Providence Stormwater Innovation Center

Providence Stormwater Monitoring Program with Will Helt & Ryan Kopp

The Nature Conservancy

Audubon Society of Rhode Island

Journey

1. What is stormwater and why do we want to manage it?
2. Why is management important in RI?
3. How does Roger Williams Park fit in?
4. What is the Providence Stormwater Innovation Center and what does it do?
5. What can you do?

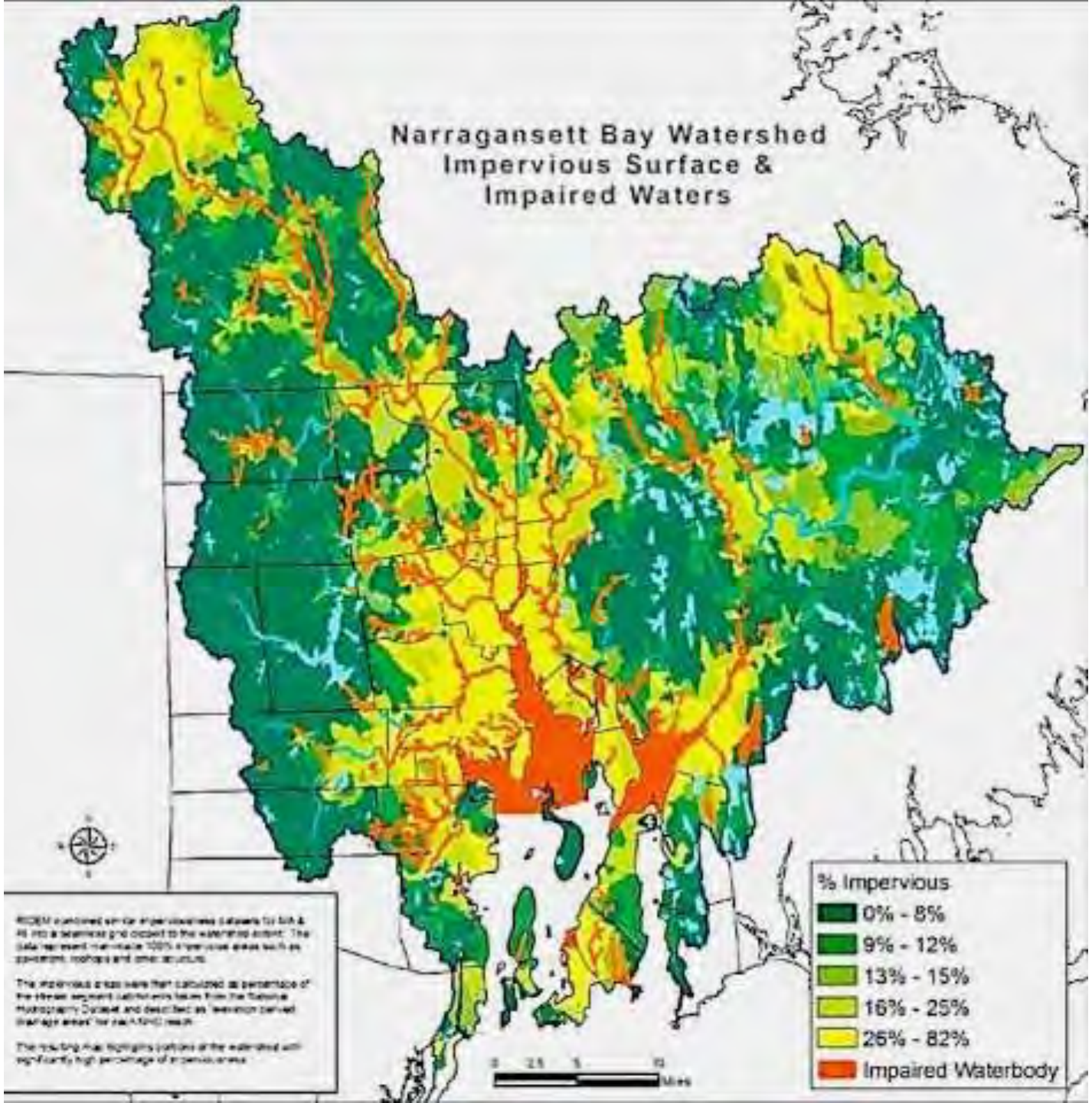
rain vs. stormwater?

Rain vs. Stormwater


INCOMING!
Dan Bousquet


Runoff from hard surfaces like roofs, driveways, and streets picks up pollutants like:
• Pet waste
• Litter
• Fertilizer
• Motor oils
• Chemicals
Polluted stormwater runoff flows directly into our local streams, the Potomac River, and eventually the Chesapeake Bay.

We start to see negative impacts to water quality ~8-10% impervious cover

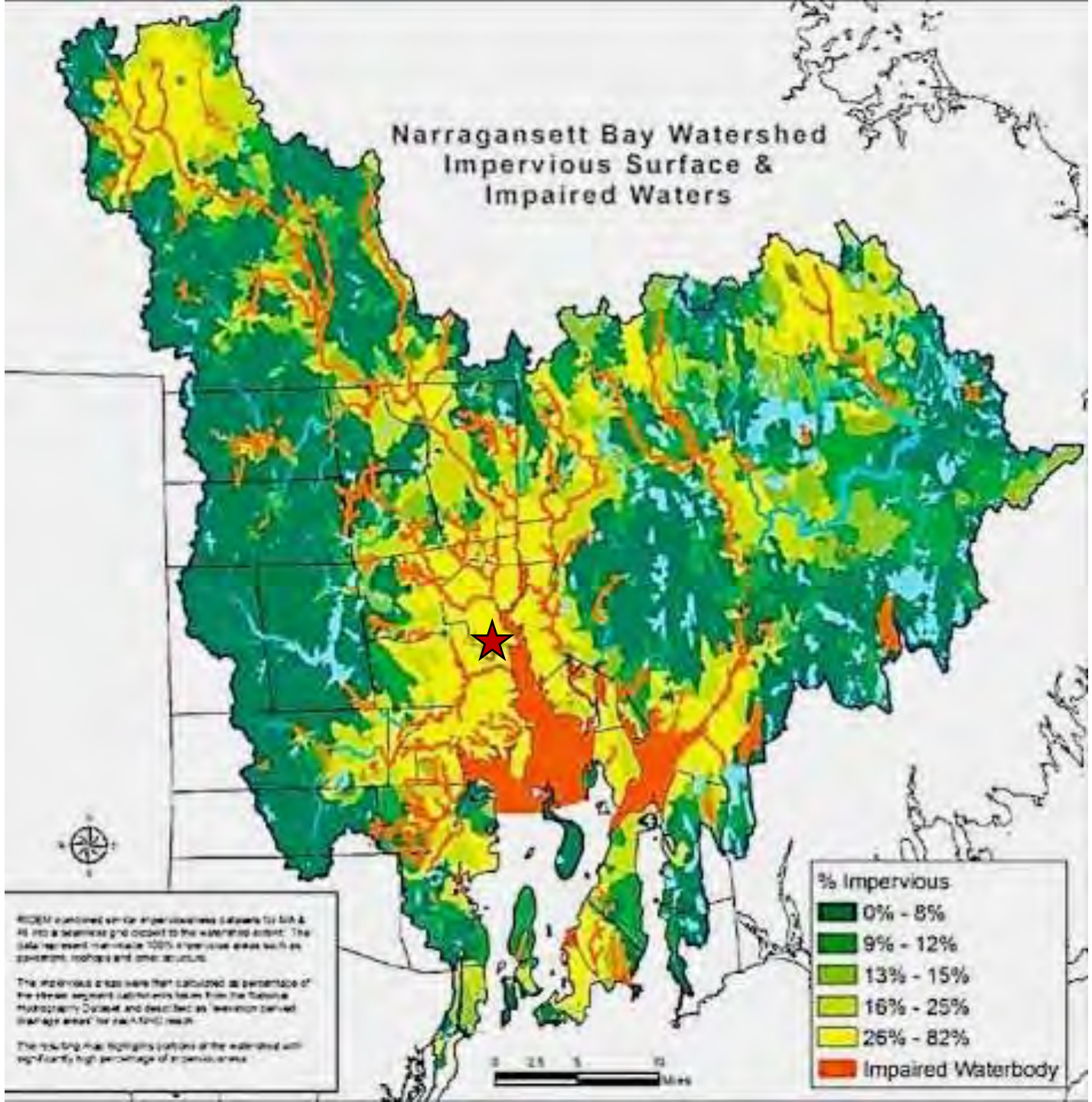


Polluted Waters

Flooding and Property Damage

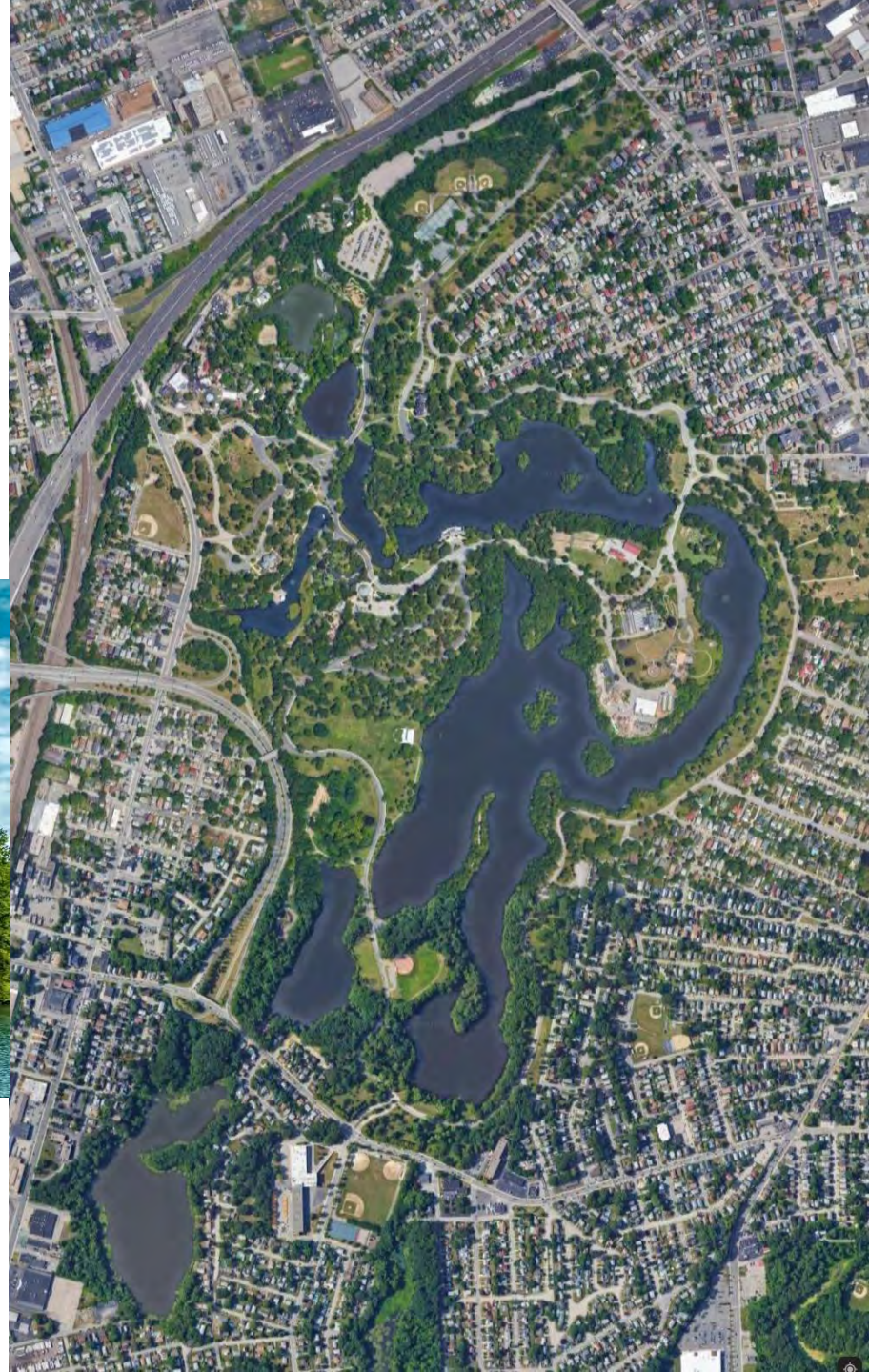
Aging and Inadequate Infrastructure

Why Roger Williams Park?



Roger Williams Park

- Bequeathed in 1871 by Betsey Williams
- Designed by Horace Cleveland to be “the people’s pleasure ground”
- Now spans 435 acres with 100 acres of water
- ~2 million visitors per year



STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

OFFICE OF COMPLIANCE & INSPECTION

IN RE: City of Providence **FILE NO.: OCI-WP 16-40**
X-ref RIPDES NO.: RIR040005

NOTICE OF VIOLATION

A. Introduction

Pursuant to Sections 42-17.1-2(21) and 42-17.6-3 of the Rhode Island General Laws, as amended, ("R.I. Gen. Laws") you are hereby notified that the Director of the Department of Environmental Management (the "Director" of "DEM") has reasonable grounds to believe that the above-named party ("Providence") has violated certain statutes and/or administrative regulations under the DEM's jurisdiction.

B. Administrative History

The DEM issued informal notices to Providence on 9 February 2009 and 24 November 2010 for the failure to comply with its storm water permit. The notices identified the actions required to correct the violations. In June 2012, the DEM met with Providence to discuss the actions required to correct the violations. To date, Providence has failed to comply with its storm water permit.

C. Facts

(1) On 19 December 2003, the DEM issued Rhode Island Pollutant Elimination System General Permit Number RIR040031 entitled "Storm Water Discharge from Small Municipal Separate Storm Sewer Systems and from Industrial Activity at Eligible Facilities Operated by Regulated Small MS4s" (the "General Permit").

(2) The General Permit authorizes the discharge of storm water from a small municipal separate storm sewer system ("MS4") that is operated by a municipality.

(3) Part I.C.2 of the General Permit required the MS4 operators to submit a completed Notice of Intent (the "NOI") and Storm Water Management Program Plan (the "SWMPP") to the DEM within 90 days of the effective date of the General Permit to obtain coverage under the General Permit.

(4) On 18 March 2004, Providence submitted to the DEM a NOI and SWMPP.

Restoring the Ponds in Roger Williams Park: Executive Summary

October 2013

Horsley Witten Group

Land & Coastal Services

Loon Environmental

Narragansett Bay Estuary Program

Providence Parks & Recreation

#	RECOMMENDATION
LWP-1	Water quality sampling
LWP-2	Public Outreach
LWP-4	Park Landscape -New Master Plan -Revised Mowing Operations -Shoreline Buffer Planting -Parkwide Planting -Erosion Control Actions
LWP-5	RWP Conservancy - Stratgegic Planning -Organizational Development -Advocacy and Fundraising
LWP-6	Chemically Treat: Weeds & Algae
LWP-7	Operations & Maintenance -Purchase Vacuum Truck -Ccatch basin cleaning -Enhanced street sweeping
LWP-8	Curb and pavement removals
LWP-9	Downspout Disconnections
LWP-10	Storm Water Retro-fits
LWP-11	Dredging Studies
LWP-12	Selective In-Pond Sediment Treatment

Structural BMPs

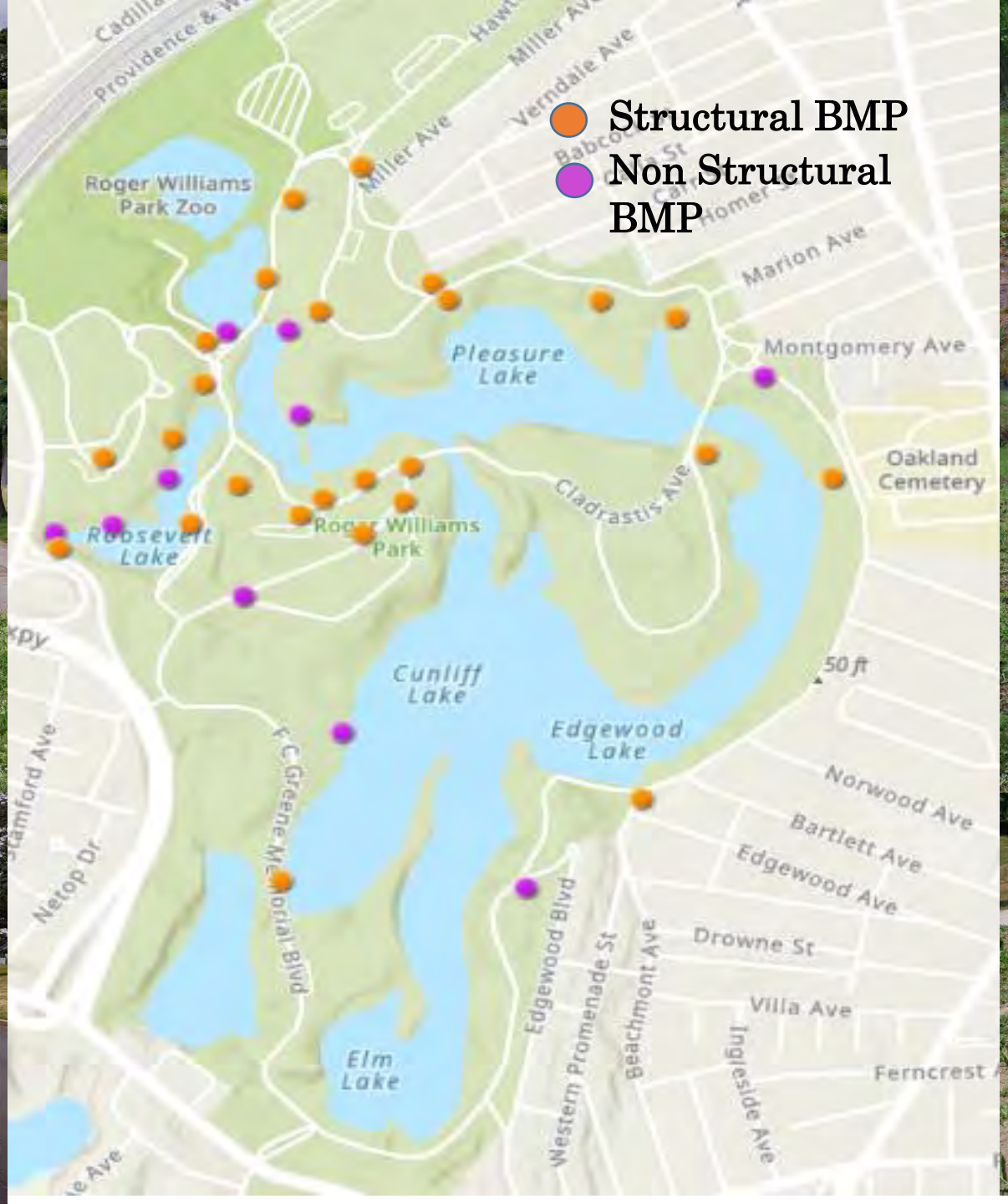
Infiltration Basin - Bioretention Basin

Other BMPs

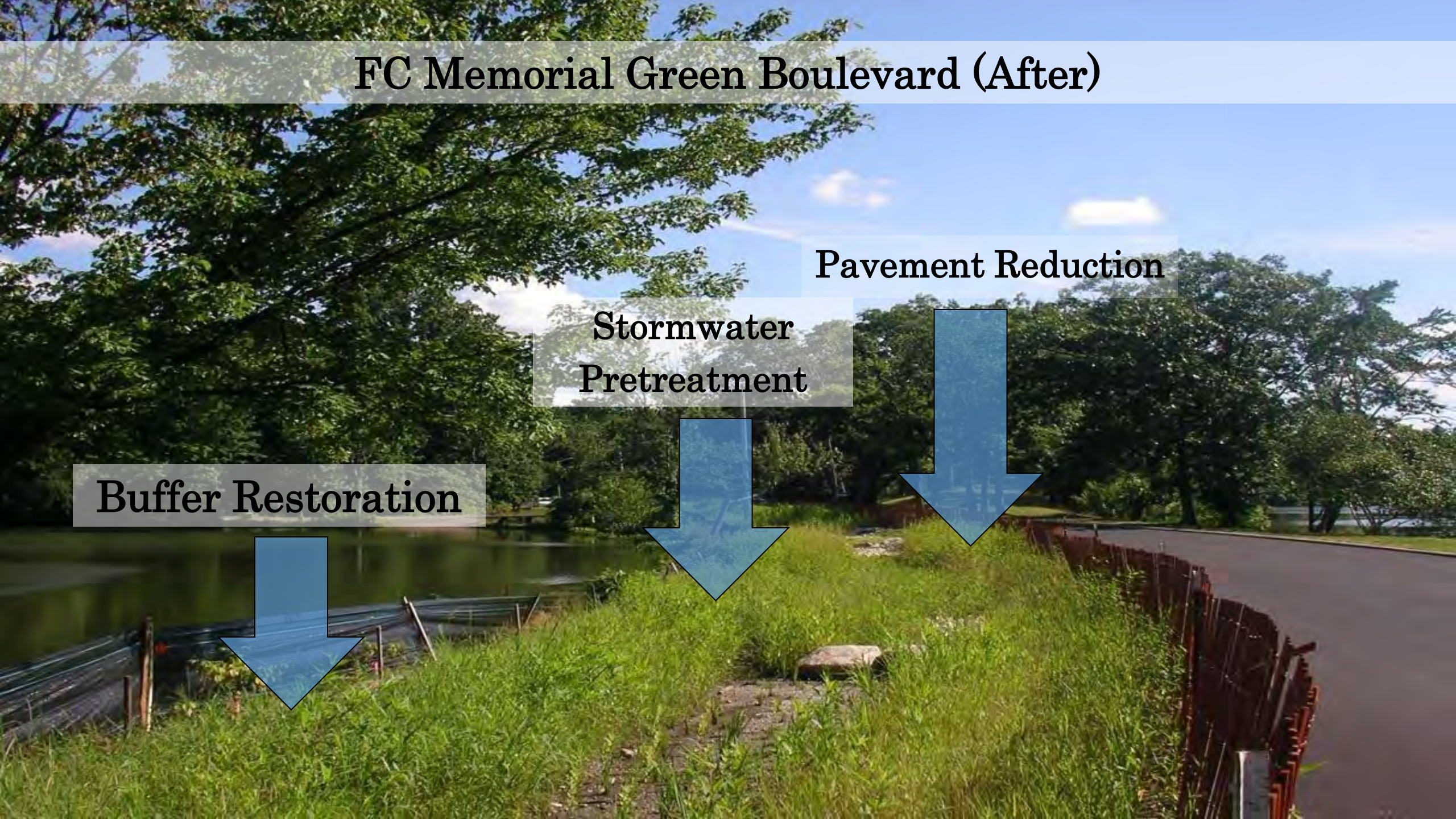
- Geese management
- Downspout disconnects
- No mow zones
- Pesticide free
- Leaf Collection

Non-Structural BMPs

- Buffer or Shoreline Plantings
- Impervious Area Management


Structural BMP
Non Structural BMP
Roger Williams Park Zoo
Pleasure Lake
Roosevelt Lake
Roger Williams Park
Cunliff Lake
Edgewood Lake
Elm Lake
Oakland Cemetery
Cladrastis Ave
Marion Ave
Montgomery Ave
Miller Ave
Verndale Ave
Edgewood Blvd
Western Promenade St
Beachmont Ave
Ingleside Ave
Drowne St
Villa Ave
Norwood Ave
Bartlett Ave
Edgewood Ave
Netop Dr
50 ft

FC Memorial Green Boulevard (Before)


FC Memorial Green Boulevard (After)
Pavement Reduction
Stormwater Pretreatment
Buffer Restoration

Providence Stormwater Innovation Center

Public Outreach – Training – Monitoring

PSIC Leadership Team

- Municipality
  - Brian Byrnes – PVD Parks
  - Lee Ann Freitas – PVD Parks
- NGOs
  - Ryan Kopp – Audubon Society of RI
  - Priscilla De La Cruz – Audubon Society of RI
  - Kevin Essington – RWP Conservancy
  - José Ramirez – RWP Conservancy
  - Wenley Ferguson – Save The Bay
  - Sheila Dormody – The Nature Conservancy
  - Meg Kerr – Retired
- Universities
  - Art Gold – URI
  - Jamie Houle – UNH

Visual Assessments

- Monthly Site Visits
- Site Visits after 1.5” rain events
- Site Visits during rain events
- Photo – Video Documentation
- Functionality Checklists


Functioning well


Unknown Issue affecting function

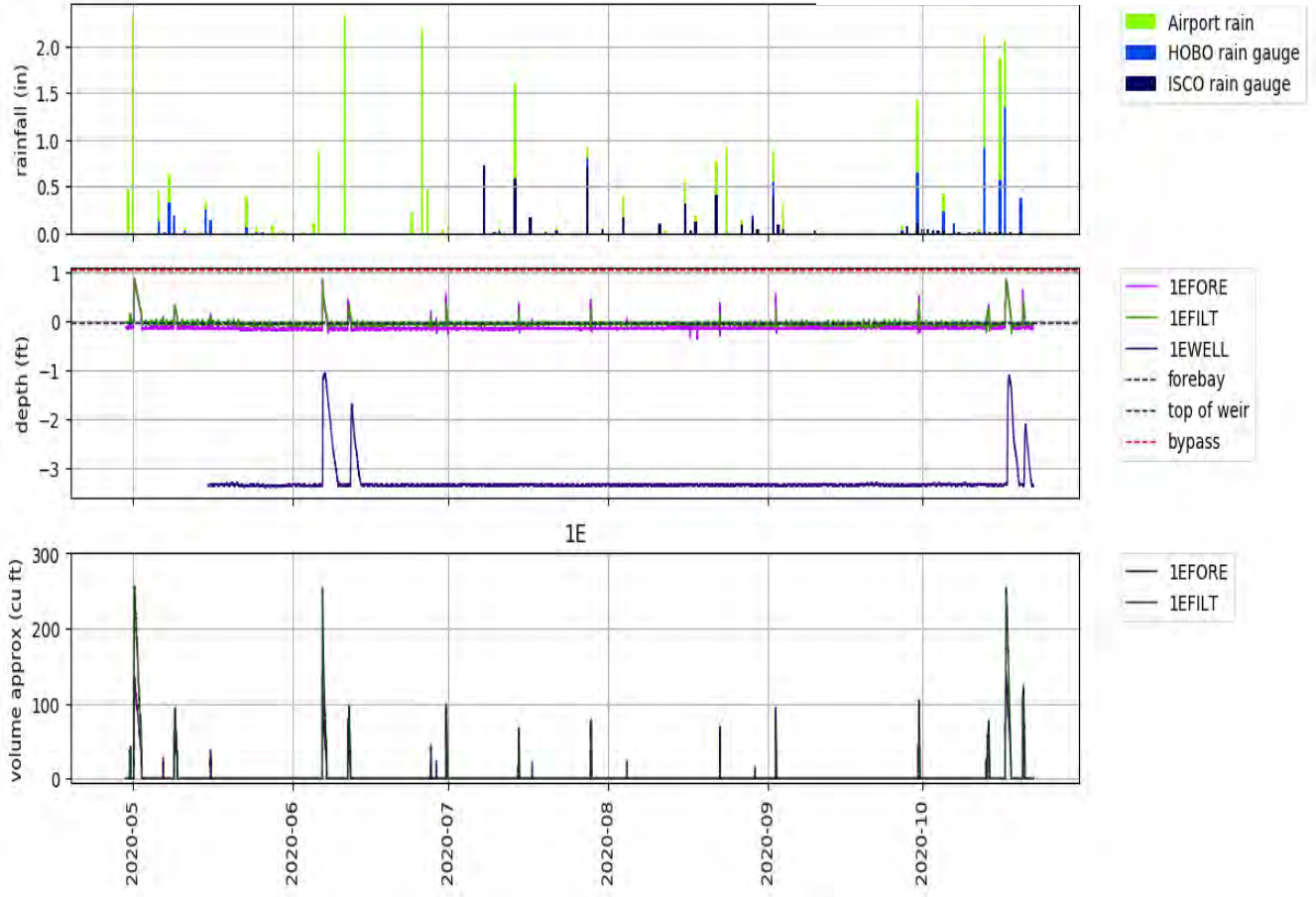

Functioning but not perfect


Maintenance affecting performance

Performance Monitoring

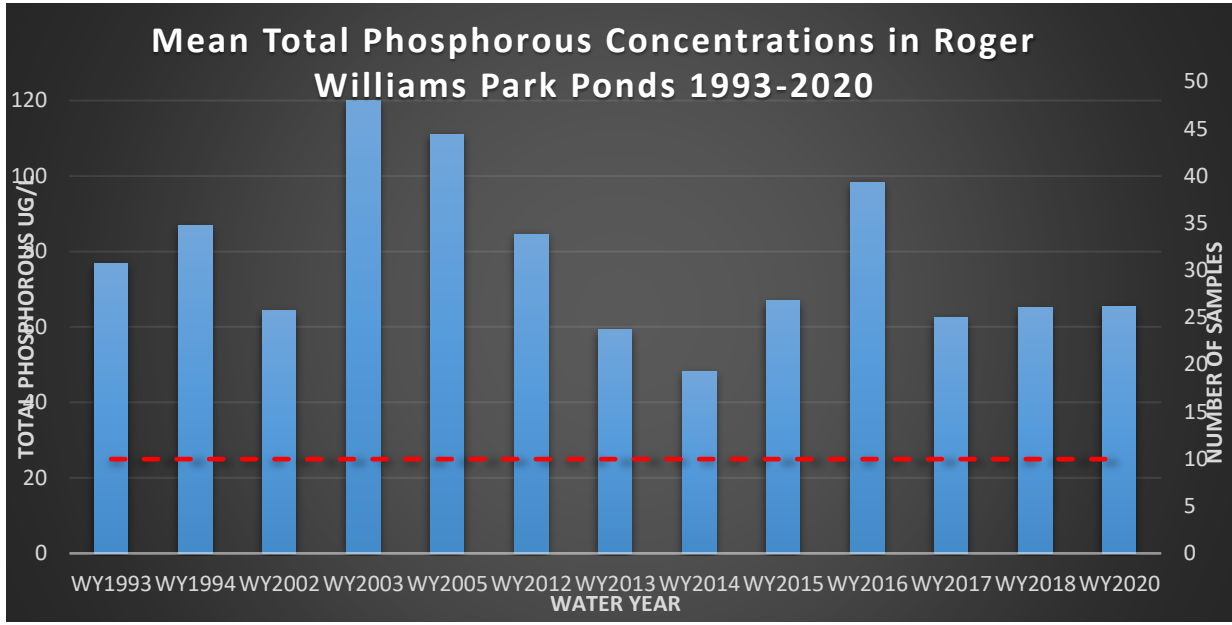
University of New Hampshire

- Logging pressure transducers in forebay, treatment area and well
- Survey the systems
- Compute volume of water entering the system
- Verify vs modeled volumes for a specific sized rain event
- Rotate tranducers between BMPs twice per year



Water Resource Monitoring

- Continuous Water Quality
- Continuous Streamflow
- Precipitation
- Volunteer Water Quality Sampling (Watershed Watch)



What is cyanobacteria?

(Blue-green algae)

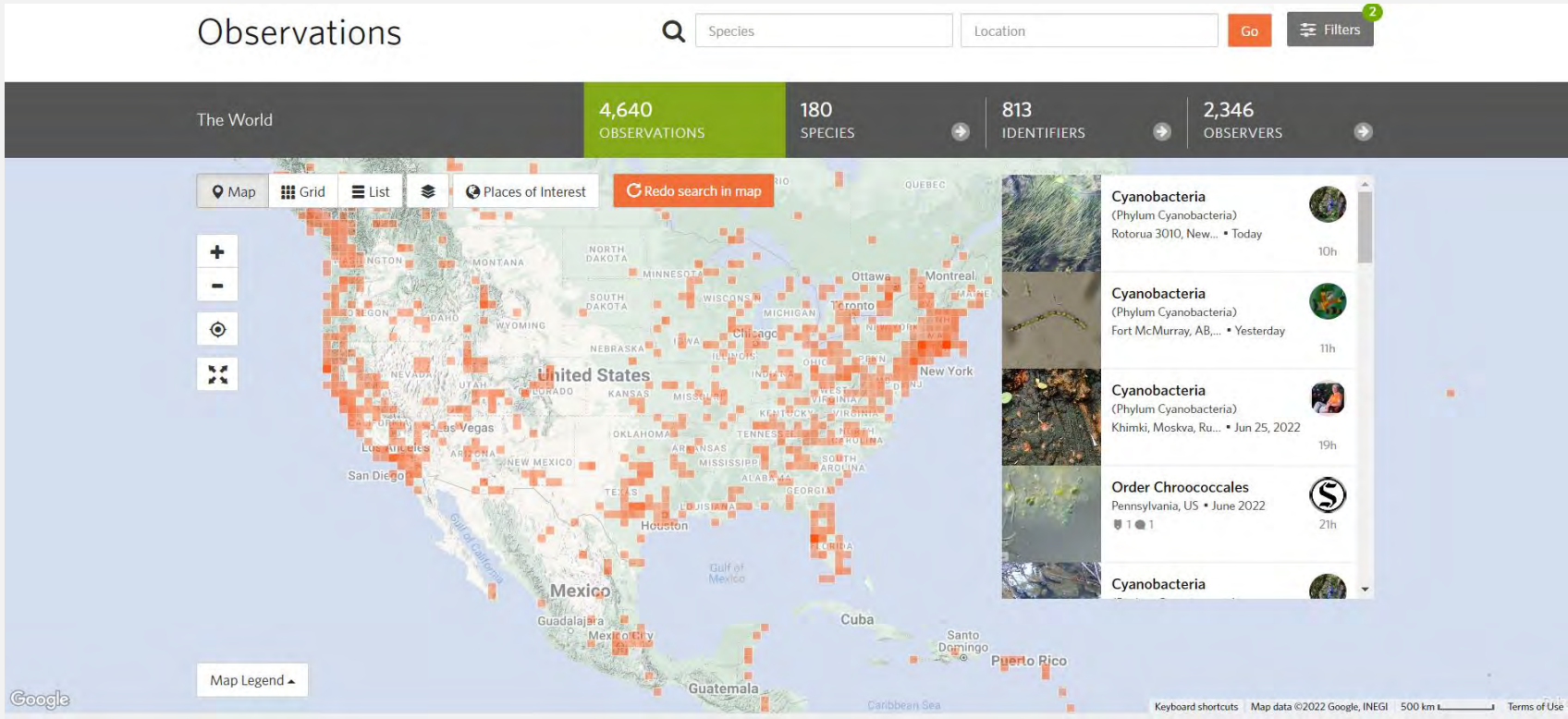
- Single celled organism
- Occur naturally in waterbodies
- Blooms can produce harmful toxins
- Reduce dissolved oxygen in water

What causes cyanobacteria blooms?

- Feed off nutrients (phosphorous + nitrogen) + warm water
- Nutrients from fertilizers – animal waste – wastewater
  - soaps and detergents - automobile exhaust -sediment
- Runoff during rain/stormwater events

Why monitor?

- Lack of overall cyanobacteria data
- Better understanding of where and when blooms occur.
- Provide information/data to local governments (RIDEM-RIDOH)
- Raise public awareness about cyano health risks



What Can You Do?

Cyanobacteria Monitoring Collaborative

Hilary Snook – EPA Region 1

Low Cost – Easily Implemented Monitoring
Establish baseline (consistent/standard methods)
3 Tiers of Involvement and Monitoring

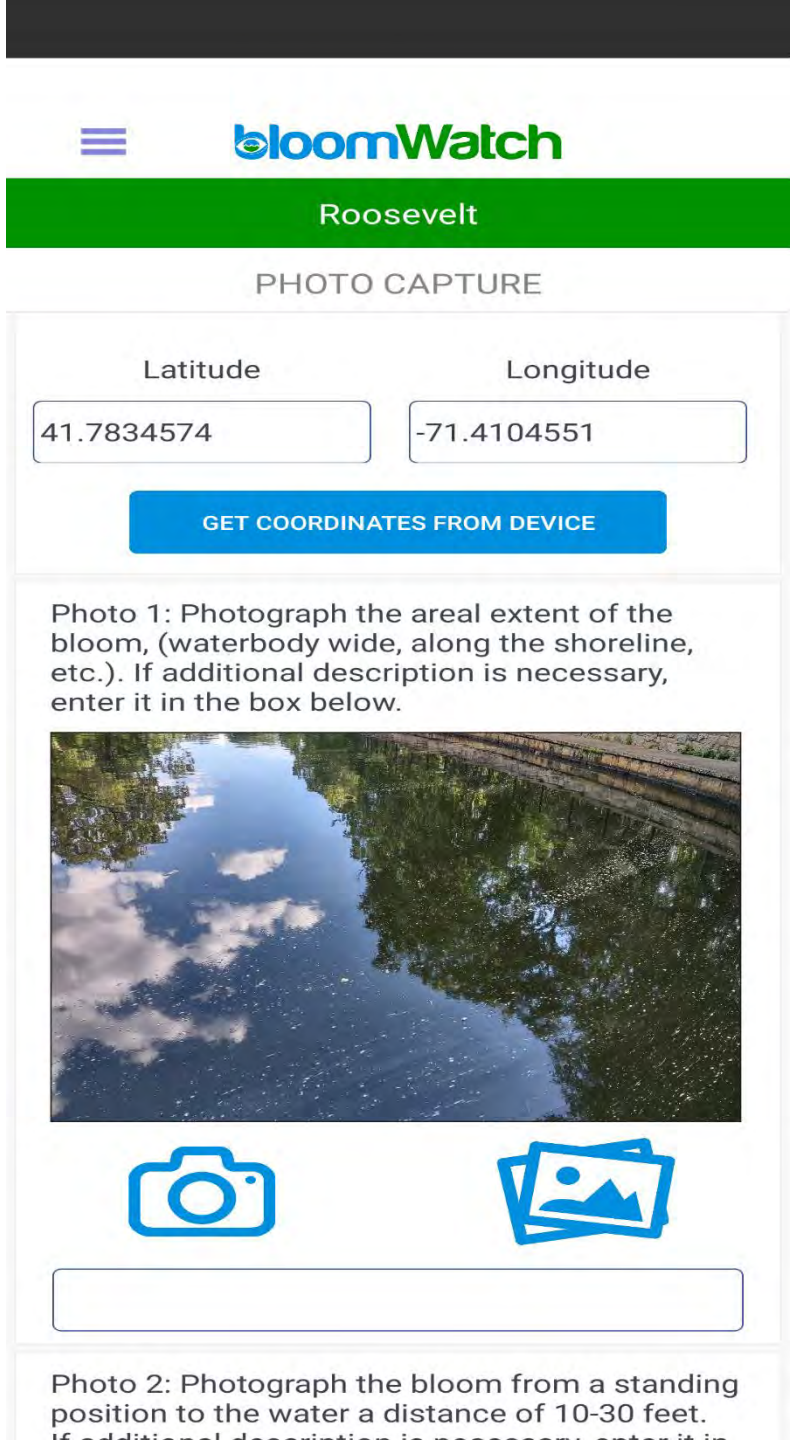
Tier 1: BloomWatch

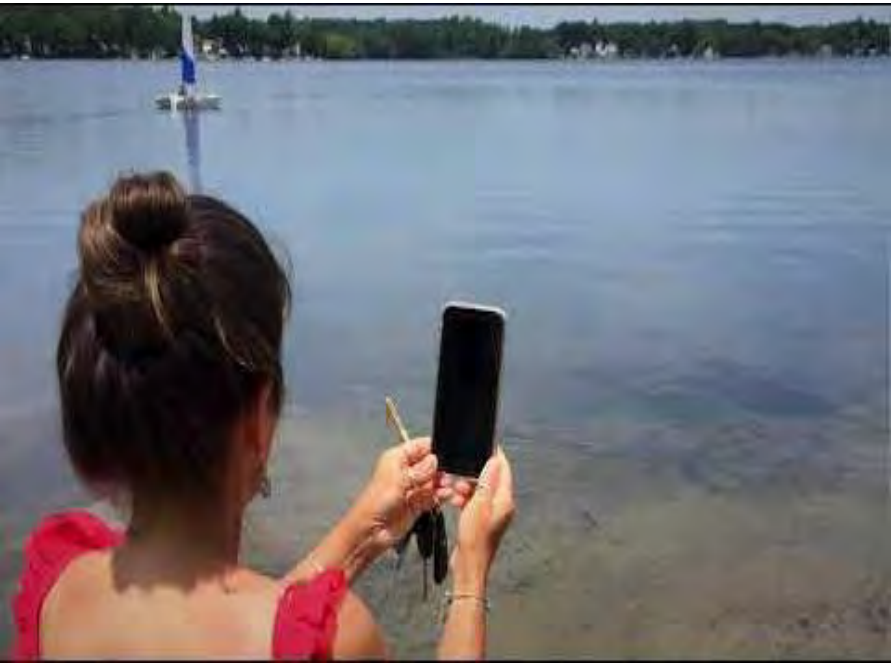
Tier 2: CyanoScope

Tier 3: CyanoMonitoring

Tier 1 - Bloomwatch

- Smartphone App – Crowdsourced Information
- Understanding of when/where blooms occur
- Volunteers Uploaded to a national database
- Simple to Use
- Triggers RIDEM/RIDOH Sample





Tier 1 – Bloomwatch, Dashboard, Email

ENGLISH ESPAÑOL About bloomWatch

BLOOMWATCH | REPORTS

REGION ALL REGIONS

reports currently

516

visible on the map

NO BLOOM OBSERVED
willow lake, Providence , RI on June 27, 2022
Lake condition: Calm Weather: Partly Cloudy
Location: 41.7862491, -71.4148128

BLOOM REPORTED | Larger than a football field
Long Pond Centerville MA, Centerville , MA on June 27, 2022
Lake condition: Calm Weather: Partly Cloudy
Location: 41.6573868, -70.3304291

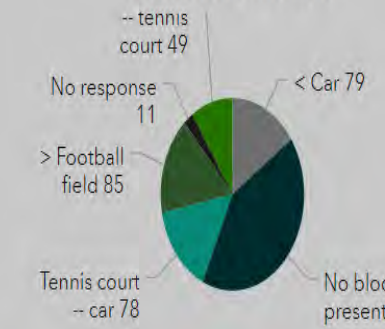
NO BLOOM OBSERVED
Roosevelt, providence, RI on June 27, 2022
Lake condition: Calm Weather: Clear
Location: 41.7834574, -71.4104551

BLOOM REPORTED | Larger than a football field
Ucd arboretum, Davis, CA on June 27, 2022
Lake condition: Calm Weather: Clear
Location: 38.5271149, -121.7632523

BLOOM REPORTED | Between a football field and a tennis court
Ball Pond, New Fairfield, CT on June 25, 2022
Lake condition: Ripples Weather: Clear
Location: 41.4643380, -73.5207460

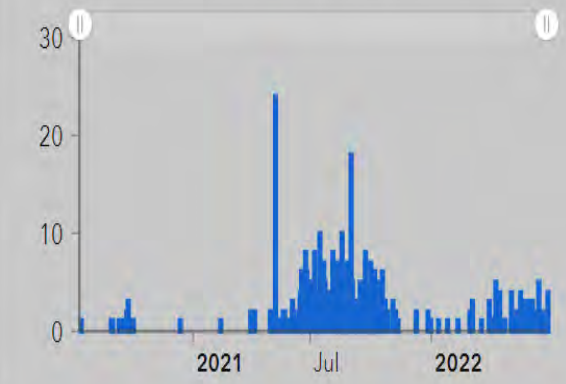
PHOTOS

Bloom extent



EXTENT SURFACE WEATHER STATUS

Report dates



bloomWatch

Roosevelt

SUBMISSION

Observation Date: 06/28/2022

Click "UPLOAD DATA" to submit your observation to our online database. Personal information (name and email) will be hidden.

Once you have submitted your data, you will have the option to email the data if you would like.

UPLOAD DATA

To view your data, go the the bloomWatch ArcGIS map page here:

BLOOMWATCH ARCGIS MAP

Click "EMAIL DATA" to send your observation to key state water quality organization(s). You can also create a custom email list (below) to send the data to others. Be sure to send the email once it appears.

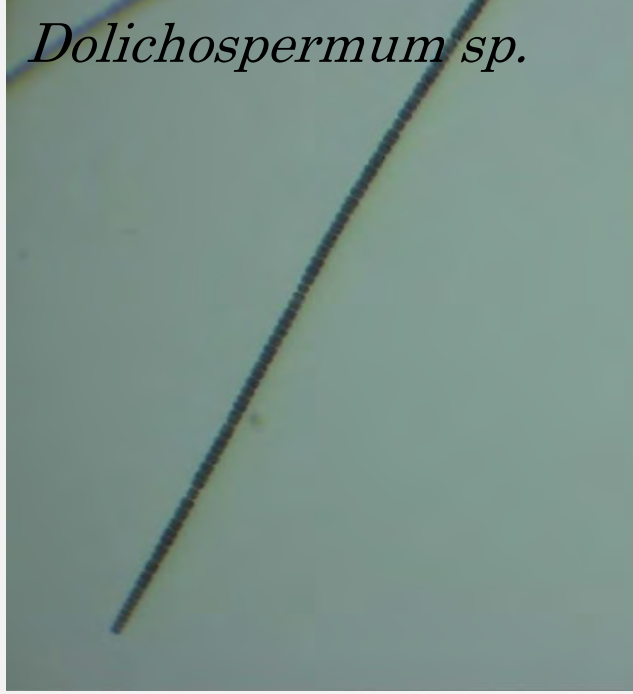
On Android devices, you may need to specify your email app prior to the email opening.

EMAIL DATA

CUSTOM EMAIL LIST

Tier 2 - Cyanoscope

- Determine occurrence and distribution of cyano genus/species
- Concentrated Samples
- Viewed under microscope
- Photos taken – uploaded to iNaturalist database
- ID'd by worldwide experts



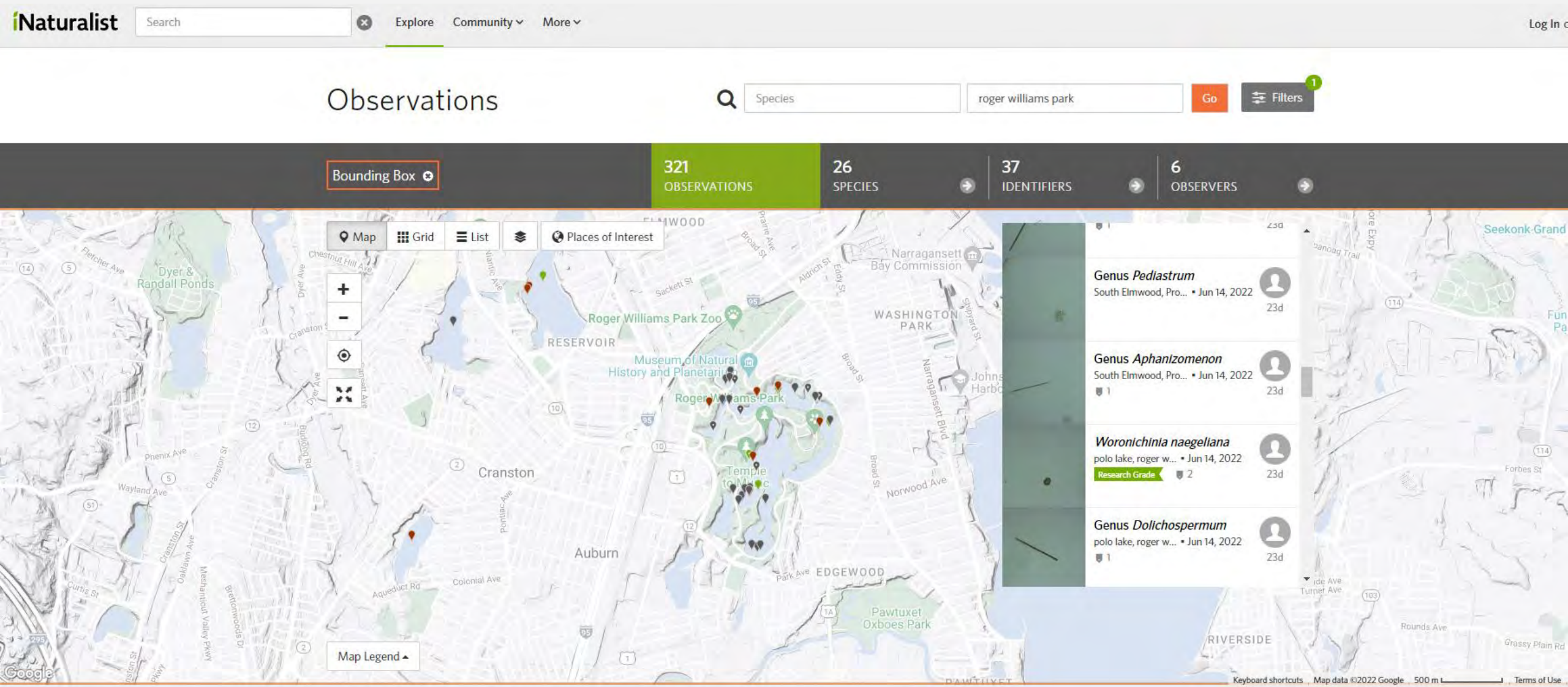
Dolichospermum sp.

Woronichinia naegeliana

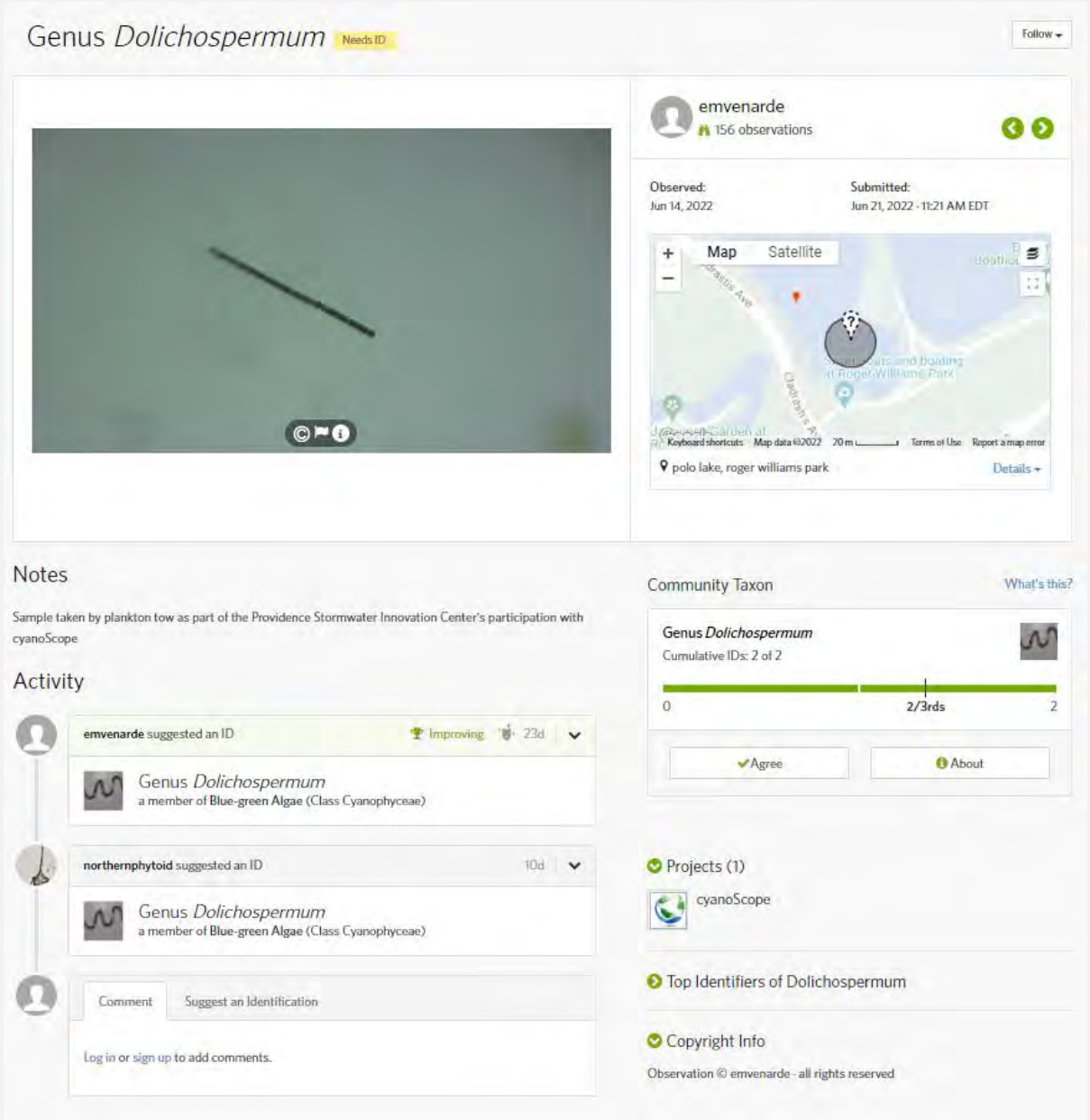
Dirty Dozen – Toxin Producing

	Genus Groups	Photo Example	Associated (known) Toxins	Reported Taste & Odor Issues
1	*Anabaena/Anabaenopsis*		anatoxin-a, microcystins	"earthy, grassy, nasturium, musty"
2	*Aphanizomenon*		neosaxitoxin, microcystins	"earthy, grassy, nasturium, musty, sweet"
3	*Aphanocapsa/Aphanothece*		microcystins	"earthy and musty"
4	*Coelosphaerium*		microcystins	"earthy and musty"
5	*Gloeocapsa/Chroococcus*		microcystins	"grassy and sweet"
6	*Gloeotrichia*		microcystins	"grassy and sweet"
7	*Lyngbya/Phormidium*		anatoxin, microcystins	"earthy"
8	*Merismopedia*		microcystins	"earthy and musty"
9	*Microcystis*		microcystins	"grassy and sweet"
10	*Nostoc*		BMAA, microcystins	"musty, septic"
11	*Oscillatoria/Planktothrix*		microcystins	"earthy, grassy, musty and spicy"
12	*Woronichinia*		anatoxin, microcystins	"earthy and musty"

iNaturalist Database



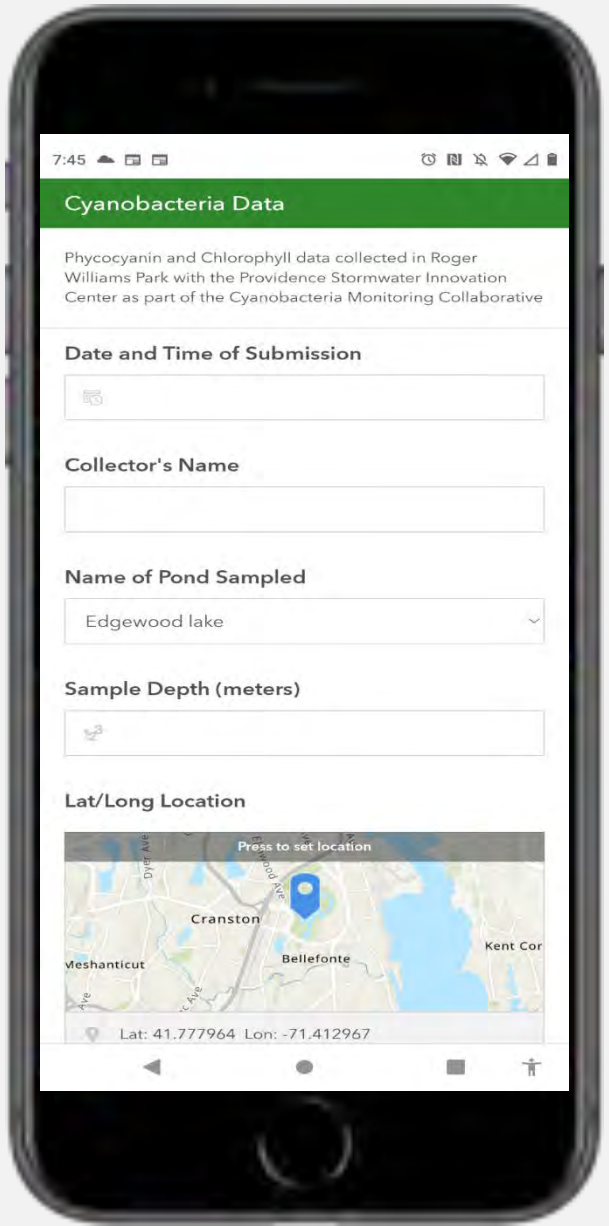
iNaturalist Database



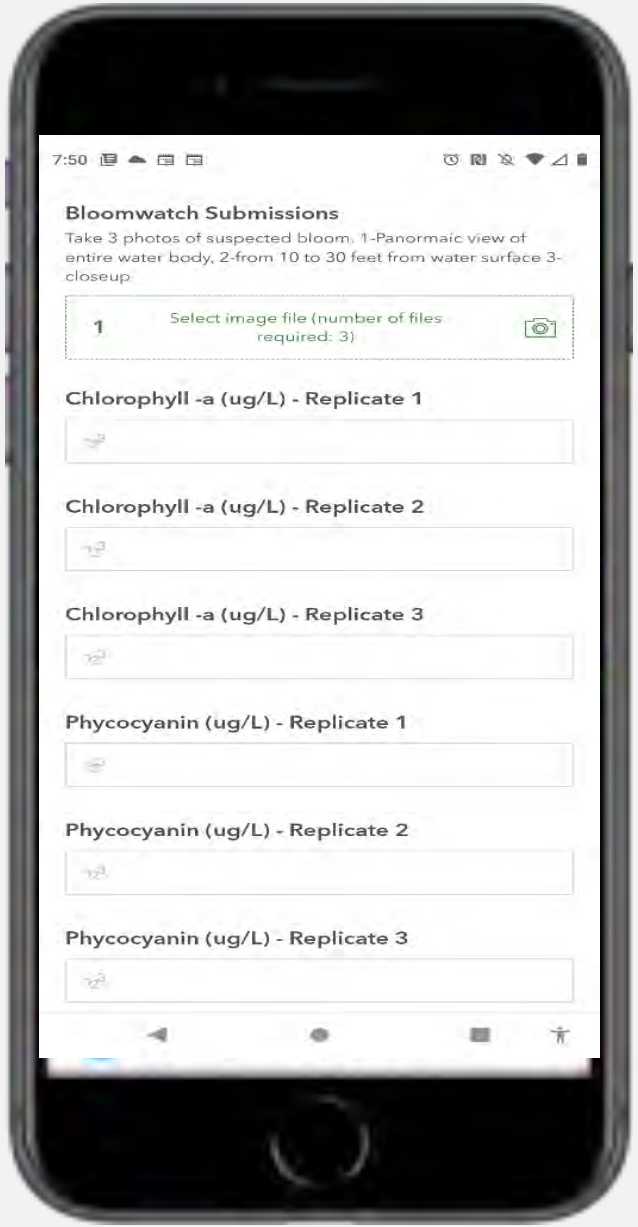
Tier 3 – CyanoMonitoring

- Tracking cyanobacteria concentrations
- Attempt to forecast blooms
- Long term assessment of changes in a waterbody
- Consistent fixed sampling points + Bloom sampling
- Quality Assurance Protocols

Tier 3 – CyanoMonitoring – Field Form – Survey123



- Digital Data Entry
- Real-time data
- Automated graphing and display



Tier 3 – CyanoMonitoring – Interactive Data Dashboard

POND SELECTOR

- ✓ Cunliff Lake
- ✓ Edgewood lake
- ✓ Elm Lake
- ✓ Pleasure Lake
- ✓ Polo Lake
- ✓ Roosevelt Lake

Reset | Deselect all

DATE SELECTOR

- Last Quarter
- This Month
- Last Month

To view data graphically, use the **POND** and **DATE SELECTOR**, **ZOOM** and **PAN** on the **MAP**.

To view Bloomwatch photos click on **SAMPLE DETAILS** in the **SUMMARY OF SAMPLE LIST.**

SUMMARY OF SAMPLE COLLECTIONS

SAMPLE DETAILS
DATE/TIME: 6/28/2022, 6:46 PM
COLLECTED BY: Kms
SAMPLE LOCATION: Polo Lake
CHLOROPHYLL -A: 2.41 ug/L
PHYCOCYANIN: 4.27 ug/L
CHL/PC RATIO: 1.77
CYANOCSCOPE PHOTO LINK

SAMPLE DETAILS
DATE/TIME: 6/28/2022, 6:41 PM
COLLECTED BY: Kms
SAMPLE LOCATION: Elm Lake
CHLOROPHYLL -A: 1.12 ug/L
PHYCOCYANIN: 16.98 ug/L
CHL/PC RATIO: 15.16
CYANOCSCOPE PHOTO LINK

SAMPLE DETAILS
DATE/TIME: 6/28/2022, 6:34 PM
COLLECTED BY: Kms
SAMPLE LOCATION: Elm Lake
CHLOROPHYLL -A: 8.93 ug/L
PHYCOCYANIN: 1,041.92 ug/L
CHL/PC RATIO: 116.67
CYANOCSCOPE PHOTO LINK

SAMPLE DETAILS
DATE/TIME: 6/28/2022, 6:28 PM
COLLECTED BY: Kms
SAMPLE LOCATION: Cunliff Lake
CHLOROPHYLL -A: 1.36 ug/L
PHYCOCYANIN: 12.67 ug/L
CHL/PC RATIO: 9.31
CYANOCSCOPE PHOTO LINK

SAMPLE DETAILS
DATE/TIME: 6/14/2022, 5:47 PM

Average Phycocyanin Concentrations Roger Williams Park

Phycocyanin | Chlorophyll

BLOOMWATCH PHOTOS

Average Chlorophyll Concentration in RWP last 2 weeks

2.3 ug/l

Average Phycocyanin Concentration in RWP last 2 weeks

139.5 ug/l

Cyanobacteria Sampling Locations in Roger Williams Park

Equipment Costs

Tier 1: BloomWatch — Free (just requires smartphone)

Tier 2: CyanoScope — $400 for kit; ~$100 for compound microscope; ~$300 for scope w/ cam

Tier 3: CyanoMonitoring — $1900

Our sampling events

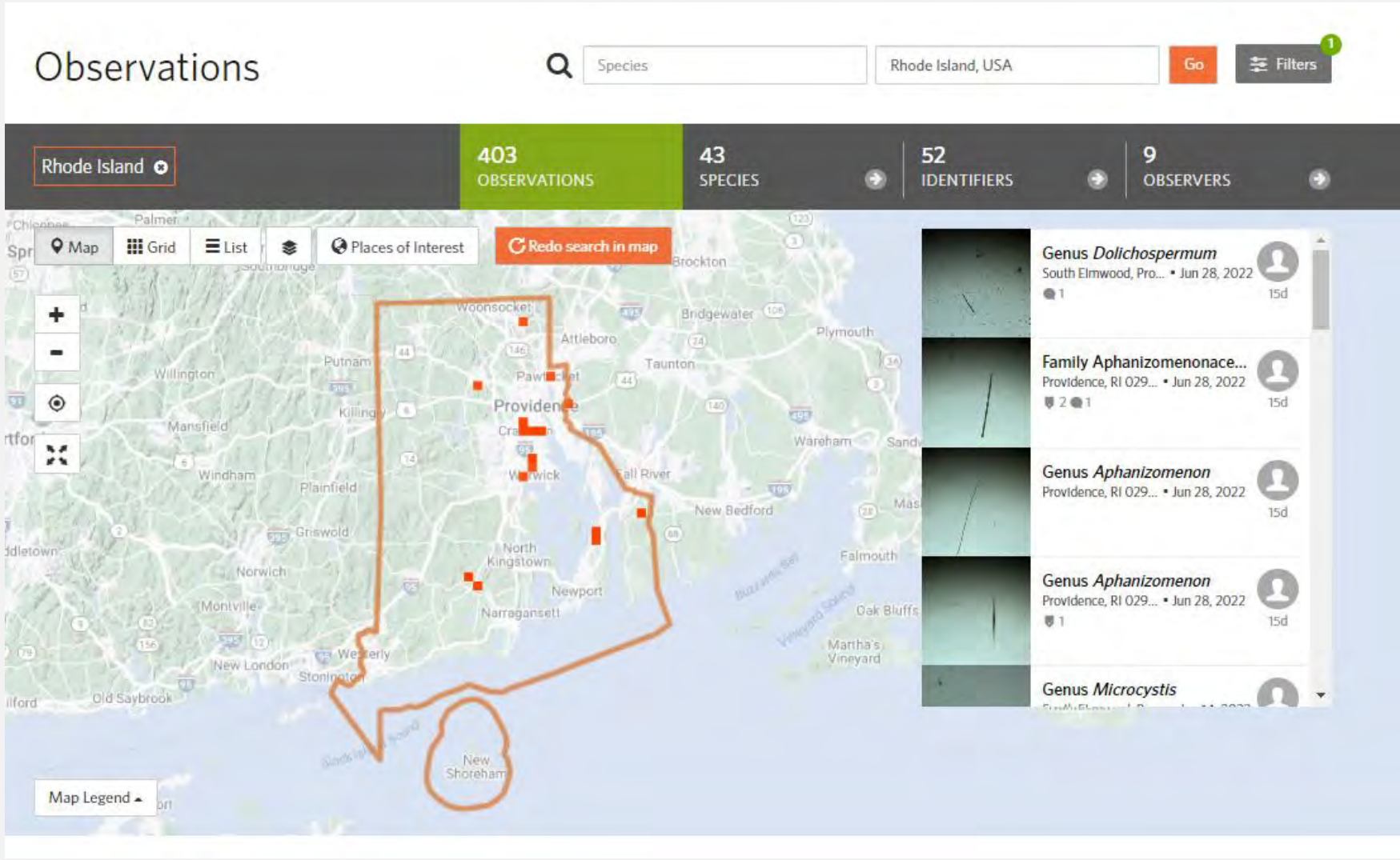
- Every other Tuesday – 5:00-7:00 pm
- Seal House – Roger Williams Park
- May - October

Need more sampling around state

Hide fields | Filter | Group | Sort | ...

	Waterbody	Town	Advisory Posted	Advisory Li...
4	Flat River Reservoir (Johnso...	Coventry	9/20/2021	12/7/2021
5	Brickyard Pond	Barrington	9/3/2021	9/30/2021
6	Briar Point Beach on Tiogu...	Coventry	8/19/2021	9/17/2021
7	Camp Hoffman at Larkin P...	South Kingstown	8/12/2021	9/3/2021
8	Sachem Pond	Block Island	8/6/2021	11/19/2021
9	Slack Reservoir	Smithfield/Johnston	8/6/2021	11/19/2021
10	Wenscott Reservoir	North Providence	8/6/2021	12/7/2021
11	Warwick Pond	Warwick	7/23/2021	9/3/2021
12	Lower Melville Pond	Portsmouth	7/16/2021	12/21/2021
13	Upper Melville Pond	Portsmouth	7/16/2021	12/21/2021
14	Blackamore Pond	Cranston	7/13/2021	
15	Mashapaug Pond	Providence	7/13/2021	12/7/2021
16	Spectacle Pond	Cranston	7/13/2021	12/21/2021
17	Upper J.L. Curran Reservoir	Cranston	7/13/2021	8/19/2021
18	Georgiaville Pond	Smithfield	6/28/2021	8/6/2021

153 records



Thank you!

Providence Stormwater Innovation Center

stormwaterinnovation.org

Ryan Kopp
rkopp@asri.org

Will Helt
william.helt@tnc.org

Supplemental Slides

Workforce training:
Learning together about mistakes and lessons learned, best practices and innovation in the classroom and and field

Providence Stormwater Innovation Center

Curriculum built from local experience and with regional experts

- Green stormwater 101 (online)
- Operation and maintenance of green stormwater practices
- Green stormwater design (online)
- Installation and construction oversight (Oct. 23 then online)

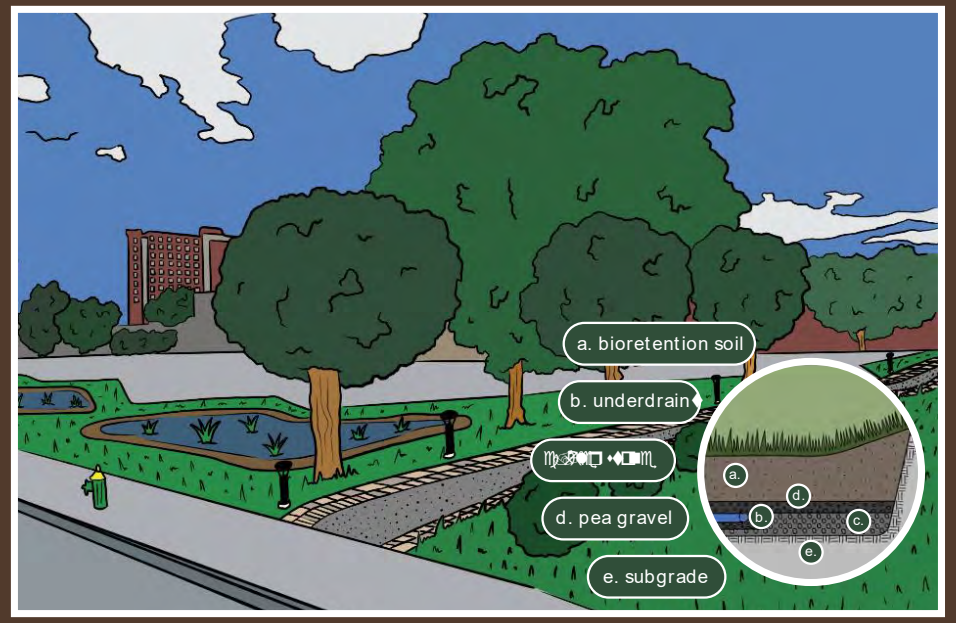
Signage to share information on “Nature at Work”

Nature at Work

Nature is at work here!

We're creating a healthy community! This site uses nature to clean dirty stormwater and reduce flooding.

www.greeninfrastructureri.org



Clean

The rain garden removes sand, dirt and other pollutants from the rain water before it enters the Woonasquatucket River.

Protect

Absorbs rain and reduces flooding.

Economy

This land is protected and used by local residents and businesses. Green space increases property values for everyone.

Cool

Removes hard surfaces that hold heat. Adds plants and trees that provide shade for people and wildlife.

Wellness

Provides cleaner air and places to rest outside, connecting people to nature in the city.

Habitat

Attracts and feeds animals like butterflies, bees and birds. Butterflies and bees are really important to local farmers who provide fresh food.

San Souci Connector Rain Gardens

This site used to be a big parking lot, but it was changed to be better for people and wildlife. All the dirty water from the parking lot used to wash straight into the river. This path and garden now create a walkway that also cleans water, leading from Olneyville Square to the Woonasquatucket River. The brick around the walkway and the garden collect and filter dirty rain water that washes off the parking lot, making the river cleaner and Olneyville greener.

RHODE ISLAND · WOONASQUATUCKET RIVER WATERSHED COUNCIL · RIDOT · Citizens Bank · RIDEM · FUSS & O'NEILL

English and Spanish versions at RWP