

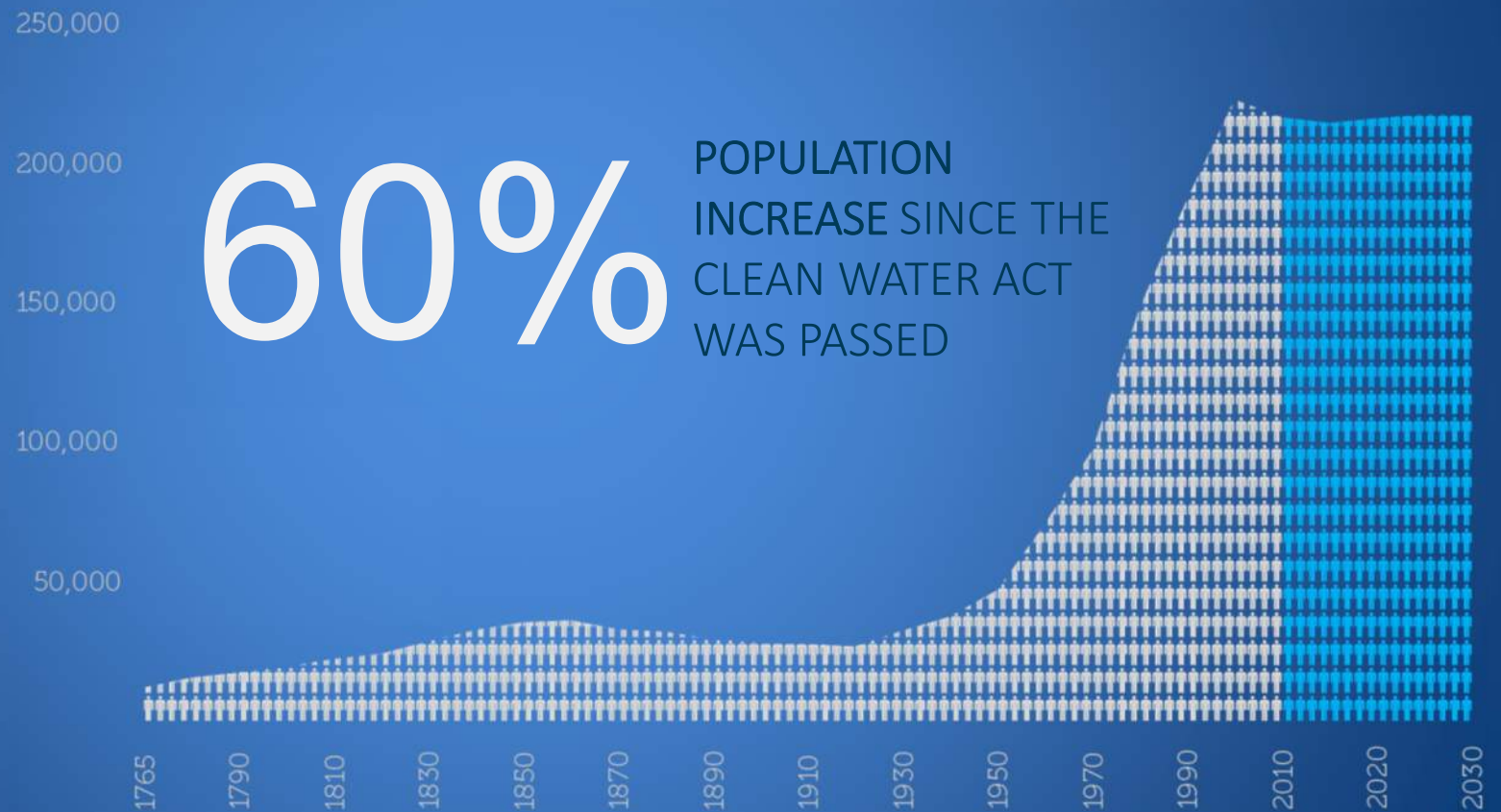
208^{PLAN}

Cape Cod Area Wide Water Quality Management Plan Update



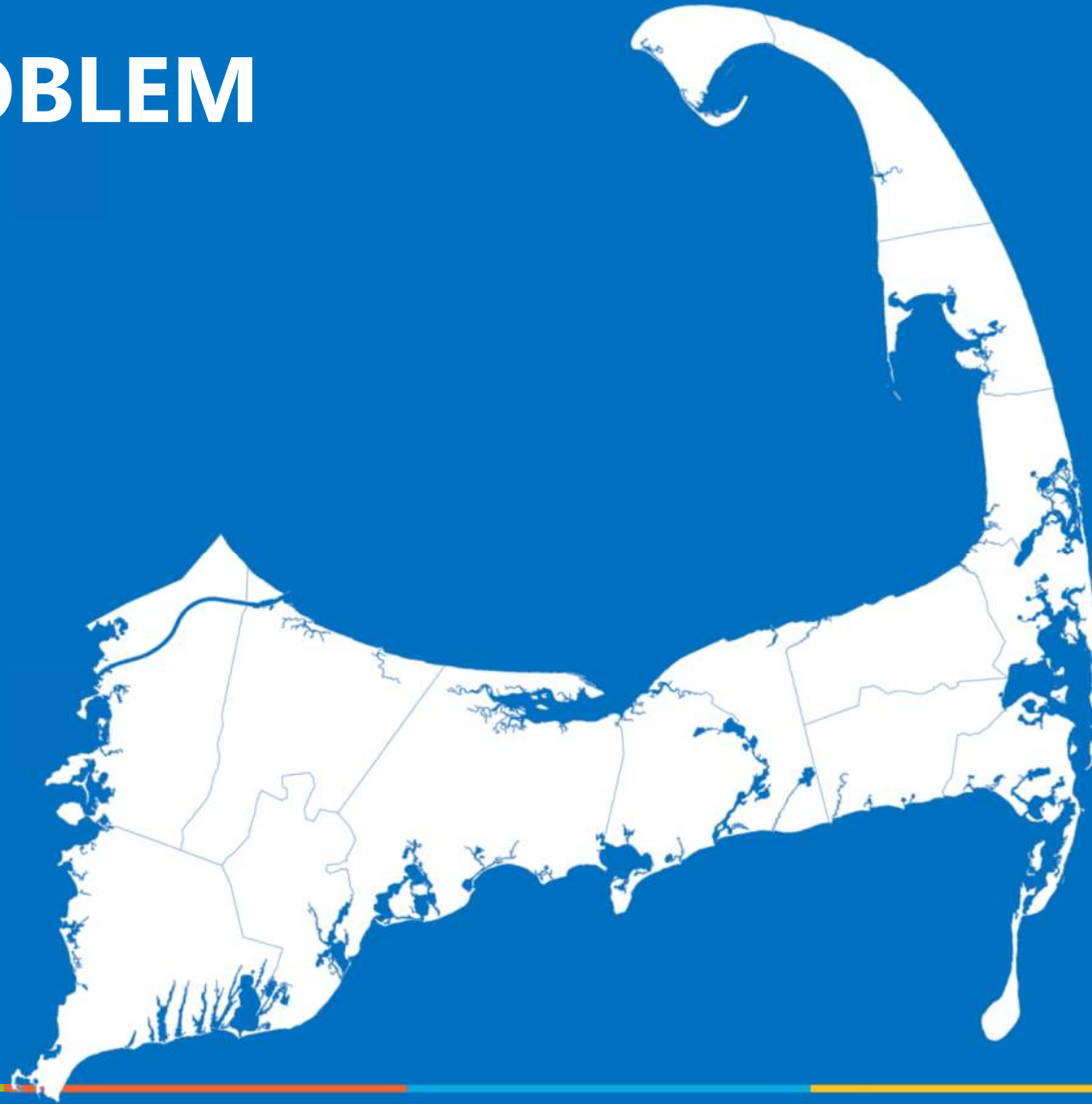
THE PROBLEM

POPULATION CHANGES



THE PROBLEM

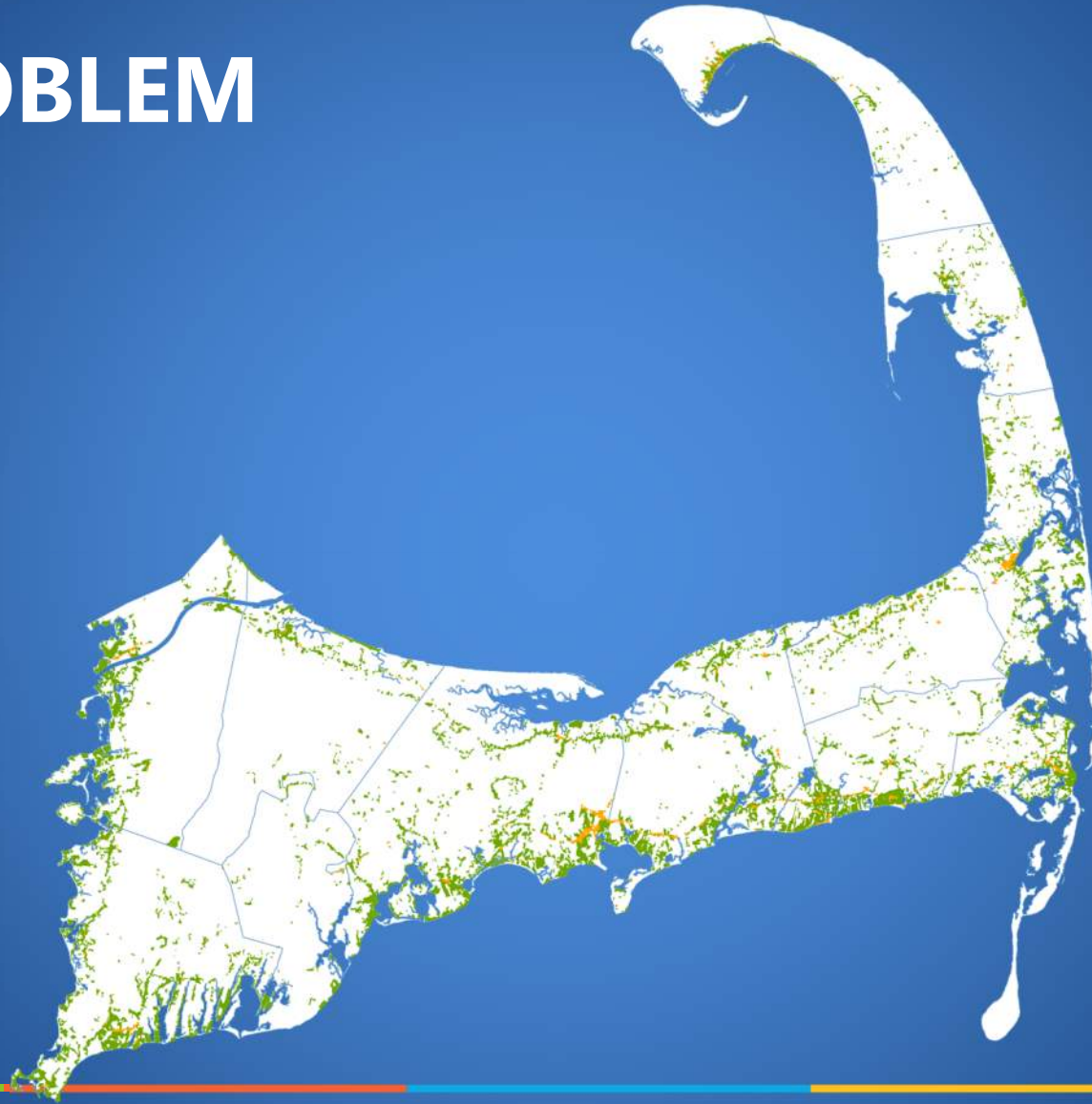
LAND USE CHANGES



THE PROBLEM

LAND USE CHANGES

1951



THE PROBLEM

LAND USE CHANGES

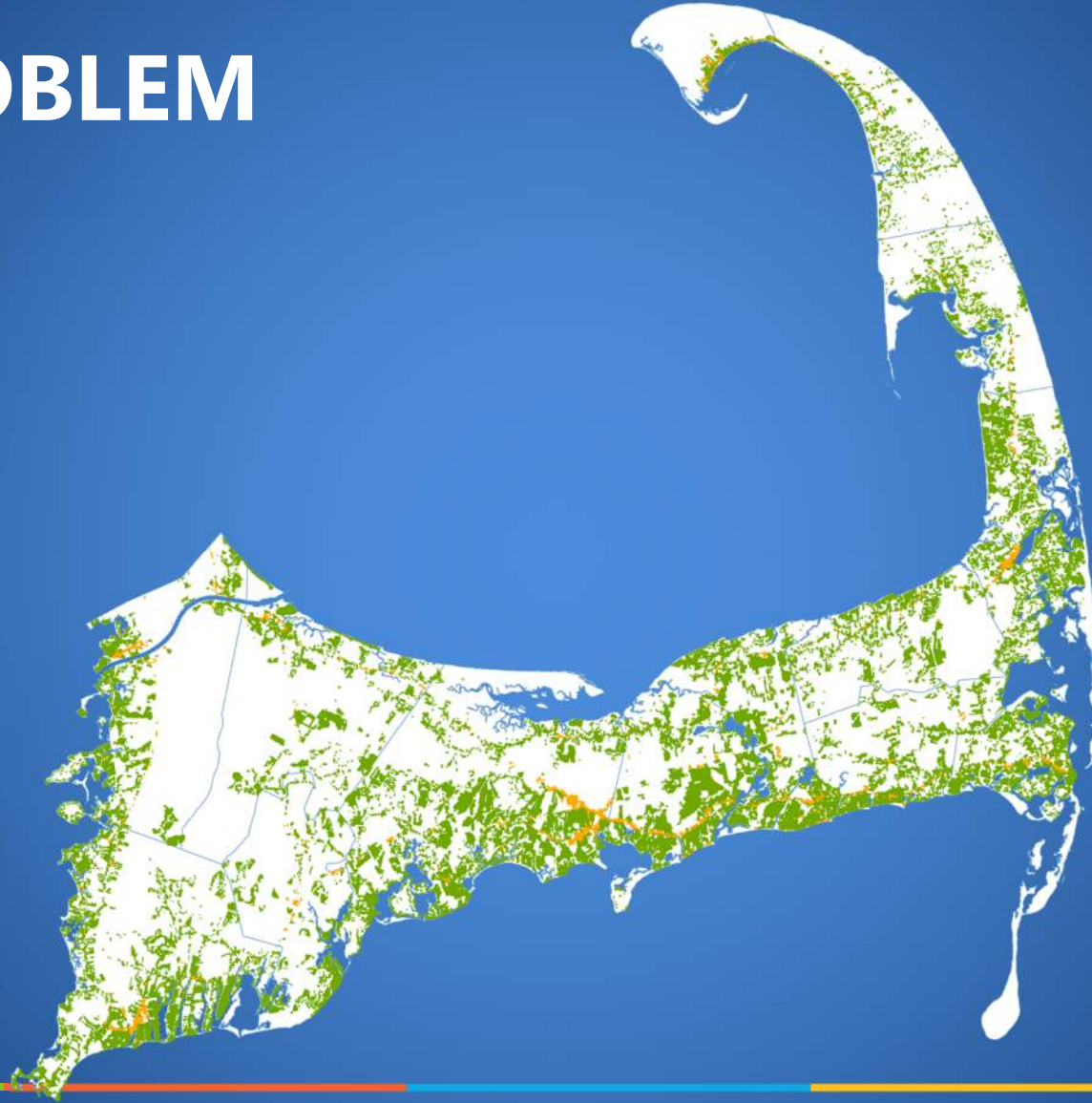
1971



THE PROBLEM

LAND USE CHANGES

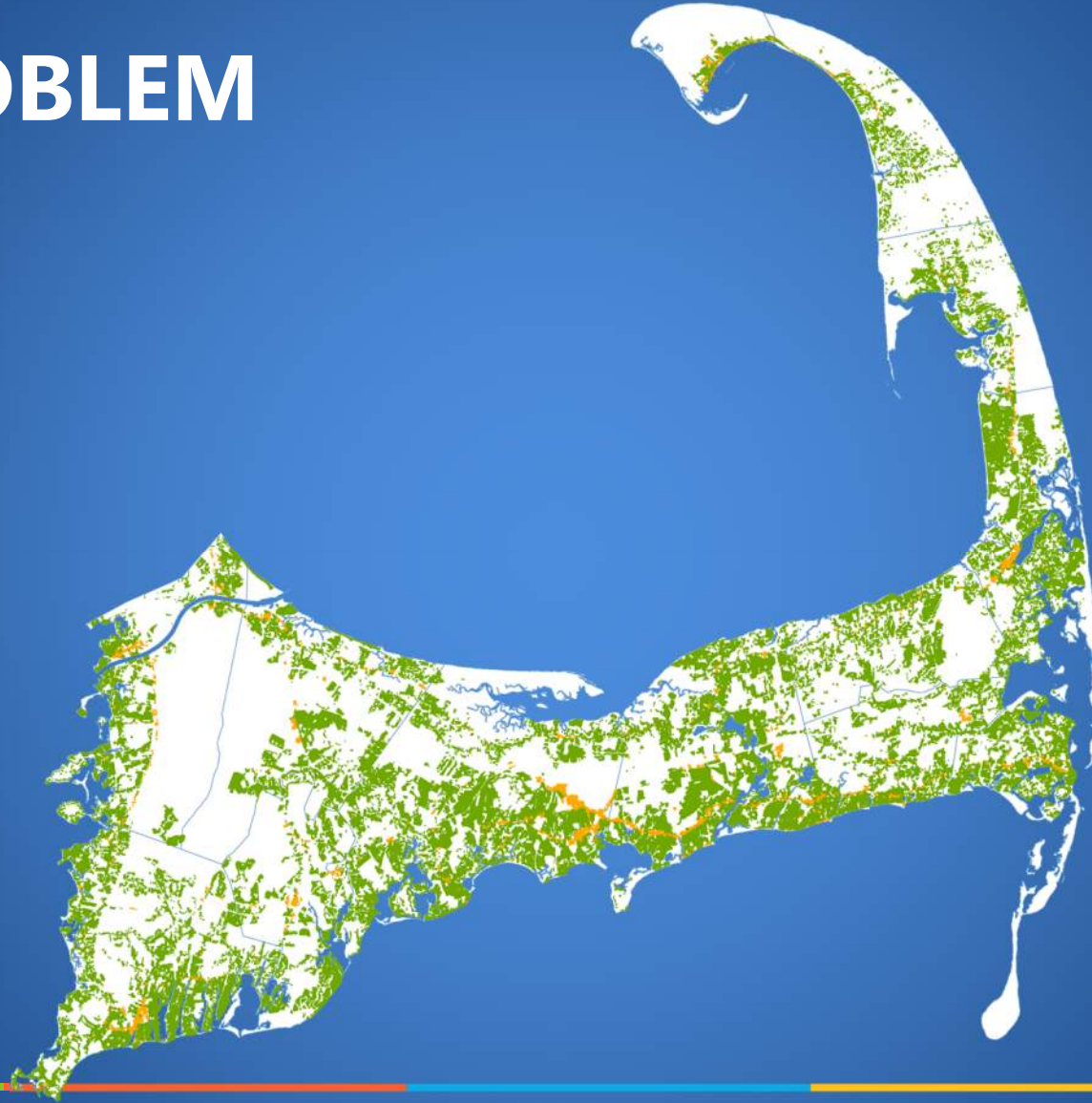
1985



THE PROBLEM

LAND USE CHANGES

1999



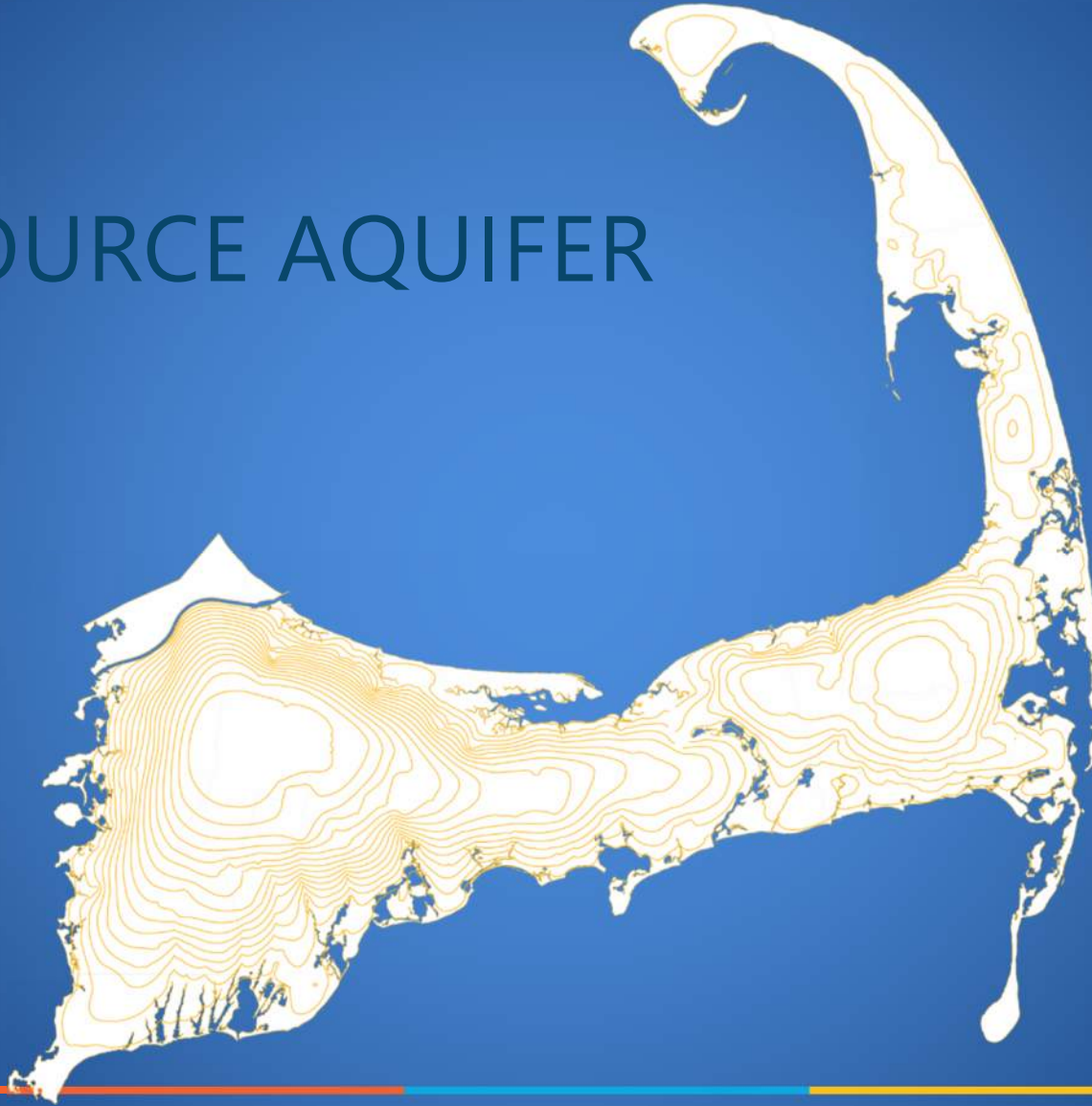
THE PROBLEM

LAND USE CHANGES

2012



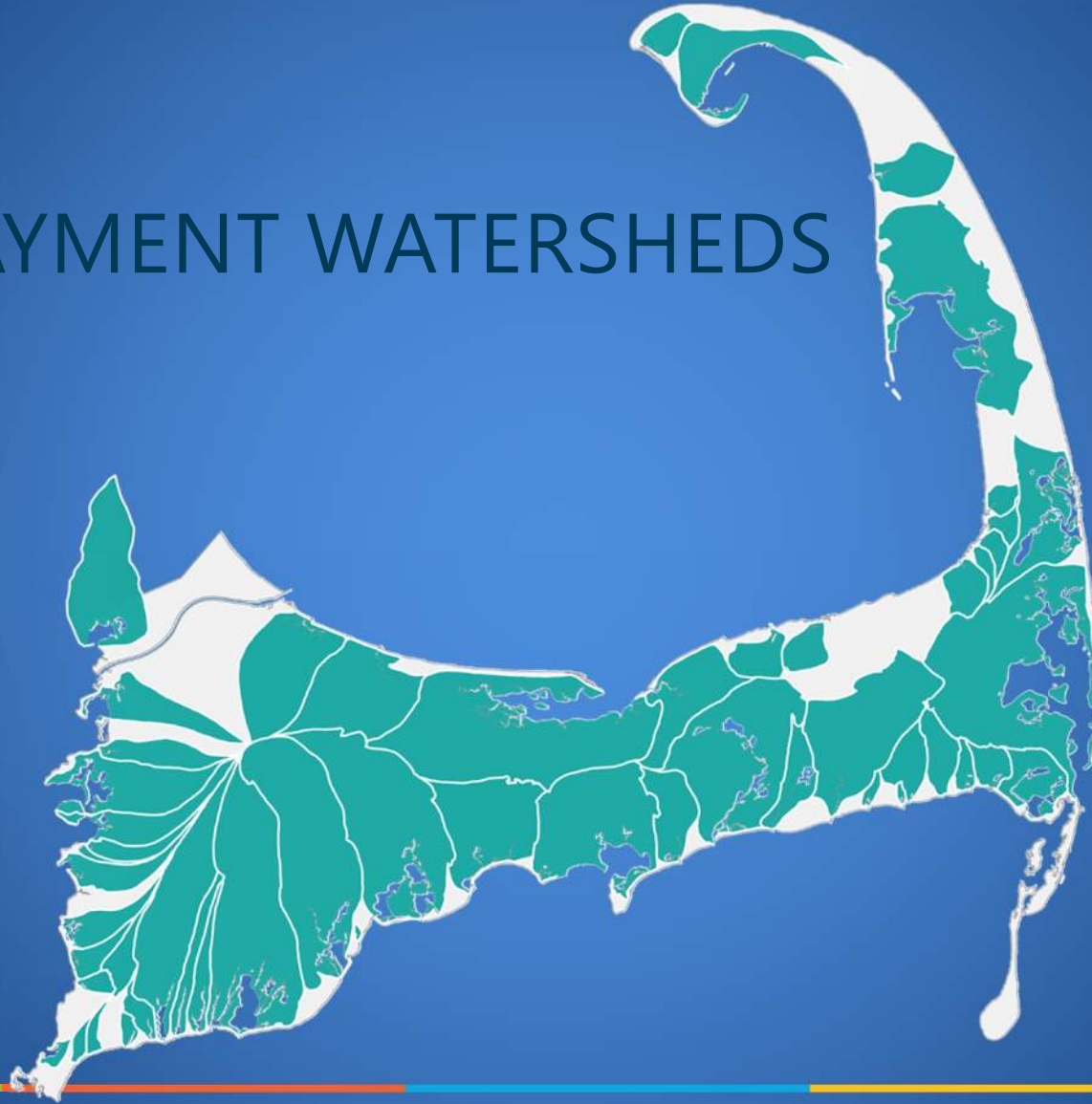
SOLE SOURCE AQUIFER



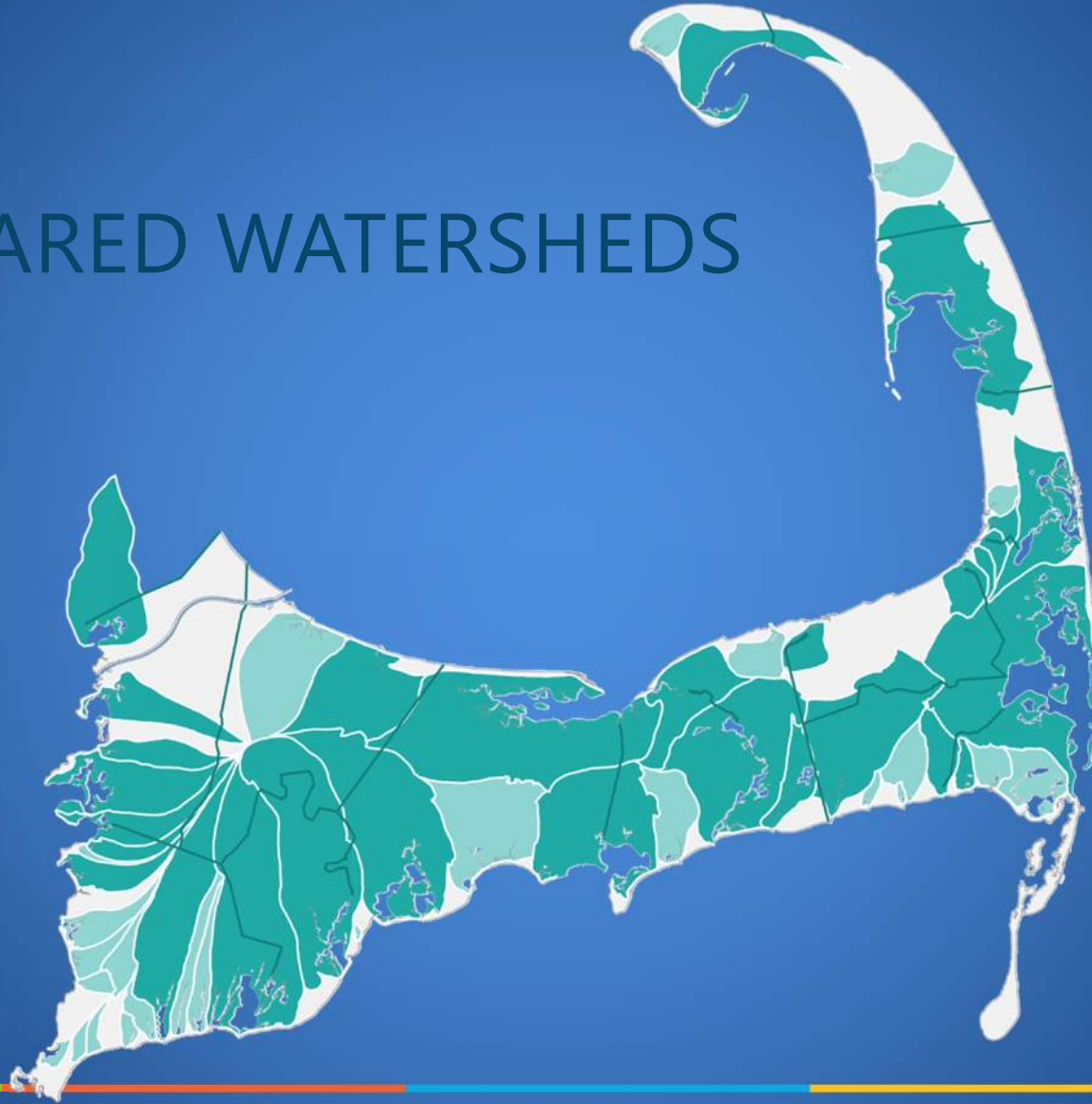
996 PONDS



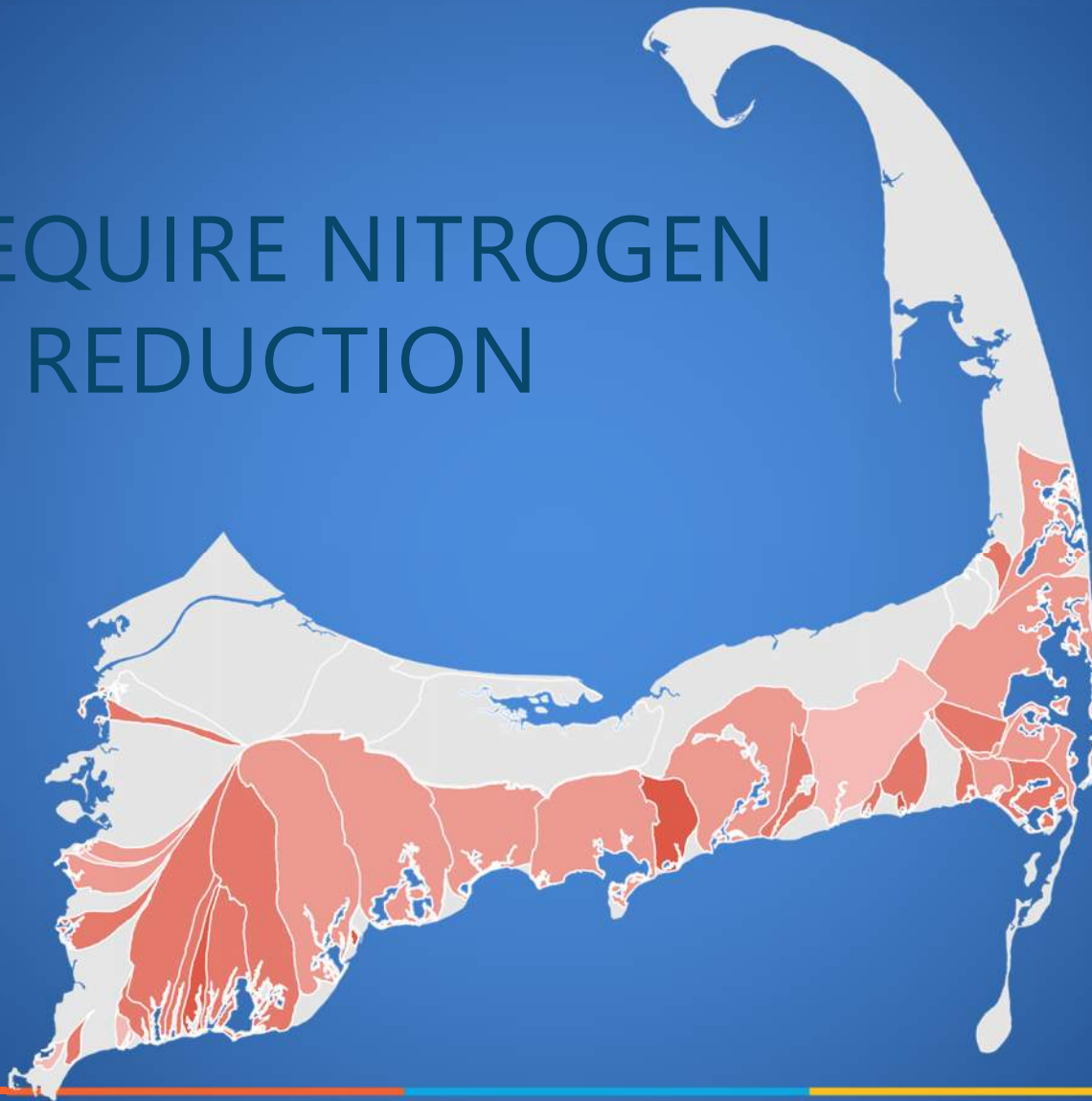
53 EMBAYMENT WATERSHEDS



32 SHARED WATERSHEDS



35 REQUIRE NITROGEN REDUCTION



15 TOWNS



INFRASTRUCTURE

Sewered Areas


Treatment Facilities



INFRASTRUCTURE

Septic Systems





Clean Water
Act Section
208

CCC directed to
update the
1978 Plan

\$3 million to
complete
the plan

Focus on 21st
century
problems



Diverse
technology
and multiple
solutions

Stakeholder
Engagement

Watershed
Based

Adaptive
Management,
Pilot Projects,
Progress
Monitoring

Support targeted
watershed
solutions under
existing plans

01 PEOPLE

The Cape Cod Model - People & Process

Stakeholder Process

strategies for establishing consensus in a regional planning process

OBJECTIVE

Facilitation to build collaboration & agreement



ON SCHEDULE



Oversight kept the process on time & on track

Built consensus to identify solutions at the watershed level

AGREEMENT



AFFORDABLE

Financial impact on homeowners considered in every watershed solution



Ensure regulatory flexibility in planning & permitting

FLEXIBLE



ENGAGING

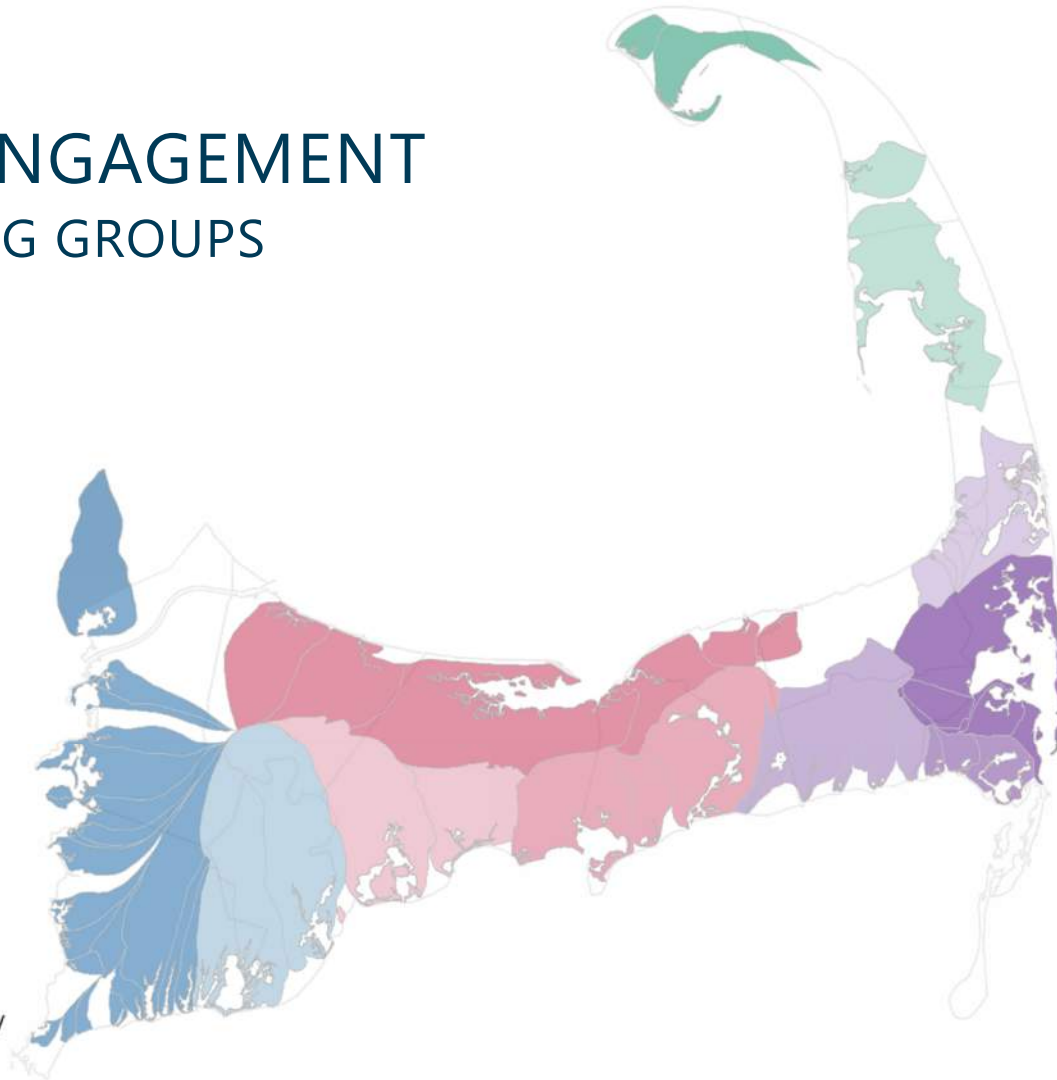
Involve the broader community through web-based engagement initiatives



STAKEHOLDER ENGAGEMENT

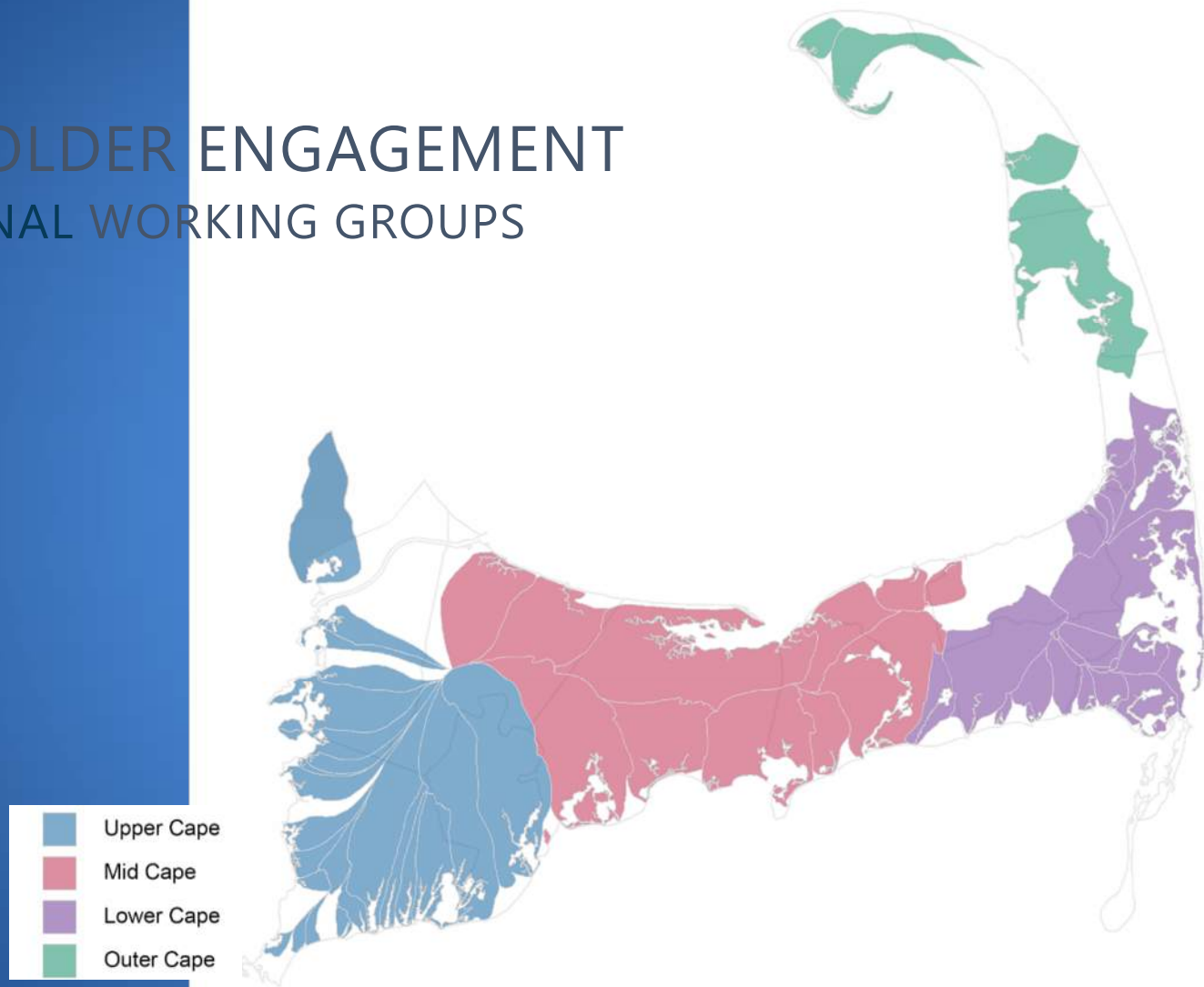
WATERSHED WORKING GROUPS

- Stage Harbor
- Herring River
- Pleasant Bay
- Marsh Group
- Provincetown Harbor
- Wellfleet Harbor & Pamet River
- Cape Cod Bay
- Lewis Bay to Bass River
- Three Bays & Centerville River
- Waquoit Bay & Popponesset Bay
- Upper Cape West & South



STAKEHOLDER ENGAGEMENT

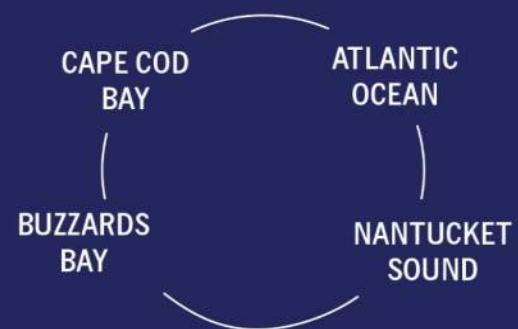
SUBREGIONAL WORKING GROUPS



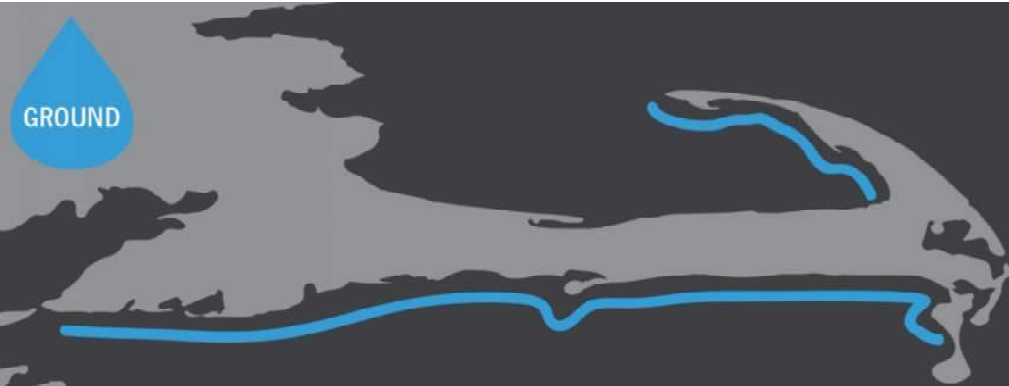
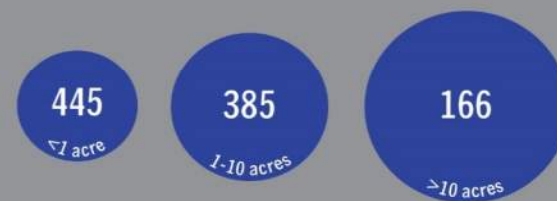
02

PROBLEM

Cape Cod Baseline - People & Place



996 PONDS



1
AQUIFER

03

POLICY

Regulations

Regulatory Streamlining

strategies to successfully implement established water quality goals

TARGETED



Targeted watershed plans reduce upfront planning time, lower cost & focus attention where most needed

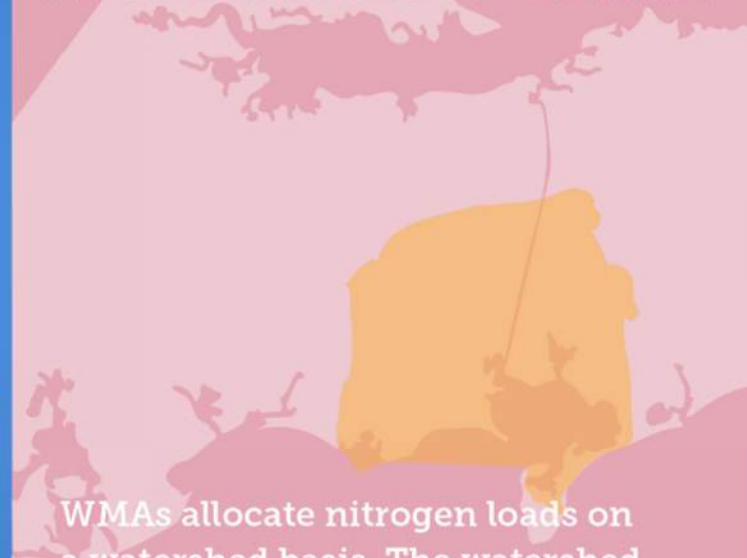


Reductions in fertilizer use and stormwater runoff, supported by performance monitoring, should lower nitrogen reduction targets



REDUCTION CREDITS

WATERSHED PERMIT



WMAs allocate nitrogen loads on a watershed basis. The watershed permit lists technology options identified for implementation by stakeholders & each permittee's specified annual discharge limit.

04 SOLUTIONS

Nutrient Mitigation Technologies & Policies



Reduction

Treatment before disposal to ground



Remediation

Treatment in groundwater



Restoration

Treatment in water body

Policy



TECHNOLOGIES MATRIX

EXPLORE

Instructions: Select a category to filter the technologies. Drag treatments to the Compare box to compare technologies. Click on a technology to see details.

Filter by Scale:

Site

Neighborhood

Watershed

Cape-Wide

Clear Filters to View All

Drag treatments to compare.

Compare

Reset



Reduction

Treatment before disposal to ground

- Hydroponic Treatment
- Toilets: Packaging
- Remediation of Existing Development
- Title 5 Septic System Replacement (Base Line Condition)
- Conventional Treatment

- Toilets: Composting
- Toilets: Urine Diverting
- Compact and Open Space Development
- IA Innovative/Alternative (IA) Systems
- Cluster Treatment System - Single-stage
- Advanced Treatment

- Toilets: Incinerating
- Fertilizer Management
- TDR Transfer of Development Rights
- Innovative/Alternative (IA) Enhanced Systems
- Cluster Treatment System - Two-stage
- Satellite Treatment
- Satellite Treatment - Enhanced



Remediation

Treatment in groundwater

- Constructed Wetlands - Surface Flow
- Phytoirrigation
- Stormwater BMP - Gravel Wetland
- Phytoremediation

- Constructed Wetlands - Subsurface Flow
- Stormwater BMP Phyto buffers
- Stormwater: Bioretention / Soil Media Filters
- PRB Permeable Reactive Barriers (PRBs) - Trench Method (Aquifer Thickness - 30 feet)

- Constructed Wetlands - Groundwater Treatment
- Stormwater BMP - Vegetated Swale
- Stormwater: Constructed Wetlands
- PRB Permeable Reactive Barriers (PRBs) - Injection Well Method (Aquifer Thickness - 30 feet)



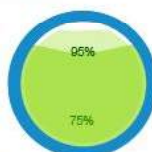
Permeable Reactive Barriers (PRBs) - Trench Method(Aquifer Thickness - 30 feet)



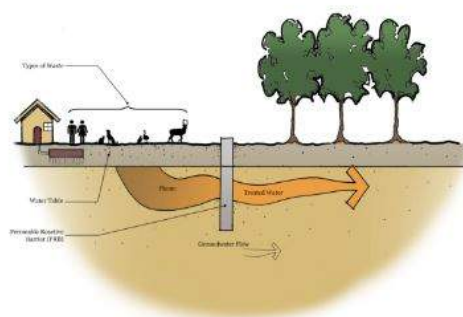
Innovative and Resource-Management Technologies

Scale: Site, Neighborhood

Nitrogen Removal



Phosphorus Removal



Description

A permeable reactive barrier (PRB) is an in-situ (installed within the aquifer) treatment zone designed to intercept nitrogen enriched groundwater. Through use of a carbon source (the PRB medium), microbes in the groundwater uptake the nitrogen, denitrifying the groundwater.

The trench method PRB uses large trenching equipment to install a mixture of coarse sand, wood chips, compost and/or other materials (medium) in the trench created by the trencher. The vertical wall can be installed to a depth of 40 feet with a width of 1.5 to 3 feet; PRBs can also be installed in large diameter columns.

As groundwater flows through the wall, the medium provides a carbon source for microbes living in the groundwater. The microbes consume the carbon source as well as oxygen, developing an anaerobic environment which releases nitrogen gas to the atmosphere, reducing the groundwater nitrogen load before reaching the estuary.

Advantages/Disadvantages

Monitoring

05 EVALUATION

The Cape Cod Model - Regional Watershed Analysis

TEAM
1



cost and effectiveness
septic nitrogen load
economies of scale
potential limitations
permissible

Traditional Approaches

TEAM
2



total controllable nitrogen load
watershed/embayment options
innovation
nitrogen reduction credits
no collection

Non-traditional Approaches

Scenarios define the outer bounds
of an adaptive management plan



Edit Polygon

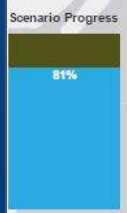
Switch Basemap

WATERSHED MVP

Subembayments for Lewis Bay

Hyannis Inner Harbor (38%)
Snows Creek (165%)
Lewis Bay (24%)
Stewarts Creek (80%)
Mill Creek - Yarmouth (65%)
Uncle Roberts Cove (84%)
Halls Creek (163%)
Simmons Pond and Well (1381%)

- Map Layers
- Towns
 - Subembayments
 - Subwatersheds
 - Wastewater Treatment Facilities
 - Ecological Indicators
 - Depth to Groundwater < 20ft
 - Existing Nitrogen Load
 - Wastewater
 - Wastewater by Treatment Type
 - Land Use Category
 - FlowThrough Co-efficient



Overview

Total Unattenuated Nitrogen: 77536kg
Total Attenuated Nitrogen: 66041kg

View Scenario Summary

Nitrogen is treated at different entrance points:

- Fertilizer (applied to the ground directly)
- Stormwater Runoff
- Septic
- Groundwater
- Embayment

Want to choose a create a new scenario or select a different embayment?
Start Over

For each of these stages, you can select technologies to remove Nitrogen from the embayment. For some, you can select the area that will be treated by drawing a polygon on the map. Your progress towards the embayment's Target Nitrogen Removal will be displayed in the graph to the left. In addition to the overall target, each sub-embayment will have its own individual Nitrogen load and target, which you can track using the graphs in the left sidebar.

Fertilizer

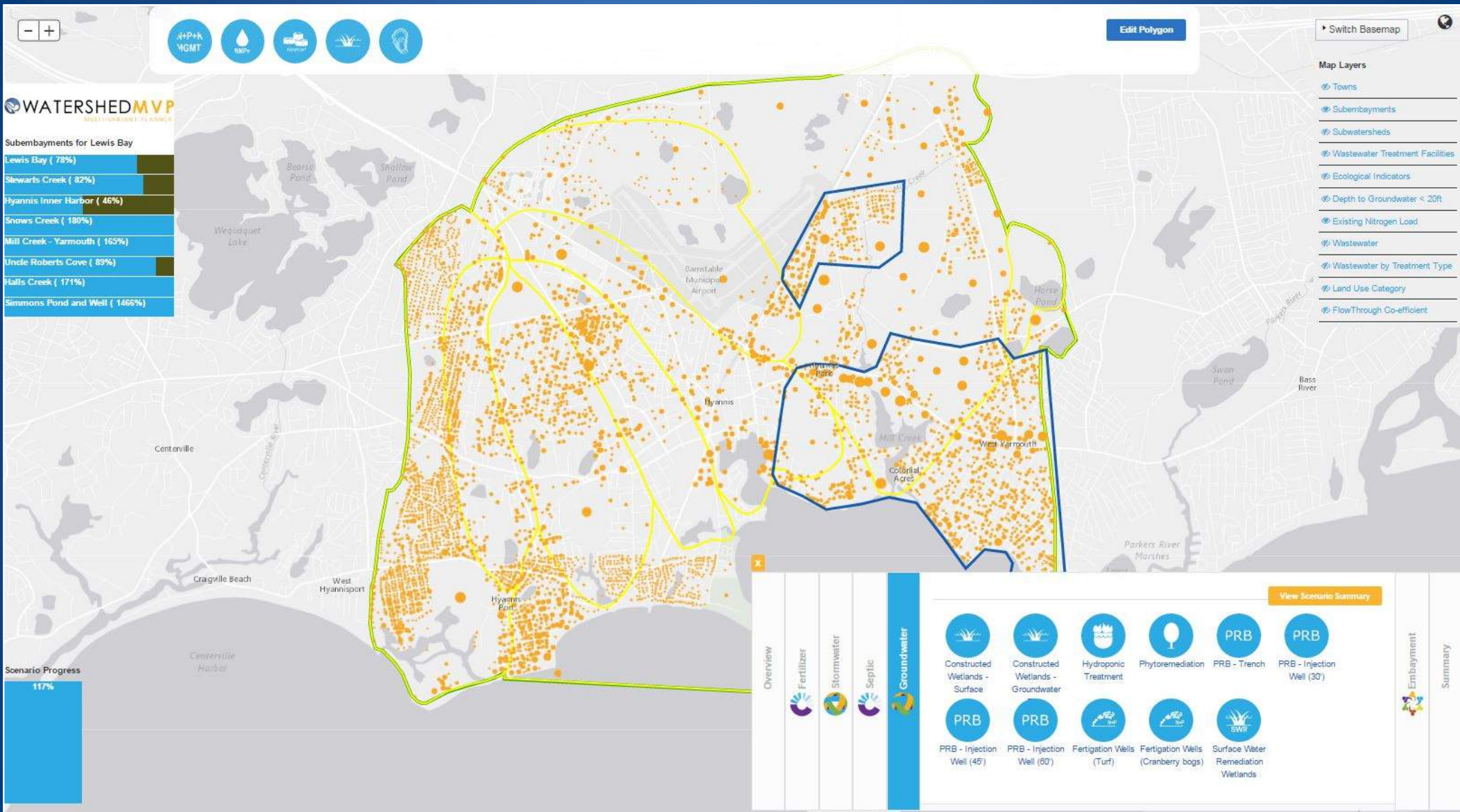
Stormwater

Septic

Groundwater

Embayment

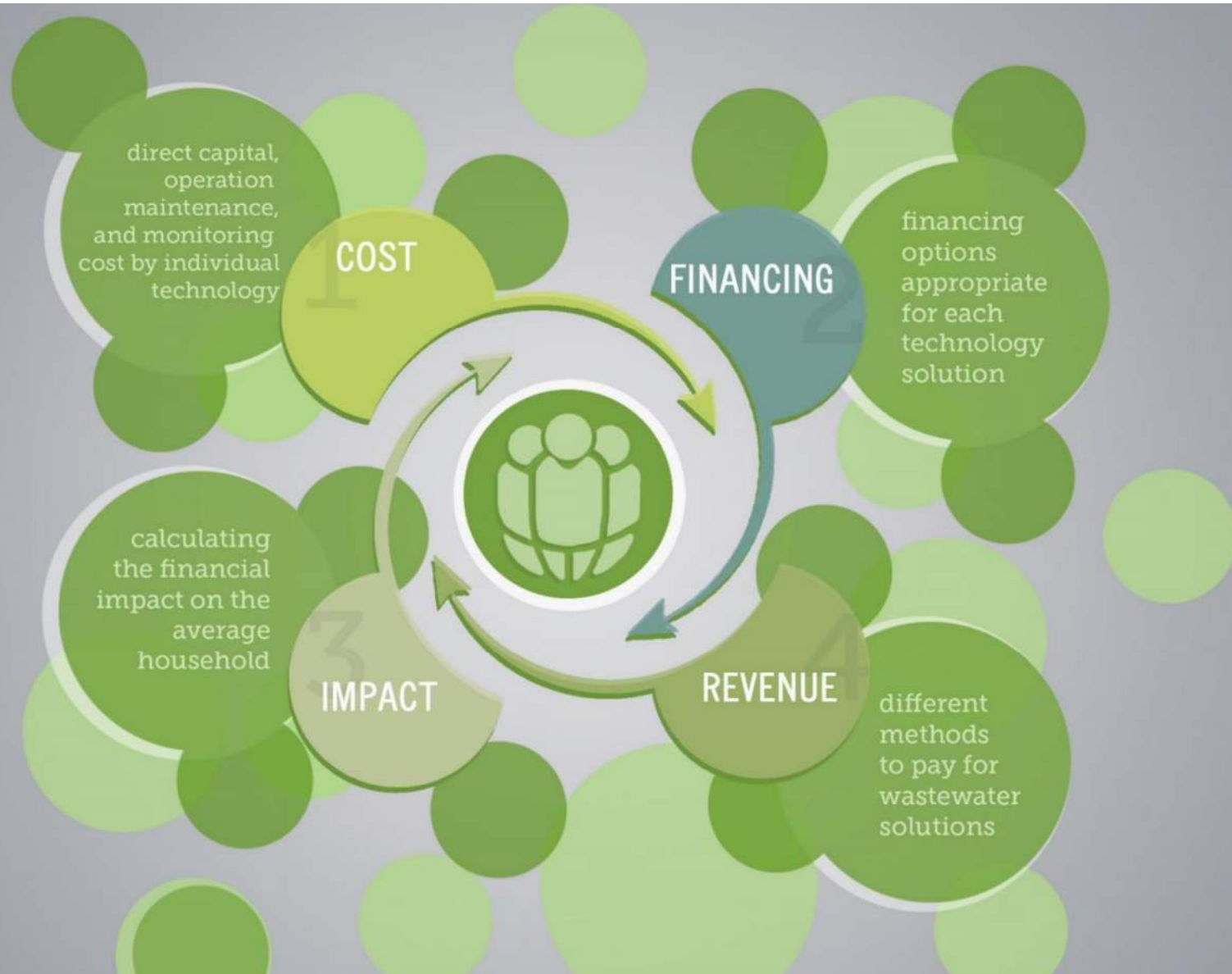
Summary



06

MONEY

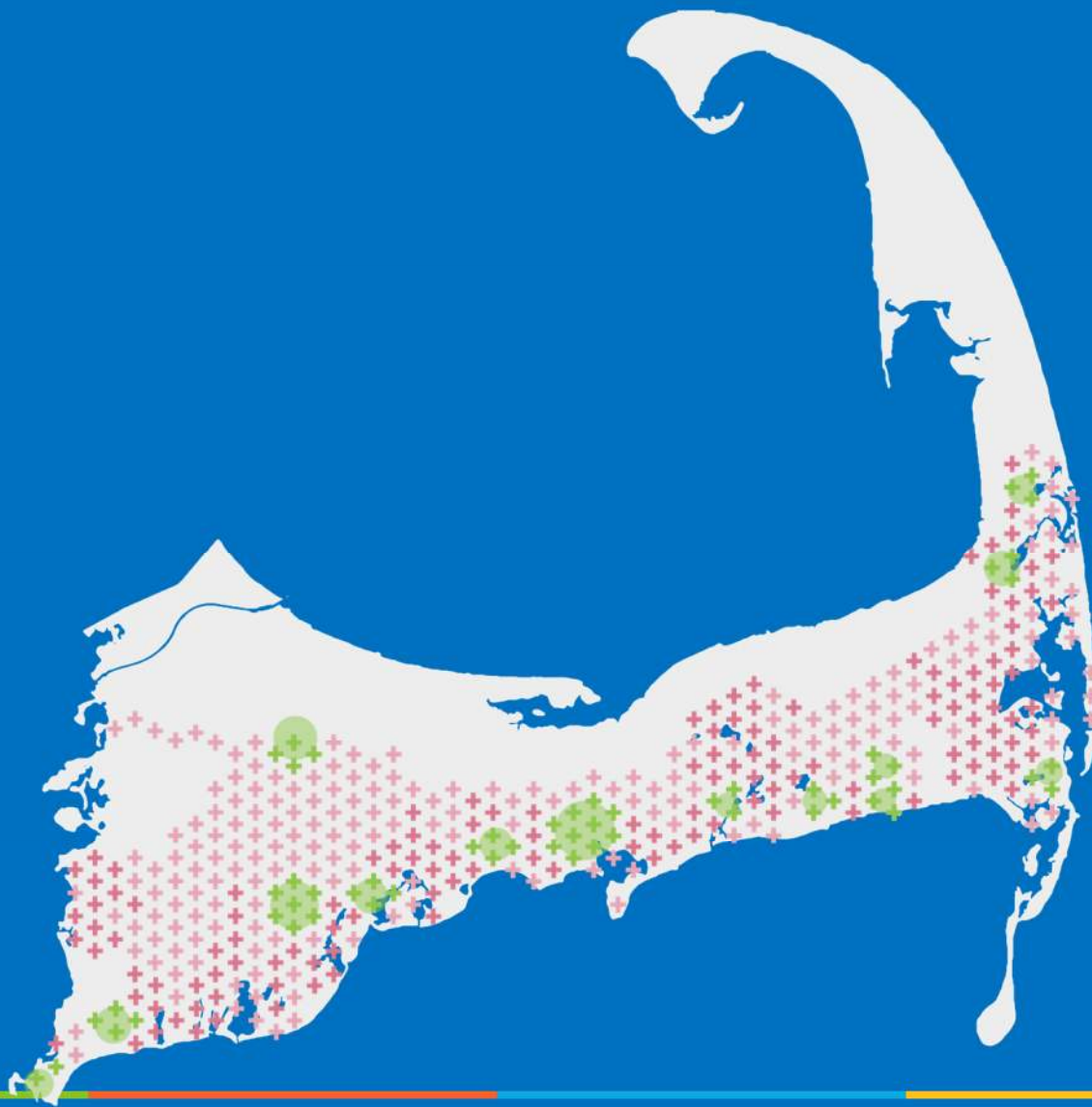
Cost & Financial Affordability



07

BALANCE

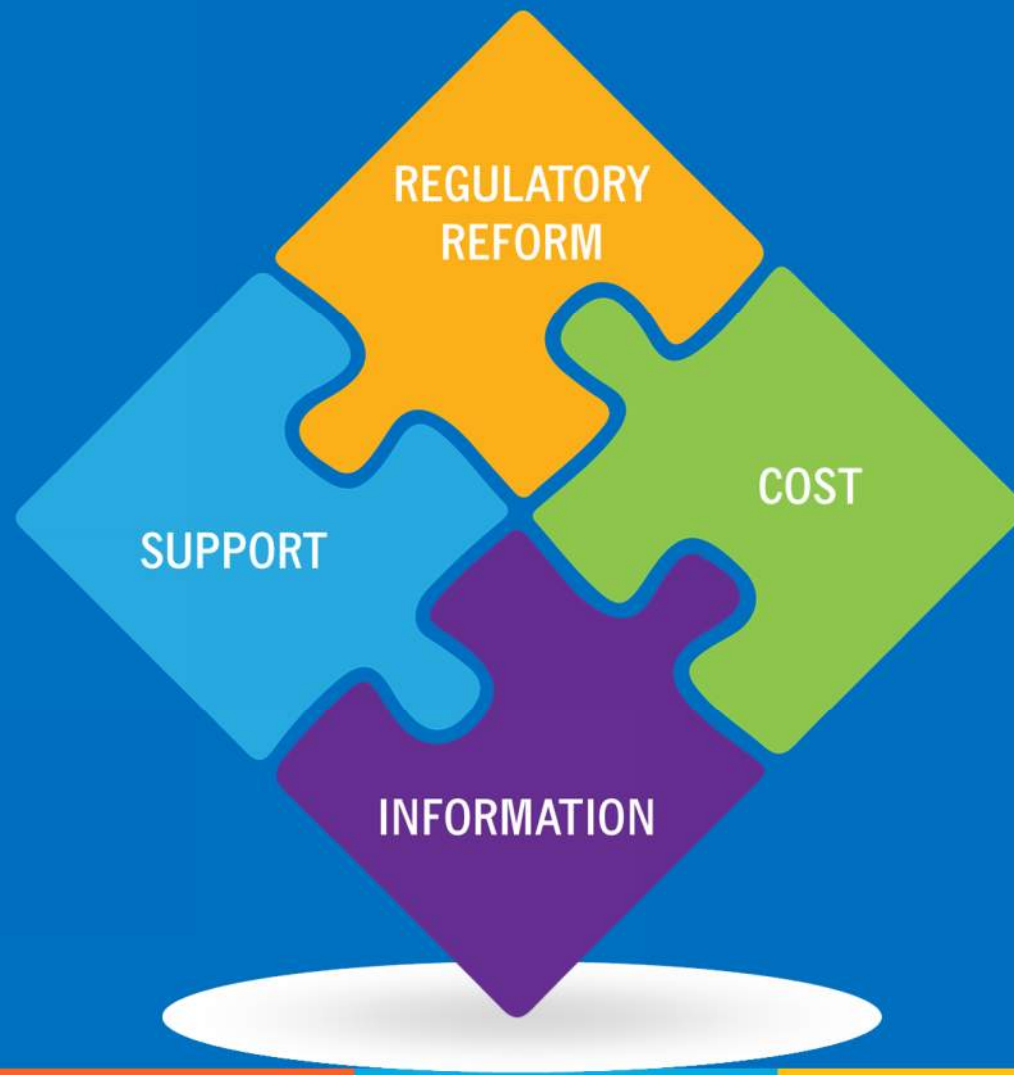
Planning & Growth Management



08

IMPLEMENTATION

Recommendations



REGIONAL PRIORITIES



FINANCE



MONITORING

FINANCING

Cape Cod and Islands Water Protection Fund

ESTABLISHED 2018

A dedicated fund within the state's Clean Water Trust set up to solely benefit communities in Barnstable, Dukes and Nantucket counties

REVENUE

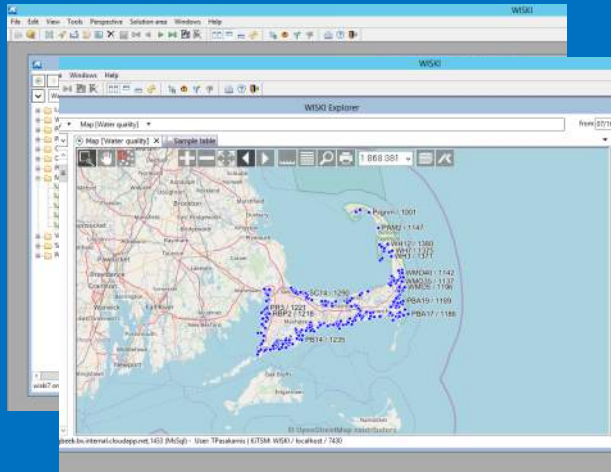
2.75% excise tax on traditional lodging and short-term rentals



Regional Monitoring Program

SNEP GRANT PROJECT

DATABASE
ESTABLISHMENT

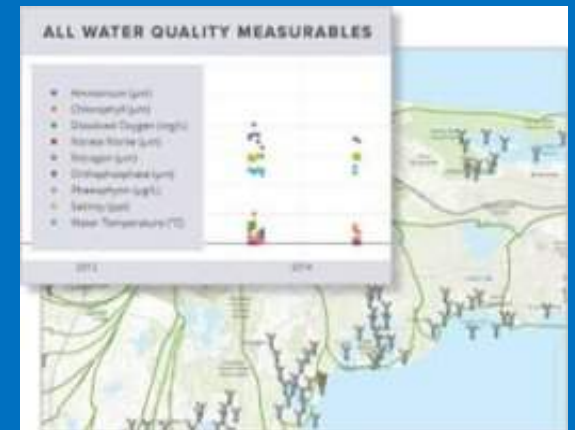


DATA ANALYSIS
PROCESSING SCRIPT



PROCESSING
SCRIPT
DESIGN

PUBLICLY ACCESSIBLE DATA



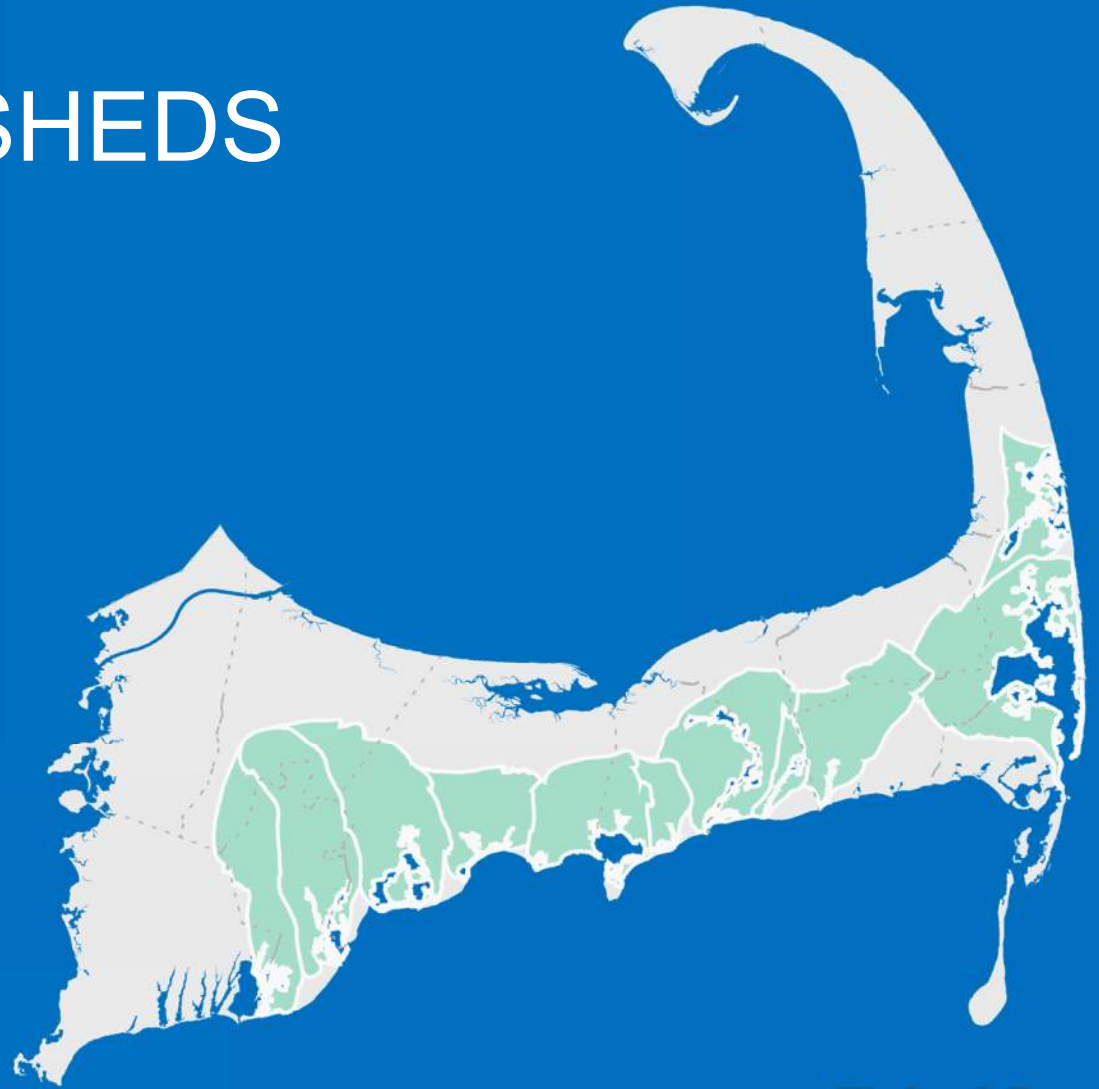
IMPLEMENTATION REPORT



PRIORITY WATERSHEDS



**REGIONAL
SEASONED WATERSHED AREA
PERIOD**



POPPONESSETT BAY

TOWNS

MASHPEE | BARNSTABLE | SANDWICH

SIZE OF WATERSHED

13,082 ACRES

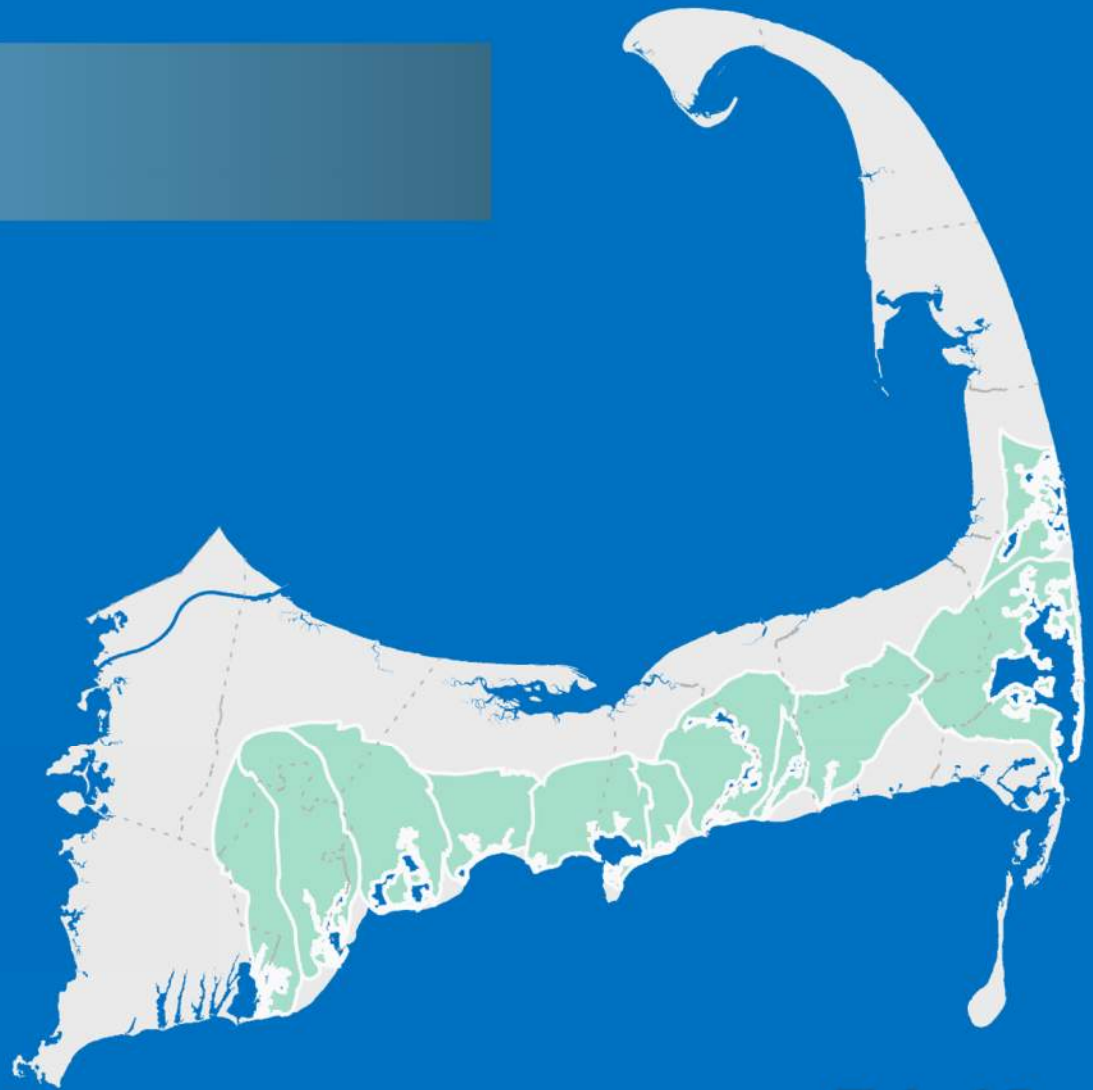
7,979 PARCELS

(78% DEVELOPED RESIDENTIAL)

21.1% SEASONAL HOMES

DEGREE OF IMPAIRMENT

HIGH



PLEASANT BAY

TOWNS

CHATHAM | HARWICH | ORLEANS | BREWSTER

SIZE OF WATERSHED

11,760 ACRES

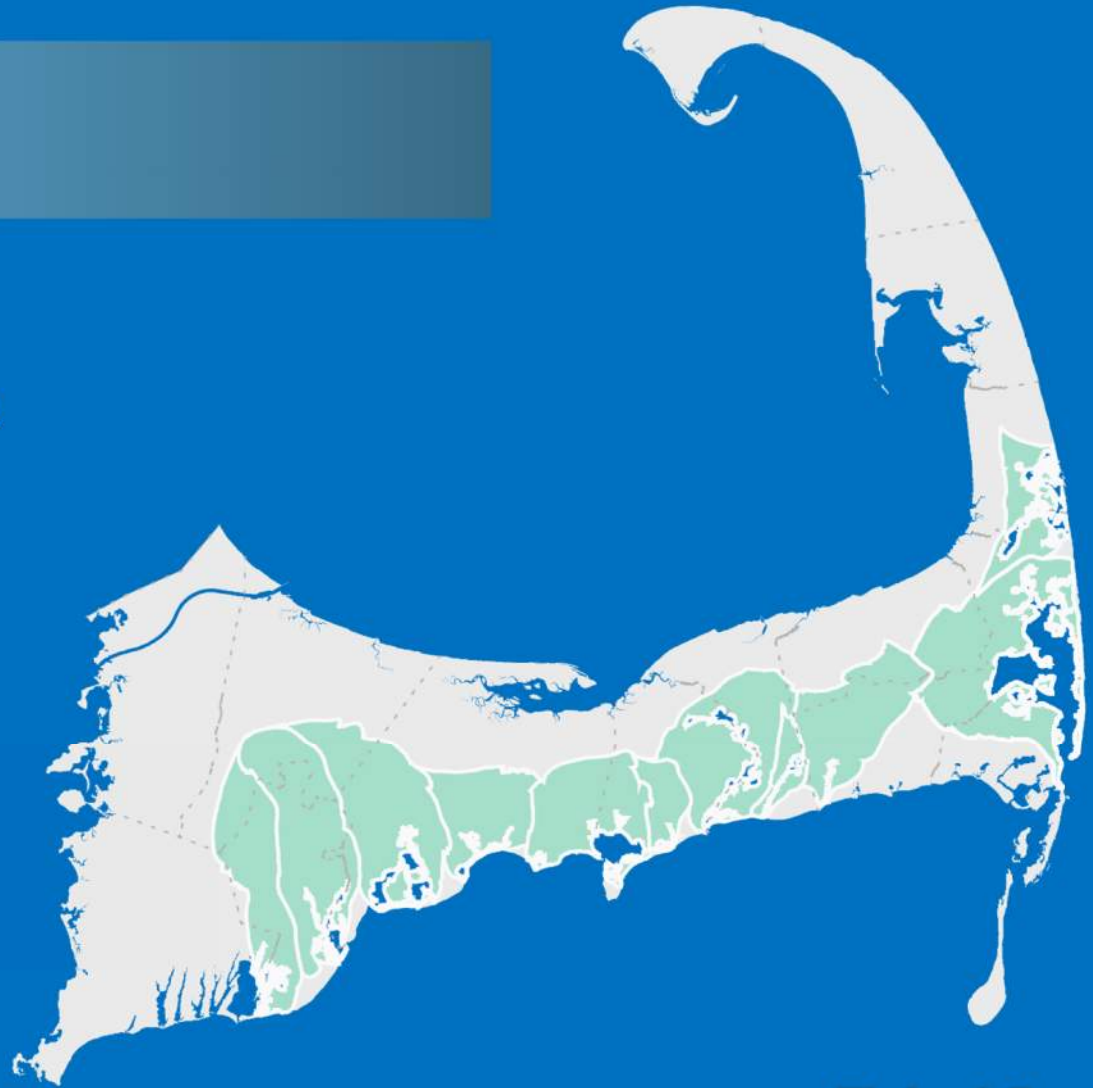
5,796 PARCELS

(79% DEVELOPED RESIDENTIAL)

33.5% SEASONAL HOMES

DEGREE OF IMPAIRMENT

HIGH



THREE BAYS

TOWNS

BARNSTABLE | SANDWICH

SIZE OF WATERSHED

12,458 ACRES

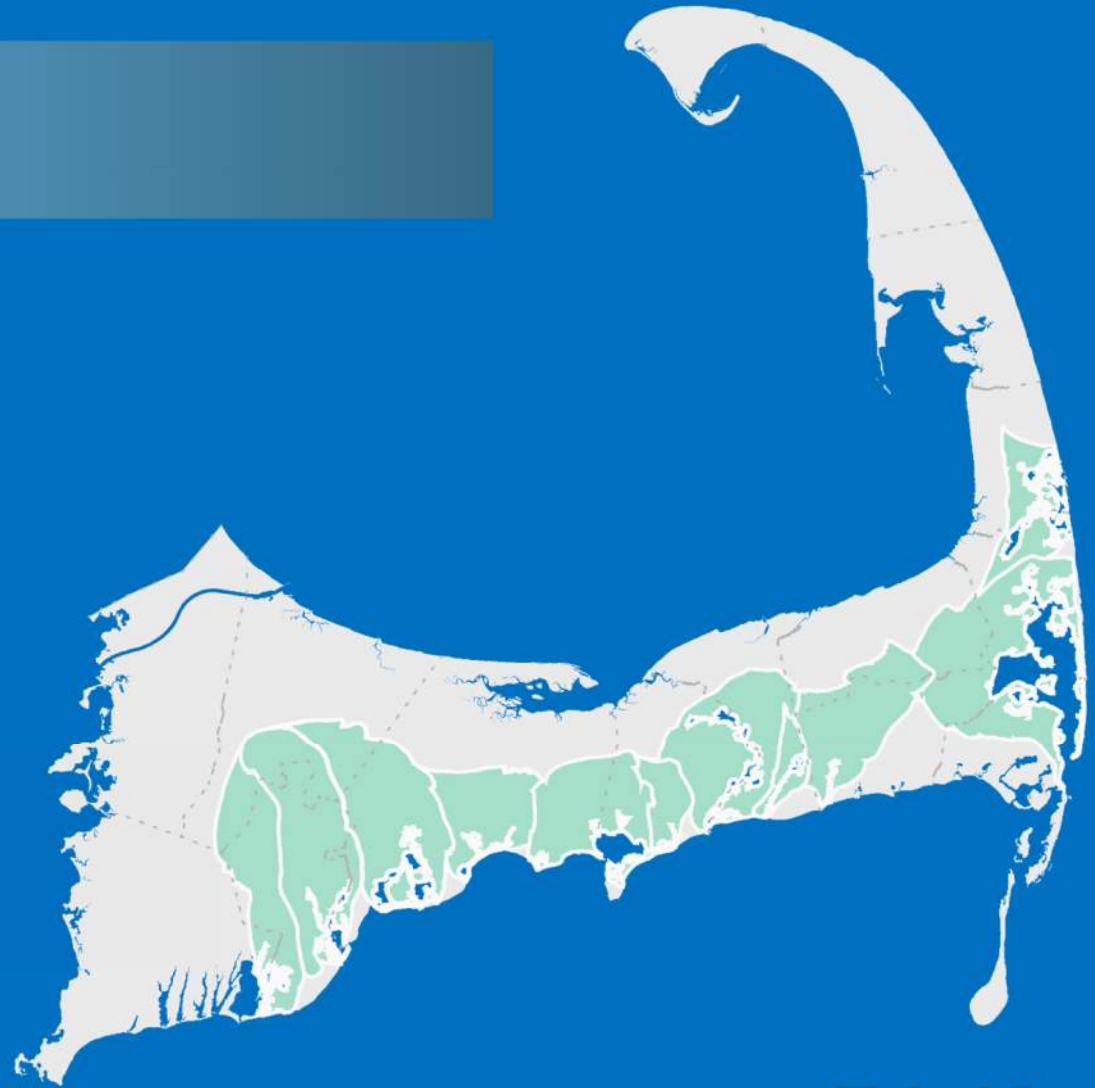
7,670 PARCELS

(85% DEVELOPED RESIDENTIAL)

22.3% SEASONAL HOMES

DEGREE OF IMPAIRMENT

HIGH

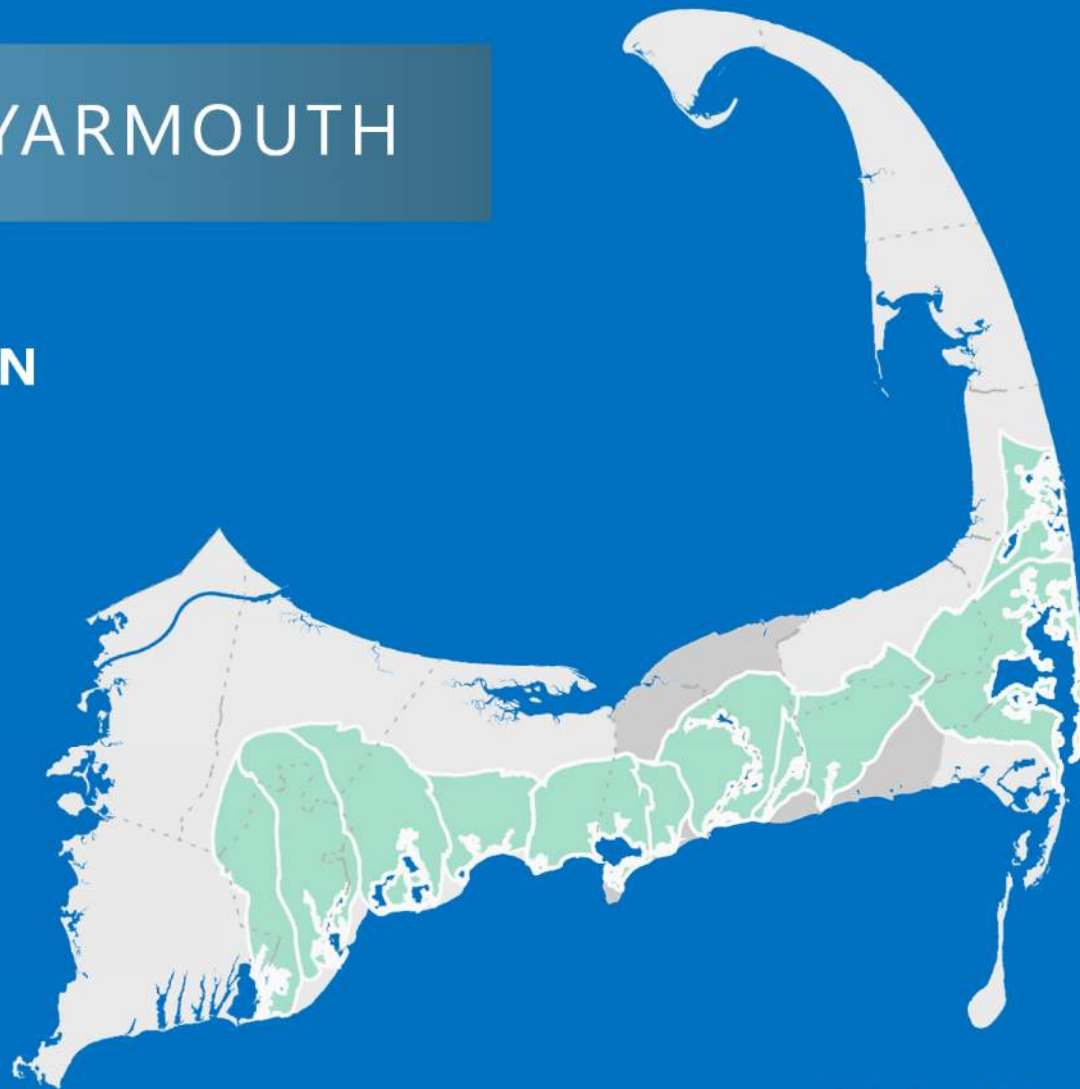


DENNIS | HARWICH | YARMOUTH

COMMUNITY PARTNERSHIP PLAN

PRIORITY WATERSHEDS

Parkers River
Bass River
Lewis Bay
Swan Pond River
Herring River (Harwich)
Pleasant Bay

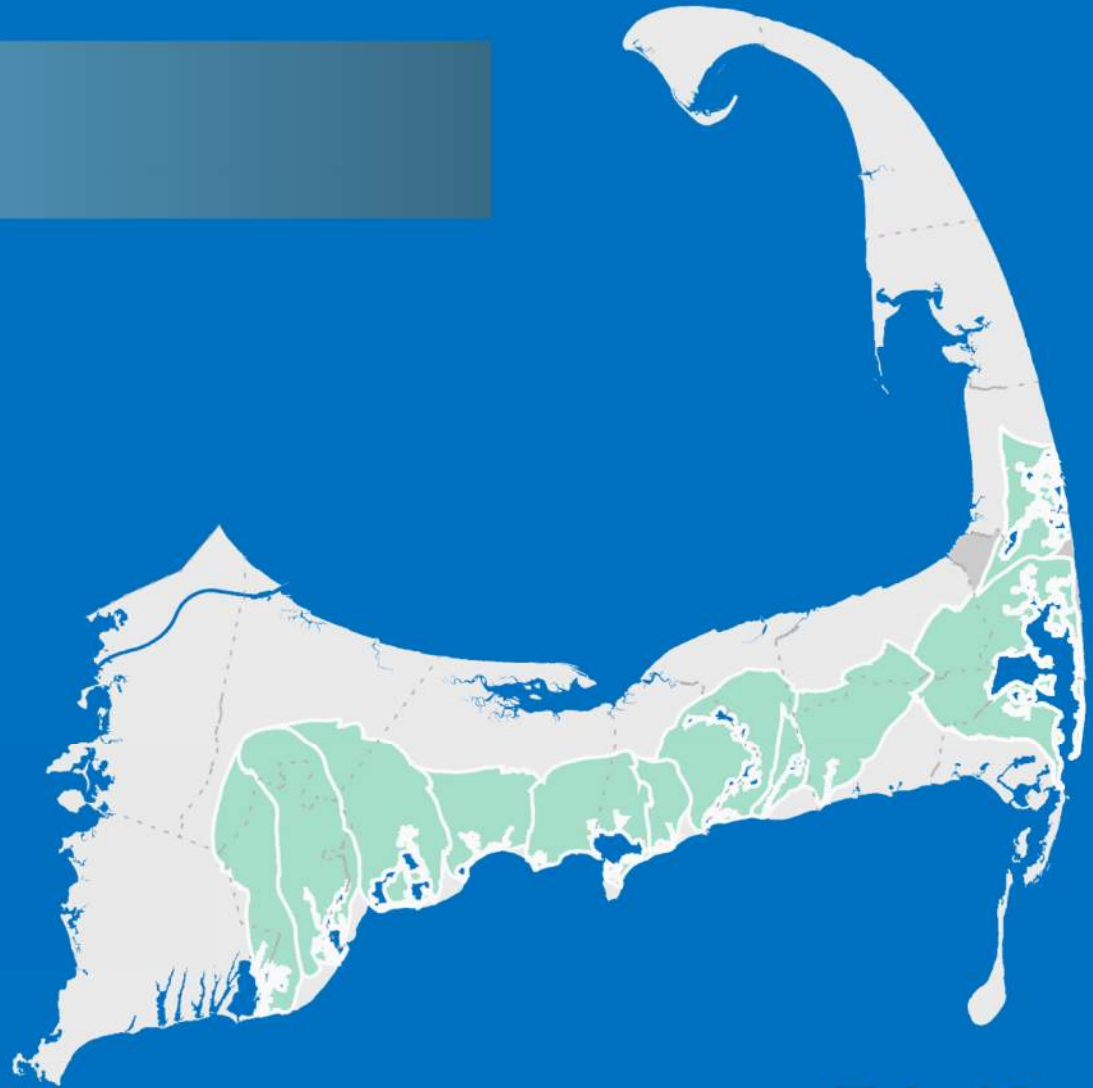


ORLEANS

AMENDED CWMP

PRIORITY WATERSHEDS

Nauset Harbor
Pleasant Bay



THANK YOU!

Sharon Rooney, AICP/RLA
Principal Planner, Tighe & Bond
srooney@tighebond.com