NYS RISE
Resiliency Institute for Storms & Emergencies

Stony Brook University
School of Marine and Atmospheric Sciences

Work Unit 3.1: Prioritization of Storm Hazards and Critical Facility Vulnerabilities

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Photo Credit: http://www.operationsplash.org/#prettyPhoto

Objectives

- Undertake a high-level inventory and prioritization of vulnerable critical facilities in the wake of Sandy.
- Examine current mitigation measures using a benefit-cost analysis.
- Examine oil spills due to infrastructure failures and the economic and environmental impact of oil and sewage discharges on fisheries and ecological resources.
- Estimate locations, tonnages, and costs of removing debris from beaches, marshes, and waterways.

Photo Credit: http://natureontheedgenyc.blogspot.com/2012/11/major-oil-spills-in-arthur-kill.html

Deliverables

- Report on inventory of vulnerable critical facilities in areas affected by Hurricane Sandy and other recent storms.
- Report with a comprehensive, wide ranging, high-level examination of current mitigation measures using a benefit-cost analysis approach.
- Report on oil spills due to infrastructure failures during Hurricane Sandy.

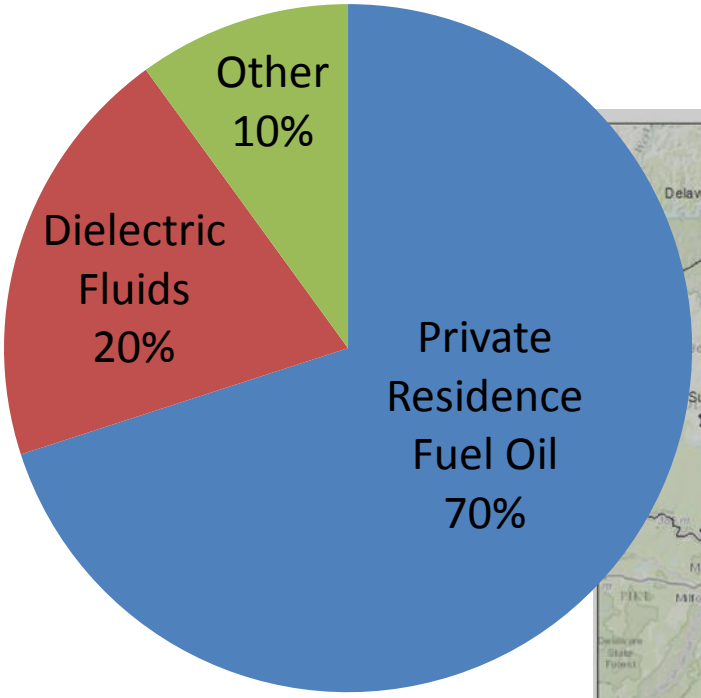
Summary of Risks of Critical Facilities to Flooding

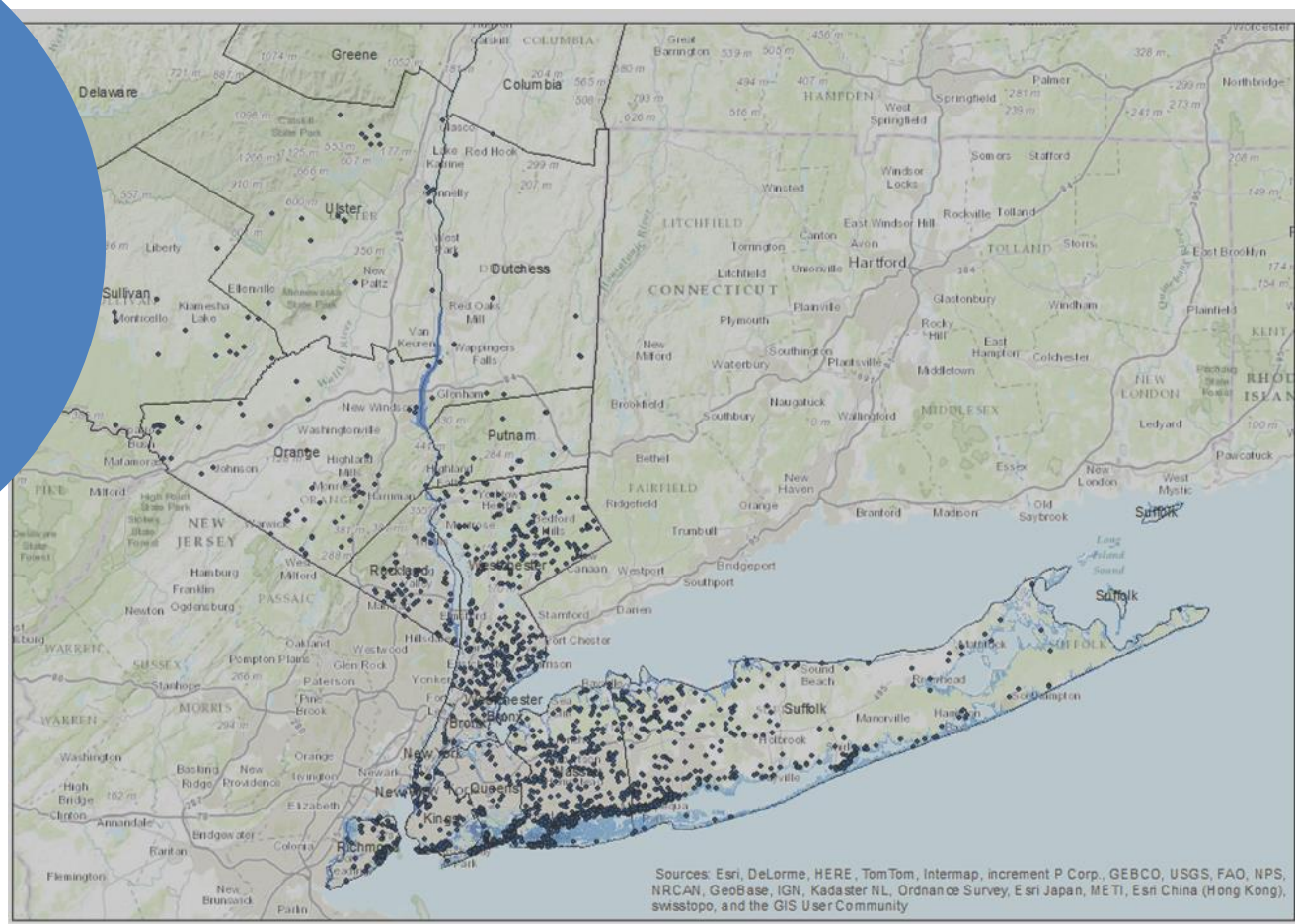
Summed data for Nassau, Suffolk and Westchester Counties

Facilities	Total Number of Facilities	Flooded by Sandy	Flooded in Slosh Model for Category 3 Hurricane
Medical Centers	35	1	2
Schools (All, FEMA)	921	34	153
Public K-12 Schools	885	36	107
Police Stations	90	7	12
Fire Departments	130	7	34
Wastewater Treatment Plants	88	11	26
Emergency Operation Centers	11	1	2
Airports	17	3	3
Major Oil Storage Facilities	70	16	27
Chemical Bulk Storage	576	39	96

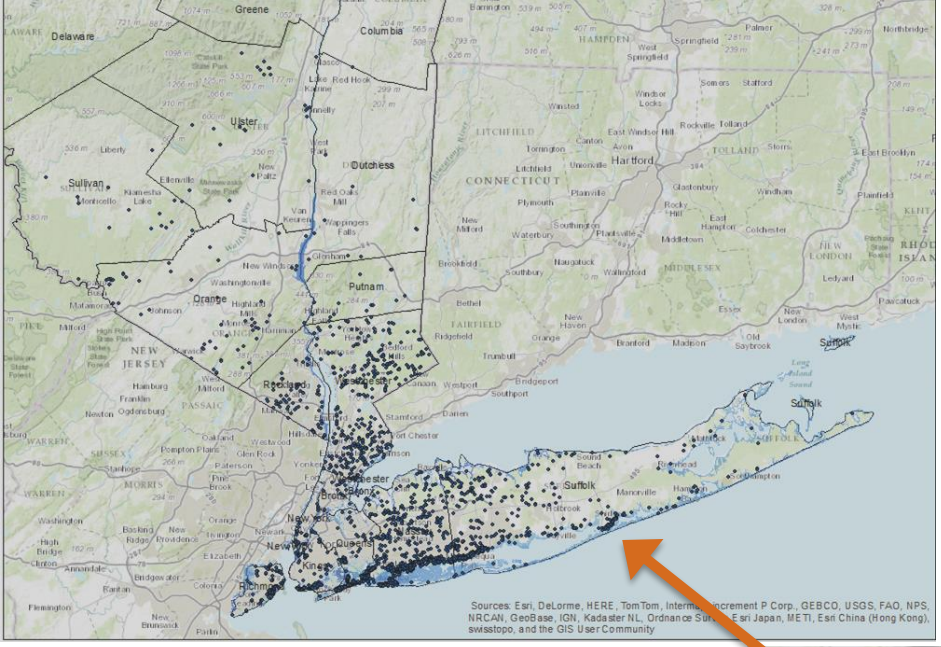
NY DEC Spill Reports Attributed to Sandy

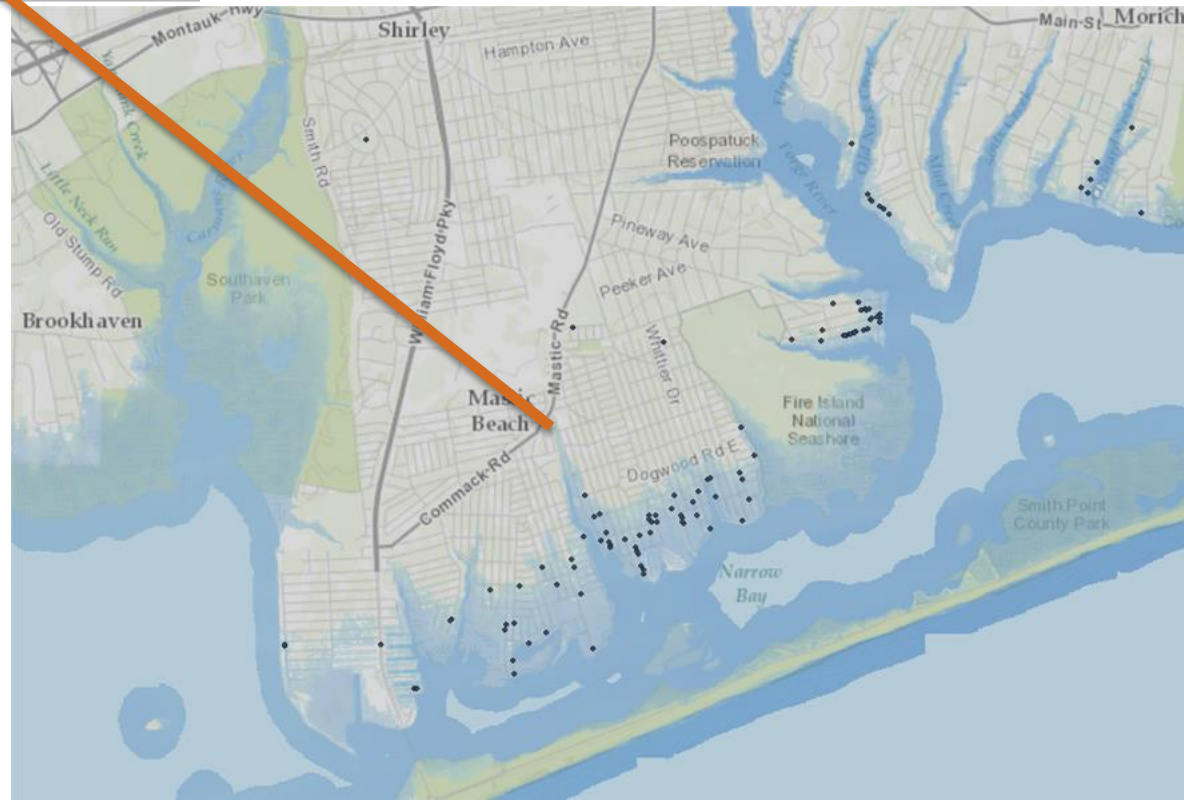
- Address matches for 4523 of 4854 spills over 14 counties
- Nassau (1684), Suffolk (999), and Westchester (391 spills)



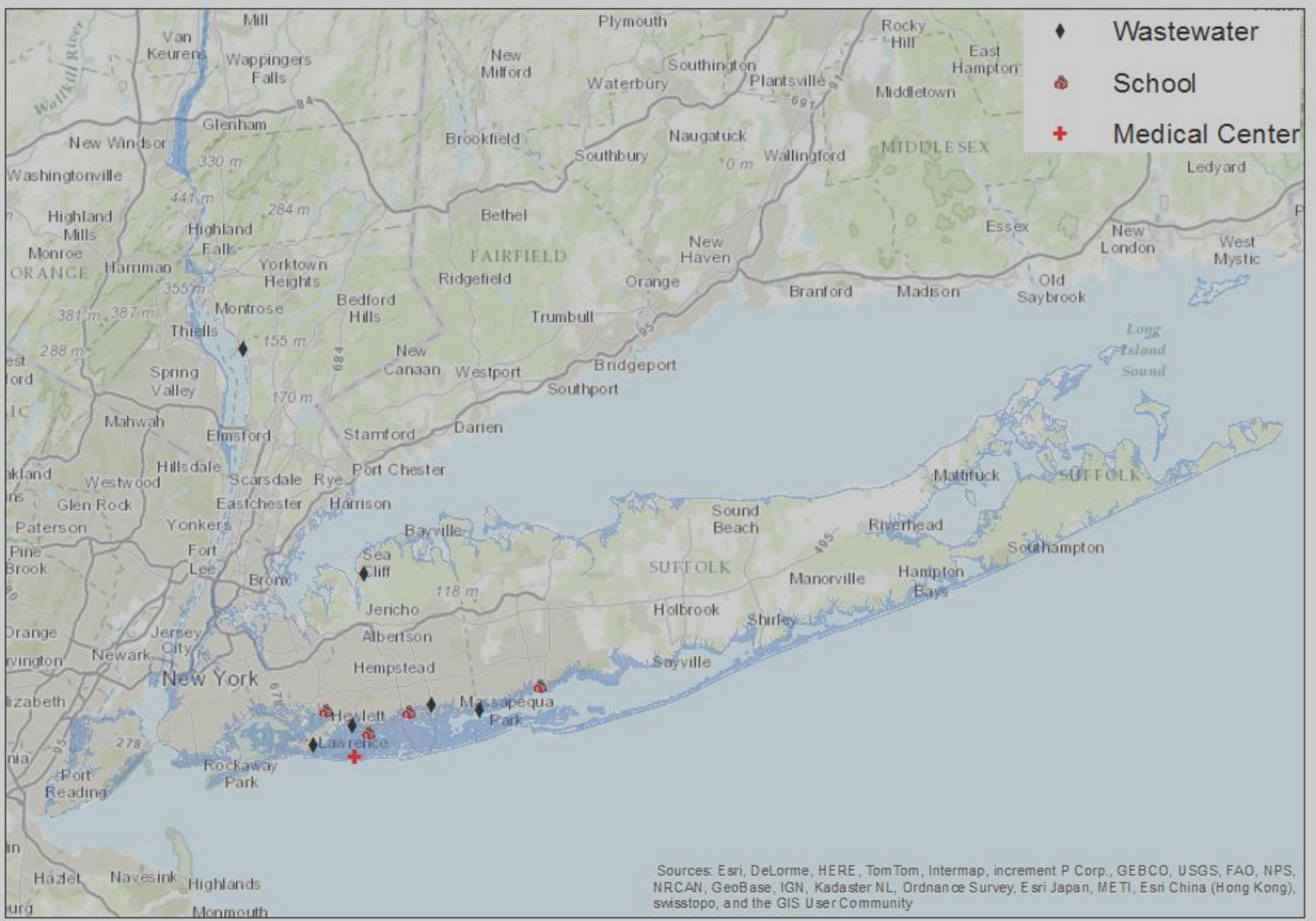


The Sandy Inundation Model, prepared from NYC and USGS measurements, accurately depicts the locations of Fuel Oil spills caused by coastal flooding

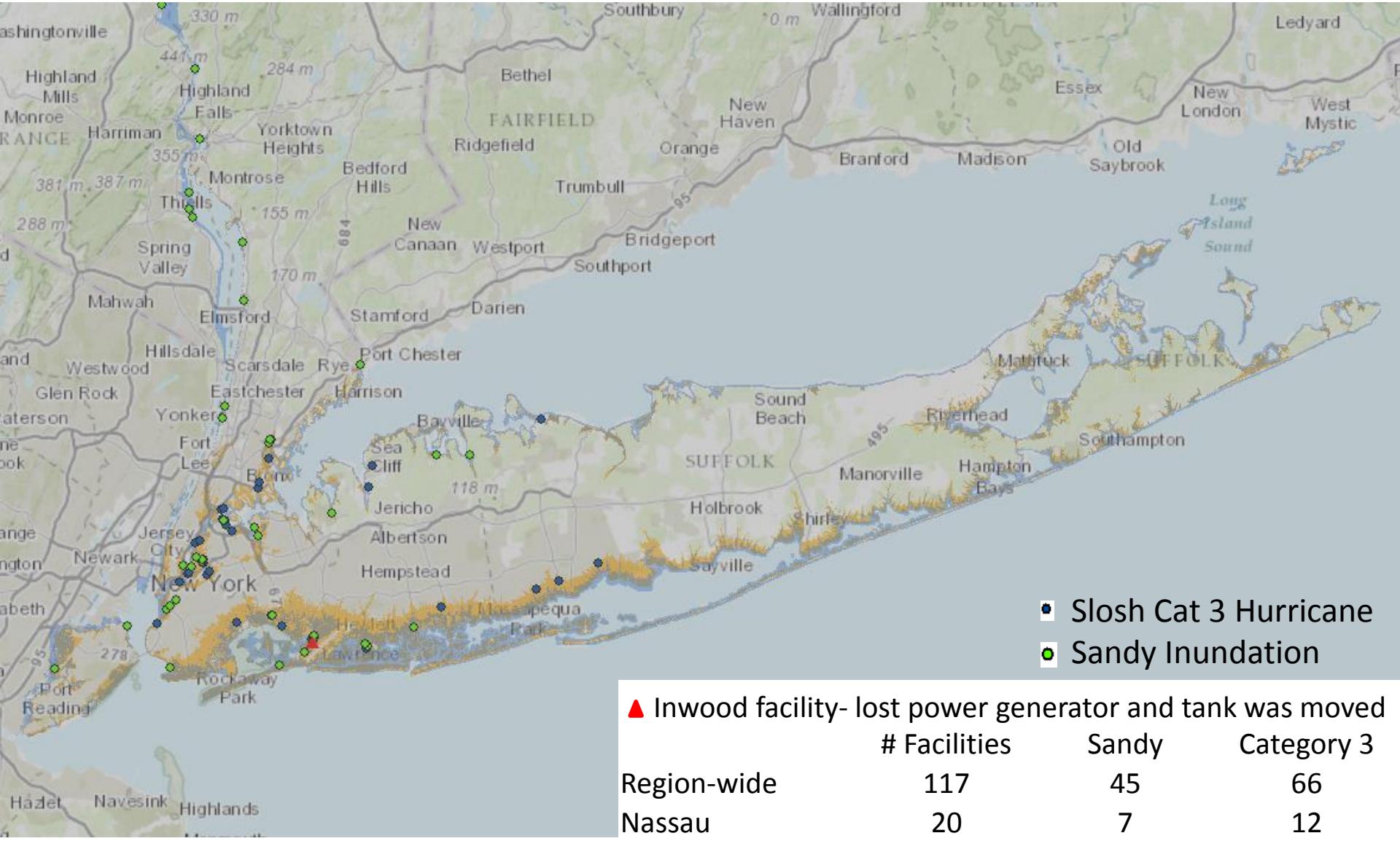




Critical Facilities in Nassau, Suffolk and Westchester Counties where Spills were Reported to the New York DEC

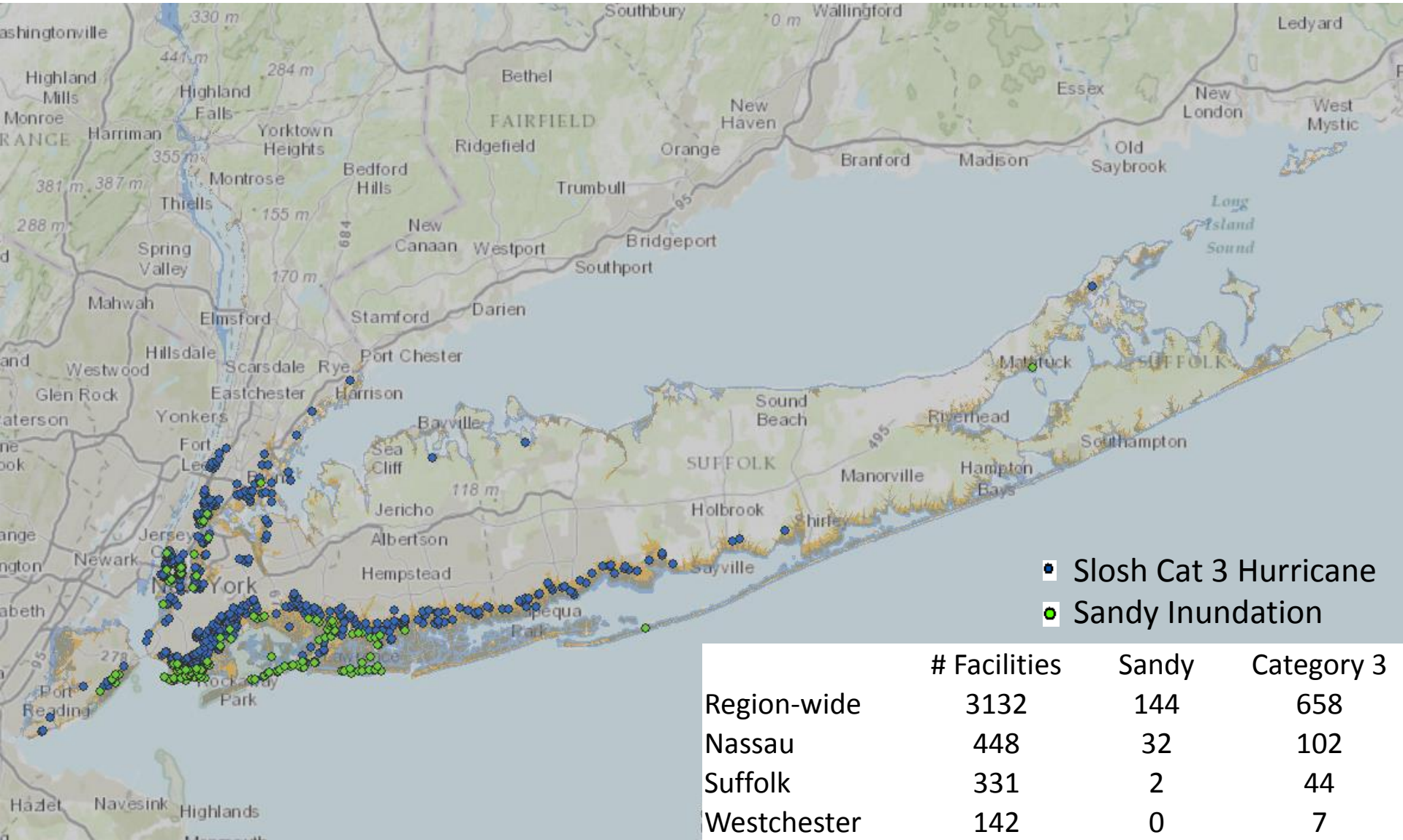


Nearshore Major Oil Storage Facilities (> 400,000 gallons)



	# Facilities	Sandy	Category 3
Region-wide	117	45	66
Nassau	20	7	12
Suffolk	32	1	5
Westchester	18	8	10

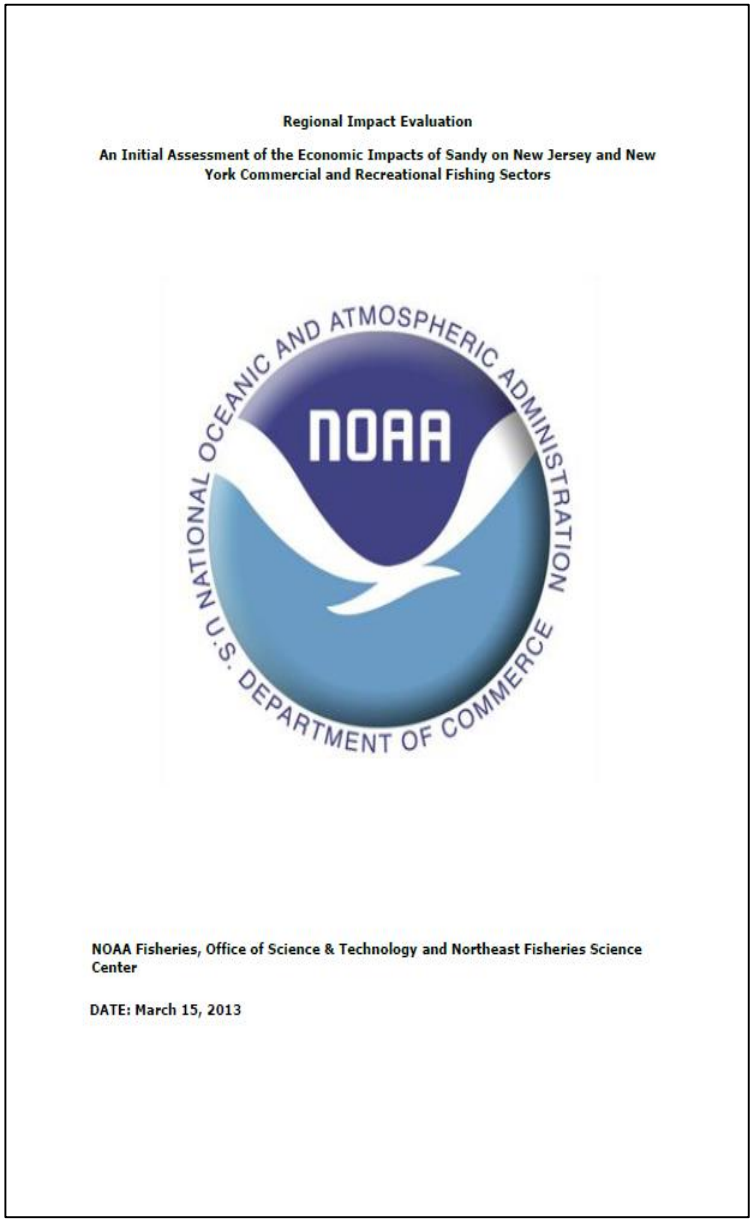
Schools represent the largest number of Critical Facilities at risk: addresses within Sandy and Slosh Model Category 3 Flood Zones (public + private schools, FEMA, circa 2008)



	# Facilities	Sandy	Category 3
Region-wide	3132	144	658
Nassau	448	32	102
Suffolk	331	2	44
Westchester	142	0	7

Impact of Spills on Fisheries

- Commercial and recreational fisheries in NY are worth $5.4 billion annually and employ 45,000 people.
- NOAA estimated $19 million in physical damage to commercial and $58 million to recreational fishing sectors.
- Loss of wages also occurred and were concentrated in first 4 weeks after Sandy



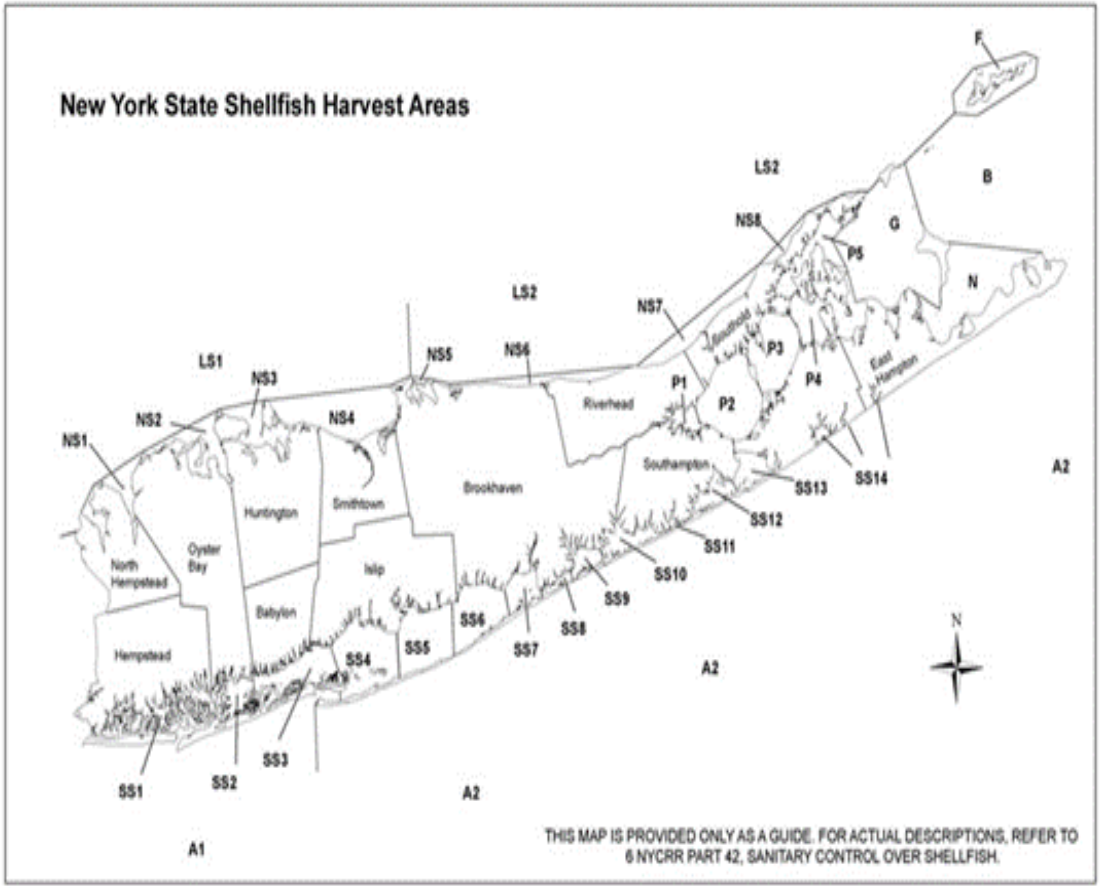
Regional Impact Evaluation

An Initial Assessment of the Economic Impacts of Sandy on New Jersey and New York Commercial and Recreational Fishing Sectors

NOAA Fisheries, Office of Science & Technology and Northeast Fisheries Science Center

DATE: March 15, 2013

- Shellfish landings in the region around Nassau and Suffolk County are reported by harvest area and summarized by NYSDEC

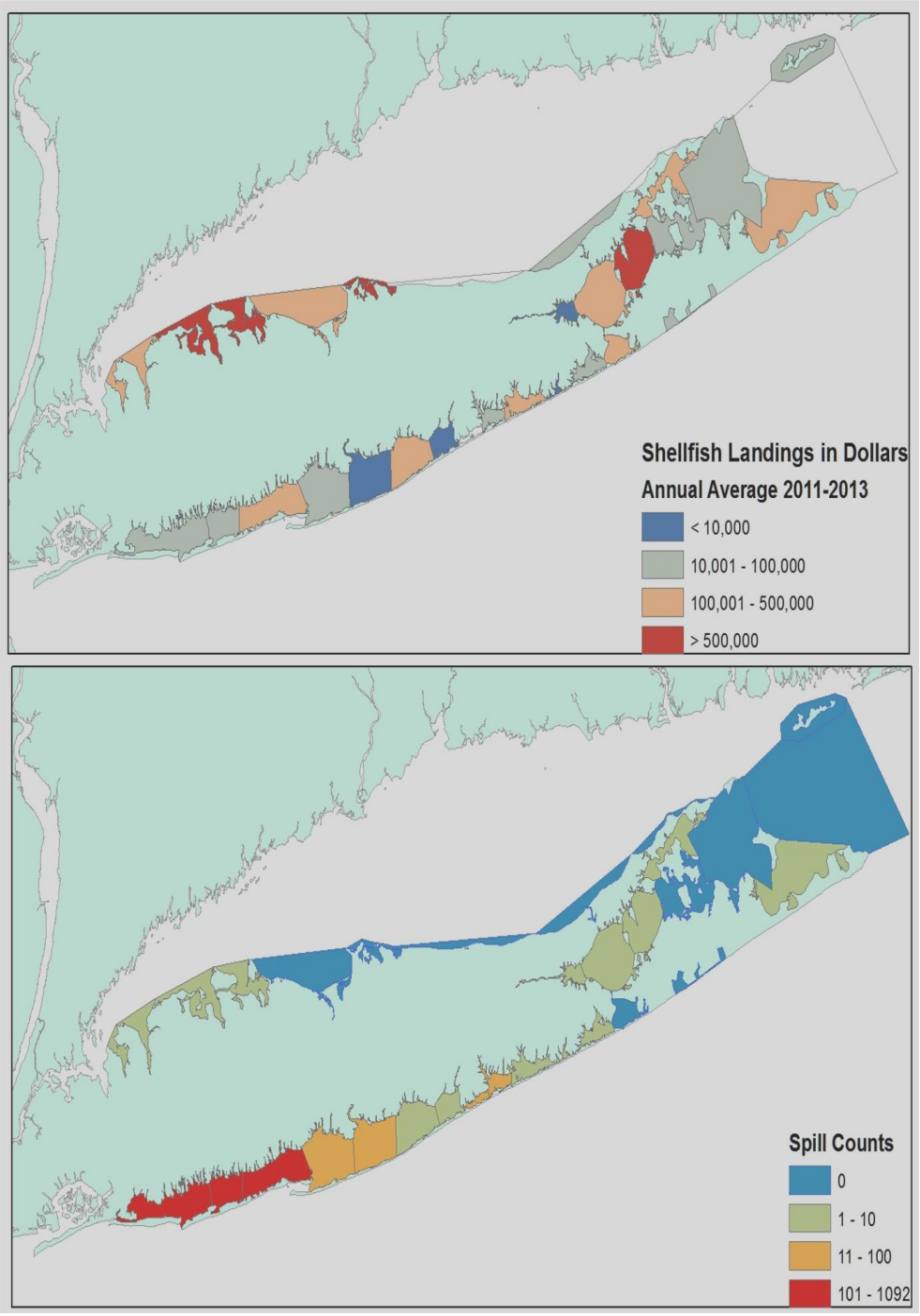


By November 30, 2012, the only normally-certified areas to remain closed because of elevated fecal coliforms were Hempstead Bay, South Oyster Bay, and an area of Great South Bay in the Town Of Babylon (SS1-3) (www.dec.ny.gov/press/87217.html).

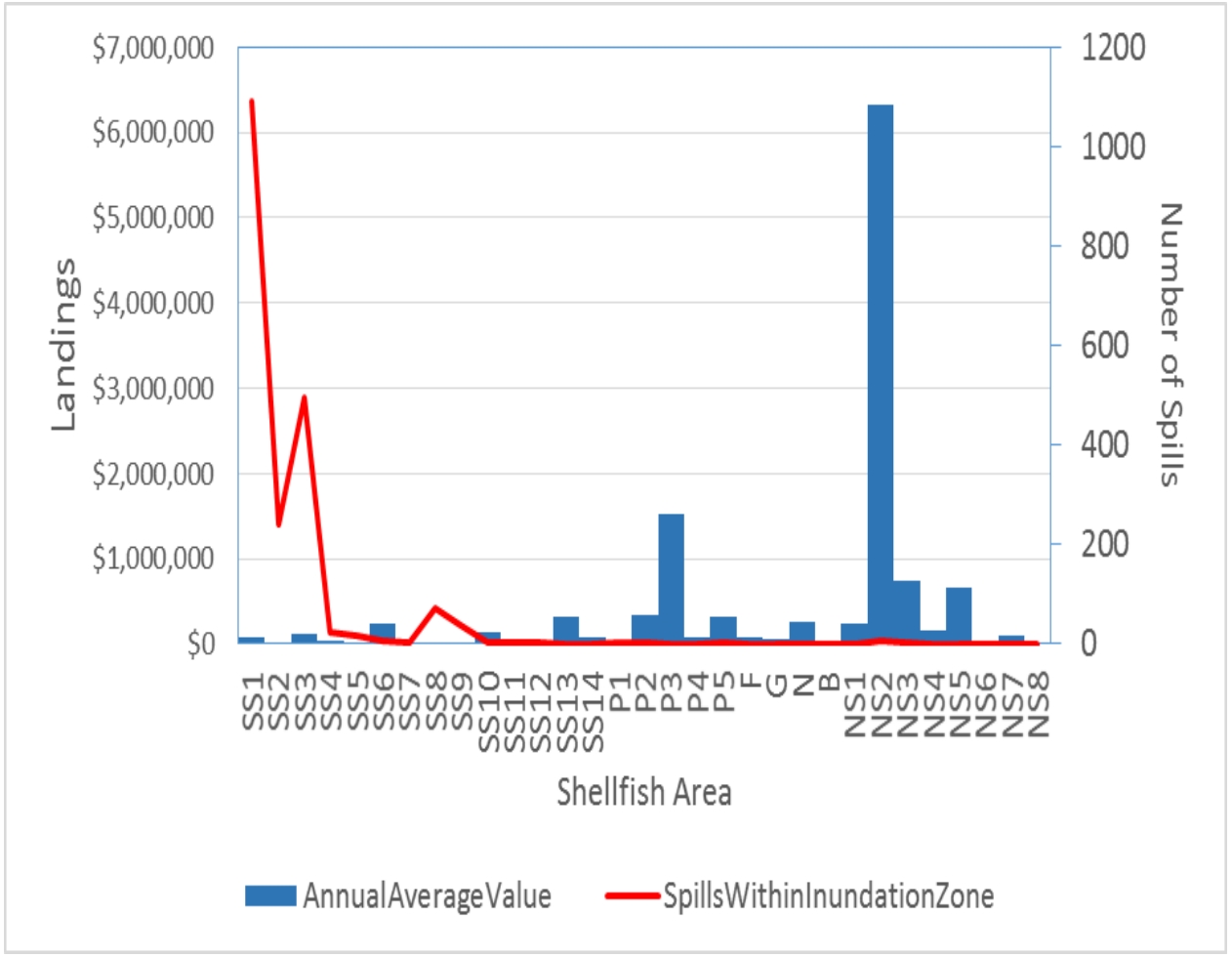
- The most valuable shellfish landing areas are Oyster Bay, Huntington-Northport Bay, Mt Sinai Harbor, and Little Peconic Bay (values are annual landings in dollars)
- Most spills within inundation zone were in Hempstead Bay, South Oyster Bay, and the western part of Great South Bay (SS1-3).

Spill data georeferenced by Bruce Brownawell.

Inundation data from FEMA (Feb 2013)



- Locations with a large number of spills within the inundation zone did not correspond to valuable shellfish landing areas (averaged over 2011-2013)



Impacts of Debris

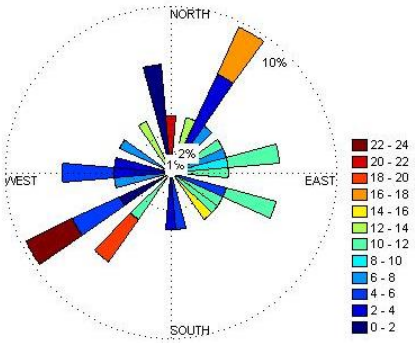
- Geoeye Satellite image (Ch 2,3,4) resolution 2 m & 0.5 m for panochromatic layer
- Besides boat traffic there is not much in the water

- Most debris was seen outside the Jones Inlet in areas marked in red
- Not much debris in the channel

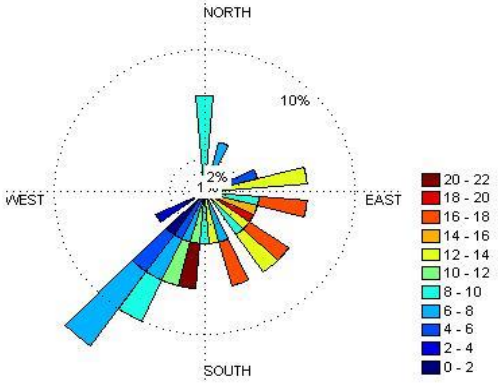
Wind Roses for Oct 2012-Mar 2013

Speed (mph), direction (degrees true)

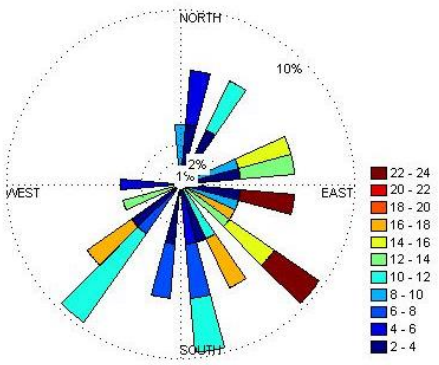
October



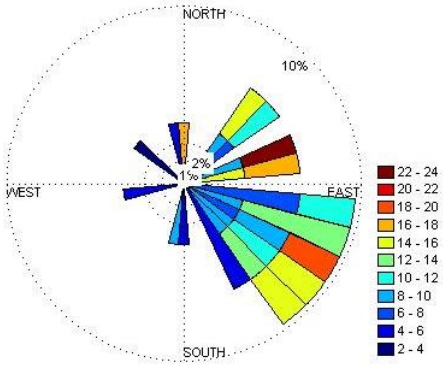
November



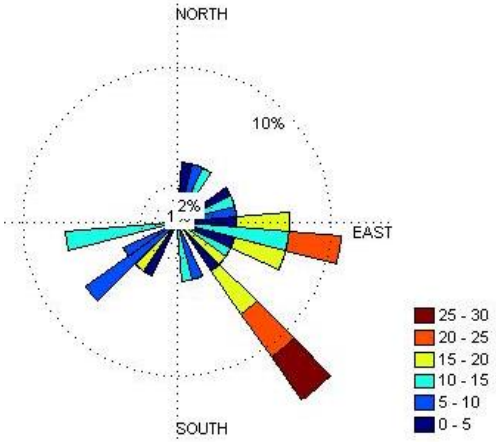
December



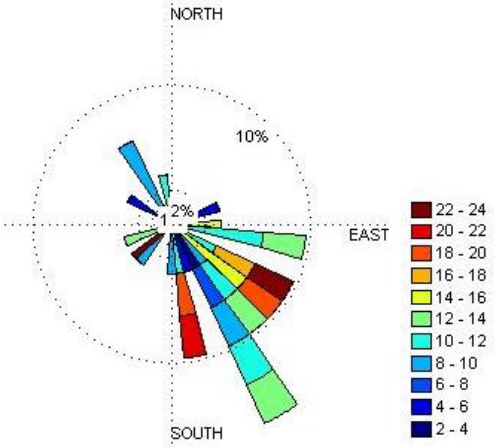
January



February



March



- Strong onshore winds kept the debris nearshore
- Occasional Southerlies and Northerlies allowed movement along shore

Data from JFK Airport

Estimated Debris Removal Costs and Magnitude

Town	Estimated Tonnage (tons)	Estimated Total Costs (millions of $)	Method of Disposal
Hempstead	120,000	8.4-9.6	Majority was relocated to WTE facilities; some was landfilled and some was composted
Babylon	13,201	5.5	
Brookhaven		8.28	
Islip		11.3	
Fire Island (Brookhaven and Islip)	~61,875*		Truck, Barge. Majority was landfilled in upstate NY and Pa. Some debris was burned at the Brookhaven landfill
Long Beach		29.7	
Suffolk County (Total)		**19.7**	
Nassau County (Total)		**69.2**	