4. MAPPING + DATA EVALUATION - Land-based Characteristics Influencing Water Quality

4.1.1 Background

In 2012, Peconic Green Growth devised a methodology using existing data to assess the need for enhanced wastewater treatment to mitigate excessive nitrogen loading for existing development based on environmental need. The goal is to provide an approach that is the first step in an implementation plan for decentralized wastewater infrastructure. The methodology relies on a series of maps to define areas of concern and attributes. Counts are then derived from spatial analyses of key conditions, and reports run on data sets. The original methodology was generated for submittal to the U.S. Department of Environmental Protection (EPA) Clean Water Needs Survey, but was ultimately rejected. Advice was given to 1) incorporate nitrogen mitigation in comprehensive plans, 2) propose actual projects, and 3) compare the costs for decentralized treatment to the cost of central sewers. This study is the next step in response to the EPA feedback. The original work was based on Town of Southampton databases, where the level of detail exceeds that of many other towns. We therefore had to drop certain data sets, in particular the age of the buildings. This detail is being picked up in the survey and/or estimates from historical photographs, which are not directly correlated with the 1973 date targeted. Where information is unavailable, efforts through other means will pick up detail at the project stage.

Maps are more than a tool for organizing data, as their visual impact allows for instantaneous understanding of complex data. The maps are invaluable as an educational as well as planning tool when sharing data with the public. Integrated data sets can trigger planning priorities and awareness of opportunities. Here we create the maps at the hamlet scale. This improves their effectiveness immensely as people can find their homes and understand how their septic systems relate to the environmental conditions discussed. We added three evaluation measures: 1) horizontal impacts of sea level rise, 2) data evaluation on nonconformance due to lot size, and 3) setback clearance from all structures to inform site selection criteria for collected systems. From the maps, data queries were conducted and summarized. The GIS department of the Town of Southampton donated the GIS services and mapping for the project. This included the digitizing of coastlines. The maps and reports will be available for public access at www.peconicgreengrowth.org.

4.1.2 Land-based Characteristics Influencing Water Quality

In order to link solutions to environmental need, the study assesses land characteristics that are known to impact water quality in both aquifers and surface water bodies. It provides a cost-effective analysis using existing data sets that helps prioritize locations needing upgrades or further study. Most new policies and more stringent standards target new construction or major reconstruction efforts, but usually grandfather existing systems or conditions. This study focuses on the existing built environment in an effort to accelerate water quality improvements where they can have the most benefit quickly. It advocates addressing existing issues that negatively impact the environment, not just establishing better guidelines for future development. The following characteristics are examined in this chapter:

1. Onsite treatment
2. Depth to Groundwater
3. Flood and SLOSH Zones
4. Horizontal impacts from inundation due to climate change
5. Soils – drainage type and ability to treat septic systems onsite
6. Density and size nonconformance

7. Groundwater Influence Zones
8. Priorities
9. Land Use
10. Aerial imagery

When calculating hamlet breakdowns, Southold had a direct correlation between zip codes and hamlets. This was not the case in Riverhead, so zip code districts were used, but named by dominant hamlet. The associated zip code is identified in the depth to groundwater tables. All other tables use associated hamlet names only, but still query data using zip codes.

4.2 Onsite Wastewater Treatments

Before 1973, cesspools were the most common method of treating onsite wastewater. Cesspools are open-sided pits that gather all the waste collected from household uses from pipes from the home. The purpose of the cesspool is to slowly filter the wastewater into the ground through openings in side walls, acting similarly to a dry well. Older ones were often made with open-jointed block. Cesspools disperse rather than treat wastewater. When the wastewater enters the soils, oxygen reacts with wastewater to nitrify it, making nutrients available for uptake or denitrification processes. With cesspools, dissolved solids as well as liquid effluent leach into the soil, filling air gaps in the soil. The soil's ability to naturally treat and filter wastewater is then compromised, resulting in surface ponding or transfer of poorer quality effluent to groundwater. Also, pathogens can be found in the solids. If there is not enough distance between the system and groundwater, these pathogens may enter groundwater, potentially impacting human health. With cesspools, no denitrification is presumed to have occurred (approximately 65 mg/L), while in septic systems at least 10% can occur naturally. Currently, it is not required by law to upgrade a cesspool to current standards in Suffolk County, due to exceptions for grandfathered installations. In addition, if a cesspool fails it may be replaced with another cesspool without the permit filings required by code-compliant systems. An increase in the number of bedrooms triggers an upgrade.

In 1973 new standards required the use of septic systems for onsite systems. The collected wastewater first enters an enclosed septic tank, where most solids precipitate out. The solids are treated naturally by microbial digestion in an anaerobic (without oxygen) state. Over time, if the natural processing does not keep up with the incoming volume of solids, the tank is pumped and the reduced volumes treated at scavenger plants (Riverhead). The excess liquid effluent passes to either separate leaching pits with sidewall openings or fields that disperse the liquid to soils, where the natural process of treatment continues. With a septic system, some nitrogen removal occurs, with typical levels of discharge being 40-60 mg/L.

To evaluate the presence of cesspools, houses built before 1973 are considered likely to be cesspools. In Southampton, building age is part of the searchable database, but other towns do not have the same record availability. For the initial assessment for the presence of cesspools, building age is assessed at the project level based on historical aerial pictures and responses to a questionnaire. More extensive queries of building permit records, when available, can supplement this evaluation. Therefore this characteristic is not evaluated at the town-wide level or mapped here. Due to the historic nature of the hamlets and seaside developments, the overall ratios can be expected to be similar to those found in Southampton, where 54% of the buildings are older than 1973. This aligns with our survey data. Out of 563 responses 57% had homes older than 1973 with most being from the North Fork (95%). Assessing buildings sized over 450SF with a total of 9,617 in the LI Sound watershed, a starting estimate for the number of cesspools needing upgrade is **5,193**.

4.3 Depth to Groundwater

Standards rely on separation distances between the bottoms of leaching fields or pits and groundwater levels to properly treat wastewater effluent by filtration and oxidation. The minimum distance is two feet for leaching fields. In 1995, the Suffolk County Department of Health Services (SCDHS) increased the required depth to groundwater from two feet to three feet for leaching pits, although still allowing two feet for alternative shallow systems approved by the department. Systems having less than two-to-three feet of clearance to groundwater below the leaching field or pit will have their operations compromised and need relocation and/or upgrades for proper function. While county standards are now three feet, NYS Department of Environmental Protection, Appendix 75-A.4 (a)(2) requires at least four feet of useable soil above rock, unsuitable soil and high seasonal groundwater and EPA documents even cite five feet as being preferred. Six feet is recommended when groundwater recharge enters potable aquifers.[1] The Town of East Hampton requires a more stringent four-foot separation to groundwater through use of a Harbor Protection Overlay District defined in the Town Code (255-3-70).

To compound the issues, the expected rise in groundwater due to climate change is expected to be one to two feet by 2080, with the East End being particularly affected due to the attenuated land masses. Figure 4-1 from the Suffolk County Comprehensive Water Resources Plan (SCCWRP), shows the predicted increase in the upper glacial water levels (groundwater levels) assuming a two-foot rise in sea level. Impacts are predicted to be more severe along the northern shore due to lower stream base flow.[2] Alternative evidence incorporating glacial melt anticipates rises as high as four feet.[3] This means that systems currently built to the limits of standards will become noncompliant with rising groundwater levels.

To assess the impacts of groundwater level rise from climate change on the basic functions of onsite wastewater systems, key distances to groundwater that triggered changes to the design of leaching systems[4] as required by the SCDHS were defined and then increased by two feet to reflect expected increases in groundwater levels. It can be expected that installations, especially older than 1995, in shallow locations, appearing here in any of the colored bands, will start to fail as the distance to groundwater shrinks. In addition SCDHS requires grading plans when the ground surface distance to groundwater is less than seven feet[5] (increased to nine feet on maps with two-foot rise adjustment). Changes to the topography can cause negative environmental repercussions, such as changes to stormwater runoff, the hardening of coastlines through the use of bulkheads, and loss of native flora. Wastewater treatment under difficult site conditions can be handled by waterproofed, enhanced systems or by relocating treatment out of critical areas. At a minimum, leaching field redesign and nitrogen treatment would be needed. Currently SCDHS does not allow septic system installation at elevations of one foot or below.[6] Since elevations of up to three feet are considered ideal for buffer zones affecting water quality, lands within this zone should be targeted for conservation or zero impact solutions.

To summarize, there are two major issues indicating the environmental failure of onsite wastewater treatment related to depth to groundwater: the presence of cesspools in shallow areas and inadequate distance to groundwater for proper function. Failure from these conditions is a serious threat to public and environmental health as both pathogens and nutrients, lacking even basic treatment, are flushed into aquifers and surface water bodies.

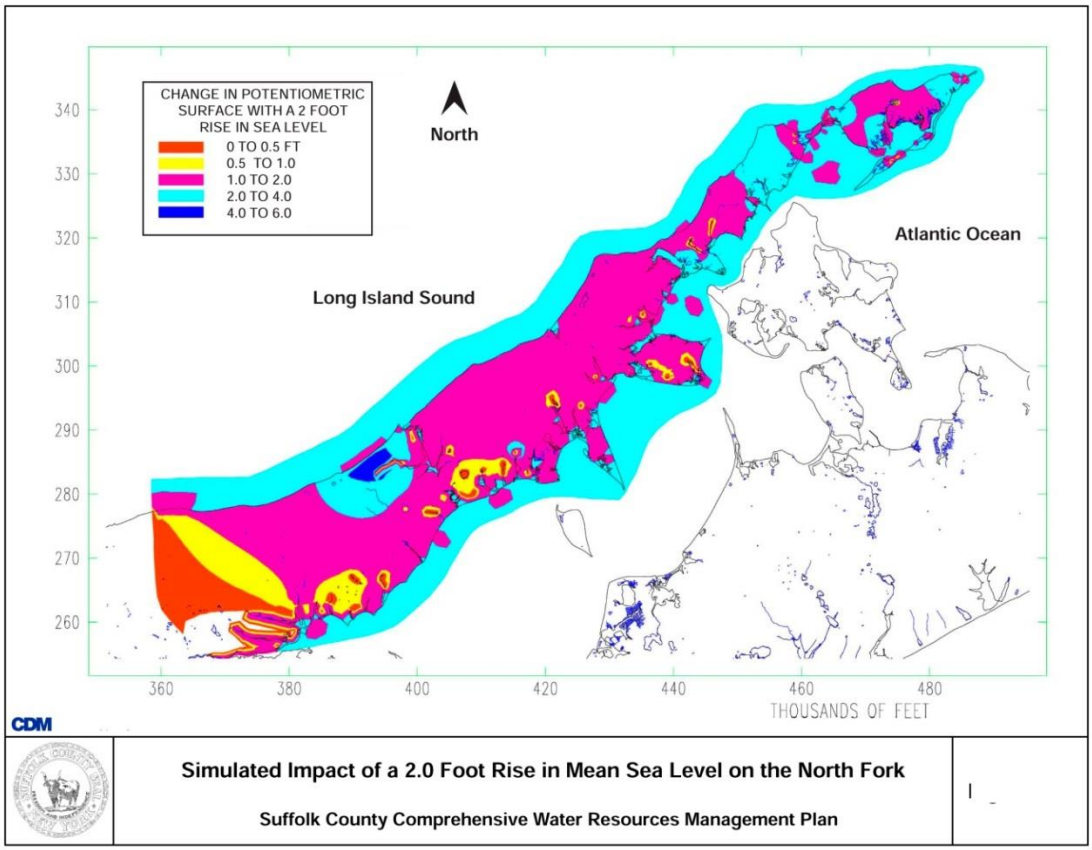
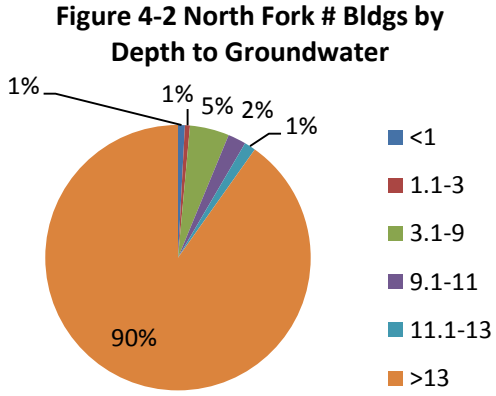


Figure 4-1 Impact on Groundwater of 2' Rise in Mean Sea Level Rise (SCCWRMP Figure 3.39)

Table 4-1 and Figure 4-2
# of BUILDINGS (>450 SF) by DEPTH TO GROUNDWATER
Long Island Sound Watershed, NORTH FORK TOTAL

# Depth to Groundwater (feet)	NORTH FORK TOTAL	% of Total	Cumulative % of Total
	North Fork		
<1	80	0.8%	0.8%
1.1-3	59	0.6%	1.4%
3.1-9	461	4.8%	6.2%
9.1-11	212	2.2%	8.4%
11.1-13	133	1.4%	9.8%
>13	8672	90.2%	100.0%
TOTAL	**9617**	**100%**	



Nine hundred forty five (945) buildings representing 9.8% of the buildings greater than 450 square feet in the Long Island Sound Watershed are situated in locations with shallow depths to groundwater. The associated onsite wastewater treatment systems for these buildings will likely be compromised due to rises in groundwater elevation caused by climate change. Southold has the major share, with 15.9% of the buildings being built on low lying lands. Since the North Fork topography along the LI Sound shore has some of the highest local elevations due to its formation as a terminal moraine, the shallow depths to groundwater are basically in creek basins. Mattituck, Fishers Island, Southold and Wading River have the highest actual numbers.

Figure 4-3
 # Bldgs with Shallow Depths to Groundwater
by Hamlet, LI Sound Watershed

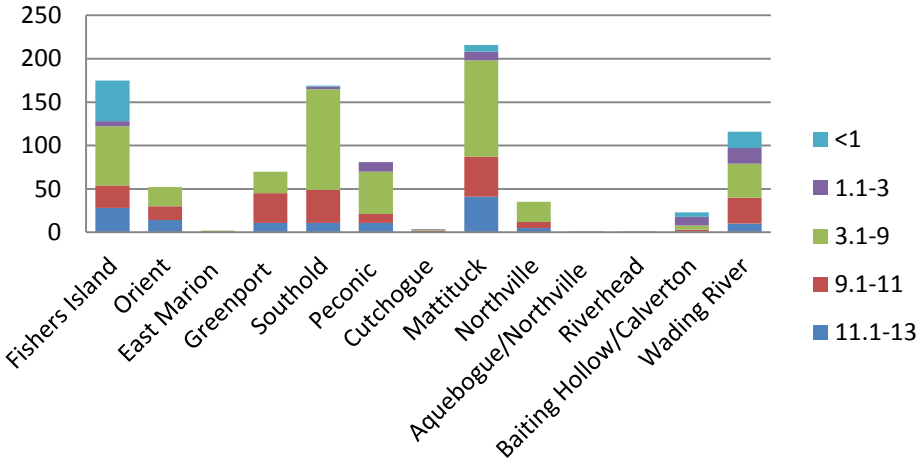


Table 4-2 # of BUILDINGS (>450 SF) by DEPTH TO GROUNDWATER
Long Island Sound Watershed - RIVERHEAD

# Depth to Groundwater (feet)	E Northville 11901	Aquebogue/Northville 11931	Riverhead 11901	Calverton/Baiting Hollow 11933	Wading River 11792	TOWN OF RIVERHEAD TOTAL	% of Total	Cumulative % of Total
	Riverhead							
<1				5	19	24	0.5%	0.5%
1.1-3				10	18	28	0.6%	1.1%
3.1-9	23			5	39	67	1.4%	2.5%
9.1-11	7	1		2	30	40	0.8%	3.3%
11.1-13	5		1	1	10	17	0.4%	3.7%
>13	280	171	761	752	2,633	4,597	96.3%	100.0%
TOTAL	**315**	**172**	**762**	**775**	**2,749**	**4,773**	**100%**	

Table 4-3
# of BUILDINGS (>450 SF) by DEPTH TO GROUNDWATER
Long Island Sound Watershed
SOUTHOLD

# Depth to Groundwater (feet)	Fishers Island 06390	Orient 11957	East Marion 11939	Greenport 11944	Southold 11971	Peconic 11958	Cutchogue 11935	Mattituck 11952	TOWN OF SOUTHOLD TOTAL	% of Total	Cumulative % of Total
	Southold										
<1	47				1			8	56	1.2%	1.2%
1.1-3	6				3	11	1	10	31	0.6%	1.8%
3.1-9	68	22	2	25	116	49	1	111	394	8.1%	9.9%
9.1-11	26	16		34	38	10	2	46	172	3.6%	13.5%
11.1-13	28	14		11	11	11		41	116	2.4%	15.9%
>13	631	361	295	343	523	182	248	1,492	4,075	84.1%	100.0%
TOTAL	**806**	**413**	**297**	**413**	**692**	**263**	**252**	**1,708**	**4,844**	**100%**	

4.4 Flooding and Storm Surge

The Flood Maps show areas susceptible to flooding as defined by the Federal Emergency Management Agency (FEMA) and the SLOSH Maps depict Sea, Lake and Overland Surges from Hurricanes (SLOSH) run by the National Hurricane Center (NHC). While the SCDHS currently does not allow septic systems to be installed in the ten year flood level,[7] a considerable amount of development has occurred within the 100 year flood and storm surge areas. With global warming the frequency of these storms is expected to increase. Even temporary episodes that pollute marine waters can have a deleterious effect on habitat, shellfish and fin fish. Cesspools in flood areas are particularly vulnerable as the waste is easily flushed into flood waters, where it potentially impacts human health. Salt water infiltration also impacts the effectiveness of the natural treatment process, requiring recovery time for the bacteria to become effective again. Also, if systems are pumped when the land is still saturated, collapses can occur due to hydrostatic pressure. Waste treatment in the SLOSH zones should, at a minimum, be flood proofed and any enhanced treatment provided with generator connections. Ideally any clustered system would transport the treatment to a location outside the susceptible zones.

4.4.1 Flood Zones

Overall, 5.1% of the buildings and their onsite systems are potentially impacted by flooding. Southold has a disproportionate share, with 393 structures threatened, or 8.1% of the structures greater than 450 SF in the Long Island Sound watershed in Southold. While Riverhead has the smaller total number, it has the unusual characteristic of having more buildings in the VE, coastline hazard area than in the 100 year flood plain, with 1.6% or 76 of the structures being vulnerable. These lie predominantly in the Wading River and Baiting Hollow/Calverton zip code areas. Mattituck, Southold and Fishers Island also have significant threats to the built infrastructure in the Long Island Sound watershed.

Table 4-4
# of BUILDINGS (>450 SF) by FLOOD ZONE (FIRM)
Long Island Sound Watershed (North Fork)
NORTH FORK TOTAL

Flood Zone	NORTH FORK TOTAL LI Sound Watershed	% of Total	Cumulative % of Total
	North Fork		
0.2 PCT annual chance Flood Hazard	33	0.3%	0.3%
AE	308	3.2%	3.5%
VE	147	1.5%	5.1%
X	9,129	94.9%	100.0%
TOTAL	**9,617**	100%	

Figure 4-4 # of BLDGS (>450 SF) in FLOOD ZONES (FIRM)

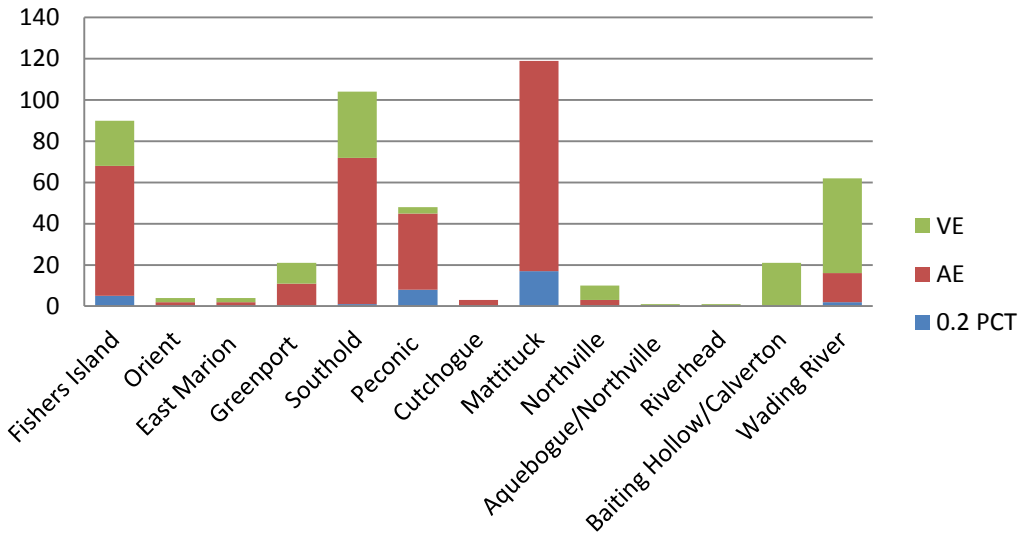


Table 4-5 # of BUILDINGS (>450 SF) by FLOOD ZONE (FIRM)
Long Island Sound Watershed (North Fork)
RIVERHEAD

Flood Zone	E Northville	Aquebogue/Northville	Riverhead	Calverton/ Baiting Hollow	Wading River	TOWN OF RIVERHEAD TOTAL LI Sound	% of Total	Cumulative % of Total
	Riverhead							
0.2 PCT annual chance Flood Hazard					2	2	0.0%	0.0%
AE	3				14	17	0.4%	0.4%
VE	7	1	1	21	46	76	1.6%	**2.0%**
X	305	171	761	754	2,687	4,678	98.0%	100.0%
TOTAL	**315**	**172**	**762**	**775**	**2,749**	**4,773**	100%	

Table 4-6 # of BUILDINGS (>450 SF) by FLOOD ZONE (FIRM)
Long Island Sound Watershed (North Fork)
SOUTHOLD

Flood Zone	Fishers Island	Orient	East Marion	Greenport	Southold	Peconic	Cutchogue	Mattituck	TOWN OF SOUTHOLD TOTAL LI Sound	% of Total	Cumulative % of Total
	Southold										
0.2 PCT annual chance Flood Hazard	5				1	8		17	31	0.6%	0.6%
AE	63	2	2	11	71	37	3	102	291	6.0%	6.6%
VE	22	2	2	10	32	3			71	1.5%	**8.1%**
X	716	409	293	392	588	215	249	1,589	4,451	91.9%	100.0%
TOTAL	**806**	**413**	**297**	**413**	**692**	**263**	**252**	**1,708**	**4,844**	100%	

4.4.2 SLOSH Zones

The vulnerability of areas impacted by storm surge is evident by the damage caused by storm events the world has witnessed over the past few years. Storm surge increases the number of homes and onsite wastewater treatment systems vulnerable during extreme weather events. The overall percentage of buildings over 450 SF in size in the Long Island Sound watershed on the North Fork increases to 10.8% or 1,043 structures. Again, Southold has a disproportionate share, with 18.6% of Southold buildings in the LI Sound watershed situated in SLOSH zones compared to only 3% in Riverhead. Mattituck, Fishers Island and Southold have the highest actual numbers of vulnerable buildings, while some hamlets have high percentages of their structures in vulnerable locations. For instance Peconic, at 33.1%, has the highest percentage of its buildings > 450 SF located in SLOSH ZONES. Southold (26.4%), Fishers Island (23.9%), Mattituck (17.7%), and Orient (17.2%) also have relatively high percentages.

Table 4-7
# of BUILDINGS (>450 SF) by SLOSH (Sea, Lake, and Overland Surges from Hurricanes) Zone
Long Island Sound Watershed - NORTH FORK TOTAL

SLOSH ZONES	NORTH FORK TOTAL LI Sound Watershed	% of Total	Cumulative % of Total
	North Fork		
Category 1	175	1.8%	1.8%
Category 2	317	3.3%	5.1%
Category 3	272	2.8%	7.9%
Category 4	279	2.9%	10.8%
No Category	8,574	89.2%	100.0%
TOTAL	**9,617**	**100%**	

Figure 4-5 # Bldgs. in SLOSH ZONES
LI Sound Watershed - North Fork

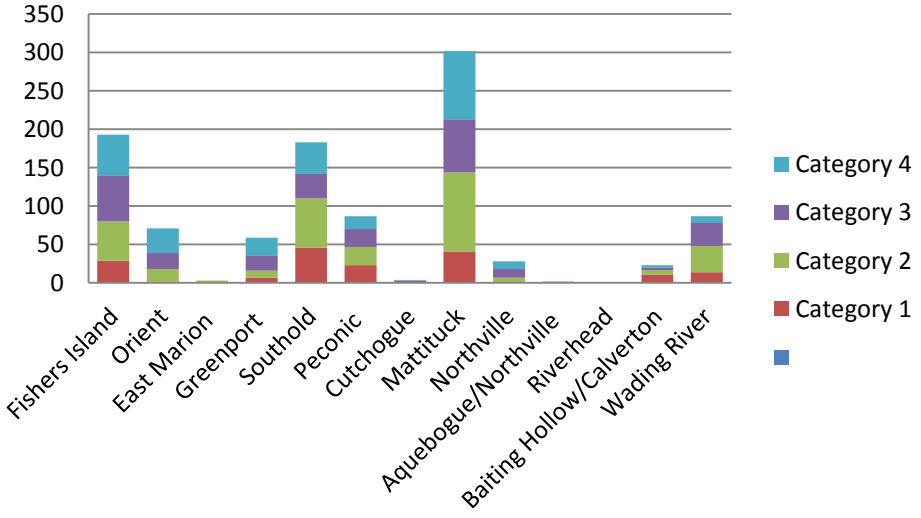


Figure 4-6 % Bldgs. > 450 SF in SLOSH ZONE
LI Sound Watershed, North Fork

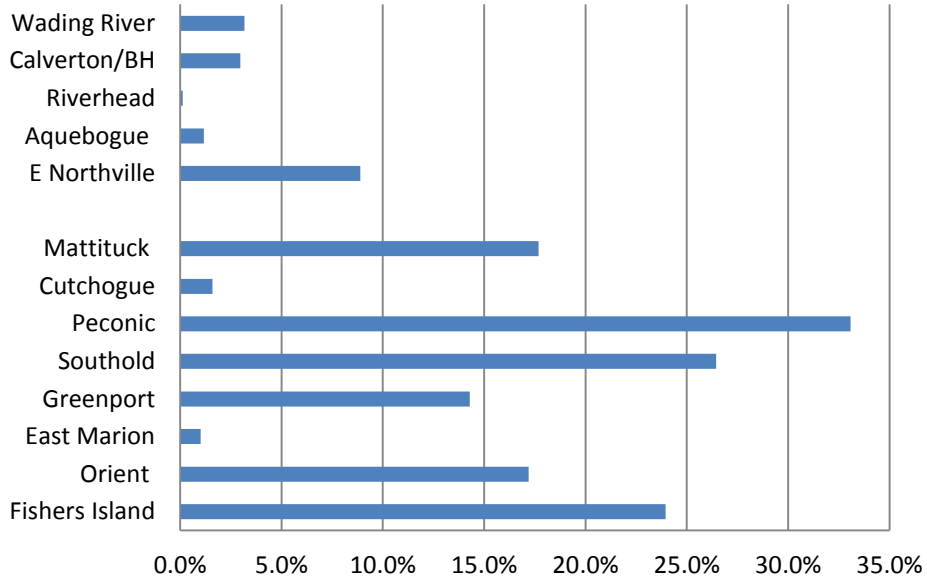


Table 4-8
% of BUILDINGS (>450 SF) in SLOSH Zones
Long Island Sound Watershed
HAMLETS

Fishers Island	Orient	East Marion	Greenport	Southold	Peconic	Cutchogue	Mattituck
23.9%	17.2%	1.0%	14.3%	26.4%	33.1%	1.6%	17.7%
Southold							

E Northville	Aquebogue	Riverhead	Calverton/BH	Wading River
8.9%	1.2%	0.1%	3.0%	3.2%
Riverhead				

Table 4-9
# of BUILDINGS (>450 SF) by SLOSH ZONE
SLOSH - Sea, Lake, and Overland Surges from Hurricanes
Long Island Sound Watershed (North Fork)
RIVERHEAD

SLOSH ZONES	E Northville	Aquebogue/Northville	Riverhead	Calverton/ Baiting Hollow	Wading River	TOWN OF RIVERHEAD TOTAL LI Sound	% of Total	Cumulative % of Total
	Riverhead							
Category 1			1	11	14	26	0.5%	0.5%
Category 2	7			6	34	47	1.0%	1.5%
Category 3	11	1		3	30	45	0.9%	2.5%
Category 4	10	1		3	9	23	0.5%	3.0%
No Category	287	170	761	752	2,662	4,632	97.0%	100.0%
TOTAL	**315**	**172**	**762**	**775**	**2,749**	**4,773**	**100%**	

Table 4-10 # of BUILDINGS (>450 SF) by SLOSH ZONE
SLOSH - Sea, Lake, and Overland Surges from Hurricanes
Long Island Sound Watershed (North Fork)
SOUTHOLD

SLOSH ZONES	Fishers Island	Orient	East Marion	Greenport	Southold	Peconic	Cutchogue	Mattituck	TOWN OF SOUTHOLD TOTAL LI Sound	% of Total	Cumulative % of Total
	Southold										
Category 1	29	2	1	7	46	23		41	149	3.1%	3.1%
Category 2	51	16	2	9	64	24	1	103	270	5.6%	8.6%
Category 3	60	21		20	32	23	2	69	227	4.7%	13.3%
Category 4	53	32		23	41	17	1	89	256	5.3%	18.6%
No Category	613	342	294	354	509	176	248	1,406	3,942	81.4%	100.0%
TOTAL	**806**	**413**	**297**	**413**	**692**	**263**	**252**	**1,708**	**4,844**	**100%**	

4.5 Horizontal Impacts from Inundation Due to Climate Change

In order to assess the number of systems that may become noncompliant to current horizontal setbacks because of sea level rise, the number of buildings 450 square feet or larger were counted based on expected inundation levels. The counts were taken from the GIS maps developed by The Nature Conservancy as part of the Coastal Resilience Project, Long Island, USA – November 2009. The low and high estimates were taken for the years 2050 and 2080. The high estimate incorporates the impact of one-meter of glacial melt. The full methodology description is in Appendix B-1. The chart counts both buildings actually inundated by sea level rise using the building centroid, and then within 100 feet of the new high tide levels. The latter reflects the 100-foot setback required by the NYSDEC/SCDHS for onsite system installations. By 2050 it can be expected that 527 to 729 buildings will have noncompliant systems due to inadequate setbacks. The numbers increases to 626 to 981 for 2080. This situation points to a need for regulations or strategies dealing with allowable mitigation options and/or abandonment for existing homes in vulnerable locations. It is usually wastewater treatment that is the limiting factor in such cases. Approaches to the issue can vary widely, for example, regulating and zoning shore hardening practices, allowing self-contained wastewater treatment within raised structures, or requiring abandonment based on rolling easements. This threat in Southold is 4.6 times that in Riverhead.

Table 4-11 NORTH FORK: # OF BUILDINGS > 450SF Impacted by Sea Level Rise
HORIZONTAL SETBACK
Based on Coastal Resilience Project, Long Island, USA - November 2009, The Nature Conservancy

Horizontal Impacts of Climate Change	NORTH FORK TOTAL LI Sound Estuary	
North Fork		
Low Level Estimate		
Categories	2050	2080
# BLDGS inundated	4	17
# BLDGS within 100' buffer of new inundation high tide levels	527	626
High Level Estimate		
Categories	2050	2080
# BLDGS inundated	45	167
# BLDGS within 100' buffer of new inundation	729	981

Table 4-12 RIVERHEAD # OF BUILDINGS > 450SF Impacted by Sea Level Rise
HORIZONTAL SETBACK

Horizontal Impacts of Climate Change	E Northville 11901		Aquebogue/ Northville 11931		Riverhead 11901		Baiting Hollow/Calverton 11933		Wading River 11792		Total RIVERHEAD LI Sound Estuary	
	Riverhead											
Low Level Estimate												
Categories	2050	2080	2050	2080	2050	2080	2050	2080	2050	2080	2050	2080
# BLDGS inundated	0	0	0	0	0	0	0	1	2	5	2	6
# BLDGS within 100' buffer of new inundation high tide levels	32	37	14	16	4	5	15	15	55	65	120	138
High Level Estimate												
Categories	2050	2080	2050	2080	2050	2080	2050	2080	2050	2080	2050	2080
# BLDGS inundated	0	0	0	0	0	0	3	11	7	14	10	25
# BLDGS within 100' buffer of new inundation high tide levels	40	46	16	17	5	5	23	28	70	80	154	176

Table 4-13 SOUTHOLD: # OF BUILDINGS > 450SF Impacted by Sea Level Rise
HORIZONTAL SETBACK

Horizontal Impacts of Climate Change	Fishers Island		Orient 11957		East Marion 11939		Greenport 11944		Southold 11971		Peconic 11958		Cutchogue 11935		Mattituck 11952		TOWN OF SOUTHOLD TOTAL LI Sound Estuary	
	Southold																	
Low Level Estimate																		
Categories	2050	2080	2050	2080	2050	2080	2050	2080	2050	2080	2050	2080	2050	2080	2050	2080	2050	2080
# BLDGS inundated	2	2	0	0	0	0	0	1	0	5	0	3	0	0	0	0	2	11
# BLDGS within 100' buffer of new inundation high tide	105	115	13	15	5	7	20	33	121	137	43	57	3	3	97	121	407	488
High Level Estimate																		
Categories	2050	2080	2050	2080	2050	2080	2050	2080	2050	2080	2050	2080	2050	2080	2050	2080	2050	2080
# BLDGS inundated	2	20	0	2		1	2	6	18	47	5	22	0	1	8	43	35	142
# BLDGS within 100' buffer of new	129	171	21	44	8	12	44	54	158	186	70	96	3	3	142	239	575	805

4.6 Soils

4.6.1 Soils: Drainage Class

Currently SCDHS references soils with meadow mat, bog, silts, clay or impervious matter extending below the groundwater table as being unsuitable for septic systems.[8] In NYSDEC Appendix 75-A.4 (a)(1) land, in the ten year flood zone and slopes greater than 15% and Appendix 75-A.4 (a)(3) soils with very rapid percolation rates faster than one minute per inch are not suitable for subsurface absorption systems unless the site is modified by blending with less permeable soil to reduce the infiltration rate. Soils that are excessively permeable do not hold the effluent long enough for natural treatment to occur in the biomat below the leaching field, increasing likelihood of groundwater contamination.

To identify soil suitability, one can identify hydrologic groups. Here we used the Web Soil Survey of the Natural Resources Conservation Services (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm). Once an area of interest is defined, under the Soil Properties and Qualities tab, Soil Qualities and Features, the drainage class can be determined. The "excessively drained, poorly drained, and very poorly drained" as defined in the Soil Survey Manual http://soils.usda.gov/technical/manual will influence the choice of appropriate solutions. Here we assigned these attributes to already mapped soil types to more simply evaluate and quantify soil suitability graphically. Under the Soil Data Explorer, Suitability and Limitations Ratings, and Sanitary Facilities tabs, the Septic Tank Absorption Fields rating is defined. The "very limited" category indicates that limitations cannot generally be overcome and should trigger alternative treatment evaluation, as well as conservation efforts. The attributes used for evaluation of soil depths from 12 to 48 inches are saturated hydraulic conductivity, depth to seasonal high water table, depth to bedrock or dense material, and susceptibility to flooding.

The maps depicting drainage types give an indication as to solution needs based on permeability. The pink zones on the Septic Absorption Maps indicate areas that will most likely need enhanced solutions to adequately treat wastewater due to soil type limitations. Solutions could include mounding, leaching fields, recirculating sand filters, vegetated filters, membrane bio-reactors, sequencing batch reactors, and others, some of which provide the secondary and tertiary treatments in prepackaged units. In some cases clustered systems may be able to relocate the treatment or recharge area to locations with suitable soils. The main challenge for the North Fork watershed is excessively drained soils, with just over 50% of the buildings being sited on porous soils. Riverhead has the most problematic soils with over 60% of the soils being excessively drained. 63.1% of the soils in Riverhead are considered to be very limited for septic absorption, while Southold has 37% of its soils in the LI Sound watershed considered very limited for ground waste disposal.

DRAINAGE CLASSIFICATION	NORTH FORK TOTAL	% of Total
	North Fork	
*not rated	391	4.1%
Excessively Drained	4824	50.2%
Moderately Well Drained	342	3.6%
Poorly Drained	48	0.5%
Very Poorly Drained	13	0.1%
Well Drained	3999	41.6%
TOTAL	**9617**	**100%**

Table 4-14 Soil: Drainage Classification

Septic Absorption Rating	NORTH FORK TOTAL	% of Total
	North Fork	
Not Rated	726	7.5%
Somewhat Limited	4088	42.5%
Very Limited	4803	49.9%
TOTAL	**9617**	**100%**

Table 4-15 Soil: Septic Absorption

RIVERHEAD

Figure 4-7 RIVERHEAD
 # Bldgs. by Soil Drainage Class

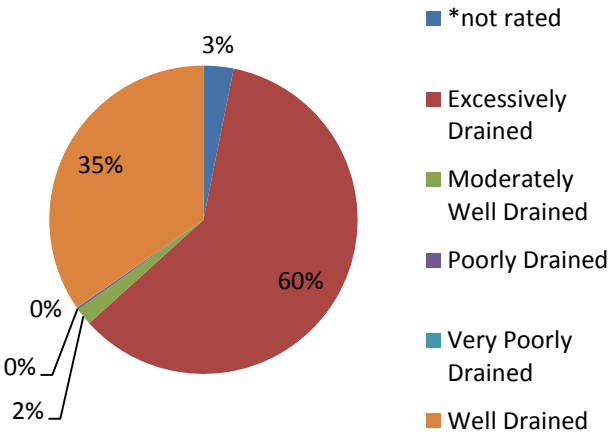
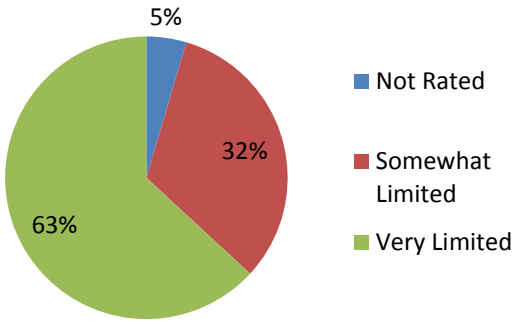


Figure 4-8 RIVERHEAD # of Bldgs. by Soil Septic Absorption Rating



SOUTHOLD

Figure 4-9 SOUTHOLD
 # Bldgs. by Soil Drainage Class

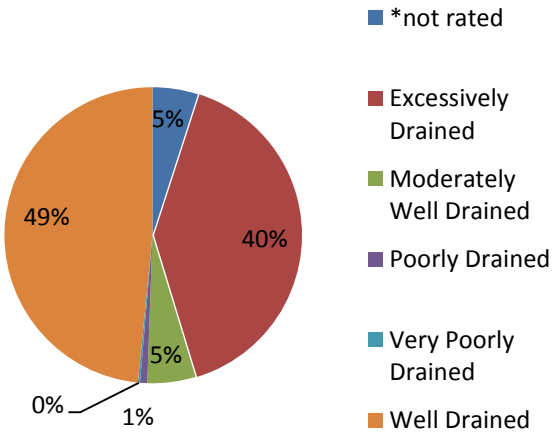


Figure 4-10 SOUTHOLD
# of Bldgs. by Soil Absorption Rating

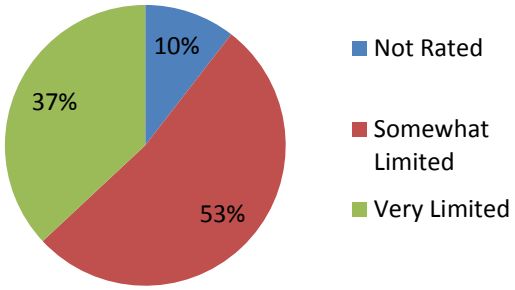


Table 4-16 # of Buildings (>450 SF) by SOIL Drainage Classification
RIVERHEAD Long Island Sound Watershed

DRAINAGE CLASSIFICATION	E Northville 11901	Aquebogue/Northville 11931	Riverhead 11901	Baiting Hollow/Calverton 11933	Wading River 11792	TOWN OF RIVERHEAD TOTAL	% of Total
	Riverhead						
*not rated	17	28	20	21	64	150	3.1%
Excessively Drained	62	40	405	526	1838	2871	**60.2%**
Moderately Well Drained	2	12	23	5	45	87	1.8%
Poorly Drained	2				8	10	0.2%
Very Poorly Drained			1		1	2	0.0%
Well Drained	232	92	313	223	793	1653	34.6%
TOTAL	**315**	**172**	**762**	**775**	**2749**	**4773**	**100%**

Table 4-17 # of Buildings (>450 SF) by SOIL: Septic Absorption
RIVERHEAD Long Island Sound Watershed

Septic Absorption Rating	E Northville 11901	Aquebogue/Northville 11931	Riverhead 11901	Baiting Hollow/Calverton 11933	Wading River 11792	TOWN OF RIVERHEAD TOTAL	% of Total
	Riverhead						
Not Rated	19	41	43	24	91	218	4.6%
Somewhat Limited	228	81	313	230	690	1542	32.3%
Very Limited	68	50	406	521	1968	3013	63.1%
TOTAL	**315**	**172**	**762**	**775**	**2749**	**4773**	**100%**

Table 4-18 # of Buildings (>450 SF) by SOIL Drainage Classification
SOUTHOLD Long Island Sound Watershed

DRAINAGE CLASSIFICATION	Fishers Island 06390	Orient 11957	East Marion 11939	Greenport 11944	Southold 11971	Peconic 11958	Cutchogue 11935	Mattituck 11952	TOWN OF SOUTHOLD TOTAL	% of Total
	Southold									
*not rated	7	1	2	5	110	64	3	49	241	5.0%
Excessively Drained	485	44	132	23	254	107	54	854	1953	40.3%
Moderately Well Drained	73	8		6	19	8	10	131	255	5.3%
Poorly Drained	6				13	5		14	38	0.8%
Very Poorly Drained						11			11	0.2%
Well Drained	235	360	163	379	296	68	185	660	2346	48.4%
TOTAL	**806**	**413**	**297**	**413**	**692**	**263**	**252**	**1708**	**4844**	**100%**

Table 4-19 # of Buildings (>450 SF) by SOIL: Septic Absorption
SOUTHOLD Long Island Sound Watershed

Septic Absorption Rating	Fishers Island 06390	Orient 11957	East Marion 11939	Greenport 11944	Southold 11971	Peconic 11958	Cutchogue 11935	Mattituck 11952	TOWN OF SOUTHOLD TOTAL	% of Total
	Southold									
Not Rated	82	1	3	14	123	79	13	193	508	10.5%
Somewhat Limited	408	367	163	379	315	68	185	661	2546	52.6%
Very Limited	316	45	131	20	254	116	54	854	1790	37.0%
TOTAL	806	**413**	**297**	**413**	**692**	**263**	**252**	**1708**	**4844**	**100%**

4.7 Density

Traditionally wastewater treatment is handled by using lot size to dilute pollutants to a level acceptable for drinking water. While this regulation defines a carrying capacity of the land to handle impacts of wastewater recharge, it also impacts land use patterns and encourages sprawl. While the SCDHS currently has two minimum sizes – nominal half acre or one acre based on hydrological zones, the draft version of the SCCWRMP recommends increasing the minimum from one-half acre to one acre in Groundwater Management Zone IV, in which the North Fork lays.[9] Also, the Suffolk County Sanitation Code (760-606 A 5) indicates that any new development with lots less than 40,000 square feet require community water systems, so areas relying on individual wells for their drinking water supply, even when in zones allowing half-acre minimum sizes, need the nominal one-acre zoning for compliance. While public water supply is available for much of the North Fork, there are still areas that rely on wells for potable water. Examples are Peconic and Orient. We also advocate that wastewater quality issues should be addressed before public water is supplied due to lowered public concern of aquifer water quality after personal needs are addressed. Normal practice is usually in the reverse order. Due to the historic nature of the North Fork's development patterns based on hamlet and seaside community developments, many parcels are nonconforming to current statutes, with 4,098 or 40.4% of the lots in the Long Island Sound watershed on the North Fork being smaller than the 20,000 SF minimum lot size. 2,876 of these lots are developed, and 1,222 are vacant. 74.2% of the lots are less than one acre (actual size) and 25.1% are ¼ acre or less. Historic development using small lots is compatible with current smart growth concepts where density supports the sustainable goals of walkable communities. Higher densities alone cannot create sustainable communities unless the natural carrying capacities of the land are also respected. Proper wastewater treatment meeting local environmental goals will go a long way to ensuring that these historic hamlets become sustainable on multiple fronts.

In Riverhead 38.8% of the lots are less than one-quarter acre, while in Southold only 11.7% are less than one-quarter acre. Riverhead continues to have a higher percentage of small lots, with a cumulative percentage of 55.9% of lots less than one-half acre compared to 37% in Southold. Wading River has the highest number of lots (817) less than one-quarter acre, followed by Calverton (567) and Riverhead (436). In Southold Greenport has the highest number of lots less than one-quarter acre (145) with Southold at 126 and Mattituck at 123 following. But these rankings change slightly if the hamlet percentage of lots is considered, with Calverton/Baiting Hollow topping the list at 53.1% of lots less than one-quarter acre, and Riverhead following at 50.1%. In Southold, Greenport remains primary with 32.0% of the lots being less than one-quarter acre, but Peconic is second with 23.2%. For lots between one-quarter acre and less than one-half acre, Wading River has the highest actual number with 563, followed by Mattituck with 502 and Southold with 202. If you look at the ranking using percentage of hamlet lots (1/4 acre - <1/2 acre), East Marion claims top ranking at 34.2%, with Greenport at 32.9% and Mattituck at 32% following closely.

Standard septic systems dispense nitrogen at a rate between 40-60 mg/l. Since 10 mg/l is the maximum contaminant level for drinking water quality, the lot size impacts the dilution factor. With the one acre standard the target nitrogen level after dilution is 4-6 mg/l.[10] The New Jersey Pine Barrens, with conditions similar to the East End, require a minimum lot size of 3.2 acres for standard septic installations, with all lots smaller than this required to have enhanced treatment in order to attain a target of 2 mg/l. A quick calculation with a goal of 2 mg/l for Suffolk County conditions indicate that three to two acres would compensate for nitrogen from wastewater within an annual rainfall range of 37.2 inches (Cornell Extension) to 46 inches (CLRsearch.com) using an attenuation rate of 41.5% without compensation for atmospheric and fertilizer nitrogen inputs, nor for nitrogen in receiving waters. Recent studies at Stony Brook University (Gil Hanson) show that after initial adsorption, attenuation is negligible on North Shore locations.

Depending upon attenuation of nitrogen, neither nitrogen goal may attain a dilution sufficient to address environmental sensitivities in water bodies, where target levels of nitrogen range from 0.3 to 0.45 mg/l. In a study of 74 watersheds in Rhode Island (similar conditions to L. I.) it was noted that two-acre lots have a negative impact on water quality.[11] In the Great South Bay Study,[12] an attenuation factor of 0.72 is applied for nitrogen derived from wastewater, which is considered applicable for lands more than 200 meters from shore. Pio Lombardo, P.E., stated that the attenuation should be 41.5% based on measured stream discharge.[13] A dilution goal of 1.6 mg/l at 72% attenuation or 0.77 mg/l at 41.5% attenuation would meet aquatic targets of 0.45. Minimum lot sizes of 8.5 to 13.6 acres would be needed to provide adequate dilution of standard septic systems. Other references note a 20-25% attenuation rate as being typical, which would be more appropriate for lands close to the coast or for measuring impact on aquifers. None of these approaches considers elevated levels of nitrogen already existing in receiving waters, as only flow is calculated. A marine environment is impacted by total pounds of nitrogen as well as concentration. TMDL's for sewage treatment plants now use both limits. A "dilution by area" approach does not take into consideration localized conditions, especially outside lot boundaries contributing to surface water bodies. For instance a localized watershed may slope to a concentrated area, increasing total nitrogen loading impacts on water bodies. Contaminants may travel in plumes rather than being diluted evenly in groundwater. The cumulative impacts of nitrogen migrating over time and distance to surface water bodies are not considered. Also the presence of buffering wetlands and the size and flushing rates of the receiving waters will dictate how sensitive surface waters are to elevated nitrogen inputs. Sub-watershed analyses based on Total Maximum Daily Load (TMDL) calculations can inform levels of treatment and prioritize implementation strategies when considering the optimum loading rates of water bodies. Basically constricted bodies of water, such as creeks or embayments, will be more sensitive than open seas.

When densities are high, not only is the amount of contamination per acre increased, but the ability of the land to mitigate conditions is compromised. With higher densities, a larger percentage of the land is covered by impervious surfaces, a condition that both hinders the groundwater recharge through precipitation, and promotes stormwater run-off, which transports more contaminants without the beneficial filtering soils provide. The smaller the lot, the more onsite wastewater treatment is the primary source of nitrogen loading. Table 4-24 represents the impact of lot size on nitrogen contributions, while Figure 4-19 shows the expected impacts of mitigation in relation to other improvements. In the SCCWRMP, the clear correlation between poor water quality and housing density is emphasized.

Figure 4-11 % by Lot Size LI Sound Watershed, North Fork

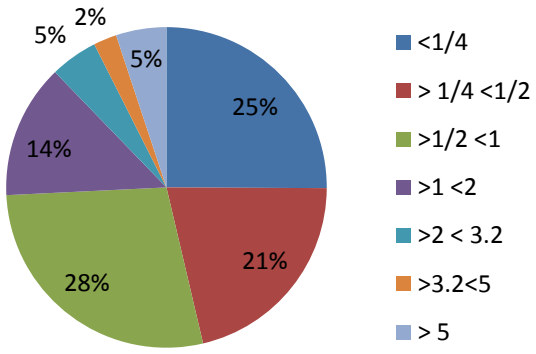


Figure 4 - 12 % of Nonconforming Lots <20,000 SF LI Sound Watershed, North Fork

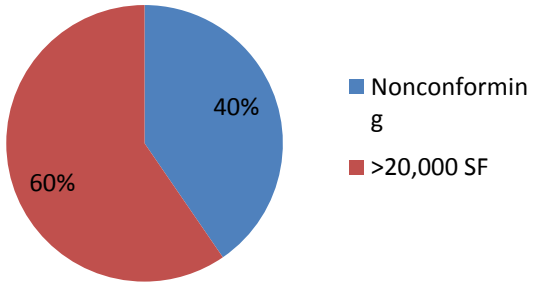


Figure 4-13
% of Lots by Size: Riverhead

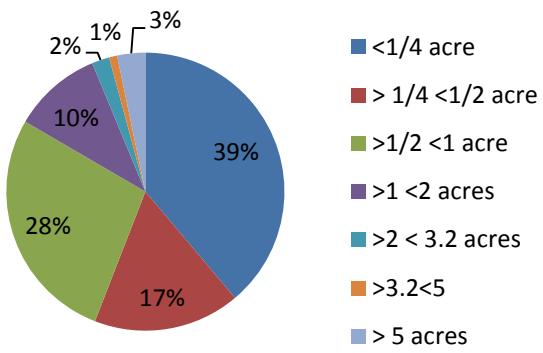


Figure 4-14
% of Lots by Size: Southold

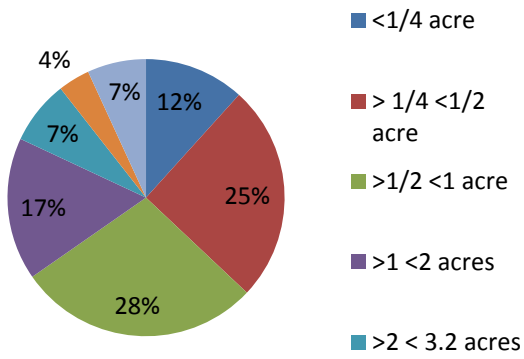


Table 4-20 Lot Size % LI Sound Watershed, North Fork Totals

	Riverhead		Southold		LIS TOTAL	%	% Cumulative
<1/4 acre	1,940	38.8%	602	11.7%	2,542	25.1%	25.1%
> 1/4 <1/2 acre	852	17.1%	1,303	25.3%	2,155	21.3%	46.3%
>1/2 <1 acre	1,373	27.5%	1,456	28.3%	2,829	27.9%	74.2%
>1 <2 acres	517	10.4%	856	16.6%	1,373	13.5%	87.8%
>2 < 3.2 acres	102	2.0%	384	7.5%	486	4.8%	92.6%
>3.2<5	47	0.9%	191	3.7%	238	2.3%	94.9%
> 5 acres	163	3.3%	353	6.9%	516	5.1%	100.0%
	4,994		5,145		10,139		

Figure 4 - 15
 # Parcels by Lot Size: Riverhead
Long Island Sound Watershed

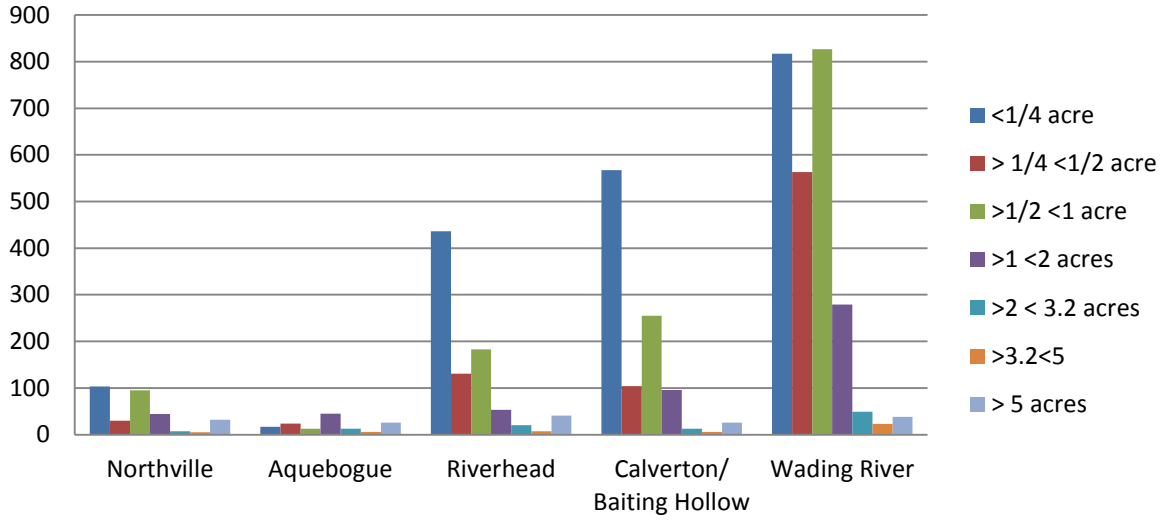


Figure 4 - 16
 # Parcels by Size: Southold
Long Island Sound Watershed

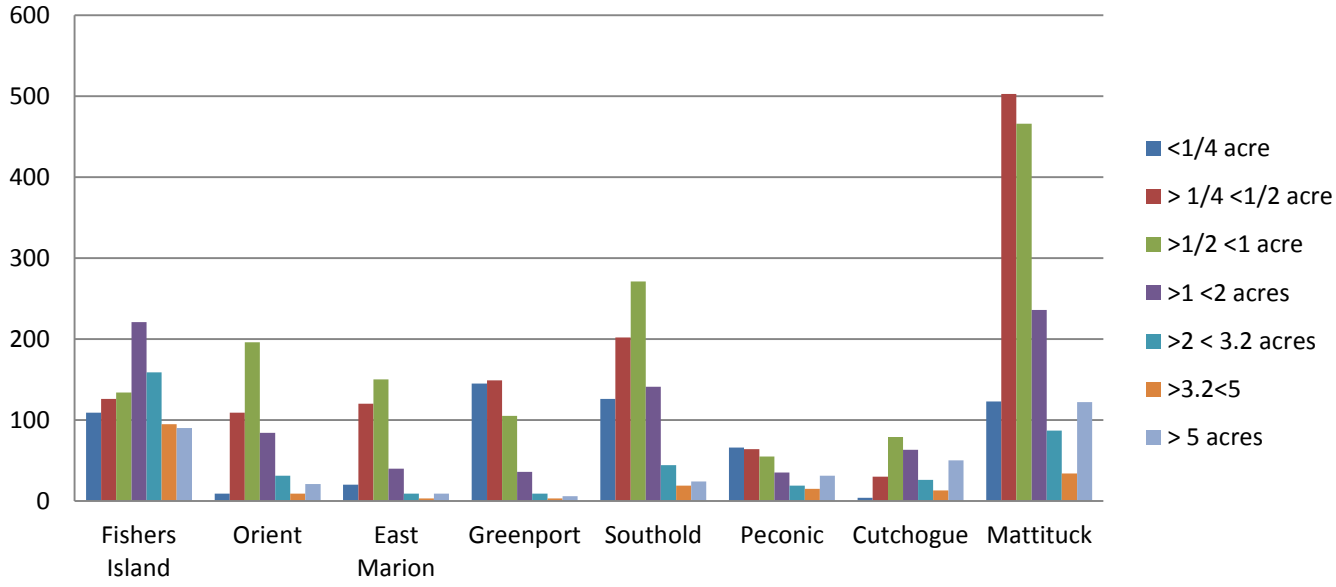


Table 4 – 21

LI SOUND STUDY WATERSHED - # OF PARCELS bu SIZE: RIVERHEAD																				
Hamlet	Lot Sizes																			
	< 1/4 acre					1/4 <1/2 acre					1/2 <1 acre					1 <2 acres				
	#	% #/ T	# Dev	# Dev no sewer	# Vacant no sewer	#	% #/ T	# Dev	# Dev no sewer	# Vacant no sewer	#	% #/ T	# Dev	# Dev no sewer	# Vacant no sewer	#	% #/ T	# Dev	# Dev no sewer	# Vacant no sewer
Northville	103	32.6%	57	57	46	30	9.5%	25	25	5	95	30.1%	78	78	16	44	13.9%	30	30	14
Aquebogue	17	11.8%	9	9	8	24	16.7%	19	19	5	13	9.0%	9	9	4	45	31.3%	28	28	17
Riverhead	436	50.1%	243	207	7	131	15.0%	116	116	15	183	21.0%	149	149	34	53	6.1%	26	26	26
Calverton/ BH	567	53.1%	285	285	282	104	9.7%	80	80	24	255	23.9%	192	192	63	96	9.0%	77	77	19
Wading River	817	31.5%	638	638	172	563	21.7%	507	507	56	827	31.9%	770	770	57	279	10.7%	232	232	47
	1,940	38.8%	1,232	1,196	515	852	17.1%	747	747	105	1,373	27.5%	1,198	1,198	174	517	10.4%	393	393	123

Hamlet	Lot Sizes																			
	2 < 3.2 acres					3.2<5					≥ 5 acres					TOTAL				
	#	% #/ T	# Dev	# Dev no sewer	# Vacant no sewer	#	% #/ T	# Dev	# Dev no sewer	# Vacant no sewer	#	% #/ T	# Dev	# Dev no sewer	# Vacant no sewer	#	% #/ T	# Dev	# Dev no sewer	# Vacant no sewer
Northville	7	2.2%	2	2	5	5	1.6%	4	4	1	32	10.1%	9	9	23	316	6.3%	205	205	110
Aquebogue	13	9.0%	9	9	4	6	4.2%	5	5	1	26	18.1%	15	15	11	144	2.9%	94	94	50
Riverhead	20	2.3%	6	5	13	7	0.8%	3	2	4	41	4.7%	19	19	17	871	17.4%	562	524	116
Calverton/ BH	13	1.2%	9	9	4	6	0.6%	3	3	3	26	2.4%	16	16	10	1,067	41.1%	662	662	405
Wading River	49	1.9%	32	32	16	23	0.9%	14	14	9	38	1.5%	19	19	18	2,596	52.0%	2,212	2,212	375
	102	2.0%	58	57	42	47	0.9%	29	28	18	163	3.3%	78	78	79	4,994		3,735	3,697	1,056

Table 4 – 22

LI SOUND STUDY WATERSHED - # OF PARCELS by SIZE: SOUTHOLD																				
Hamlet	Lot Sizes																			
	<1/4 acre					1/4 <1/2 acre					1/2 <1 acre					1 <2 acres				
	#	% #/ T	# Dev	# Dev no sewer	# Vacant no sewer	#	% #/ T	# Dev	# Dev no sewer	# Vacant no sewer	#	% #/ T	# Dev	# Dev no sewer	# Vacant no sewer	#	% #/ T	# Dev	# Dev no sewer	# Vacant no sewer
Fishers Island	109	11.7%	64	57	41	126	13.5%	100	82	23	134	14.3%	98	82	32	221	23.7%	133	131	86
Orient	9	2.0%	2	2	7	109	23.7%	84	84	25	196	42.7%	140	140	56	84	18.3%	49	49	35
East Marion	20	5.7%	7	7	13	120	34.2%	96	96	24	150	42.7%	111	111	39	40	11.4%	29	29	11
Greenport	145	32.0%	120	51	25	149	32.9%	108	108	41	105	23.2%	77	77	28	36	7.9%	25	25	11
Southold	126	15.2%	62	62	64	202	24.4%	163	163	39	271	32.8%	203	203	68	141	17.0%	107	107	34
Peconic	66	23.2%	46	46	20	64	22.5%	51	51	13	55	19.3%	47	47	8	35	12.3%	21	21	14
Cutchogue	4	1.5%	1	1	3	30	11.3%	26	26	4	79	29.8%	61	61	18	63	23.8%	36	36	27
Mattituck	123	7.8%	95	95	28	503	32.0%	442	442	61	466	29.7%	379	379	87	236	15.0%	181	181	55
	602	11.7%	397	321	201	1,303	25.3%	1,070	1,052	230	1,456	28.3%	1,116	1,100	336	856	16.6%	581	579	273

Hamlet	2 < 3.2 acres					3.2<5					≥ 5 acres					TOTAL				
	#	% #/ T	# Dev	# Dev no sewer	# Vacant no sewer	#	% #/ T	# Dev	# Dev no sewer	# Vacant no sewer	#	% #/ T	# Dev	# Dev no sewer	# Vacant no sewer	#	% #/ T	# Dev	# Dev no sewer	# Vacant no sewer
Fishers Island	159	17.0%	86	80	72	95	10.2%	49	47	46	90	9.6%	45	41	45	934	18.2%	575	520	345
Orient	31	6.8%	22	22	9	9	2.0%	4	4	5	21	4.6%	12	12	9	459	8.9%	313	313	146
East Marion	9	2.6%	4	4	5	3	0.9%	1	1	2	9	2.6%	5	5	4	351	6.8%	253	253	98
Greenport	9	2.0%	7	7	2	3	0.7%	2	2	1	6	1.3%	2	2	4	453	8.8%	341	272	112
Southold	44	5.3%	28	28	16	19	2.3%	12	12	7	24	2.9%	10	10	14	827	16.1%	585	585	242
Peconic	19	6.7%	14	14	5	15	5.3%	8	8	7	31	10.9%	18	18	13	285	5.5%	205	205	80
Cutchogue	26	9.8%	13	13	13	13	4.9%	9	9	4	50	18.9%	22	22	28	265	5.2%	168	168	97
Mattituck	87	5.5%	69	69	18	34	2.2%	27	27	7	122	7.8%	72	72	50	1,571	30.5%	1,265	1,265	306
	384	7.5%	243	237	140	191	3.7%	112	110	79	353	6.9%	186	182	167	5,145		3,705	3,581	1,426

Figure 4 - 17
 # Nonconforming Lots <20,000 SF by Hamlet, LIS

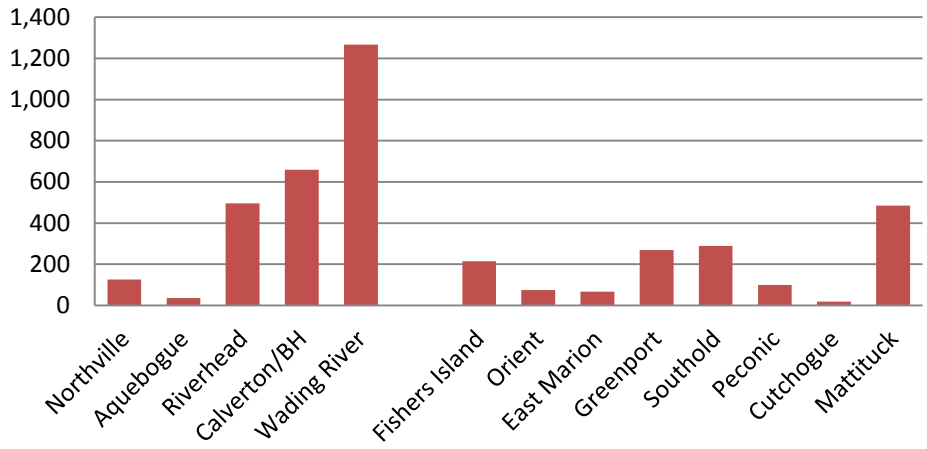


Figure 4 - 18
% of Nonconforming Lots <20,000SF to Hamlet Totals, LIS

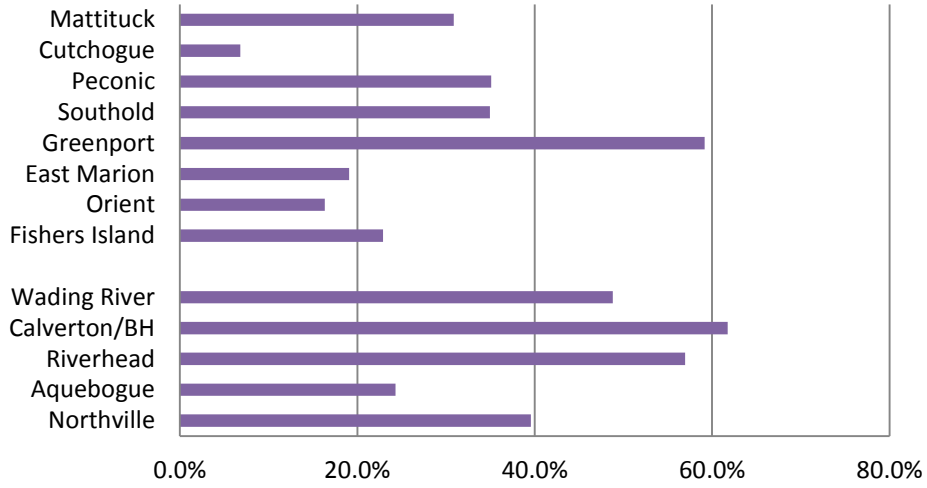


Table 4 – 23

# OF NONCONFORMING PARCELS in the LI Sound Watershed, RIVERHEAD							
Hamlet	Lots						
	#	# Developed	# <20,000 Developed	% dev <20k to dev	# Vacant	% <20k to total hamlet #	% <20k to total NF LIS #
Northville	316	205	75	36.6%	50	39.6%	1.2%
Aquebogue	144	94	24	25.5%	11	24.3%	0.3%
Riverhead	871	562	294	52.3%	202	56.9%	4.9%
Calverton/BH	1,067	662	357	53.9%	302	61.8%	6.5%
Wading River	2,596	2,212	1,039	47.0%	228	48.8%	12.5%
Riverhead Town	**4,994**	**3,735**	**1,789**	**53.8%**	**793**	**57.8%**	**25.5%**

# OF NONCONFORMING PARCELS in the LI Sound Watershed, SOUTHOLD							
	Lot Sizes						
	< 20,000SF LIS						
	#	# Developed	# <20,000 Developed	% dev <20k to dev	# Vacant	% <20k to total hamlet #	% <20k to total NF LIS #
Fishers Island	*934*	575	147	25.6%	67	22.9%	2.1%
Orient	459	313	55	17.6%	20	16.3%	0.7%
East Marion	*351*	253	45	17.8%	22	19.1%	0.7%
Greenport	*453*	272	144	52.9%	124	59.2%	2.6%
Southold	827	585	193	33.0%	96	34.9%	2.9%
Peconic	285	205	73	35.6%	27	35.1%	1.0%
Cutchogue	*265*	168	12	7.1%	6	6.8%	0.2%
Mattituck	1571	1265	418	33.0%	67	30.9%	4.8%
Southold Town	**5145**	**3636**	**1087**	**29.9%**	**429**	**29.5%**	**15.0%**

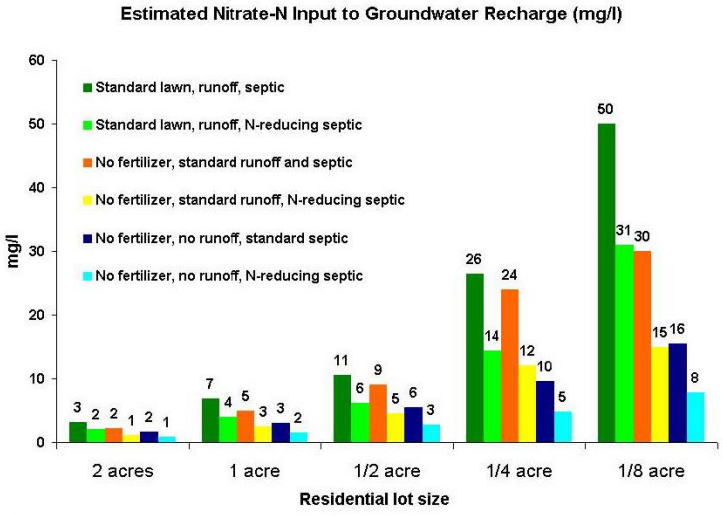
LI Sound Watershed TOTAL	**10,139**	**7,371**	**2,876**	**39.0%**	**1,222**	**40.4%**	**40.4%**

	Onsite Wastewater (1)	Lawn Fertilizer (2)	Pet Waste (3)	Unfertilized Pervious (4)
N Source Load	21	175	1.23	1.2
Leaching Rate	80%	13%	20%	13%
% N on 2 acre	42.1%	56.9%	0.6%	0.4%
% N on 1 acre	58.9%	39.9%	0.9%	0.3%
% N on 1/2 acre	73.8%	25.0%	1.1%	0.2%
% N on 1/4 acre	84.4%	14.3%	1.2%	0.1%

1. N load /dwelling/year assumes 3 people/dwelling
2. N load/acre/year, assumes half fertilized
3. N load / dwelling/year assumes 3 people/dwelling
4. N load/acre/year, assumes half unfertilized

Table 4 - 24 Relative N Contribution Based on Lot Size

Generic N loading Assumptions
Onsite systems: 7 lb N/person/year, 80% leaching to groundwater
Lawn fertilizer: 175 lb N/acre/year, 6 to 20 % leaching to groundwater
Agriculture (cropland): 175 to 215 lb N/acre/year, 20% leaching to groundwater
Pet waste: 0.41 lb N/person/year,
Unfertilized pervious area, • 1.2 lb N/acre/year [45]



Nitrate-Nitrogen Loading Estimates for Different Lot Size Densities Subject to Different Fertilizer, Runoff, and Onsite Wastewater Treatment Options

Figure 4 - 19: Impacts on Nitrogen Loading by Lot Size, Wastewater Treatment, Fertilizer Use, and Stormwater Run-off

Wastewater Planning Handbook: Mapping Onsite Treatment Needs, Pollution Risks, and Management Options Using GIS, Project No. NDWRCDP, WU-HT-01-07. Figure 10-3.

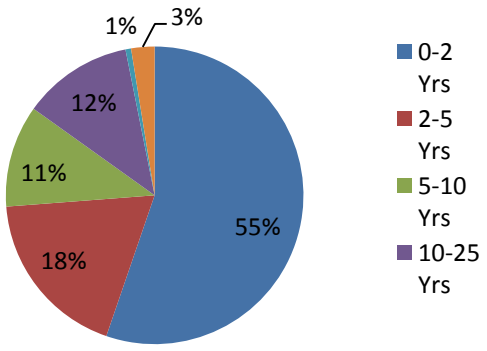
4.8 Groundwater Influence Zones

While it is desirable to evaluate all systems within a watershed, as some contaminants in groundwater migrate over considerable distances and time to impact surface water bodies, the level of attenuation of the contaminant is affected by the distance traveled. For instance, in the Chesapeake Bay systems within 1000 feet of the bay are targeted for enhancement. Instead of a setback distance, this study uses the Areas Contributing Groundwater to Surface Waters illustrated in the Suffolk County Comprehensive Wastewater Resources Management Plan – Draft (SCCWMP).[14] These zones depict how long it takes precipitation falling upon the ground to travel through the Upper Glacial aquifer to discharge to surface waters measured in years.

Fifty four percent of the buildings greater than 450 SF in the Long Island Sound watershed in Riverhead and Southold are in the 0-2 year Groundwater Influence Zone. If one adds the 2-5 year Groundwater Influence Zone, the total represents 72.3%. In Riverhead, Wading River, by far, has the highest number of buildings (1,240) within the 0-2 year influence zone. In Southold, Fishers Island has 806 and Mattituck 637 structures greater than 450 SF in the 0-2 year influence zone. If one looks at percentage of buildings in the 0-2 year influence zone to total number of buildings within the same hamlet study area, Fishers Island tops the chart with 100%, with Peconic ranked second at 81.7% and Calverton and Greenport following with 65.8% and 63.9% respectively. While the proximity to surface waters highlights the rapidity and importance of onsite wastewater on surface water quality, it also indicates that any substantial improvements should have a beneficial impact on water quality in a relatively short time period, barring legacy issues and water body configuration.

Groundwater Influence Zones
Long Island Sound Watershed, North Fork

Figure 4 - 20
% North Fork Buildings >450 SF in LIS Watershed by Groundwater Influence on Surface Waters Zones (Time - Years)



Groundwater Influence Zones	NORTH FORK TOTAL LI Sound Watershed	% of Total	Cummulative % of Total
	North Fork		
0-2 Yrs	5205	54.1%	54.1%
2-5 Yrs	1745	18.1%	72.3%
5-10 Yrs	1243	12.9%	85.2%
10-25 Yrs	1128	11.7%	96.9%
25-50 Yrs	57	0.6%	97.5%
>50 Yrs	239	2.5%	100.0%
TOTAL	**9617**	**100%**	

Table 4 - 25

Figure 4 - 21
 # Bldgs. > 450 SF in Groundwater Influence on Surface Waters
Zones - RIVERHEAD LIS Watershed
(Travel Time - Years)

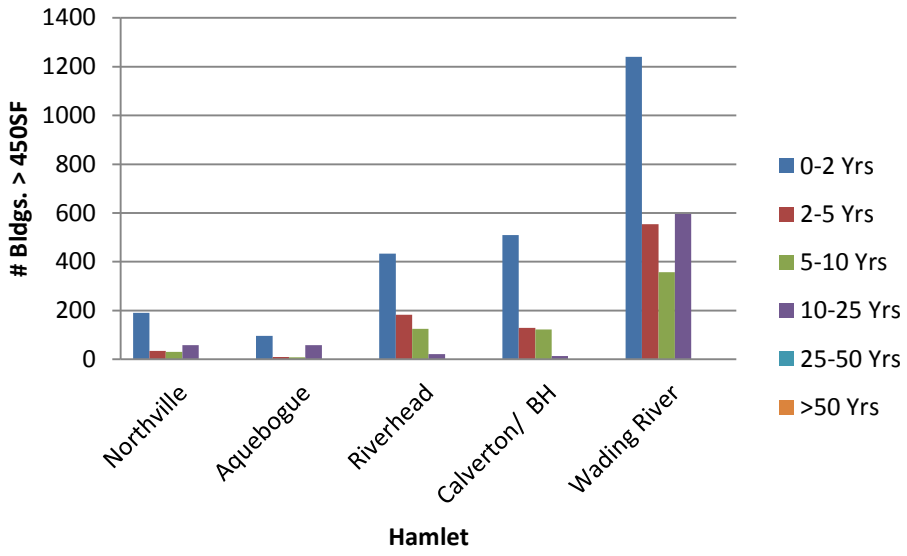


Figure 4- 22
 # Bldgs.> 450 SF in Groundwater Influence on Surface Waters
Zones - SOUTHOLD LIS Watershed
(Travel Time - Years)

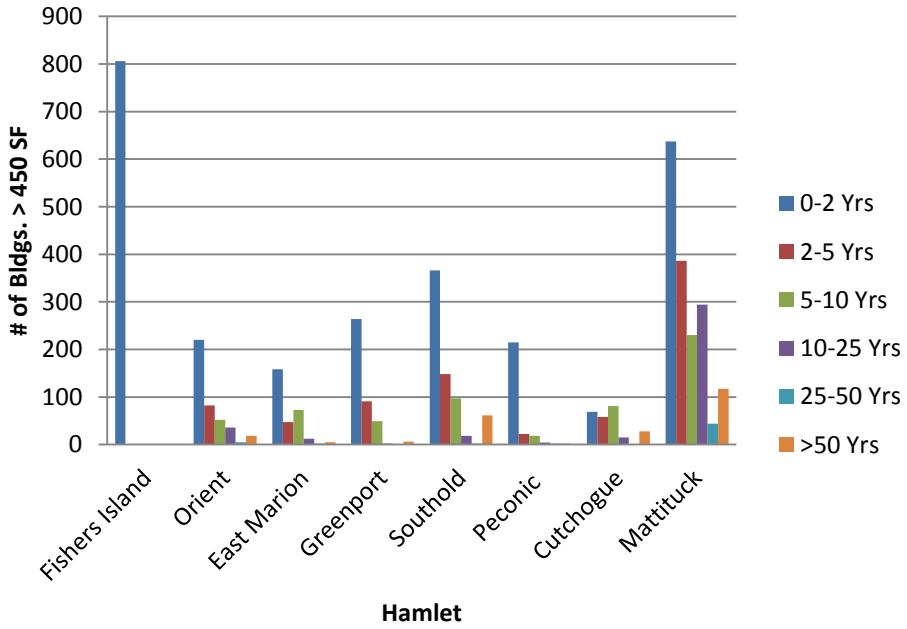


Figure 4 - 23
% Bldgs. > 450 SF in 0-2 Influence Zone

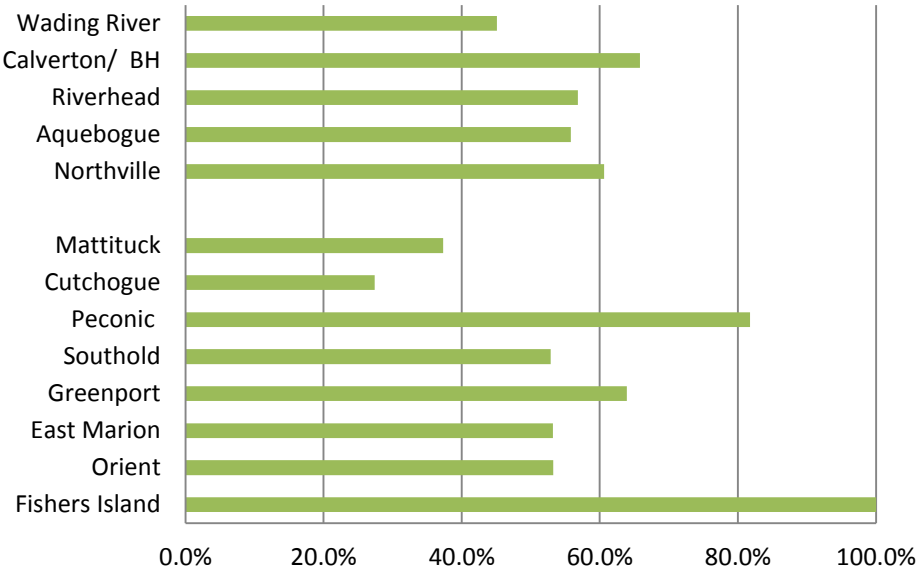


Table 4 – 26
 # Bldgs. > 450 SF in Groundwater Influence on Surface Waters Zones
RIVERHEAD LIS Watershed
(Travel Time - Years)

Groundwater Influence Zones	Northville	Aquebogue	Riverhead	Calverton/ BH	Wading River	TOWN OF RIVERHEAD TOTAL LI Sound Watershed	% of Total	Cummulative % of Total
	Riverhead							
0-2 Yrs	191	96	433	510	1240	2470	51.7%	51.7%
2-5 Yrs	35	10	183	129	554	911	19.1%	70.8%
5-10 Yrs	31	8	125	122	357	643	13.5%	84.3%
10-25 Yrs	58	58	21	14	596	747	15.7%	100.0%
25-50 Yrs						0	0.0%	100.0%
>50 Yrs					2	2	0.0%	100.0%
TOTAL	**315**	**172**	**762**	**775**	**2749**	**4773**	**100%**	

Table 4 – 27
 # Bldgs. > 450 SF in Groundwater Influence on Surface Waters Zones
SOUTHOLD LIS Watershed
(Travel Time - Years)

Groundwater Influence Zones	Fishers Island	Orient	East Marion	Greenport	Southold	Peconic	Cutchogue	Mattituck	TOWN OF SOUTHOLD TOTAL LI Sound Watershed	% of Total	Cummulative % of Total
	Southold										
0-2 Yrs	806	220	158	264	366	215	69	637	2735	56.5%	56.5%
2-5 Yrs		82	47	91	148	22	58	386	834	17.2%	73.7%
5-10 Yrs		52	73	49	97	18	81	230	600	12.4%	86.1%
10-25 Yrs		36	12	2	18	4	15	294	381	7.9%	93.9%
25-50 Yrs		5	2	1	2	2	1	44	57	1.2%	95.1%
>50 Yrs		18	5	6	61	2	28	117	237	4.9%	100.0%
TOTAL	**806**	**413**	**297**	**413**	**692**	**263**	**252**	**1708**	**4844**	**100%**	

4.9 Priorities

In an attempt to combine the separately evaluated conditions that impact water quality, the Priorities Maps overlay information with assigned points to each category, which become cumulative. Peconic Green Growth worked on a committee with the SCDHS to devise a ranking system for the distribution of incentive funds for clustered decentralized wastewater treatment projects. The ranking sheet, viewable in Appendix B-3 incorporated many factors that cannot be mapped, but are related to solutions and viability, such as level of nitrogen mitigation, financial capacity, and compliance with local comprehensive plans. The maps overlay the characteristics of physical attributes referenced that can be spatially depicted and for which existing data is available, with the addition of soil types. Small lots in the top and mid-high rankings are flagged in black, as these parcels are considered appropriate for community systems. Decentralized cluster systems become more economically feasible when collection distances are less than 75 feet apart, effluent-only or low-pressure options[15] are introduced, and reuse opportunities incorporated. Therefore lot sizes of one-half acre or less in size are considered appropriate for cluster formations within the same watershed, depending upon the configurations and site conditions. In the study of the Great South Bay, Erin L. Kinney and Ivan Valiela note that when the number of homes that were sewered exceeded 75% of a watershed, the drop in nitrogen was pronounced and therefore a significant minimum target for watershed mitigation through advanced treatment of wastewater.[16] Therefore it makes sense to concentrate mitigation efforts within sub-watershed areas rather than distribute improvements uniformly.

Chesapeake Bay studies[17] identify the potential for sewer expansion when target systems are within one mile, but in fact rank clusters equal to sewer expansion when the distance is 0.75 mile. On the East End, clusters would be more appropriate as there are disparate clusters amid an environmentally sensitive landscape. The densities at Wading River and possibly Mattituck could trigger a more extensive solution.

The flagged areas depict the starting point for the identification potential clustered areas for nitrogen mitigation, whose eventual boundaries would be impacted by the receptivity of the community, cost implications, boundaries of home owner associations or other organizational factors, and proximity to locations for shared treatment. For the initial cut, in the town of Riverhead, 153 developed lots outside sewer districts were considered prime for clustered solutions. In Southold, 672 developed parcels were considered appropriate for a clustered approach. Lots half-acre or larger with high and mid-high rankings were considered appropriate for single onsite enhancements. Riverhead had only two, while Southold had 465. In this evaluation, low-lying properties received higher points. PGG is considering the need for two additional adjustments, based on the data findings: 1) increasing the points for lots less than one-quarter acre, as nitrogen loading increases and 2) adding another two points for soils that drain excessively, as this increases the rate of nitrogen loading to the Sound. The overall districts for nitrogen mitigation should be as encompassing as possible (whole watersheds or towns), and divorced from the type of mitigation applied with solutions tailored for effectiveness, impact and cost.

Condition	*Points Assigned*
In a TMDL area	8
No Public Water available	4
Within 0-10 year travel time to significant surface water body	4
Within 0-2 year travel time to significant surface water, additional points:	4
Lots less than 1 acre	4
Lots less than ½ acre, additional points	4
SLOSH Zone	4
Flood Zone, additional points	4
Soils considered very limited for sanitary treatment	2
TOTAL	38

Mapped Priorities Rankings	*Point Range*
Low Priority	0-8
Medium Low Priority	9-15
Medium Priority	16-23
Medium High Priority	24-30
High Priority	31-38

Table 4 -28 Priority Ranking Point System

4.10 Land Use and Clearances

Land use is an important factor indicating pollution risks, since high-intensity use, impervious cover, and reduced natural environment are all linked to development. While this study is focused on residential needs, thereby using density as an evaluation of intensity, uses that trigger extreme or high risk evaluation can be evaluated and added to the needs evaluation.

The land use maps combine zoning districts with lot size information. They also distinguish vacant from developed lots. Opportunities become evident. If wastewater can be reused for toilet flushing, irrigation, nutrient extraction, and energy or heat recapture, not only does the wastewater become a beneficial commodity, but costs for both wastewater treatment and ensuring a potable water supply can be reduced. Vacant lots near dense residential areas can be used for clustered wastewater treatment. Aerial imagery and maps delineating buffer zones of 200 feet around existing buildings help to initially identify areas potentially available for community wastewater systems. The 200-foot minimal aerial separation distance from existing buildings for wastewater treatment processes enclosed in a building, buried or using covered sand filters is identified in the NYSDEC Draft Design Standards for Intermediate-sized Wastewater Treatment Systems 2012 Table B.1. The North Fork has a strong program of land conservation for farmland and open space protection, usually enacted through the purchase of development rights. This means that most locations suitable for the siting of a community treatment system may have restriction that limit this use or be parcels targeted for such protection.

4.11 Hamlet Highlights - SOUTHOLD

4.11.1 Fishers Island

Fishers Island, the eastern outpost of Suffolk County, displays a few unique characteristics. It is the only location in the Town of Southold that has a wastewater treatment district, with the Town Board as the governing body. The large septic system, with no secondary or tertiary treatment, was a good test case for evaluating the impacts of supplemental treatment, as well as testing the regulatory and functional issues related to natural treatment. Despite some setback issues, and the classification of the filtering bed, Suffolk County has expressed acceptance of the concept as designed here, pending further details.

Another unique characteristic was the fact that 100% of the buildings greater than 450 SF lie within 0-2 year influence zone, implying that attenuation of nitrogen is minimal pending evaluation of shoreline features. Most of the development (79.3%) is outside locations with shallow depths to groundwater, but 23.9% is within a SLOSH zone. 60.1% of the buildings are on soils that drain excessively, pointing to the value of enhanced treatment. 25.2% of the parcels are less than ½ acre.

Besides the recommended improvements to the existing sewer district, enhanced wastewater treatment should be considered for the watershed of Pirates Cove and the peninsula lying between West and Hay Harbors. Tangential explorations might be the landscaping, water and wastewater management practices of the island golf clubs.

4.11.2 Orient

The Orient community, by far, showed the most interest in the issue. The actual responses to the survey did not vary too much from the overall reactions, but the participation and willingness to explore the issue was by far the most proactive. This may be partly due to the fact that the local aquifer is the source of drinking water and the fact that people choose to live here because of its environmental beauty. There is a long history of environmental activism that helped save the shores of Hallock Bay from development. The Orient community also successfully stopped public water from being brought in over the causeway, mostly due to a fear of accompanying overdevelopment. Any solution will need to have proper safeguards in place to protect against increased development in order to gain this community's support.

Orient is a historic community, with much of its hamlet area included in a National Landmark District. From the survey, 58.9% of the respondents had homes older than 1973, pointing to the likelihood that cesspools predominate. While most of the vulnerable areas with shallow depths to groundwater and SLOSH zones lie in the Peconic Estuary, there is an integration of uses that argue for a coordinated effort. Most of the best opportunities for treatment lie in the LI Sound watershed. At the eastern tip, the old seaside communities tend to line the Sound shore. Only 10.9% of the buildings are on soils very limited for onsite treatment. The predominate lot sizes are less than one acre, with 25.7% of the lots in the LI Sound watershed being less than one-half acre. PGG recommended consideration of four clusters that are in the LI Watershed, and another that bridges the boundary between watersheds. Greenway (District 6) has been the most responsive home owner association in the LI Sound watershed. The school, located in District 2, is considering whether or not they would be willing to use their site for collective treatment.

Figure 4-24 Proposed Wastewater Districts in Orient

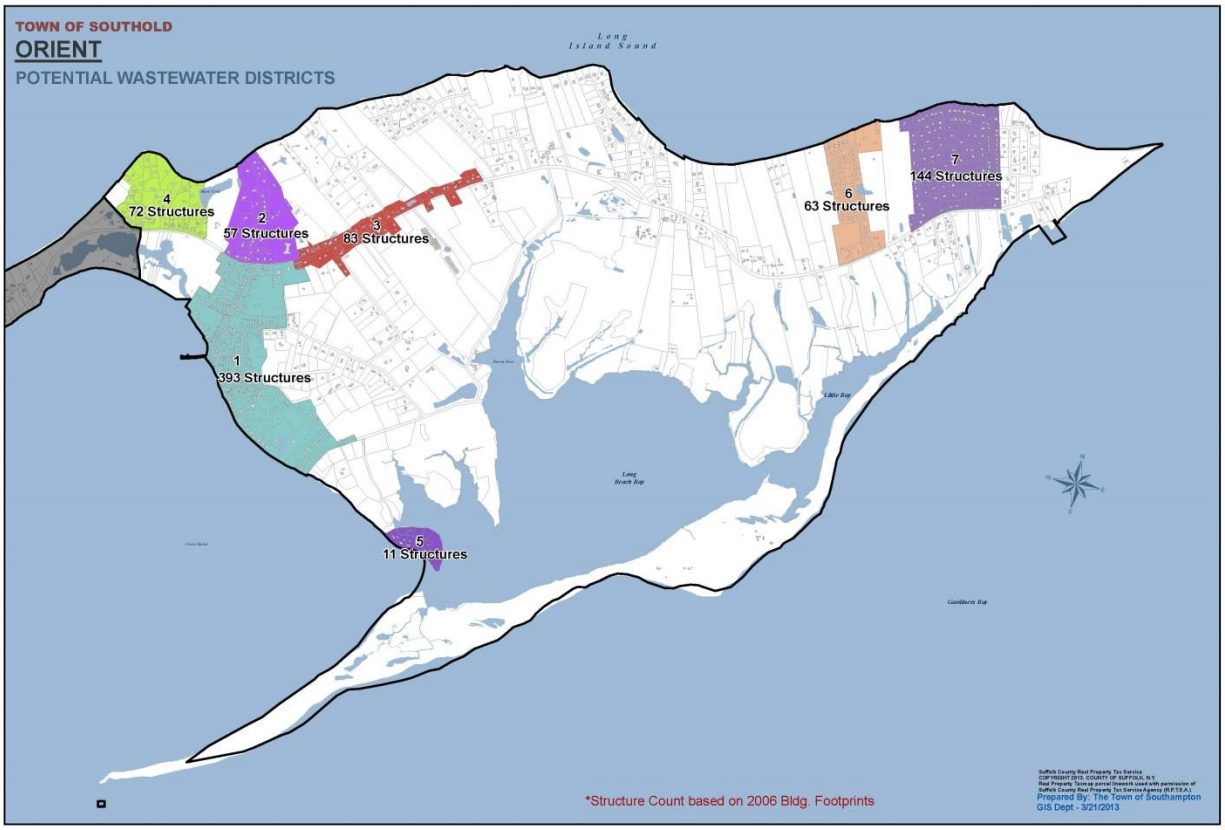


Figure 4-25 200' Buffers to Existing Buildings, Orient

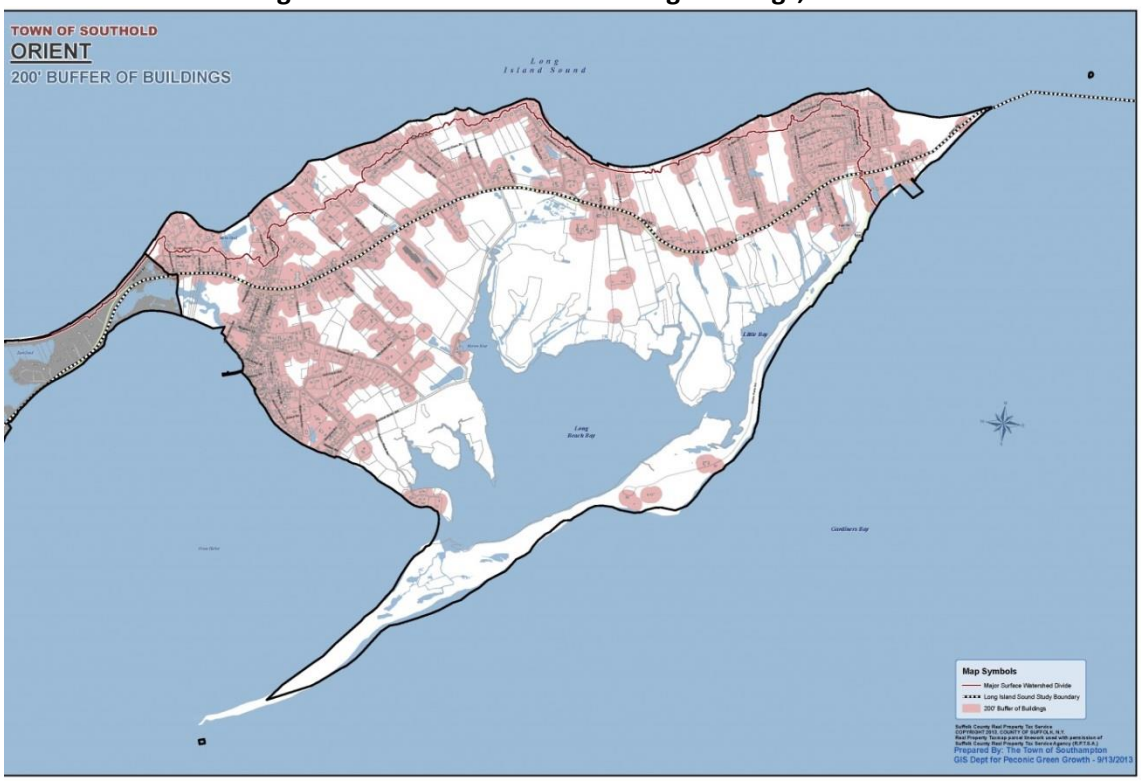
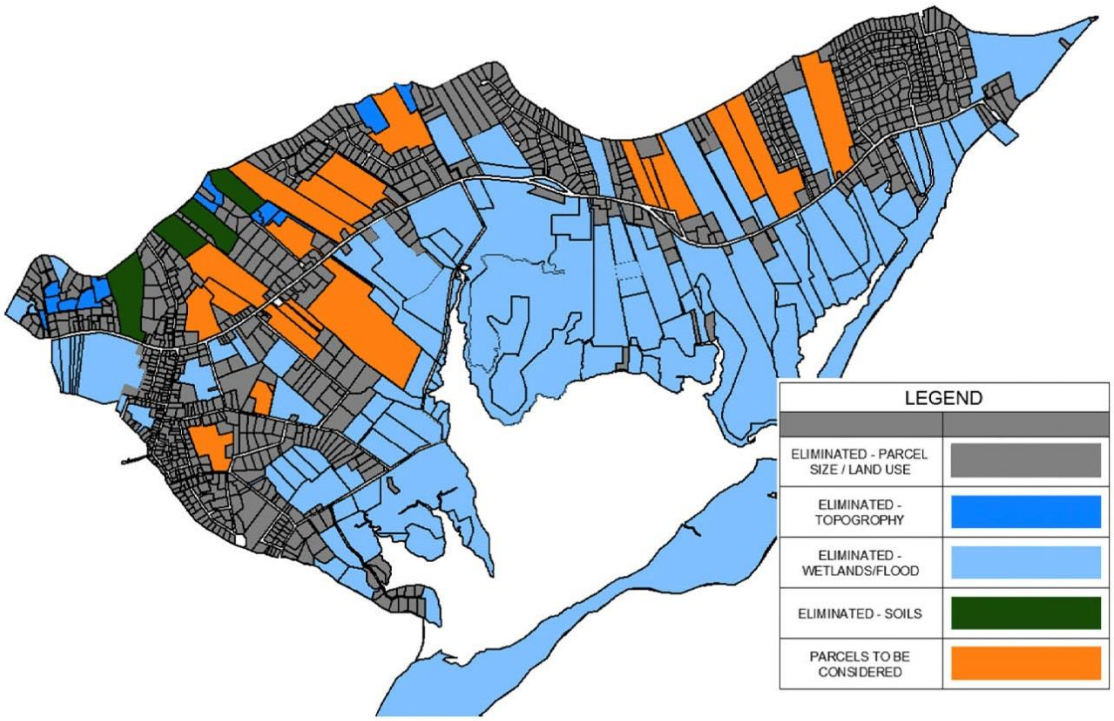


Figure 4-26 Parcel Suitability for Wastewater Disposal, Orient

(Orient Feasibility Report by Clark Engineering P 3-2)



4.11.3 East Marion

Forty four percent of East Marion buildings greater than 450 SF in the Long Island Sound Watershed have excessively drained soils. Forty percent of the lots are less than one-half acre, making lot size the more pressing factor for consideration of enhanced treatment. East Marion has been tentative in its consideration of the issue as they work to gain community consensus. Conditions are more critical for this community in the Peconic Estuary, so an initial pilot will probably be on its southern shores. If a clustered approach were considered, then a linear system along Aquaview Avenue and Stars Road is a potential project. Enhanced single onsite systems may also be appropriate.

4.11.4 Greenport

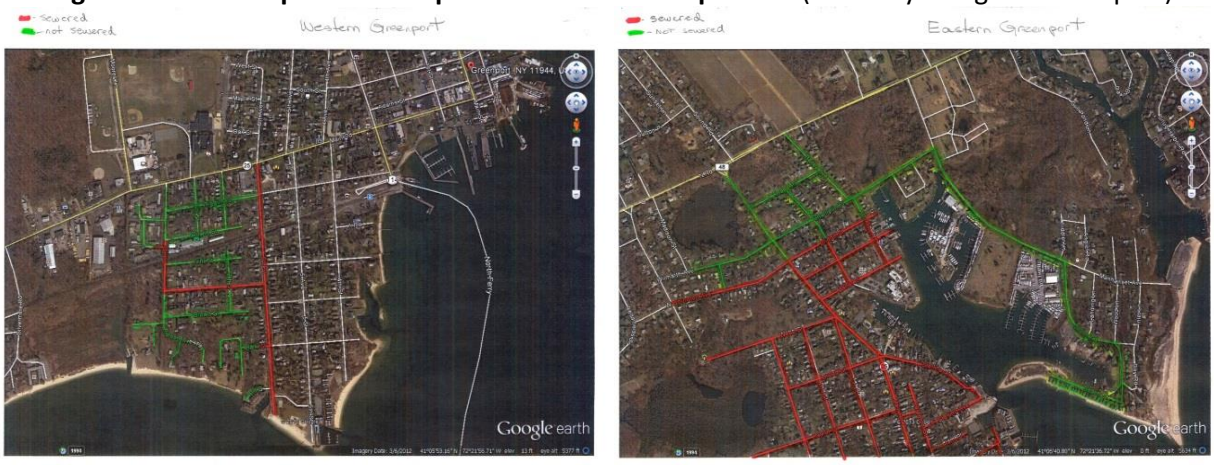
Fifty nine percent of Greenport lots are nonconforming with the minimal 20,000 SF minimum, making lot size the primary issue. Soils are good for onsite treatment. The main characteristic for the Greenport hamlet is its proximity to the Village of Greenport Sewer District. Currently only Cliffside Resort, a 68 unit condominium/motel and Peconic Landing, a retirement community with life-care facilities are currently connected to the sewage treatment plant. The outfall pipe of the treatment plant has direct discharge to the LI Sound at Clarks Beach. With the exception of the two developments mentioned, all other loading from the plant originates in the Peconic Estuary watershed.

The original plant was built with federal Works Progress Administration money during the Depression in 1935. In 2008, the Village of Greenport began the $8.1 million project of reconstructing the sewage treatment plant in response to a consent order. A stimulus allocation of $4.3 million was awarded to the project to attain a reduction in the nitrogen loading to the Long Island Sound. The new plant provides tertiary treatment, which the former plant did not. The plant design uses a combination of suspended growth and fixed growth technology for biological nutrient removal and ultraviolet sterilization, is rated for 6 mg/l, but is operating at roughly 3 mg/l of nitrogen loading, considered the best attainable technology. The new plant is rated for 650,000 gallons per day (gpd), but can hold up to 1.4 million gallons for a 48 hour period. Current daily usage may peak at 400,000 gallons in the summer months, but the 2012 average flow was 280,000 gpd. The plant is operating at roughly one-third to one-half its capacity. Half of the plant is shut down from September to May. Some spiking episodes are evident, but it is believed that these are caused by stormwater infiltration, which needs to be further explored and corrected. The Village aims to expand the district by another 200,000 gallons per day (equivalent of 666 dwelling units). Their first annexation proposal is illustrated in green on the maps, Figures 27+28, extending both east and west within the Peconic Estuary. Eastern Greenport extents include Beach Street to Sandy Beach Road to Beach Road to Manhasset Avenue to Champlin Place, north along Baily Avenue including Knapp Place, Wilmarth Avenue, Booth Place and portions of North Main Street, Stirling Avenue and Atlantic Avenue. The western proposal extends west of 6th St and south of Main Road. The number of parcels and estimated load have not yet been determined. In addition, Peconic Landing is adding 32 nursing/assisted- living beds and 46 apartments to their current configuration.

The Village currently charges a $15,000 per dwelling hook-up fee ($50/gallon), not including direct connection or expansion costs. The scope of the proposed expansion is influenced by the geopolitical boundaries where average income is low enough to garner subsidy of the hook-up charges. This is why areas in the LI Sound watershed are not included.

The plant is currently removing nitrogen at a rate below 5 mg/l, the limit of present technology, and half the maximum allowable limit for drinking water standards. But marine environments are more

Figures 27 + 28 Proposed Greenport Sewer District Expansion (Courtesy Village of Greenport)



susceptible to nitrogen loading, with recommended ranges being approximately 0.5 mg/l. Also the marine environment responds to total loads of nitrogen, not just flow rates. While the TMDL lbs/d was decreased from 27 (2009 TMDL) to 11 (2014 TMDL), the plant had a 12 lbs/d rate in 2012. The vulnerability is in pounds of nitrogen loading, rather than flow rates. Some of the current gains in water quality to the LI Sound will be lost when the expansion occurs, as the proposed expansions will either shift nitrogen loading from the Peconic Estuary to the LI Sound. There are four ways of mitigating this:

1. When expanding the sewer district, assign at least a 25% of the expansion to properties in the LI Sound watershed. The removals of direct on-site loading in the LI Sound watershed will counter the additional loading from the Peconic Estuary, creating overall benefit. (See Table 29 below.)
2. Divert some of the outfall to the Peconic Estuary. This will maintain existing hydrology patterns, but requires a change in the SPDES permit. Another alternative is to recharge a proportion to ground.
3. Reuse the treated wastewater to reduce the amount of treated effluent release (High School, campground).
4. Further treat the effluent to remove additional nitrogen (new technology in testing phase).

Table 29 Greenport Watershed Mitigation

Nitrogen Loading		*gal/day*	*# dwelling equivalent*	*# N from Hsehold/yr*	*N flow mg/l from hsehold*	*N flow mg/l after treatment*	*Estimated N# /yr to LI Sound*
1	Older Sewage Plant	300,000	1,000	33	60	10	**5,500**
2	New Sewage Plant	300,000	1,000	33	60	5	**2,750**
3	Expansion of 200,000 g/d	500,000	1,667	33	60	5	**4,583**
	If balance watersheds						
4a	Locate 25% of expansion from LI watershed, subtract direct load to watershed	50,000	167	16.5	30		**-2,750**
4b	Expansion of 200,000 g/d	500,000	1,667	33	60	5	4,583
4							**1,833**
5a	Locate 50% of expansion from LI watershed	100,000	333	16.5	30		-5,500
5b	Expansion of 200,000 g/d	500,000	1,667	33	60	5	4,583
5							**-917**
	Assumes 33 # N load and rate of 60 mg/l per typical household when dispensed directly to sewer,						
	Assumes 16.5 # N load and rate of 30 mg/l per typical household when dispensed to on-site septic system						
	Source: Memorandum dated 2/22/2013 from Lomardo Associates, note: RI estimates 7#/per/yr loading, after septic tank or 21 #/home						

The expansion of the sewer district into the LI Watershed makes the most sense, as it will balance future loading transferred from the Peconic Estuary. The planned infrastructure will be in close proximity to the target area. This should be a priority project as a mitigation factor for the plant expansion and to treat the high percentage of nonconforming lot sizes still using onsite systems. It also maximizes the benefit of the investment in the existing, underutilized facility.

4.11.5 Southold

Twenty four percent of buildings greater than 450 SF are sited on shallow depths to groundwater. Southold has the second highest number of buildings in a flood zone, after Mattituck and 183 or 26.4% in a SLOSH zone. Thirty six percent of the soils are very limited for septic absorption, with excessively drained soils. Forty percent of the parcels are less than one-half acre. Thirty three percent of the hamlet's developed lots in the LI Sound watershed are nonconforming for drinking water standards, being less than 20,000 SF. The two areas of concern are the lots on the interswale dunes separating Great Pond from the LI Sound. The other vulnerable area is along Soundview Avenue and Route 48 near Town Beach. Depending upon capacities and costs for pumping, it may be possible to link to the Greenport Sewer District in the latter location.

4.11.6 Peconic

Most of the Peconic residences, like Orient, still rely on individual wells for drinking water. Surveyed residents on Henrys Lane all had reverse osmosis water purification systems for their drinking water due to pollution issues. Eighty one structures greater than 450 SF are on shallow depths to groundwater, with a number on a sand bar separating a pond from the bay. Peconic has the highest proportion of buildings being vulnerable to storm surge, with 33.1% in a SLOSH zone. Up to 96 developed properties will be impacted by horizontal inundation. Forty four percent of the soils are considered very limited for septic absorption, mostly due to soils that drain excessively. Forty six percent of lots are less than one-half acre in size, with 35.1% of the lots in Peconic being nonconforming to the 20,000 SF lot minimum required for onsite wastewater. This situation is even worse here, as the minimum lot sizes increase to 40,000SF when individual wells are used. 65% of the parcels are less than one-acre in size. 215 buildings greater than 450 SF representing 81.7% of the buildings in Peconic are in the 0-2 year influence zone pointing to direct impacts.

The neighborhood has a mixture of civic and home owner organizations, while some streets have no local organizational structure. PGG concentrated door-to-door survey outreach on Henrys Lane and found a respectful amount of receptivity to the idea. The Group to Save Goldsmith's Inlet did not embrace the wastewater effort, mostly due to their ongoing efforts to identify the source of pathogen contamination to the inlet. Of the 11 samples evaluated for pathogens, Autumn Pond averaged 6,953 MPN during wet conditions. 12 out of 165 samples were tested for DNA processing. Only the station at Autumn Pond showed human source isolates, with 37% human sourced. Wildlife and birds are believed to be the major sources of pathogens. This report led people to believe that their onsite wastewater systems were not the cause of pollution. Nitrogen tests from the sampling stations were high in wet events, with an average of 0.81 and a high of 2.05. There was no explanation for the differences in pollution type, origin or issues. Since pathogens from onsite systems are usually filtered by soils, it is conceivable that the nitrogen loading could have a higher human-sourced origin. Testing for nitrogen sources is therefore a needed evaluation tool to better target priority areas and correctly inform the public. Based on the mapping of conditions executed here, Peconic does exhibit the land use

characteristics that indicate excess nitrogen loading from human sources. The area would be appropriate for future onsite wastewater enhancement projects and is marked as a high priority area.

4.11.7 Cutchogue

Except for the end of Duck Pond Road, Cutchogue is dominated by farmland and is not a high priority area for this project.

4.11.8 Mattituck

Mattituck has the highest number of buildings greater than 450 SF in the North Fork LI Sound watershed that are on shallow depths to groundwater (216/12.6%), in a flood zone (119/6.9%), and in SLOSH zones (302/17.7%). Up to 239 buildings will have setbacks compromised by horizontal inundation due to climate change. Half of the Mattituck buildings are sited on excessively drained soils, and considered very limited for onsite wastewater treatment. Forty percent of Mattituck structures are less than one-half acre in size, and 33% or 1571 parcels are nonconforming to the minimum size recommended for the protection of drinking water quality. Thirty seven percent (637) of the buildings are in the 0-2 year influence zone, measuring how long it takes groundwater to travel horizontally to surface waters. High nitrogen levels have been measured in groundwater and algal blooms are occurring in the Creek. Alexandrium fundyense, which produces the chemical toxin (saxitoxin), was present in 2012, and a rust tide occurred in 2013. Priority areas for treatment are in three locations at the head of the creek, and Captain Kidd Estates, closer to the Sound. Two of the priority areas at the head of the Creek were selected for project development.

4.11.9 Northville/Riverhead East 11901

Eleven percent of Northville's 315 buildings are on shallow depth to groundwater, with 10 in a flood zone and 28 (8.9%)in a SLOSH Zone. Forty six structures may have setbacks compromised by the rising seas. Twenty percent of Northville's soils drain excessively, and are therefore not suitable for onsite treatment. Thirty three percent (103) of Northville's parcels are less than one-quarter acre in size and 36.6% of developed lots are nonconforming, being less than 20,000SF. Sixty percent of the parcels are in the 0-2 year influence zone. Only the homes along Sound Shore Road are labeled as priority areas. These might be more suitable for a composting/urine diversion solution due to the difficult siting issues.

4.11.10 Aqueboque

Within the LI Sound watershed, Aquebogue is a low priority compared to other hamlets. It has negligible exposure to shallow depths and storm surge, only 23.3% of its soils are unsuitable to onsite treatment, and only 28.5% of lots are less than one-half acre.

4.11.11 Riverhead

The hamlet of Riverhead in the LI Sound watershed does not have an issue with shallow depths to groundwater or flooding. Fifty three% of its soils are very limited for onsite wastewater treatment. The most significant issue is that 65% of its lots are less than one-half acre, with 50.1% being less than one-quarter acre. Fifty seven percent are nonconforming with the 20,000 SF minimum lot size for onsite wastewater treatment. Fifty seven percent of the buildings greater than 450 SF are in the 0-2 year influence zone. Reeves Park is an area needing treatment based solely on lot size. Most of the homes are old and likely to have cesspools.

4.11.12 Calverton/Baiting Hollow

While only 3% or 23 buildings are sited in areas with shallow depths to groundwater or SLOSH zones, 67.8% (526) of the buildings are on soils considered very limited for onsite wastewater treatment.

Calverton has a high percentage of small lots, with 72.8% being less than one-half acre, 53.1% being less than one-quarter acre, and 61.8% being nonconforming to county regulations for minimum lot sizes. This impact is reinforced by the fact that 510 or 65.8% of buildings > 450 SF are in the 0-2 year influence zone. Selected neighborhoods should be prioritized based on lot size and soil limitations.

4.11.13 Wading River

Wading River has depth to groundwater issues, with 4.2% or 116 buildings (>450SF) on sites with shallow depths to groundwater. Wading River has the highest number of buildings in a VE flood zone, the most hazardous category. Sixty seven percent of the buildings are sited on soils very limited for onsite wastewater treatment. Wading River has the highest actual number of small lots, with 1380 or 53.2% being less than one-half acre and 817 (31.5%) being less than one-quarter acre. 48.8% of the lots are nonconforming with lots less than 20,000 SF. 45.1% or 1240 buildings lie in the 0-2 year influence zone. PGG targeted Wading River Shores Beach Club Civic Association due to the age of the community and the prevalence of small-scaled lots of the community, but the association cancelled a presentation and chose not to participate. Wildwood Acres is another target community suitable for community enhancement, but was unresponsive to outreach. Wildwood State Park needs to upgrade its wastewater treatment and hopefully will consider enhanced treatment for its public facilities, campgrounds and the residential cabins. The park is well situated for a joint approach to wastewater treatment with dense communities on either boundary, but at this time the park prefers to restrict its investigations to its own needs. Wading River also has a number of houses sited on the sand bar separating Wading River from the LI Sound on Creek Road. This area is difficult to service with a community system, but is a vulnerable area with critical treatment needs. Although Wading River is classified SC and therefore not appropriate for shellfish harvesting, it is an important wildlife habitat and could benefit from improvements. Onsite wastewater systems are listed as a suspected source for pollutants impacting water quality for Wading River. Selected areas are priorities and Wading River should be a focus of future study for the significant volumes evident in this hamlet.

4.12 Maps of key indicators of nitrogen pollution

The following maps were developed for both town and hamlet boundaries. They also can be viewed at http://peconicgreengrowth.org/community-maps-2014/

Maps of key indicators of nitrogen pollution

1. Water Quality: Depth to Groundwater:
   http://www.peconicgreengrowth.org/docs/maps/orient/Orient_GW_DEPTH.pdf
2. Flood and SLOSH zones
3. Sea Level Rise 2050 (town only)
4. Sea Level Rise 2080 (town only)
5. Soil: Drainage Soil:
6. Septic Absorption
7. Parcel Density
8. Influence Zones

Maps for planning purposes:

9. Priority areas
10. Proposed districts for community systems (selected hamlets only)
11. Land Use
12. Aerial:
13. Clearance distances to buildings (200 ft) (selected hamlets only)