

Optical Brighteners and Source Tracking

Bill Heddendorf

NJDEP Water Monitoring and
Standards

Bureau of Marine Water
Monitoring



OVERVIEW

- Background Information
- Creating Methods
- Applications for the use of OB testing in New Jersey waters
- Optical Brighteners/Bacterial Correlations
- Future Plans



What are Optical Brighteners?

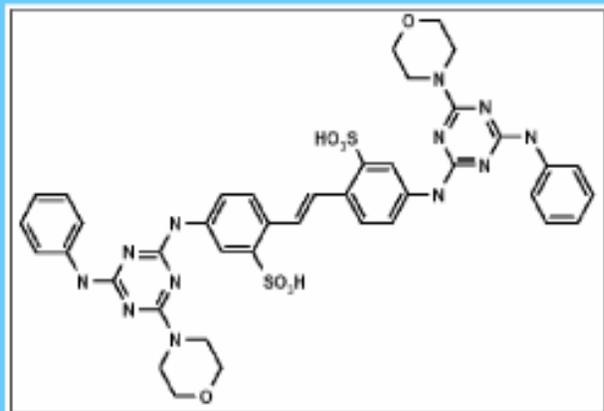
- Soaps
- Laundry Detergents
- Cleaning Agents
- Shampoo and Conditioner



Fluorescent Whitening Agents

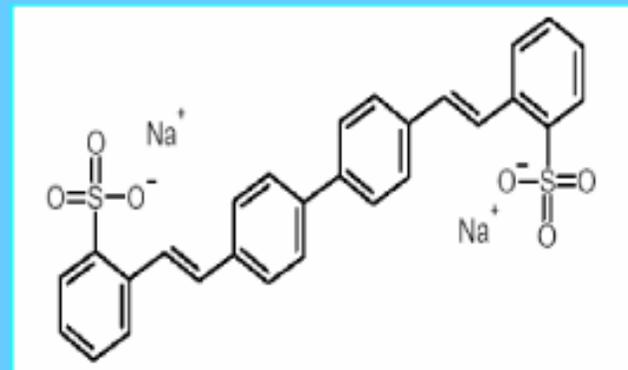
Triazinylaminostilbene (FB)

OB: FWA -1 has the chemical name **DISODIUM 4,4'-BIS[(4-AMINO)-6-MORPHOLINO-1,3,5-TRIAZIN-2-YL)AMINO] STILBENE -2,2'-DISULPHONATE** (CAS No. 16090-02-1). It is a stilbene compound, also called FB-28 or DAS-1.



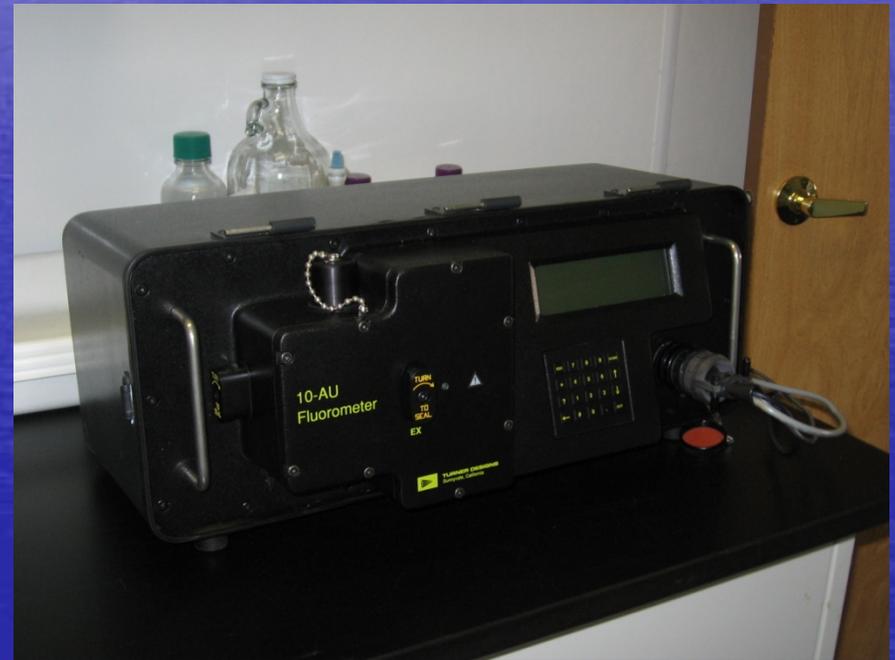
Distyrylbiphenyl (DSBP)

OB: FWA -5 has the chemical name **Benzenesulfonic acid, 2,2'-bis[(1,1'-biphenyl)-4,4'-diyl]di-2,1-ethenediyl]bis-disodium salt** (CAS No. 27344-41-8). FWA -5 is often referred to as **DSBP (Distyryl biphenylsulfonate)** or **Tinopal CBS-X**.



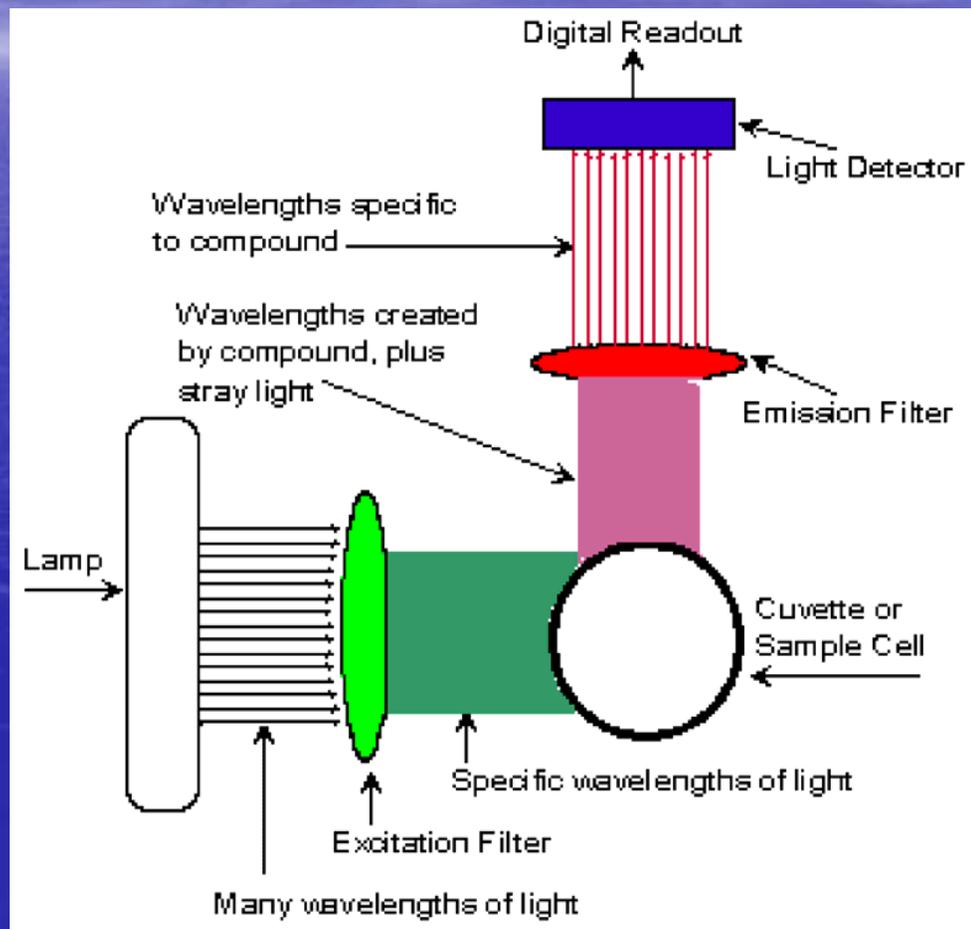
Turner Design 10-AU Fluorometer

- Laboratory
- Field
- OBs
- Dye Studies
- Chlorophyll a
- Ammonium



Fluorescence

- Fluorescence is the emission of visible light by a substance that has absorbed light of a different wavelength



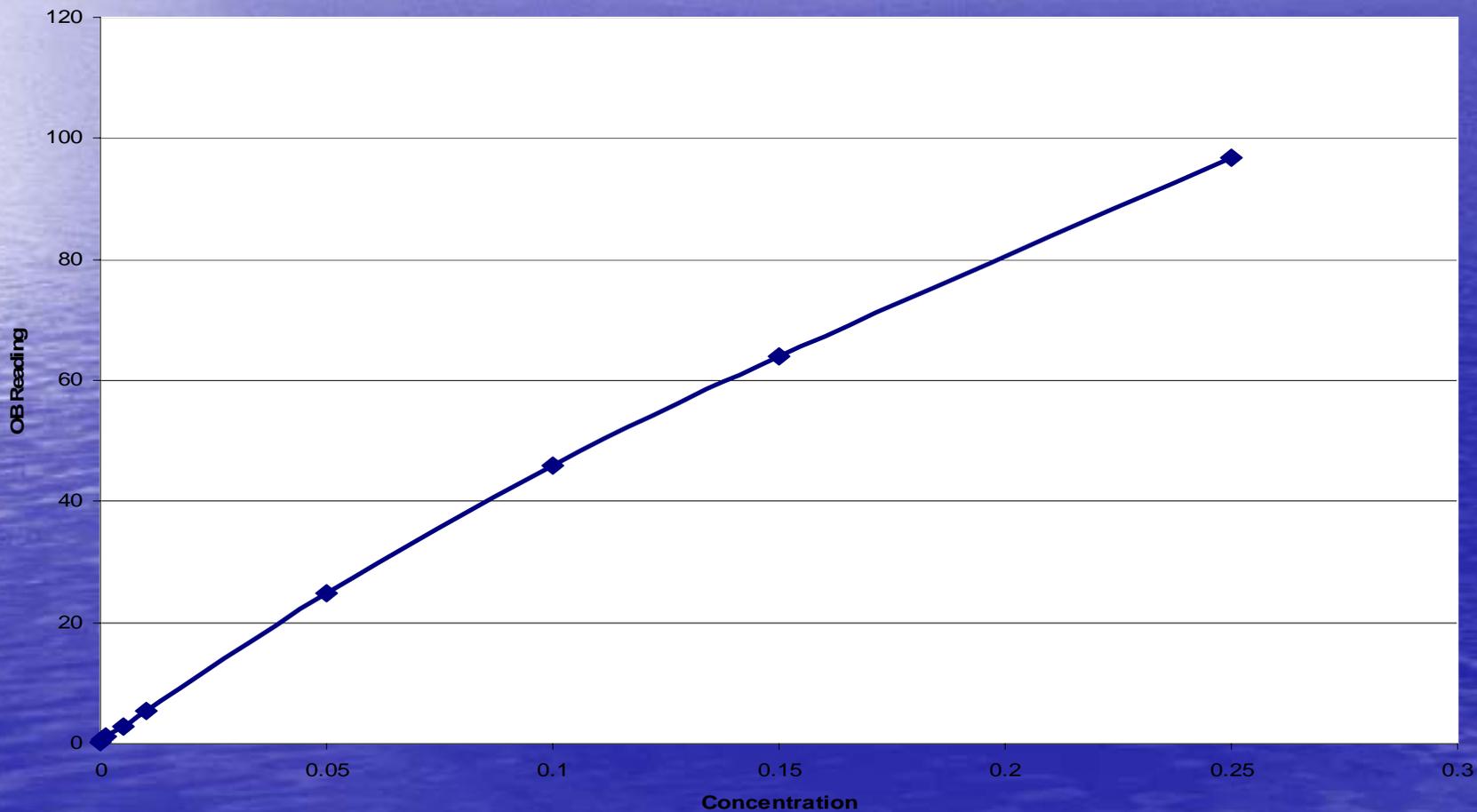
Creating Methods

- Holding times
- Blanks
- Interferences
- Find the linear range



Finding the Linear Range of Tide

Tide (Linear Range)



Applications for OB Testing

- Not a “Silver Bullet”
- Stormwater runoff
- Failing septic tanks
- Maybe even beach closures
- Should be used as a tool to pinpoint a source for more intensive investigations



OB/Bacterial Correlation

Bacterial Count		Optical Brightener		Likely Result
High		High		Malfunctioning septic system or leaking sewer pipe
High			Low	Non-human warm-blooded animals
	Low	High		Gray water in storm water system
	Low		Low	No evidence of fecal contamination at the time



Source Tracking Projects

- Delaware Bay Sampling (Faulty Septic)
- Wreck Pond (Beach Closures)
- Navesink River (Shellfish Harvesting Areas)



NJDEP'S
MICROBIAL SOURCE
TRACKING STRATEGY

**Scientific
Weight
Of Evidence**

**Utilize MST tools
including;
coliphage, ARA, and
Optical Brighteners**

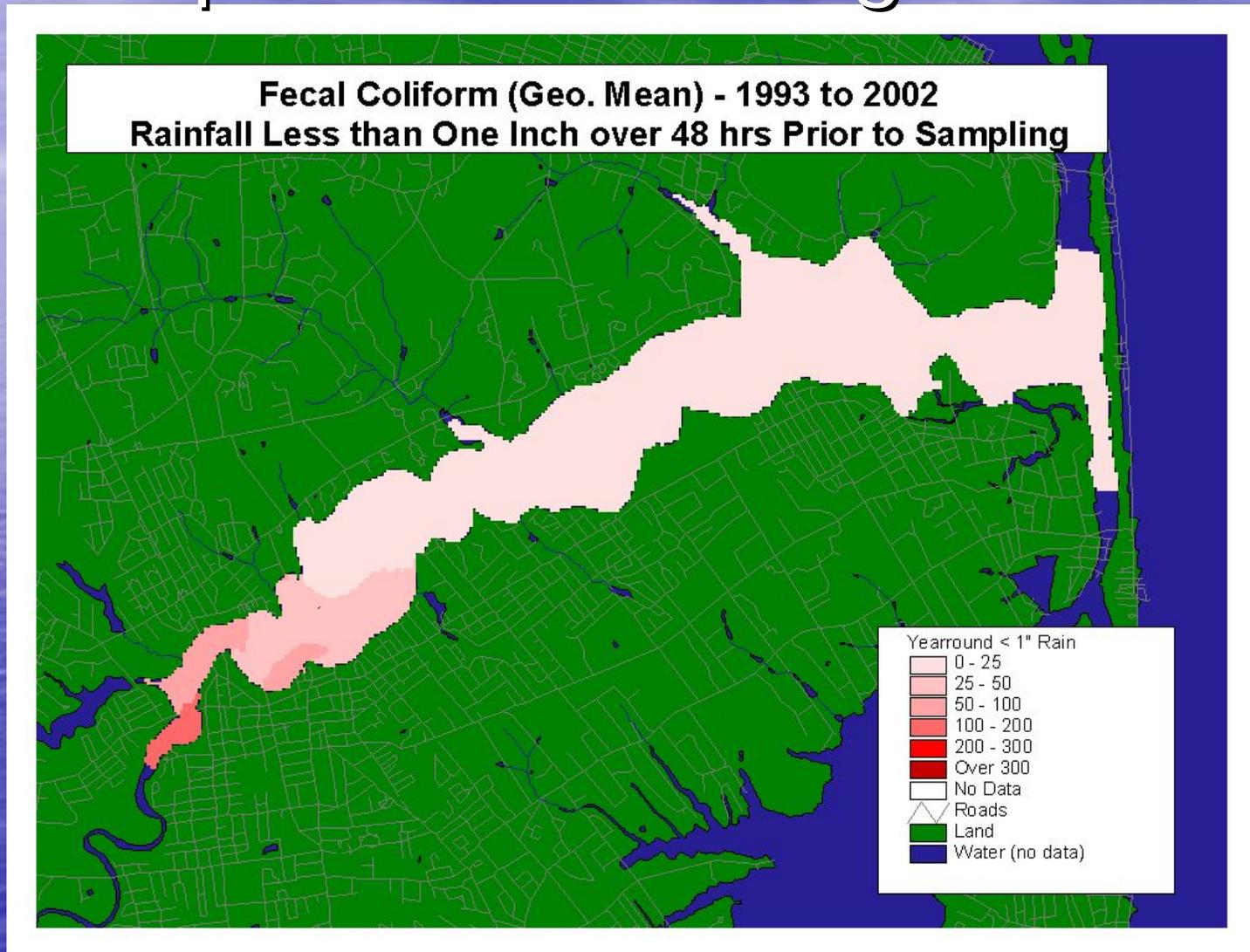
**Perform intensive monitoring
under APC regime using conventional
indicators: FC, Entero, *E.coli*. Sample
at dry, first flush, hour intervals, next day**

**Perform shoreline survey of the watershed
Utilize GIS and land use coverage
Consider sampling logistics**

**Identify impaired areas (i.e. beach closures,
closed shellfish areas) – based
on long-term monitoring data analysis**

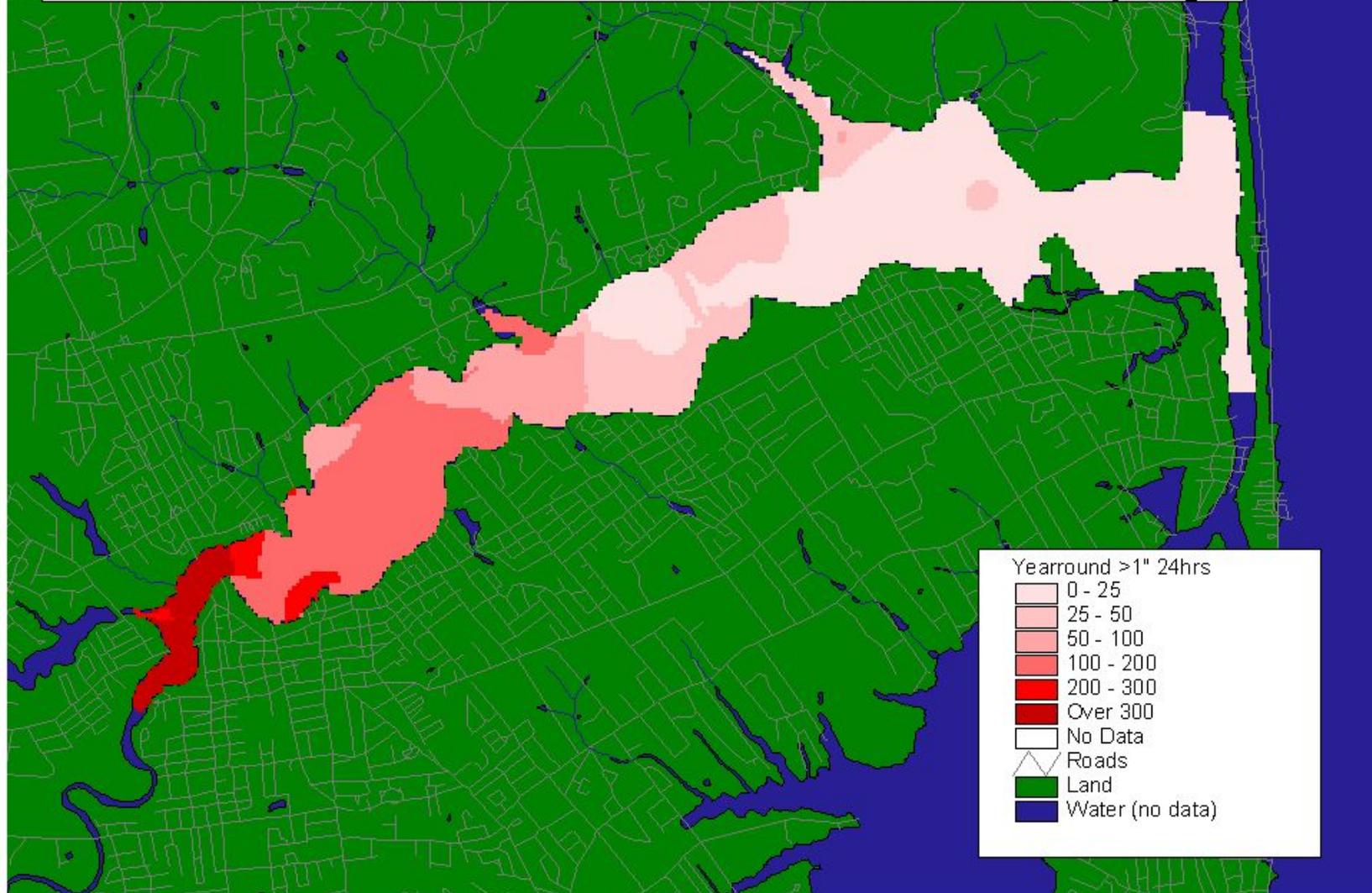


First Step – Evaluate long-term data

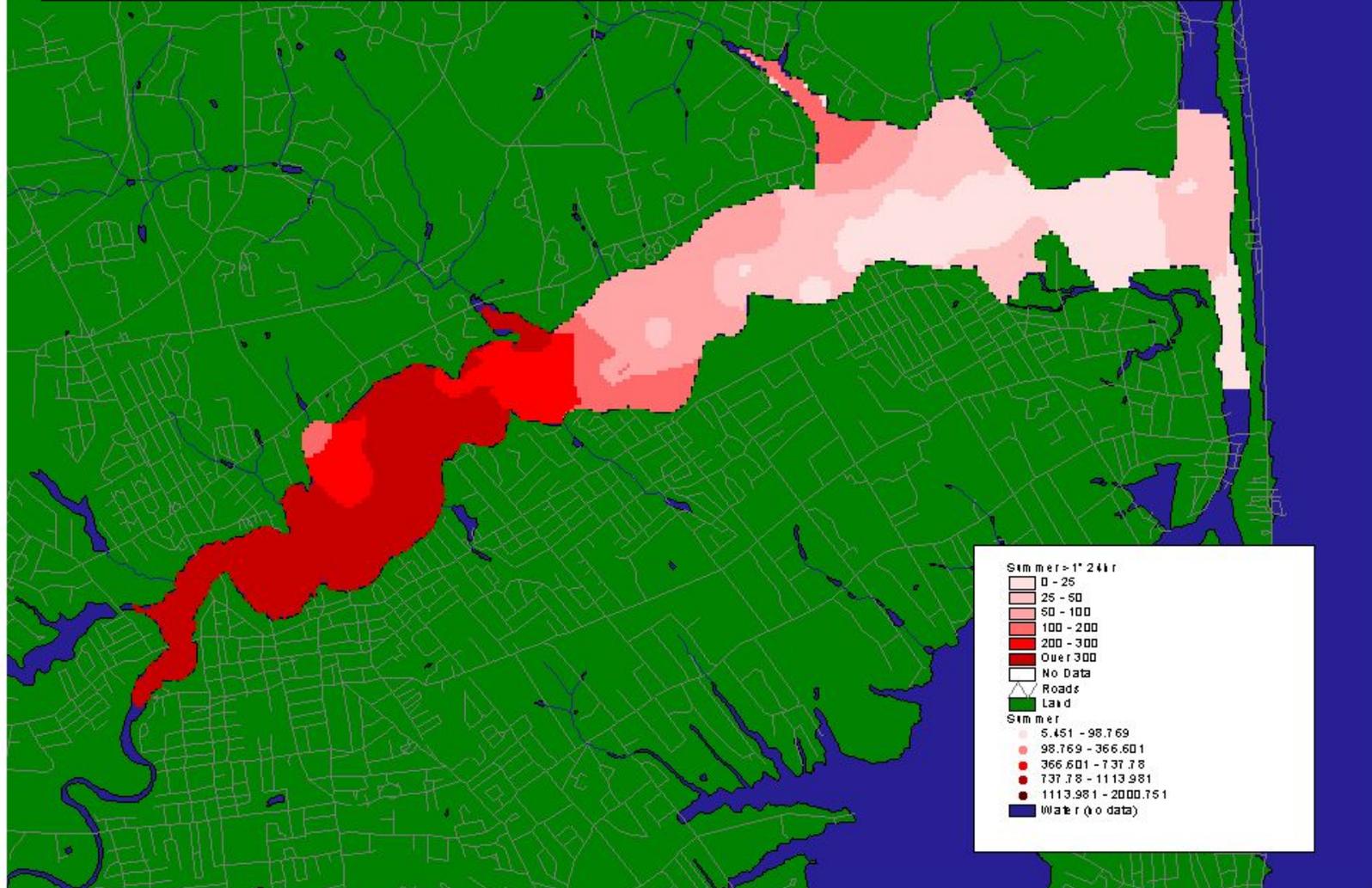


Fecal Coliform (Geo. Mean) - 1993 to 2002

Rainfall More than One Inch over 24 hrs Prior to Sampling



Fecal Coliform (Geo. Mean) - 1993 to 2002 (Summer) Rainfall More than One Inch over 24 hrs Prior to Sampling



Designing the Study: Actual and Potential Sources of Pollution



Oyster Point



Stormdrain @ Newman Springs Rd.

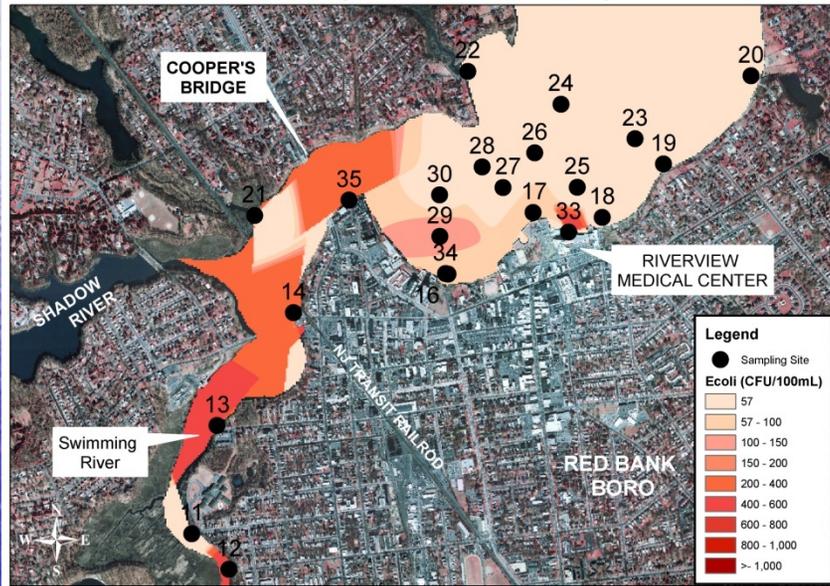


Stormdrain Upstream Swimming River

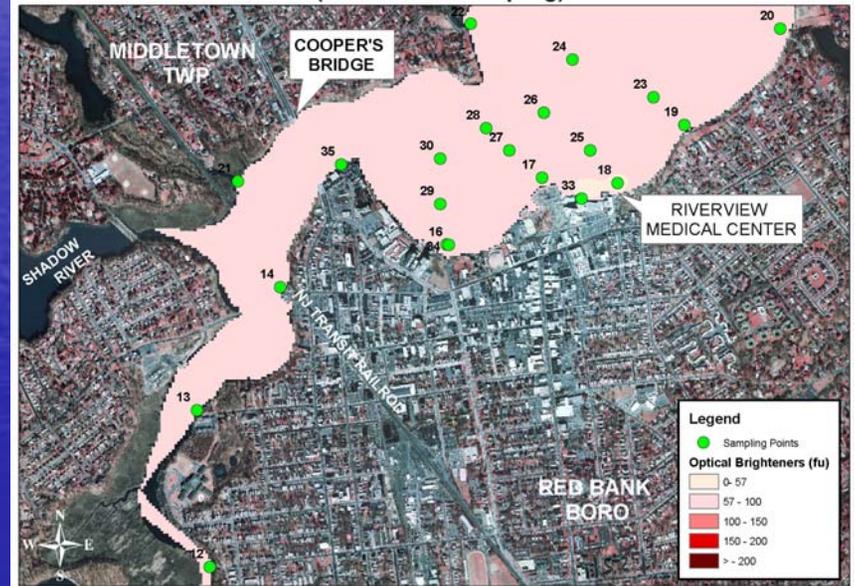


Navesink Initial Sampling

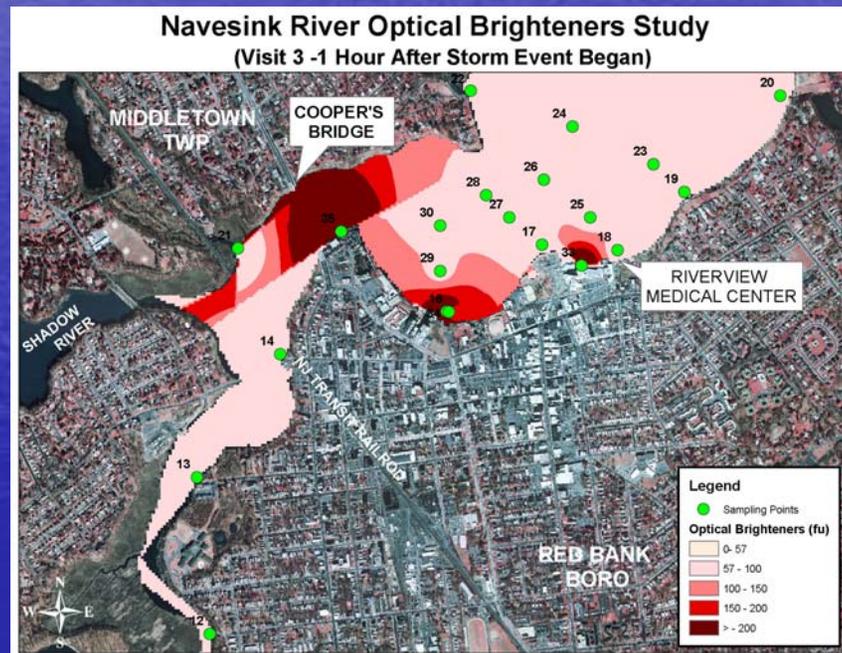
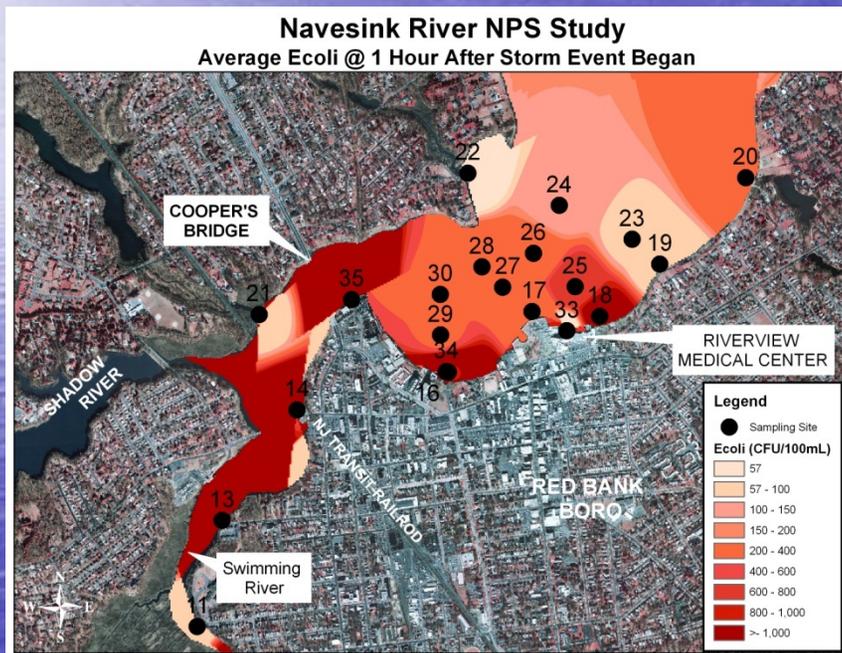
Navesink River NPS Study
Average Ecoli At Initial Sampling



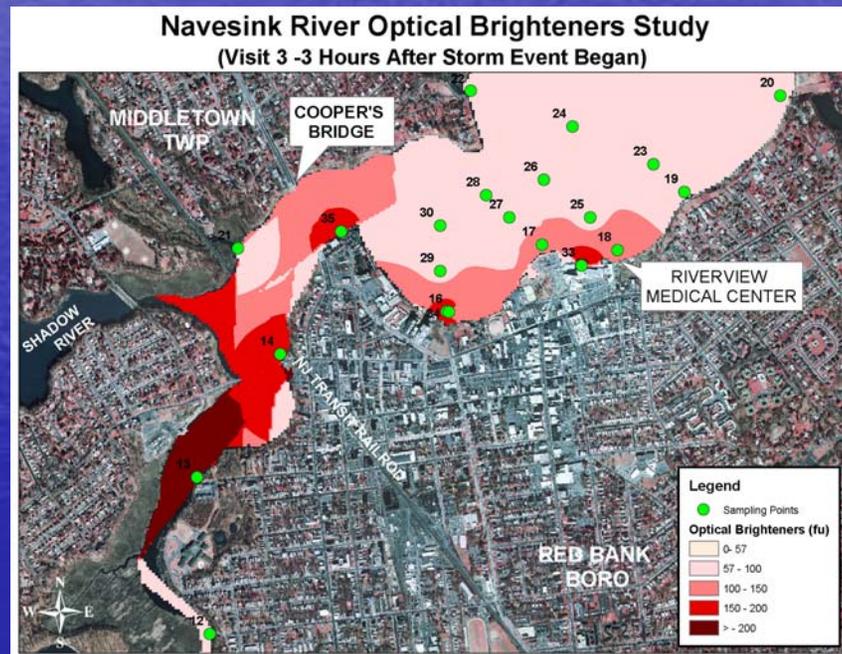
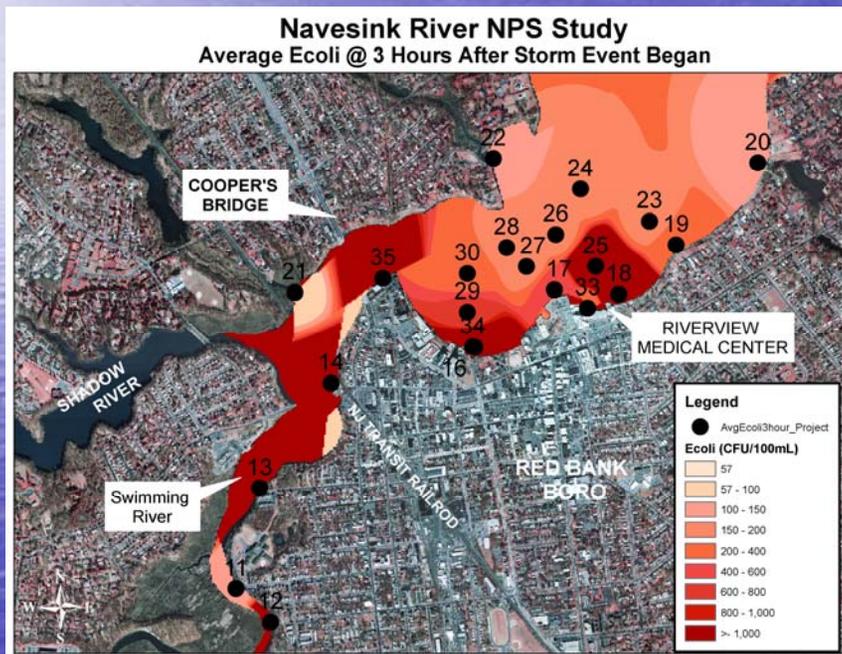
Navesink River Optical Brighteners Study
(Visit 3 - Initial Sampling)



Navesink 1 Hour Later



Navesink 3 Hours Later



Possible Sources

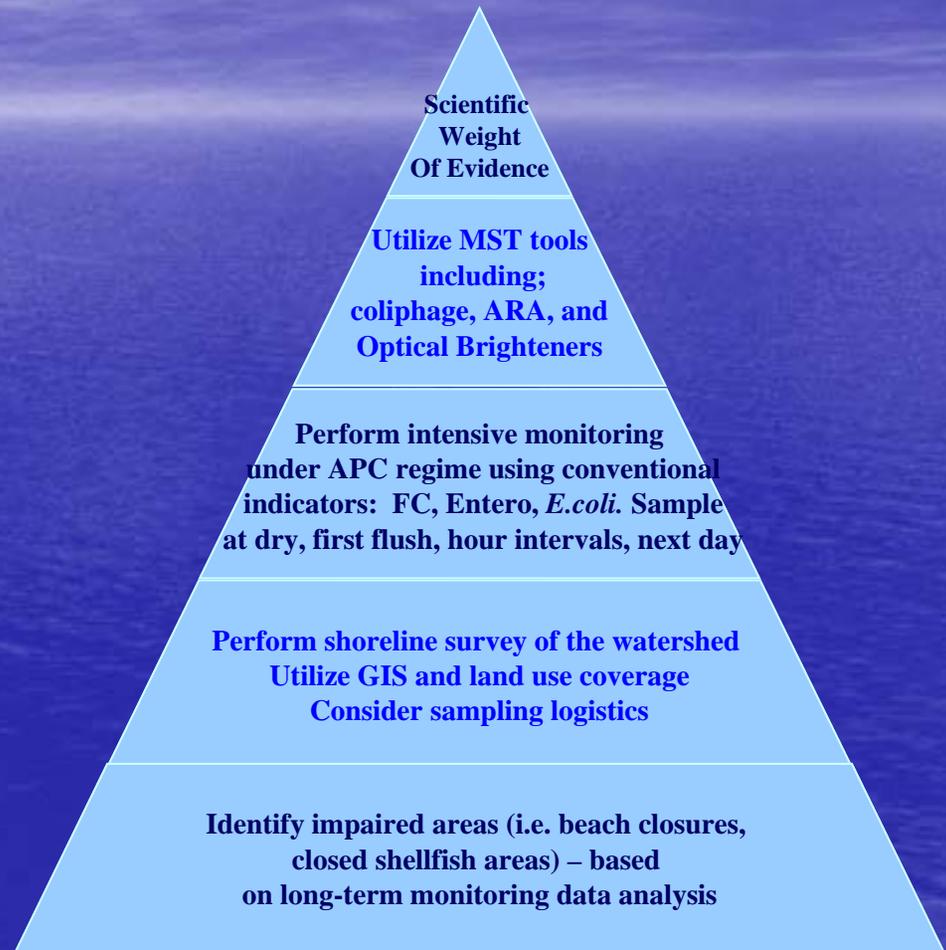
- Oyster Point (Station 35)
- Maple Ave (Station 34)
- Hospital (Station 33)

- Maple Ave and Hospital had elevated coliphage and antibiotic resistance to penicillin, amoxycillin, ampycillin



Wreck Pond

- Use tiered approach to determine possible pollutant sources





Potential Pollutant Sources

- Upper Watershed
- Wreck Pond
- Stormwater discharges
- Resuspension of bacteria in sediments
- Offshore Impacts

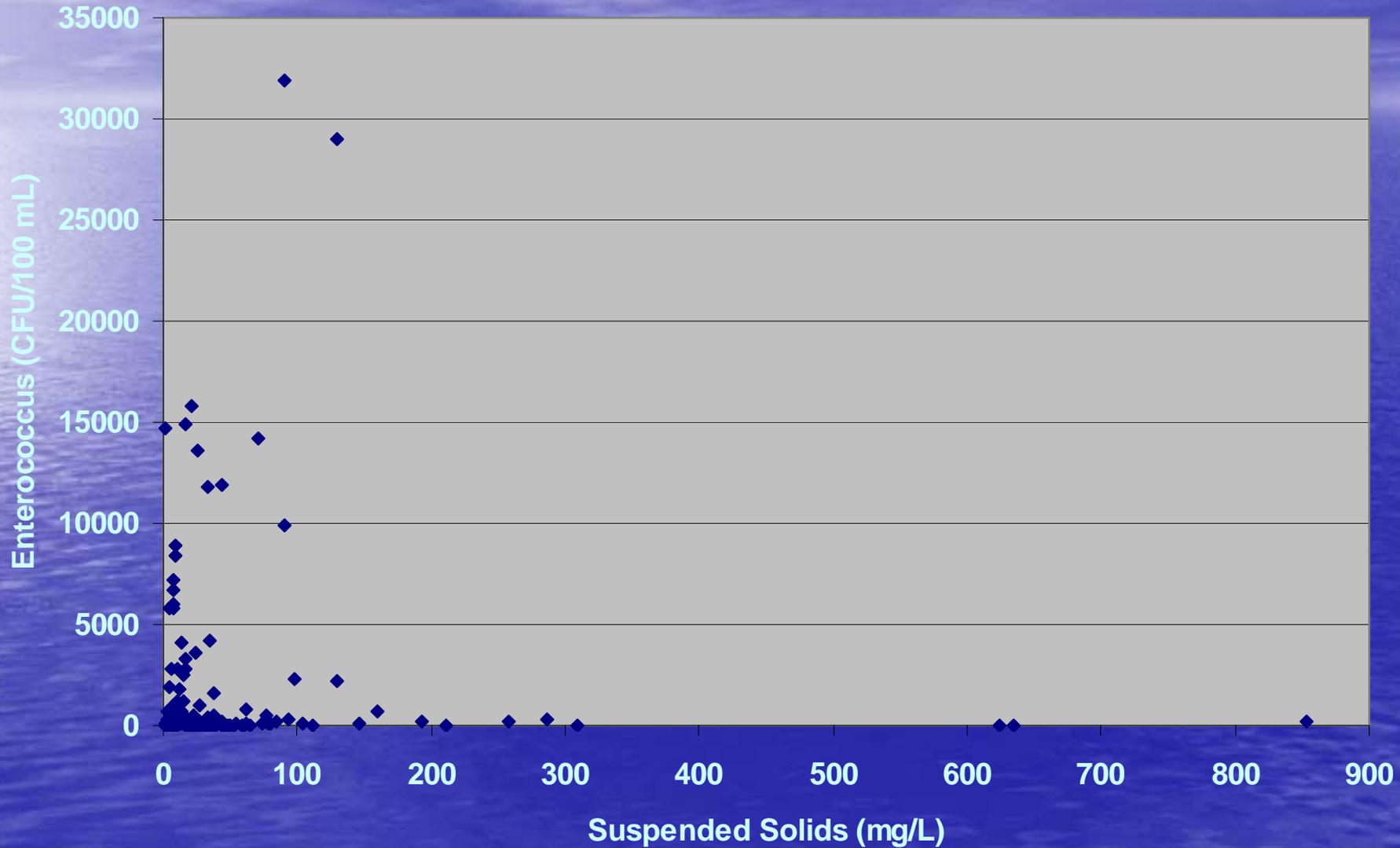


Offshore/Ocean Impacts

- NJDEP Monitoring – 0.25 – 3.0 nm offshore
- >3,800 samples collected in the vicinity of Wreck Pond from 1993 – 2007
- Maximum level found was 95 FC MPN/100 mL
- 99.8% of the results were < 10 FC MPN/100 mL



Enterococcus vs Suspended Solids



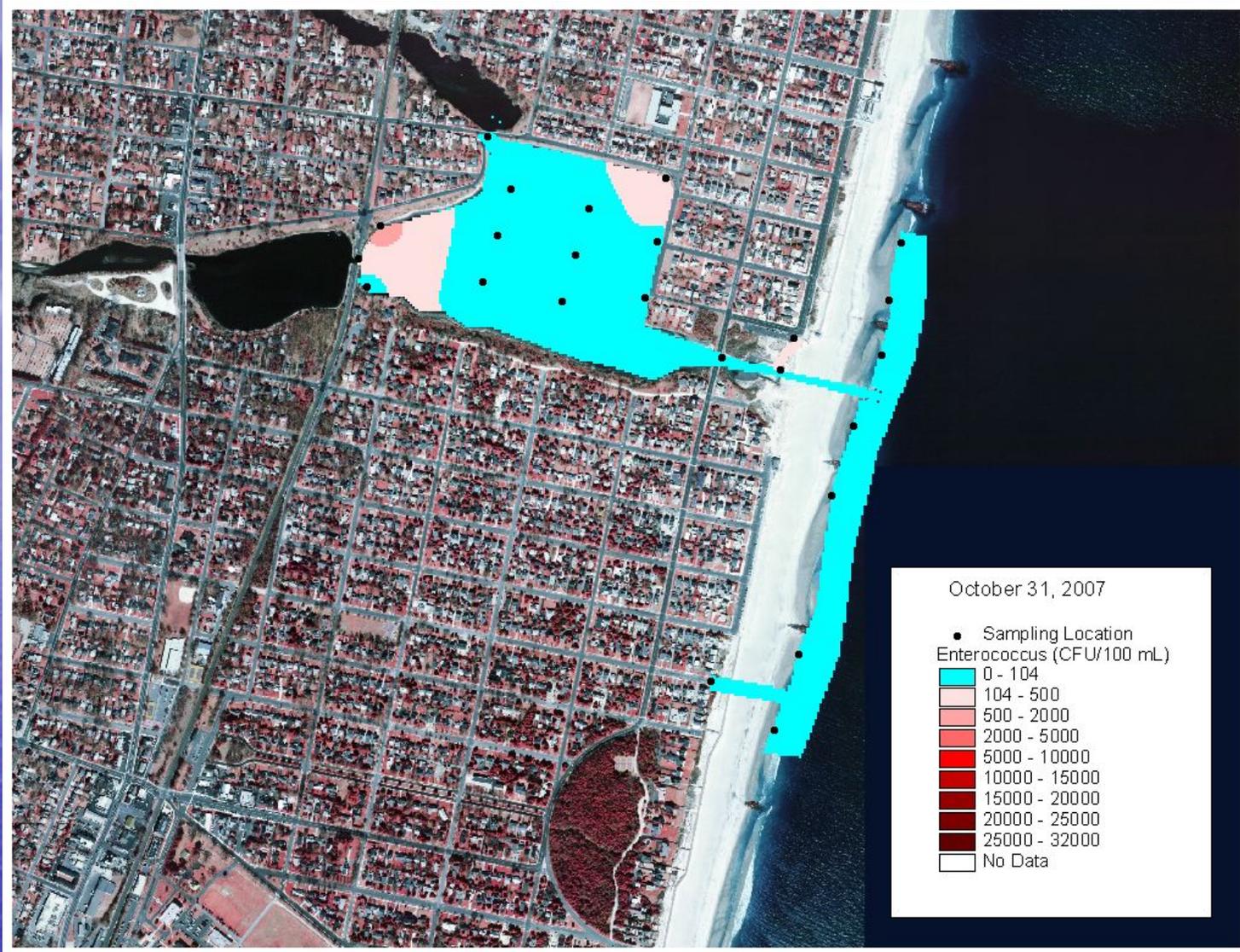
Sampling



Enterococcus Levels

Spring Lake /
Sea Girt

10/31/2007
@ 10 AM



No appreciable rainfall 3 days prior.

Wind Speed: ~10 kts

Wind Direction: SE

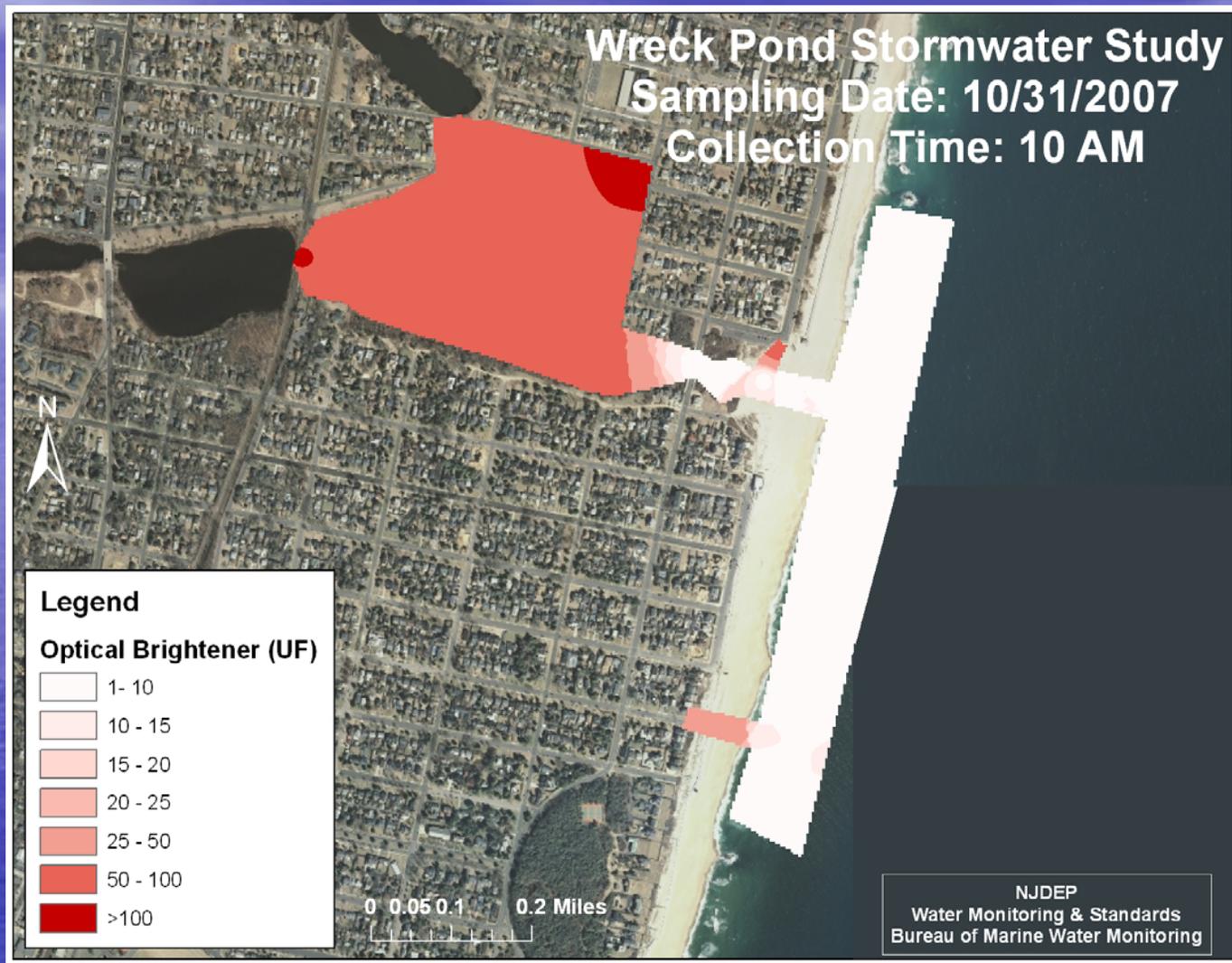
Total 24 hr. rainfall: 0.0"



Optical
Brightener
Levels

Spring Lake /
Sea Girt

10/31/2007
@ 10 AM



No appreciable rainfall 3 days prior.

Wind Speed: ~10 kts

Wind Direction: SE

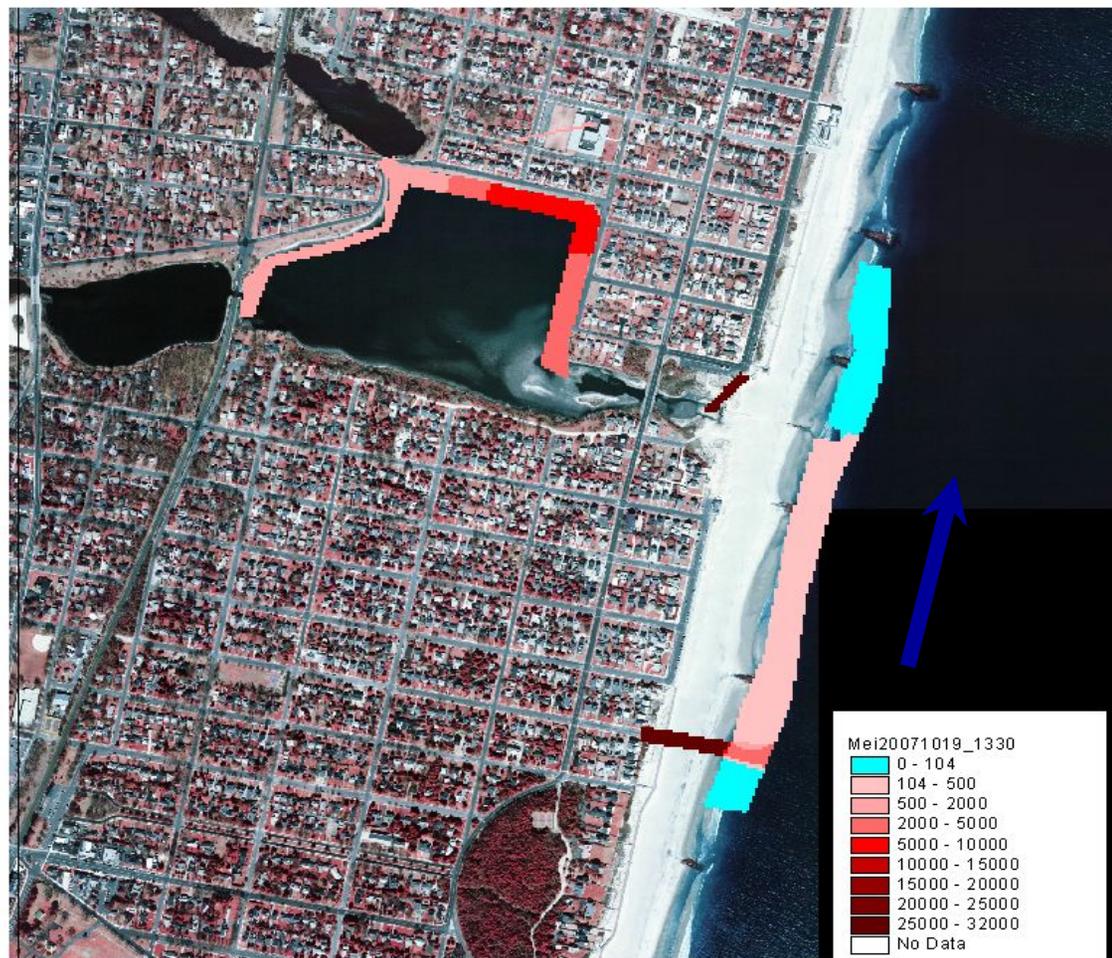
Total 24 hr. rainfall: 0.0"



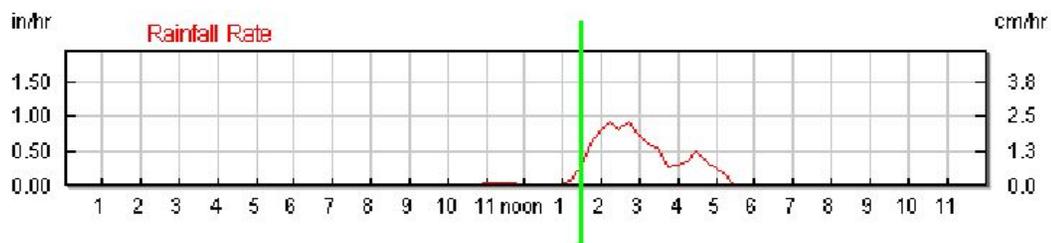
Enterococcus Levels Spring Lake / Sea Girt 10/19/2007 @ 1:30 PM

- Early in storm event
- Elevated levels in Wreck Pond near discharge from Spring Lake
- Very high levels at Baltimore Ave. stormwater discharge
- Predominant nearshore ocean current is south to north.

Wind: S
Tide: 2.58 ft > MLW
24 hr. Rainfall: 2.20"



2007, NJDEP, Bureau of Marine Water Monitoring Levels reported as Enterococcus CFU/100 mL



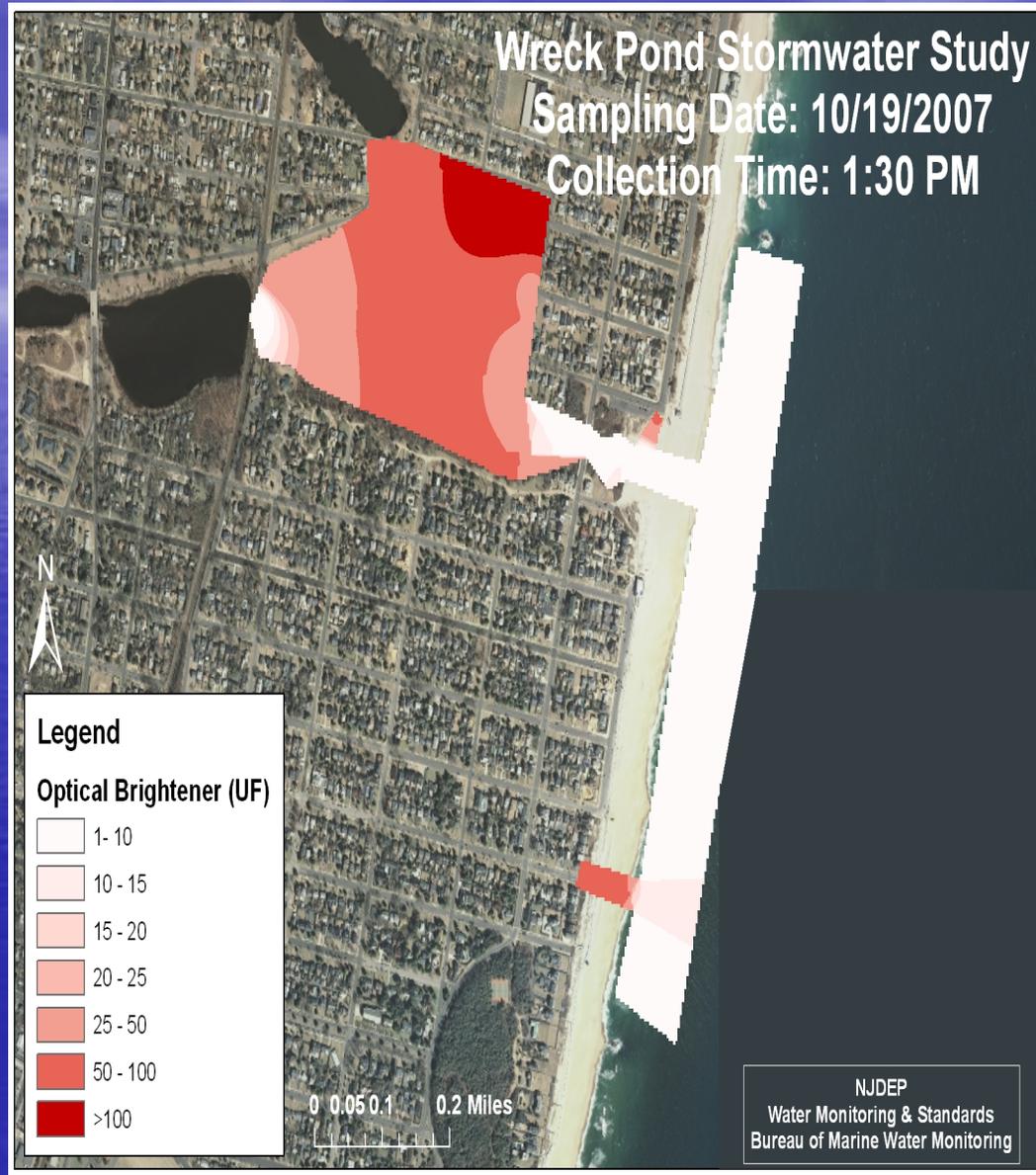
Optical Brightener Levels
Spring Lake / Sea Girt
10/19/2007 @ 1:30 PM

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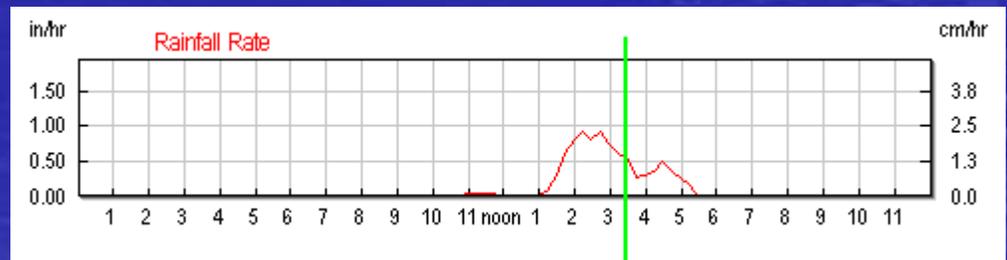
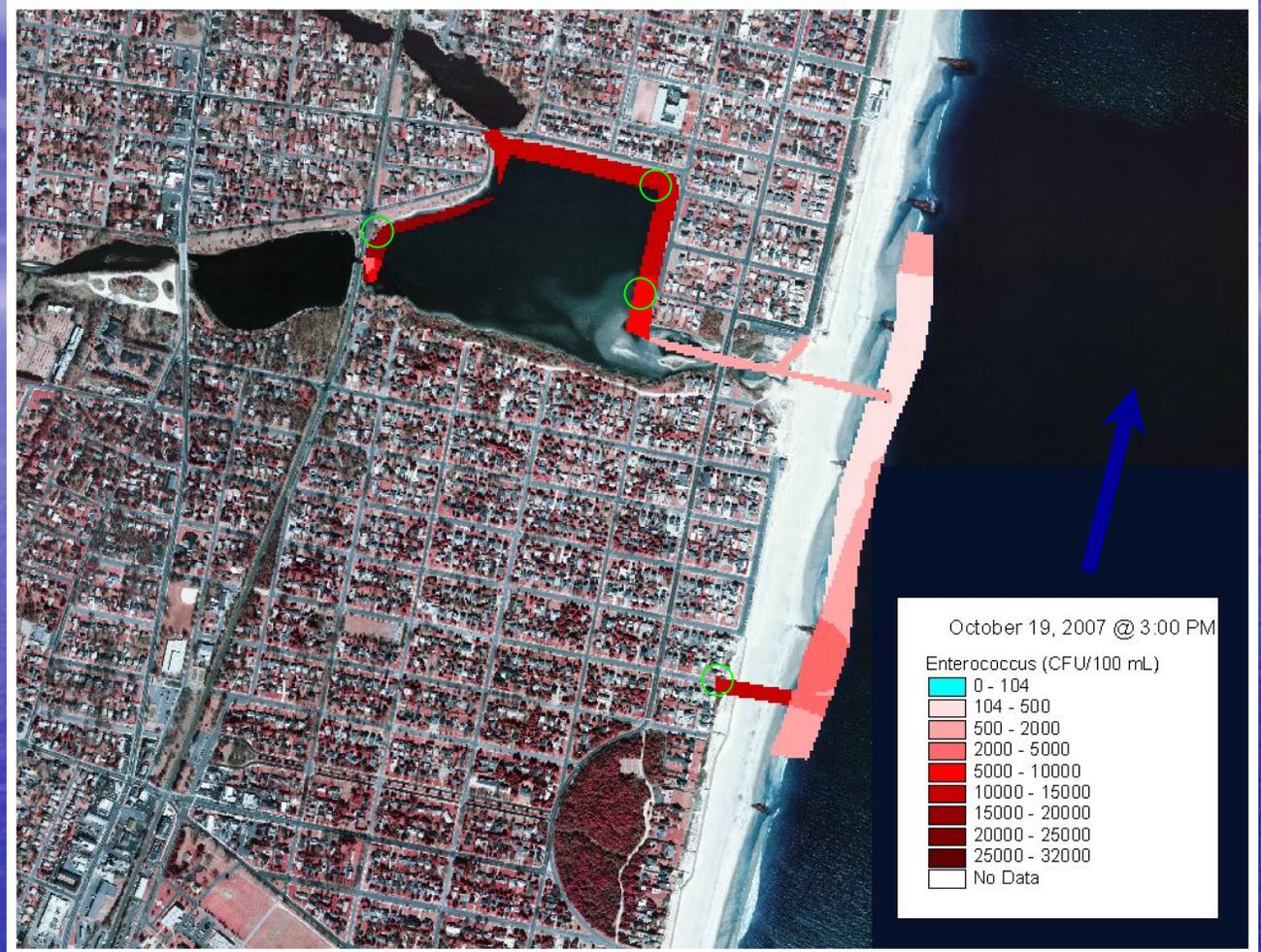
24 hr. Rainfall: 2.20"



Enterococcus Levels
Spring Lake / Sea Girt
10/19/2007 @ 3:30 PM

Wind: S
Tide: 4.13 ft > MLW

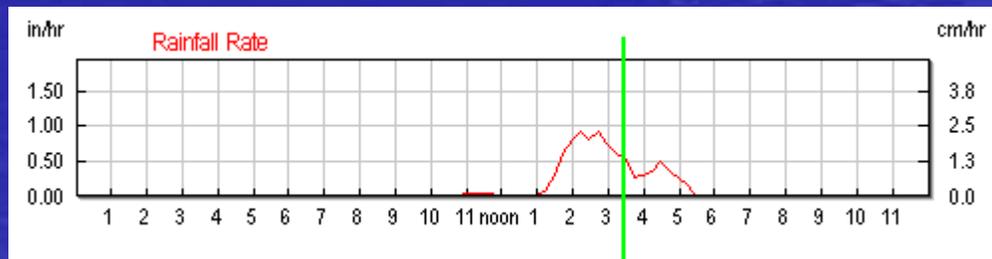
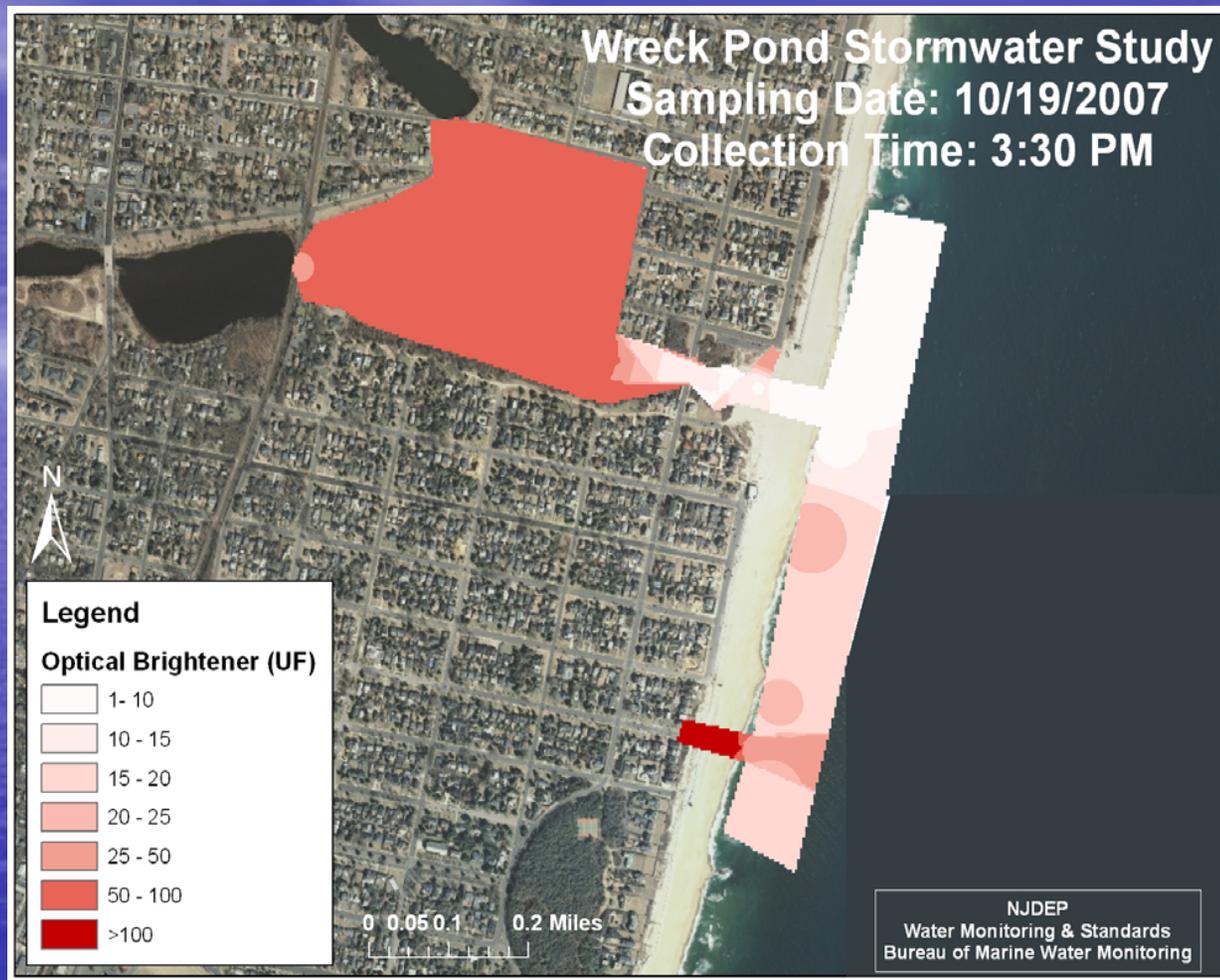
Green Circles show
where ARA suggests
human source.



Optical Brightener Levels
Spring Lake / Sea Girt
10/19/2007 @ 3:30 PM

Wind: S
Tide: 4.13 ft > MLW

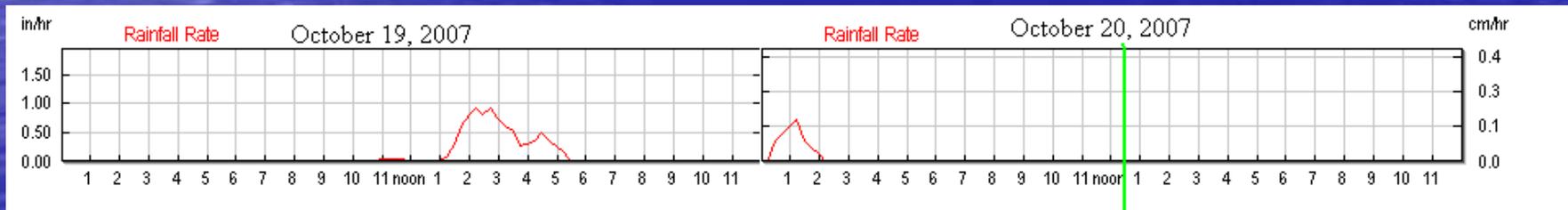
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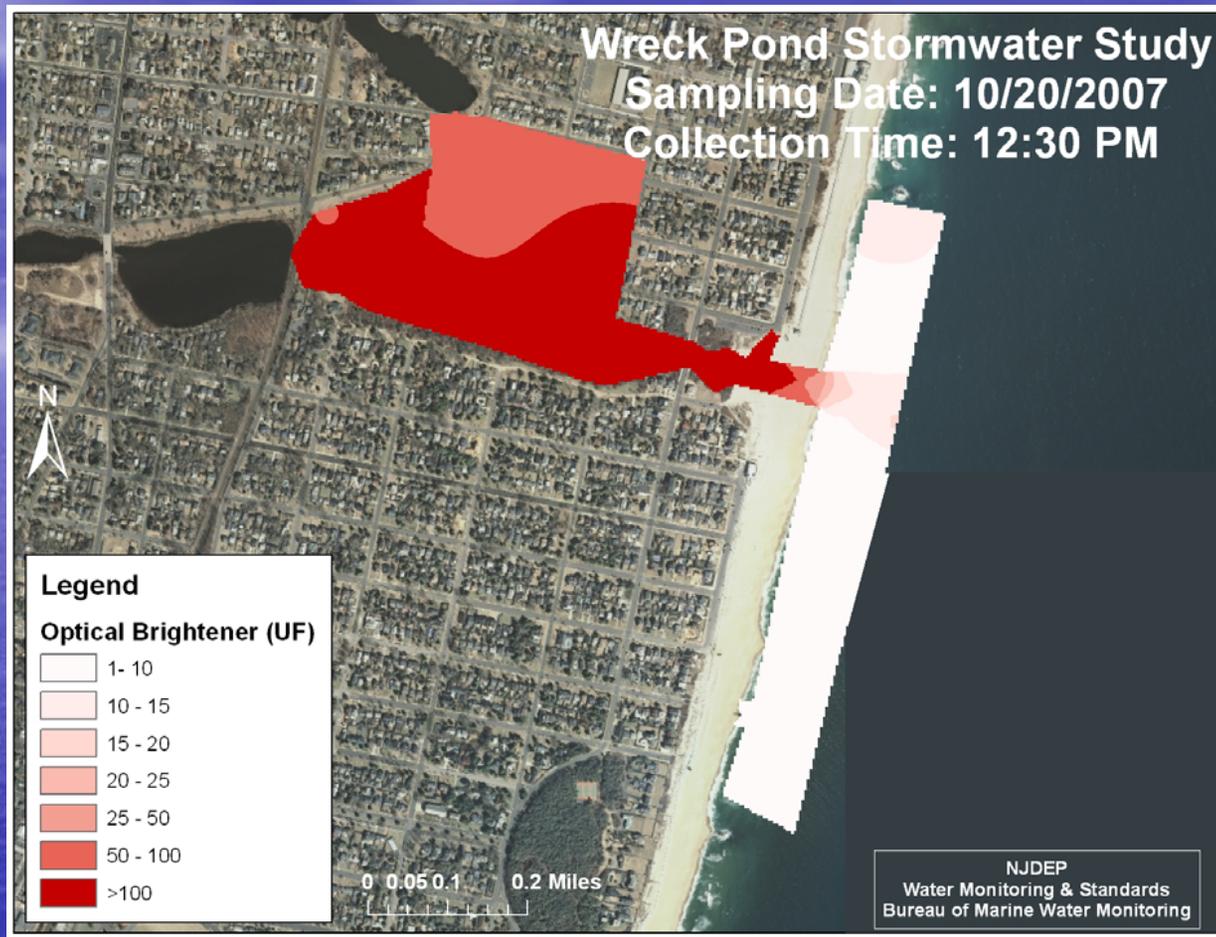
Enterococcus Levels
Spring Lake / Sea Girt
10/20/2007 @ 12:30 PM



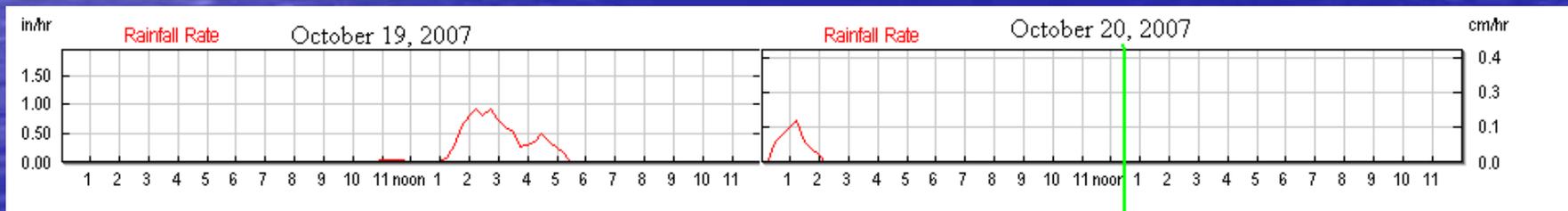
Tide: 2.22 ft > MLW



Enterococcus Levels
 Spring Lake / Sea Girt
 10/20/2007 @ 12:30 PM

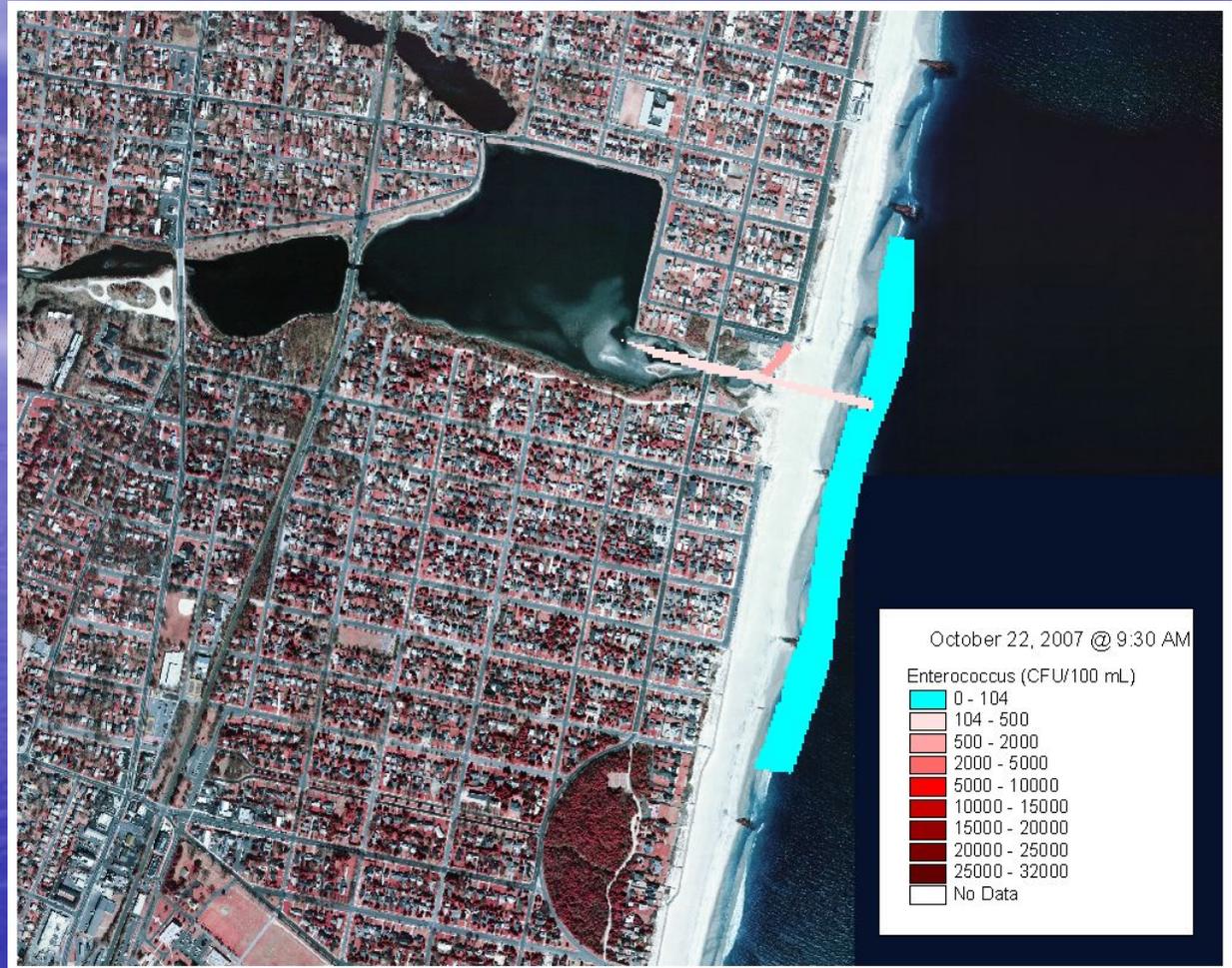


Tide: 2.22 ft > MLW



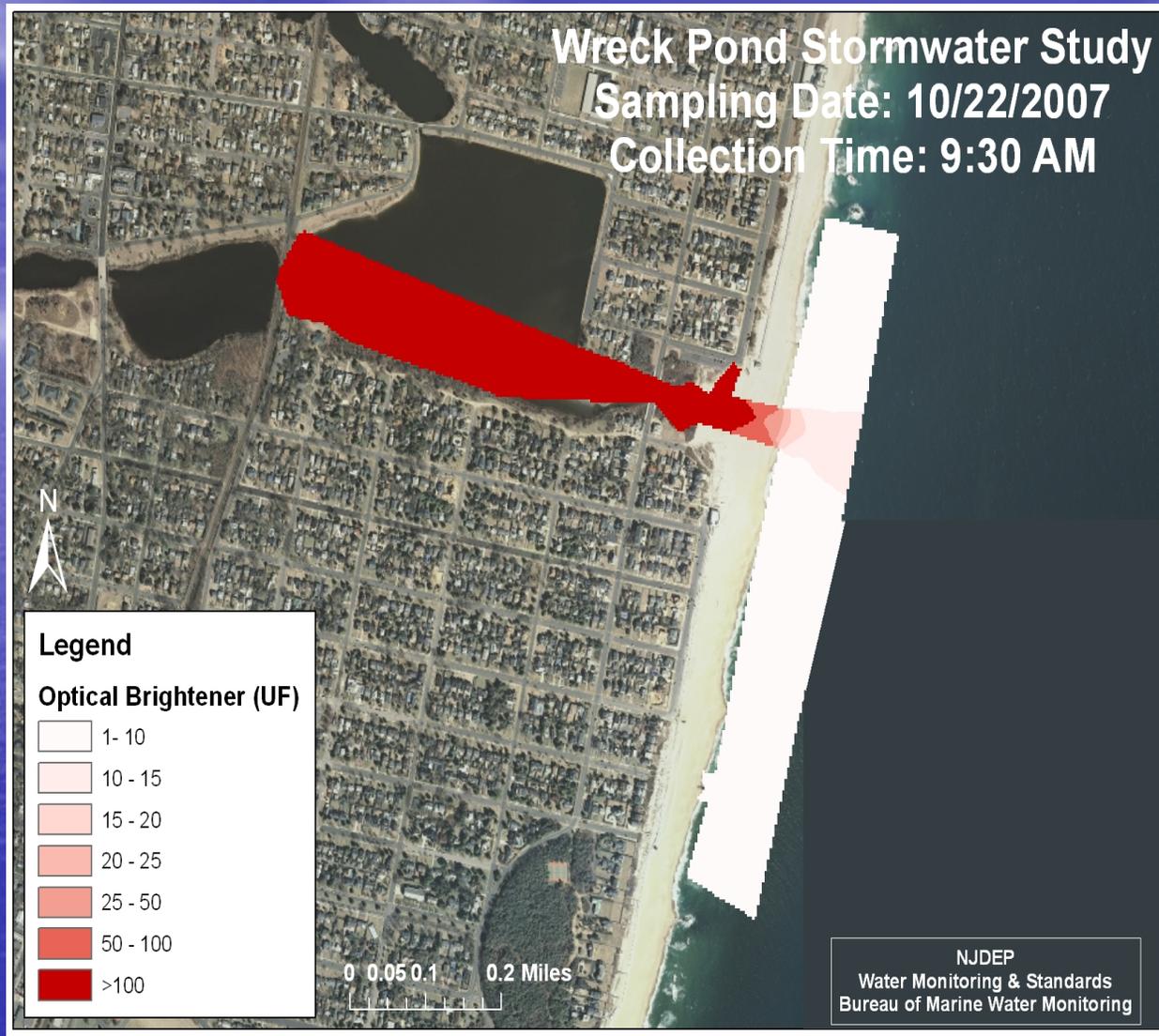
Enterococcus Levels
Spring Lake / Sea Girt
10/22/2007 @ 9:30 AM

Tide: 4.31 ft > MLW



Optical Brightener Levels
Spring Lake / Sea Girt
10/22/2007 @ 9:30 AM

Tide: 4.31 ft > MLW



Enterococcus Sources

- Upper Watershed – not impacting within 24 hrs.
- **Wreck Pond (stormwater discharges to it)**
- **Stormwater discharges (Baltimore Ave)**
- ~~Resuspension~~ of bacteria in sediments – no evidence of this as a major impact to beaches.
- Offshore Impacts – no evidence of this as a major impact to beaches.



LESSONS LEARNED

- Importance of the shoreline survey (site selection, sampling logistics)
- Need for intensive monitoring including APC, first flush, temporal and spatial considerations
- Use of multiple MST lab methods
- Evaluation of the data collectively to build "Scientific Weight of Evidence"



Plans for the Future

- Universal Standard
- Eliminate background interferences due to organic compounds
- Use as a tool to identify where potential pollutant sources could be located



Contact Information

- Bill Heddendorf - NJDEP Bureau of Marine Water Monitoring
- Bill.Heddendorf@dep.state.nj.us
- 609- 748-2000
- <http://www.nj.gov/dep/bmw/>

