



NATIONAL WATER QUALITY MONITORING COUNCIL  
*Working Together for Clean Water*

# AGRICULTURAL CHARACTERIZATION, LANDUSE ASSESSMENT AND MST IN THE WRECK POND WATERSHED

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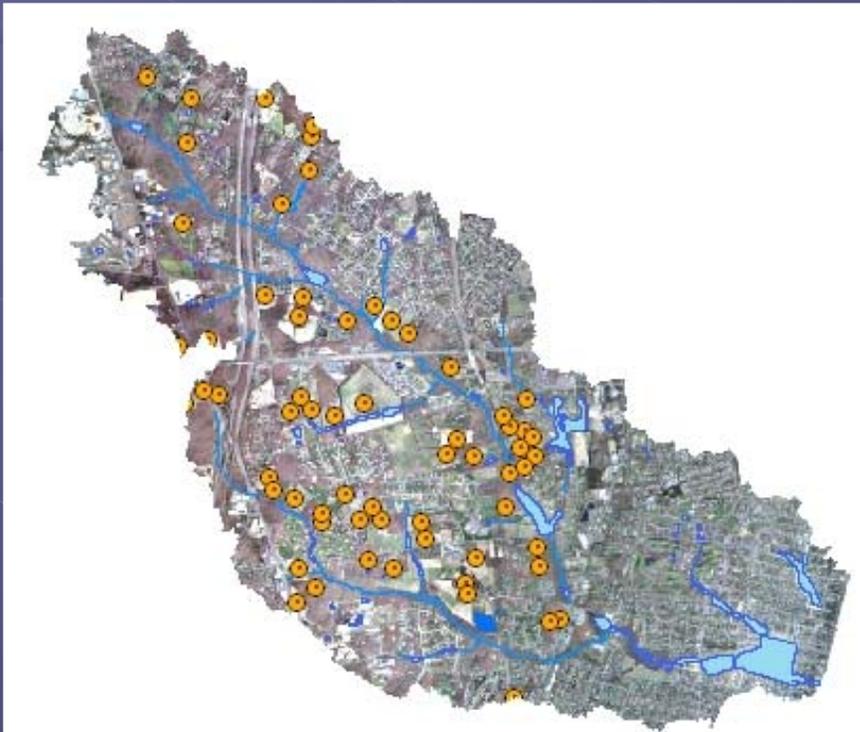
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# KNOW YOUR WATERSHED

- CHARACTERIZE
- INVENTORIZE
- VISUALIZE
- QUALIFY
- QUANTIFY
- CLARIFY PROBLEMS
- REMEDIATE
- EVALUATE

# Tier 1- Ag & Rec Land Characterization

- 2005 Tax Atlas
- GIS LU & Mail Aerial Photos
- Ag Land Survey
- Local Agent Knowledge



RCRE Wreck Pond Agricultural Assessment ID# \_\_\_\_\_  
Page 1

 NJ AGRICULTURAL EXPERIMENT STATION  
**RUTGERS**  
COOPERATIVE RESEARCH & EXTENSION

Agricultural Assessment

Please take a few moments to contribute to this research project. All submitted data will only be used to summarize information about the total amount and character of farmland in the Wreck Pond Brook Watershed. Please circle the appropriate answer to each question. If a line or box is provided, please fill in the information asked for if applicable.

**Assessment Section**

1. Are you the owner or renter of an agricultural property in Wall Township?  
YES NO Not Sure (explain)
2. Is this property currently being used for agriculture?  
YES NO Not Sure (explain)
3. Has this property been used for agriculture within the last 5 years?  
YES NO Not Sure (explain)
4. Is there a stream or drainage area running through this property?  
YES NO Not Sure (explain)
5. What is the size of this property?  
0-5 Acres 5.1-20Acres 20.1-50 Acres more than 50 Acres
6. What is the size of the property currently in agricultural use?  
0-5 Acres 5.1-20Acres 20.1-50 Acres more than 50 Acres

**If the answers to the above questions are "NO", and the answer to 5 is zero, you are finished. Thank you, and please return the survey.**

7. What type of agriculture occurs on this property? Circle all that apply.  
Crop/Vegetable Orchard/Vineyard Livestock/Animals Ornamentals/Nursery Other
8. Are there domestic animals or livestock on this property?  
YES NO Not Sure (explain)



# Ag and Rec Land Assessment

## *Agricultural Land Results*

Land Use	Size (acres)	Area Actively Farmed (acres)
Pasture	164.17	128.18
Crop	836.62	382.53
Nursery	27.71	17.35
<b>Total</b>	<b>1208.5</b>	<b>528.06</b>

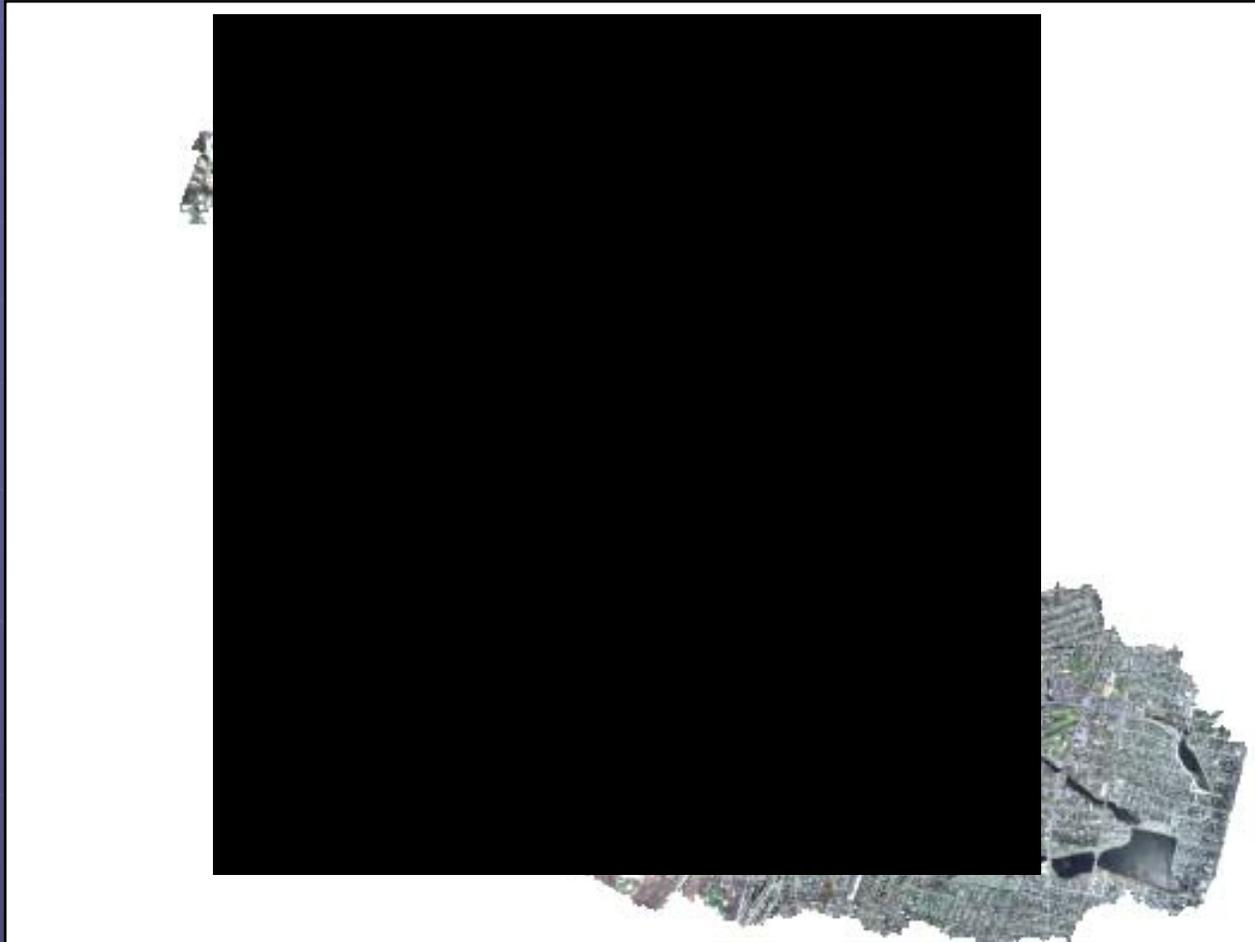
## *Recreational Land Results*

Land Use	Size (acres)	Impervious (acres)
Recreational	140.25	9.38
Golf Course	369.2	50
Athletic Field	23.92	0
<b>Total</b>	<b>533.37</b>	<b>59.38</b>

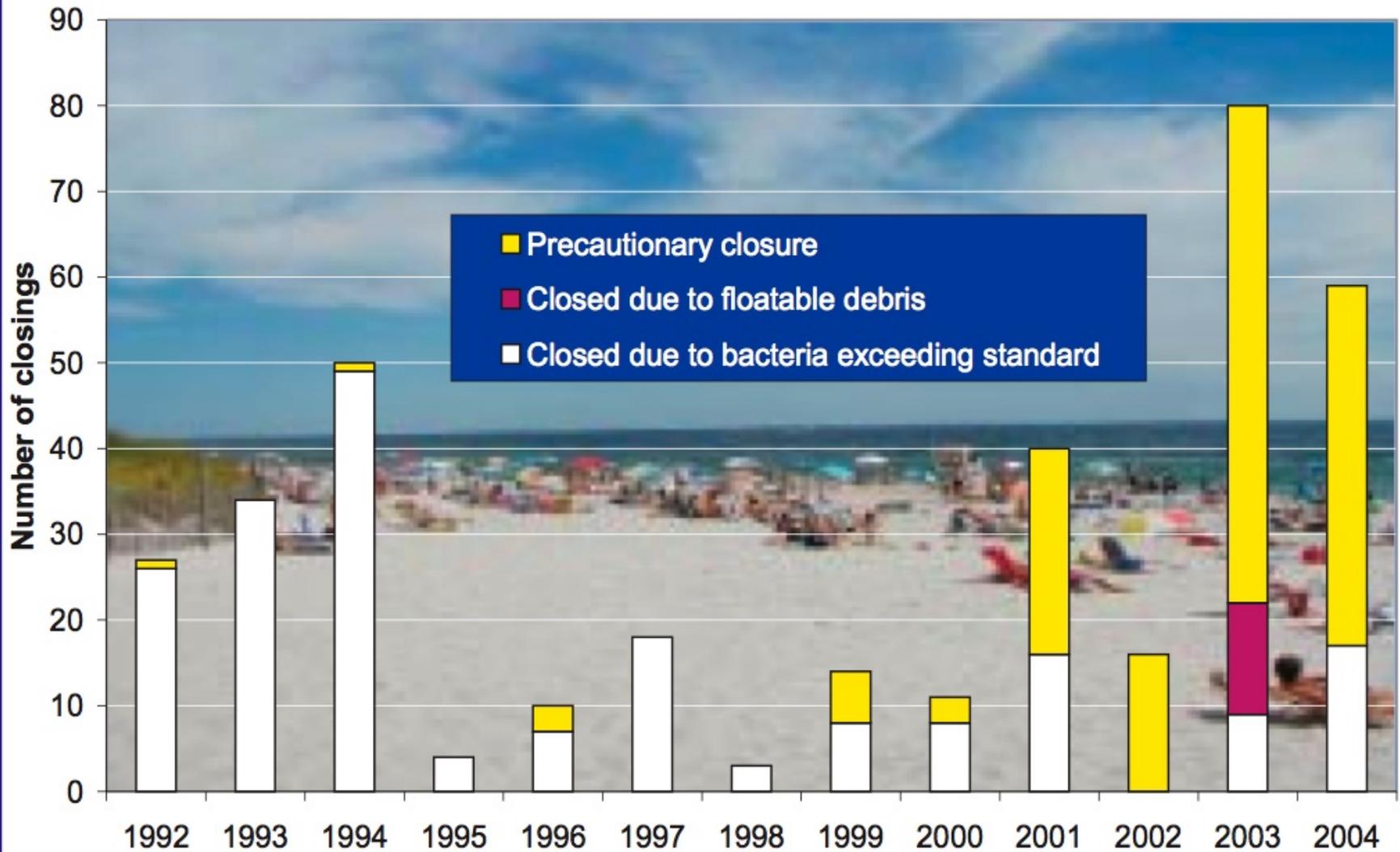
## *Livestock Results*

Animal	Total Animal Number	Number of Owners
Chickens	70	2
Cows	12	1
Cats/Dogs	3	3
Horses	78	2
Mini Donkeys	7	2
Pigs	4	1
Rabbits	40	1
Sheep	5	1
<b>Total</b>	<b>219</b>	

# Visualizing, Assessing & Modeling

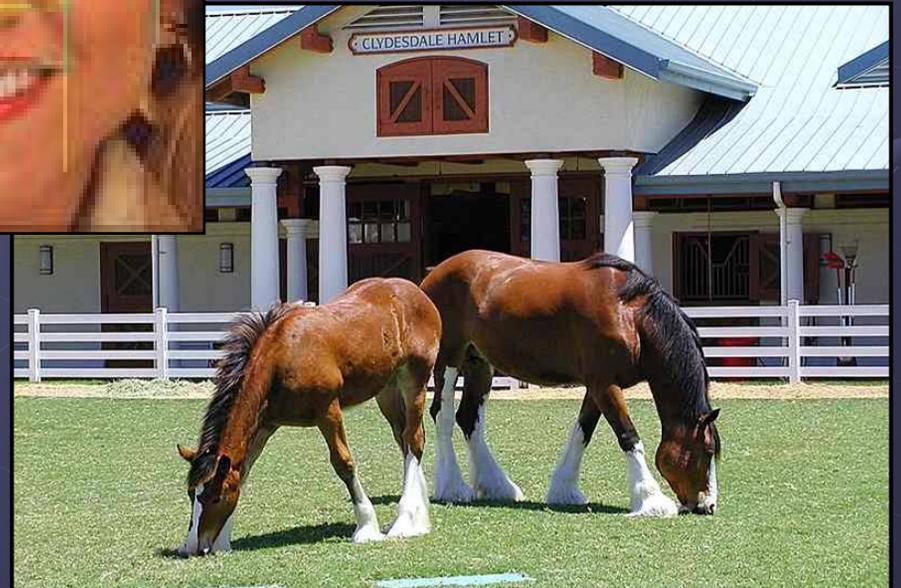
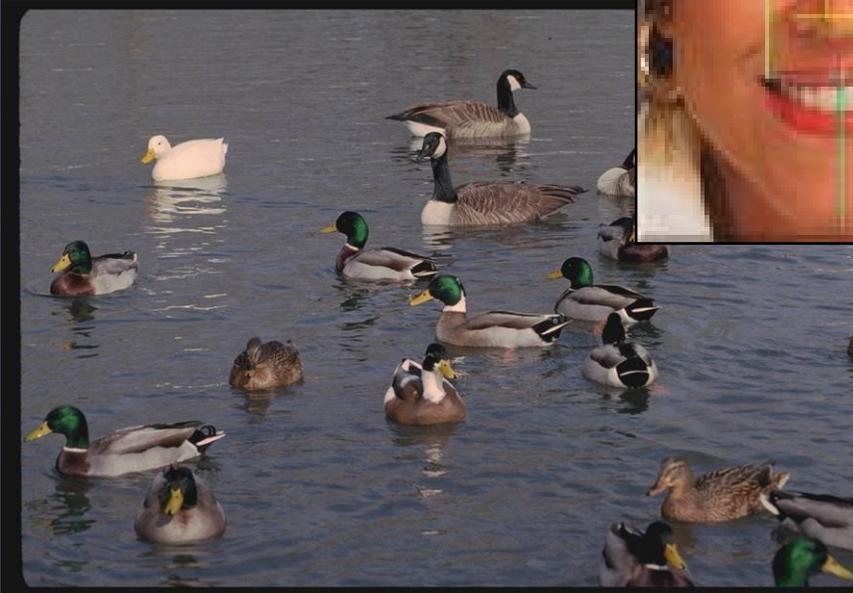
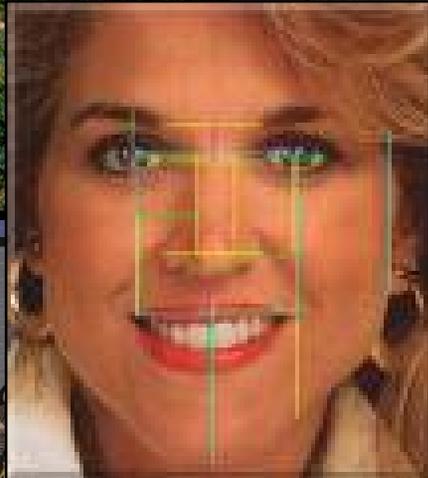


## Ocean Beach Closings



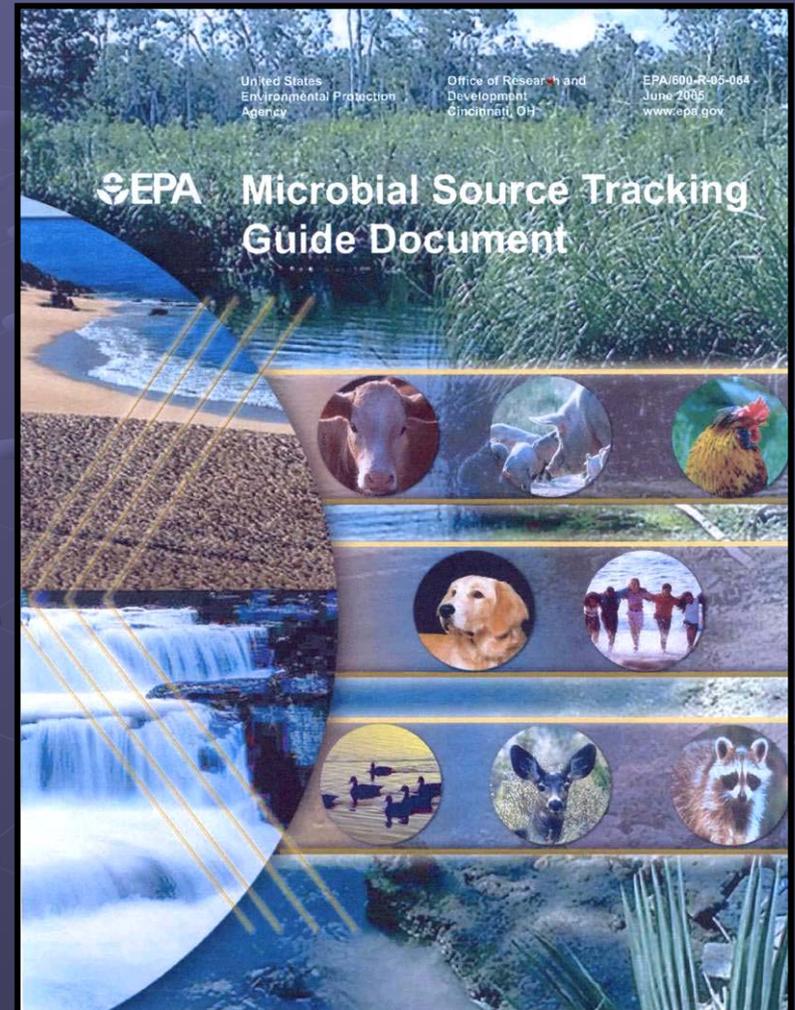
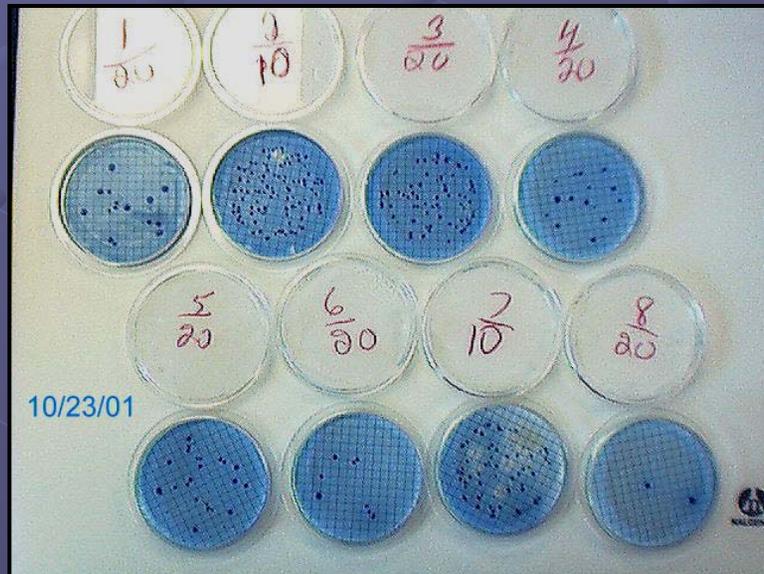
# Bacterial Sources of Pollution

## The Usual Suspects

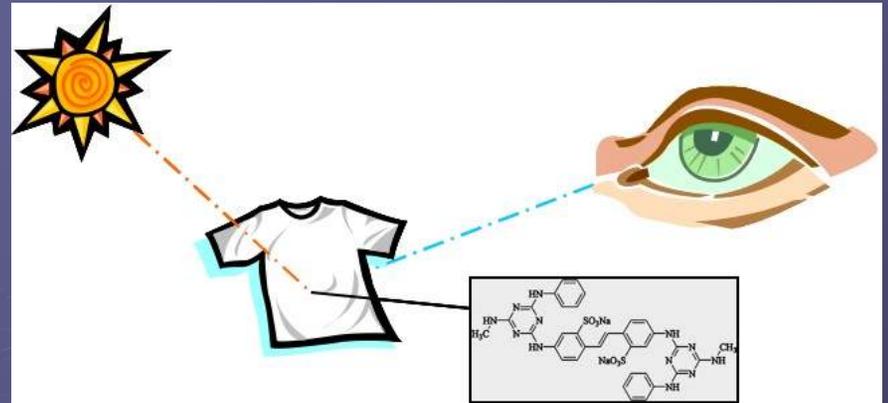


# MST Indicators & Pathogens

- Fecal coliforms
- Escherichia coli
- Enterococcus species
- Animal specific bacteriophage
- Human enteric viruses
- Bacteroides-Prevotella



# MST Tier 2 Optical Brighteners



- Fluorescent white dyes added to laundry detergents produce a “brighter white”
- Fluoresce under ultra violet light
- Are a definitive HUMAN indicator
- Persist in the environment, for a limited time
- Present in septic and sewer wastewater
- Indicates presence of untreated human effluent



# MST Tier 3 - qPCR

## Microbial Speciation-ID

### ● Polymerase chain reaction

- Highly qualitative
- Potentially quantitative
- Decreasing in cost
- Non-regulatory
- Fast turnaround



# MST Assessment in the Wreck Pond Watershed

## Study Objectives

- Identify sources of pathogen contamination using microbial source tracking techniques
- Match sources to land uses within the watershed
- Develop best management practice (BMP) recommendations that are matched with sources
- Align recommendations with regional stormwater management initiatives

# MST Assessment in the Wreck Pond Watershed

## Potential Sources of Bacterial Contamination: The Usual Suspects

- Stormwater and runoff
- Recreational and commercial vessels
- Pets (cats and dogs)
- Avifauna (waterfowl, gulls, etc.)
- Wildlife (raccoons, deer, etc.)
- Farm Animals (horses, cows, chickens, etc.)

# MST Assessment in the Wreck Pond Watershed

## Microbial Source Tracking: What Is It?

- Microbiological and molecular biology methodologies that discriminate sources of fecal bacteria in waterways
- This approach is an important step towards designing and implementing effective best management practices for controlling fecal pollution

# MST Assessment in the Wreck Pond Watershed

## Microbial Source Tracking Using Antibiotic Resistance Analysis (ARA)

- ARA can discriminate among fecal bacteria from various host groups (human and non-human)
- ARA data can be used to rule out some sources of contamination and identify potential important sources of contamination



# Experimental Approach: Antibiotic Resistance Analysis (ARA)

Collect Samples at Representative Stations



Membrane Filtration & Culture on Modified  
mTEC Agar



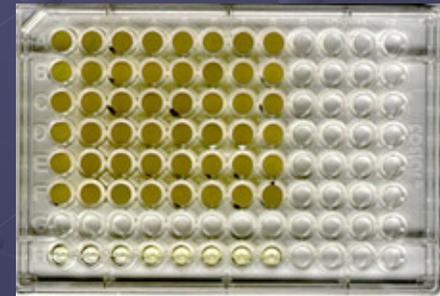
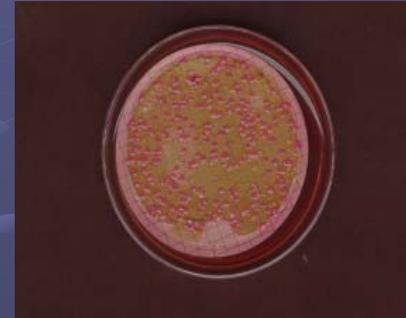
Mac-Positive Colonies Cultured in  
48-Well Tissue Culture Plate



Replica Plate Isolates onto Control  
Plates & 12 Antibiotic Plates



ARA Patterns for Samples Compared to  
ARA Patterns from Fecal *E. coli* ARA  
Database



# MST Assessment in the Wreck Pond Watershed

## ARA Results

- Multiple sources exist in the watershed, including human, avifauna, wild animals
- Patterns matching human suggest problems with sewage and stormwater infrastructure
- Inadequate manure management practices in areas with concentrations of farm animals may also contribute to bacterial loadings in western reaches
- Pets do not appear to be causing problems
- Sediments may be a reservoir for bacteria and resuspension of viable sediment-bound bacteria may be an issue

SOURCE CATEGORY	MANAGEMENT STRATEGIES	POTENTIAL RESPONSIBLE ENTITY
Human		
Septic Systems	<ul style="list-style-type: none"> <li>•Septic system maintenance, replacement, remediation, and proper closure</li> </ul>	<ul style="list-style-type: none"> <li>•Individual citizens</li> </ul>
	<ul style="list-style-type: none"> <li>•Conduct sanitary surveys to identify inadequate operation and maintenance of on-site disposal systems</li> </ul>	<ul style="list-style-type: none"> <li>•Municipalities</li> </ul>
	<ul style="list-style-type: none"> <li>•Adopt and enforce septic management ordinances and programs</li> </ul>	<ul style="list-style-type: none"> <li>•Municipalities</li> </ul>
Sewage Conveyance Facilities	<ul style="list-style-type: none"> <li>•Conduct infrastructure surveys and implement corrective actions (maintenance and repair)</li> </ul>	<ul style="list-style-type: none"> <li>•Municipalities</li> <li>•Sewerage Authority</li> </ul>
Storm Sewer Systems	<ul style="list-style-type: none"> <li>•Conduct infrastructure surveys and implement corrective actions (maintenance and repair)</li> </ul>	<ul style="list-style-type: none"> <li>•Municipalities</li> </ul>
	<ul style="list-style-type: none"> <li>•Investigate and repair illicit connections of sanitary sewers to storm sewer systems</li> </ul>	<ul style="list-style-type: none"> <li>•Municipalities</li> <li>•Sewerage Authorities</li> </ul>
	<ul style="list-style-type: none"> <li>•Implement measures required under municipal stormwater permitting program and any additional measures determined in the future to be needed through the TMDL process</li> </ul>	<ul style="list-style-type: none"> <li>•Municipalities</li> <li>•Regional Planning Group</li> </ul>

SOURCE CATEGORY	MANAGEMENT STRATEGIES	POTENTIAL RESPONSIBLE ENTITY
Wildlife		
Waterfowl	<ul style="list-style-type: none"> <li>• Educate citizens to avoid feeding waterfowl</li> </ul>	<ul style="list-style-type: none"> <li>• Municipalities</li> <li>• Individual citizens</li> </ul>
	<ul style="list-style-type: none"> <li>• Develop and implement a waterfowl population management plan (habitat modification; reproduction control)</li> </ul>	<ul style="list-style-type: none"> <li>• Municipalities</li> </ul>
		<ul style="list-style-type: none"> <li>• Municipalities (permits may be needed)</li> </ul>
Other Indigenous Wildlife	<ul style="list-style-type: none"> <li>• Increase animal control efforts (trapping and removal)</li> </ul>	<ul style="list-style-type: none"> <li>• Municipalities</li> </ul>
	<ul style="list-style-type: none"> <li>• Riparian buffer restoration</li> </ul>	<ul style="list-style-type: none"> <li>• Municipalities</li> </ul>







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# COMMENTS – QUESTIONS?

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