

A nitrogen reducing septic system for Westhampton Beach High School and Middle School



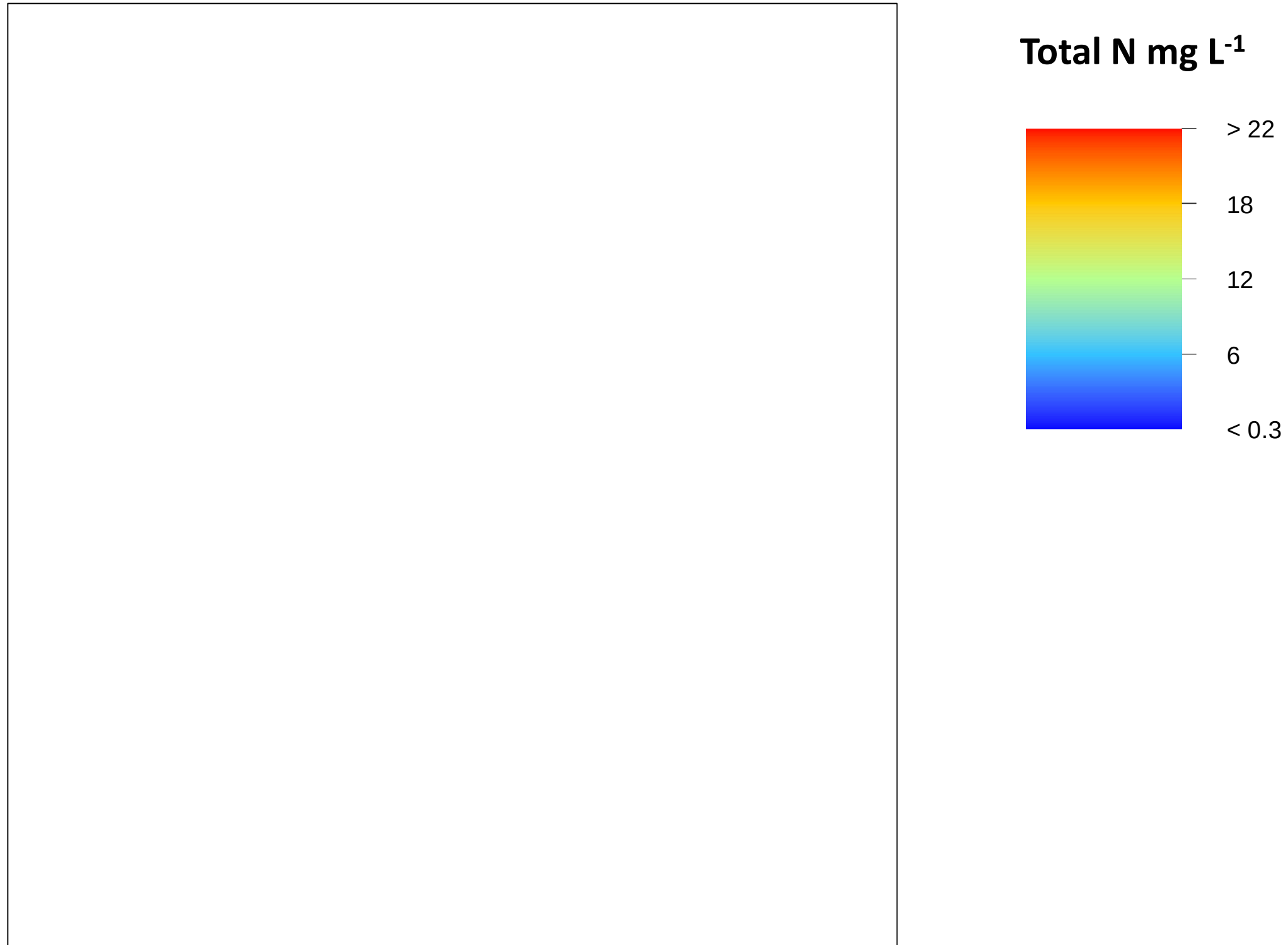
Stony Brook
University



New York State Center for Clean Water Technology

**Director, Dr. Chris Gobler
Associate Director, Frank Russo, P.E.**

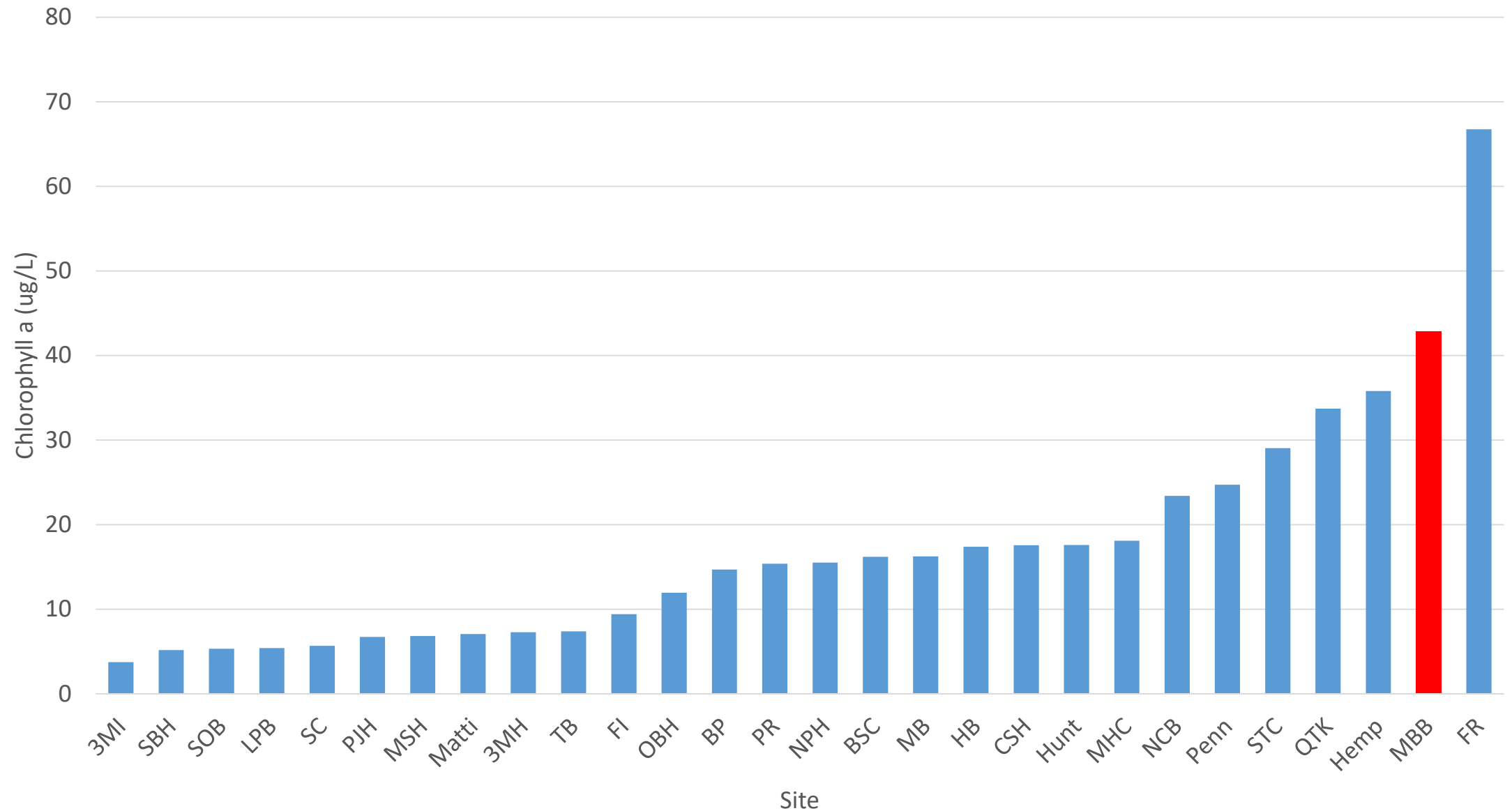
Ground Water Nitrogen Concentrations



Long Island Water Quality Report *Thursday evening weather forecasts, May – September 2014 - 2018*

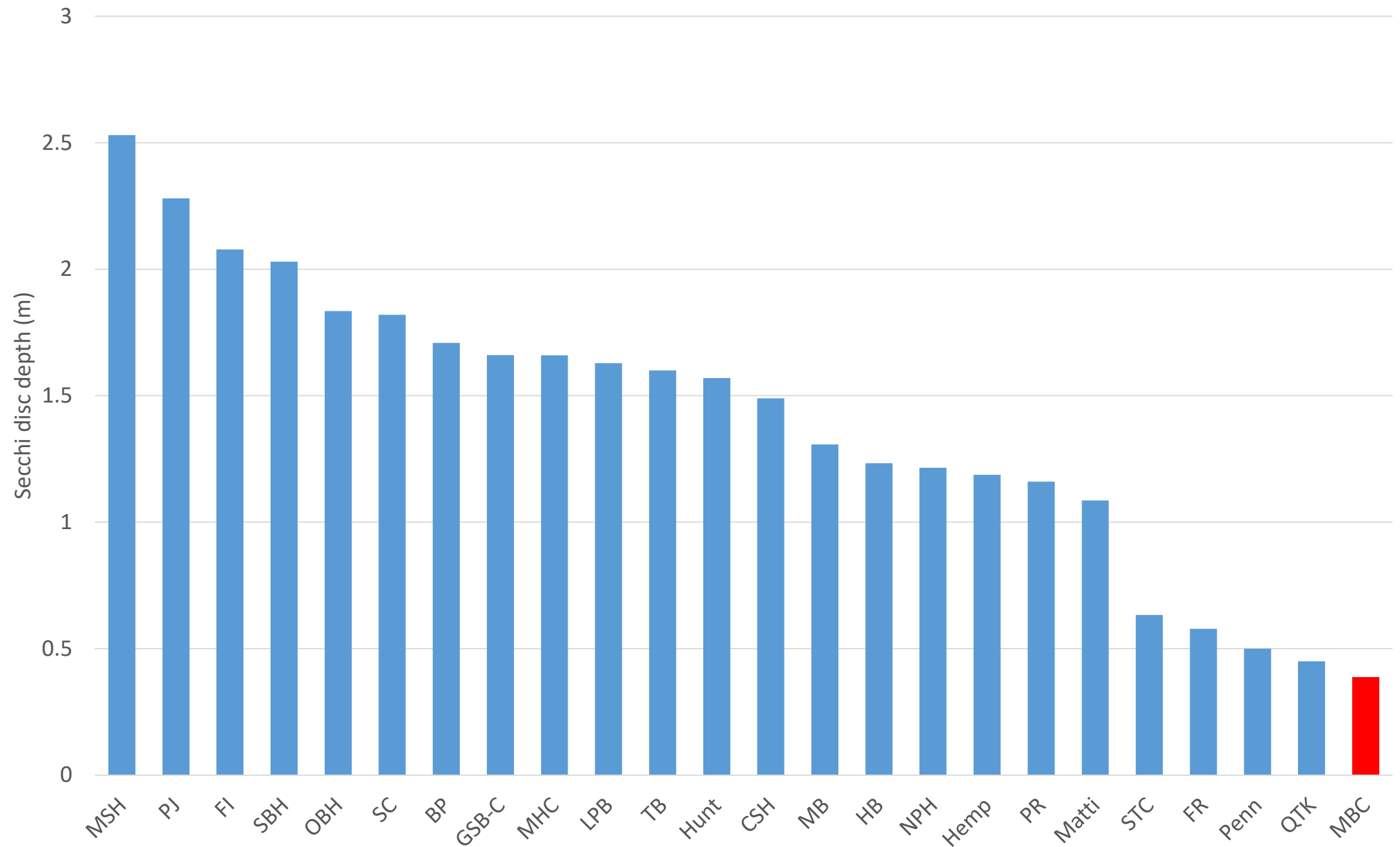


Algae levels across Long Island, 28 sites



Moniebogue Bay was the second worst site across all of Long Island.

Water clarity across Long Island, 24 sites

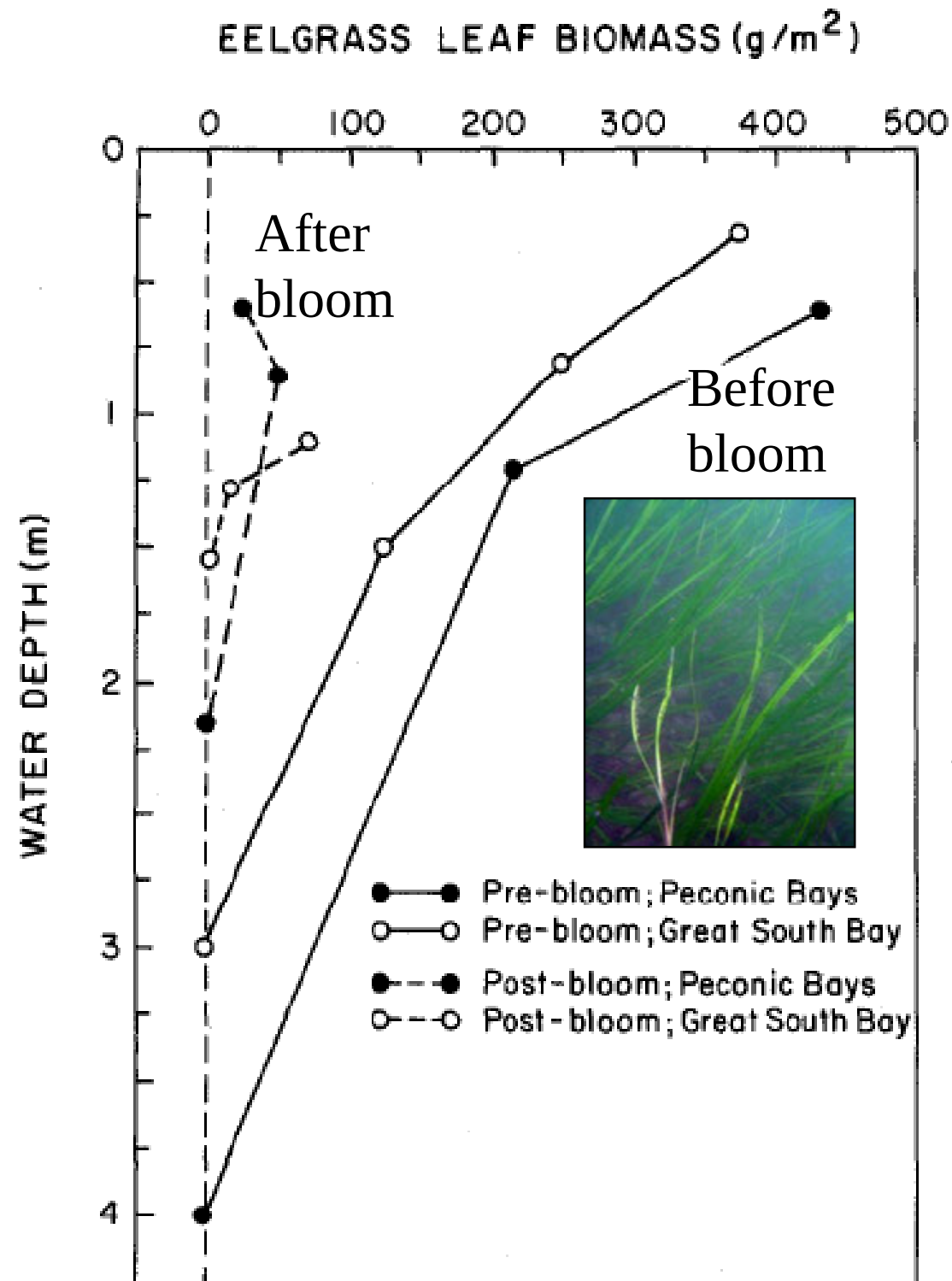
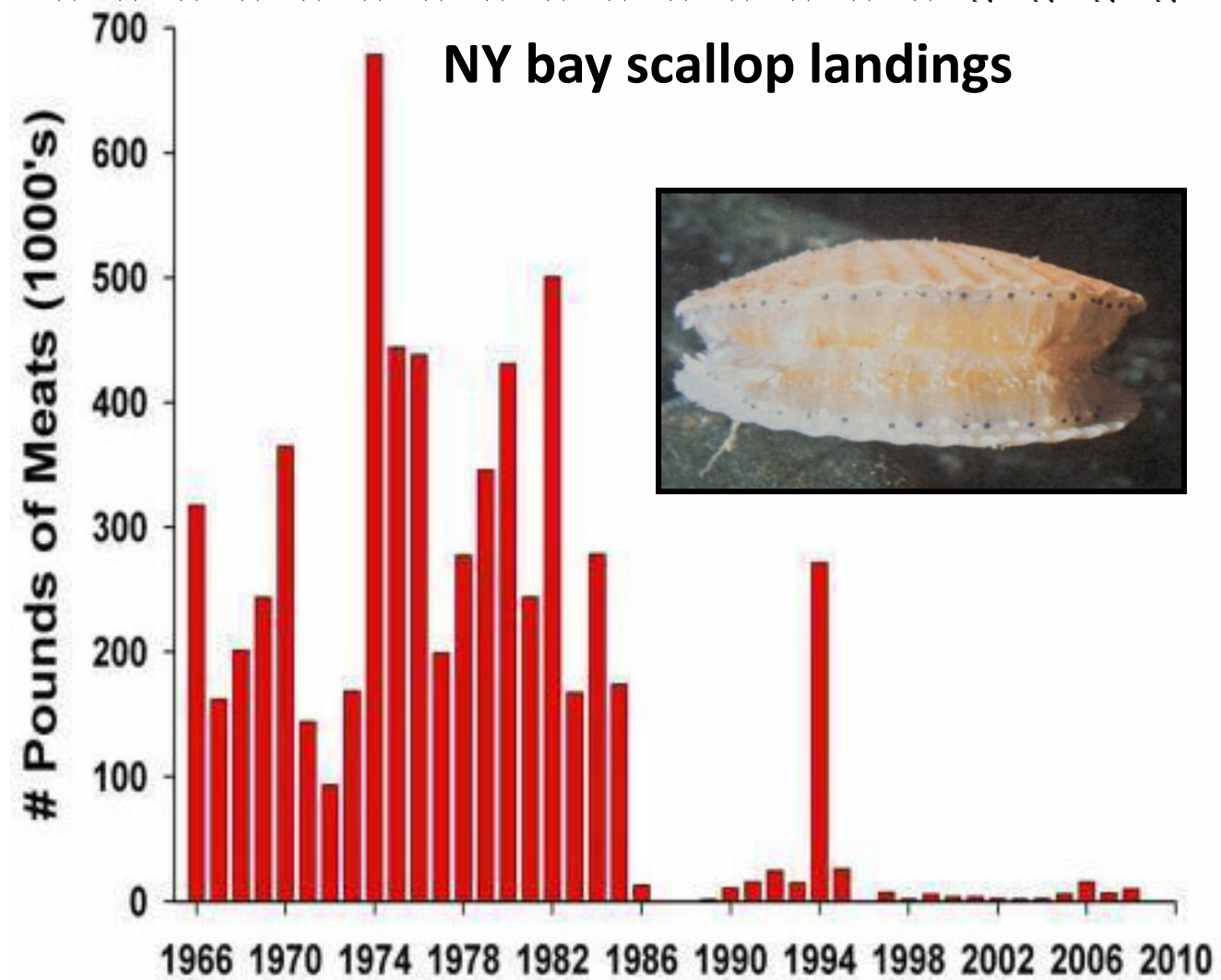
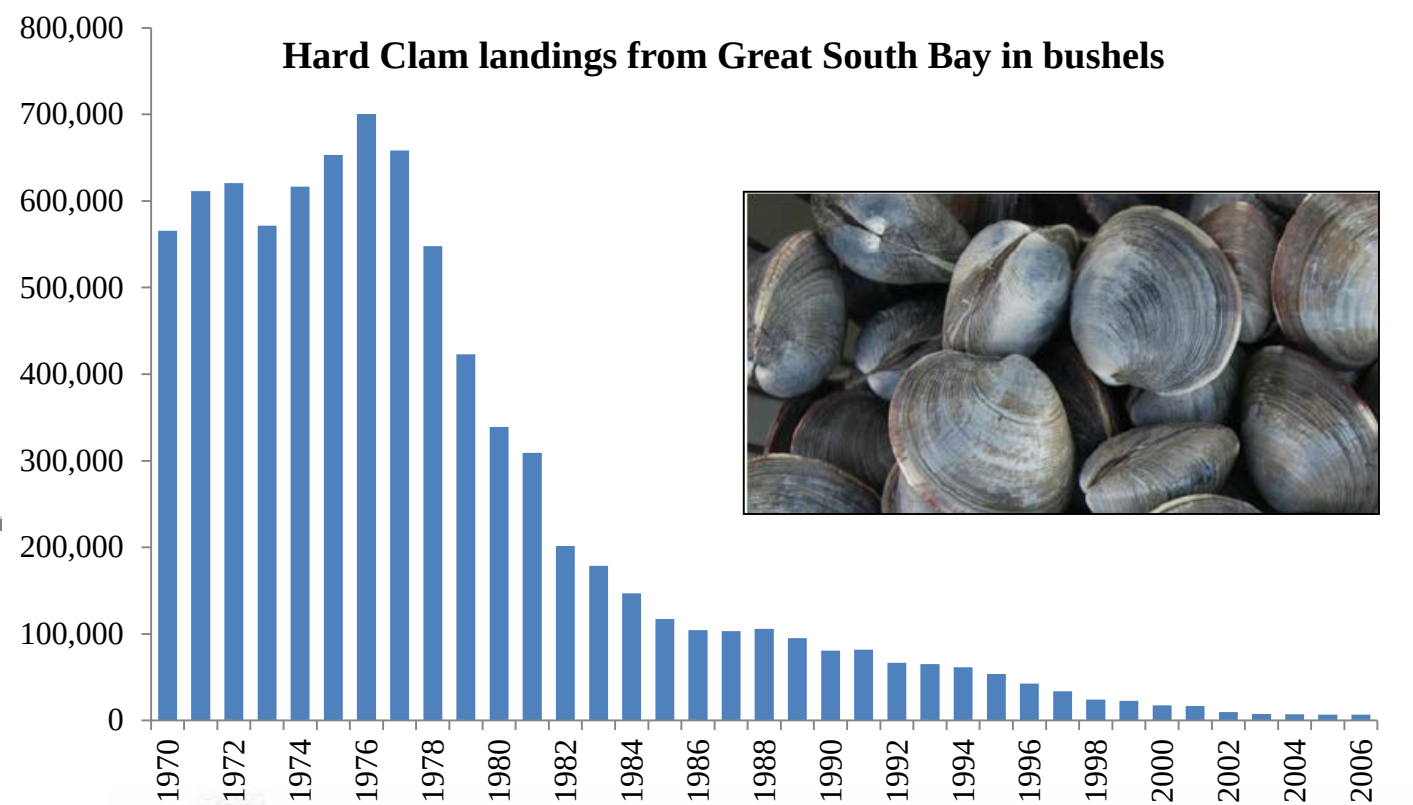


Moniebogue Bay was the worst site across all of Long Island.

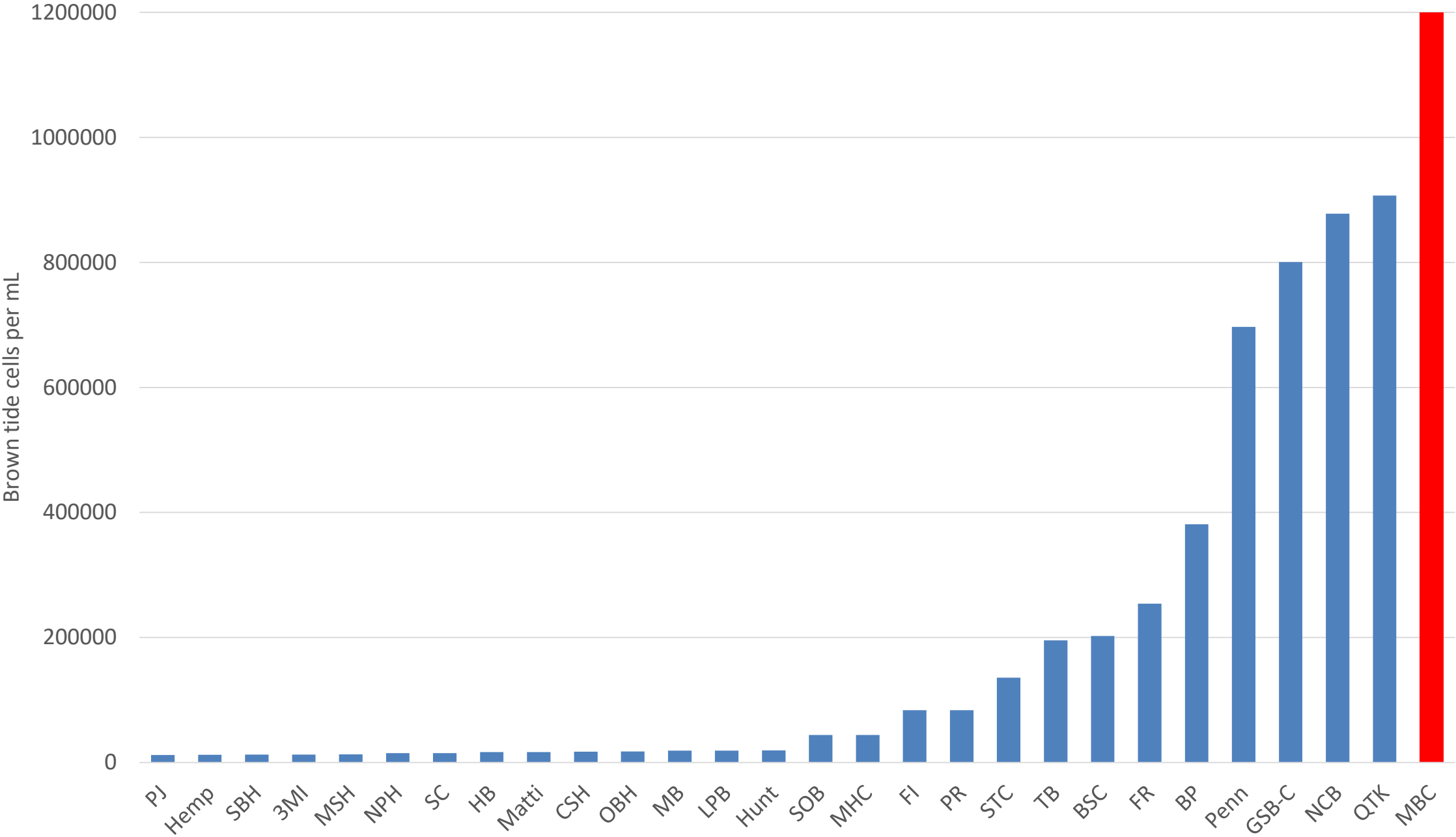
Brown tides in Westhampton



Impacts of brown tides

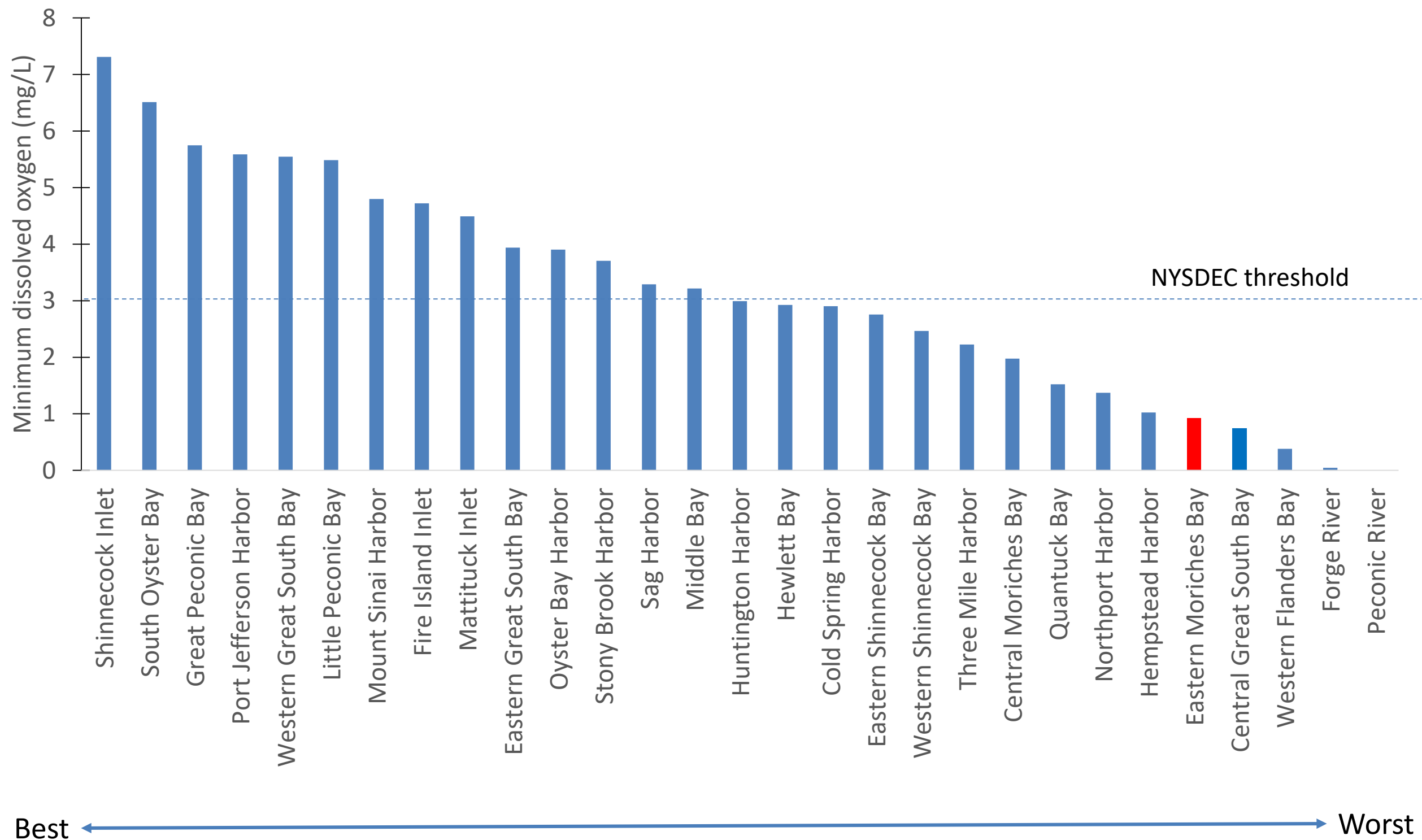


Brown tide densities, 2015



Moniebogue Bay was the worst site across all of Long Island.

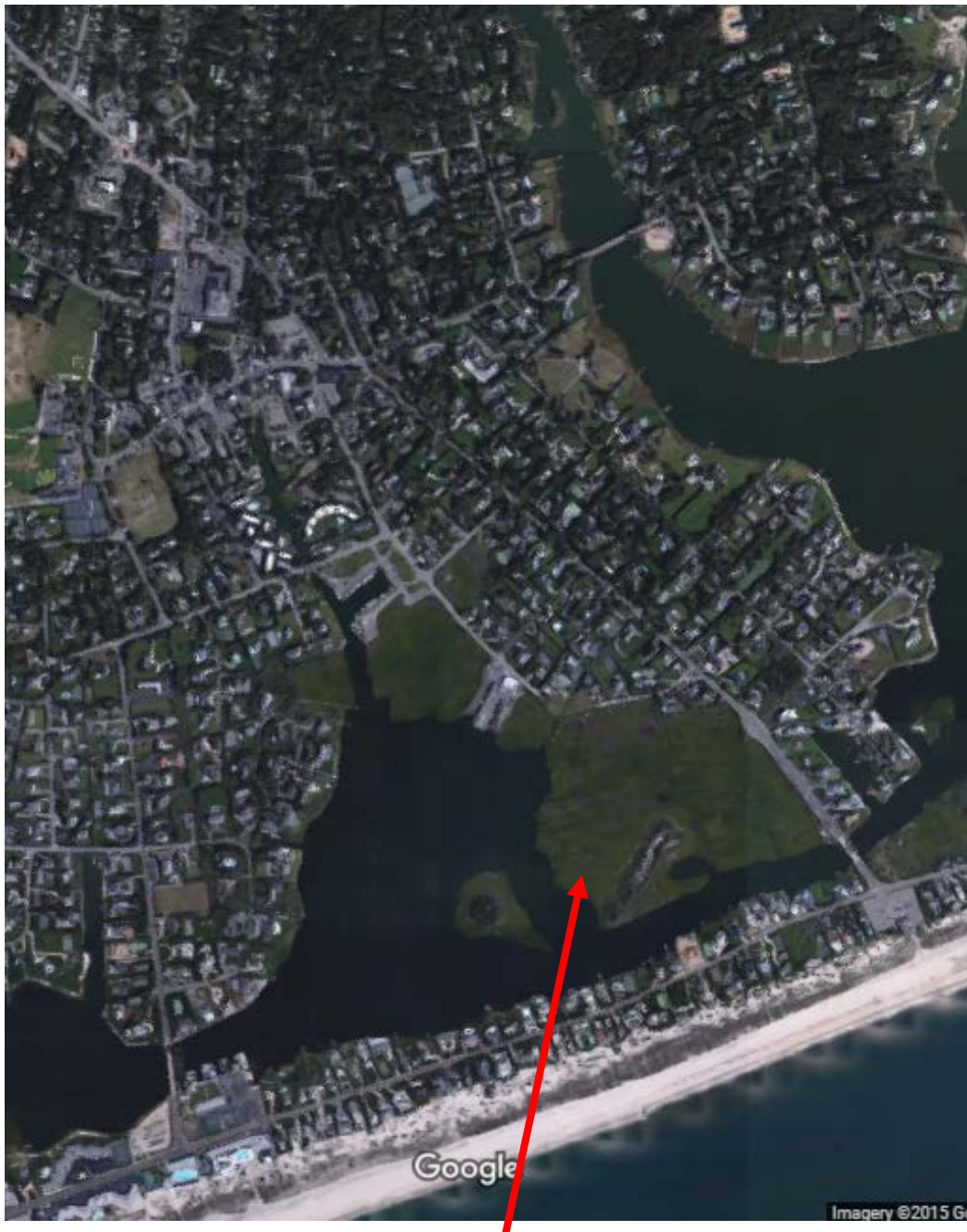
Dissolved oxygen minimum across sites around Long Island as measured during the summers of 2014-2018



Salt marsh ecosystems



Salt marshes protect coastlines

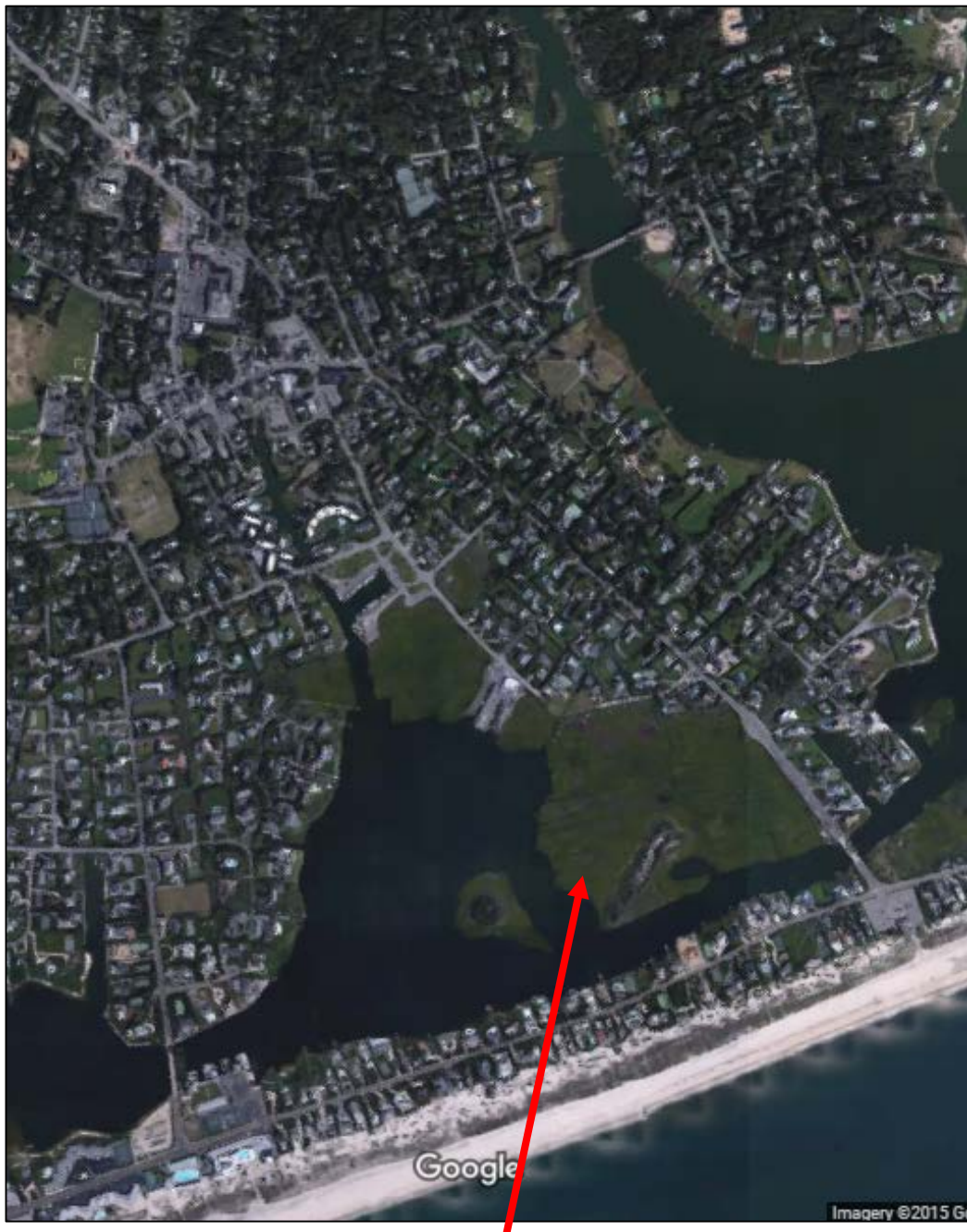


Salt marsh



Sea level by year 2050

Salt marshes protect coastlines

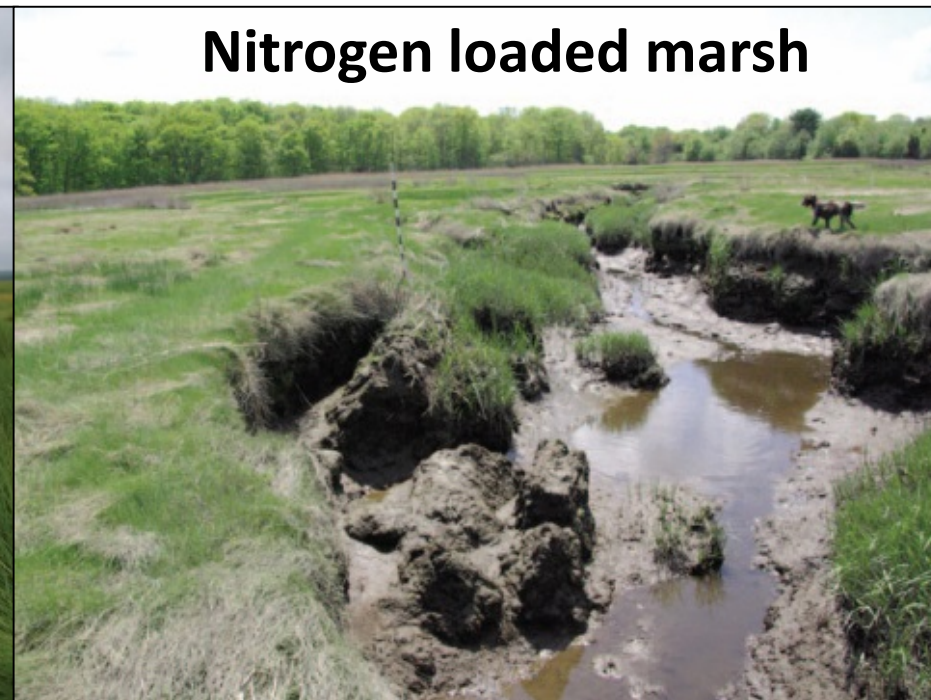


Salt marsh

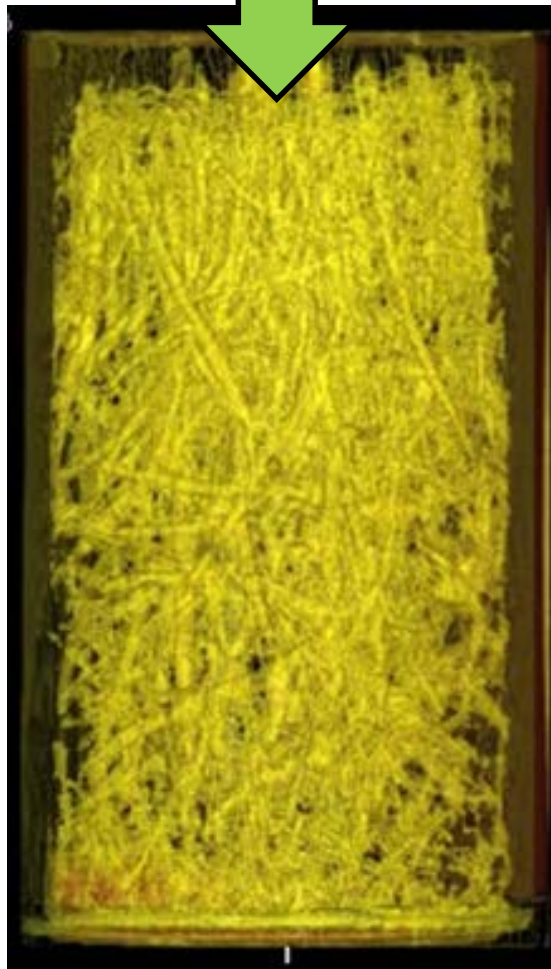


Flooding, Hurricane Sandy

“Coastal eutrophication as a driver of salt marsh loss”, Deegan et al 2012, Nature



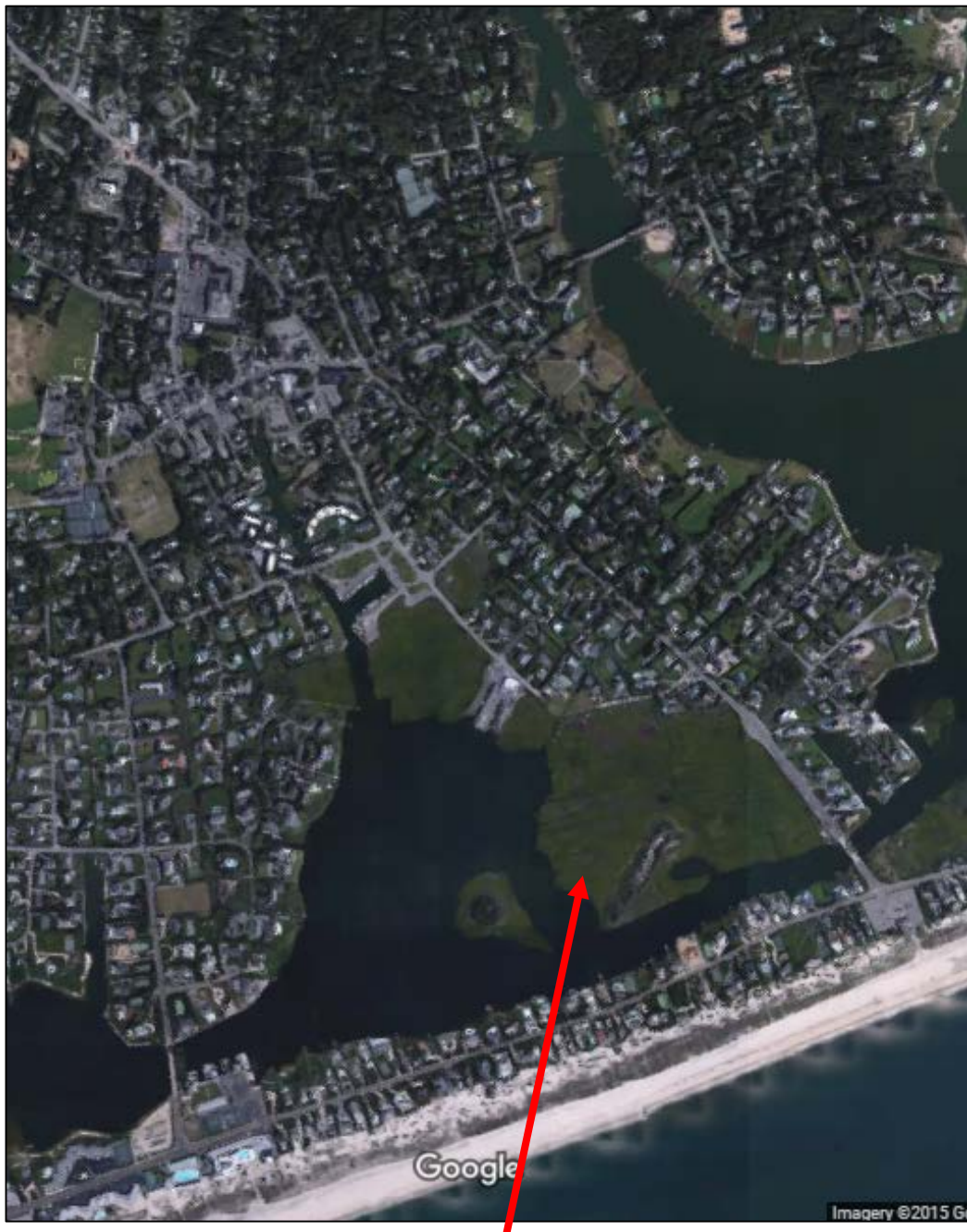
**Dense,
strong
roots**



**Nutrient
weakened,
roots**



Salt marshes protect coastlines

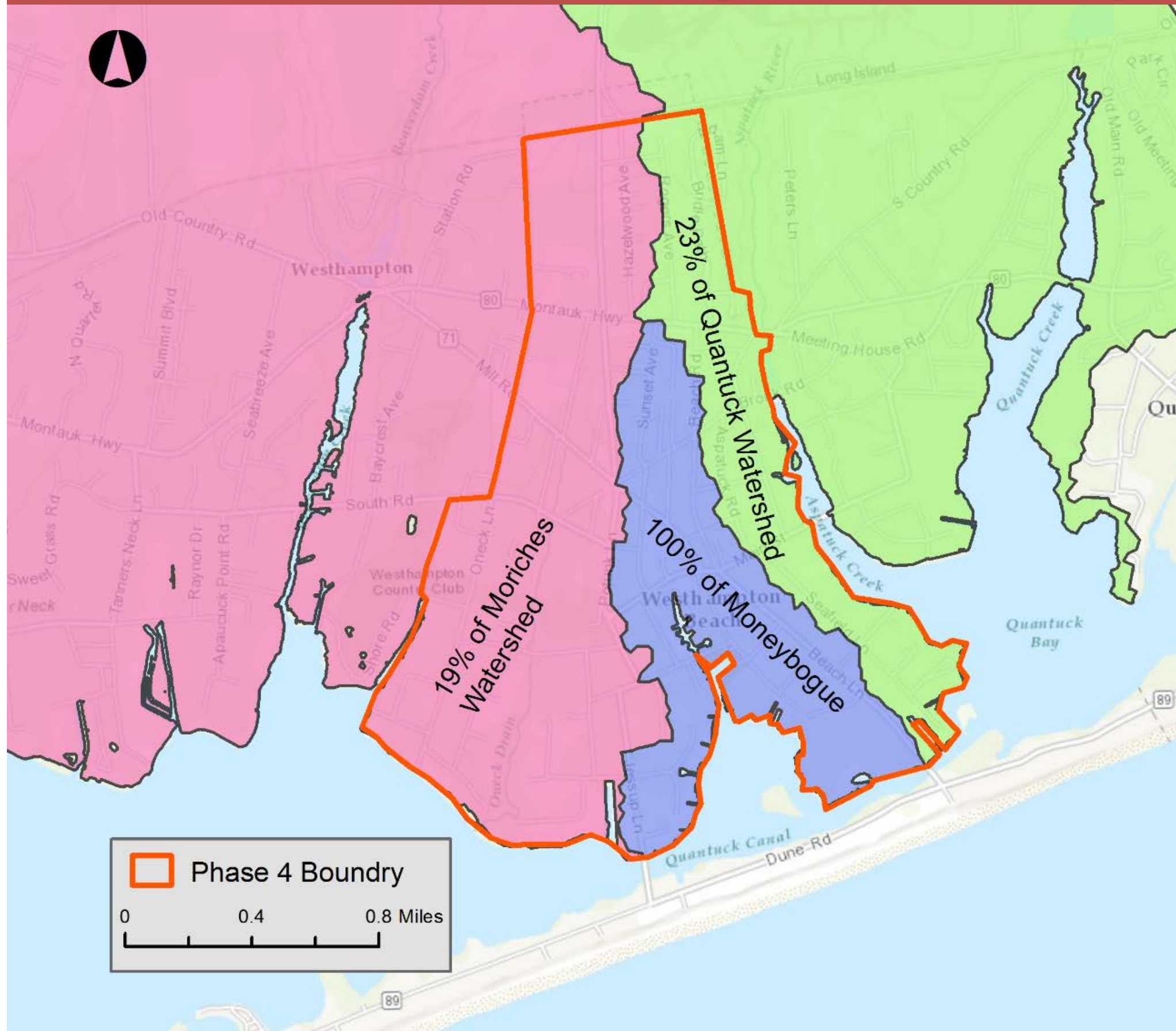


Salt marsh

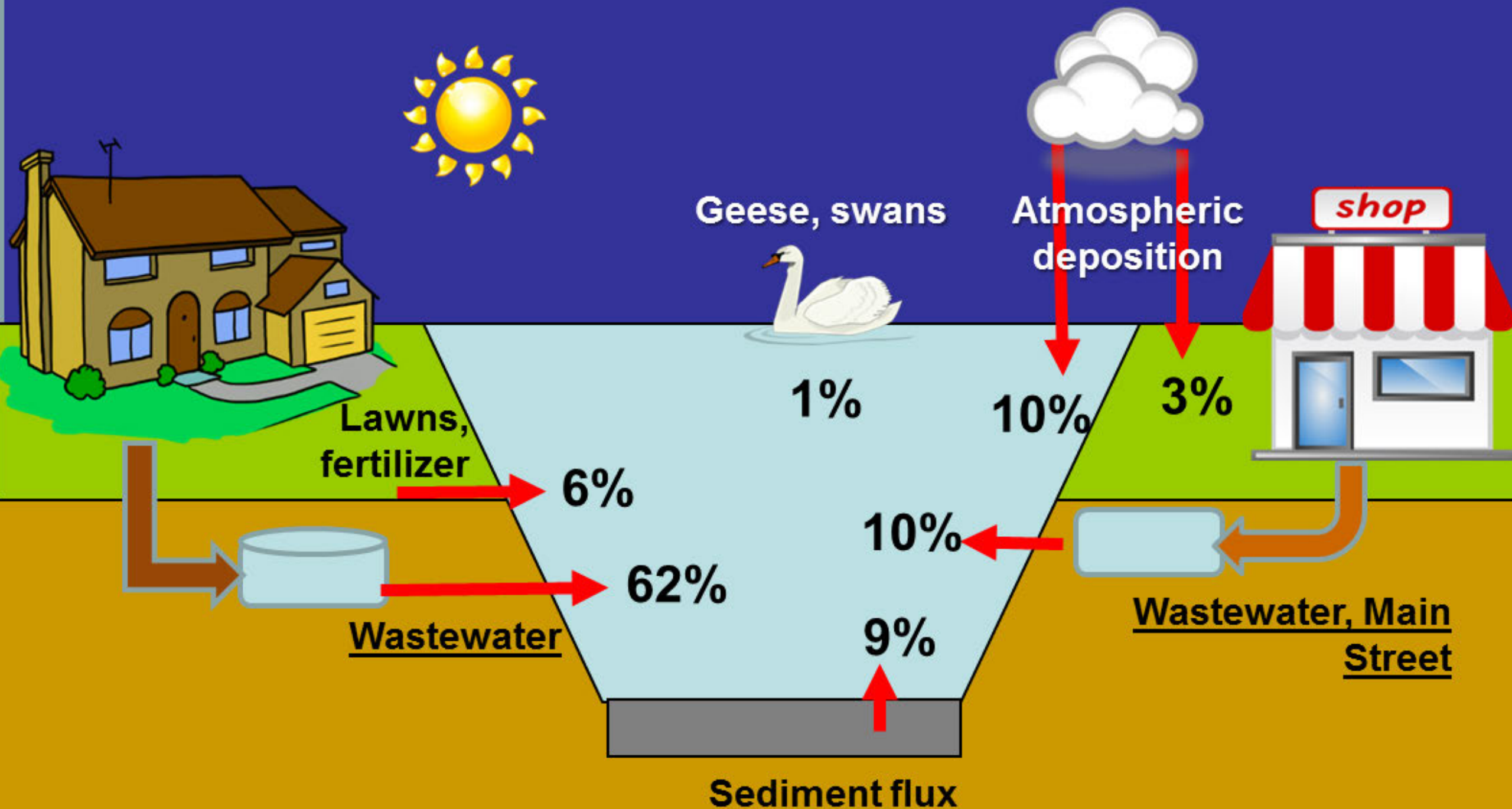


Flooding, Hurricane Sandy

The watersheds of Westhampton Beach Village

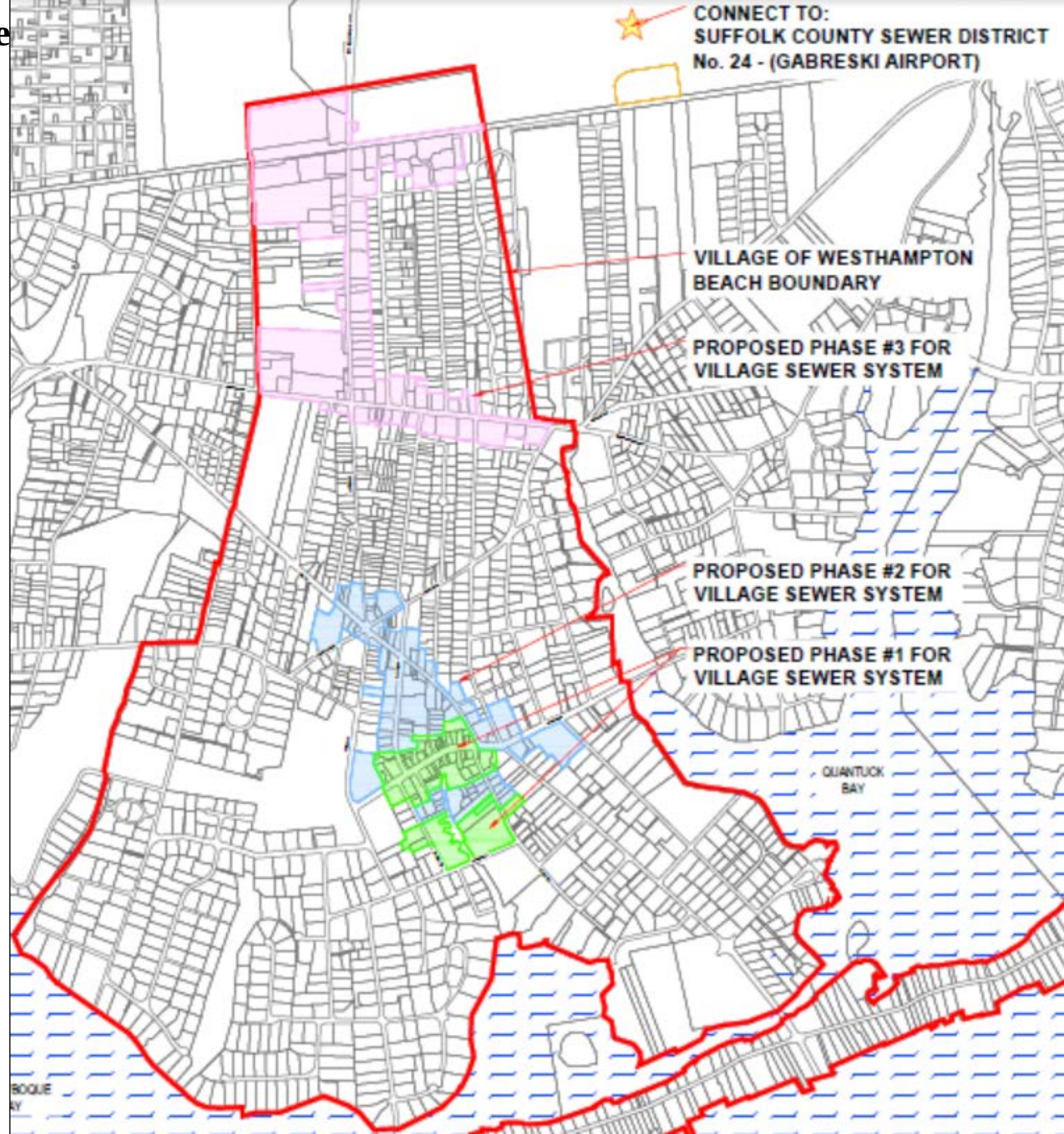


Nitrogen loading Moniebogue

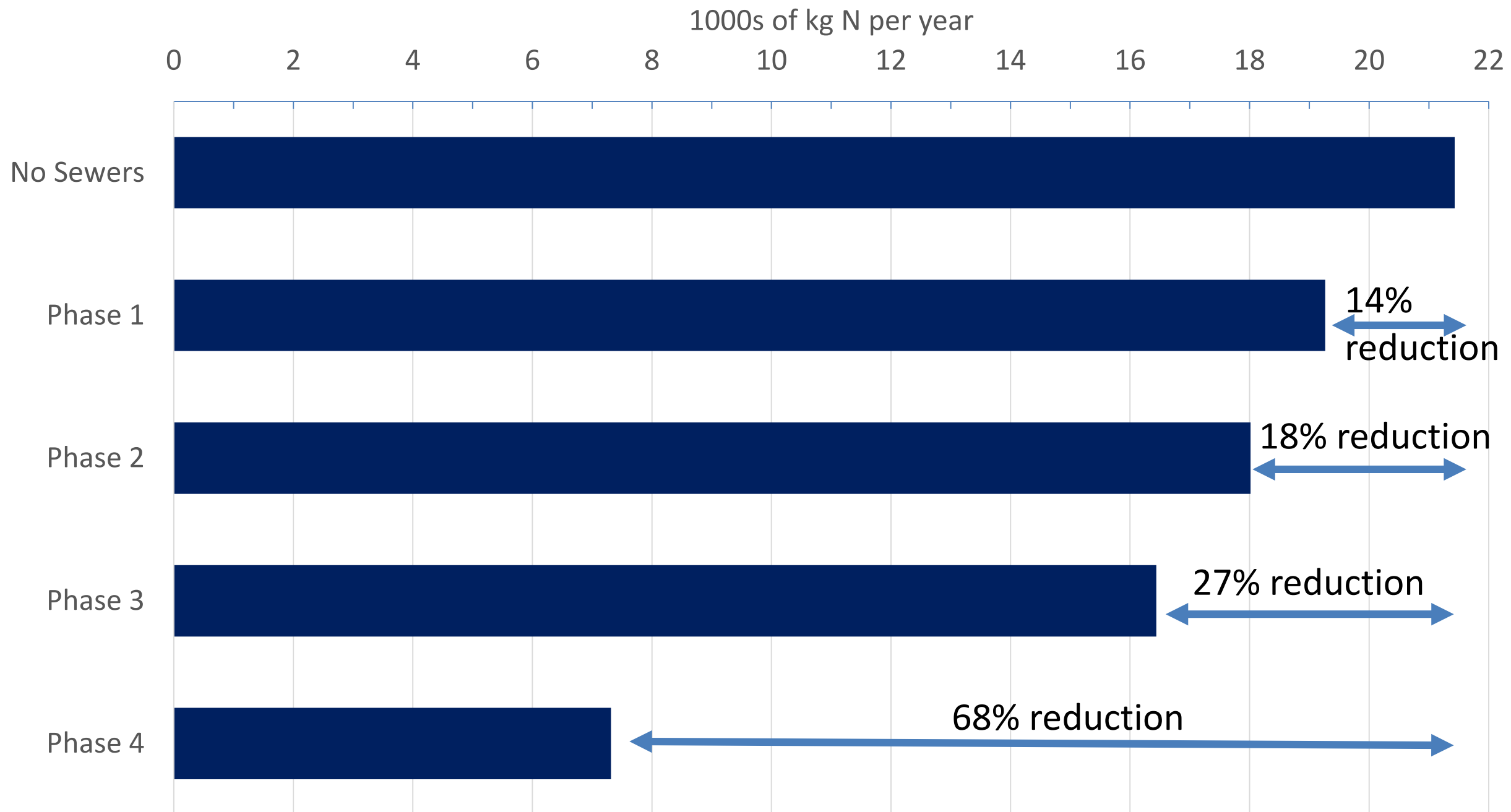


Westhampton Beach Village and the four phases of the septic program

- Village is within two year travel time for groundwater.
- Phase one connects downtown region to Grabeski STP (green region).
- Phases two and three connects two additional regions to the STP (blue and pink regions).
- Phase four upgrades septic systems all other homes in the region in high nitrogen removing systems.



Total nitrogen load from Village of Westhampton Beach

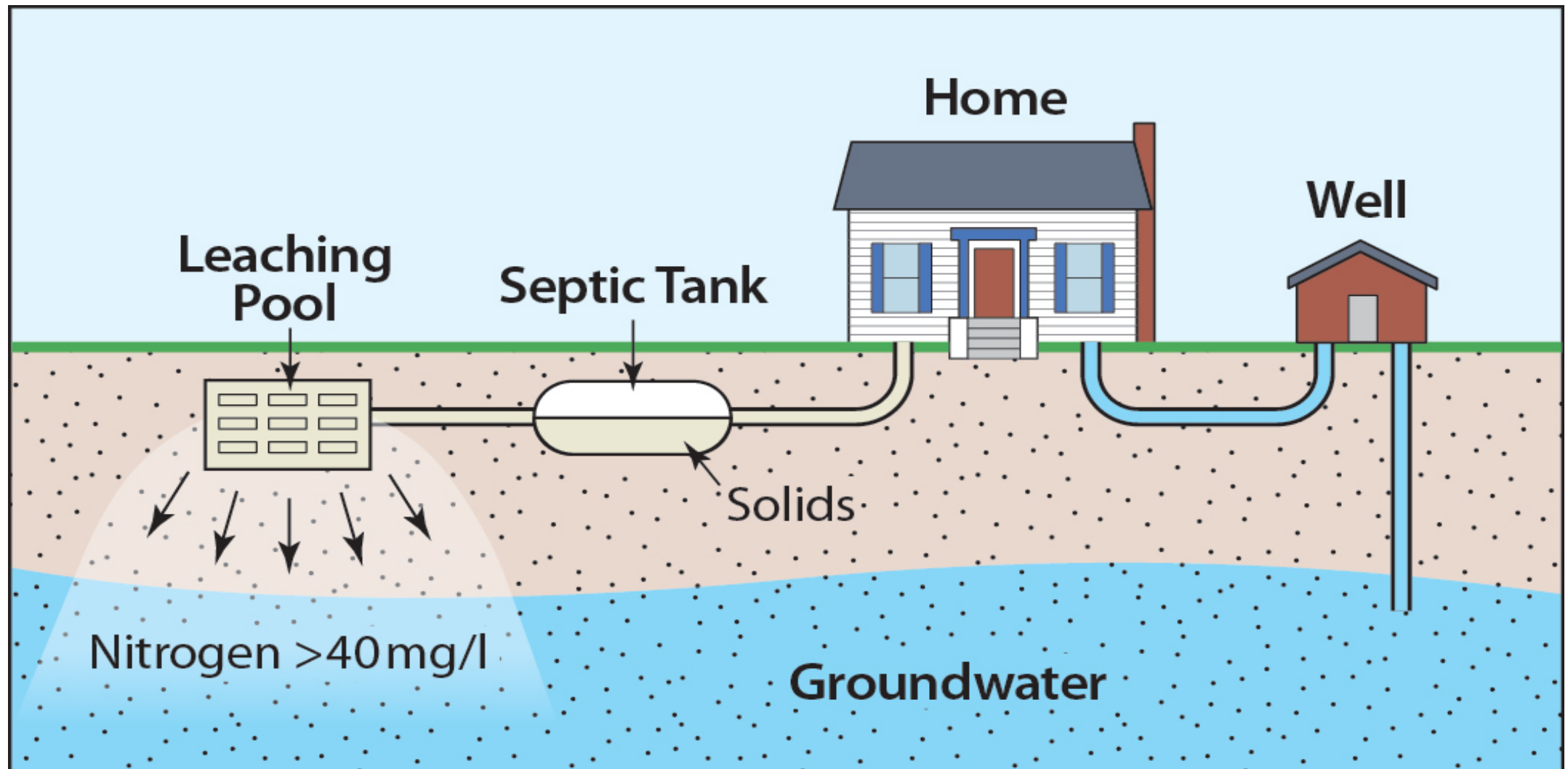


New York State Center for Clean Water Technology

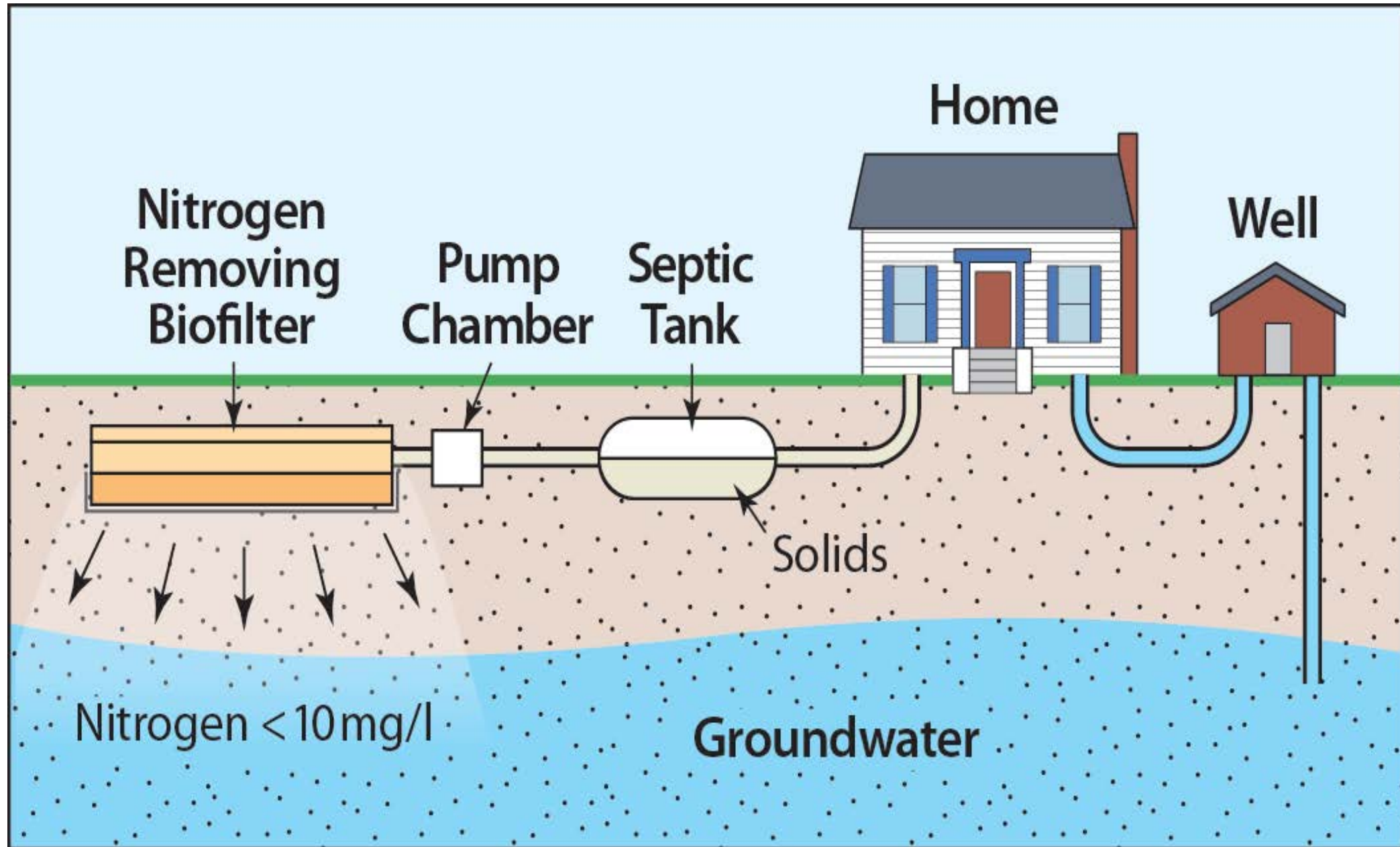
Wastewater Goal: 10-10-30

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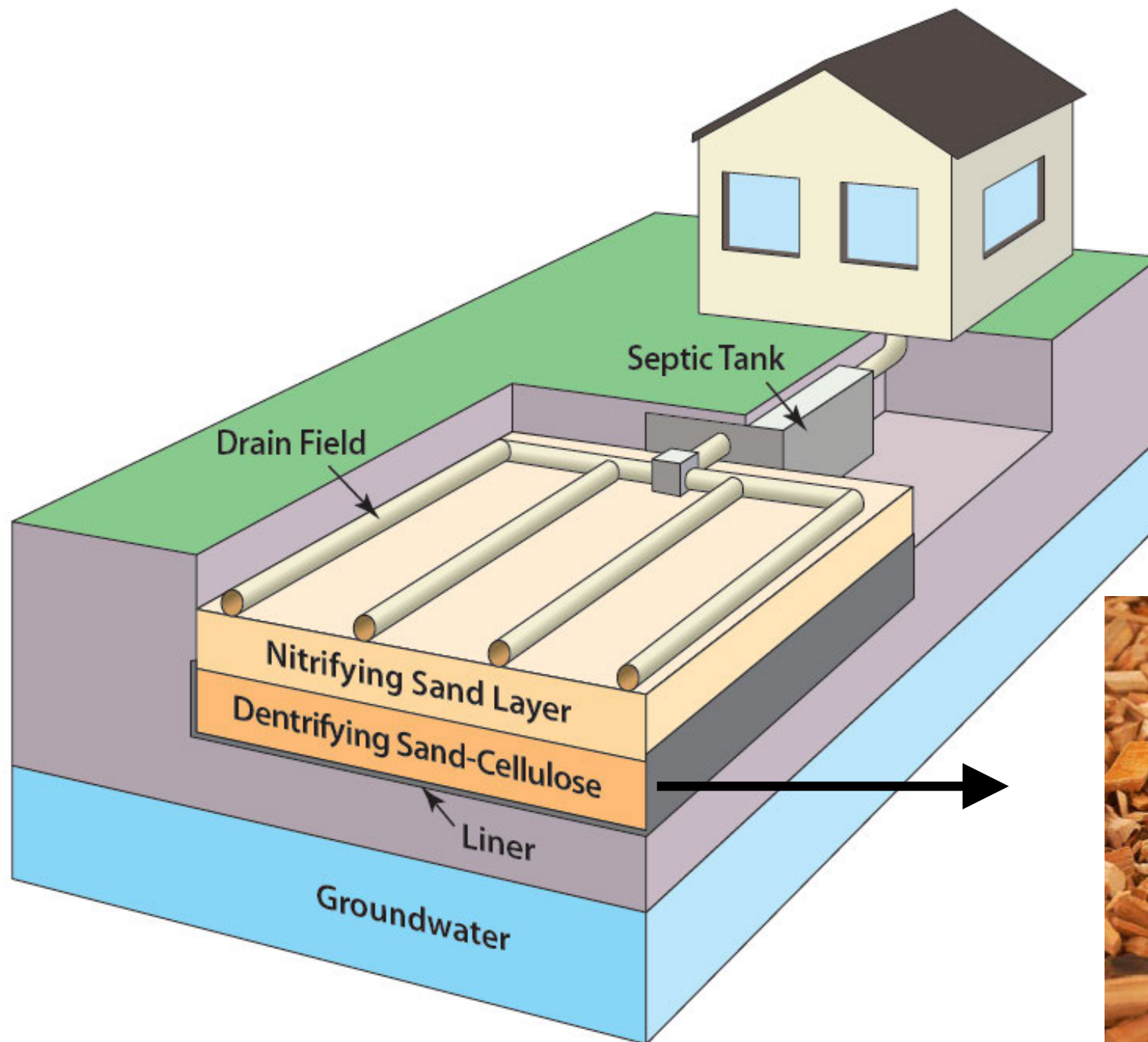
Current onsite wastewater systems



Nitrogen Removing Biofilters (NRB)



Nitrogen Removing Biofilters (NRB)

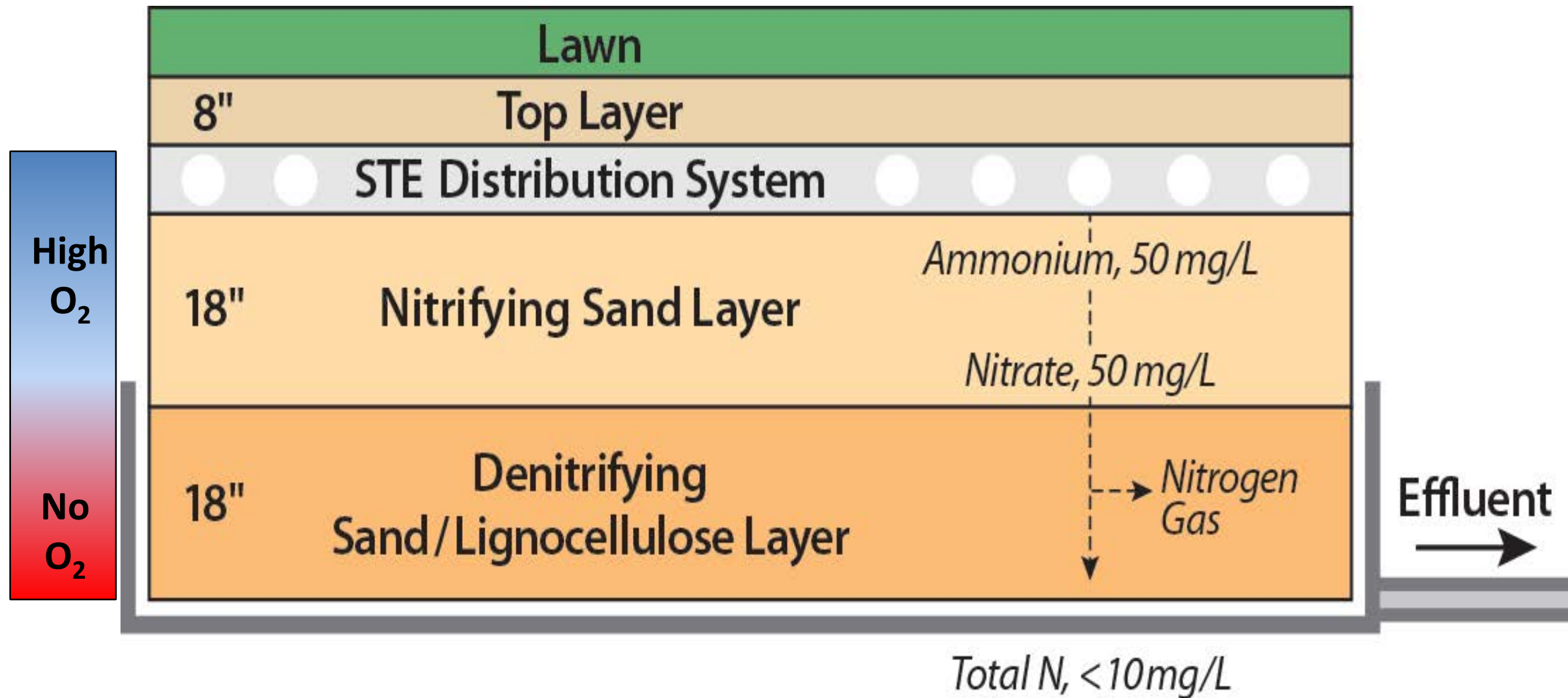


Lignocellulose = wood, chips



Carbon source to promote denitrification

Nitrogen Removing Biofilters (NRB)



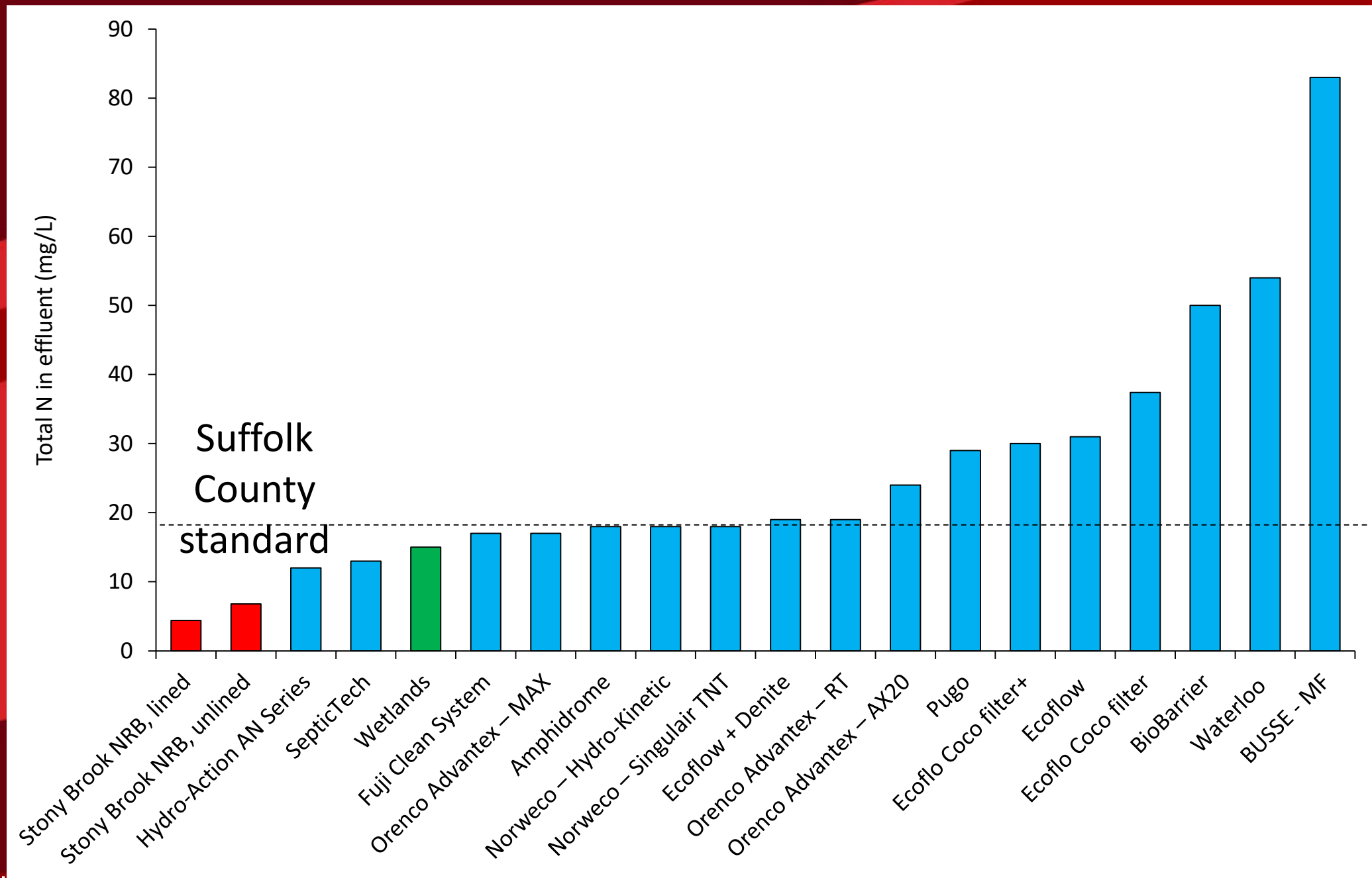
SANITARY CODE ARTICLE 19

MANAGEMENT OF INNOVATIVE AND ALTERNATIVE ONSITE WASTEWATER TREATMENT SYSTEMS



Bill signing August 10, 2016

Measuring up...



Removal of drugs and pharmaceuticals by NRBs

	Channel Influent (ng/L)	LINED Septic Tank Effluent (ng/L)	LINED Effluent (ng/L)	Removal Channel Influent To Effluent (%)
Acetaminophen	67,000	56,000	<MDL (75)	>99
Atenolol	380	250	21	94
Caffeine	65,000	38,000	<MDL (69)	>99
Cotinine	1,300	1,800	<MDL (48)	96
DEET	5,100	2,500	54	99
Diltiazem	<MDL (123)	<MDL (43)	<MDL (19)	84
Diphenhydramine	470	220	<MDL (23)	95
Metoprolol	350	280	27	92
Nicotine	1,700	1,100	<MDL (24)	99
Paraxanthine	30,000	9,300	<MDL (62)	>99
Sulfamethoxazole	1,000	3,200	50	95
Trimethoprim	560	430	<MDL (21)	96

<MDL values are calculated using the MDL

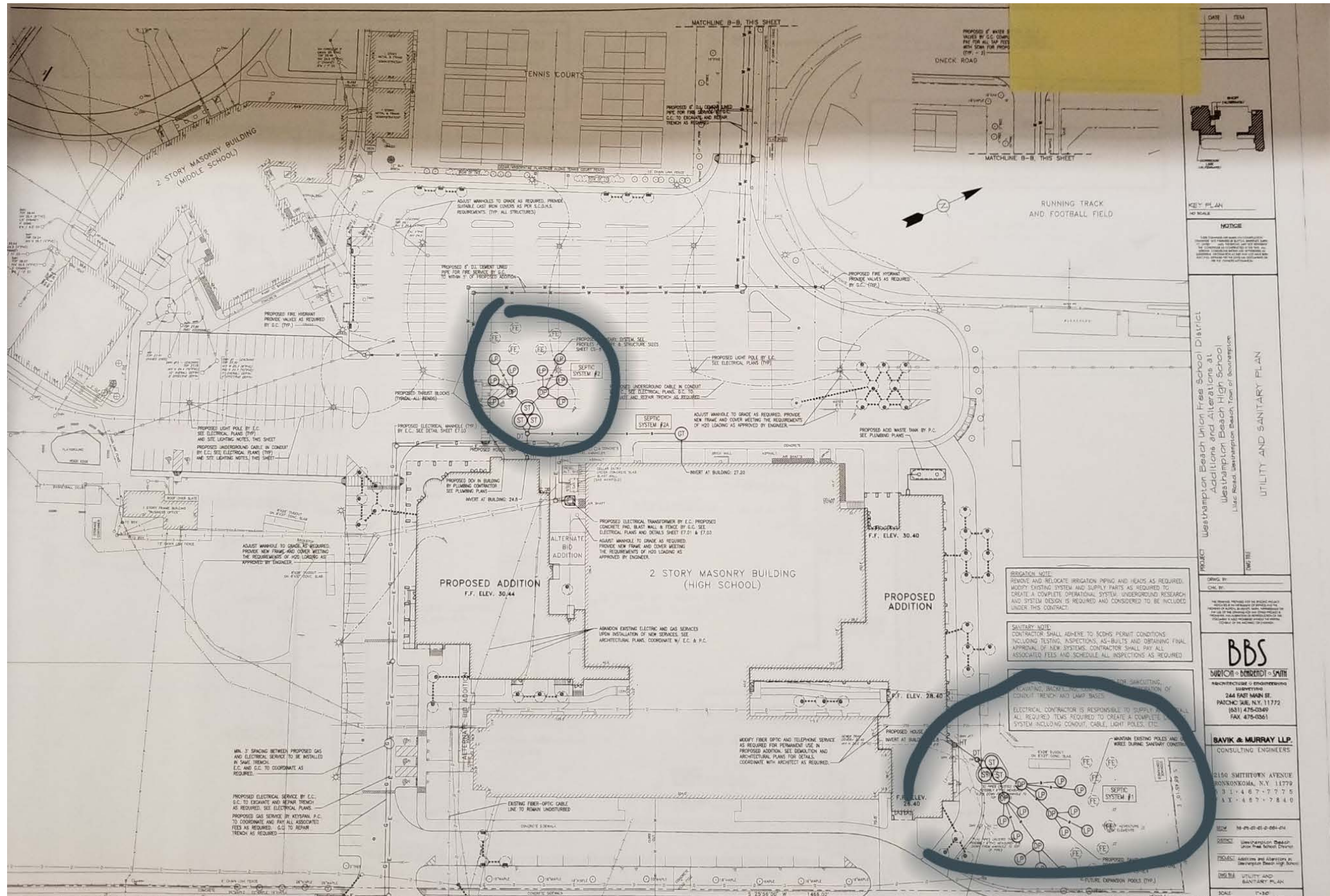
Westhampton Beach High School
Location map for CPF Grant Application

Legend

- Westhampton Beach Senior High School



Existing septic system WHB HS and middle school



The Two-Stage, Partnership Plan

Phase I

- Partner with Engineering Firm via RFP
- Wastewater characterization study of school system
- Engineering Design Report
- Preparation of Construction Plans and Specifications
- CFP request = \$195,000
- CCWT donates \$48,000 in time and services

Phase II

- Construction supported by CPF
- Performance evaluation by CCWT (ELAP certified laboratory)

CCWT contributes tens of thousands of dollars to the project

Suffolk County has pledged \$10,000 to the project

The Design

- The optimal nitrogen reducing septic system will depend on site conditions and wastewater effluent attributes
- The system producing the lowest nitrogen effluent for the lowest cost will be chosen.
- Reuse of the existing septic tanks and leaching pools to the maximum extent possible will minimize costs
- A lined NRB maximum area is approximately 1/4 acre (11,400 sq. ft.) which can be located on the site in consultation with the Superintendent.
- Alternatively, a commercial systems or series of commercial systems may provide ideal solution.
- The septic tank effluent from both systems would be pumped to a flow dispersion manhole for subsequent dosing to the nitrogen reducing system.
- Final effluent dispersal would be via the existing leaching pools.
- Additional nitrogen polishing can be provided within or before the leaching pools to obtain an effluent nitrogen concentration, prior to groundwater discharge, of < 5 mg/L.

Westhampton Beach Middle School, High School

- The school population as provided by the Superintendent of Schools is 1,140 capita.
- The flow, using a SCDHS standard of 7.5 gpd/capita, is 8,550 gpd.
- Typical septic tank effluent from a school is estimated to be 100 mg/L, which must be confirmed during the design report stage of the project.
- Therefore, total current nitrogen load is estimated to be 7.13 lbs/day.
- Assuming a school year of 200 days, the current annual load is at least 1,426 lbs/yr.
- The use of the school nearly every weekend and through the summer, albeit by fewer people, means the load is likely up to 25% higher, **1,800 lbs per year.**
- Our lined NRBs are reducing N effluent to 5 mg / L, meaning the effluent would be reduced to 90 lbs per year or **1,710 lbs removed from groundwater per year or 95% reduction in N load.**

Spring School, East Hampton



Cost - benefit

- This project is the equivalent to ~60 homes (at 330 gpd per home and an average TKN septic tank effluent concentration of 50 mg/L).
- Assuming an I/A system installation cost of \$25,000, this equates to an equivalent cost of approximately \$1.5 million.
- The probability of 60 homes converting to an I/A system within GMZ VI and the Village, within the project time frame of 2 years is considered low.

Additional (non-environmental) project benefits:

- First public school to receive an I/A system in the Town of Southampton; blue print for future efforts.
- Incredible education opportunity that will take advantage of by middle school and high school students.

I.D. REF.	Task	Contractual Services	In-House Match	Year #
1.0	Project Management / Preparation of RFP for Professional Engineering Services		\$ 27,000	Year 1
2.0	Project Management and Administration		\$ 16,000	
Subtotal . . .			\$ 43,000	
3.0	Design Information Collection			
3.1	Wastewater Characterization Study:			
3.1.1	Sample Collection 5-Day Intensive sampling of wastewater produced by the high school during a typical school week.	\$ 3,500		
3.1.2	Sample Analysis Sample analysis by CCWT ELAP certified laboratory.		\$ 3,000	
3.1.3	Data Syntheses Determine design parameters , TKN concentration		\$ 2,000	
3.2	Soil Classification Soil Borings, Groundwater Piezometers Installed, Groundwater Depth Determination	\$ 3,500		
3.3	Topographical Survey 2 ft. contour map and physical location facilities.	\$ 18,000		
Subtotal . . .		\$ 25,000	\$ 5,000	
4.0	Engineering Design Report			Year 1
	SCDHS Requirements			
	Basis of Design / Design Flow			
	Effluent Requirements			
	Wastewater Design Concentrations			
	Unit Sizing			
	Process Schematics			
	Location of Facilities			
	Hydraulic Profile			
	Preliminary Specifications			
	Project Cost Determination			
	O & M Annual Costs			
Subtotal . . .		\$ 20,000		
5.0	Preparation of Construction Plans and Specifications	\$ 150,000		Year 2
6.0	Construction Phase:			
	Construction Estimated Cost	\$ 1,245,000		
	Construction Administration	\$ 10,000	\$ 5,000	
	Construction Inspection (Part-Time)	\$ 35,000		
	Start-Up, Commissioning	\$ 7,500		
	O & M Manual	\$ 7,500		
Subtotal . . .		\$ 1,305,000	\$ 5,000	
7.0	Performance Evaluation		\$ 16,000	
Total Project Cost (Estimated)		\$ 1,500,000	\$ 69,000	\$ 1,569,000.0