



Freshwater Harmful Algal Blooms In Rhode Island

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Presentation Overview

- Algae and Algae Blooms
- Cyanobacteria and Harmful Algal Blooms
- Cyanobacteria Blooms in Rhode Island
- RI's Cyanobacteria Monitoring and Bloom Response Program
- Case Study- Cyanobacteria in Drinking Water Supplies- Newport Reservoirs

Freshwater Algae- what are they and why are they important?



- A diverse collection of aquatic organisms that, in general, have the ability to produce their own food through the process of photosynthesis.
- Make up an important part of the food web in aquatic ecosystems. Form the basis of aquatic food web.
- They provide oxygen as a by-product of photosynthesis, a food source for other organisms such as zooplankton, insects and snails.
- Study of algae can supply useful information about the productivity and health of aquatic ecosystems. Some forms of algae are indicative of low nutrient conditions while others indicate high nutrient levels.
- Most common types:
 - Diatoms
 - Green Algae
 - Blue-Green Algae (Cyanobacteria)

What are Algae Blooms?



- All types of algae can cause 'blooms' under ideal conditions
 - Generally considered an indication of environmental stress
- Defining Characteristics
 - Extremely high algae densities (20,000-100,000 and > cells/ml)
 - Domination by a single species (or a few)
 - Visible accumulation of algae, Clear and distinct discoloration of water
- Causal Factors
 - Nutrients
 - Water Temp
 - pH
 - Circulation
 - Hydrology
 - Weather
 - Temp
 - Sunlight
 - Wind



Cyanobacteria Bloom Melville Pond 2015



Credit: NYSDEC- Green Algae Bloom



Why are algae/cyanobacteria blooms a problem?

- Aquatic Life

- Low Dissolved Oxygen
- Fish Kills
- Shading- Loss of other algae
- Changes in Community Structure and Composition

- Economic Concerns

- Loss of recreational value
- Aesthetic concerns
- Property Values
- Taste and odor issues
- Disinfection by-product link
- Added drinking water treatment costs

- Health Concerns (Pets and Humans)

- Toxicity (Cyanobacteria only)
- Disinfection by-product link

Gardiner Pond- fish kill 2015



Warwick Pond 2015



Bloom and Bust: Toxic Algae's Impact on Nearby Property Values

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Cyanobacteria and Harmful Algal Blooms

- Cyanobacteria are also known as blue-green algae
- Cyanobacteria are a phylum of bacteria that obtain their energy through photosynthesis.
- Cyanobacteria are a natural part of freshwater plankton but dominate under high nutrient/temperature conditions
- Some cyanobacteria can produce toxins harmful to people and pets
- The toxins can affect:
 - Liver
 - Nervous system
 - Skin
- When a bloom is shown to exhibit toxicity its referred to as a HAB

Gardiner Pond 2015

Who are Rhode Island's Common Cyanobacteria?



Woronchinia



Image by Jason Oyadomari posted online

Anabaena



Image by UNH posted online

Microcystis

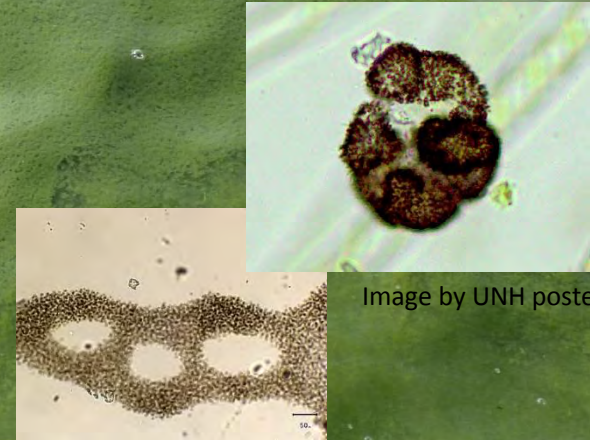


Image by UNH posted online

Also: *Planktothrix* and *Aphanizomenon*



What types of Toxins to Cyanobacteria Produce?

- Hepatoxins (liver)
 - Microcystins, cylindrospermopsin, nodularin
 - Symptoms of exposure:
 - Vomiting
 - Diarrhea
 - Fever
 - Cramps
- Neurotoxins (nervous system)
 - Anatoxins, saxitoxins
 - Symptoms of exposure:
 - Paralysis
 - Seizure
- Dermatoxins (skin)
 - Lyngbyatoxin
 - Symptoms of exposure:
 - Skin lesions
 - Rashes
 - Eye, Ear, Throat Irritation



Credit: RIDEM

How can you be exposed to cyanotoxins?



- Humans
 - Accidental Ingestion or inhalation
 - Inhalation of aerosolized toxins
 - Skin exposure (dermal contact)
- Pets
 - Ingestion (Directly or indirectly)
 - Skin exposure (dermal contact)



Credit: Ohio Dept. of Health

Credit: Wilson Lab, Auburn University

www.pethealthcare.co.za

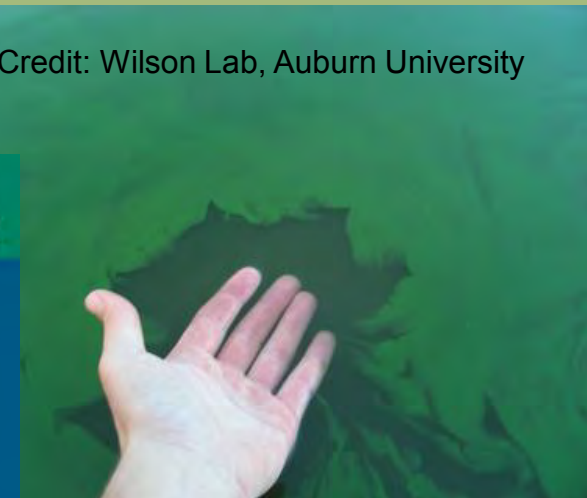


Credit: pethealthcare.co.za

CYANOBACTERIA BLOOMS
When in doubt, it's best to keep out!



Credit: CDC







Sisson Pond
2016/07/15



Nonquit Pond

2015/ 7/29



Turner Reservoir 2007



Rhode Island's Cyanobacteria Monitoring and Bloom Response Program

Lawton Valley Reservoir 2016



Response to Reports of Cyanobacteria Blooms

- DEM staff respond to all reports of cyanobacteria blooms and ask that individuals e-mail photos of the suspected bloom to DEM (before staff are deployed).
- DEM staff conduct site visit to visually inspect waterbody and collect samples from representative location(s).
- DEM staff conduct microscopic examination of sample(s) to confirm presence of cyanobacteria species and estimate cell densities.
- Sample(s) are sent to laboratory for analysis of toxin analysis, and cyanobacteria identification and enumeration (dependent on funding availability).
- Public health advisory issued if visual and/or analytical threshold criteria are exceeded



RI Public Health Advisory Criteria



- Developed by DOH/DEM in 2010, based largely on advisory established by MA Department of Public Health
- DOH/DEM jointly issue health advisory when any of the following three guidelines, indicating presence of a bloom, are met:
 - Evidence of widespread or significant visible scum or mat present, or waterbody-wide bloom
 - Total Cyanobacteria Cell Count > 70,000 cells/ml
 - Microcystin toxin concentration > 14 ppb



Response to Confirmed Cyanobacteria Blooms



- HEALTH issues joint DOH/DEM press release.
- HEALTH sends letters informing affected municipalities of the advisory and requesting that signs be placed at places of public access informing public of the health advisory
- HEALTH posts advisories on social media feed (HEALTH Facebook page and Twitter)
- Utilizes email listserves to notify volunteer monitors, lake associations, and watershed groups



RI's Cyanobacteria Health Advisory



- Instructs individuals to avoid all contact with the affected waterbody, including recreational activities such as swimming, boating, or fishing.
- People are also advised to not eat fish from the affected waterbody or to allow pets to wade or swim in, or drink untreated water from the affected waters.
- Health advisories remain in effect for the remainder of the recreation season (November 1st), unless follow-up sampling by a city, town, or other party indicate that the advisory can be lifted.



Process for Rescinding a Cyanobacteria Public Health Advisory

- Health advisories may be lifted after two successive and representative sampling rounds, two weeks apart, demonstrating:
 - no evidence of a cyanobacterial scum or mat
 - cyanobacteria cell counts and toxin levels below threshold concentrations.
- Due to lack of state funding, municipality, lake association, watershed group, or other interested individuals are responsible for follow-up sampling

Confirmed Harmful Algal Blooms 2011-2017



Waterbody	Town
Blackamore Pond J.L. Curran Reservoir Spectacle Pond	Cranston
Omega Pond Turner Reservoir Ten Mile River	East Providence
Watson Reservoir	Little Compton
Scott Pond	Lincoln
Bailey Brook Easton Ponds – North & South Gardiner Pond Paradise Pond	Middletown
Almy Pond	Newport
Slater Memorial Park Pond	Pawtucket
Lawton Valley Reservoir Melville Ponds Sisson Pond St. Mary's Pond	Portsmouth
Mashapaug Pond Roger Williams Park Ponds	Providence
Slack Reservoir	Smithfield-Johnston
Barber Pond	South Kingstown
Warwick Pond	Warwick



If you suspect a cyanobacteria bloom:

- Report the suspected bloom to DEM at 222-4700
- Take a photograph of the bloom and send it to DEM (DEM and DOH are investigating creation of a “Cyanobacteria” email address and will provide email address once it is established)
- Prevent exposure to potential toxins and other harmful affects of cyanobacteria blooms!
 - People, pets and livestock should avoid contact with water that is discolored or has a scum on the surface

Cyanobacteria and the Drinking Water Perspective- Case Study- Newport Reservoirs



Why are excess algae and cyanobacteria a problem in drinking water supplies?

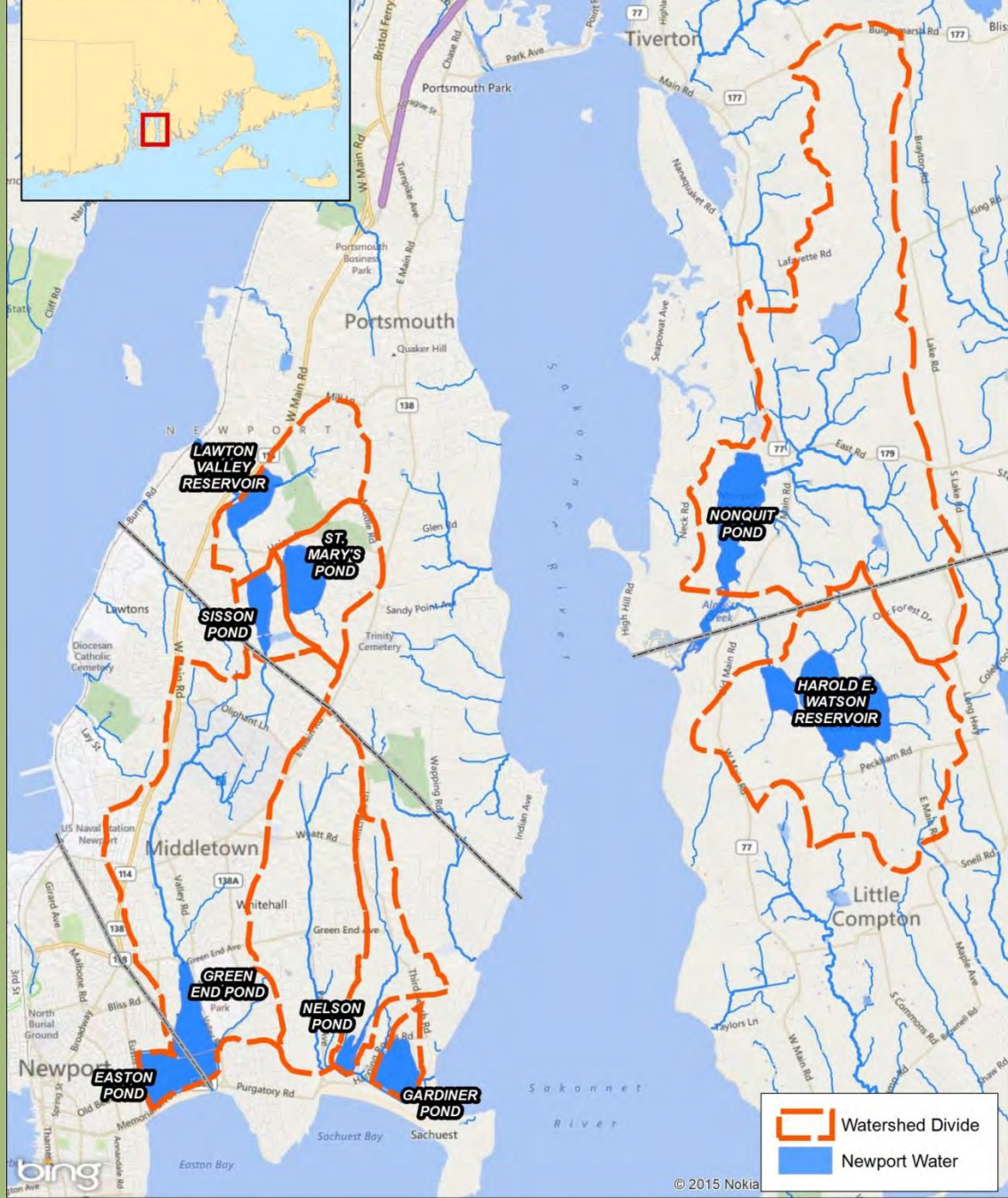


Taste and odor issues
Disinfection by-product link
Added drinking water treatment costs

SOURCE WATER PROTECTION INITIATIVE FOR NEWPORT WATER SUPPLY RESERVOIRS

Scott Ribas
Brian Zalewsky
RIDEM Office of Water Resources
June 11, 2015





Title:
Scale:
Date: 3/25/2015

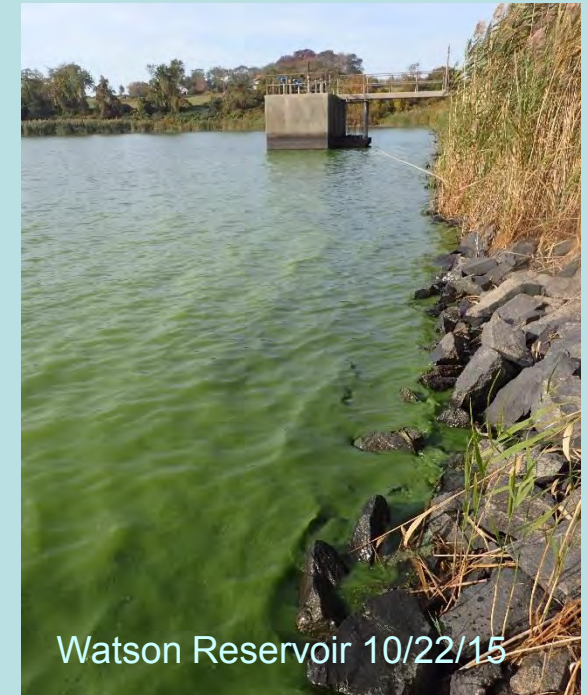


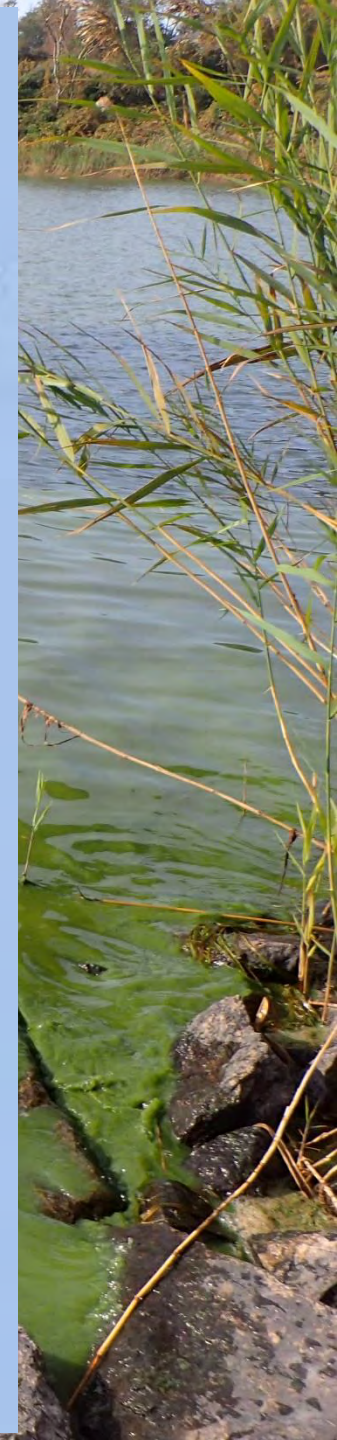
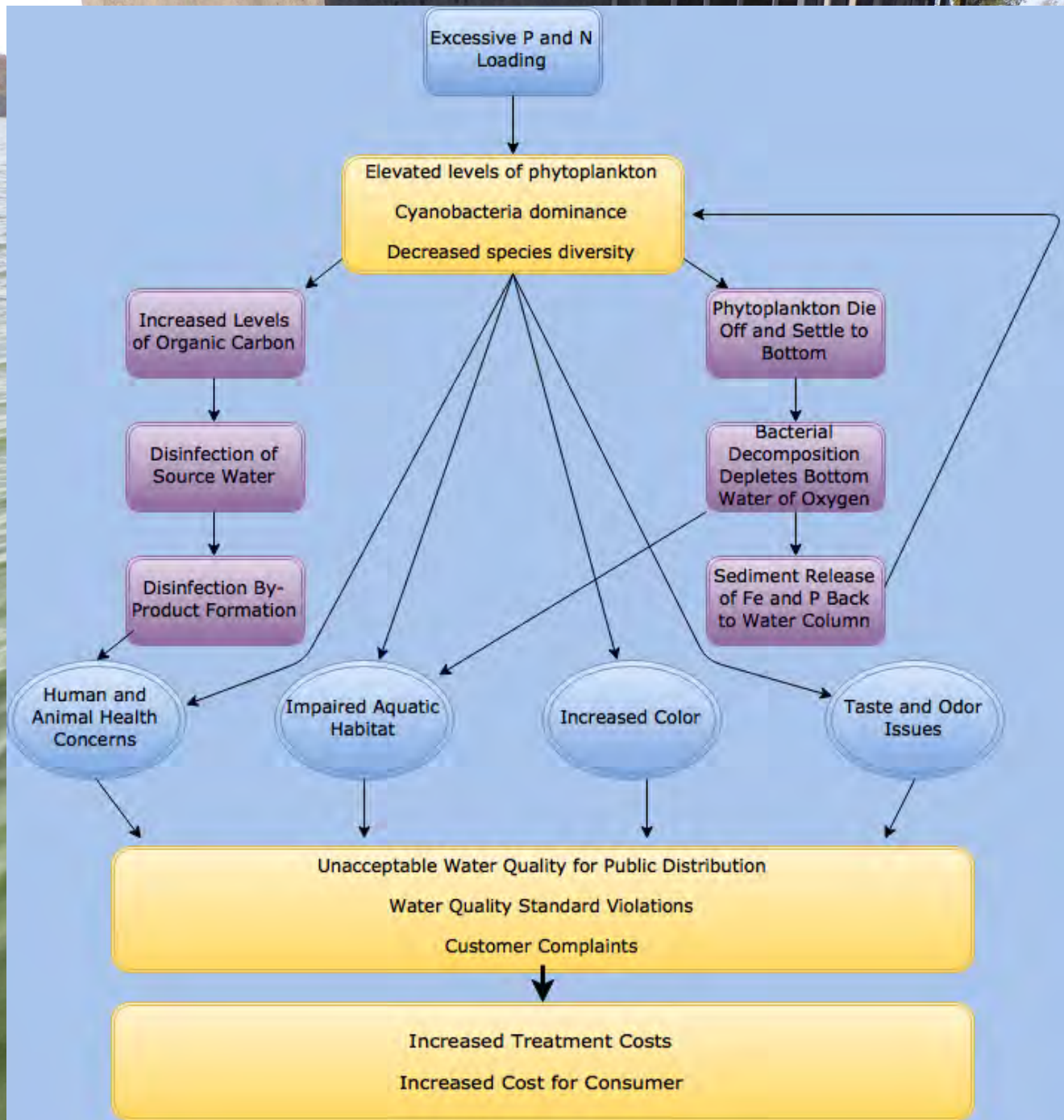
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Newport Reservoirs







Newport Water Supply Reservoirs TMDL Study Objectives

- Reduce phosphorus levels to a target concentration, which in turn is expected to reduce:
 - Algal/Phytoplankton biomass
 - Dissolved organic carbon
 - Disinfection by-product formation potential (TTHM)
 - Taste and odor issues
 - Frequency and severity of cyanobacteria blooms
 - Low oxygen levels in the reservoirs
- Identify pollutant sources contributing to the impairment
- Provide a framework (which includes both recommendations and requirements) to reduce sources of nutrients



TMDL Technical Approach Overview

- Conduct Monitoring of Nine Reservoirs (completed in 2015):
 - Investigate Total Phosphorus > chl a > DOC > DBP formation potential
 - Evaluate cyanobacteria bloom frequency, severity, & toxin formation
 - Obtain data to estimate release of phosphorus from reservoirs' sediments
- Establish target nutrient and chlorophyll a concentrations for the reservoirs
- Determine existing nutrient loads from watersheds and release of phosphorus from reservoirs' sediments
- Determine allowable nutrient loads and necessary reductions to achieve desired targets
- Identify sources of nutrients
- Identify watershed and stormwater management actions to achieve necessary reductions in phosphorus





Thank You

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South Easton Pond