Monitoring After Severe Floods/Storms in NJ: Challenges, Solutions & Unanswered Questions

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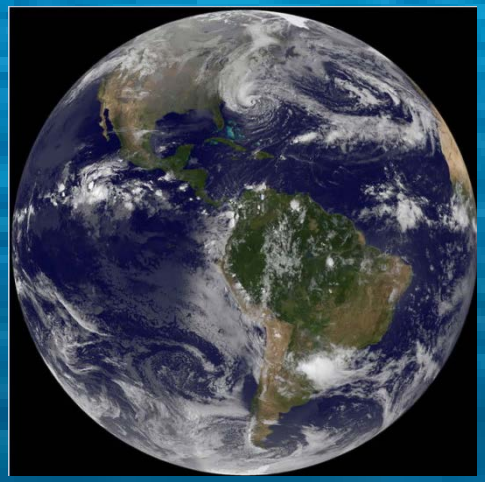
National Water Quality Monitoring Council Webinar:
Monitoring During Extreme Events
December 16, 2014

(Original panel presentation: Adapting to Extreme Climate – Best Practices, Solutions & Unanswered Questions
April 30, 2014, Cincinnati, OH)

Atlantic City (near Absecon Inlet)



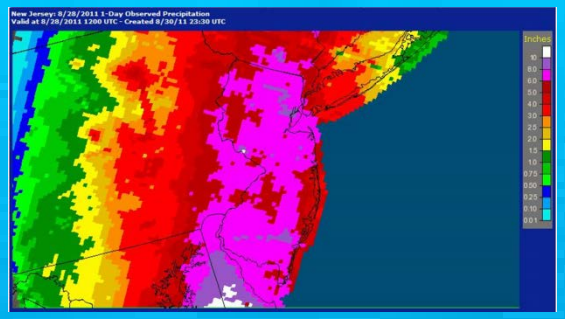
Harvey Cedars, Long Beach Island

Overview

- 3 Severe Storms Impacted NJ : Irene & Lee, and Sandy
- 2 types monitoring:
  - Coastal shellfish waters
  - Inland waters
- Key Lesson from Irene & Lee
- Superstorm Sandy Monitoring
- Challenges, Some Solutions, Unanswered Questions
- Resources or Best Practices Used/Needed

3 Recent Extreme Weather Events in NJ

- **Hurricane Irene (August 27-28, 2011)**
  - Major hurricane in NJ (Category 1)
  - Both coastal & in-land
  - 6-8” of rain statewide; >11” of rain in local areas; 9’ storm surge
  - Flooding, power outages, sewage bypasses, & sanitary sewer overflows
  - Degraded water quality, statewide shellfish closures, and ocean bathing beach closures



1-Day Observed Precipitation Image: NWS

- **Tropical Storm Lee (September 8, 2011)**
  - Both coastal & in-land
  - Combined rainfall 2 storms results in record precipitation
  - Severe flooding, pump station failures & sewage overflows
  - Degraded water quality and shellfish closures (some remaining after Irene)

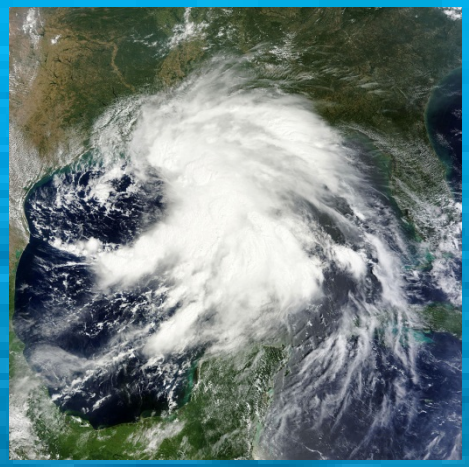


Image: NASA

- **Superstorm Sandy (October 29, 2012)**
  - Tropical storm force winds extended ~1,000 miles (one of largest tropical storms ever recorded)
  - Severe coastal flooding, limited inland waters flooding
  - Wide range total rainfall in NJ: <1” to >12”.
  - Barrier islands completely inundated/breached due to storm surge & waves
  - Extensive power outages, sewage bypasses & sanitary sewer overflows
  - Degraded water quality and statewide shellfish closures

Image: NASA

A Key Lesson from Hurricane Irene/Tropical Storm Lee (August & Sept, 2011)

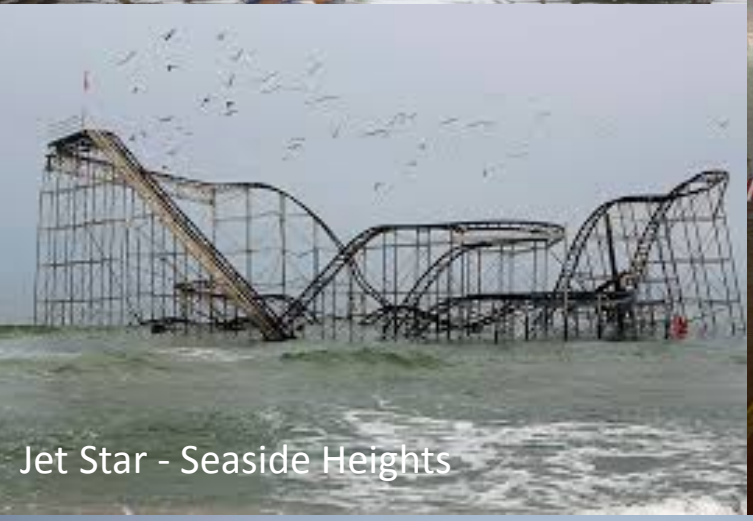
- Available emergency closure/reopening SOP followed for shellfish monitoring
- Limited ability to respond to call for inland flood waters sampling - some USGS bacterial sampling for DEP
- Preparation and planning needed for inland waters
- Began development (w/ NJ Water Monitoring Council) of inland waters flood monitoring plan
- Then along came Sandy….

Hackensack

Long Beach Island

Hudson County

Union Beach

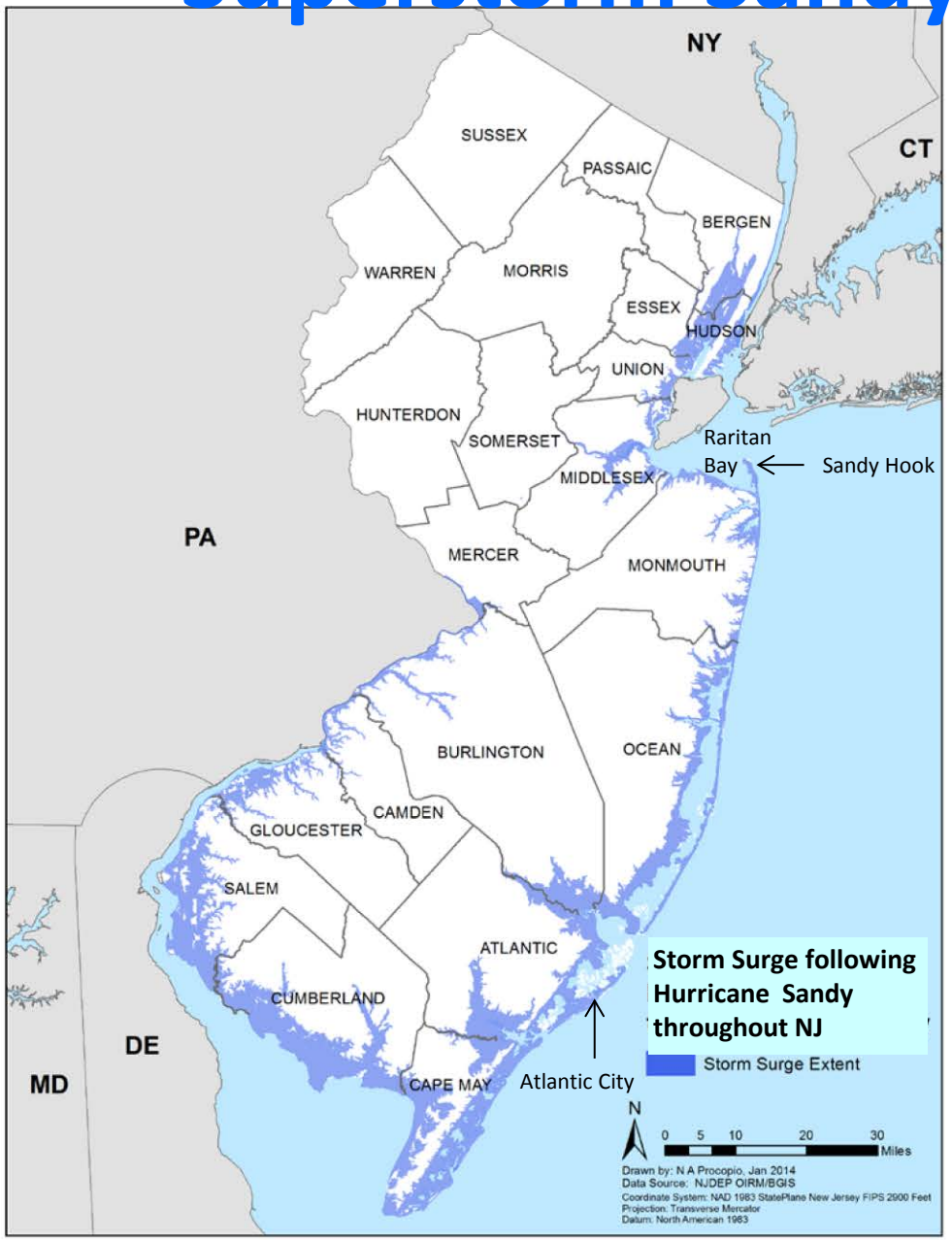

Jet Star - Seaside Heights

NYC Subway

Mantoloking

Mantoloking

Superstorm Sandy



Courtesy of NJDEP Office of Science

Storm Surge

- Highest storm surge measured was 8.57 ft. above mean high tide levels at the north end of Sandy Hook
- Since the Sandy Hook station failed during the storm, it is likely that actual storm surge was higher
- Storm surge pushed into New York and Raritan Bays, causing sea water retention within the coastal waterways & wetlands of Newark Bay, the Hudson, Passaic and Hackensack Rivers, Kill Van Kull, & Arthur Kill
- USGS surveyed high-water marks as high as 4 to 5 ft. above ground level in Sea Bright, Tuckerton, Seaside Park, & LBI
- Barrier islands were completely inundated/breached in some areas due to storm surge & waves
- NOS tide gauges in Atlantic City and Cape May measured storm surges of 5.82 ft. and 5.16 ft., respectively

Storm Effects - Sandy

- Surge, rainfall, and inland elevated flows & flooding were issues in some areas more than others.
- Surge damaged municipal storm water and waste water infrastructure.
- ~ 80 sewage treatment plants affected (lost power or damaged)

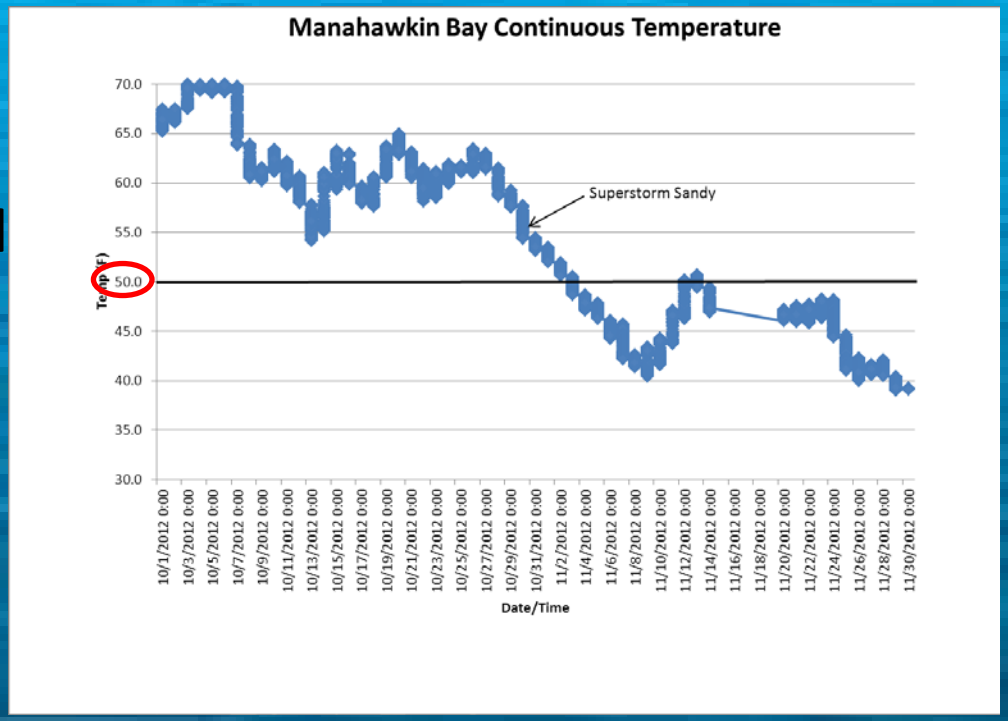
Passaic Valley Waste Water Treatment Plant

Sandy – Shellfish Monitoring

- Followed SOP (Shellfish Emergency Response Plan)
- Statewide shellfish closure in advance of storm (10/28/12)
- 47+ stations sampled for pathogens, starting 11/1/2012
- Due to infrastructure damage, coastal flooding & power outages, much contamination from sewage bypasses & overflows
- Used bacterial (fecal coliform) water analyses & shellfish harvest criteria for reopening
- Also used shellfish tissue viral (coliphage) analyses for reopening (criteria - <50 PFU/100g)
- Approved use of coliphage analysis from FDA & Interstate Shellfish Sanitation Conference (ISSC)

Sandy Shellfish Bed Openings: Long- term Monitoring Requirement

- Some areas opened for harvest in 2 weeks (Southern waters)
- Some not opened for ~ 5 months until April 2013 (Barnegat Bay)
- Waters remained closed until tissue viral criterion met
- Tissue contamination persisted - cooling water temperature (<50° F) reduced shellfish ability to purge
- Continuous Temp data available



Shellfish Water Quality Sampling: Challenges & Potential Solutions

Challenges

- Power outages - state labs, field offices, employee residences
- Access/ damage to boat ramps & marinas
- Boat navigation - debris in water
- Quick access to GIS maps & info on large # sewage bypasses/ overflows
- Sustained monitoring to reopen waters (>500 water samples, > 1000 shellfish collected)
- 7 day/week sampling and analyses required
- Additional monitoring partners needed

Some Solutions

- Hardening of lab facilities, consider generators for labs
- Steps being taken to provide quicker access to storm-related spill info
- Continuous Temp data helpful in predicting/confirming need for closures (Temp < 50^0 F)
- Partner with shellfish industry for shellfish collection

Resources Used

- Followed State emergency shellfish closure/opening SOP
- Bacterial & coliphage criteria available for reopening waters

NJ: Recreational Fishing and Boating Advisory 11/2/12 (4 days after Sandy)

- Recreational boaters, anglers, and crabbers - avoid selected waterways (including some **inland waters**)
- Advised not to eat fish, crustaceans or shellfish from these waters
- Thoroughly wash, clean and disinfect fishing gear
- Included **Passaic**, Hudson & Raritan Rivers, Newark & Raritan Bays, among others
- Boating, fishing and crabbing advisories lifted for many waterways – December 7, 2012

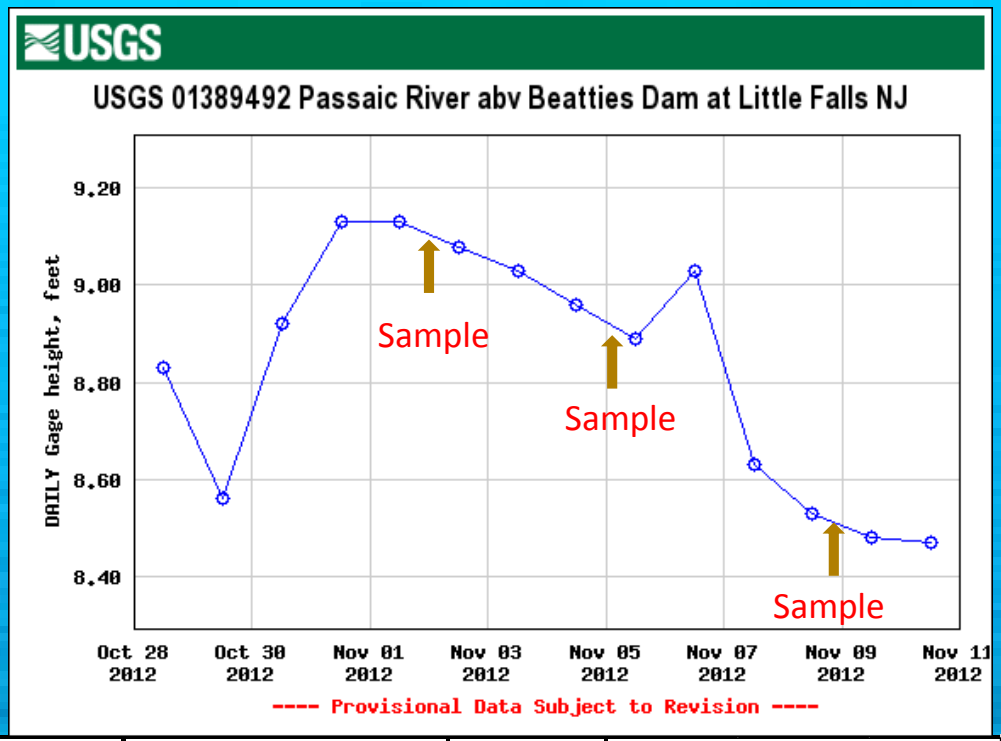
Inland Flood Water Sampling

- Where sample?
- When?
- How often?
- Which parameters?
- Response plan (recreational use?) or study of flood impacts?

Developing Inland Flood Monitoring Response to Sandy

- **Lacked flood – specific monitoring SOP, but better prepared after Irene/Lee**
- **Management request – sample public access areas with elevated flow/flooding & sewage impacts**
- **Multiple potential objectives - long-term ecological impacts of floods or short –term information (e.g. secondary contact exposure). DEP focused on latter.**
- **Sought assistance for flood monitoring response from other states, EPA, USGS-NJWSC, and NJ Water Monitoring Council**

Example *E. coli* Results Near Public Access Points After Sandy: Passaic River



Flood Stage = 11.3'

Site	Site ID	Location	Historical E. coli Ranges (MPN/100ml)	E. coli Results (MPN/100ml)			
				11/2/2012	11/5/2012	11/9/2012	
Passaic R.	01382000	Two Bridges Rd, Two Bridges	20-5000	34.5	49.6		NJ SWQS Primary Contact Recreation, Single Sample Maximum = 235/100 ml No Secondary Contact Recreation Criteria
Passaic R.	01389500	Union Ave, Little Falls	0-3200	195.6	37.9		
Passaic R.	01389870	Morlot Ave, Fairlawn	not sampled	648.8	410	325.5	
Passaic R.	01389880	Rt. 46, Elmwood Park	5000-14000*		630	81.3	

Blanks= bacterial indicator not collected

* Historical results * are only from two samples taken immediately following **Hurricane Irene** by USGS, 8/31&9/1/11.

Water-quality Sampling during Extreme Weather – Field Challenges

Collecting a representative sample

- Streams expand across flood plain
- Increased depth and velocity
- What sampling method is best?

Access to sampling sites

- Roads closed
- Bridge safety – debris (floating and accumulated), structural integrity

Wall of debris

Inland Waters: Challenges/Solutions/Resources Needed

Challenges

- Sampling prep. w/o field office power
- Coordination of lab emergency sample receipt & processing
- Lab QA/QC documentation for quick turnaround samples
- Assuring field personnel safety
- Maintaining communication re: monitoring activities (e.g., USGS phones down)
- Secondary contact criteria unavailable for inland waters

Some Solutions

- Readily-accessible maps and data - paper or electronic remote access
- Established lab emergency protocols
- Crews have on-hand all required sample containers and submission forms
- Sampling delayed until emergency conditions cease
- Two-person crews, readily equipped with necessary safety gear
- Partnering with other agencies where possible (e.g., USGS)
- Draft Inland Flood Monitoring Plan developed

Resources Needed/Used

- Need for flexible Plan to address management requests
- Finalize Draft Plan with NJ Water Monitoring Council
- Need secondary contact guideline/criterion
- Gained knowledge from:
  - 2008 Iowa flooding (Iowa DNR)
  - 2005 Hurricane Katrina -New Orleans (EPA R6)
  - 2011 Hurricane Irene in New Jersey (USGS NJWSC)
  - EPA HQ Monitoring Branch
- Need ready access to best inland flood monitoring practices– NWQMC website?

In-land Water-quality Sampling during Extreme Weather – Planning & Preparation

- **Set purpose & scope**
  - How will data be used?
  - Flexible – respond to management needs, environmental conditions and potential pollutant sources
- **Develop Sampling plan**
  - Set triggers to begin sampling
  - Site selection
  - Duration and frequency
  - Parameters
  - Lab capacity
- **Safety Preparations**
  - Site specific plans
  - Job hazard analysis
  - Safety gear

In-land Water-quality Sampling during Extreme Weather – Planning & Preparation (cont)

- **Event Preparation**
  - **NWS Quantitative Precipitation Forecasts (7days prior)**
  - **NWS Flood forecasts (5-days prior)**
  - **NWS Flood impacts**
- **Event Monitoring**
  - **USGS Water Alert (threshold notification)**
    - **http://water.usgs.gov/wateralert/**
  - **USGS Water Now (Latest data texted to cell phone)**
    - **http://water.usgs.gov/waternow/**
  - **USGS Water Watch (Near Real-time data, Current flood stages)**
    - **http://waterwatch.usgs.gov/**
  - **NWS Doppler Radar**
  - **Flood Inundation mapping**
    - **USGS** http://water.usgs.gov/osw/flood_inundation/
    - **NWS** http://water.weather.gov/ahps/inundation.php
- **Implement plan**
  - **Notify sampling partners**
  - **Notify laboratory**
  - **Conduct sampling**

Acknowledgements

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1. NJDEP –

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http://water.usgs.gov/floods/events/2012/sandy/sandymapper.html

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