

# EVALUATION OF BAY BACTERIA AFTER PHASE I AND II OF THE NARRAGANSETT BAY COMMISSION'S CSO ABATEMENT PROJECT

NEERS Fall Meeting

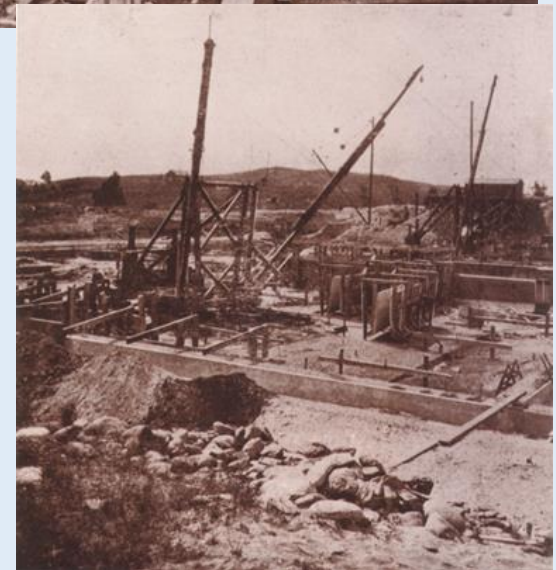
October 22, 2016

Christine Comeau & Eliza Moore



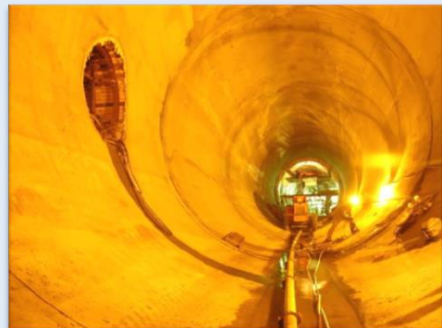
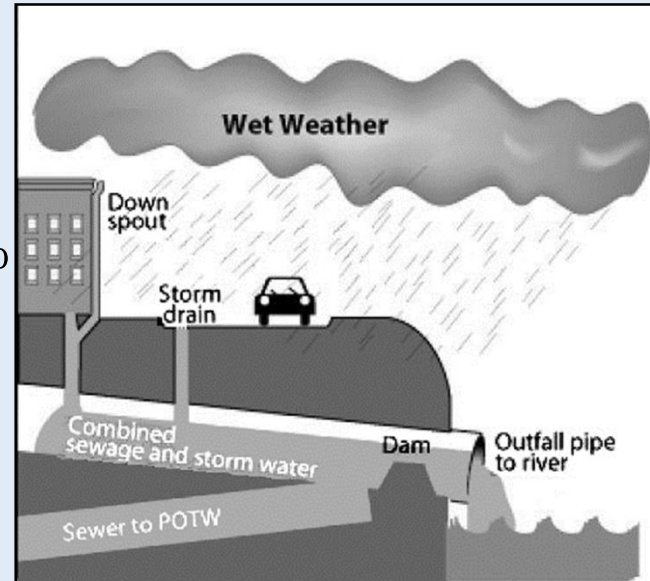
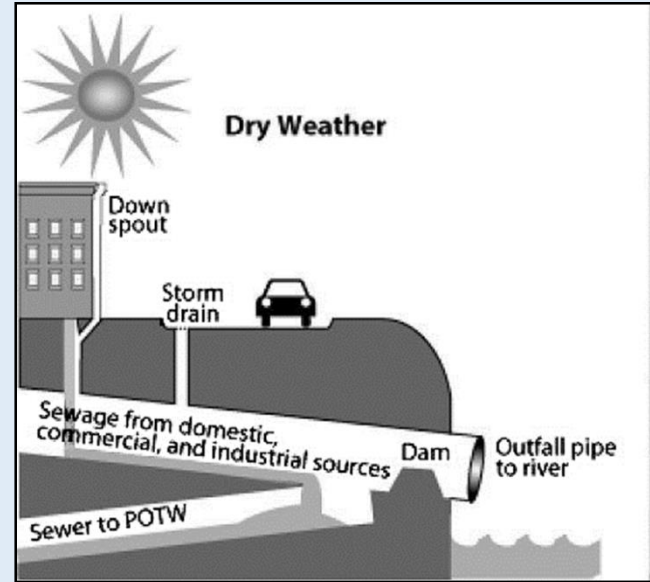
# Narragansett Bay Commission – History of Combined Sewer Outfalls

- Late 1870's - City of Providence constructs a sewer system which conveys waste through a series of 65 sewer outfalls directly into Providence's urban rivers and harbor
- 1901 - Fields Point Chemical Precipitation Plant
- Much original infrastructure still remains, as well as the 65 outfalls
- Legacy of 100+ year old sewer systems
  - Providence, Pawtucket, Central Falls
- **Combined Sewer System** - all flow, including domestic sewerage, industrial waste, and rainwater all flow into the same pipe



# Combined Sewers

- Dry Weather – system works
- Overflows occur when stormwater overwhelms capacity of sewer pipes
  - Excess combined sewage discharges into local rivers
- Discharge of 2.2 Billion gallons/year
- Public health & water quality issues
- Discharges violate Clean Water Act
  - CSOs are a major source of fecal coliform to receiving waters.
- CSO Abatement Project: reduce discharge by 98%



# CSO Abatement Project: 3 Phases - ~\$1.2 Billion

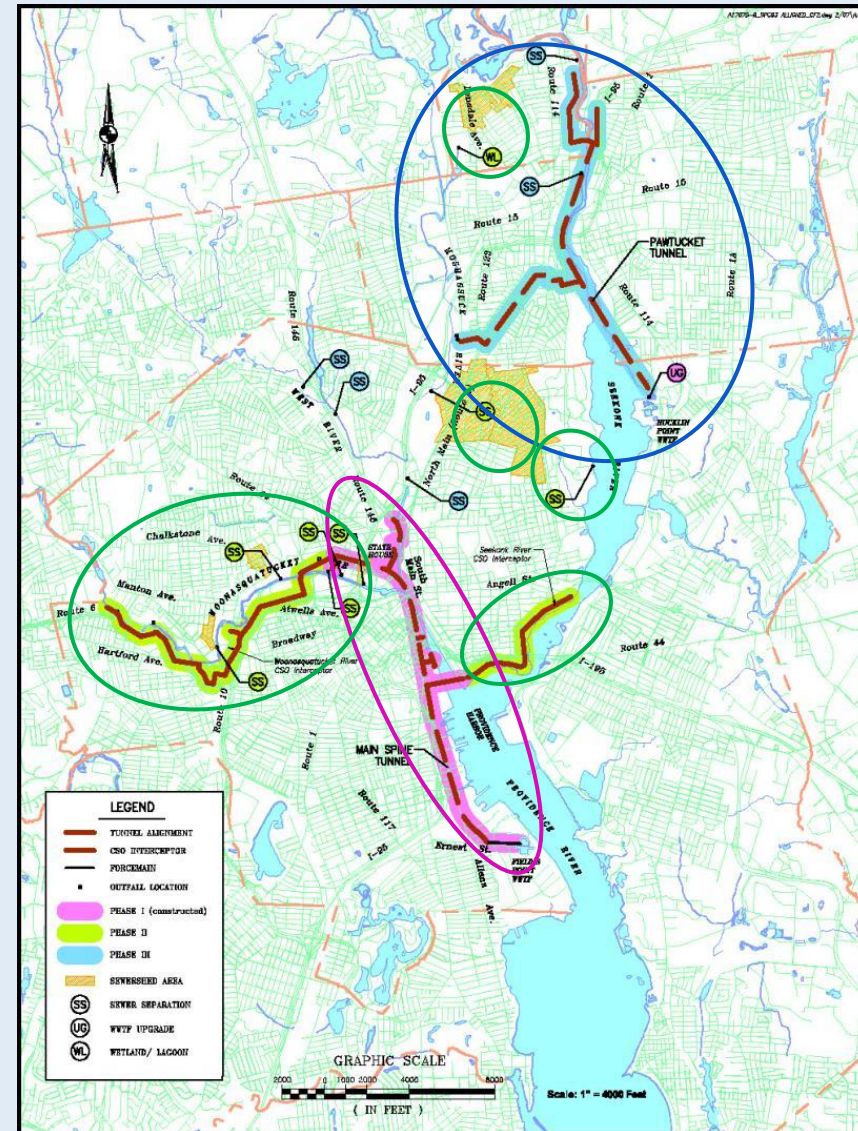
## PHASE I (2001 – Oct 2008)

“3-month storm” 1.65 inches in 6 hours

- 26 ft diameter deep rock tunnel
- 3+ mile long, 300 ft. below ground
- 62 MG design capacity; 7 drop shafts to divert flow to tunnel
- 12 CSOs

## PHASE II (2012 – 2015)

- Woonasquatucket & Seekonk River interceptors constructed to transport flow to the CSO tunnel
- Two sewer separations –
  - Storm and sewer lines separated
- Constructed wetlands facility in Central Falls
  - 0.32 MG of storage
  - Pumped to sanitary sewer after rain event
  - Overflows to wetlands when tanks are full
- 10 CSOs



# CSO Abatement Project: 3 Phases - ~\$1.2 Billion

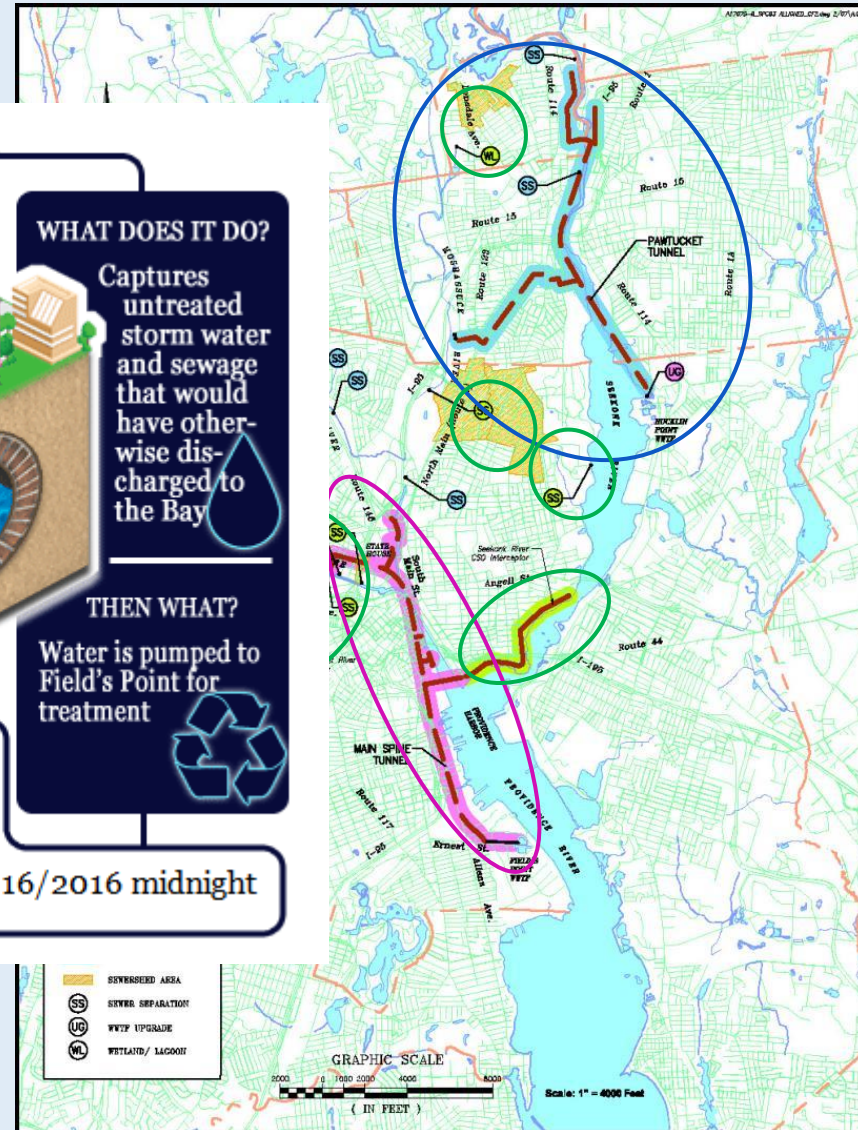
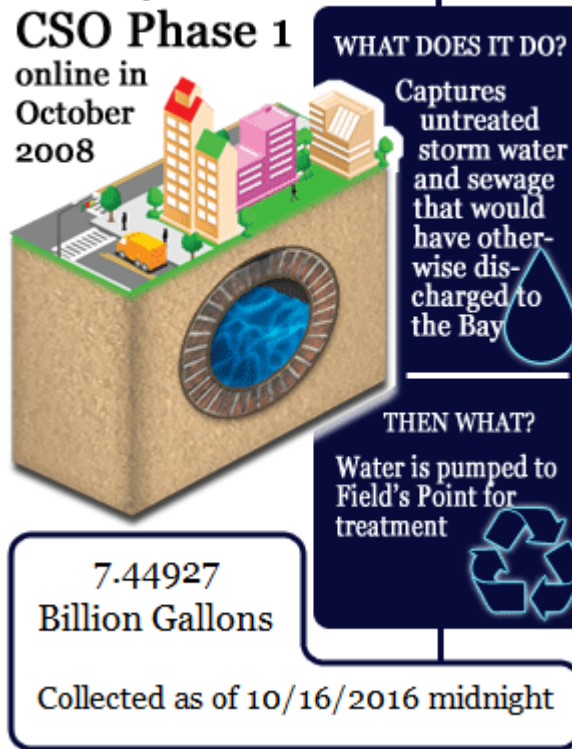
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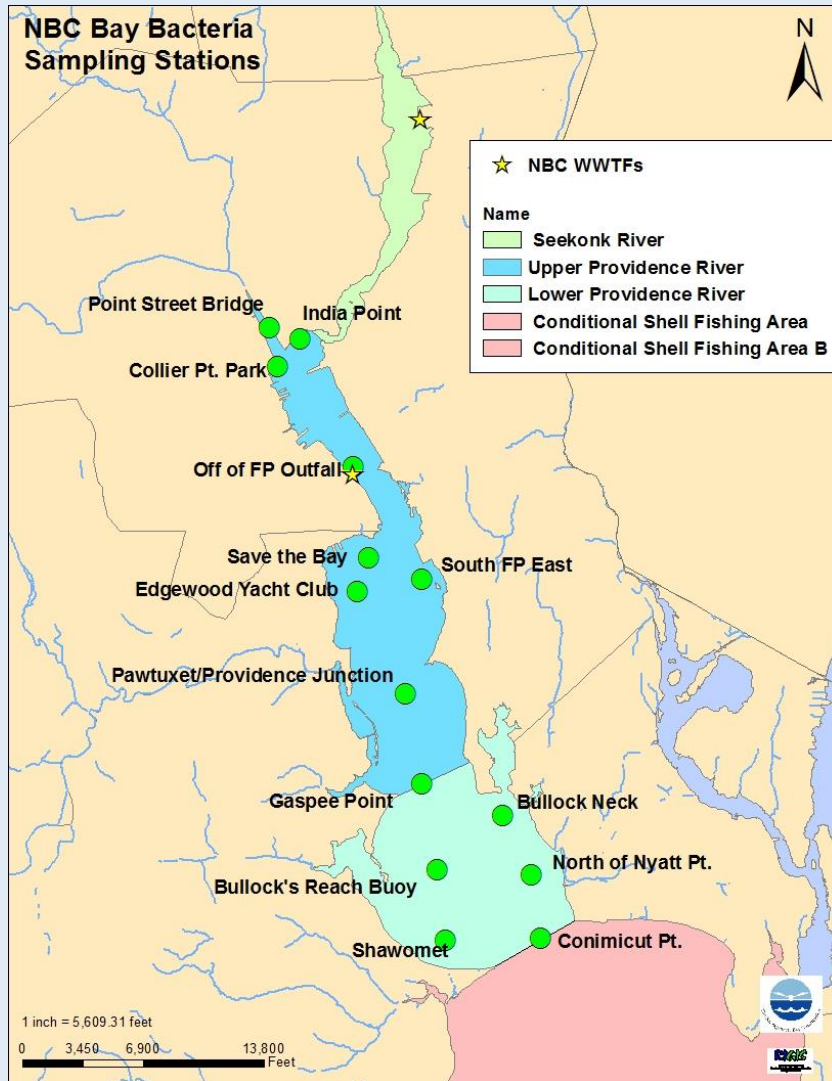
- 26 ft diameter deep rock tunnel
- 3+ mile long, 300 ft. below ground
- 62 MG design capacity; 7 drop shafts to allow flow to tunnel
- 12 CSOs

## PHASE II (2012 – 2015)

- Woonasquatucket & Seekonk Rivers
- constructed to transport flow to treatment
- Two sewer separations –
  - Storm and sewer lines separated
- Constructed wetlands facility in Cranston
  - 0.32 MG of storage
  - Pumped to sanitary sewer after rain event
  - Overflows to wetlands when tanks are full
- 10 CSOs

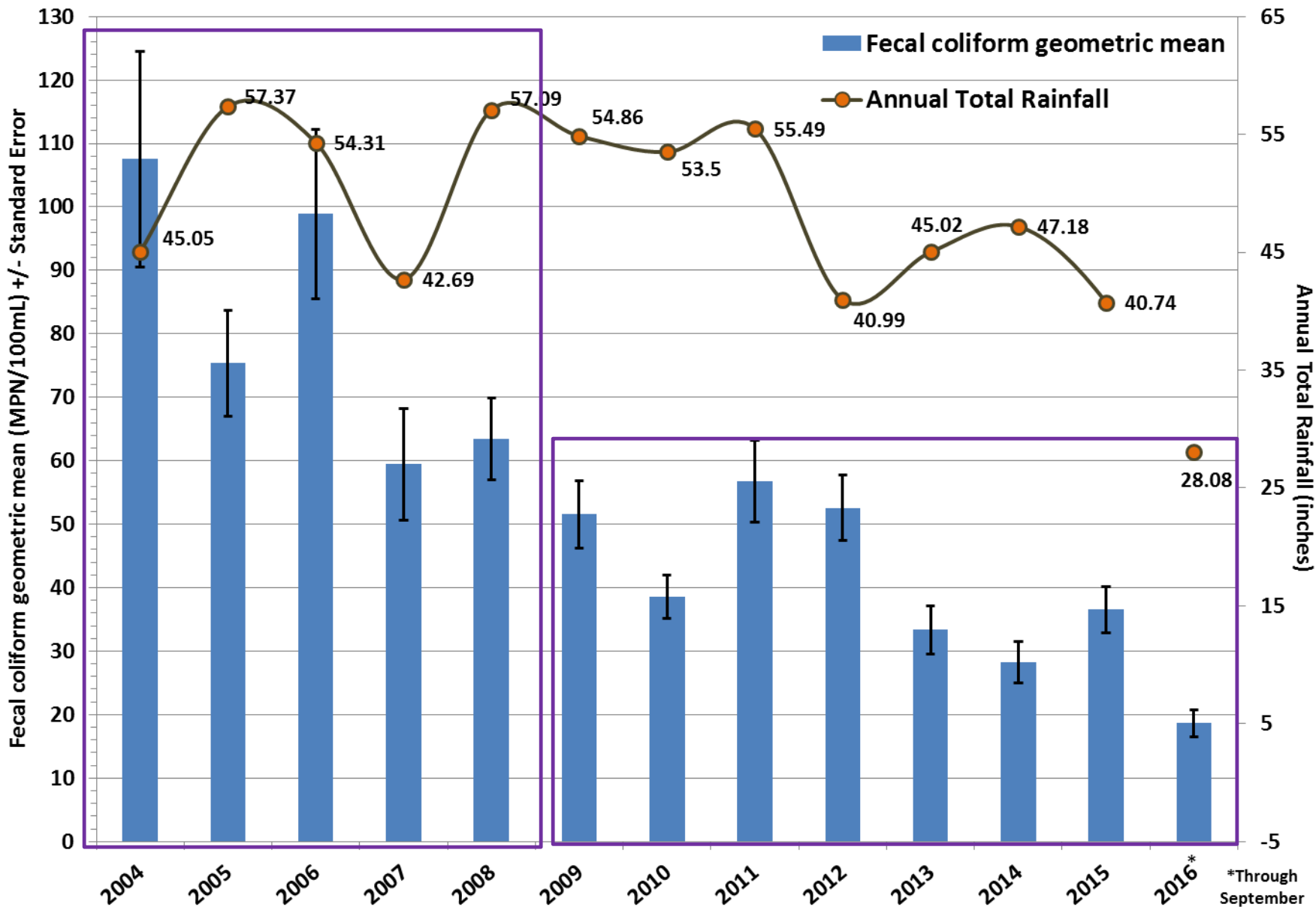


# Upper Bay Bacteria Monitoring



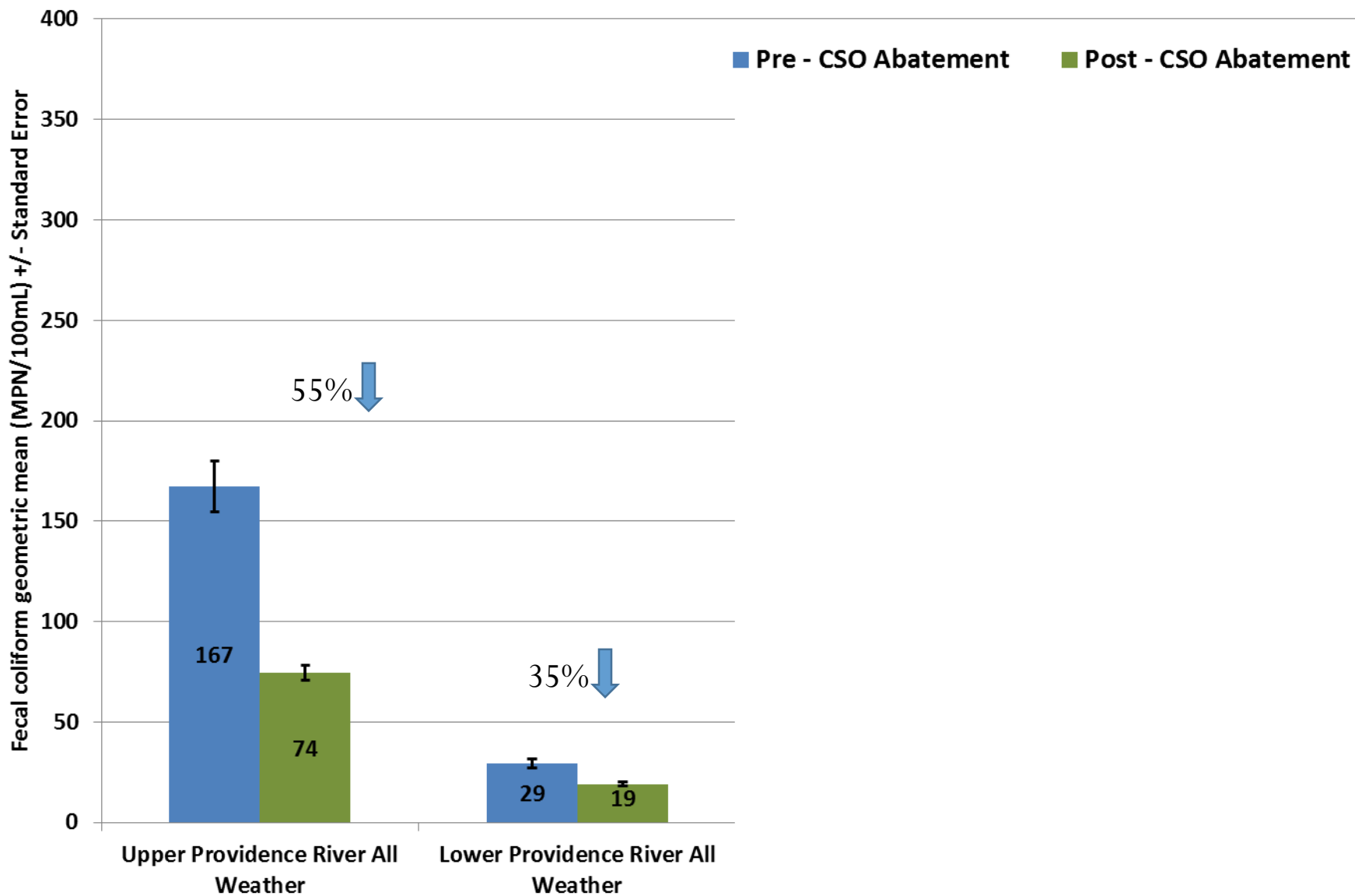
- 20 NBC Bay monitoring stations in Seekonk and Providence “Rivers”
  - 6 sites in Seekonk River
  - 14 sites in Providence River
    - 8 site in Upper Providence River
    - 6 sites in Lower Providence River
- Biweekly throughout year for fecal coliform bacteria
- Pre-Phase I & II (June 2004 – Oct 2008)
- Post-Phase I & II (Nov 2008 – Sept 2016)
- Dry day – <0.1 inches rainfall 3 days prior
- Wet day – >0.1 inches rainfall 3 days prior
- Why monitor? – what impact do large scale infrastructure projects have on water quality in the bay?

# Providence River Annual Fecal coliform Geometric Mean



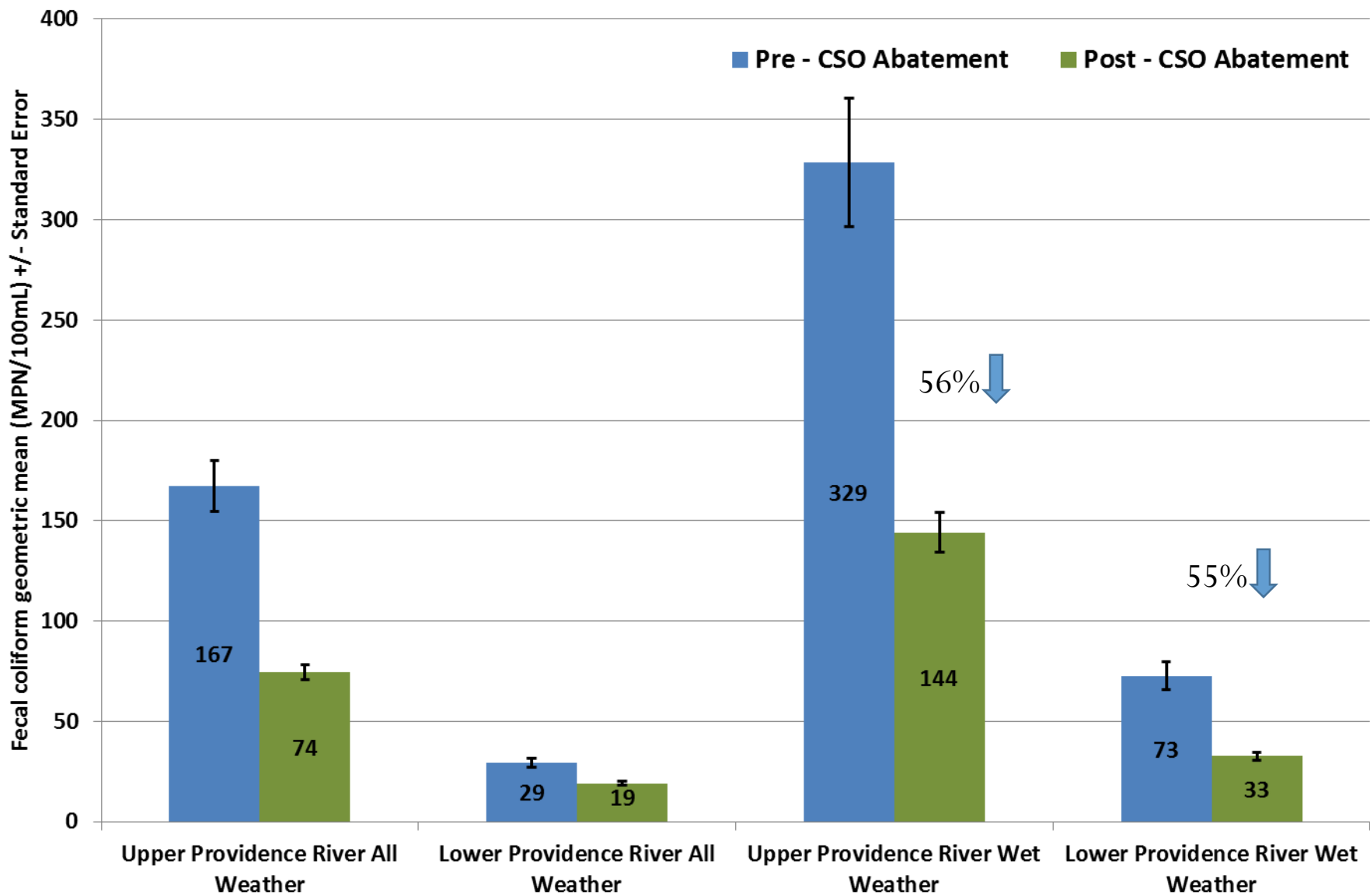
\*Through September

# Fecal coliform Geometric Mean of Upper and Lower Providence River Pre and Post CSO Abatement Project





# Fecal coliform Geometric Mean of Upper and Lower Providence River Pre and Post CSO Abatement Project



# NBC Bay Bacteria Sampling Stations

Fecal coliform concentrations - Wet Weather

Point Street Bridge

India Point

Collier Pt. Park\*

Off of FP Outfall

Save the Bay

South FP East

Edgewood Yacht Club

Pawtuxet/Providence Junction

Gaspee Point

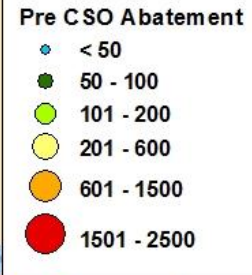
Bullock Neck

Bullock's Reach Buoy

North of Nyatt Pt.

Shawomet

Conimicut Pt.



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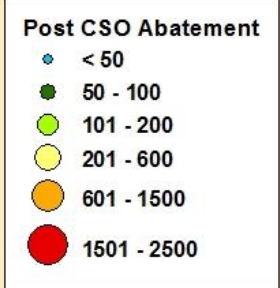
Bullock Neck

Bullock's Reach Buoy

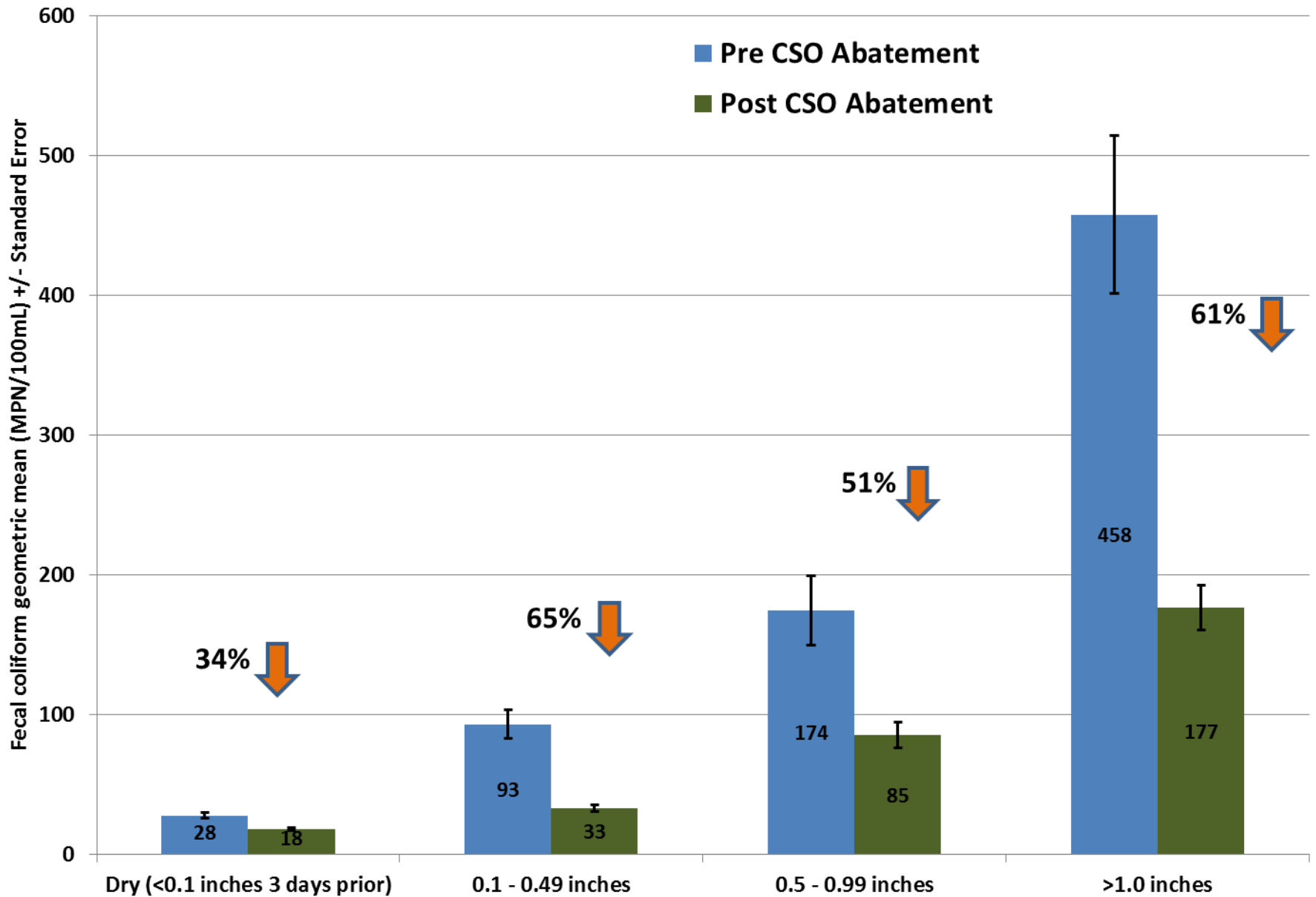
North of Nyatt Pt.

Shawomet

Conimicut Pt.



## Fecal coliform geometric means as a function of rainfall amounts



# Reductions in Fecal coliform Concentrations

- Significant decrease in Upper and Lower PR
- All sites have had a decrease in fecal coliform
  - 10/14 sites overall (all samples);
  - 11/14 sites in wet weather
- Significant decrease in rainfall events
- What does this mean for water quality?

Sampling Locations	Percent of Decrease All Samples	Percent of Decrease Wet Weather
Point Street Bridge	68%	50%
India Point	64%	60%
Collier Point Park	47%	40%
F.P. Outfall	62%	56%
Save the Bay	43%	60%
South F.P. East	47%	46%
Edgewood Yacht Club	48%	59%
Pawtuxet/Providence Junction	44%	59%
Gaspee Point At Channel	50%	57%
Bullock Neck	17%	43%
Bullocks Reach Buoy	30%	51%
North of Nayatt Point	18%	50%
Shawomet	40%	64%
Conimicut Point	38%	55%

# Comparison to Primary Contact Standards

- RIDEM Primary contact standards: May – October geomean; not more than 50 MPN/100 mL and not 10% of samples above 400 MPN/100 mL
- Average overall “compliance”: Pre: 27%; Post: 57%
  - Upper PR: Pre CSO: 3%; Post CSO: 36%
  - Lower PR: Pre CSO: 61%; Post CSO: 85%

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016*
<b>Point Street Bridge</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>India Point</b>	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES	NO	NO
<b>Collier Point Park</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES
<b>Off of F.P. Outfall</b>	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	YES	NO	NO
<b>Save the Bay</b>		NO	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	YES
<b>South F.P. East</b>	NO	NO	NO	YES	NO	YES	YES	NO	NO	NO	YES	NO	YES
<b>Edgewood Yacht Club</b>	NO	NO	NO	NO	NO	YES	YES	YES	NO	NO	YES	YES	NO
<b>Pawtuxet/Providence Junction</b>		NO	NO	NO	NO	NO	YES	NO	NO	NO	YES	NO	NO
<b>Gaspee Point At Channel</b>	NO	NO	NO	NO	NO	YES	YES	YES	NO	YES	YES	YES	YES
<b>Bullock Neck</b>	YES	YES	YES	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES
<b>Bullocks Reach Buoy</b>	NO	NO	NO	YES	YES	YES	YES	YES	YES	NO	YES	YES	NO
<b>North of Nayatt Point</b>		YES	YES	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES
<b>Shawomet</b>		YES	NO	YES	YES	YES	YES	YES	NO	NO	YES	YES	YES
<b>Conimicut Point</b>	YES	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
<b>Seasonal Rainfall</b>	22.31	29.05	32.6	14.93	24.04	29.62	19.22	30.78	24.85	24.3	14.94	20.14	10.89

\*2016: May – September only

# Shellfishing Areas in Upper Bay

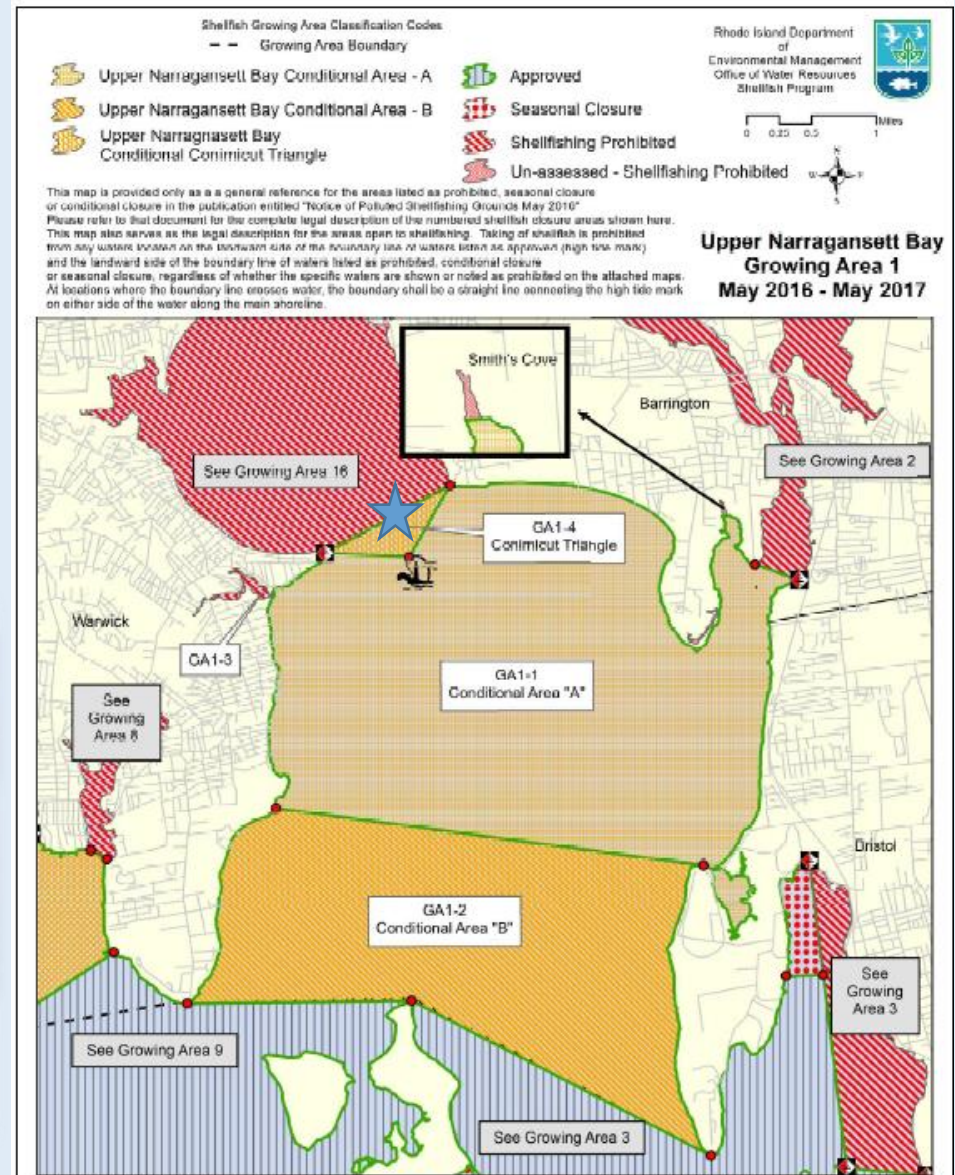
- Conditional Areas A & B, and small acreage area called Conimicut Triangle (Area C)
- Closures based on rainfall amounts, and bypasses from WWTFs
  - 7 days or 10 days

**Quahogs main shellfish harvested in RI**

**~\$5 million dockside value of quahogs (2012)**

**54% of the quahog harvest came from Areas A, B, & C (2013)**

(The Rhode Island Shellfish Management Plan, 2014)



# Developments in Shellfishing regulations since CSO Abatement Project

- **Feb 2009:** DEM and FDA agree on new monitoring procedures to allow DEM to re-open Conditional Areas A & B to shellfish harvesting as soon as the data demonstrates it is safe to do.
  - Has resulted in ~ 36 days of early opening since 2009 due to good water quality
- **May 2011:** Conditional Area A, closed after 0.8 inch of rainfall, up from 0.5 inch. Conditional Area B closed after 1.5 inches of rainfall, up from 1.0 inch
  - Area A: open ~ 65 more days/year;
  - Area B: open ~ 45 more days/year
  - Closure criteria remained at 0.5 inches rainfall at Conimicut Triangle
- **May 2013:** 462 acre area in Lower PR: rainfall closure criteria increased from 0.5 inches to 0.8 inches of rainfall received in the Providence area. Size of the "Conimicut Triangle" will be reduced and the size of Conditional Area A will increase
- **May 2016:** Lower portion of Providence River is showing promise and may be reopened conditionally to shell fishing in future years, though shellfish management plans must be developed
  - 2 most southern monitoring stations have shown results in compliance with shellfishing standards in 3 of the past 4 years!



# Acknowledgements

## *Special Thanks to:*

- E. Moore (co-author)
- P. Reitsma, T. Breeden, K. Cortes
- NBC Environmental Monitoring and Data Analysis team
- NBC Laboratory
- Policy, Planning, & Regulation staff

Data and Presentations are available on NBC Website at

<http://snapshot.narrabay.com>

