Freshwater Initiative

Stakeholder Meeting 1 – Monomoy Lens

HARWICH COMMUNITY CENTER | MARCH 20, 2024

CAPE COD COMMISSION

FRESHWATER INITIATIVE

Agenda

Meeting 1

- Welcome
- Introductions
- Freshwater Initiative Overview
- Cape Cod Ponds and Lakes in Context
- Understanding Economic Impacts of Cape Cod's Freshwater
- The Data
- Discussion
- Next Steps

PLEASE BRIEFLY SHARE THE FOLLOWING:

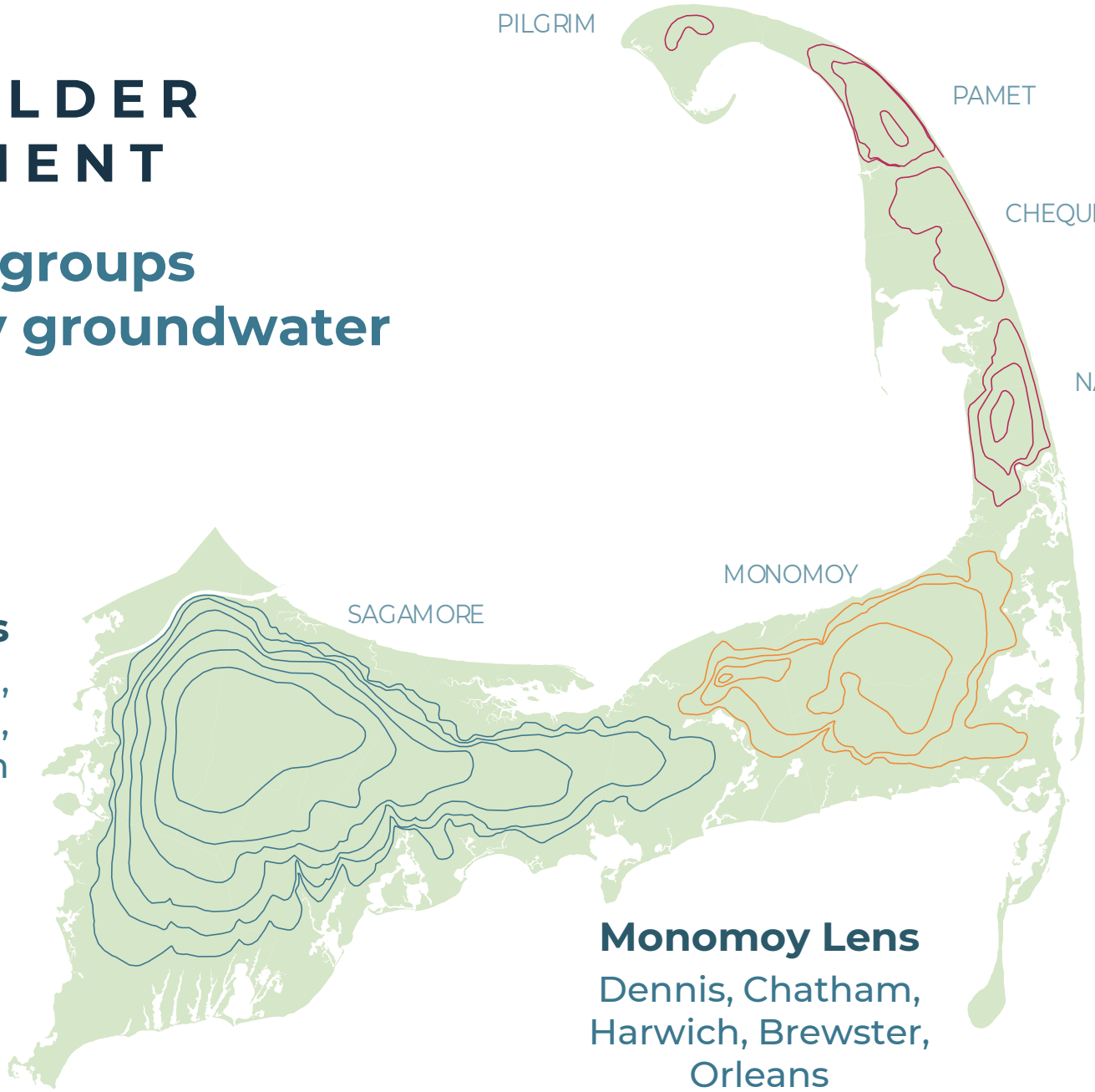
Name

Organizational Affiliation (if any)

What is your favorite pond?

STAKEHOLDER ENGAGEMENT

Stakeholder groups organized by groundwater lenses



Outer Cape Lenses
Eastham, Wellfleet, Truro, Provincetown

Sagamore Lens
Bourne, Falmouth, Sandwich, Mashpee, Barnstable, Yarmouth

Monomoy Lens
Dennis, Chatham, Harwich, Brewster, Orleans

CAPE COD FRESHWATER INITIATIVE

Stakeholder Meetings

MARCH 19 AND 20

Meeting 1

Defining the Problem

Establish a shared understanding of freshwater systems, the Freshwater Initiative, and stakeholder perspectives

APRIL 22 AND 23

Meeting 2

Exploring Strategies and Priorities

Highlight existing pond management strategies, review breadth of potential strategies and identify priorities, discuss future pond management prioritization

JUNE 3 AND 4

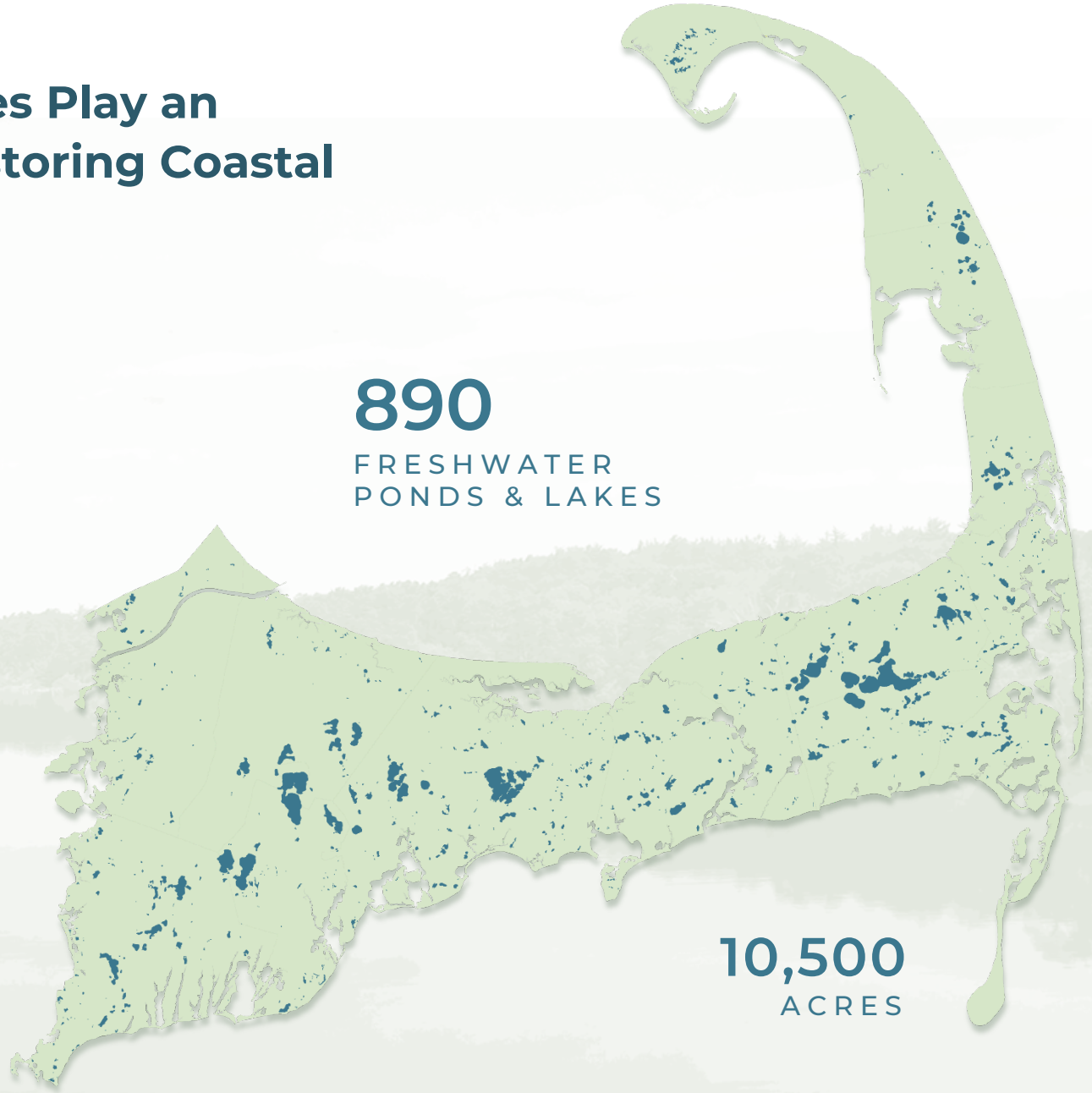
Meeting 3

Reviewing the Implementation Plan

Discuss recommendations and implementation plan; solicit stakeholder feedback

Properly Functioning Ponds and Lakes Play an Important Role in Preserving and Restoring Coastal Water Quality

Ponds are credited with reducing up to 50% of the nitrogen that passes through them on its way to coastal embayments.



Lack of Consistent and Consecutive Data Collection

less than 10%

of Cape Cod's ponds and lakes are monitored

Cape Cod Freshwater Initiative

A science-based, information-driven planning process that will engage stakeholders and enable action to protect and restore Cape Cod's freshwater ponds

ESTABLISHING THE BASELINE

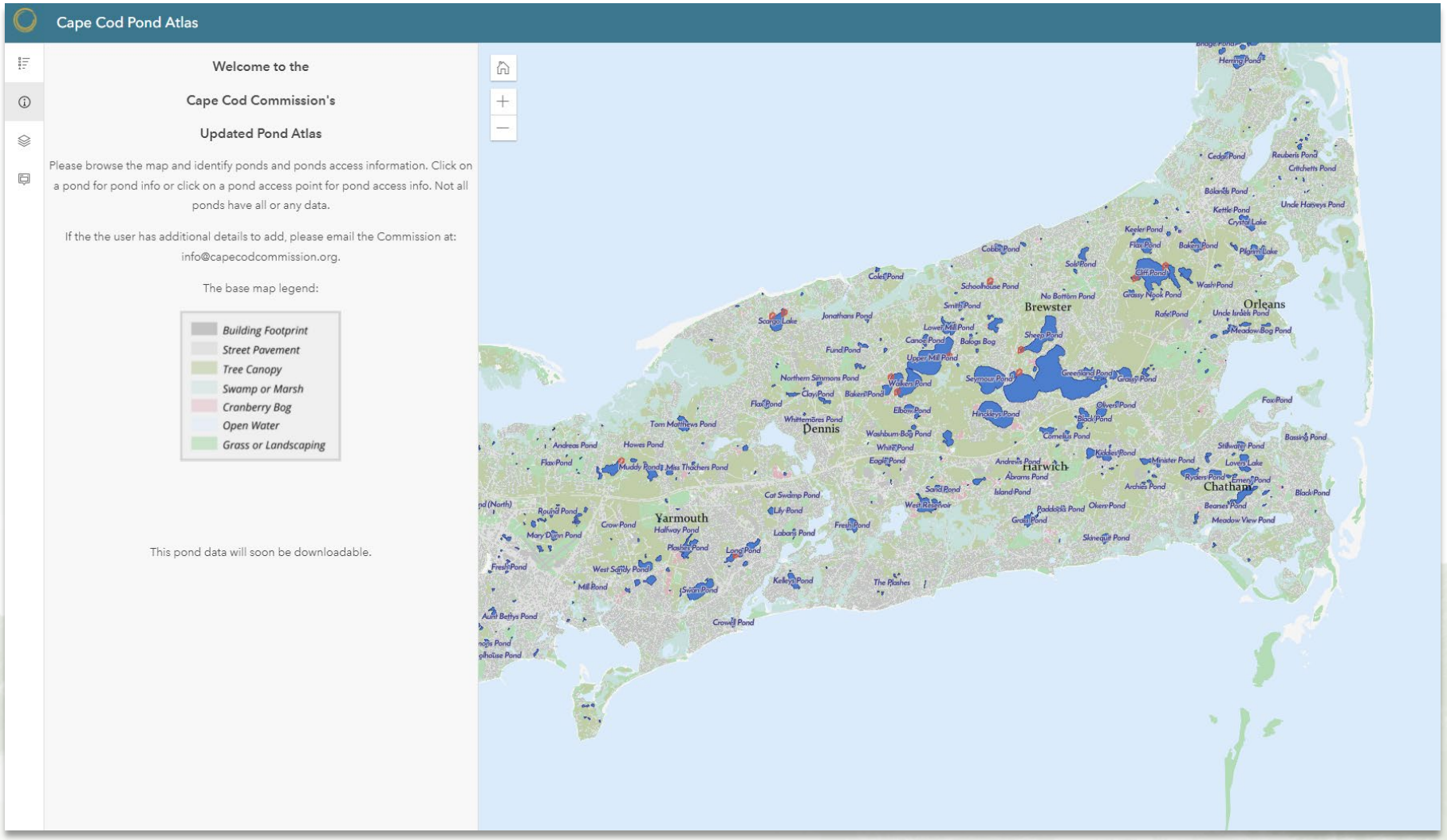
- Ponds And Lakes Atlas Update
- Physical Characteristics
- Data Management And Analysis
- Remote Sensing

STRATEGY DEVELOPMENT

- Engagement and Outreach
- Strategies Database
- Economic Analysis
- Legal Analysis

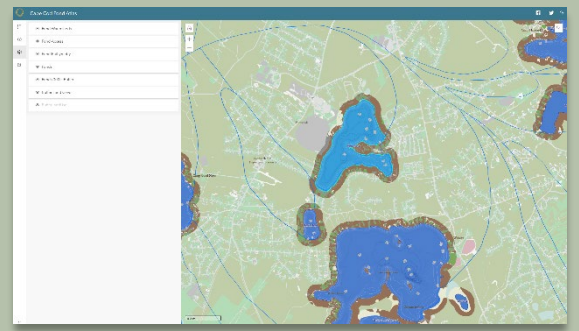
ONGOING MONITORING AND ANALYSIS

- Monitoring Program
- Ongoing Data Management and Analysis



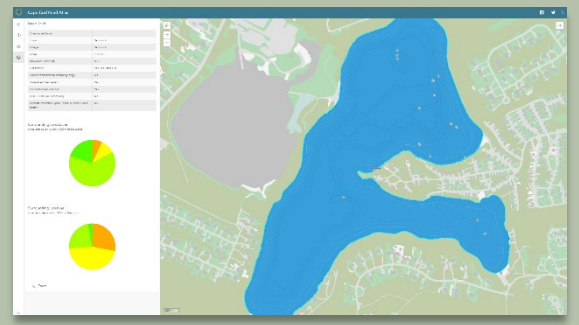
Cape Cod Pond Viewer

The Pond Viewer serves as a companion to the Atlas and can be used to explore Cape Cod's ponds, ecology, and the challenges they face.



MAP LAYERS

Available map layers include access points, pond watershed delineations, bathymetry data, 300 ft. pond buffer area, and other pond and surrounding land use characteristics.



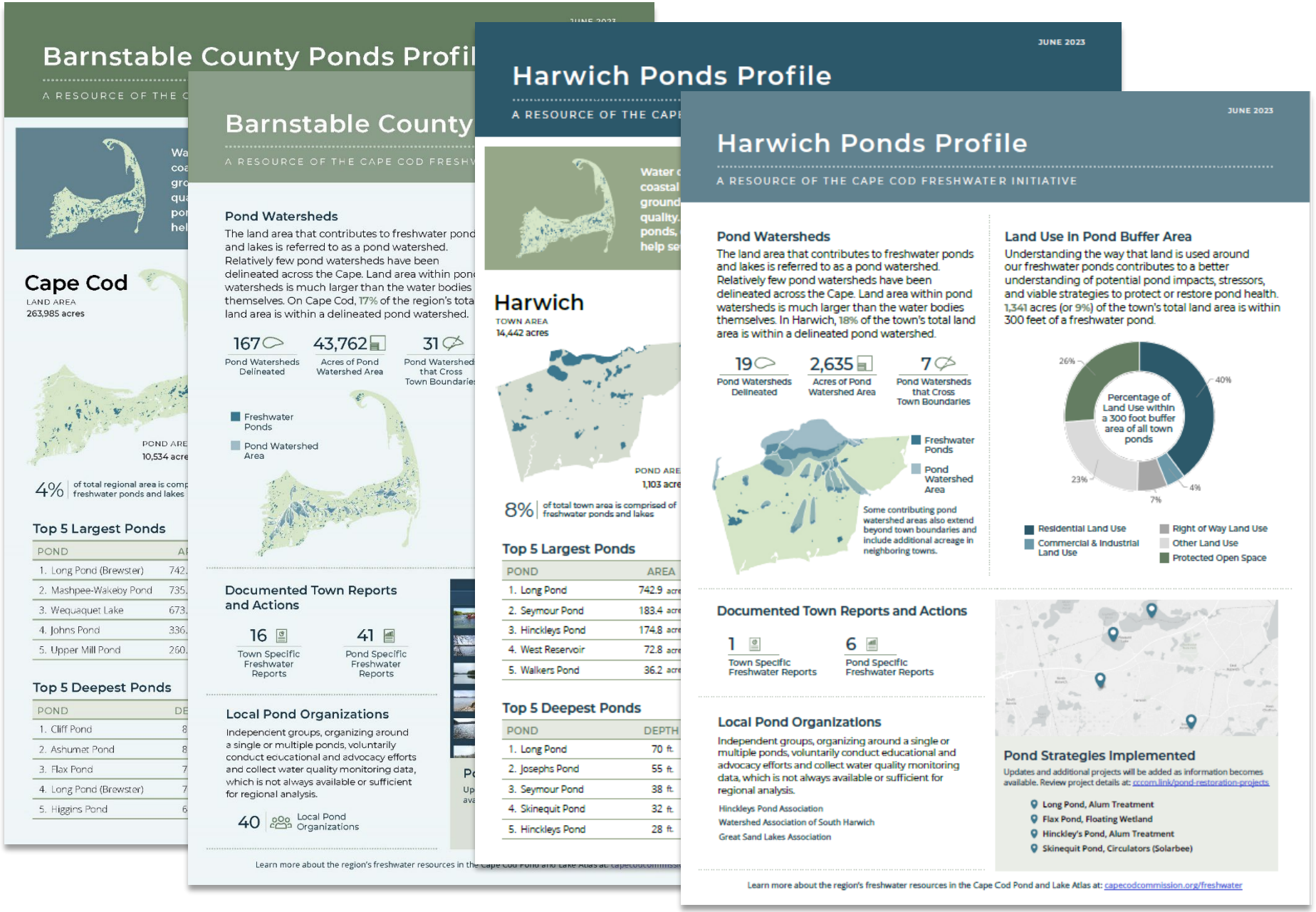
POND CHARACTERISTICS

Select a pond and open the Info Panel to view related characteristics including acreage, depth, and more. Users can also explore surrounding land cover and land use summaries within a 300 ft. pond buffer area.

EXPLORE: cccom.link/pond-atlas

Pond Profiles

Expanded Pond Profiles provide a snapshot of regional and town-by-town pond information, including physical characteristics, existing monitoring efforts, watersheds, strategies, and more.



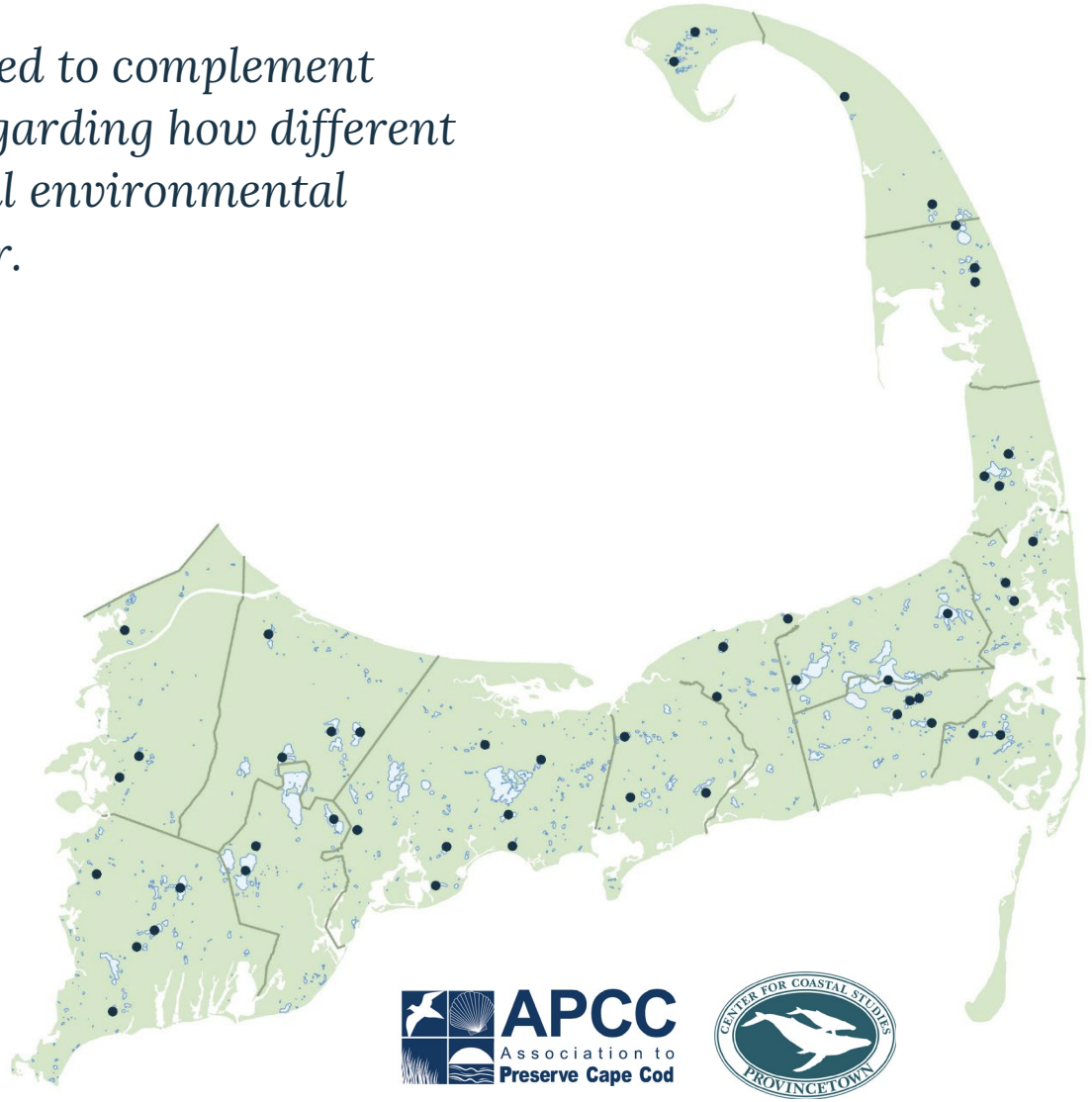
MONOMOY LENS

REGIONAL POND MONITORING PROGRAM

The Regional Pond Monitoring Program has been designed to complement existing monitoring efforts and provide baseline data regarding how different types of ponds on Cape Cod respond to changing regional environmental conditions throughout the summer and from year to year.

Pond selection criteria:

- Spatial coverage across all towns and aquifer lenses
- Range of pond physical characteristics (e.g., size, depth, level of watershed development)
- Stream/herring run connections, implementation projects, and Coastal Plain Pondshores
- Water quality status
- Public uses of ponds
- Located in or adjacent to environmental justice area



APCC Association to Preserve Cape Cod

Center for Coastal Studies Provincetown

REGIONAL POND MONITORING PROGRAM

First season of monitoring program complete

- **50 ponds** monitored from April to November
- **346 pond visits** by staff and volunteers
- **3,113 sample bottles** sent to the lab for processing and analysis
- **Over 500 volunteer hours** spent monitoring ponds

Center for Coastal Studies analyzed samples

Monitoring efforts will resume in March 2024

APCC Association to Preserve Cape Cod

Center for Coastal Studies Provincetown

ENGAGEMENT AND OUTREACH

Pond Network

Coalition of pond groups and associations or pond water quality monitors to invite connection, collaboration, and shared resources

Technical Advisory Groups

Technical experts will advise components of the Initiative such as the water quality improvement strategies database

Community Outreach and Input

Engage the broader community to understand public perception, awareness, and priorities

Stakeholder Engagement

Engagement that incorporates broad stakeholder representation to understand priorities, the range of potential solutions, and build consensus on a framework for action

Cape Cod Ponds and Lakes in Context

Cape Cod Ponds by the Numbers

CAPE COD PONDS AND LAKES

890 PONDS

171 10+ Acre Ponds

395 Named Ponds

LARGEST PONDS *by area*

1. Long Pond
   Brewster and Harwich
2. Mashpee-Wakeby Pond
   Mashpee and Sandwich
3. Wequaquet Lake
   Barnstable

DEEPEST PONDS *with data available*

1. Cliff Pond
   Brewster
2. Hamblin Pond
   Barnstable
3. White Pond
   Chatham

27 Fish Stocked Ponds

107 Ponds Adjacent to Cranberry Bogs

22 Ponds that Cross Town Boundaries

96 Ponds with Public Access*

30% Protected Open Space
within pond 300ft buffer

14% Impervious Surfaces
within pond 300ft buffer

**Includes public beaches, boat ramps, and launches*

RECOMMENDED ACTION

Update and Expand Understanding of Freshwater Resources Data

Compile available freshwater resources water quality data into a regional database.

Seek funding to update ***the Cape Cod Ponds and Lakes Atlas to reflect current water quality data*** *collected by the Ponds and Lakes Stewardship Program.*

Cape Cod's freshwater ponds are fragile systems especially vulnerable to pollution and human activity.

Despite data gathered by citizen monitoring groups and assessments that document water quality impairment*, the state has listed only a few freshwater ponds on the 303d list for impaired waters for nutrients under the Clean Water Act.* ***Additional dialogue is needed*** *between the towns, state and county to evaluate the best use of the information collected and how it should be incorporated into the Commonwealth's clean water program.*

Cape Cod Pond Ecology

Liz Moran – Anchor QEA, LLC

Kettle Ponds: Unique Ecosystems

- Remnants of glacial ice retreat, 14,000 – 17,000 years ago
- Varied ecology based on landscape position, depth, and soil texture
- Provide terrestrial, wetland, and aquatic habitat to a diverse assemblage of native species

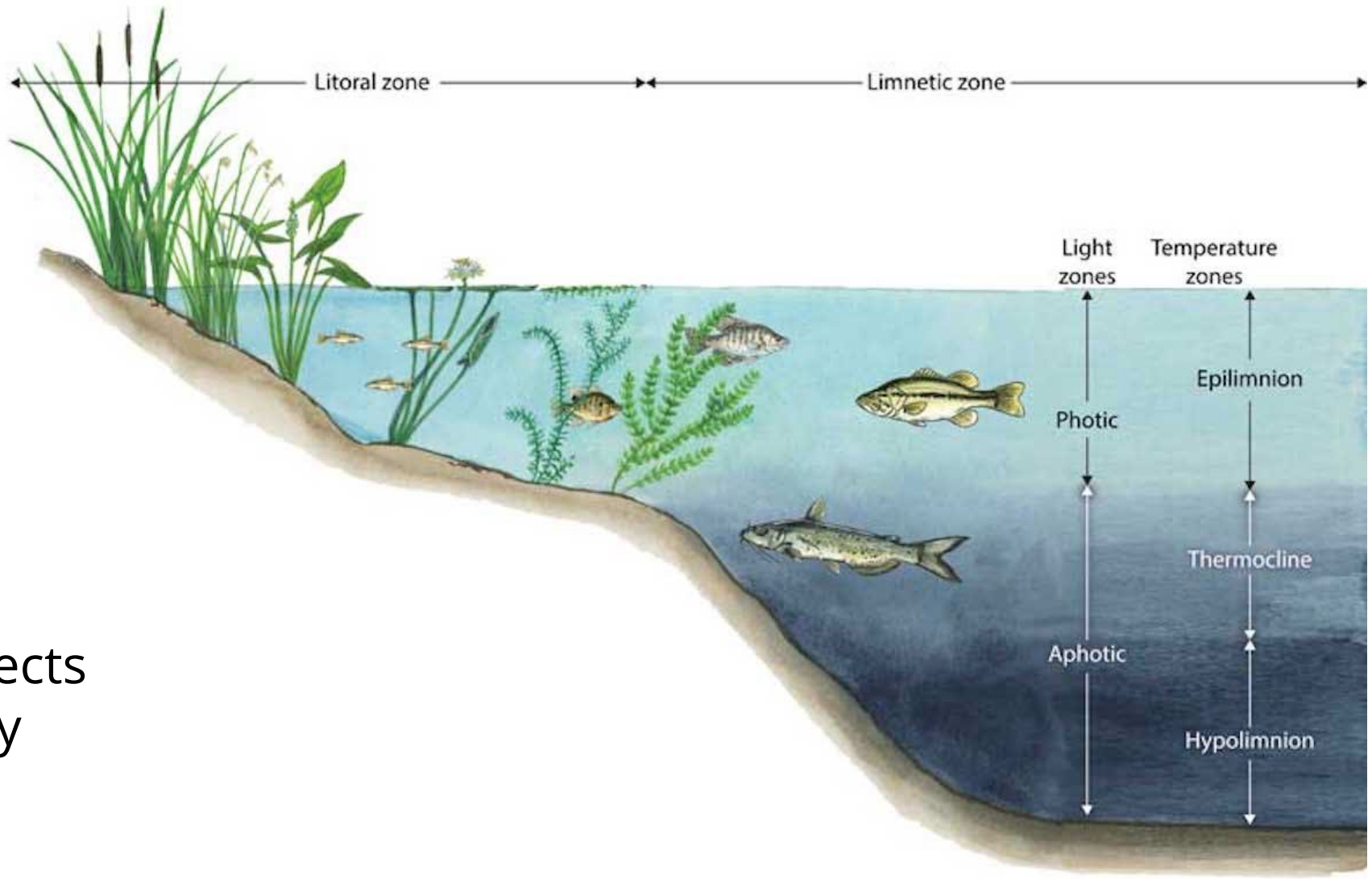
Source: Cape Cod Commission Pond Atlas, 2021

Unique but Interconnected

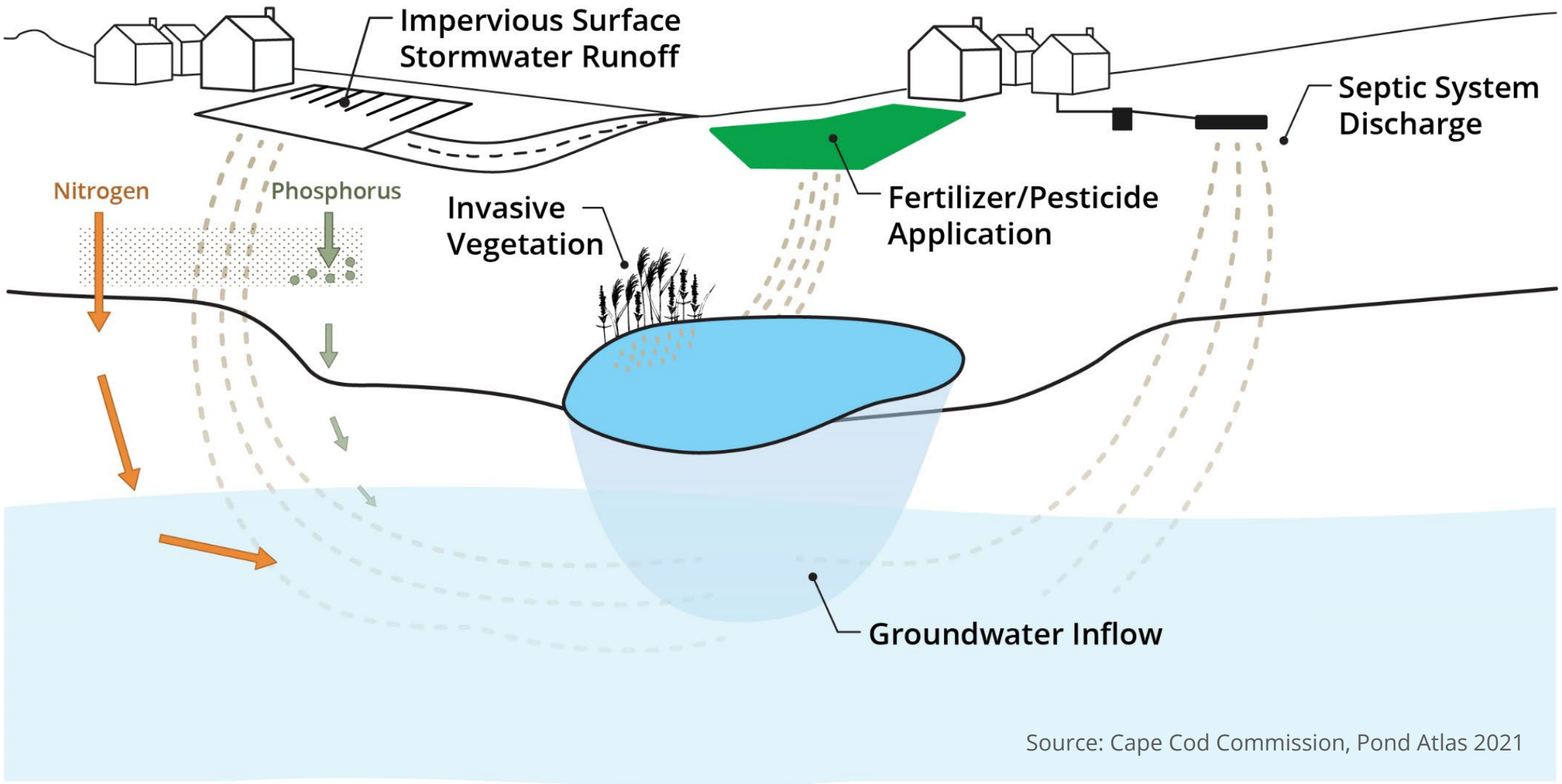
- Surface water and groundwater connections
- Discharge to coastal estuaries
- Conditions influenced by local actions and regional trends
  - Nutrient sources
  - Changing climate
  - Water level/sea level rise

Phosphorus (P) is Key to Pond Ecology

- Limiting nutrient
- Accumulates in ponds
- P cycle affected by pond depth, thermal stratification, and productivity
- Dissolved oxygen affects habitat and chemistry



LANDSCAPE CONDITIONS AFFECT NUTRIENT FLUX



Source: Cape Cod Commission, Pond Atlas 2021

POND CHARACTERISTICS AFFECT THEIR RESPONSE

Morphometry

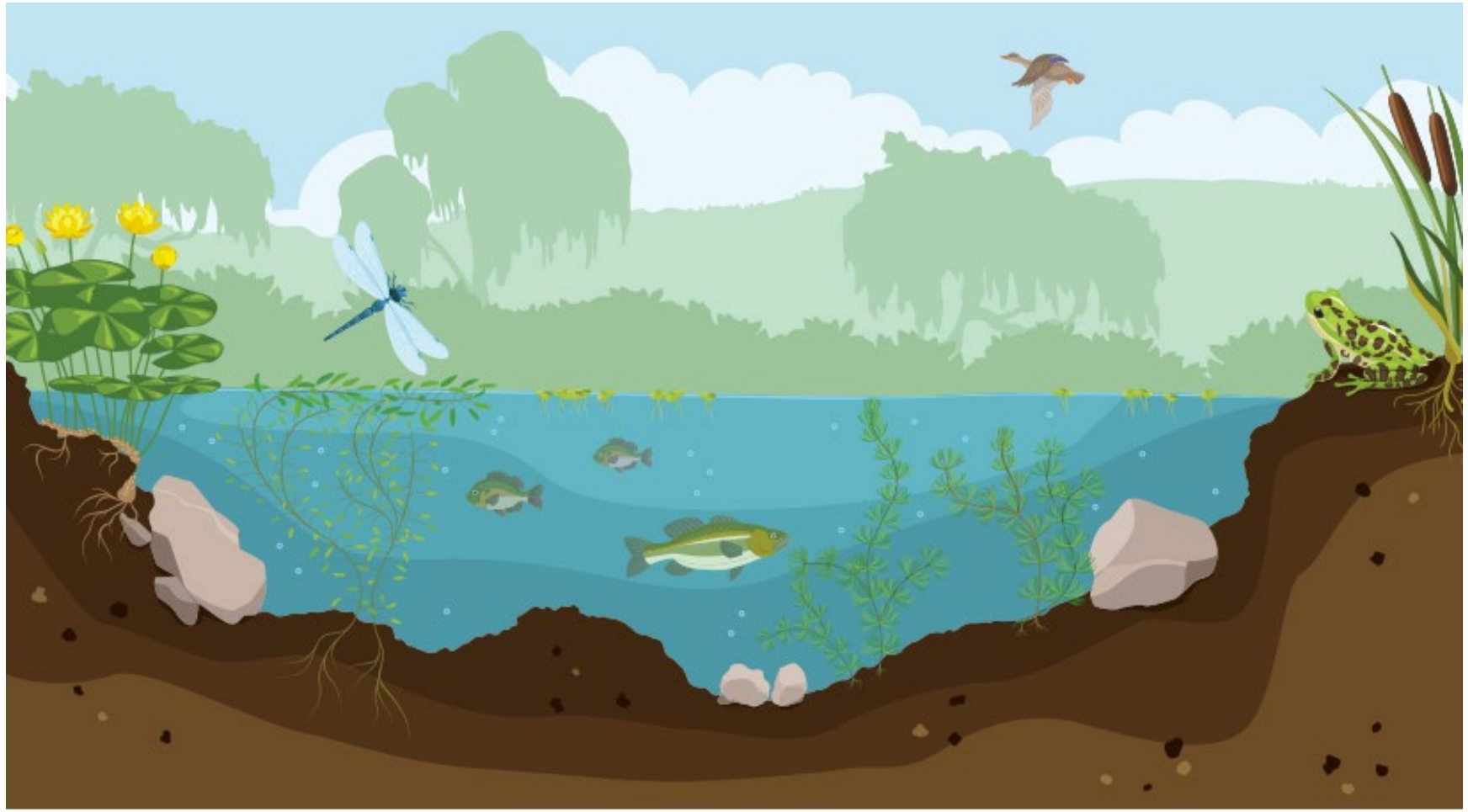
- Depth
- Surface Area
- Water Residence Time
- Connectivity

Ecology

- Fish community
- Invasive species

Management

- Fish stocking
- Interventions



POND CHARACTERISTICS

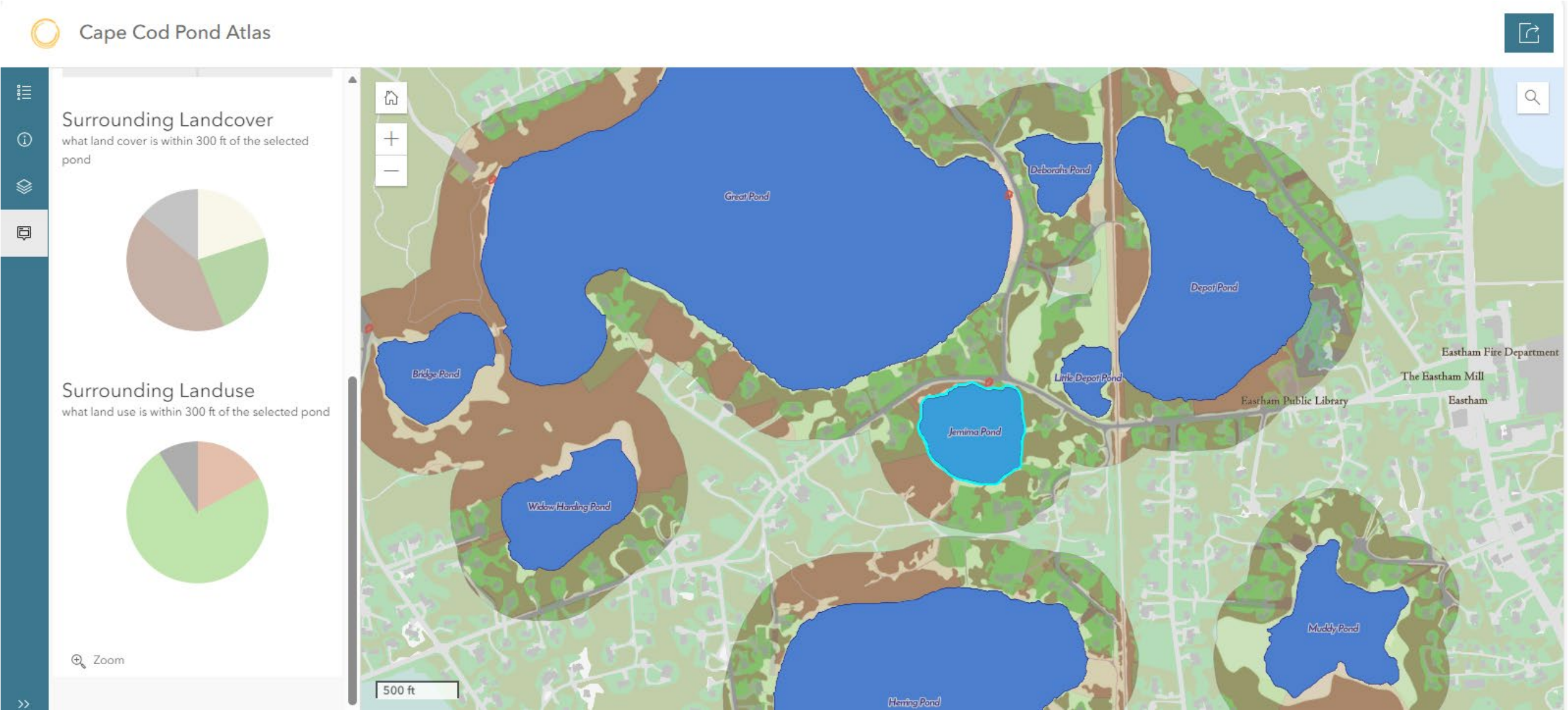
Cape Cod Pond Atlas

Jemima Pond

Alternative Name	
CCC-GIS-ID	EA-100
Town	Eastham
Village	Eastham
Acres	6.53
Maximum Depth (ft)	15.0
Great Pond	No
Watershed Delineated	Yes
Ponds stocked with fish	No
NHESP Natural Community	No
Percent Protected Open Space in Pond's 300ft. buffer	14%
Cranberry Bogs within 300ft Buffer	No
Golf Course within 300ft Buffer	No

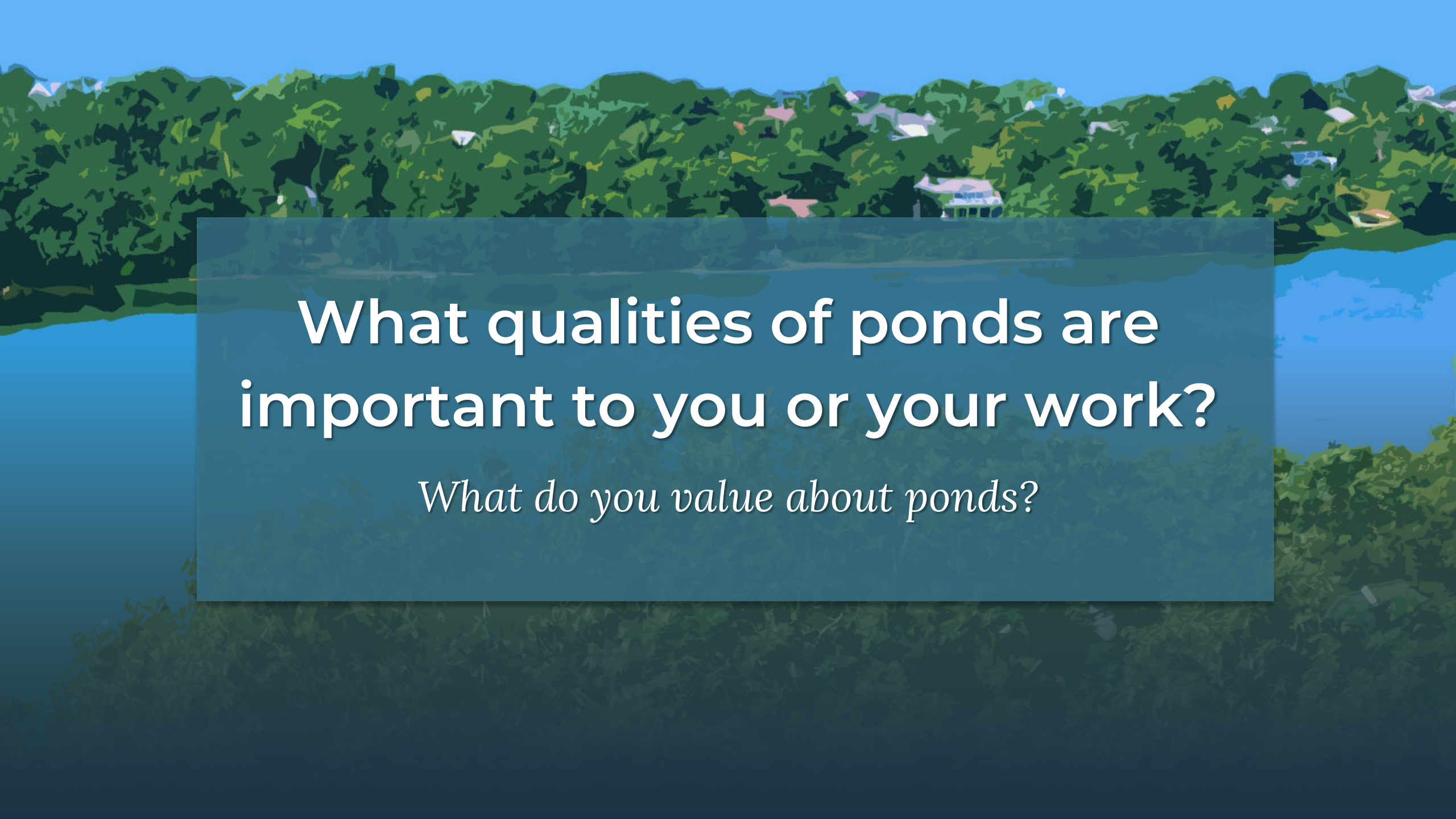
Surrounding Landcover

POND CHARACTERISTICS



Ponds Support Human Well-being

- Sense of Place
- Recreation
- Aesthetics
- Environmental education
- Denitrification – coastal estuary goals
- Angling – food and recreation
- Economy – tourism and tax base



What qualities of ponds are important to you or your work?

What do you value about ponds?

Understanding Economic Impacts of Cape Cod's Freshwater

Charles Goodhue – ERG

CAPE COD FRESHWATER INITIATIVE

Core Components of the Economic Analysis

Perceptions Survey
Identifies preferences, perceptions and attitudes towards freshwater

Intercept Survey
Assesses the economic impact of freshwater ponds on the economy

Hedonic Analysis
Quantifies the impact of freshwater ponds on property values

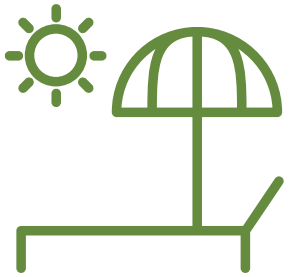
Discrete Choice Experiment
Estimates the value of certain freshwater attributes based on “willingness to travel”

Perception Survey Methods

What:	Web-based survey using Qualtrics panel
Why:	Attitudes, recreation, visitation rates
Details:	827 respondents ▪ 587 visitors ▪ 154 residents ▪ 86 non-resident homeowners

Cape Cod ponds and lakes are popular destinations.

82%



of Cape residents, non-resident homeowners, and tourists reported sometimes or frequently visiting ponds and lakes

1.3 to 1.7 million

Estimated visits to Cape Cod ponds and lakes annually

66%

of visits come between June and August

Cape residents and non-resident homeowners support targeted pond improvements.

The **most impaired** ponds and lakes, the ones with the **highest support** for improvement, and the **most used/visited should be prioritized**.

Cape residents and NROs also overwhelmingly indicated that pond improvement projects with **ecosystem benefits should be prioritized**.

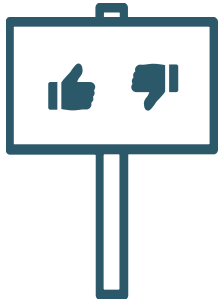
Discrete Choice Experiment Methods

What:	"Stated preference" survey asking about preferences for specific attributes
Why:	Understand value of water quality signs, bacterial issues, beach size, litter, shoreline development, amenities, and time to travel
Details:	382 respondents ▪ 102 residents ▪ 13 non-resident owners ▪ 267 visitors

People prefer to visit ponds and lakes with clean water and clean beaches.

Visitors are **1.8 TIMES** more likely to visit A pond that **rarely or never has bacterial issues** than a pond with issues every summer.

Visitors are **2.5 TIMES** more likely to visit a pond that has **little to no litter** than a pond with a noticeable amount of litter.



Visitors are **1.2 TIMES** more likely to visit a pond that has **signs about recent water testing** than one with no sign.

Discrete Choice Experiment

We Asked Cape Cod Residents and Visitors What Attribute They Considered Most Important When Deciding to Visit a Lake or Pond:

37%
said bacterial issues

20%
said signs of water quality

14%
said litter or garbage

11%
said amenities (picnic tables, bathrooms)

8%
said beach size

4%
said shoreline development

4%
said time to drive to pond

2%
said none in particular

Hedonic Property Price Analysis Methods

What:	Value of attributes of a property
Why:	Value of proximity to ponds and pond water quality
Details:	▪ 21,000+ home sales ▪ 8,000 rental properties

Cape residents and non-resident homeowners value clean ponds.

A **home** near a pond with clear water will sell for **$22,300 more*** than a similar home near a pond with algal issues.

(5 percent more than the median sales price)

A **rental property** near a pond with clear water will rent for **$189 MORE** per week than a similar rental property near a pond with algal issues.

(8 percent increase over median weekly rental value)

91% either "agree" or "strongly agree" that ponds and lakes are important to the Cape Cod environment, and they are willing to pay a premium to live near them.

Intercept Survey Methods

What:	In-person survey of people at ponds
Why:	Counts and spending to get economic contribution
Details:	▪ 75 unique ponds ▪ 606 surveys covering spending of 2,252 people ▪ 20 days of data collection

Lakes and ponds are important to the Cape Cod economy.

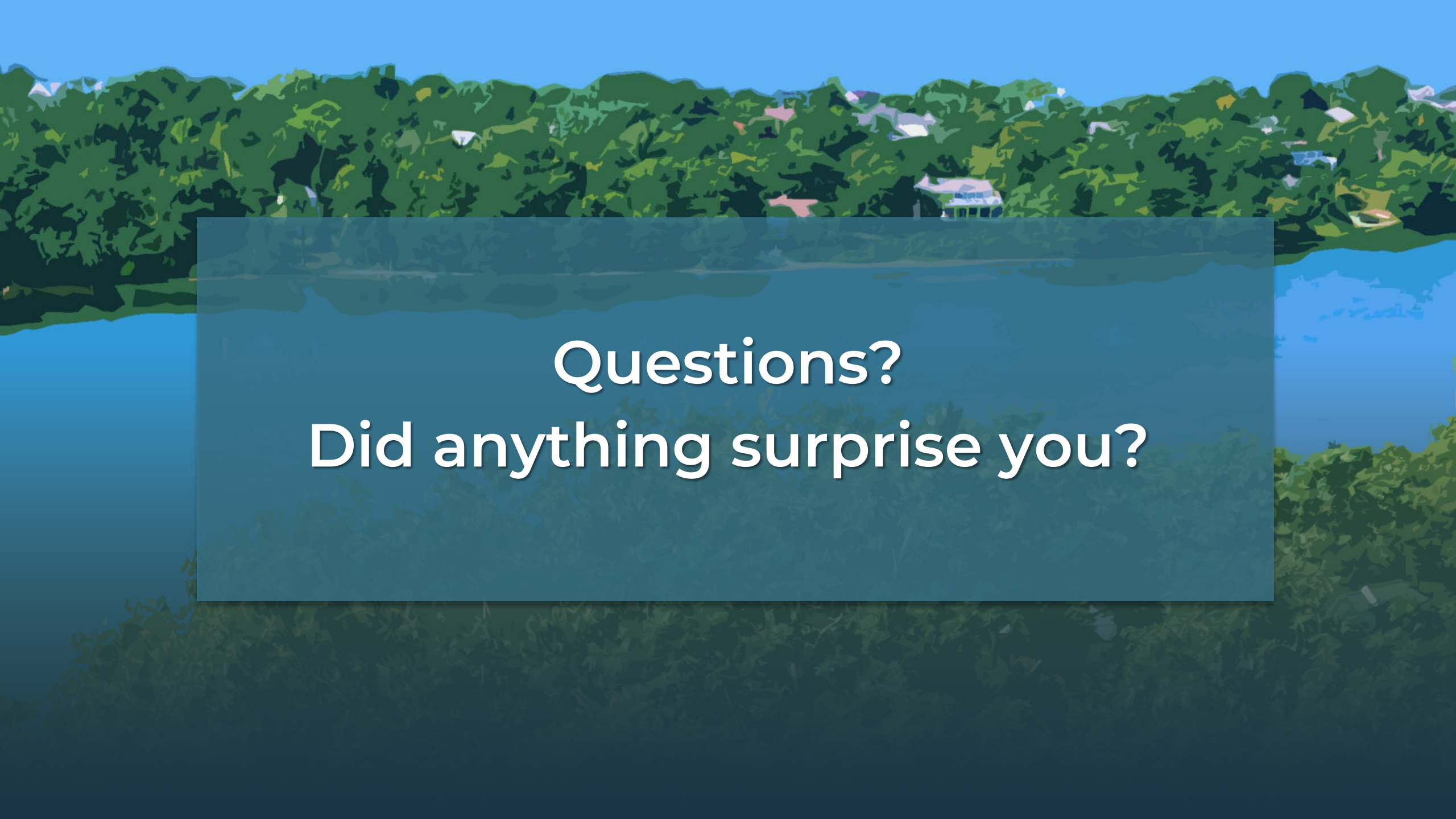
84%

of Cape residents and non-resident homeowners either “agree” or “strongly agree” that **ponds and lakes are important to the Cape Cod economy**

660 to 830 jobs annually can be attributed to spending associated with visits to lakes and ponds

$70 - $89 million of the region’s GDP is associated with visits to lakes and ponds

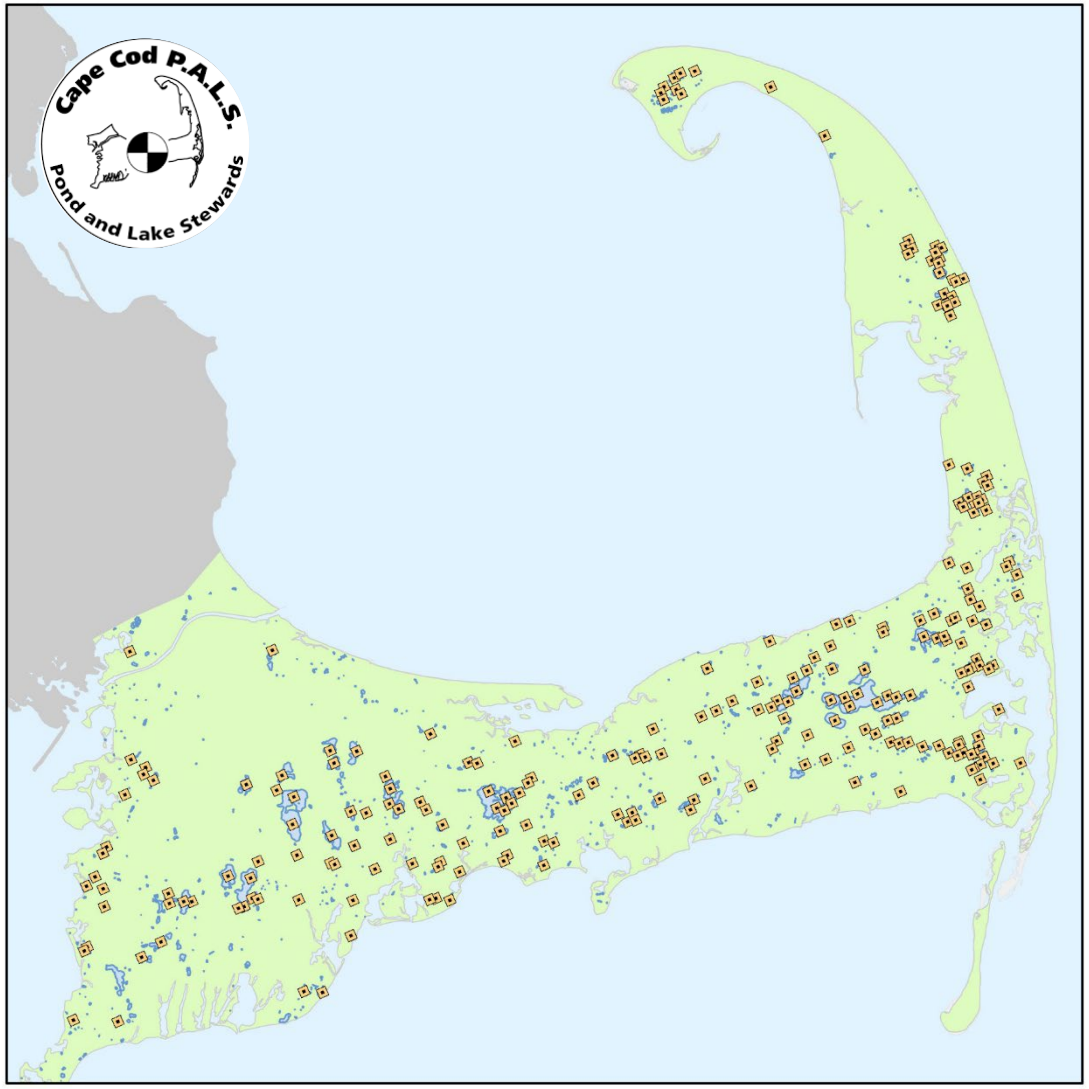
Visitors **spend an average of $50** locally per visit


Questions?
Did anything surprise you?

Water Quality Data

Tim Pasakarnis – Cape Cod Commission

CAPE COD'S HISTORY OF POND MONITORING



1+ data sheet per town per year

x

15 towns

x

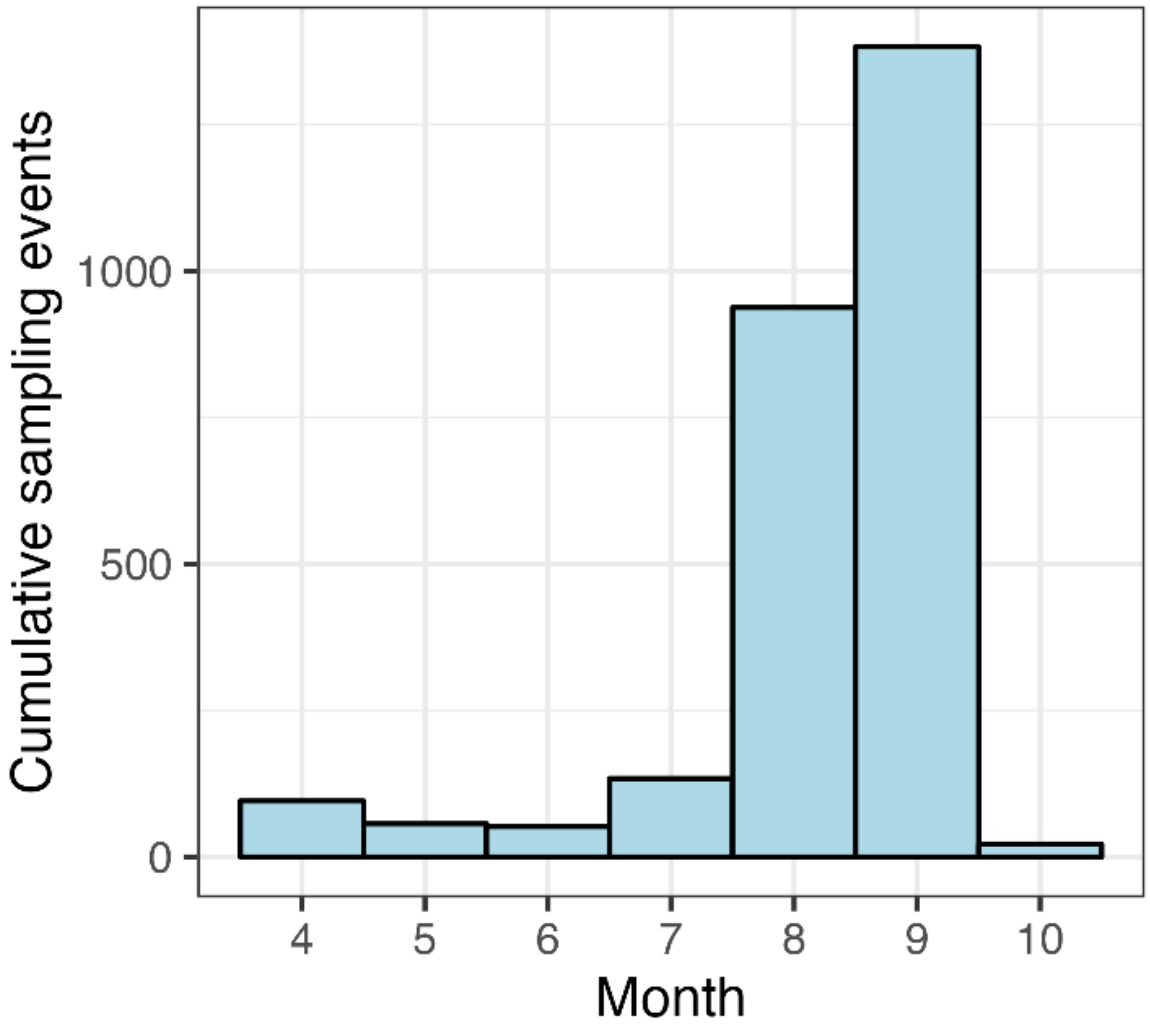
20+ years of pond monitoring

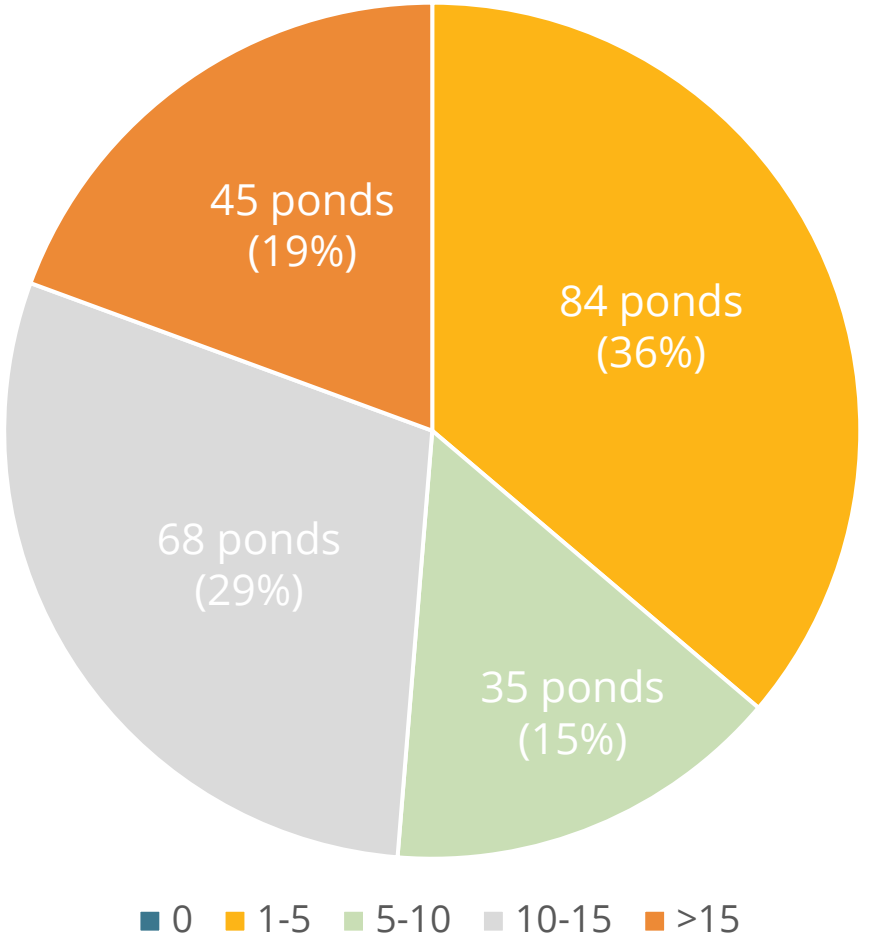
= 125,000+ sample results

= 200+ ponds

= 100+ spreadsheets

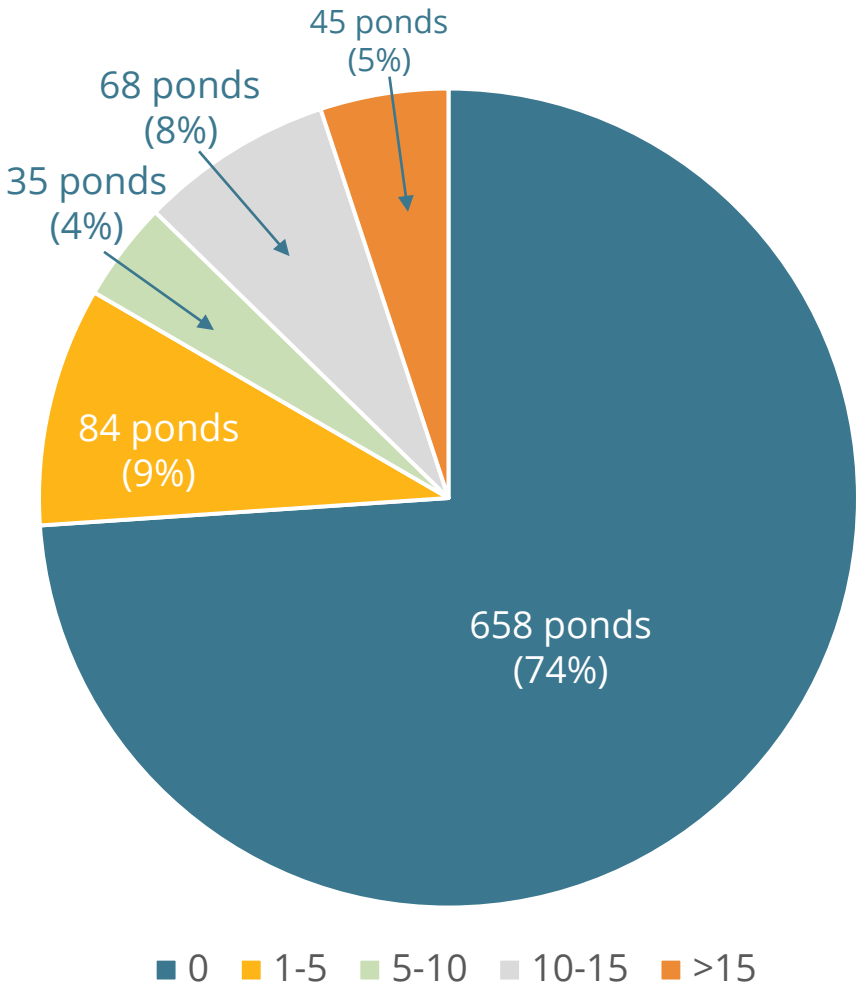
PONDS MONITORED



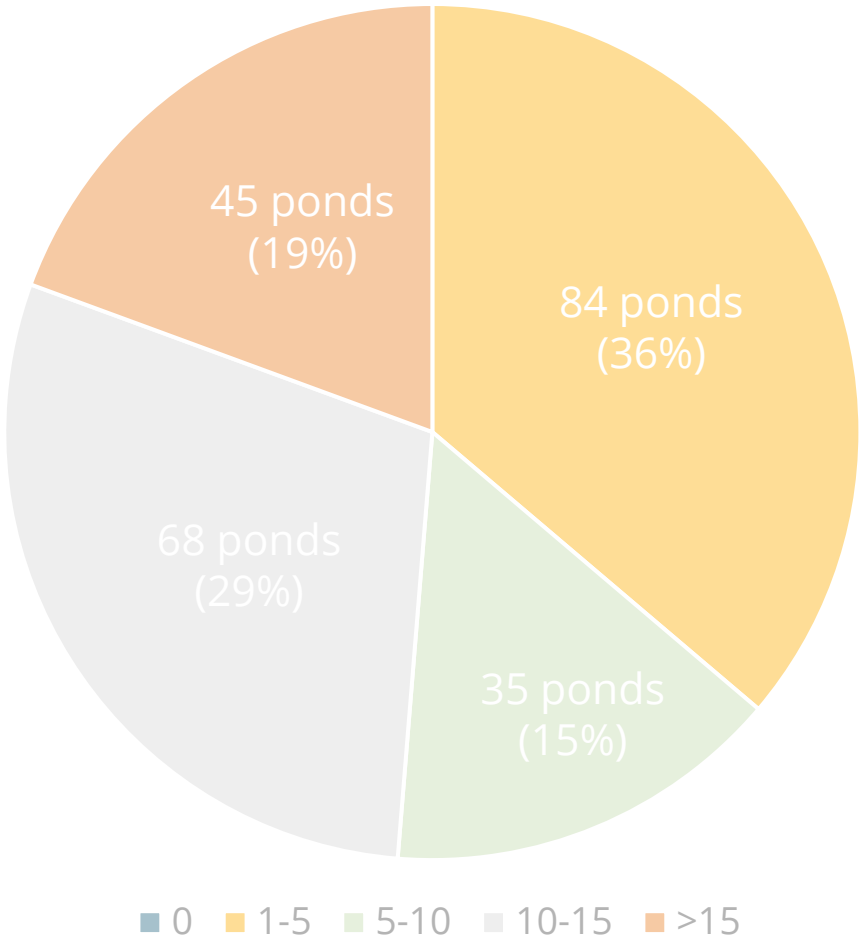


Years Monitored - Ponds with Data

PONDS MONITORED

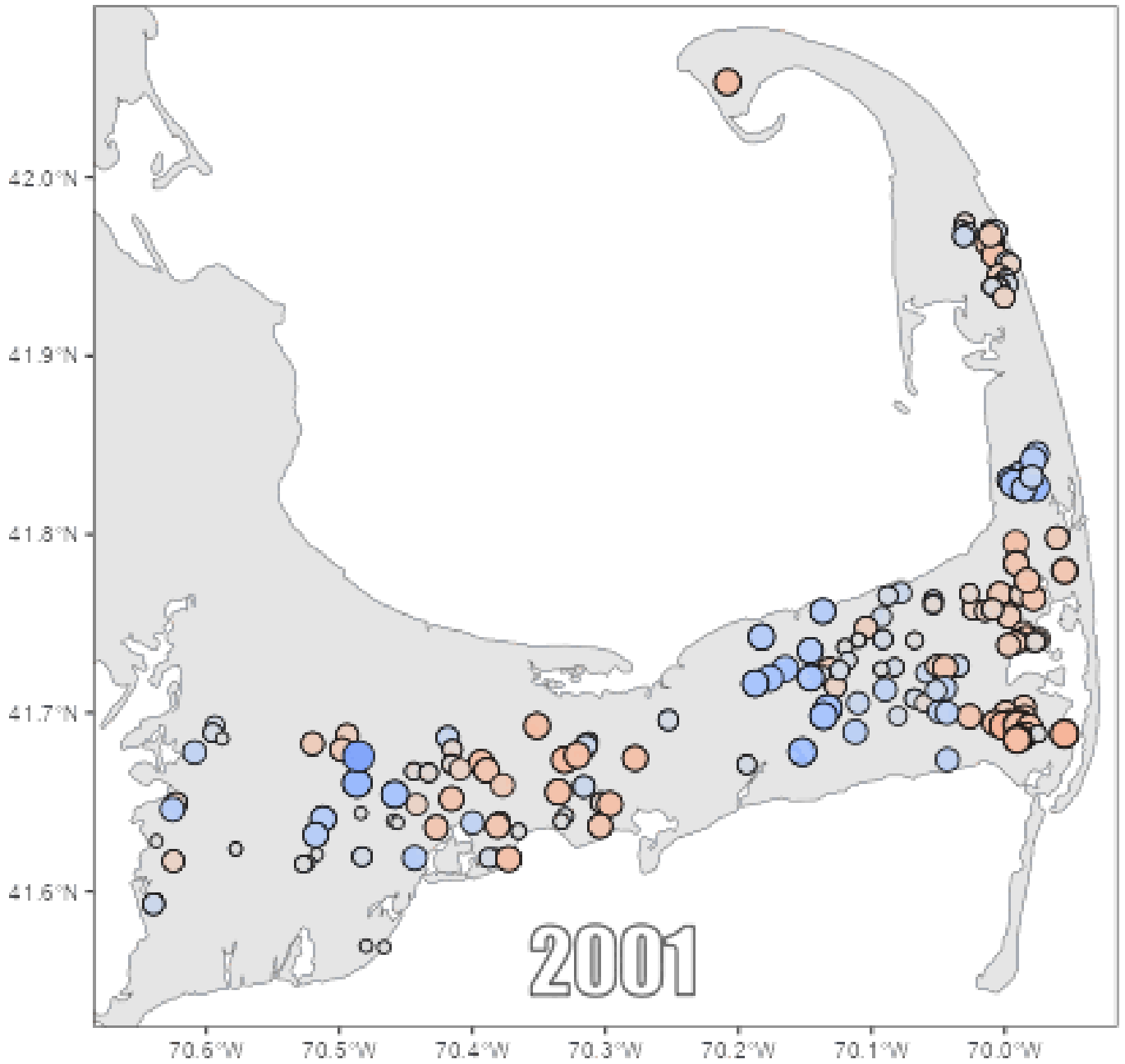


Years Monitored - All Ponds

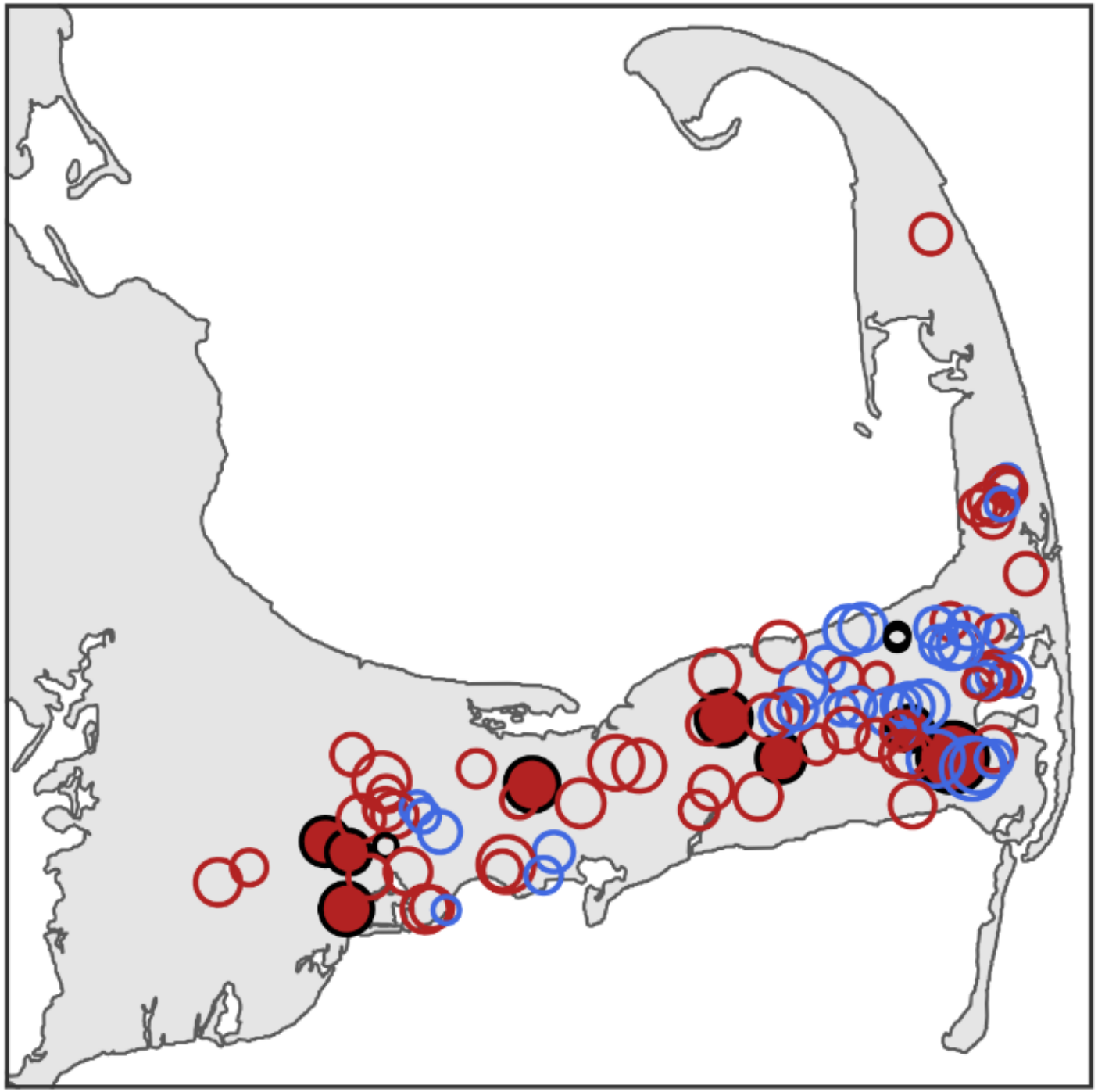


Years Monitored - Ponds with Data

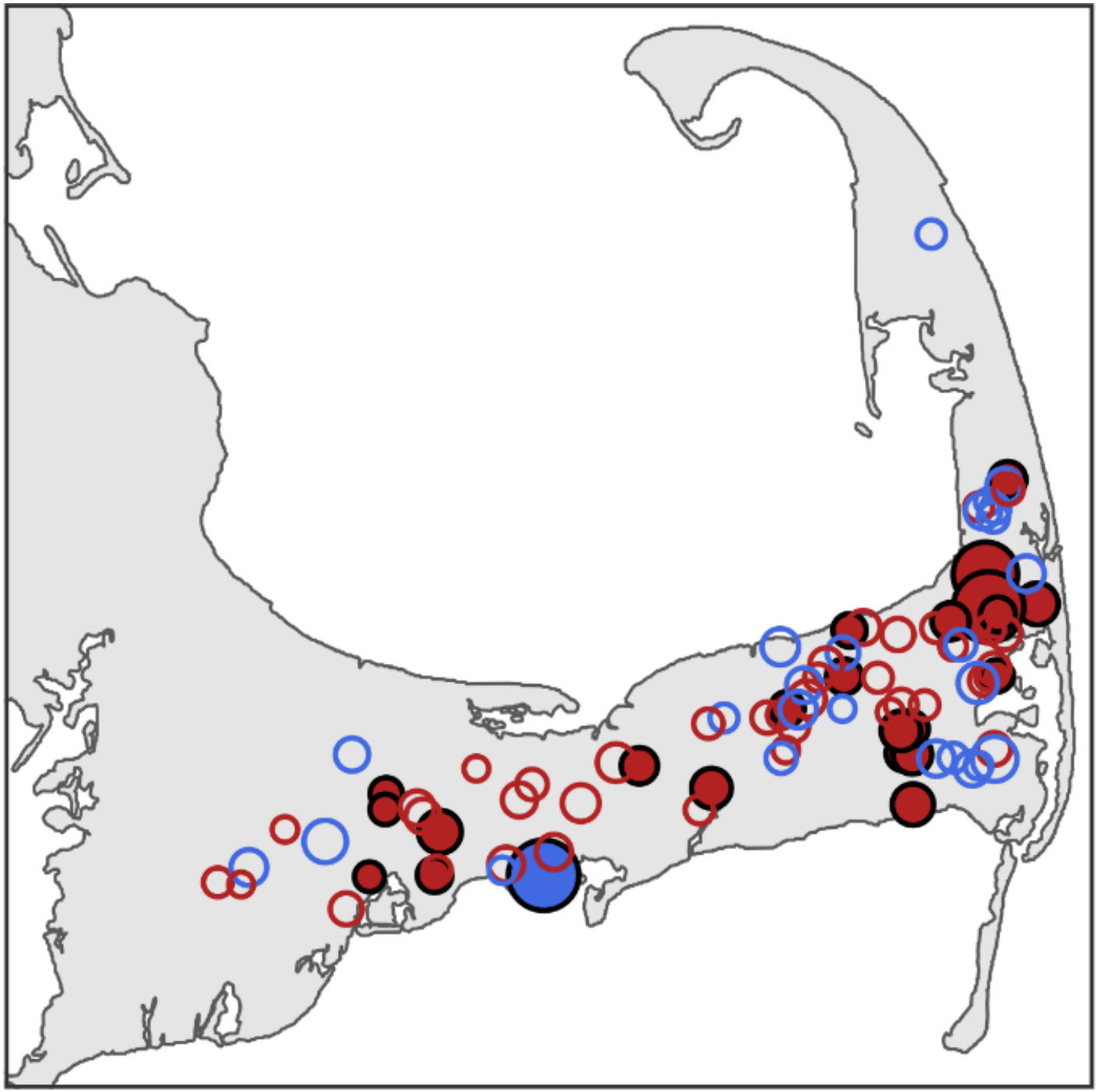
Ponds Monitored



Regional Trends in Surface Temperature



Regional Trends in Phosphorus



POND MONITORING PROGRAM

Pond Water Quality Monitoring Program

Develop and implement a plan for coordinated and consistent regional pond monitoring

Data Collection

Collect and manage data from representative ponds under EPA-approved Quality Assurance Project Plan

Centralized Database

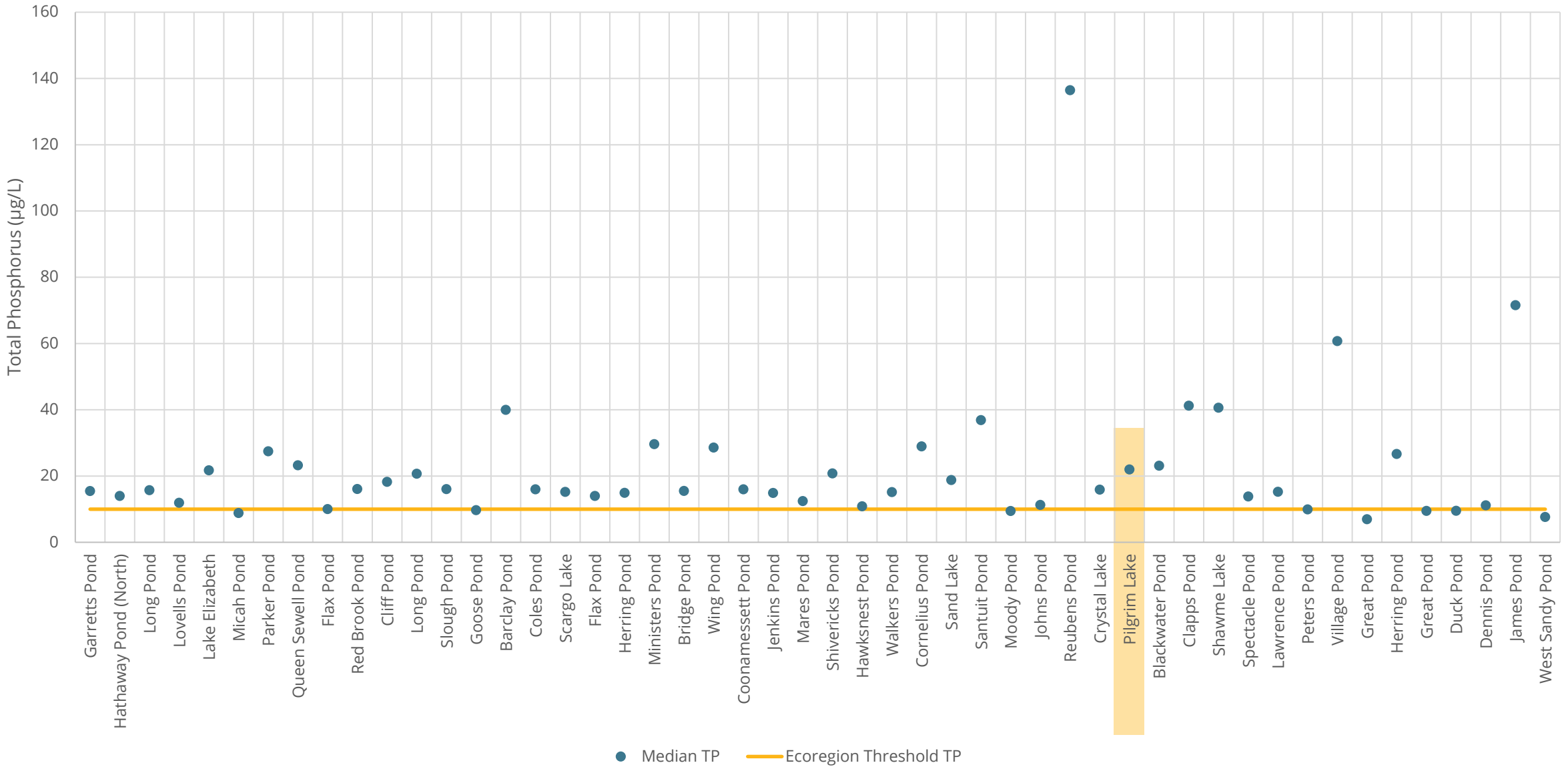
Report data directly to Water Quality Database

Integrated Planning

Coordinate with other Freshwater Initiative elements (regional trend analysis, GIS screening)

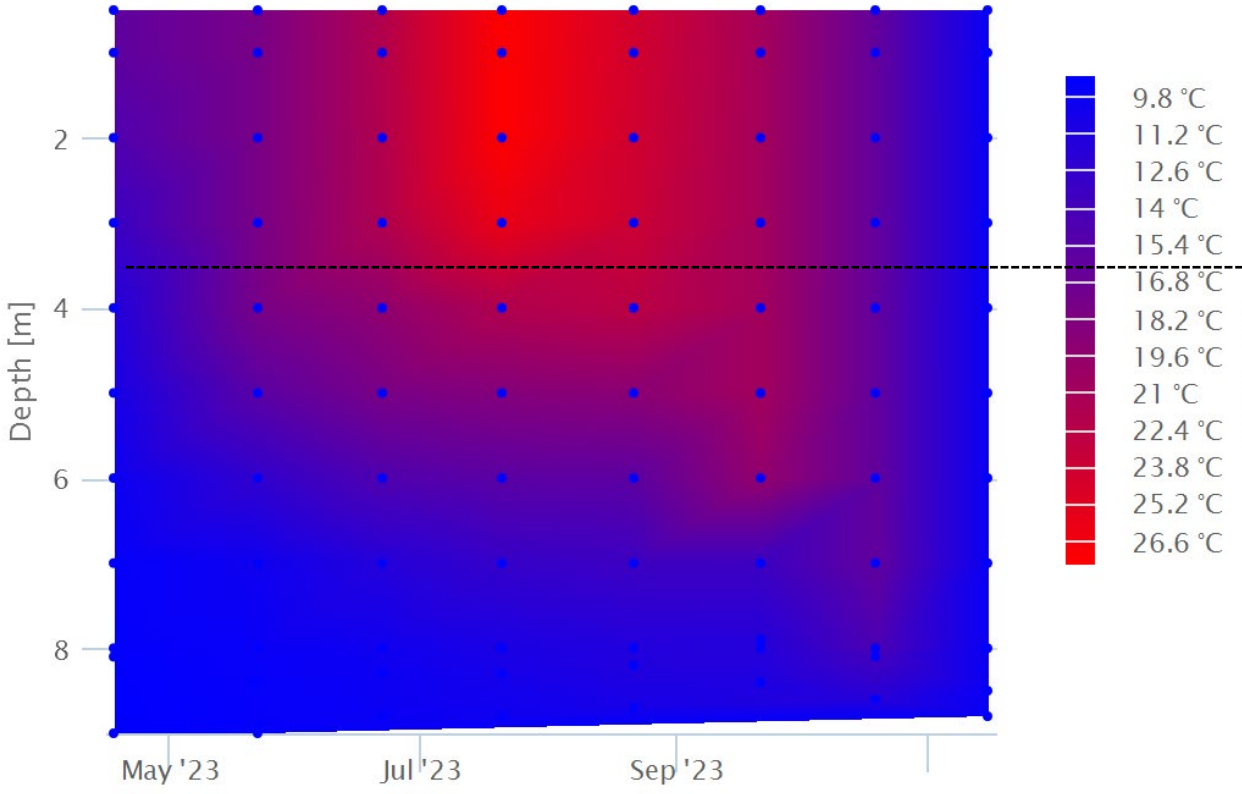
POND MONITORING PROGRAM RESULTS

POND MONITORING PROGRAM RESULTS

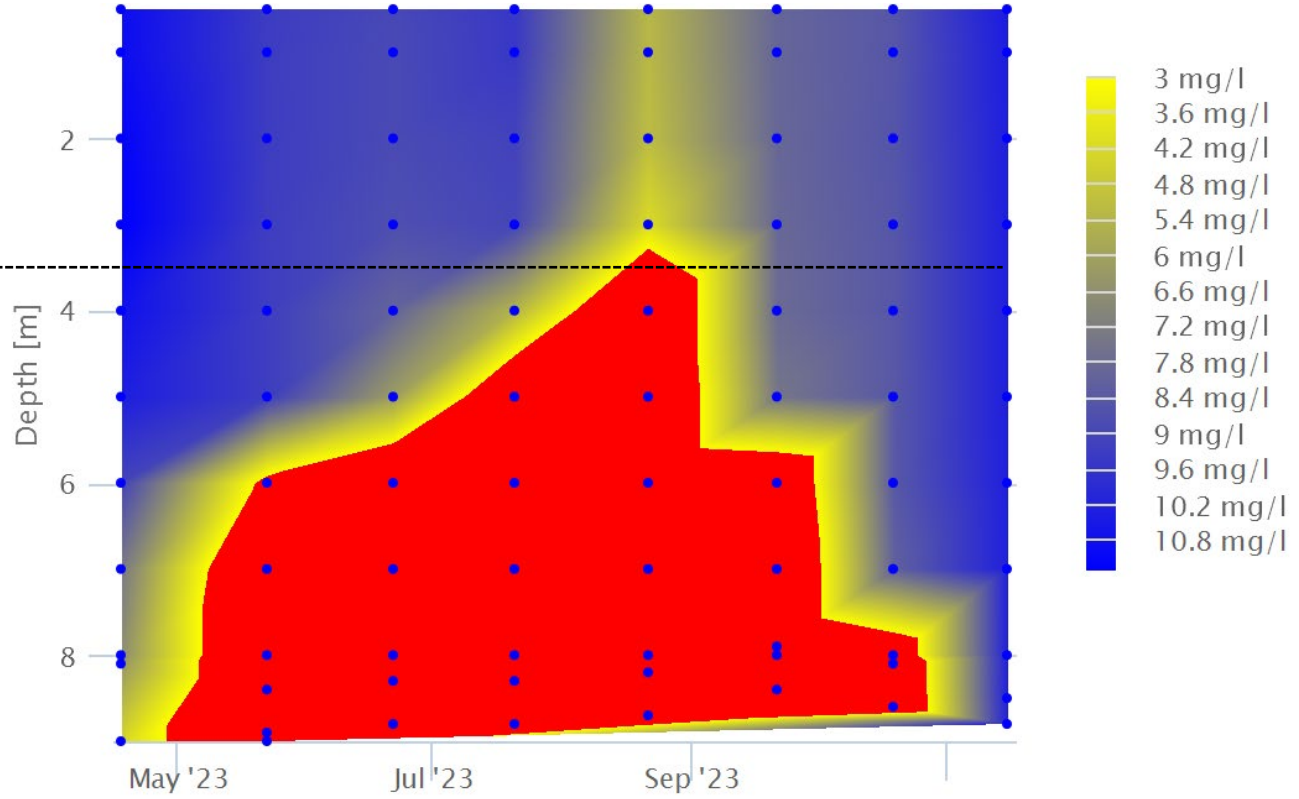


Pilgrim Lake - Orleans

Water Temperature

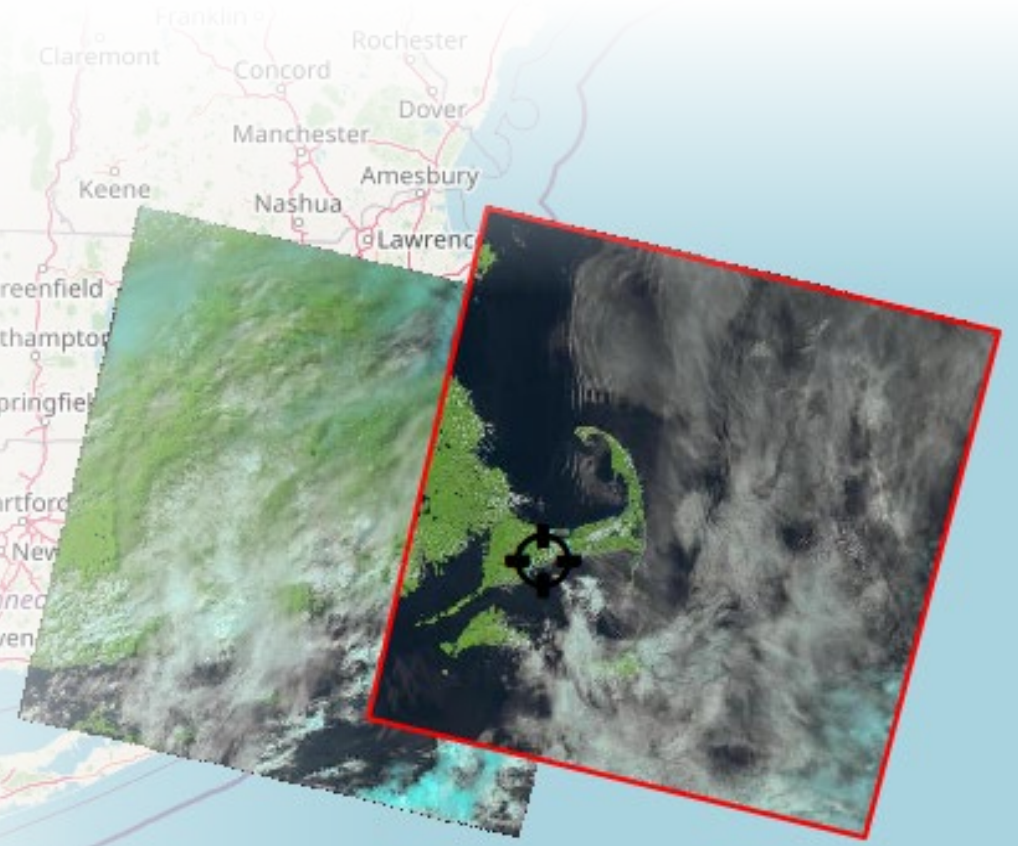


Dissolved Oxygen



REMOTE SENSING

How can satellite-derived imagery and existing pond water quality data help quantify changes in pond characteristics?



- Two projects using satellite imagery to estimate water quality characteristics in ponds and lakes
- Field data used to calibrate satellite predictive model
  - gathering information about additional ponds

CAPE COD COMMISSION

NOAA

Cape Cod P.A.L.S. Pond and Lake Stewards

NATIONAL PARK SERVICE

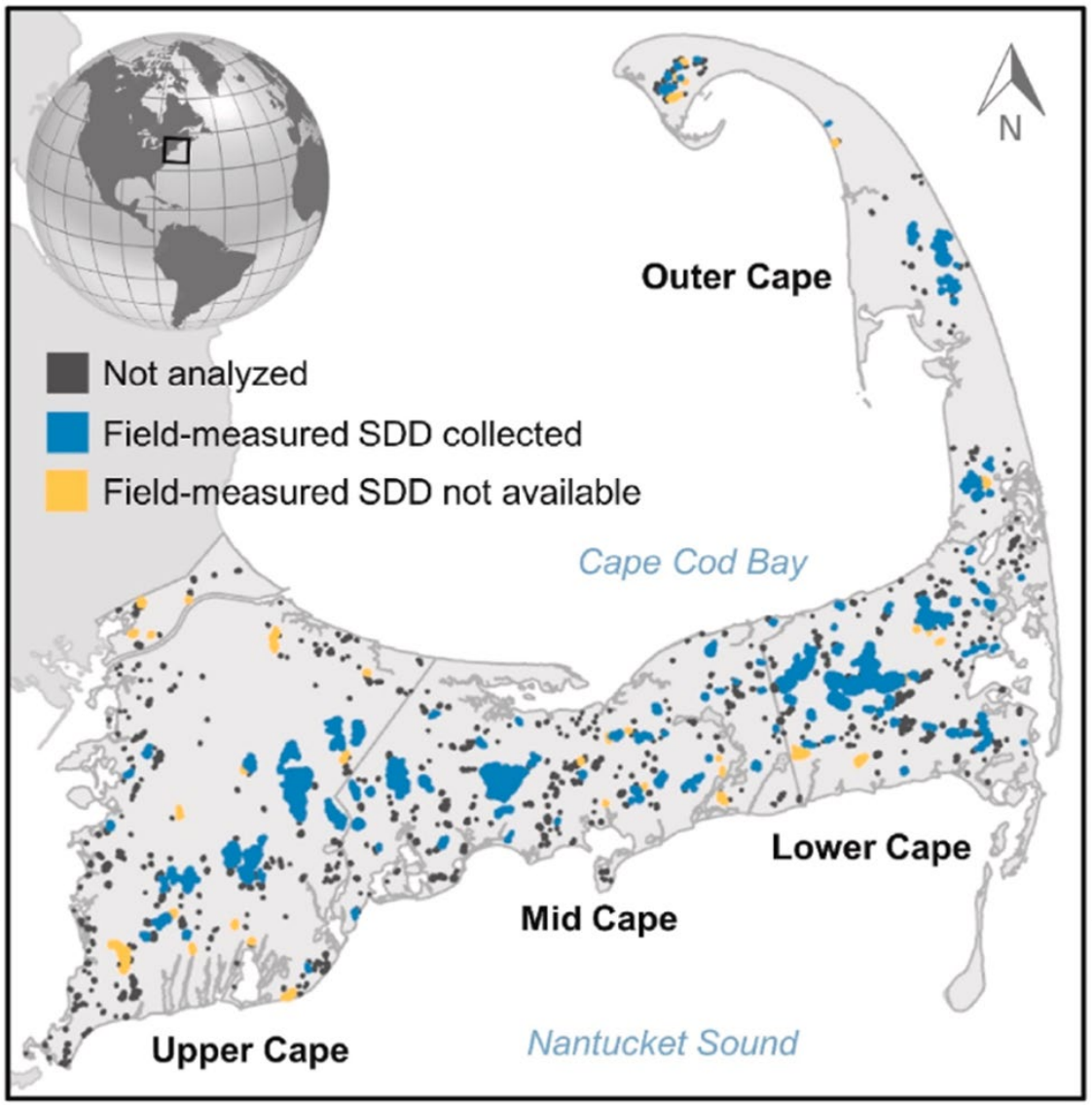
Commonwealth of Massachusetts DIVISION of MARINE FISHERIES

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

APCC Association to Preserve Cape Cod

THE UNIVERSITY OF RHODE ISLAND

REMOTE SENSING



- ~40% of Cape Cod's ponds were large enough for analysis by satellite (> 1 hectare)
- Analyzed 193 ponds for long-term (1984-2022) water clarity trends
- Observed substantial interannual variability in water clarity, long-term water clarity generally improved across the Cape.
- Water Clarity ≠ Quality

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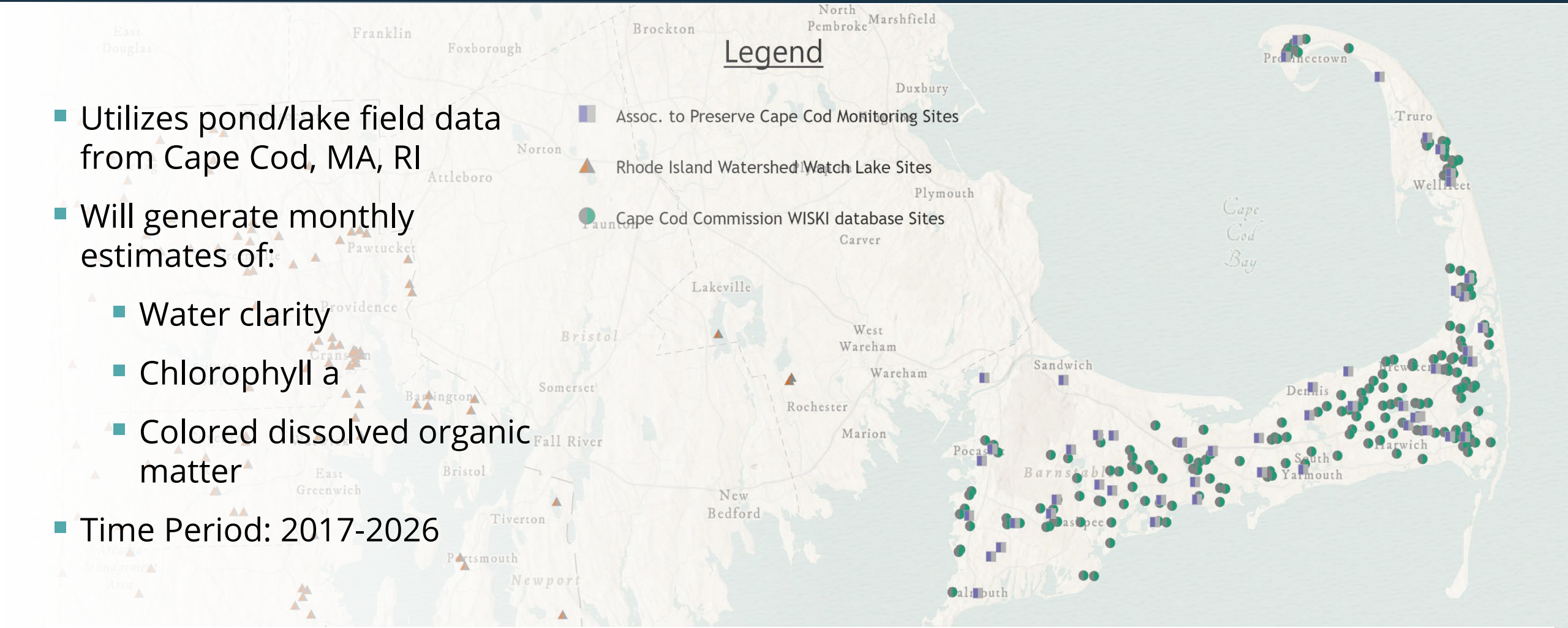
APCC Association to Preserve Cape Cod

NOAA

REMOTE SENSING – NEXT STEPS

- Utilizes pond/lake field data from Cape Cod, MA, RI
- Will generate monthly estimates of:
  - Water clarity
  - Chlorophyll a
  - Colored dissolved organic matter
- Time Period: 2017-2026



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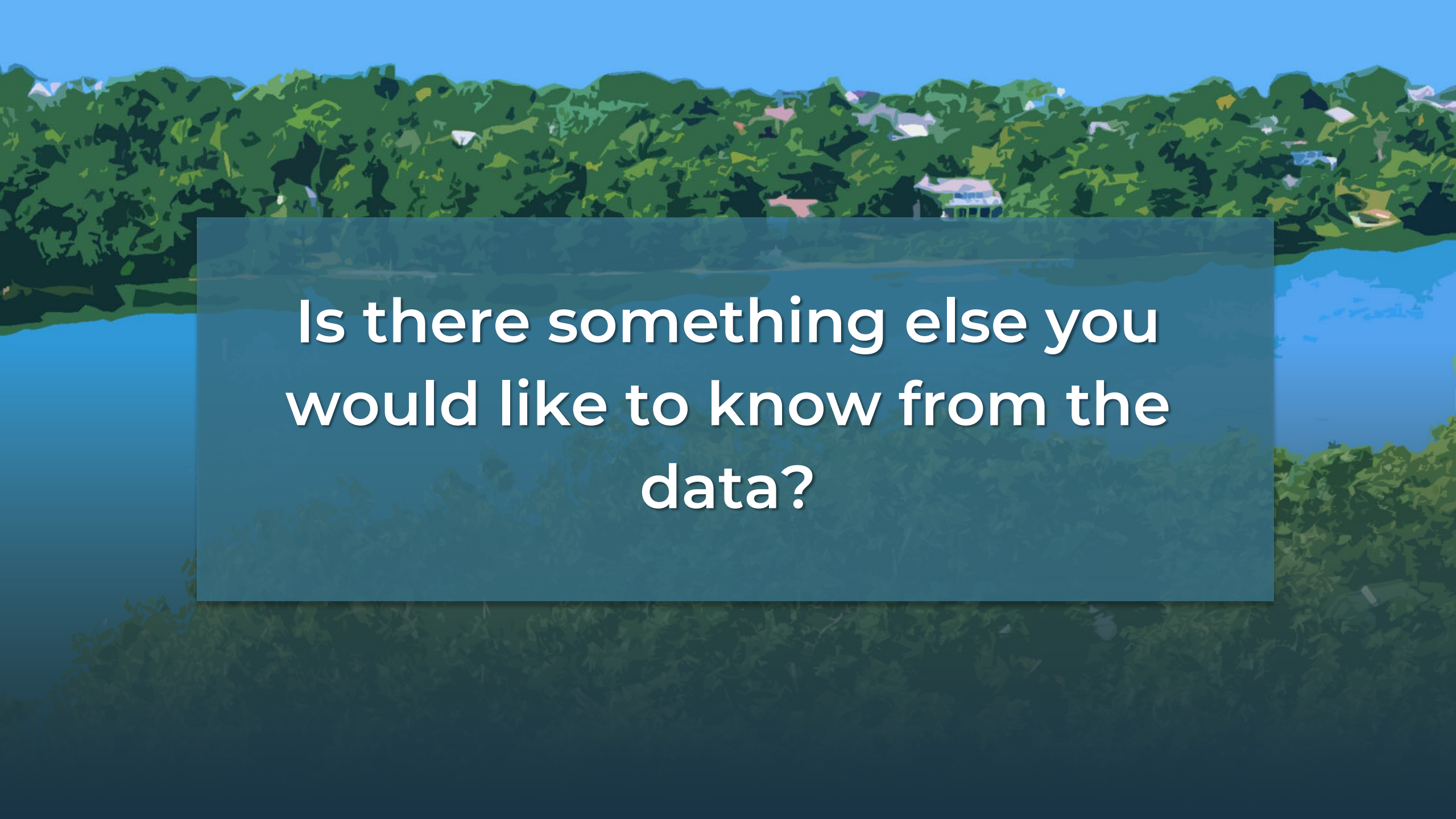
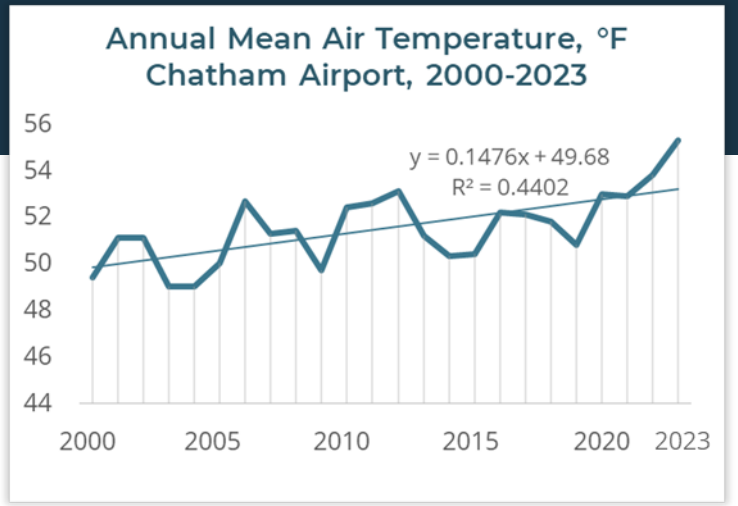

Is there something else you would like to know from the data?

Regional Drivers of Change

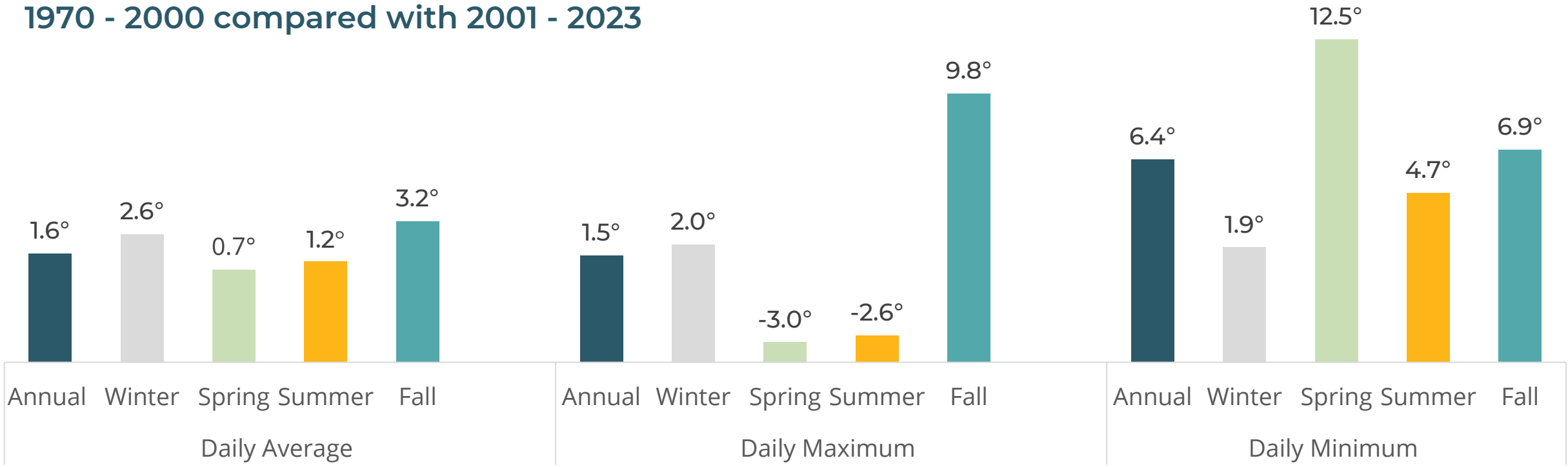
Liz Moran

CLIMATE IMPACTS: **PHYSICAL**



- Stratification and Mixing Regime
- Warming waters- Seasonal Impacts

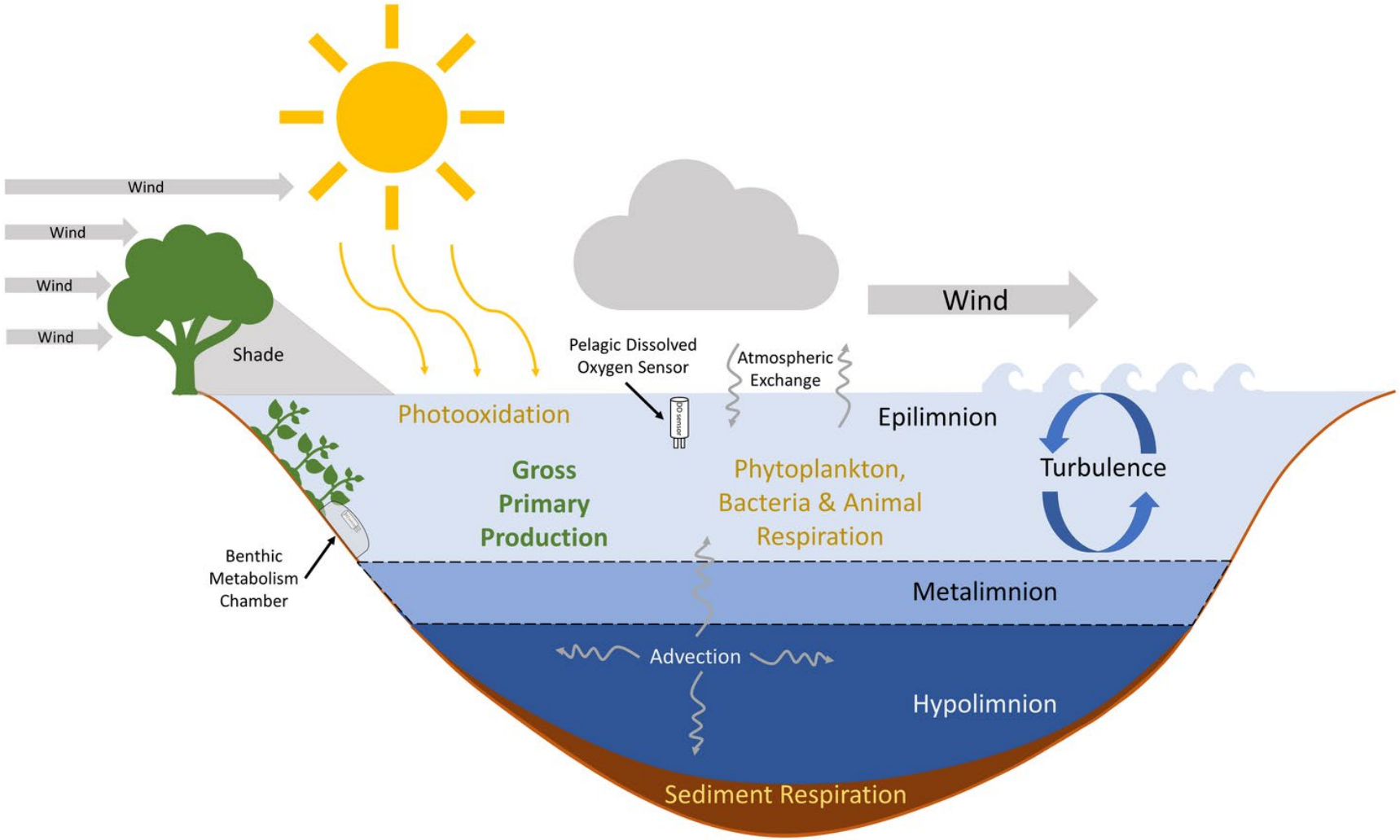
Air Temperature Change, Chatham Airport
1970 - 2000 compared with 2001 - 2023



CLIMATE IMPACTS: **CHEMICAL**

Longer duration of stratification- increased risk of oxygen depletion

Chemical changes at sediment surface- phosphorus mobilization

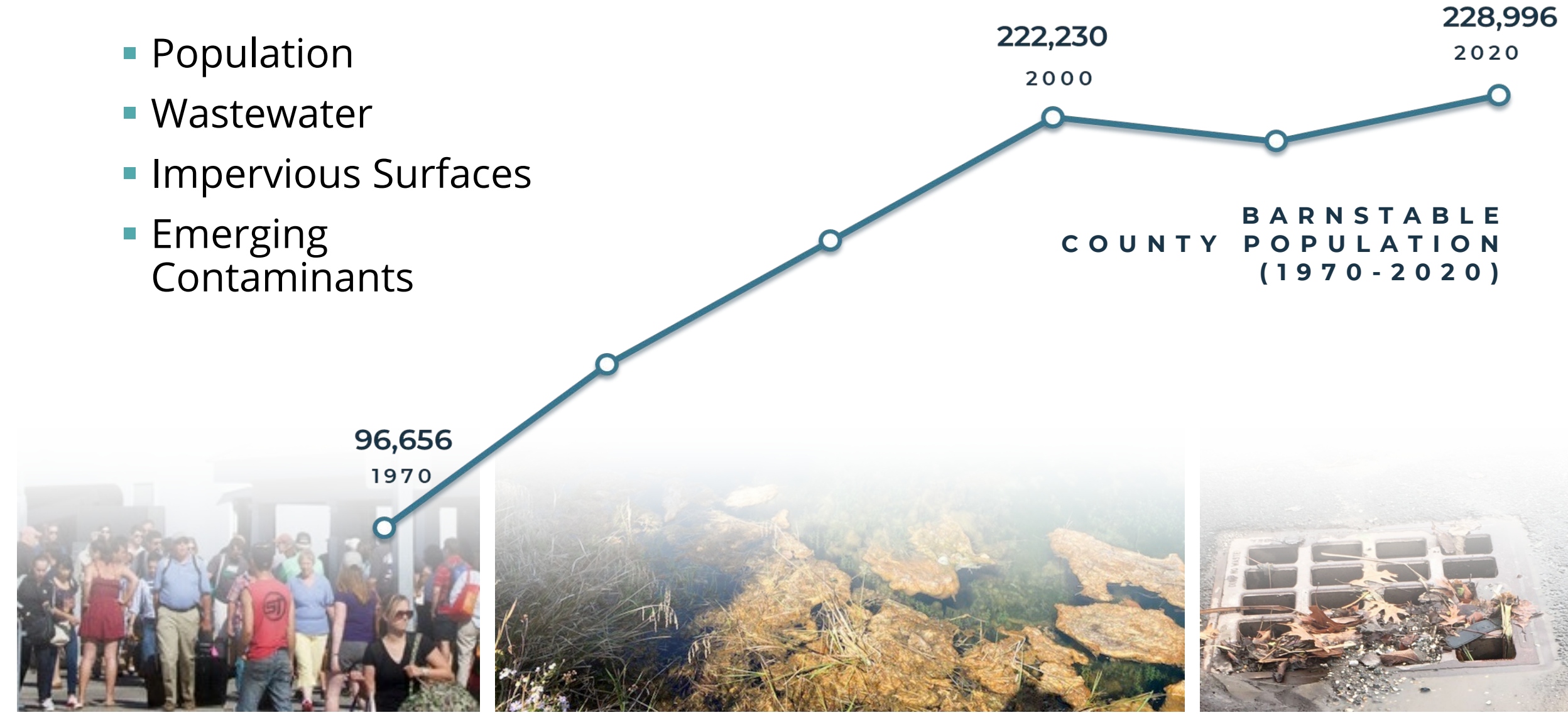


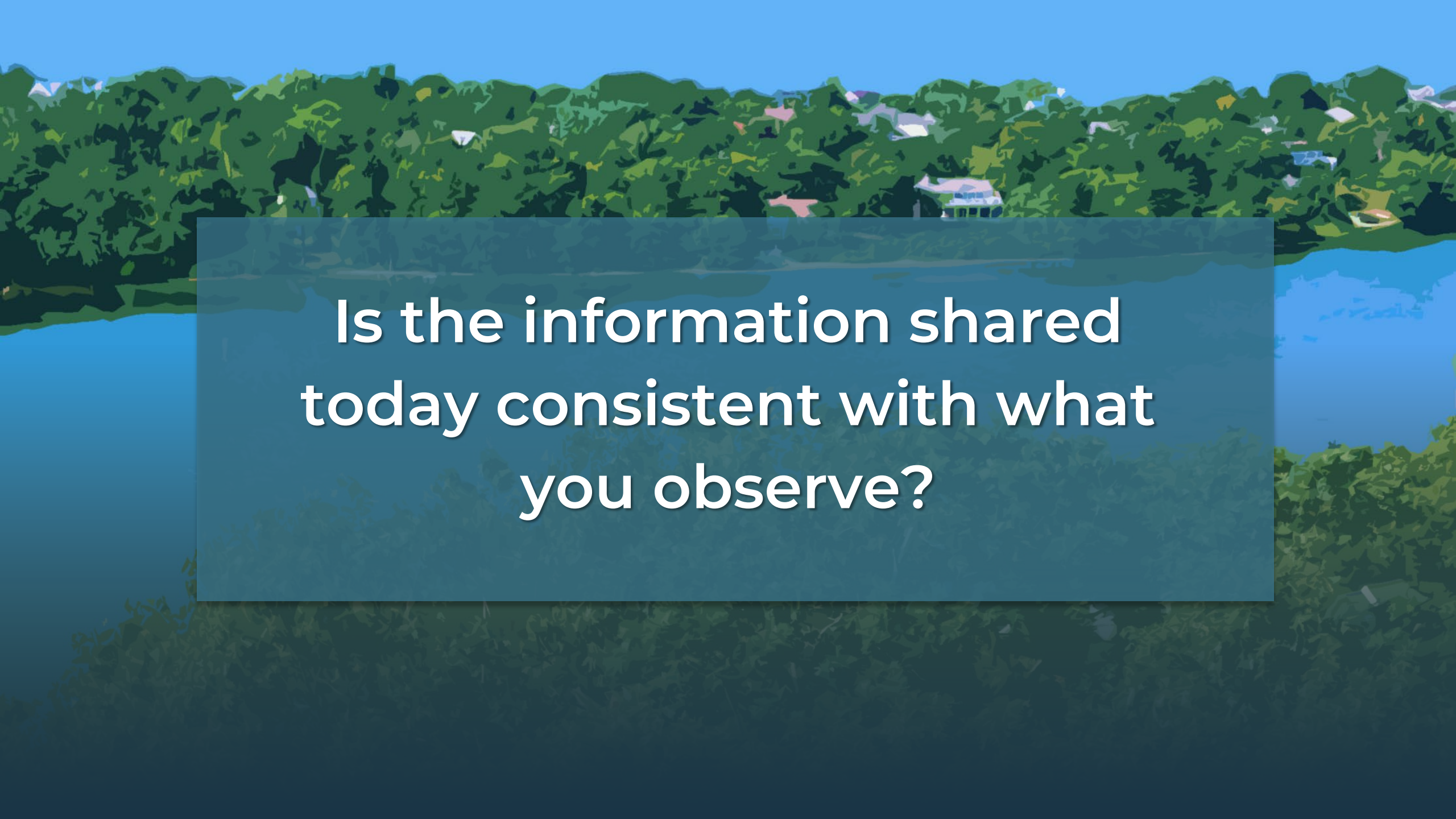
CLIMATE IMPACTS: **BIOLOGICAL**

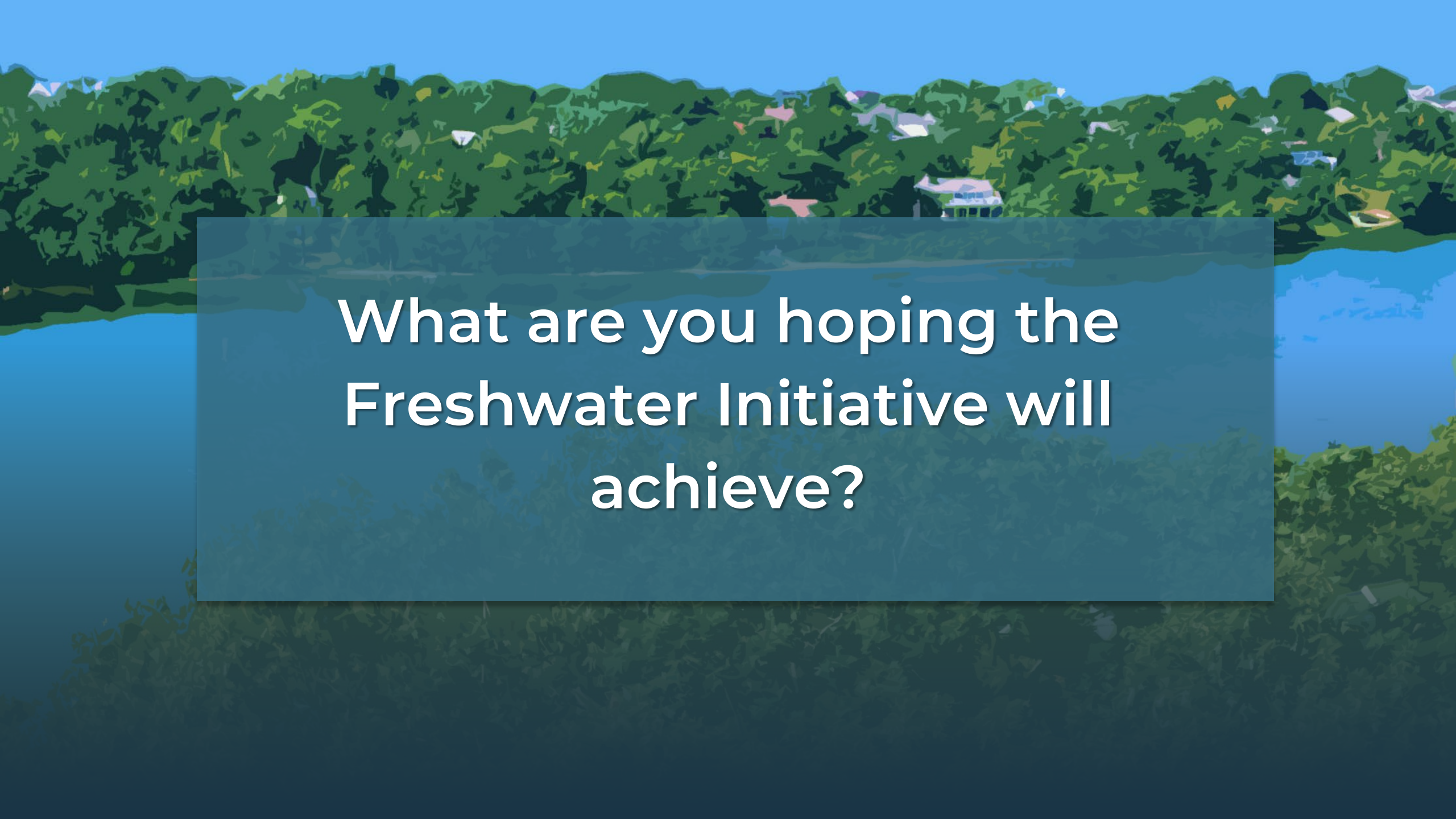
- Warmer waters affect biochemical reaction rates
- Habitat impacts on aquatic biota – temperature and oxygen
- Expanding range for invasive species
- Cyanobacterial advantages: buoyancy, nitrogen-fixation, less grazing pressure

CULTURAL DRIVERS OF CHANGE

- Population
- Wastewater
- Impervious Surfaces
- Emerging Contaminants




Is the information shared today consistent with what you observe?


What are you hoping the Freshwater Initiative will achieve?

UPCOMING STAKEHOLDER MEETINGS

APRIL 22 AND 23

Meeting 2

Exploring Strategies and Priorities

- Strategies Overview
- Identifying Priorities
- Comment and Discussion

JUNE 3 AND 4

Meeting 3

Reviewing the Implementation Plan

- Incorporating Stakeholder Feedback
- Recommendations
- Implementation
- Discussion

Other questions or feedback?

www.capecodcommission.org/freshwater

Thank you!

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