

# What About Phosphorus?

Tara Nye Lewis

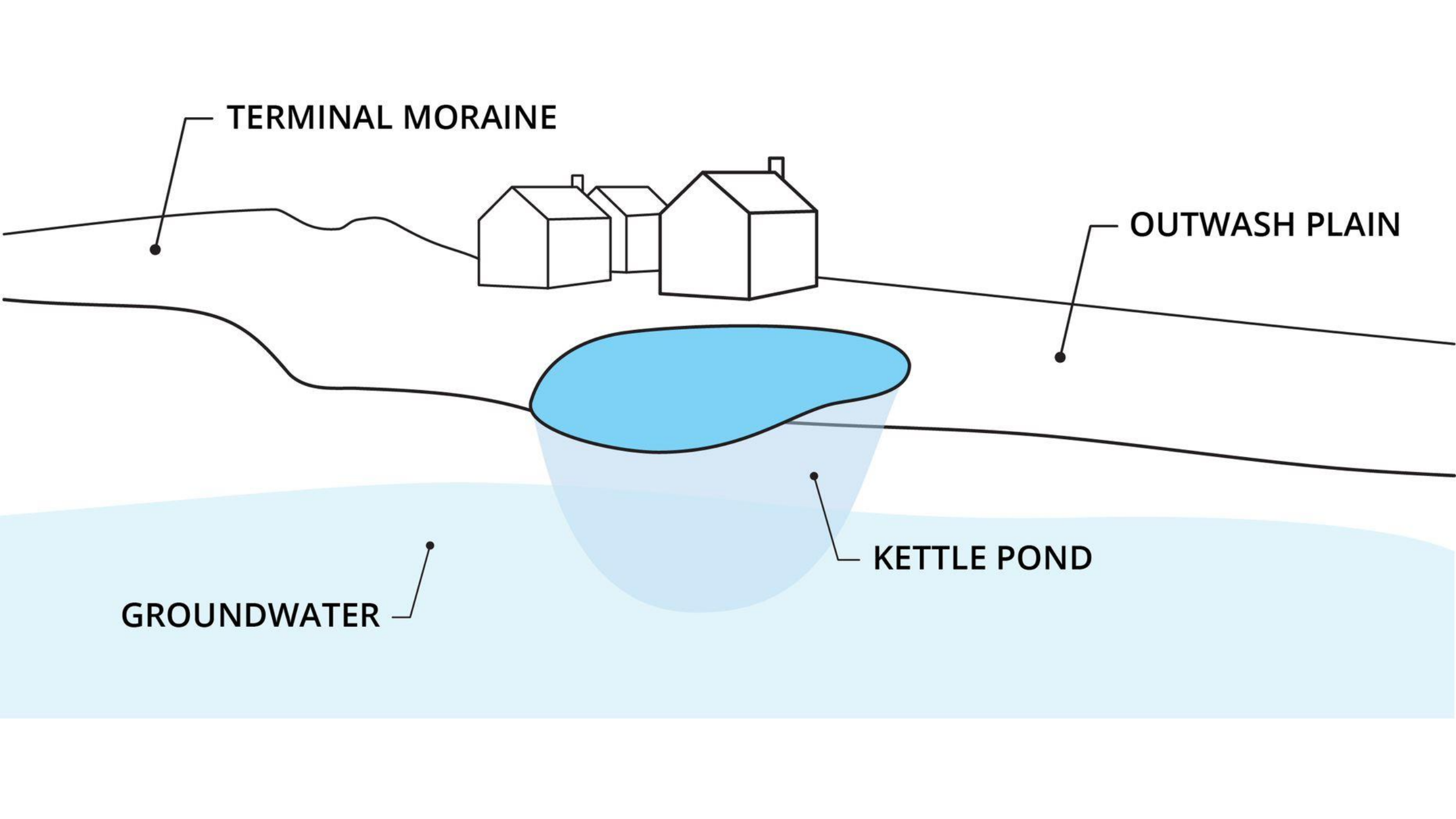
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Water Resources Analyst  
Cape Cod Commission

# Cape Cod Commission

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- Regional land use agency for Cape Cod
- Established by the Cape Cod Commission Act (1990)
- Created to promote, maintain and enhance:
  - Public health, safety and general welfare
  - Sound local economies
  - Balanced economic development
- While also protecting these values:
  - Unique natural, coastal, scientific, historical, cultural, architectural, archeological, recreational values

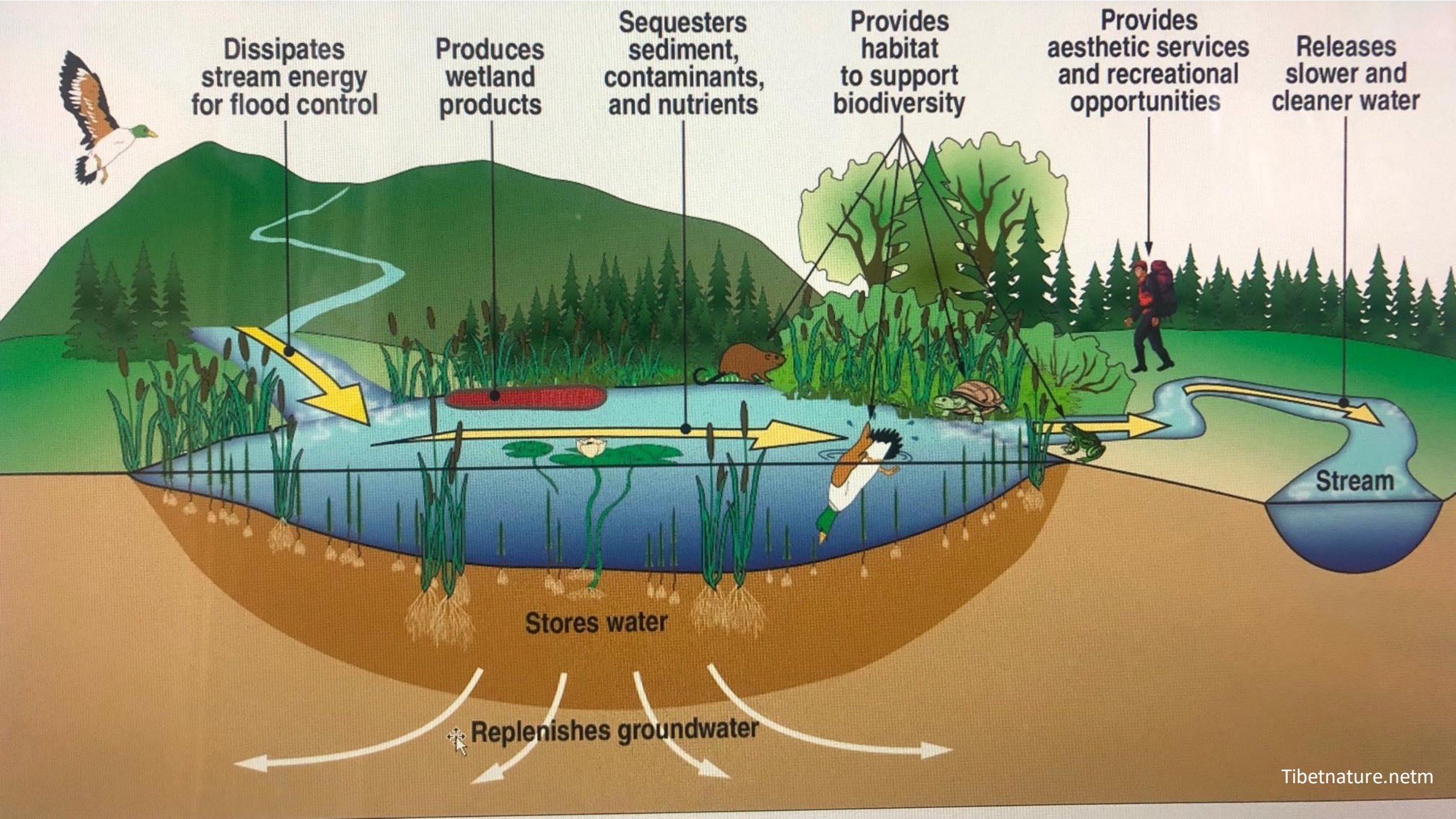


TERMINAL MORAINE

OUTWASH PLAIN

KETTLE POND

GROUNDWATER



Dissipates stream energy for flood control

Produces wetland products

Sequesters sediment, contaminants, and nutrients

Provides habitat to support biodiversity

Provides aesthetic services and recreational opportunities

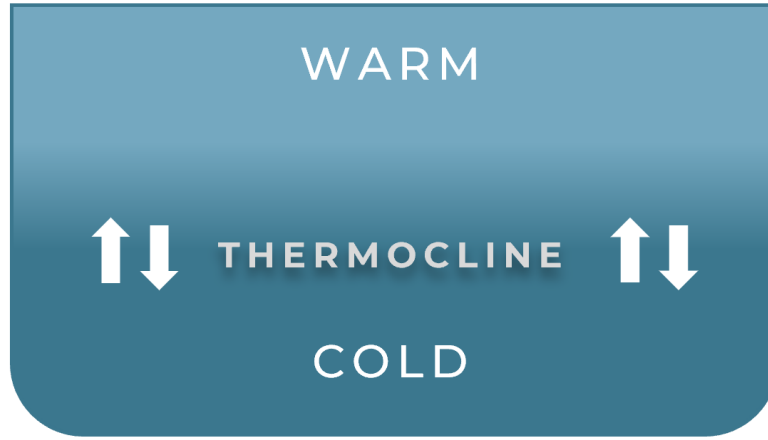
Releases slower and cleaner water

Stores water

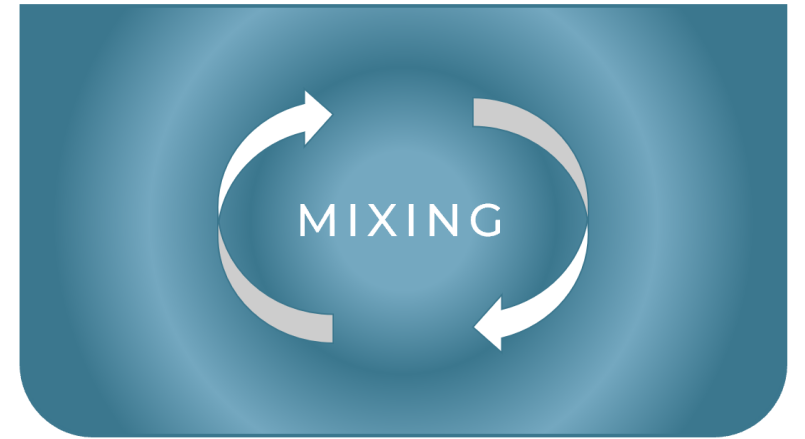
Replenishes groundwater

Stream

# SUMMER



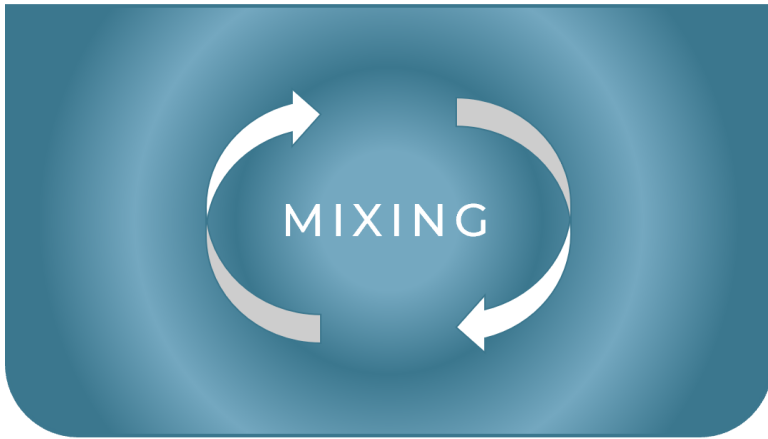
# AUTUMN



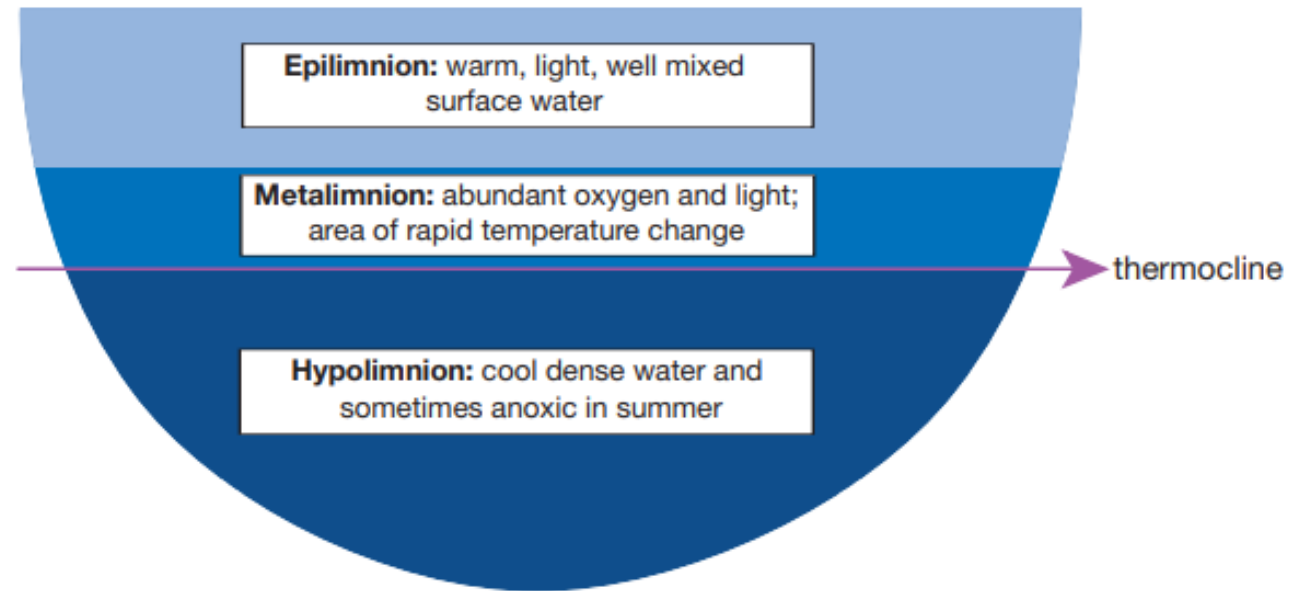
# WINTER



# SPRING



## Layers in a Stratified Lake



## Trophic Status Classification

**LOW  
NUTRIENT  
INPUT**

Oligotrophic

Mesotrophic

Eutrophic

Hypereutrophic

**HIGH  
NUTRIENT  
INPUT**

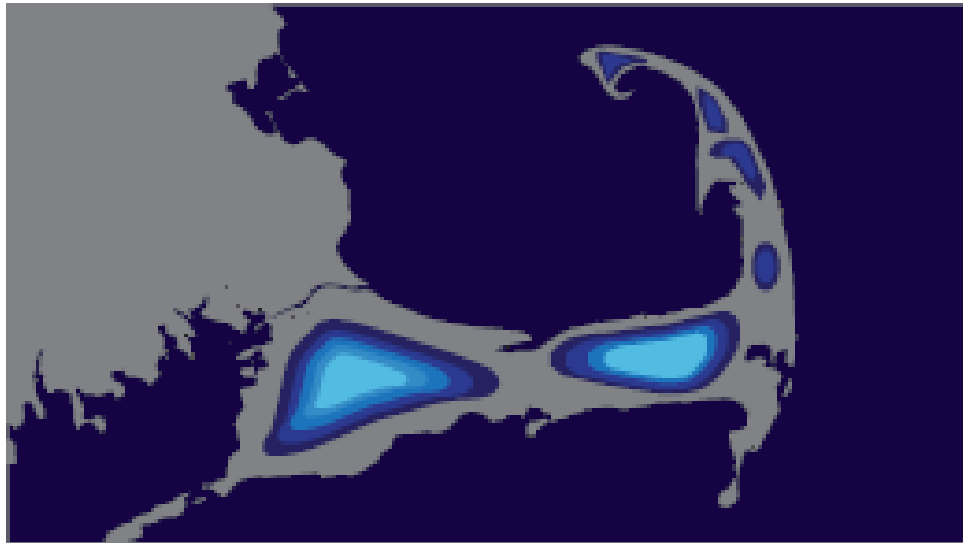




Water resources on Cape Cod are interconnected.



# | CONNECTING LAND TO WATER



The aquifer is comprised of six lenses of groundwater that are separated by major drainage divides



Groundwater is in a state of dynamic equilibrium between recharge from precipitation and discharge to surrounding marine waters

BELOW IS A CROSS-SECTION OF THE MID-CAPE

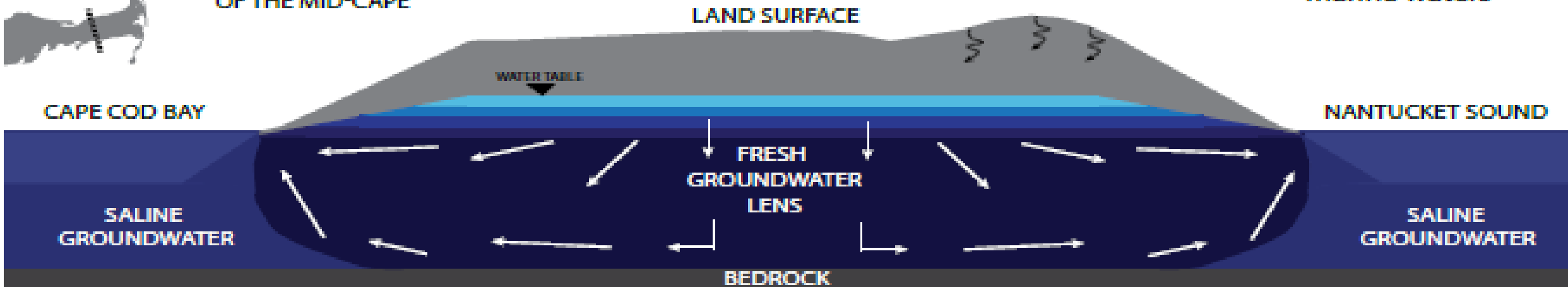


DIAGRAM DRAWN WITH VERTICAL EXAGGERATION FOR ILLUSTRATION PURPOSES

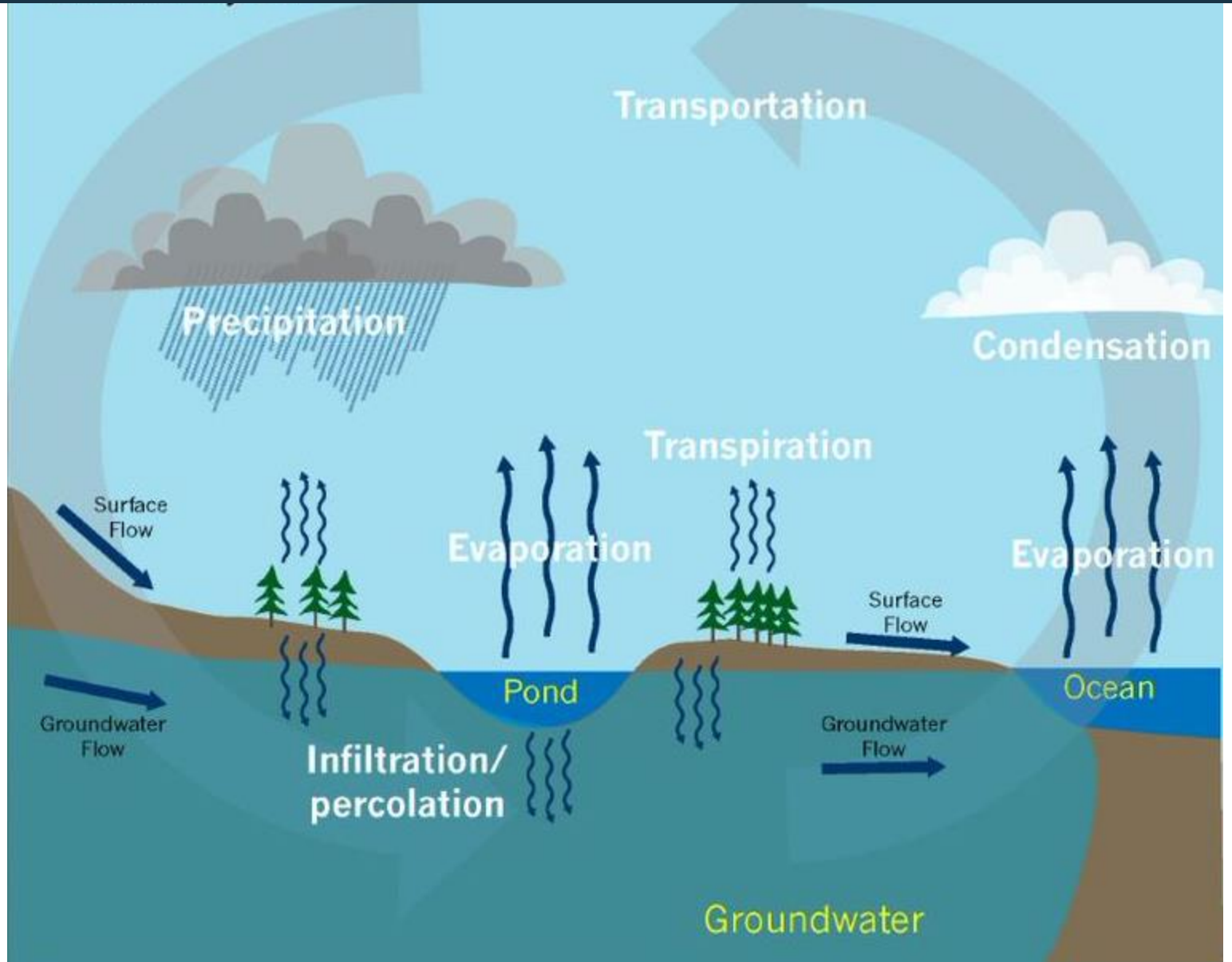
# | CONNECTING WATER TO WATER

Water cycle

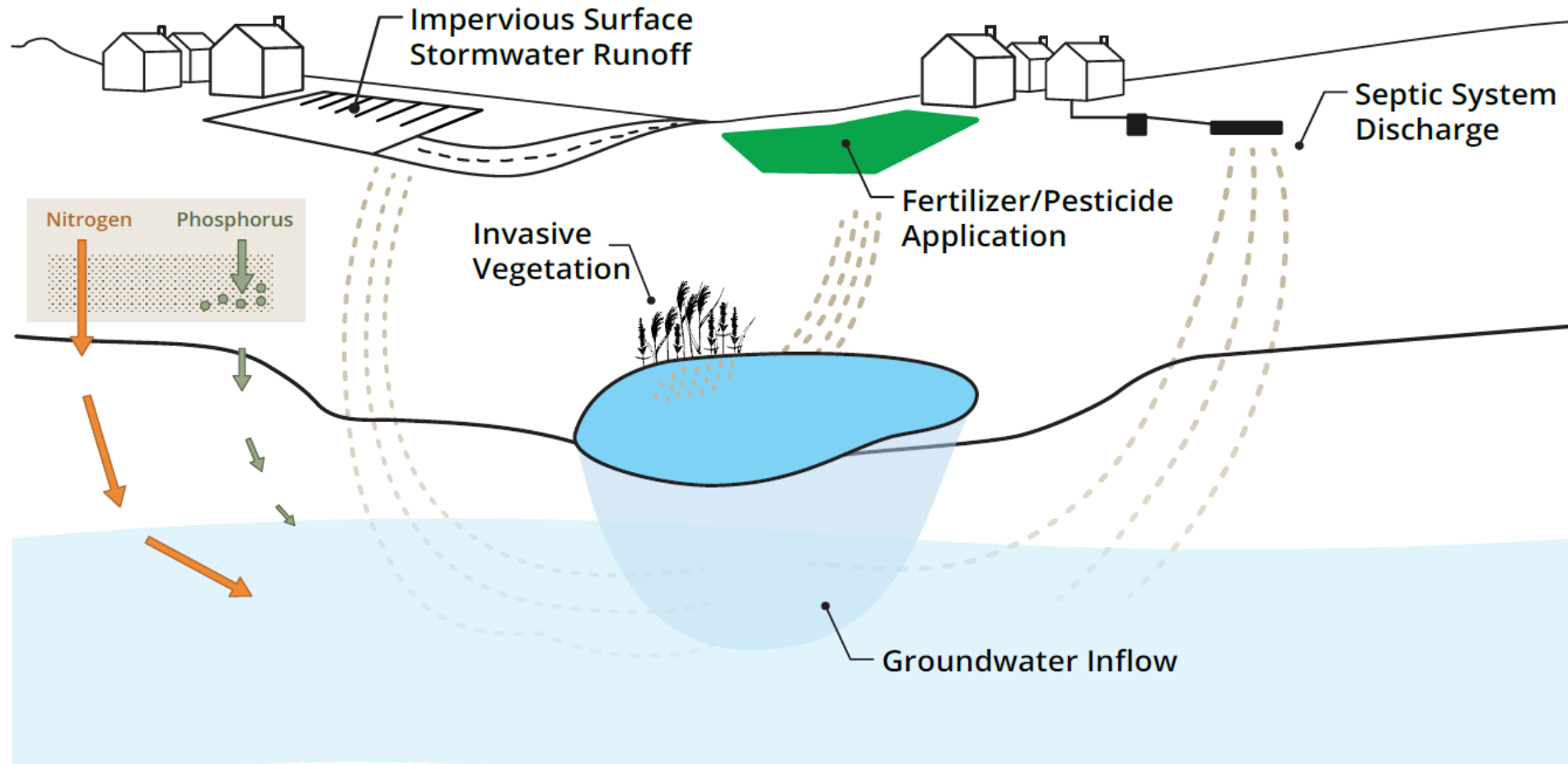
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Ponds connected to groundwater

Groundwater connected to ocean



# | THREATS TO PONDS



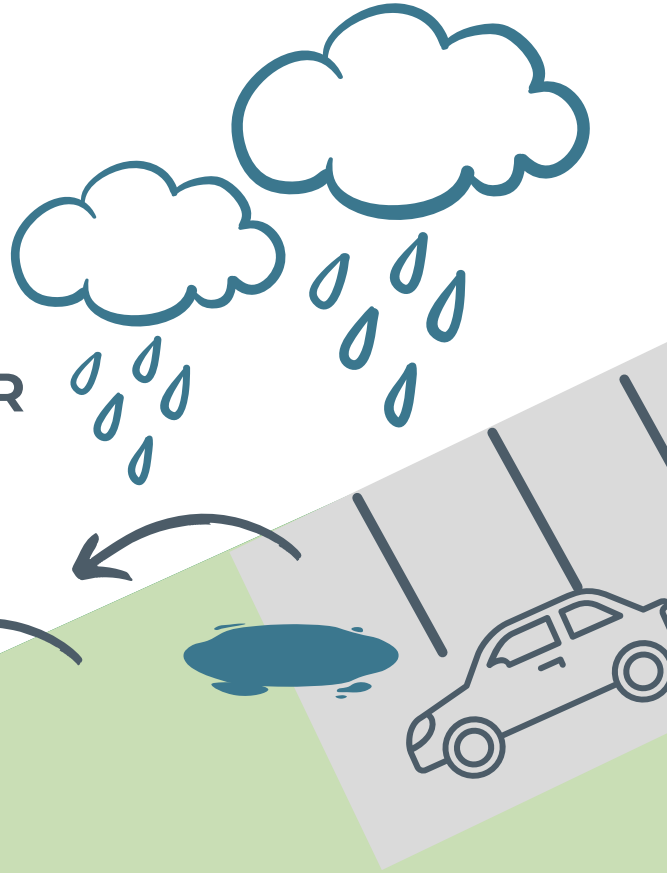
**SUBSURFACE  
FLOW**



**INVASIVE  
SPECIES**



**STORMWATER  
FLOW**



**POND**



**GROUNDWATER INFLOW**



Created by Andrew Brown

Created by Andrew Brown  
from Nature Project

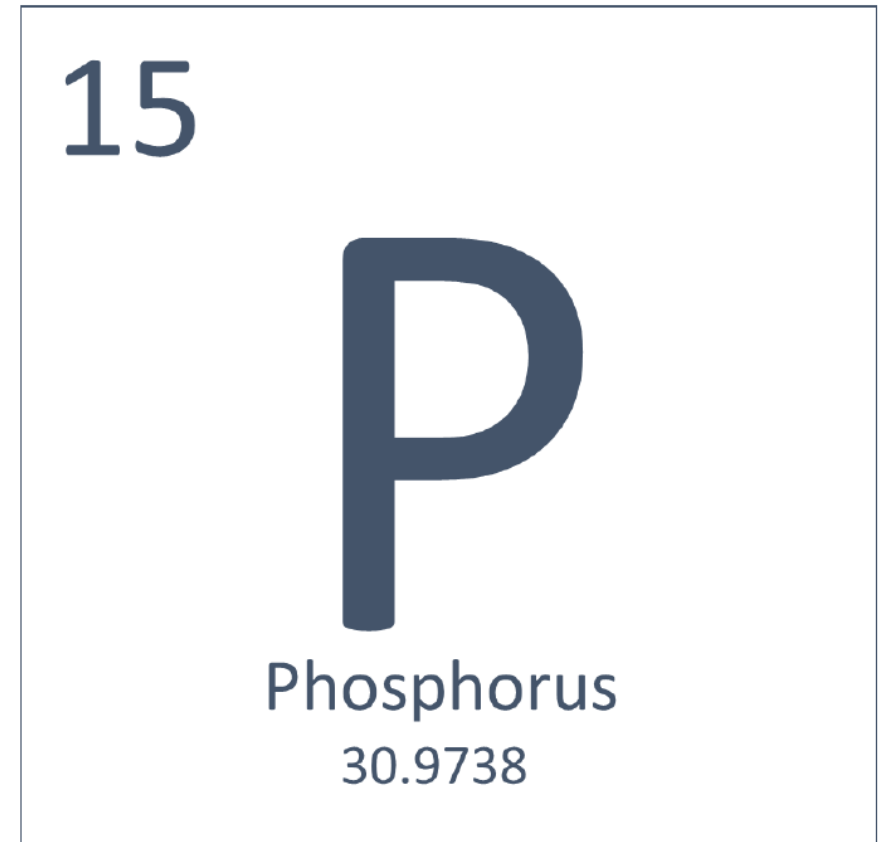
# 208 PLAN

Cape Cod Area Wide Water Quality Management Plan Update

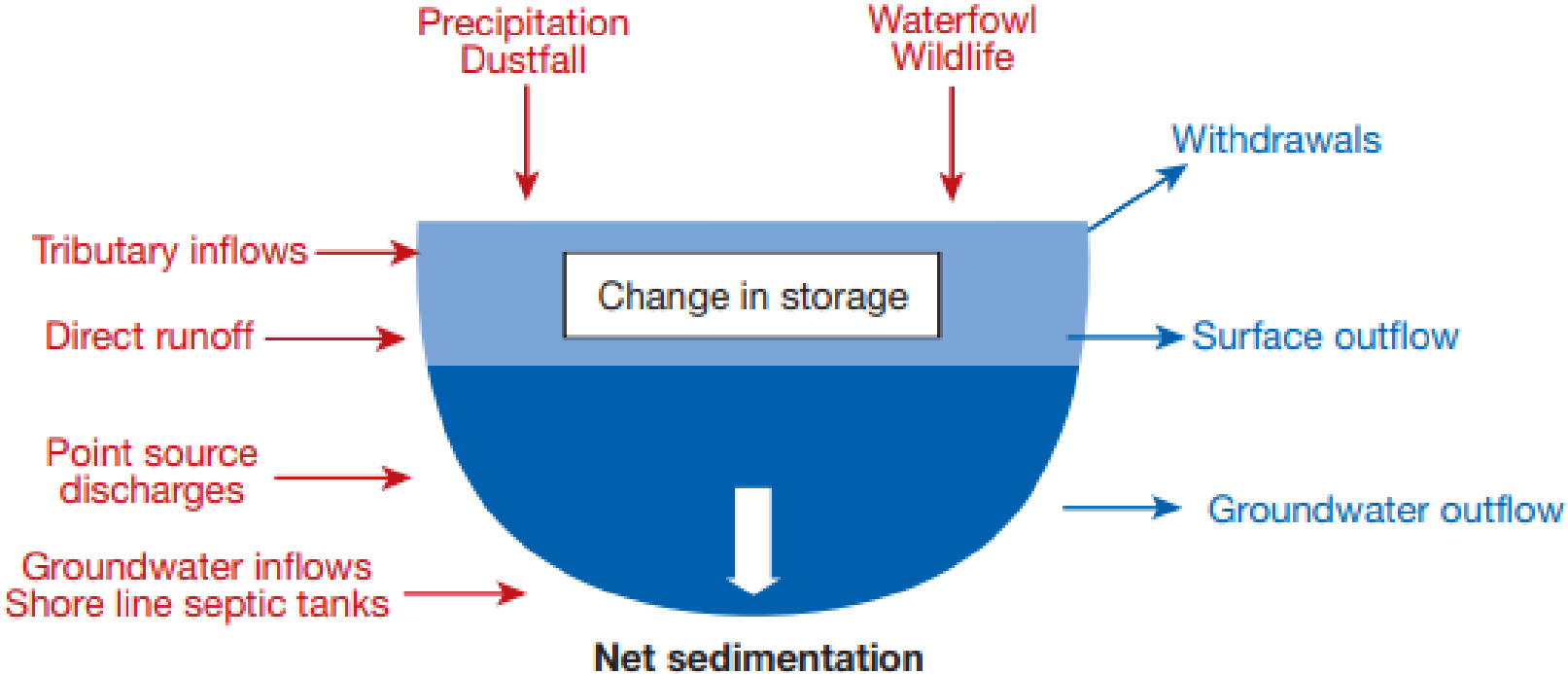


# | PHOSPHORUS

- Naturally occurring mineral
- Rocks contain P – when rock erodes P is released to the soil
- Essential to all living things
- P helps things like algae and bacteria grow, but too much of it makes them overgrow



# Phosphorus cycle in a waterbody



PHOSPHORUS FROM  
WATERSHED



USE BY AQUATIC  
PLANTS AND ALGAE



ALGAE  
GROWTH



POND OR LAKE

PHOSPHORUS RELEASE  
FROM BOTTOM SEDIMENT



DYING  
ALGAE



DECAYING ALGAE REDUCES  
OXYGEN CONCENTRATION





# | EUTROPHICATION

- Aesthetic
- Impaired water quality
- Loss of habitat
- Fish kills



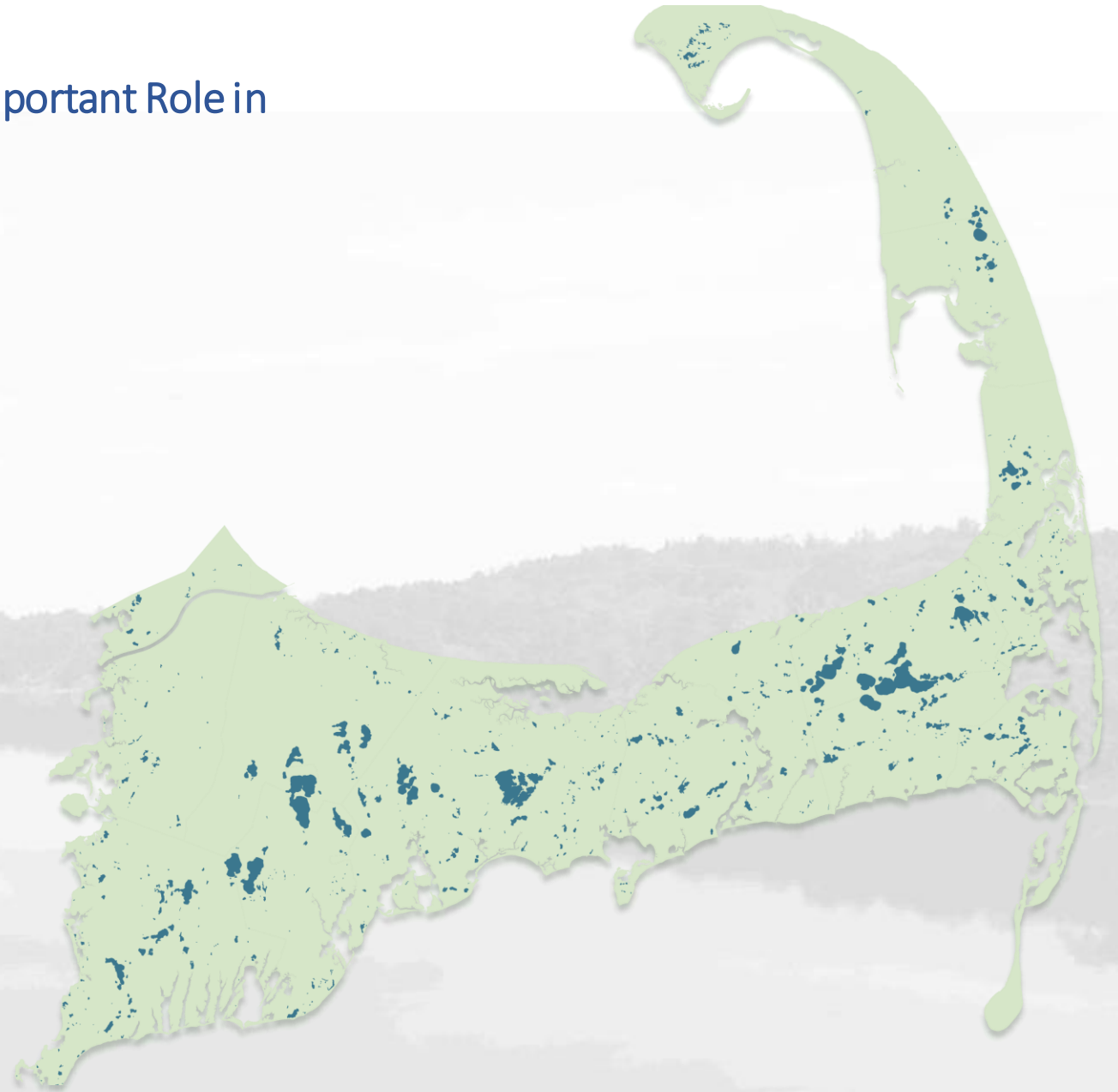
## Properly Functioning Ponds and Lakes Play an Important Role in Preserving and Restoring Coastal Water Quality

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



## Increasing Concern and Awareness for Freshwater Quality

Documented impairments to ponds include harmful algal blooms, increased nutrients and eutrophication, low dissolved oxygen, and high phosphorus levels.





## THE FRESHWATER INITIATIVE

- A science-based, information-driven planning process
- Engaging stakeholders
- Enabling action to protect and restore freshwater ponds.

# Freshwater Initiative



## REMOTE SENSING

Investigating the use of satellite-derived imagery and existing pond water quality data to quantify changes in pond characteristics



## DATA MANAGEMENT AND ANALYSIS

Developing freshwater monitoring database, processing scripts for trend analyses, and accessible user interface



## PHYSICAL CHARACTERISTICS

Assessing, through the use of GIS and other data sources, characteristics that may contribute to changes in water quality, and determining potential internal and external drivers of water quality degradation



## PONDS AND LAKES ATLAS UPDATE

An update to the Cape Cod Ponds and Lakes Atlas has been completed to serve as a resource for updated pond information and provide the basis for the Freshwater Initiative



## STRATEGIES DATABASE

Developing a pond-specific strategies database that includes a range of technologies, regulatory and voluntary options, and management approaches for protecting and restoring pond water quality



## ENGAGEMENT AND OUTREACH

Engaging stakeholders to develop a framework for identifying and implementing pond management strategies



## ECONOMIC ANALYSIS

Quantifying the costs and benefits of pond management strategies, including the cost of no action and the impacts of degraded freshwater quality on the regional economy



## LEGAL AND JURISDICTIONAL ANALYSIS

Reviewing federal and state laws relative to public and private interests in and around freshwater ponds, and identifying opportunities for local and regional action



## MONITORING PROGRAM

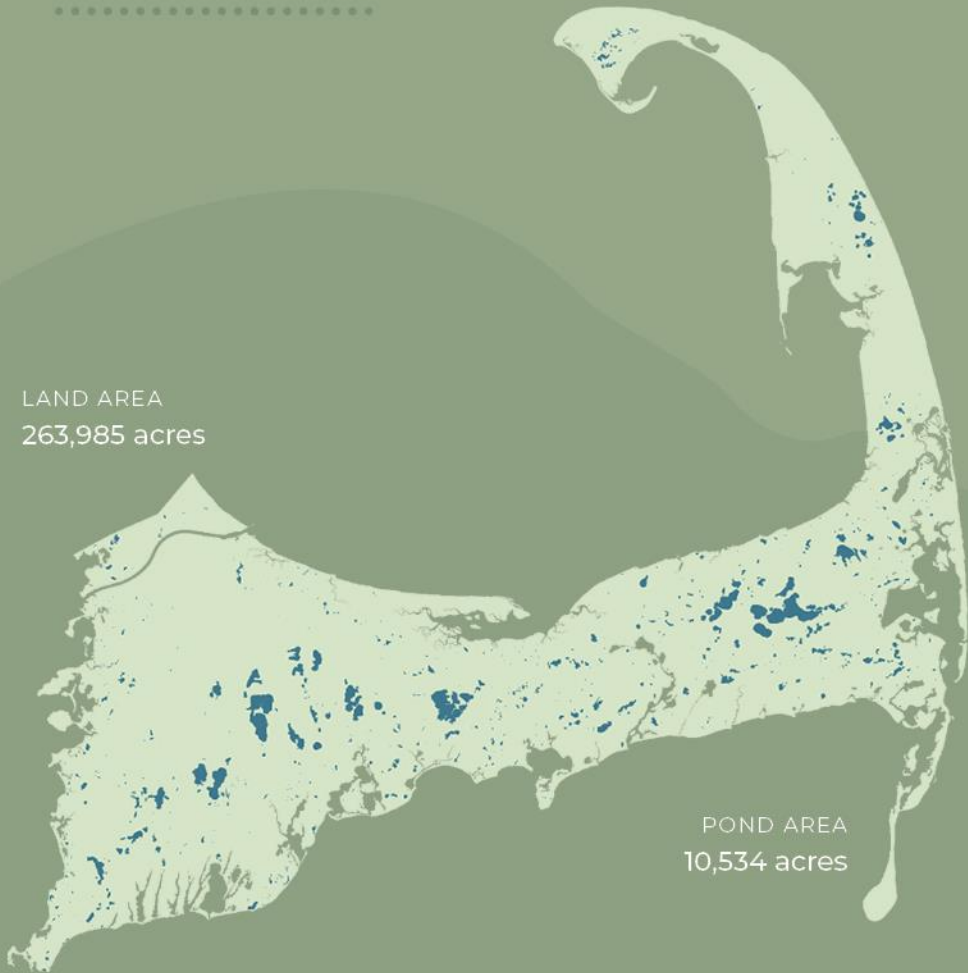
Expanding pond monitoring to collect data necessary to support management decisions and track performance



## ONGOING DATA MANAGEMENT AND ANALYSIS

Managing and maintaining accessible pond monitoring datasets and providing on-demand trend analyses through a web-based interface

# Cape Cod Ponds by the Numbers



CAPE COD PONDS AND LAKES

**890**  
POND S

**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%** 

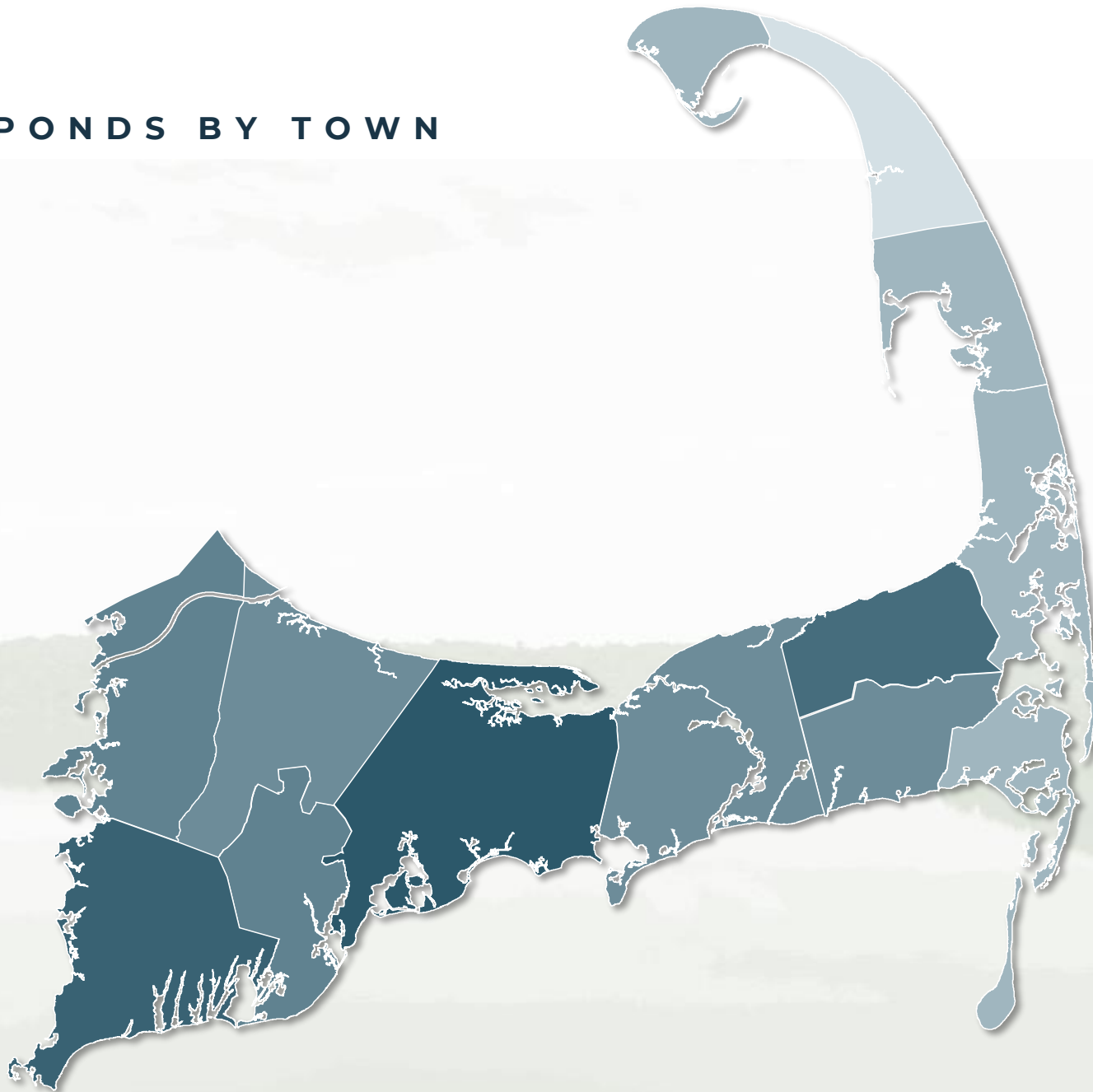
Protected Open Space within pond 300ft buffer

**14%** 

Impervious Surfaces within pond 300ft buffer

\*Includes public beaches, boat ramps, and launches

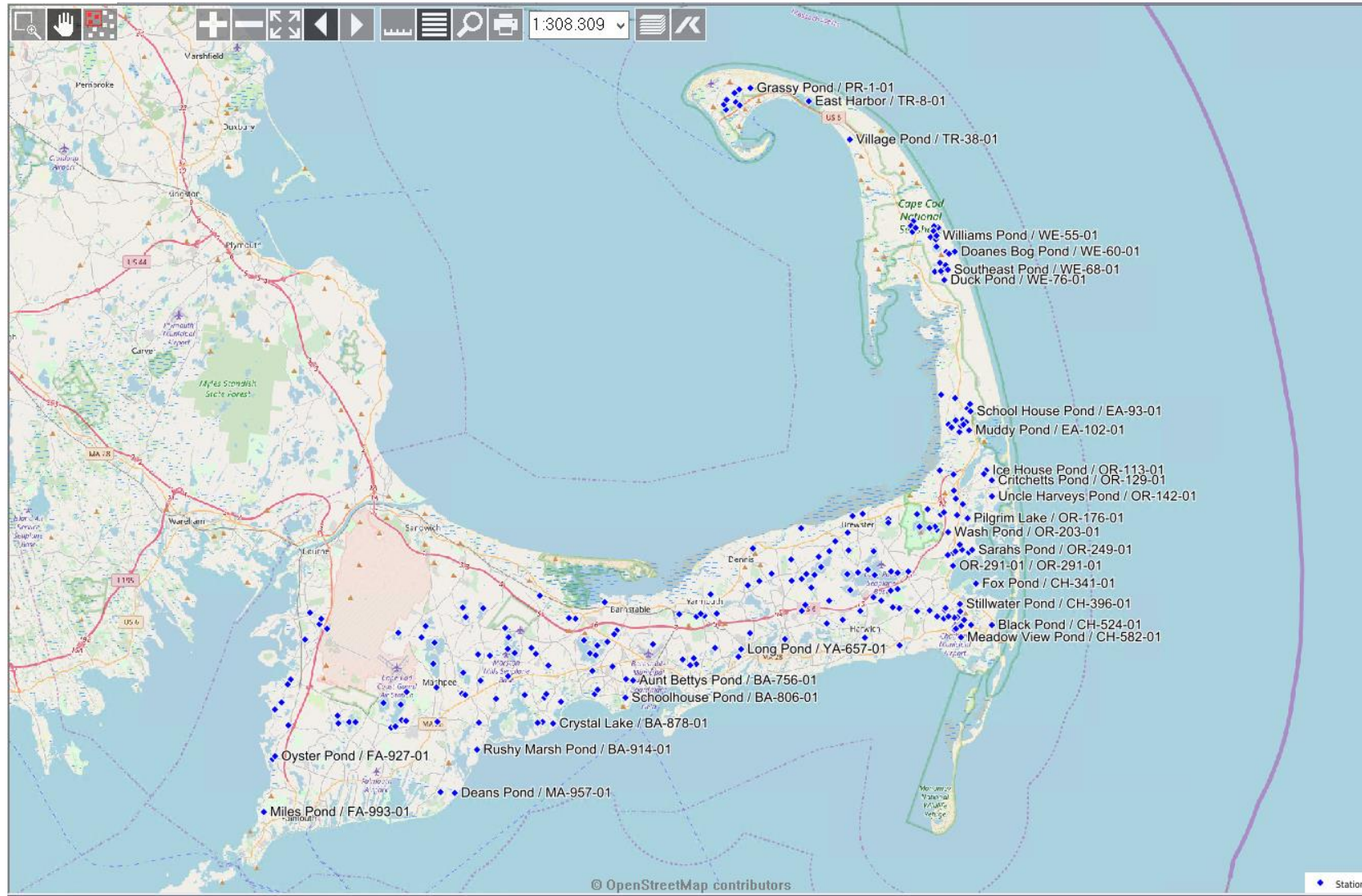
# # PONDS BY TOWN



## Cape Cod 890

Barnstable	●	163
Falmouth	●	123
Brewster	●	82
Mashpee	●	69
Bourne	●	64
Harwich	●	62
Yarmouth	●	60
Sandwich	●	55
Dennis	●	52
Orleans	●	49
Chatham	●	37
Provincetown	●	36
Wellfleet	●	25
Eastham	●	23
Truro	●	15

# Where are Ponds Monitored?



# Pond Network Structure and Objectives



Provide a single forum and meeting place for pond groups throughout the Cape Cod region to share and receive resources



Provide a venue for ongoing updates on pond topics of regional interest



Help inform stakeholder engagement process of Freshwater Initiative



Help advance pond improvement strategies and solutions identified through the Freshwater Initiative at the local level



CAPE COD  
COMMISSION





Sign up for the Cape Cod Pond Network information and meetings

[Cape Cod Ponds Network | Association to Preserve Cape Cod \(apcc.org\)](https://apcc.org)

<https://apcc.org/cape-cod-ponds-network/>

[Cape Cod Ponds Network | Cape Cod Commission](#)

# Thank you

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CAPE COD  
COMMISSION