variables
1.0 Nitrogen		2	SCDHS	SCDPW	n. Continue to develop new standards for clustered decentralized systems and for flows ranging from 1,000 - 30,000 gpd.	Short term - On schedule		
		1	SCDHS	SCDEDP	o. Develop and implement a drainfield demonstration program providing alternatives to leaching pools	Short term - On schedule	Suffolk County Water Quality Protection and Restoration Program	
	1.3 Develop short term and long term water quality funding and financing mechanisms in partnership with federal, state, county and local agencies and private industry - short term activities may include voluntary homeowner upgrades and in the long term, possible mandatory upgrades that meet specific locational and environmental criteria	1	SCDEDP	SCDPW, SCWA, NYS EFC, USEPA, Towns, NY Works, LIRPC, TNC, CCE, LCV, Estuary Programs	a. Access all potential funding mechanisms, including financing mechanism for long term loans for homeowners, grant opportunities, aquifer protection fee, tax credits, insurance rate adjustments, public private partnerships, benefit assessments, user fees, tax credits, Finance Committee, etc.	Short term - On schedule	To be determined - could include Watershed Improvement Districts, State Revolving Loan Fund, NYS Water Quality Improvement Program, the Suffolk County Water Quality Protection and Restoration Program, the proposed Aquifer Protection Fee by the Suffolk County Water Authority, and for the East End the Community Preservation Fund if supported at the local and state levels	Available funding streams, investor interest, SCWA and homeowner participation
	1.4 Nurture the development of local industries to perform R&D and provide capital to address advanced wastewater treatment	1	SCDHS	SC DPW, SCDEDP, EPA , NYSDEC, LIREDC	a. Participate in the development of a regional (New England and coastal NY) data sharing agreement modeled after CBW data sharing agreement to streamline I/A approval processes	Medium - On schedule		Local industry interest
		1	Stony Brook University	SCDHS, SCDEDP, EPA , Southampton, NYSDEC, LIREDC	b. Participate in the creation of a Wastewater Institute at Stony Brook University	Medium - On schedule		
	1.5 Determine the range of technology options for advanced wastewater treatment by subwatershed to facilitate further prioritization for collective regional action	1	SCDHS	SCDHS, SCDEDP, SCDPW, USEPA, NYSDEC, NYSDOH, local stakeholders	a. Finalize RFP b. Engage stakeholders c. Identify priority subwatersheds d. Establish goals for nitrogen load allocation for watersheds, estuaries; Evaluate feasibility of enhancing effluent and review water quality goals e. Finalize methodology for parcel analysis for wastewater technology treatment options	Short term - On schedule		US EPA 3VS Systems Model NYSDEC nutrient criteria development, water body-specific TMDLs
	1.6 Evaluate the feasibility of updating the Sanitary Code to prohibit the "grandfathering" of State Pollutant Discharge Elimination System (SPDES) and/or SCDHS permitted sanitary flows that exceed and predate Sanitary Code density requirements on other than single-family residential lots, without the installation of an I/A OWTS or connection to sewers; review options to effect upgrades under ECL,NYCCR,SPDES	2	NYSDEC, SCDHS	SCDEDP, NYSDOH, local municipalities and stakeholders	a. Fund and conduct a feasibility study or health impact analysis of possible code changes	Short term - On schedule	Underway with existing staff and funding	

Water Resources Management Plan Framework

Area	Recommendation	Priority	Owner	Collaborators	Key Milestones and Actions	Action Status and Time Range	Funding Status	Variables
1.0 Nitrogen	1.7 Evaluate the feasibility of updating the Sanitary Code to prohibit the replacement of failed onsite wastewater technology (e.g., "replacement in-kind") without SCDHS approval.	1	SCDHS	SCDEDP, SCDPW, USEPA, NYSDEC, NYSDOH, Towns	a. Conduct a health impact analysis of possible Code amendments	Short term - On schedule	Health Impact Assessment funded by the US EPA	Stakeholder input
	1.8 Establish governance to enable the installation and compliance/performance monitoring of appropriate wastewater technology County-wide	1	SCDEDP	SCDPW, SCDHS, NYSDEC	a. Establish legal authority	Short term - On schedule		
					b. Establish wastewater management district			State approval
					c. Establish Responsible Management Entity to manage funding, implementation, operation and maintenance		Initial funding legislatively approved from the Suffolk County Water Quality Protection and Restoration Program	SCDPW, SCDHS, SCWA collaboration, see: http://www.werf.org/i/c/KnowledgeAreas/DecentralizedSystems/RMEsite/RMEs_2.aspx
					d. Staff Responsible Management Entity			Selected organizational approach
	1.9 Facilitate conditions for decentralized/virtual sewer districts, where appropriate with local neighborhood interest	1	SCDPW/ SCDHS	NYSDEC, SCDEDP, Towns, Stakeholders	a. Identify tax defaulted properties and develop siting standards for neighborhood sewage treatment plants	On schedule		
					b. Fund initial feasibility and engineering studies	Completed		
	1.10 Continue to maintain active oversight of existing STPs and operators to maintain compliance with effluent nitrogen limit; where possible and appropriate attain more stringent performance goals to protect groundwater and surface waters	1	SCDHS	NYSDEC	a. Continue monitoring and enforcement efforts	On-going, On schedule	Underway with existing staff and funding; continue to seek additional revenue streams	
			SCDHS	NYSDEC	b. Continue to evaluate new and improved technologies for nitrogen and PPCP removal	On-going, On schedule	Underway with existing staff and funding; continue to seek additional revenue streams	
	1.11 Continue to reduce nitrogen load from homeowner fertilizer application.	1	SCDEDP	SCDHS, PEP	a. Assess effectiveness of and potential improvements to Suffolk County Local Law 41-2007 to reduce nitrogen pollution by reducing use of fertilizer in Suffolk County. Suffolk County continues to use two and a half times the amount of residential fertilizer as any other county in NYS	Short Term, On schedule	Underway with existing staff and funding	Evaluation/documentation of effectiveness . Access and analyze additional public and private data on fertilizer inventory, revenue, and sales
		1	SCDEDP	SCDHS, PEP, NYSDEC, USEPA, CCE, municipalities	b. Enhance educational and advocacy efforts aimed at reducing the negative impacts of residential and commercial yard care (fertilizer and pesticides) on ground and surface water quality	Medium, On schedule	Suffolk County secured funding from NYSDEC for implementation in 2015	Funding
	1.12 Evaluate the feasibility of replicating the Riverhead Sewage Treatment Plant's initiative to re-use wastewater effluent for golf course irrigation countywide, where appropriate	2	SCDHS	SCDPW, NYSDEC	a. Conduct a feasibility study on implementing reuse at candidate sites	Short Term High Priority		Funding

Water Resources Management Plan Framework

Area	Recommendation	Priority	Owner	Collaborators	Key Milestones and Actions	Action Status and Time Range	Funding Status	Variables
1.0 Nitrogen	1.13 Work with agricultural community to reduce use and impacts of excess fertilization	1	SCDEDP	SCDHS, NYSDEC	a. Release updated Agricultural Stewardship Plan	Short term, On schedule		Funding
		1	SCDEDP	SCDHS, NYSDEC, PEP, NRCS, SCSWCD	b. Secure funding to implement the Agricultural Stewardship Plan, and continue to fund the CCE Agricultural Stewardship Program.	Short term, Continuous, On schedule		Funding
		1	Cornell Cooperative Extension	SCDHS, SCDEDP, NYSDEC	c. Provide technical staff to implement research, piloting, testing, reporting and education	Short term, Continuous, On schedule		Funding
		1	SCDEDP	Agricultural Stewardship Committee, NYSDEC, CCE, SCSWCD	d. Work with the agricultural community and other stakeholders to incentivize farmers, especially those participating in the County's purchase of development rights program, to implement BMPs to reduce nitrogen release to ground and surface waters.	Short term, Continuous, On schedule		
	1.14 Increase scavenger plant capacity to process waste from on-site system pump-outs	2	SCDPW		a. Evaluate capacity of existing facilities to receive and treat pump-out	Medium, On Schedule		Ability to expand existing capacity
	1.15 Seek ways to remediate existing nitrogen pollution and its impacts (see Coastal Resiliency & Surface Water Quality actions for more detail)	1	SCDHS	Estuary Programs, NYSDEC, SCWA, Scientists, Cornell Cooperative Extension	a. Continue to implement the Harmful Algal Bloom strategy, wetland stewardship, shellfish restoration; continue to support and fund the use, where appropriate, of marine plants and shellfish as biofiltration to reduce nitrogen in surface waters	On-going, On schedule		Funding, technology development, permitting, species selection for uncertified waters
		1	SCDEDP	Towns, NYSDEC	b. Mitigate the nitrogen and bacterial contribution from wildlife and pets by implementing public education and encouraging alternative population control measures	Short term, Not yet scheduled		
		2	USGS	SCDHS	c. Consider localized studies to evaluate nutrient flux from the sediments into the water column and evaluate sediment management options.	Medium, Not yet scheduled		
		2	SCDHS	NYSDEC and municipal partners	d. Encourage the development of pilot programs for the installation of permeable reactive barriers and other innovative in-situ water quality remediation techniques. Work to identify suitable locations for pilot installation, and support monitoring of effectiveness of nitrogen reduction	Short term, Not yet scheduled	Use existing resources and continue to seek supplemental funding sources	Suitable locations and technology effectiveness
		2	SCDHS	Towns, Villages	e. Consider changing densities in all hydrogeologic zones; evaluation of zone 4 would be the first priority, subject to cost benefit analysis	Short term, Not yet scheduled		Effectiveness of I/A OWTS

Water Resources Management Plan Framework

Area	Recommendation	Priority	Owner	Collaborators	Key Milestones and Actions	Action Status and Time Range	Funding Status	Variables
2.0 Volatile Organic Compounds (VOCs)	2.1 Implement VOC Action Plan	1	SCDHS		a. Identify and inspect high priority facilities (e.g., gas stations/dry cleaners)	Short term, Continuous, On schedule	$100,000 appropriated	Available funding
			SCDHS	NYSDEC, USEPA	b. Initiate enforcement activities to bring facilities into compliance and clean-up actions to address contaminant releases as necessary.	Short term, Continuous, On schedule	Use existing resources and continue to seek supplemental funding sources	Results of initial inspections
			SCDHS		c. Within an adaptive management framework, annually reassess inspection priorities, and continue to inspect the next category(ies) of high priority facilities. Based upon status and trends of VOCs detected in drinking water, refine monitoring and inspection strategies	Continuous, On schedule	Use existing resources and continue to seek supplemental funding sources (see below)	
			SCDHS		d. Establish and apply a fee system to fund continued implementation of the inspection/compliance program.	Short term, On schedule		Number of facilities not in compliance with regulations/or with contaminant releases to the environment
			NYSDEC	USEPA	e. Develop and implement a Gas Station operator training/certification program	Medium term, Not yet scheduled		Available funding
			SCDEDP	SCDHS, SCLD	f. Continue to coordinate with Suffolk County Land Bank to identify, evaluate, and prioritize tax-defaulted environmentally contaminated properties	Short term, Continuous, On schedule	Use existing resources	Funding status for initial sites secured through EPA, NYS AG office and NYSDEC.
	2.2 Implement Reducing Toxics Capital Program	1	SCDHS		a. Develop approach to prioritize inspection of remaining 17,000 +/- facilities; consider prioritizing those within supply well contributing areas	Short term, On schedule	$100,000 from 1/4% Program	Available funding
			SCDHS	NYSDEC, NYSDOH	b. Inspect facilities in accordance with identified approach	Short term, Schedule under development	One full time equivalent person to begin implementation in 2016	Available funding
			SCDHS	NYSDEC, USEPA	c. Initiate enforcement/clean-up activities	Medium term, On schedule	Use existing resources and continue to seek supplemental funding sources	Available funding
			SCDHS	NYSDEC, USEPA	d. Continue to require that facility owners at VOC release sites perform soil vapor intrusion investigations where necessary and continue to identify new construction sites with soil vapor intrusion potential.	Short term, Continuous, On schedule	Underway with existing resources	Federal/state guidance, Town/village building codes
	2.3 Implement Remedial Actions	1	SCDHS	NYSDEC, USEPA	a. Initiate enforcement/clean-up activities, refer to Superfund as appropriate	Short term, Continuous, On schedule	Use existing resources and continue to seek supplemental funding sources	Available funding

Water Resources Management Plan Framework

Area	Recommendation	Priority	Owner	Collaborators	Key Milestones and Actions	Action Status and Time Range	Funding Status	Variables
2.0 VOCs	2.4 Increase awareness of harmful household products	1	SCDHS	SCDEDP, SCWA, SCDPW, USEPA, NYSDEC, NYSDOH	a. Continue to collaborate with other agencies, remain current on literature to identify bad actors and safer alternatives	Short term, Continuous, On schedule	Use existing resources and continue to seek supplemental funding sources	Availability of green alternatives, funding
			SCDHS	SCDEDP, SCWA, USEPA, NYSDEC, NYSDOH, Estuary Programs	b. Conduct public education and outreach to engage public and modify choices . Educate public about EPA Safer Choice labeling program and encourage consumers to adopt it	Short-term, Continuous, On schedule	Use existing resources and continue to seek supplemental funding sources	Availability of green alternatives, funding
			SCDHS	NYSDOH, NYSDEC, Estuary Programs	c. Work with County and/or State Legislators to ban any harmful products/additives where viable alternatives are available and expand upon the Suffolk County's Green Clean Purchase program	Medium term, Not yet scheduled		Identification of harmful products with available alternatives, available funding
			SCDHS	Towns, SCDEDP, SCWA, NYSDEC, NYSDOH, USEPA, Estuary Programs	d. Increase awareness of and participation in Town STOP programs	Short-term, Continuous, On schedule		Convenience of/availability of Town programs, funding
	2.5 Implementation of sanitary sewering in priority areas	1	SCDPW	SCDEDP, SCDHS	a. Include areas with high priority facilities in areas to be served by sanitary sewers; see nitrogen recommendations	Medium term, Not yet scheduled		Available funding and competing priorities
	2.6 Continue to evaluate impact of cesspool additives	2	SCDHS		a. Monitor retailers and supply houses to identify drain cleaners and cesspool additives listing organic chemicals as ingredients, and work with companies that have not applied for product certification to remove the products from shelves, obtain certification of safety (if appropriate), or face possible fines.	Short term, Continuous, On schedule	Underway with existing resources	Identification of unregistered products containing organic chemicals

Water Resources Management Plan Framework

Area	Recommendation	Priority	Owner	Collaborators	Key Milestones and Actions	Action Status and Time Range	Funding Status	Variables
3.0 Pesticides	3.1 Work with Agricultural Community to Reduce Use and Impacts of Harmful Pesticides	1	SCDEDP	Cornell, SCDHS, NYSDEC, USGS	a. Update Agricultural Stewardship Program (also supports Nitrogen Recommendation 1.13 above)	Short term, On schedule		Funding
		2	SCDEDP	Cornell, SCDHS, NYSDEC, USGS	b. Establish Agricultural Stewardship Advisory Council	Short term, On schedule		Funding
		1	Cornell Cooperative Extension	SCDEDP, SCDHS, USGS	c. Continue to identify pesticides that are persistent/mobile and used on Suffolk County crops, and identify crop-specific integrated pest management or safer alternatives.	Short term, Continuous, On schedule		Funding, ability to identify more environmentally friendly alternatives, participation of the agricultural community
	3.2 Develop a comprehensive pesticide management strategy, incorporating SCDHS recommendations concerning establishment of a pesticide rating testing system that guides pesticide registration/re-registration and integrate into comprehensive lawn care management initiatives.	2	NYSDEC	SCDHS, CCE	a. Formally incorporate SCDHS into the pesticide registration process.	Short term, Not yet scheduled		NYSDEC priorities
		2	NYSDEC	SCDHS, CCE, USGS	b. Modify pesticide registration process to require piloting to assess leachability, mobility, persistence, toxicity or issue conditional registration with targeted monitoring until pesticide impacts are assessed. Work toward implementation of NYSDEC "Long Island Pesticide Pollution Prevention Strategy"	Short term, Not yet scheduled	NYSDEC, pesticide manufacturers	NYSDEC priorities, manufacturer participation
		1	NYSDEC	SCDHS, CCE, USGS	c. Initiate targeted monitoring in the event that a new pesticide is detected in groundwater and consider implementing use restrictions and/or re-registration requirements as appropriate. Work with collaborators to analyze for pesticides that PEHL can not analyze for	Short term, Continuous, On schedule		
	3.3 Increase public awareness of pesticide impacts and encourage use of safer replacements when possible.	1	NYSDEC	SCDHS, CCE, USGS	a. Outreach and education to engage public and modify choices. Enhance commercial applicator training	Short term, On schedule	Funded through NYSDEC	Ability to identify available, effective alternatives.

Water Resources Management Plan Framework

Area	Recommendation	Priority	Owner	Collaborators	Key Milestones and Actions	Action Status and Time Range	Funding Status	Variables
4.0 Pharmaceuticals and Personal Care Products (PPCPs)	4.1 Provide actionable information regarding use and disposal of household products, pharmaceuticals and personal care products	1	SCDHS	USEPA, NYSDEC, SCWA	a. Continue to monitor Contaminants of Emerging Concern (CECs), contaminants on the Contaminant Candidate Lists (CCL), and literature	Short term, Continuous, On schedule	Use existing resources and continue to seek supplemental funding sources	Cooperative opportunities, grant availability, other funding options
		1	SCDHS	USEPA, NYSDEC, SCWA	b. Identify safer alternatives to harmful ingredients/additives identified in PPCPs	Short term, Continuous, On schedule	Use existing resources and continue to seek supplemental funding sources	Cooperative opportunities, grant availability, other funding options
		2	SCDHS	USEPA, NYSDEC, SCWA, Group for the East End, Estuary Programs	c. Continue to collaborate with others to implement education and outreach program including development and posting of no-flush signs at pharmacies and identifying the locations of take-back programs. The Group for the East End reports that 2,000 lbs. of unused medications were disposed at seven police stations in east end towns during the first year of program implementation; the program was publicized via mailings, press releases, email blasts and radio and newspapers.	Continuous, On schedule	Implementation of the east end program has been provided through Feb 2016. Covanta Energy's RX disposal program is providing free destruction at the East Northport facility. Continue to use existing resources and continue to seek supplemental funding sources, including 1/4% funding for east end towns	Cooperative opportunities, grant availability, other funding options
	4.2 Continue to assess occurrence of PPCPs in groundwater as well as PPCP sources, to support development of informed management decisions	1	SCDHS	SCWA, USGS, NYSDEC	a. Increase PEHL capabilities to include the following analytes: cotinine, diltiazem, hydrochlorothiazide, meprobamate, metropolol, naproxen, 4-nonylphenol, phenobarbital, sulfamethoxazole, tramadol, Tributylphosphate (TBP), Triphenylphospate (TPP), Tri (2-butoxy-ethyl) phosphate (TBEP), Tri (2-chloro-ethyl) phosphate (TCEP), Tri (2-dichlorisopropyl) phosphate (TDPP) and the Ames test.	Short term, Continuous, On schedule	PEHL analytical capabilities have been expanded to include 1,4-dioxane; SCDHS has entered into a cooperative agreement with SCWA who will analyze approximately 50 samples from small public supply and private wells for seven PPCPs that currently cannot be analyzed by SCDHS PEHL	Funding options, cooperative opportunities
		1	SCDHS	SCWA, USGS, NYSDEC	b. Continue to expand analytical capabilities based on information from other investigations, occurrence data, and available information on mobility, persistence and toxicity	Short term, Continuous, On schedule	PEHL analytical capabilities have been expanded to include 1,4-dioxane; SCDHS has entered into a cooperative agreement with SCWA who will analyze approximately 50 samples from small public supply and private wells for seven PPCPs that currently cannot be analyzed by SCDHS PEHL	Funding options, cooperative opportunities
		1	SCDPW, SCDHS	USGS,USEPA	c. Implement PPCP Monitoring Plan to evaluate PPCPs in wastewater and effectiveness of existing treatment modalities	Short term, Continuous, On schedule		Funding
		1	SCDHS	SCWA, USGS, NYSDEC	d. Assess magnitude of 1,4-dioxane sources (e.g., industrial/commercial vs. household) by targeted monitoring downgradient of laundromats and other potential sources	Short term, Not yet scheduled	Use existing resources and continue to seek supplemental funding sources	
		1	SCDHS	NYSDEC	a. Update annual notice that goes out to all New York State registered facilities if and when changes/amendments are made.	Short term, On schedule	Use existing resources and continue to seek supplemental funding sources	Changes in regulations
		2	SCDHS		b. Work with facilities to keep them current and implement any changes/amendments as needed to stay compliant	Short term, On schedule	Use existing resources and continue to seek supplemental funding sources	

Water Resources Management Plan Framework

Area	Recommendation	Priority	Owner	Collaborators	Key Milestones and Actions	Action Status and Time Range	Funding Status	Variables
5.0 Potable Supply	5.1 To the extent that it is practical, extend community supply to all residents.	1	SCDHS	SCWA	a. Prioritize areas where availability of public supply should be provided	Short term, Continuous, On schedule	SCWA, customers and grants	Community support, infrastructure siting/permitting, funding
		1	SCWA	SCDHS	b. Identify supply sources (existing or new wells) as necessary	Short term, Continuous, On schedule	SCWA	Community support, infrastructure siting/permitting, funding
		1	SCWA	SCDHS	c. Design, construct and connect	Short term, Continuous, On schedule	SCWA	Community support, infrastructure siting/permitting, funding
	5.2 Implement conservation plan to reduce domestic and outdoor irrigation use	2	Suffolk County		a. Require rain sensors/moisture sensors in new sprinkler systems	Short term, Not yet scheduled		Enforcement
		2	Suffolk County	Cornell Cooperative Extension	b. Identify daily irrigation needs on website	Short term, Not yet scheduled		
		2	Suffolk County		c. Implement odd/even irrigation program for non-agricultural properties	Short term, Not yet scheduled		Enforcement
		2	Suffolk County water suppliers		d. If other conservation measures are ineffective, then implement conservation measures including conservation pricing/seasonal rate pricing	Short term, Not yet scheduled		
		2	Suffolk County	SCWA and suppliers, Estuary Programs	e. Implement public outreach/education program to encourage use of water conservation plumbing fixtures	Short term, Schedule varies		
	5.3 Provide safe drinking water to all residents	1	Suffolk County water suppliers	SCDHS	a. Incorporate sub-standard supplies into SCWA or other effectively managed municipal water district.	Short term, Continuous; Schedule varies		
		1	SCDHS		b. Increase capability to analyze private well samples	Short term, Continuous, Not yet scheduled		Funding
		1	SCDHS		c. Increase outreach to private well owners	Short term, Continuous, Not yet scheduled		Funding
		2	SCDHS		d. Increase private well income exemption to $50,000/year	Short term, Continuous, Not yet scheduled		Funding
	5.4 Evaluate Lloyd aquifer	3	NYSDEC	SCDHS, USGS,SCWA	e. Investigate potential impacts and safe yield of water supply pumping from the Lloyd aquifer. Identify and quantify conditions under which the commissioner of NYS DEC can grant exemptions to non coastal communities to pump water from the Lloyd aquifer	Medium, Not yet scheduled	No funding in place	Scope, work plan and funding

Water Resources Management Plan Framework

Area	Recommendation	Priority	Owner	Collaborators	Key Milestones and Actions	Action Status and Time Range	Funding Status	Variables
6.0 Project Management and Data Collection	6.1 Develop a cross departmental leadership team to implement the Reclaim Our Water initiative and manage the County's water from 'cradle to grave.'	1	SCDEDP	SCDHS, SCDPW, SCWA, County Attorney		Completed		
	6.2 Secure the resources and staff necessary to implement the initial phases of the Water Resources Management Plan	1	SCDHS		a. New positions are being filled	Underway, On schedule	Funding from Suffolk County and NYSDEC	
	6.3 Explore the feasibility of operating the existing 193 sewage treatment plants in Suffolk County under the control of the Suffolk County Department of Public Works	1	SCDPW	SCDEDP, SCDHS, NYSDEC	a. Complete sewer consolidation analysis	Short term, Not yet scheduled		
	6.4 Integrate water and wastewater operations	2	SCDEDP	SCDHS, SCDPW, SCWA	a. Assess the feasibility and business case for consolidation	Medium term, Not yet scheduled		
		2	SCDEDP	SCDHS, SCDPW, SCWA	b. Define a future operating model for water and wastewater operations across the County	Medium term, Not yet scheduled		
		2	SCDPW	NYSDEC, Municipalities	c. Evaluate feasibility of including stormwater utility development	Medium term, Not yet scheduled		
	6.5 Facilitate communities to embrace the solutions for improving water quality	1	Suffolk County	SCDEDP, SCDHS, SCDPW, NYSDEC, Estuary Programs, Towns	a. Provide easily accessible information on water quality through online and social media outlets for public knowledge and use	Ongoing, On schedule		
		1	SCDHS	USEPA, Estuary Programs	b. Develop the economic and social value of clean water to our region	Short term, On schedule	Funding secured by EPA for an ecological assessment study and US EPA 3V scoping project which will build social capital among decision makers and stakeholders on water quality issues and more.	
		1	Suffolk County	County, State, Federal and nonprofits	c. Conduct a marketing campaign around the need for upgraded septic systems (2014 Crapshoot Video contest, Teleconference Town Hall with the County Executive)	Ongoing, On schedule	Funding secured	

Water Resources Management Plan Framework

Area	Recommendation	Priority	Owner	Collaborators	Key Milestones and Actions	Action Status and Time Range	Funding Status	Variables
6.0 Project Management and Data Collection	6.6 Implement a comprehensive integrated data collection, analysis and evaluation program to monitor groundwater, drinking water and surface water, and guide informed protection and management strategies. Reinstate comprehensive groundwater and stream monitoring program and report annually	1	SCDHS	USGS, SCWA, USEPA, NYSDEC, NYSDOH	a. Collaborate to provide sampling and analytical capabilities to assess contamination by Contaminants of Emerging Concern (CEC) and contaminants on the Contaminant Candidate Lists (CCL)	Short term, On schedule	Position funded for dioxane, cooperative effort with SCWA established	Plethora of new analytes, laboratory capacity, funding, cooperator analytical capabilities and funding
		1	SCDHS		b. Enhance SCDHS's capabilities to respond to home owners request for private well testing and increase the ability to perform private well surveys of areas of suspected contamination	Short term, Not yet scheduled		Laboratory capacity, funding
		1	NYSDEC	SCDHS	c. Require that all non-residential private wells report well location, depth, screened interval and pumpage to NYSDEC	Short term, Continuous, Not yet scheduled		Legal authority, cooperation
		1	SCDHS		d. Continue community and non-community well sampling	Short term, Continuous, On schedule		
		1	SCDHS	NYSDEC	e. Pesticide monitoring in target areas	Short term, Continuous, On schedule	NYSDEC grant	Farmer cooperation, analytical capabilities and capacity
		1	SCDHS, SCWA	NYSDEC	f. Salt water intrusion monitoring	Short term, Continuous, On schedule		
		1	SCDHS	NYSDEC	g. Groundwater monitoring in industrial areas based on Reducing Toxics capital program	Short term, Continuous, Schedule under development		
		1	SCDHS	USEPA	h. Beach Monitoring in compliance with BEACH act	Short term, Continuous, On schedule	BEACH Act Grant HSV-2355	
		1	SCDHS	USGS, Estuary Programs, Stony Brook University	i. Implement stream and estuary monitoring programs	Short term, Continuous, On schedule		Analytical capabilities and laboratory capacity
		1	SCDHS	USEPA, NYSDEC, Towns, USGS, Stony Brook University, Estuary Programs	j. Monitor to support TMDL programs	Short term, Continuous, On schedule		
		1	SCDHS	USEPA, NYSDEC, NYSDOH, USGS, SCWA	k. Continue to update data collection and analytical capabilities to support decision making and consideration of emerging issues	Short term, Continuous, On schedule		
		1	SCDHS	NYSDEC, USGS	l. Update water level monitoring program, focus in particular on unsewered near-shore areas to assess impact on on-site wastewater systems	Short term, Continuous, Not yet scheduled		Resources

Water Resources Management Plan Framework

Area	Recommendation	Priority	Owner	Collaborators	Key Milestones and Actions	Action Status and Time Range	Funding Status	Variables
6.0 Project Management and Data Collection	6.7 Implement and upgrade the Bureau of Public Health Protection and Division of Environmental Quality databases and enhance their capabilities to provide a comprehensive integrated geo-coded data management program for all regulated facilities, public and non-residential private wells (location, pumpage and quality), private well quality, groundwater and surface water quality data, salt water intrusion monitoring data, facility data, inspection records, STP Discharge Monitoring Reports (DMRs) and monitoring data and on-site wastewater management systems' installation, maintenance, inspection and performance	1	SCDHS SCDOIT	SCDPW, SCDEDP	a. Develop scope of work, issue RFP and select data management system	Short term, On schedule with 2015 Capital Program	Capital Project 4081	Funding
		1	SCDHS SCDOIT	SCDPW, SCDEDP	b. Populate database, develop protocols and provide access and training	Short term, On schedule with 2015 Capital Program	Capital Project 4081	Funding
		1	SCDHS SCDOIT	SCDPW, SCDEDP	c. Migrate existing databases to new platform	Medium, On schedule with 2015 Capital Program	Capital Project 4081	Funding
		1	SCDHS SCDOIT	USEPA, NYSDEC, Suffolk County, Estuary Programs	d. Utilize database to access information for management and decisions	Medium, Continuous, On schedule with 2015 Capital Program		Funding
	6.8 Adapt the business processes in the Suffolk County Department of Public Works and Department of Health Services to meet expanded integrated water management responsibility	1	Suffolk County	SCDPW, Performance Management	a. Identify process owners and change agents to prioritize and lead improvement initiatives, create action plans to eliminate problem areas and duplicative work, measure improvements	Ongoing, On schedule		
	6.9 Establish standards for the digital transfer of water quality data parameters between ELAP certified laboratories and NYSDOH, NYSDEC and stakeholders.	2	NYSDOH	SCDHS, NYSDEC, ELAP approved Laboratories	a. Establish Electronic Data Transfer (EDT) standards for water quality parameters	Medium, NYSDEC has standard for non potable water. NYSDOH has no standard.		Funding, Staff
	6.10 Work closely with federal, state and local partners to share readily accessible, actionable information, identify synergies and share resources	1	Suffolk County	USEPA, NYSDOH, NYSDEC, NYSDOS, Towns & Villages, SCWA and other suppliers, stakeholders	a. Produce annual water quality reports on-line including identification of improving trends, areas of concern, new issues	Short term, Continuous, Not yet scheduled		Cooperation and resources
	6.11 Evaluate feasibility of inter-governmental water resource cradle to grave data management plan.	1	Suffolk County	USEPA, USGS, NYSDEC, NYSDOH, SCDHS, SCWA	a. Identify key partners and assess volume of data of interest, data format, plan for periodic EDT updates	Short term, Continuous, Not yet scheduled		Funding, cooperation
		1	Suffolk County	USEPA, USGS, NYSDEC, NYSDOH, SCDHS, SCWA	b. Incorporate key partners' data into County data management plan RFP	Short term, Continuous, Not yet scheduled		Funding, cooperation
		1	Suffolk County	USEPA, USGS, NYSDEC, NYSDOH, SCDHS, SCWA	c. Complete project, mine data from key partners, share access to database with water resource managers/partners	Short term, Continuous, Not yet scheduled		Funding, cooperation
	6.12 Continue to evaluate and address the impacts of composting facilities ,dump sites, micro plastics , sand mines and other emerging contaminants upon water resources	2	SCDHS,CCE, Municipalities	NYSDEC	a. Conduct targeted groundwater monitoring down gradient of composting facilities and work with NYSDEC to define classes of composting and assess appropriate response activities	Short term, Continuous, On schedule	Use existing resources and continue to seek supplemental funding sources	Results of groundwater monitoring

Water Resources Management Plan Framework

Area	Recommendation	Priority	Owner	Collaborators	Key Milestones and Actions	Action Status and Time Range	Funding Status	Variables
6.0 Project Management and Data Collection	6.13 Continue to acquire land and development rights for open space based on water quality criteria	1	SCDEDP	SCDHS	a. Within the context of the SCDEDP's Comprehensive Master List and land acquisition procedures, prioritize parcels within the 50 year contributing area to public supply wells and 25 year contributing area to surface water features for preservation	Continuous, On schedule		Available funding and other priorities
	6.14 Delineation of ground-water source areas and times-of-travel to Long Island streams and estuaries	1	USGS	TNC,SCDHS,NYSDEC	a. Delineate groundwater sources areas and travel times to Long Island streams and estuarine embayments, and (2) produce geospatial layers and metadata that describe these delineations for public dissemination via the Internet.	Short term, Proposed, Not yet scheduled		Funding, cooperation
	6.15 To the extent that it is practical and cost effective incorporate the values and methodologies of EPA's Triple Value decision support tools into the implementation of SCCWRMP	2	SCDHS	SCDEDP	Incorporate the tools of EPA's 3VS into the decision making process of plan implementation	Continuous, Not yet scheduled		Training
	6.16 Optimize compliance with SEQRA regulations. Participate in SEQRA process with towns and other municipalities	2	SCDPW, SCDHS, NYDEC	EPA,NYSDOH, SCWA	Complete Environmental Impact Statement where appropriate.	Medium - On schedule		
	6.17 Coordinate plan implementation with local municipalities. Participate in SEQRA review process and provide data, tools and guidance to municipalities .	2	Towns	SCDHS, SCDPW, SCDEDP, Stakeholders	In implementing plan, county state and municipalities should optimize inter-governmental coordination. This includes participating in SEQRA review, use of GIS coverages (travel times to surface waters and public supply wells), training sessions on wastewater alternatives and programs. SCDHS should continue to use priority sensitive zones (50 yr. to public supply wells 25 yr. to surface water) for programs such as TDR, STP siting, wastewater upgrades and pollution source tracking.	Medium - On schedule		
	6.18 Continuously collect, tabulate and review performance measures of key program elements.	2	Towns	SCDPW, Stakeholders	Annually review key performance indicators and programmatic outcomes. Adaptively manage programs to maximize outputs. At five year intervals reassess programs and goals and key performance indicators	Continuous On schedule		

Water Resources Management Plan Framework

Area	Recommendation	Priority	Owner	Collaborators	Key Milestones and Actions	Action Status and Time Range	Funding Status	Variables
7.0 Coastal Resiliency and Surface Water Quality	7.1 Continue to coordinate regional efforts to address Harmful Algal Blooms by developing and implementing the Harmful Aquatic Blooms Action Plan	1	SCDHS / New York State Sea Grant	SCDHS, NOAA, CCE, PEP	a. Complete HAB Action Plan	Short term, Preliminary Plan Sept. 2015, Final Plan Sept. 2016	SCDHS has developed a work plan and budget for the program.	
	7.2 Coordinate with Federal, State, and local partners to continue to assess the vulnerabilities to sea level rise in Suffolk County and develop action plans that mitigate impacts	1	Suffolk County	NYSDEC, NYSDOS, FEMA, EPA, USACOE, TNC, NY Rising, Estuary Programs, SCSWCD	a. Identify critical areas and review options for sanitary code revisions to address long term needs. Work with local municipalities to help implement Climate Action Plans	Medium term, Underway, On schedule		
	7.3 Implement the Fire Island to Montauk Point project in coordination with the Army Corps of Engineers and appropriate stakeholders	1	US Army Corps of Engineers	Suffolk County, NYSDEC, towns and stakeholders		Short term, Ongoing, On schedule	The Fire Island to Montauk Point (FIMP) project, on the drawing boards since 1964 in various iterations, was allocated $700M by the Superstorm Sandy relief bill. Preliminary projections approximate $450M for road and house elevations, with 7 million cubic yards (cy) of sand borrowing from the Atlantic going to a $207 million, 19 mile-long, 9.5 foot berm to 15 foot dune line interfaced with beach nourishment, plus $60M for green infrastructure projects.	
	7.4 Support the practical implementation of ideas generated by the Rebuild by Design teams	1	New York State			Medium term, Not yet scheduled		
	7.5 Support the implementation and expansion of NY Rising Community Reconstruction Program	1	New York State	Suffolk County		Short term, ongoing, On schedule	Various projects throughout Suffolk County including the "Living" Marsh Grand Canal Levee Improvement	
	7.6 Implement and expand Wetlands Stewardship Strategy efforts throughout Suffolk County	1	SCDEDP	SCDPW, Estuary Programs	a. Implement ongoing and recently funded projects, continue to seek new funding for priority projects identified by stakeholders	Short term, Ongoing	$1,310,000 grant to Suffolk County from the NFWF for Integrated Marsh Management. $525,000 for Smith Point HMGP and $600,000 from NRCS .	
	7.7 Develop drainage strategies in chronically flooded areas through the installation of green infrastructure measures like permeable pavers	1	SCDPW	Estuary Programs, Municipalities, SCSWCD		Short term, Not yet scheduled		Funding
	7.8 Develop a robust stormwater management program in coordination with local municipalities and New York State	1	Suffolk County	NYSDEC, local municipalities, Estuary Programs	a. Assess the effectiveness of current program and funding allocations. Update town codes as necessary.	Short term, Not yet scheduled		
		2	SCDPW	Towns, NYSDEC, SCSWCD	b. Improve coordinated management of streams/sediment removal	Medium Term, Not yet scheduled		
		2	Towns	Suffolk County	c. Continue to support municipal stormwater efforts using Suffolk County Water Quality Protection and Restoration funding	Ongoing	Suffolk County Water Quality Protection and Restoration Program	

Water Resources Management Plan Framework

Area	Recommendation	Priority	Owner	Collaborators	Key Milestones and Actions	Action Status and Time Range	Funding Status	Variables
7.0 Coastal Resiliency and Surface Water Quality	7.9 Assess the feasibility and effectiveness of hardening coastal infrastructure and the potential to incorporate living shoreline concepts wherever possible and effective.	1	SCDPW, USACE	SC Parks, Estuary Programs NYSDEC, Municipalities	a. Feasibility study completed; identify early implementation tasks and funding sources	Completed		
	7.10 Support the development of an Inter-municipal Agreement among the East End towns and Villages and Suffolk County with the Peconic Estuary Program to implement water quality initiatives	1	PEP	Suffolk County, East End towns	a. Continue to provide funding for the development of clear and measurable outcomes within the Peconic Estuary	Completed	Resolution 440-2014	
	7.11 Examine feasibility of participating in/initiating other inter-municipal agreements (e.g. Northport Harbor, Oyster Bay/Cold Spring Harbor)	2	Suffolk County	Municipalities	a. Prioritize existing funding for joint water quality improvement initiatives	Short Term, PEP IMA Approved by Suffolk County others pending		LISS,SSER, Municipalities
	7.12 Continue to support and coordinate with the Peconic Estuary Program, Long Island Sound Study, and the South Shore Estuary Reserve Program to implement projects	1	Suffolk County	Estuary Programs	a. Provide in-kind staff and financial support to advance the implementation of stakeholder driven initiatives	Short term, Ongoing, On schedule		
	7.13 Optimize the use of data, computer models and TDRs to minimize the siting of wastewater facilities in 25 and 50 year travel time to surface waters and public supply wells.	1	SCDPW, SCDHS, NYDEC, Private industry	SCWA, stakeholders	a. Disseminate water quality, hydrologic data and computer model outputs to optimize siting. Implement SPDES action limits for enhanced performance standards, ensuring nitrogen loading is reduced compared with as-of-right unsewered alternative	On going	Suffolk County Water Quality Protection and Restoration Program	
	7.14 Continue to evaluate and promote development of improved pollution control management measures and structures	2	Towns	Suffolk County	a. Work with towns promote structural and non-structural methods to reduce pollutants	On going		

Key:

Priority - 1 highest to 3 lowest

Schedule - short term - < 5 years
5 years < medium > 10 years
Long term > 10 years

LIST OF ACRONYMS

CCE	Cornell Cooperative Extension	NYSDOS	New York State Department of State
CP	Capital Program	NYSEFC	New York State Environmental Facilities Corporation
ECL	Environmental Conservation Law	PEP	Peconic Estuary Program
ELAP	Environmental Laboratory Accreditation Program	RFP	Request for Proposal
ESDC	Empire State Development Corporation	SCDEDP	Suffolk County Department of Economic Development and Planning
FDA	Federal Drug Administration	SCDHS	Suffolk County Department of Health Services
FEMA	Federal Emergency Management Agency	SCDOIT	Suffolk Department of Information Technology
HMGP	Habitat Management Grant Program	SCDPW	Suffolk County Department of Public Works
I/A OWTS	Innovative Alternative Onsite Wastewater Treatment System	SCDPW	Suffolk County Department of Public Works
IMA	Inter-Municipal Agreement	SCLD	Suffolk County Law Department
LCV	League of Conservation Voters	SCWA	Suffolk County Water Authority
LIREDC	Long Island Regional Economic Development Council	SCSWCD	Suffolk County Soil and Water Conservation District
LIRPC	Long Island Regional Planning Commission	SPDES	State Pollutant Discharge Elimination System
LISS	Long Island Sound Study	STP	Sewage Treatment Plant
NFWF	National Fish and Wildlife Federation	SSER	South Shore Estuary Reserve
NOAA	National Oceanic and Atmospheric Administration	TNC	The Nature Conservancy
NRCS	National Resources Conservation Service	USACOE	United States Army Corps of Engineers
NYSDEC	New York State Department of Environmental Conservation	USEPA	United States Environmental Protection Agency
NYSDOH	New York State Department of Health	USGS	United States Geological Survey