



# **Herring River Group**

---

**Baseline Conditions & Needs Assessment**

# **What is the 208 Plan?**

---

# Clean Water Act Section 208



The Commission was directed to update the 1978 Plan

The Commonwealth provided \$3 million to fund the project

# Focus on 21<sup>st</sup> Century Problems

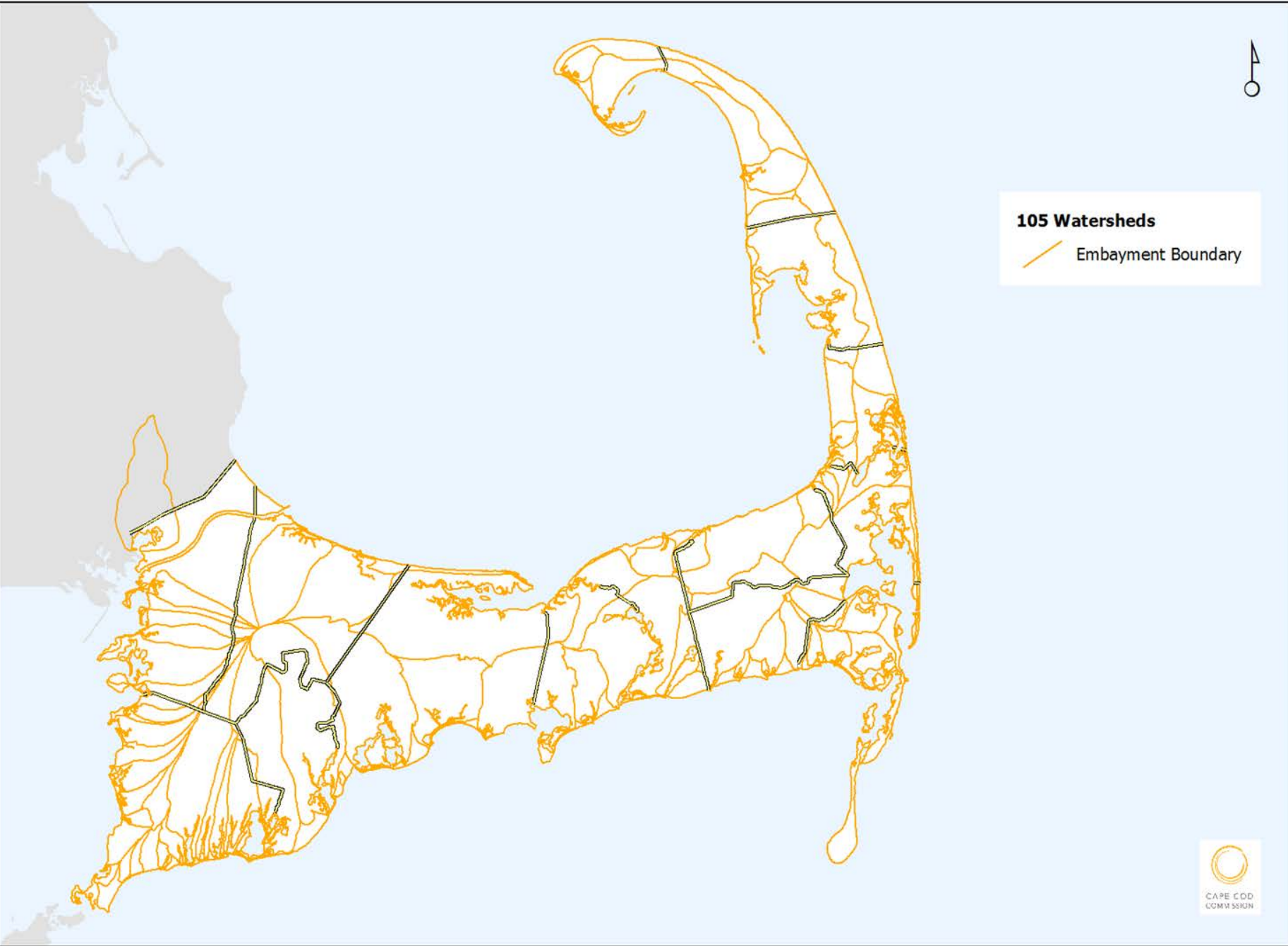
Nitrogen:  
Saline Waters

Phosphorus:  
Fresh Waters

Growth &  
Title 5  
Limitations



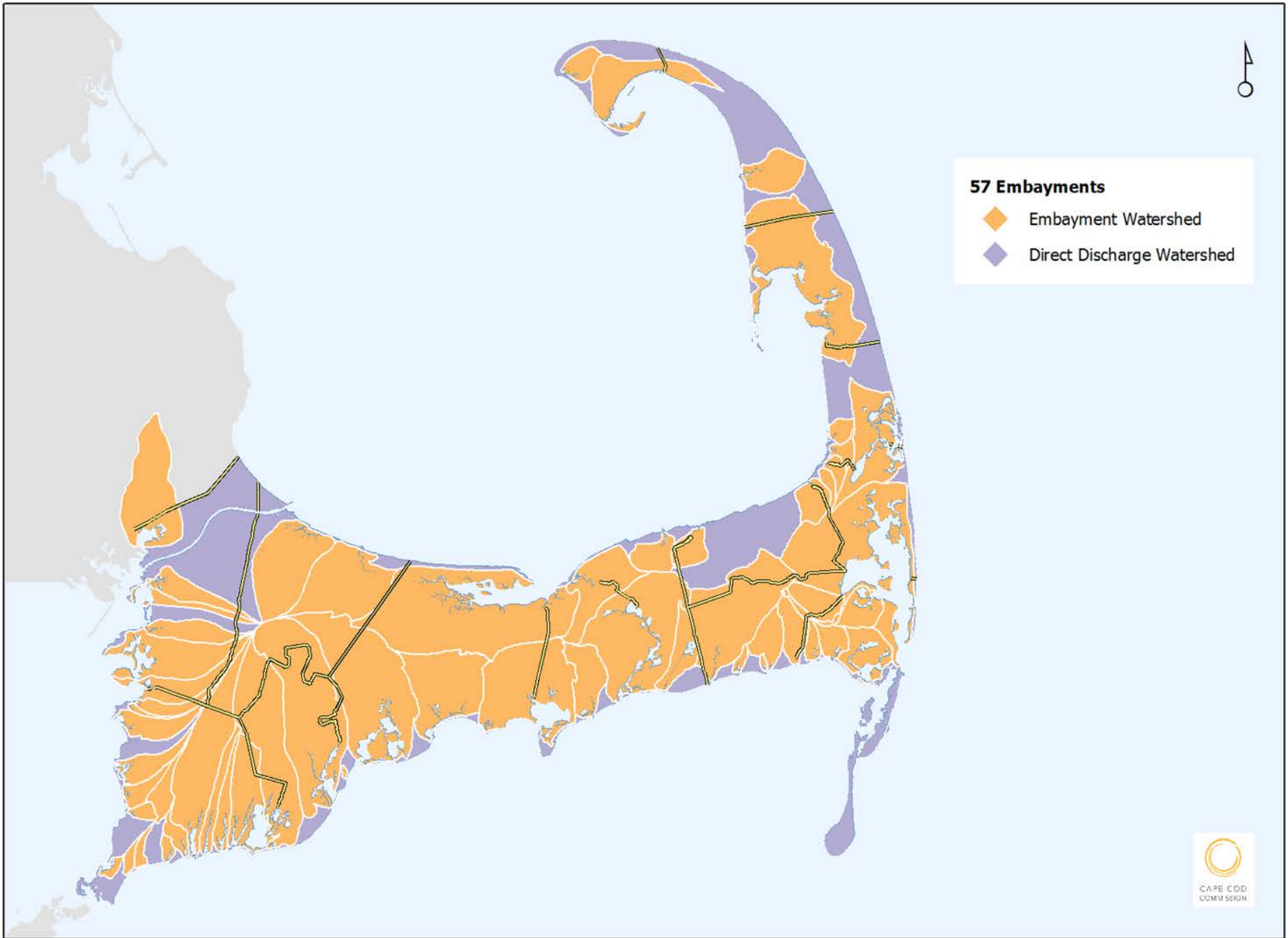
**105 Watersheds**  
— Embayment Boundary





**57 Embayments**

- ◆ Embayment Watershed
- ◆ Direct Discharge Watershed

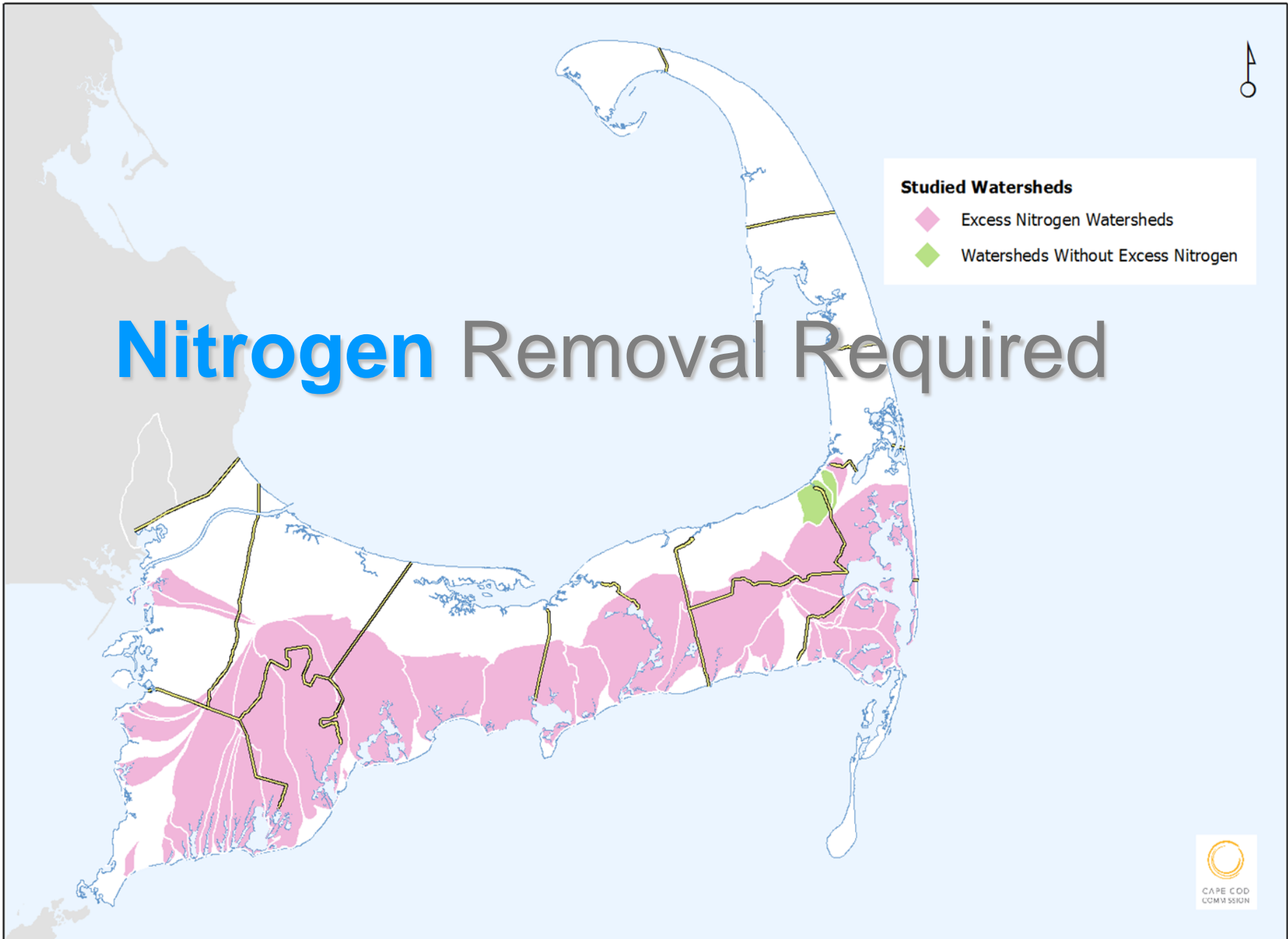




**Studied Watersheds**

- ◆ Excess Nitrogen Watersheds
- ◆ Watersheds Without Excess Nitrogen

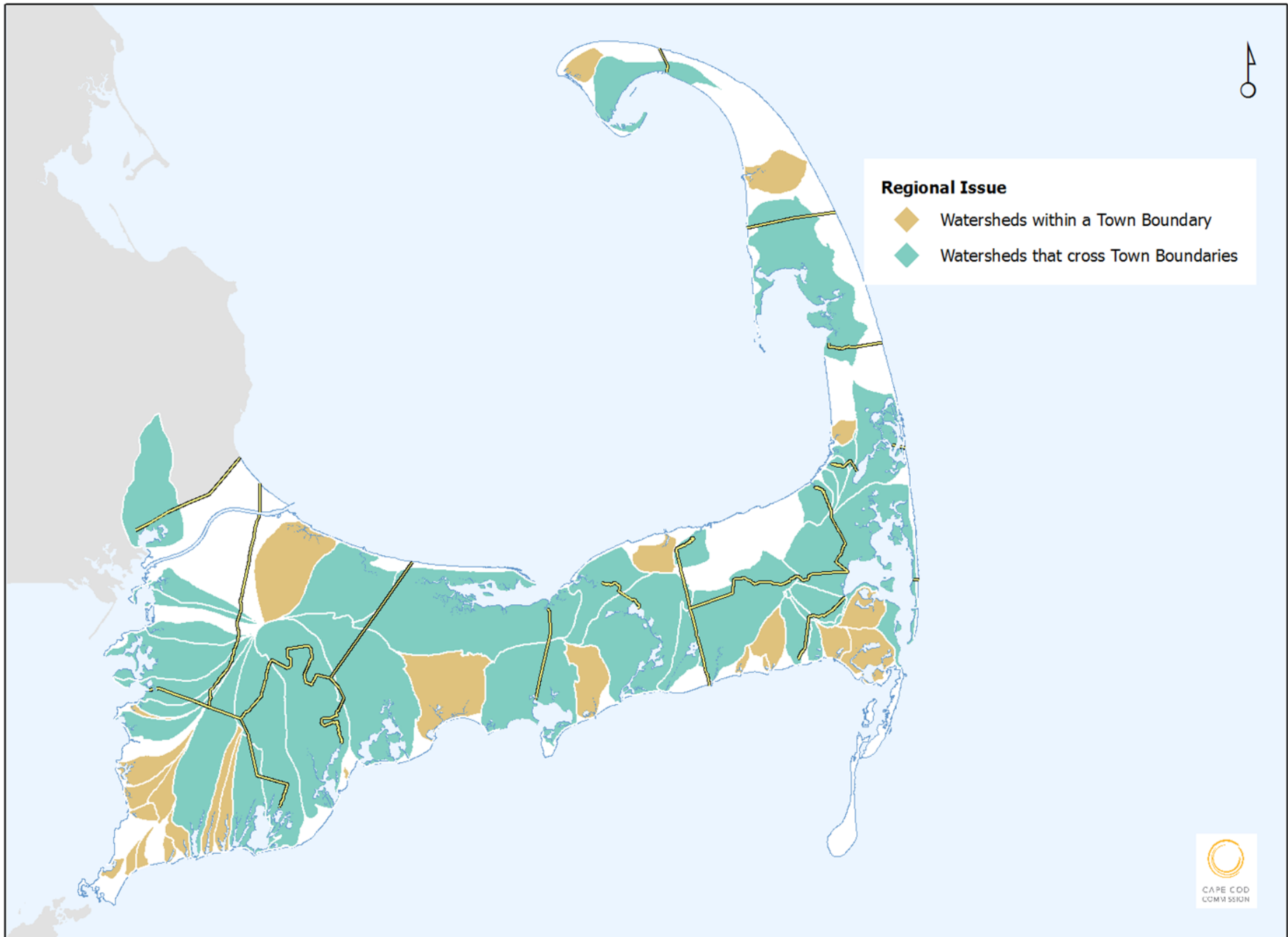
# Nitrogen Removal Required





**Regional Issue**

- ◆ Watersheds within a Town Boundary
- ◆ Watersheds that cross Town Boundaries





# Approach to the 208 Plan Update

Watershed  
Based

Stakeholder  
Engagement

Maximize Benefits  
of Local Planning

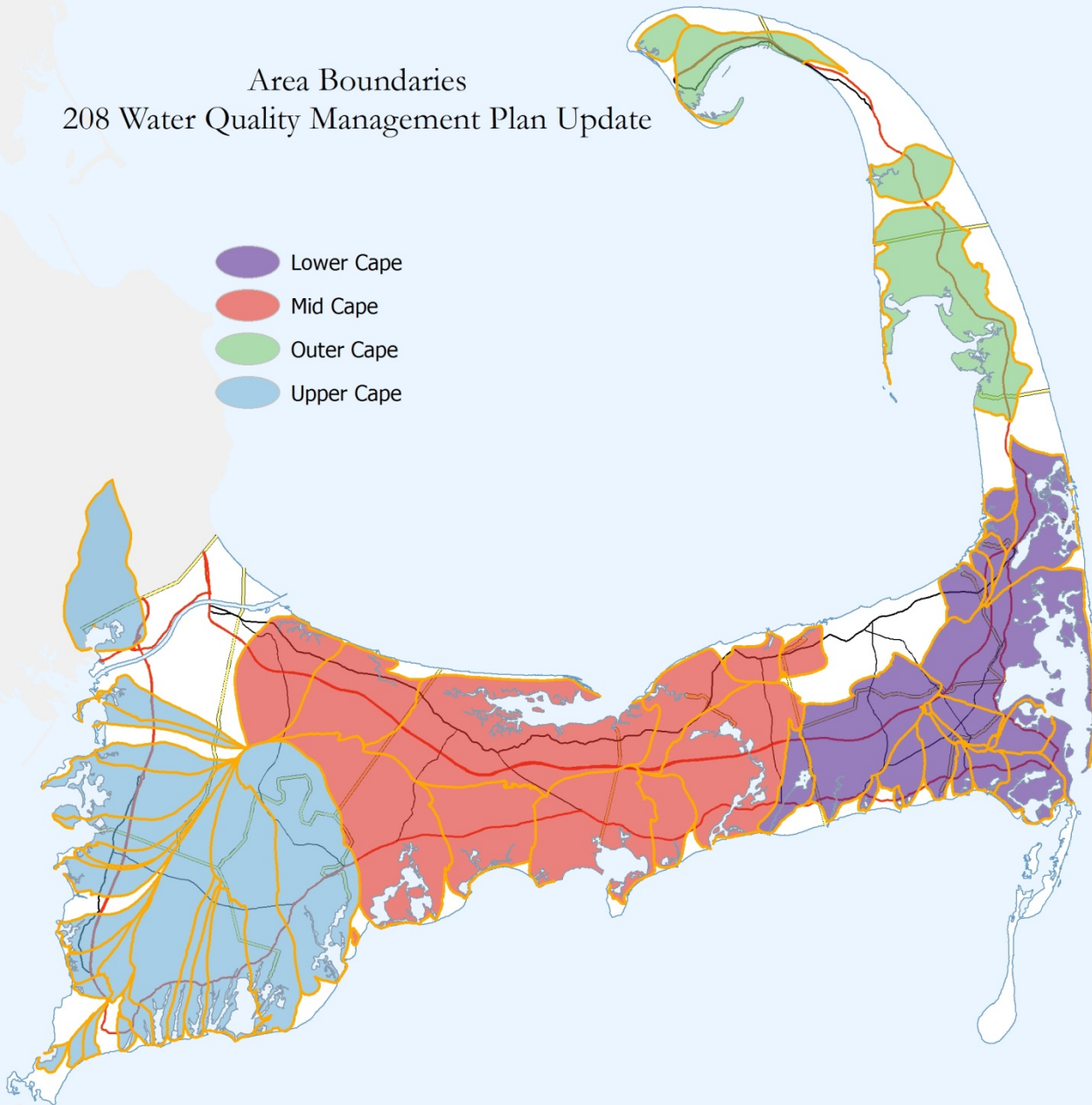
No Optimal  
Solutions

## **Goal:**

To generate a series of approaches in each watershed that will meet water quality standards

# Area Boundaries 208 Water Quality Management Plan Update

- Lower Cape
- Mid Cape
- Outer Cape
- Upper Cape



# Subgroup Boundaries 208 Water Quality Management Plan Update



## Lower Cape

- Herring River
- Pleasant Bay
- Stage Harbor Group
- Nauset and Cape Cod Bay Marsh Group

## Mid Cape

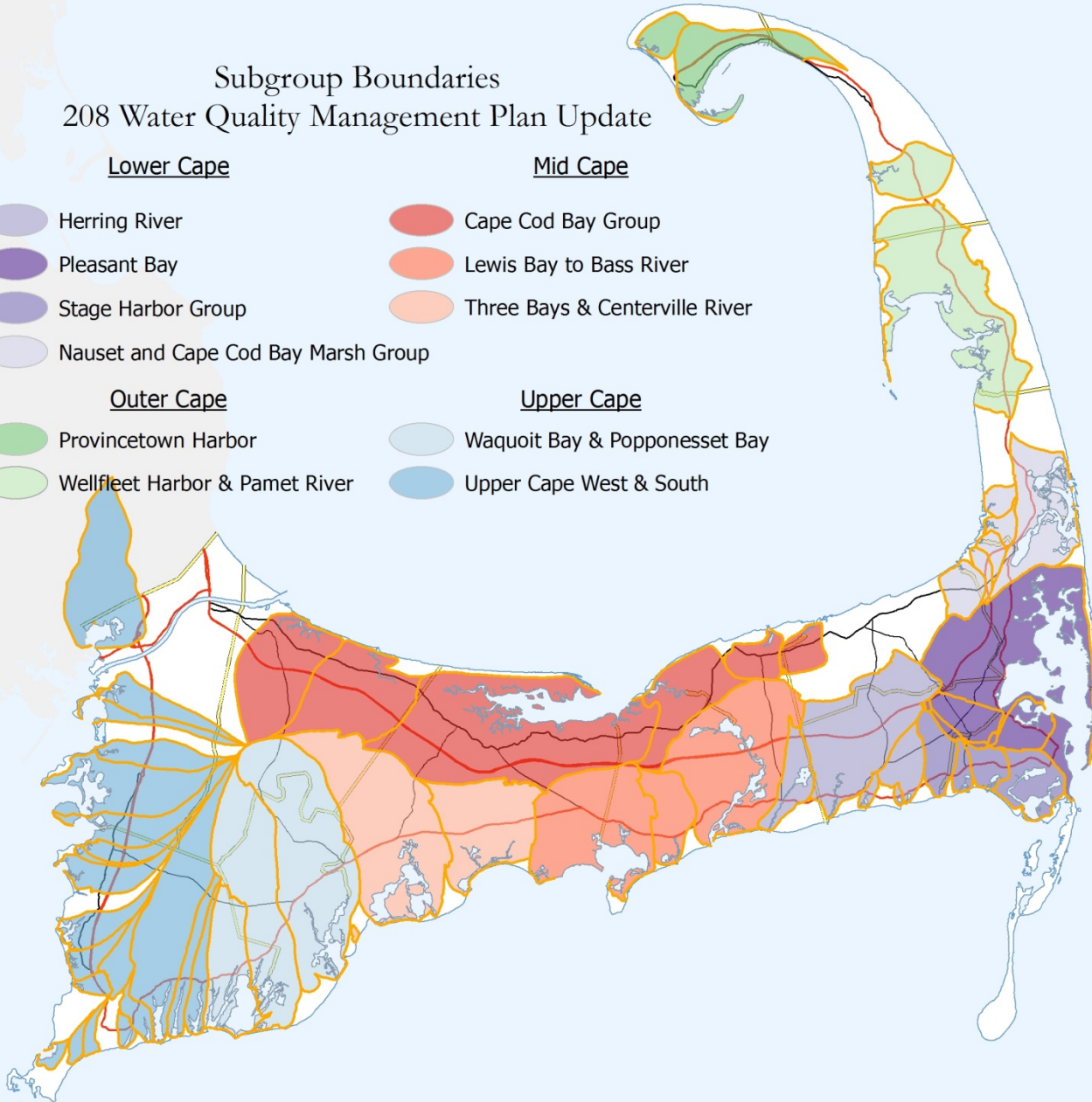
- Cape Cod Bay Group
- Lewis Bay to Bass River
- Three Bays & Centerville River

## Outer Cape

- Provincetown Harbor
- Wellfleet Harbor & Pamet River

## Upper Cape

- Waquoit Bay & Popponesset Bay
- Upper Cape West & South



**What is the stakeholder process?**

---

## Public Meetings

## Watershed Working Groups

Goals,  
Work Plan  
& Roles

Affordability,  
Financing

Baseline  
Conditions

Technology  
Options  
Review

Watershed  
Scenarios

July

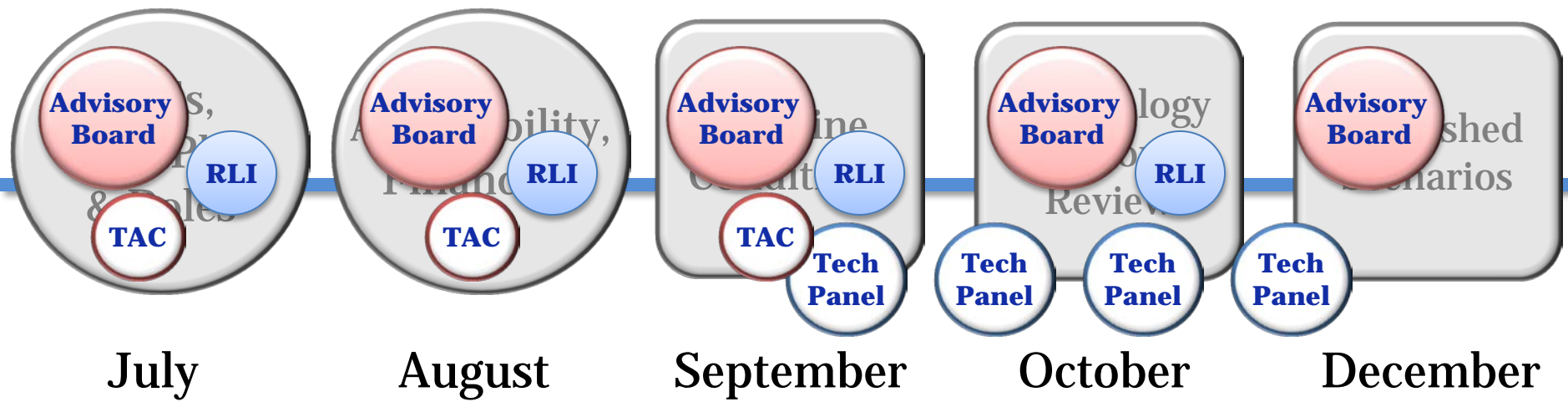
August

September

October

December

**208 Planning Process**



 **Regulatory, Legal & Institutional Work Group**

 **Technical Advisory Committee of Cape Cod Water Protection Collaborative**

# 208 Planning Process

Goals,  
Work Plan  
& Roles

Affordability,  
Financing

Baseline  
Conditions

Technology  
Options  
Review

Watershed  
Scenarios

4 Public  
Meetings:  
July 15-18

4 Public  
Meetings:  
Aug 26-29

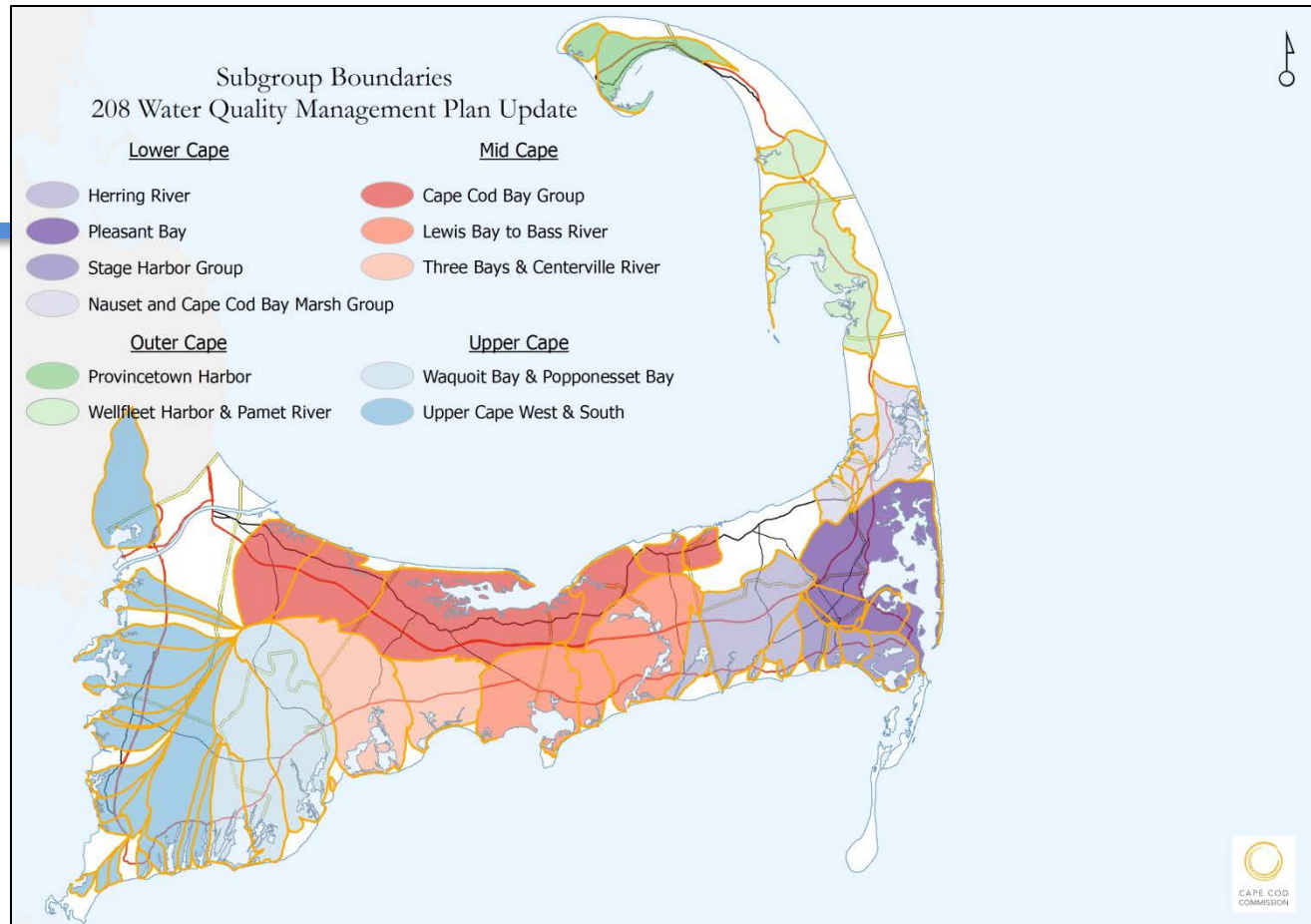
## 208 Planning Process

Baseline  
Conditions

11 Working  
Group Meetings:  
Sept 18-27

Technology  
Options  
Review

Watershed  
Scenarios



**208 Planning Process**



# Baseline Conditions

11 Working Group Meetings:  
Sept 18-27

# Technology Options Review

11 Working Group Meetings:  
Oct 21-Nov 5

# Watershed Scenarios



# 208 Planning Process

Baseline  
Conditions

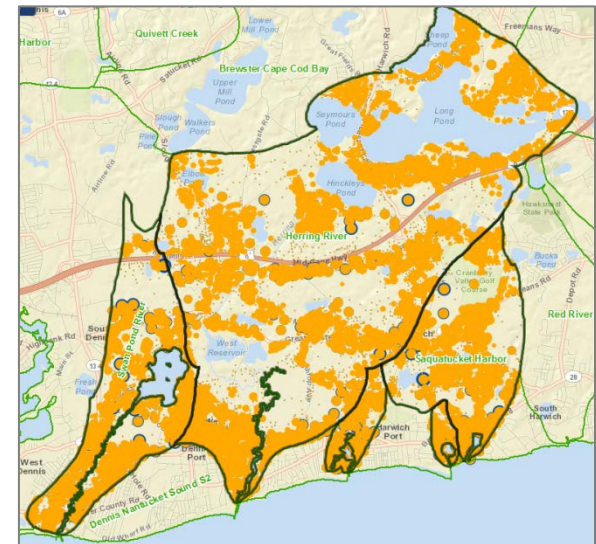
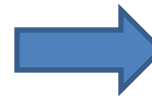
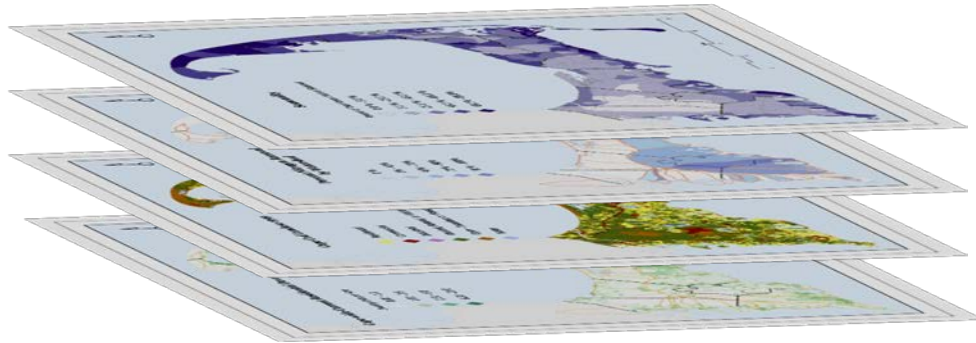
11 Working  
Group Meetings:  
Sept 18-27

Technology  
Options  
Review

11 Working  
Group Meetings:  
Oct 21-Nov 5

Watershed  
Scenarios

11 Working  
Group Meetings:  
Dec 2-11



**208 Planning Process**

Baseline  
Conditions

11 Working  
Group Meetings:  
Sept 18-27

Technology  
Options  
Review

11 Working  
Group Meetings:  
Oct 21-Nov 5

Watershed  
Scenarios

11 Working  
Group Meetings:  
Dec 2-11

---

**208 Planning Process**

Baseline  
Conditions

11 Working  
Group Meetings:  
Sept 18-27

## Goal of Today's Meeting:

To review and develop shared understanding of the characteristics of these watersheds, the work done to date, existing data and information available, and how to apply all of this to planning for water quality improvements for these watersheds moving forward.

**208 Planning Process**

# Local Progress to Date



Allen Harbor  
Herring River  
Saquatucket Harbor  
Swan Pond River  
Wychmere Harbor

# Brewster

## From 1978 Section 208 Plan

▶ Present and future town well sites should be protected from the non-point sources resulting from New development by creating Watershed Protection Districts.

▶ The town should cooperate in regional water supply planning to determine future water supply needs of neighboring towns and whether it can assist.

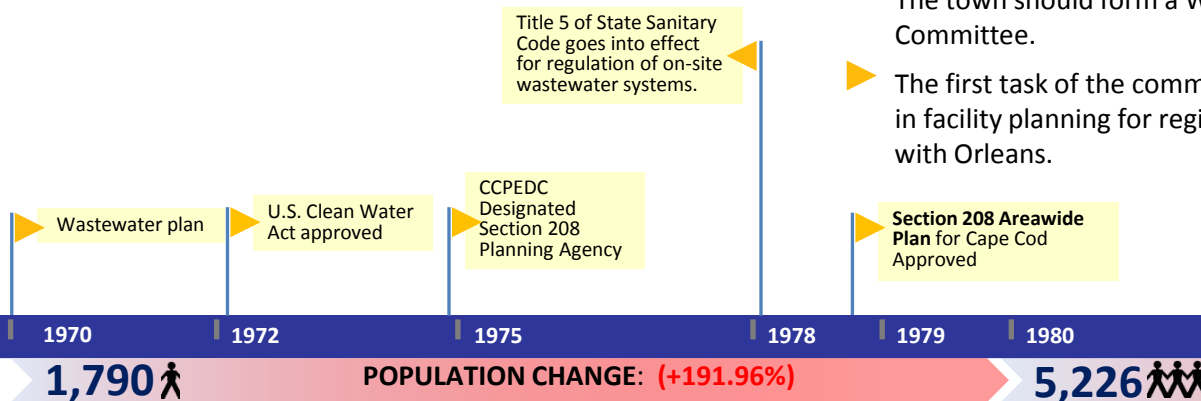
▶ WASTEWATER: It is expected that no new problem areas will develop and that present problem areas will be controlled during the planning period.

▶ The Orleans 201 facility plan will soon be underway and the cooperation of Brewster in the planning of a septage facility in Orleans that can meet Brewster's septage treatment needs is highly recommended.

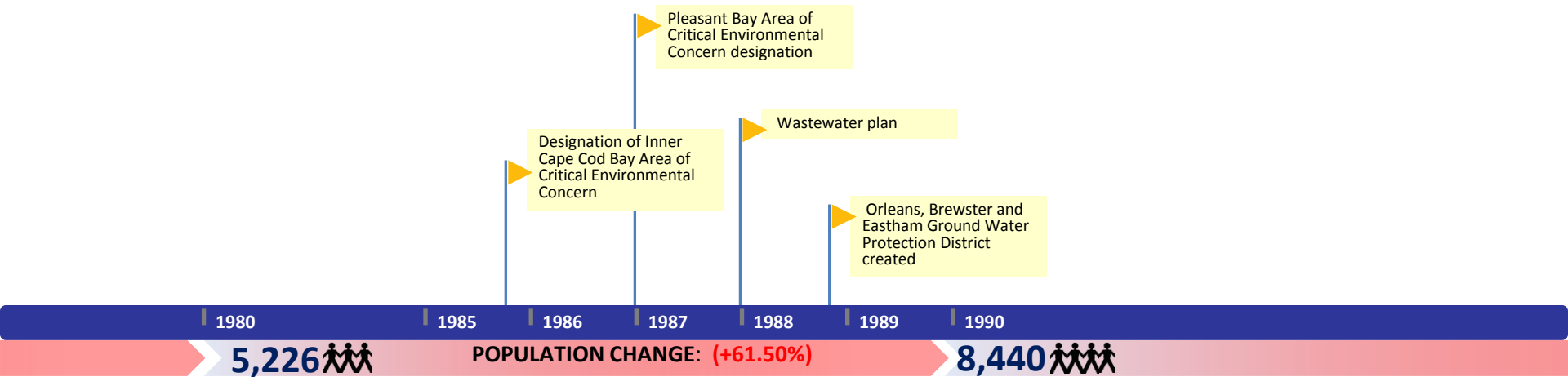
▶ It is recommended that Brewster consider cooperating in a regional landfill monitoring program.

▶ The town should form a Water Quality Advisory Committee.

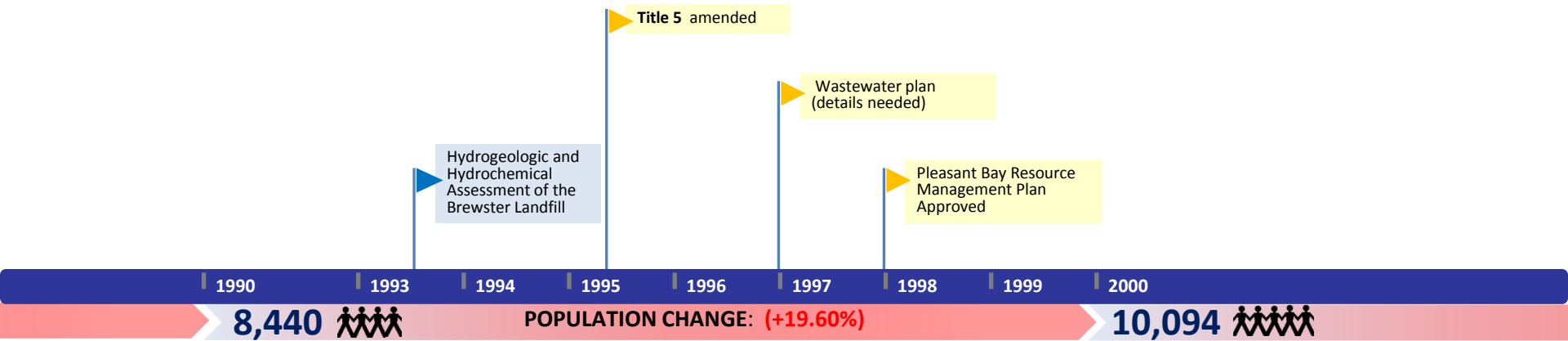
▶ The first task of the committee might be participation in facility planning for regional septage treatment with Orleans.



# Brewster: 1970-2013

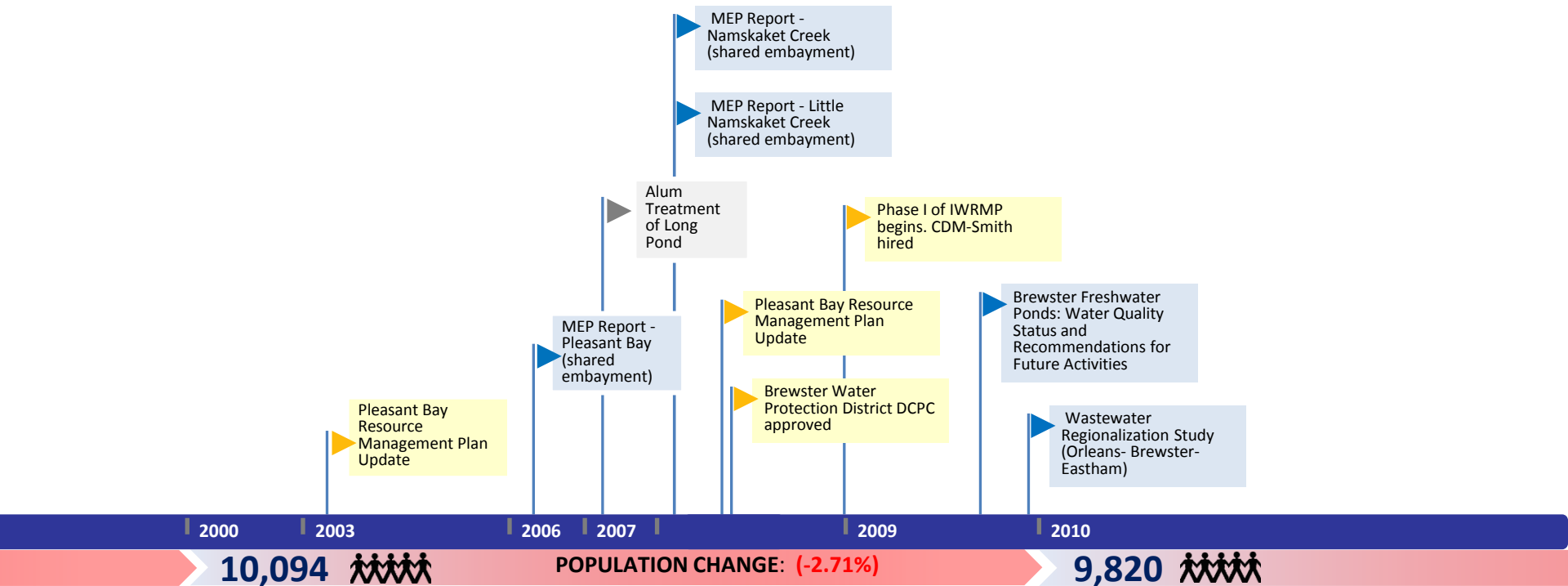


# Brewster: 1970-2013

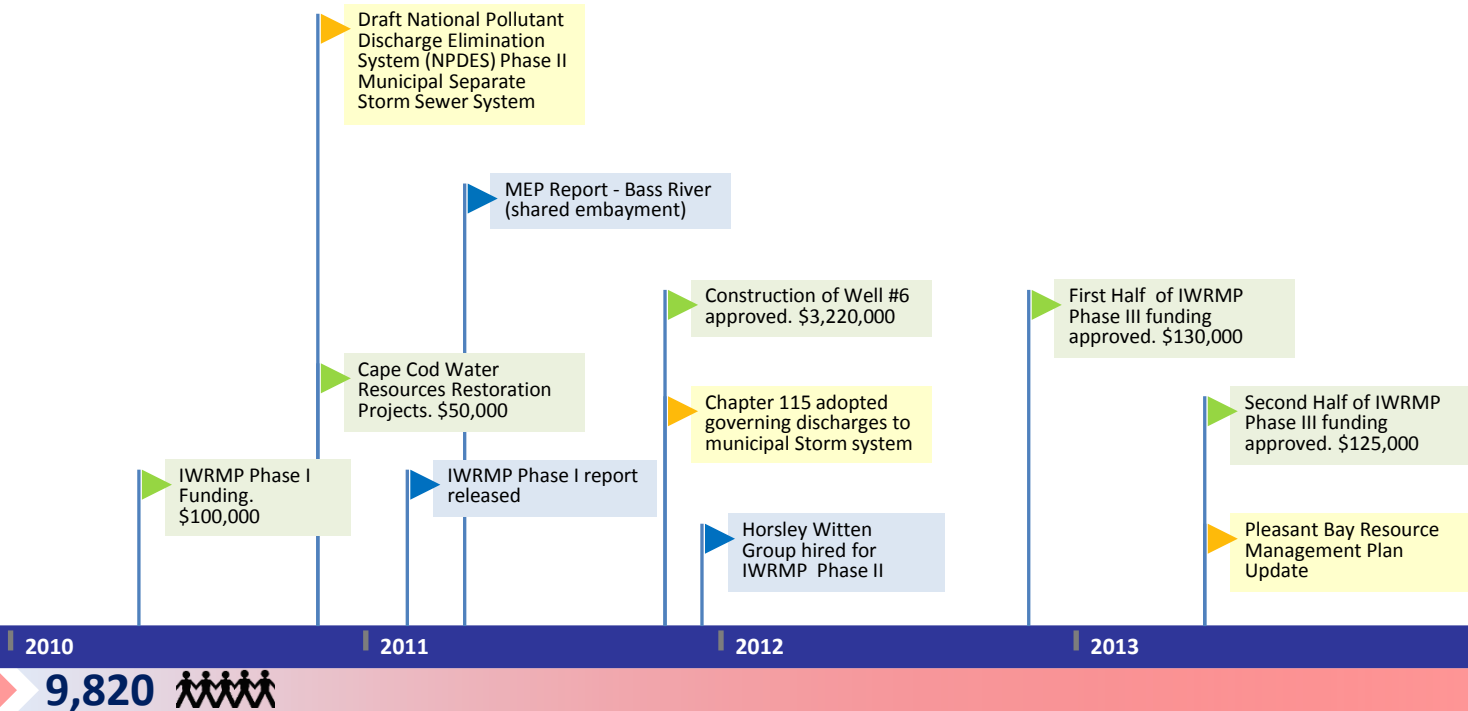




# Brewster: 1970-2013



# Brewster: 1970-2013



# Dennis

## From 1978 Section 208 Plan

- ▶ Dennis has a professional health agent and the town's health regulations already implement many of the 208 plan recommendations.
- ▶ It is recommended that the town consider creating a "Seasonal Residential District" in the area south of Lower County Road and carefully control the conversion of seasonal dwellings in this area.
- ▶ Septage treatment is a problem in Dennis. It is recommended in the discussion of "Facility Planning in Non-Sewered Areas" that Dennis should join with Yarmouth in a regional facility.
- ▶ Since the town is not planning to construct any sewage collection systems, septage flows may be large enough to make a separate facility cost-effective. Another possibility that should be investigated is regionalization with Harwich.
- ▶ Implementation of the 208 water quality plan in Dennis should give priority to establishing watershed protection districts and implementing on-site system management and septage treatment.
- ▶ The Water District has developed extensive wellfields and pumping capacity, which should require little expansion to serve the 1995 population
- ▶ Dennis may have water resources in excess of its needs, which could be called upon to supply other towns in the future.
- ▶ Dense development in the southern half of Dennis and along Bass River may restrict the amount or area available for recharge protection purposes.

Title 5 of State Sanitary Code goes into effect for regulation of on-site wastewater systems.

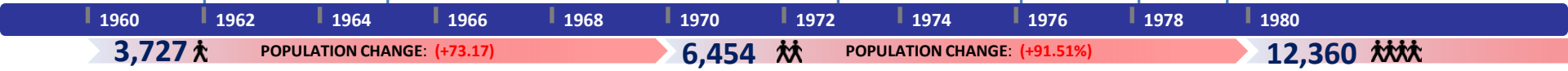
Bass River wastewater study

Facilities plan recommending sewer system

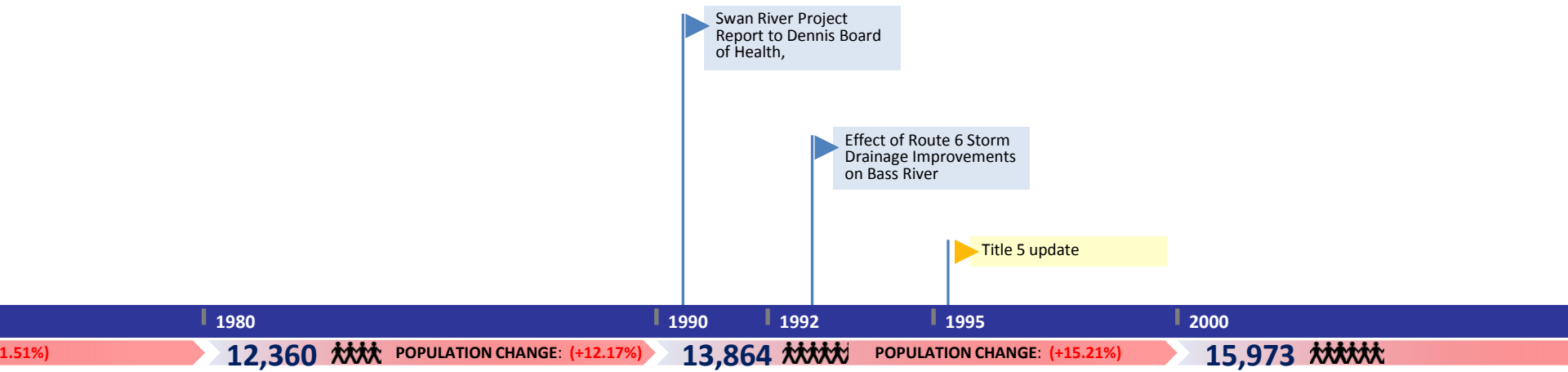
U.S. Clean Water Act Approved

CCPEDC Designated Section 208 Planning Agency

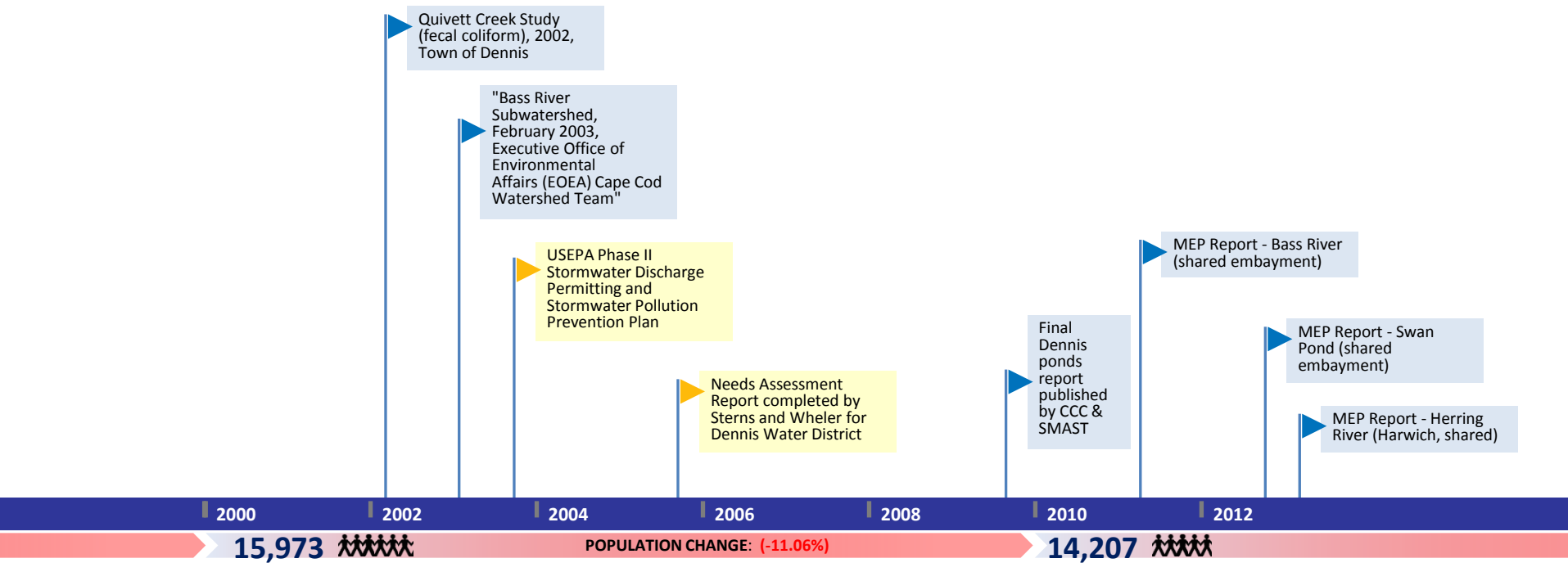
Section 208 Areawide Plan for Cape Cod Approved



# Dennis: 1970-2013



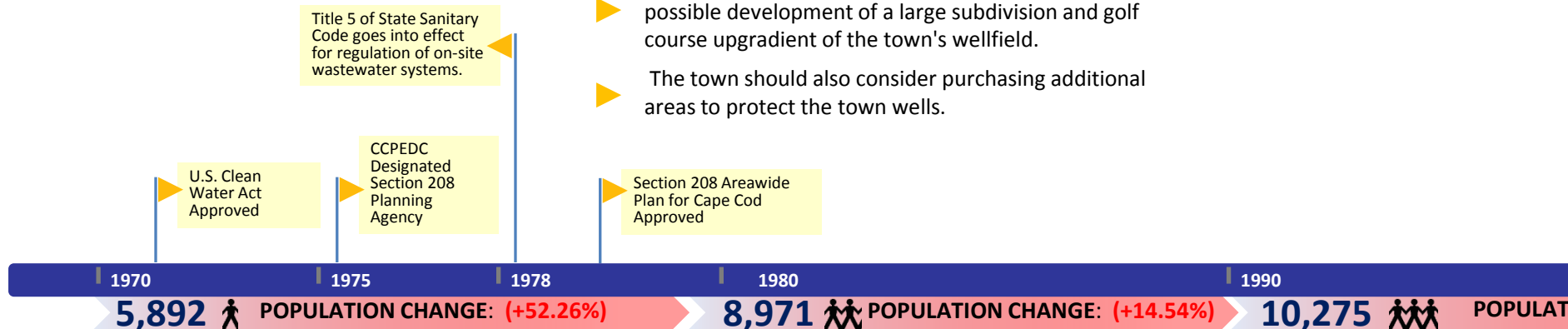
# Dennis: 1970-2013



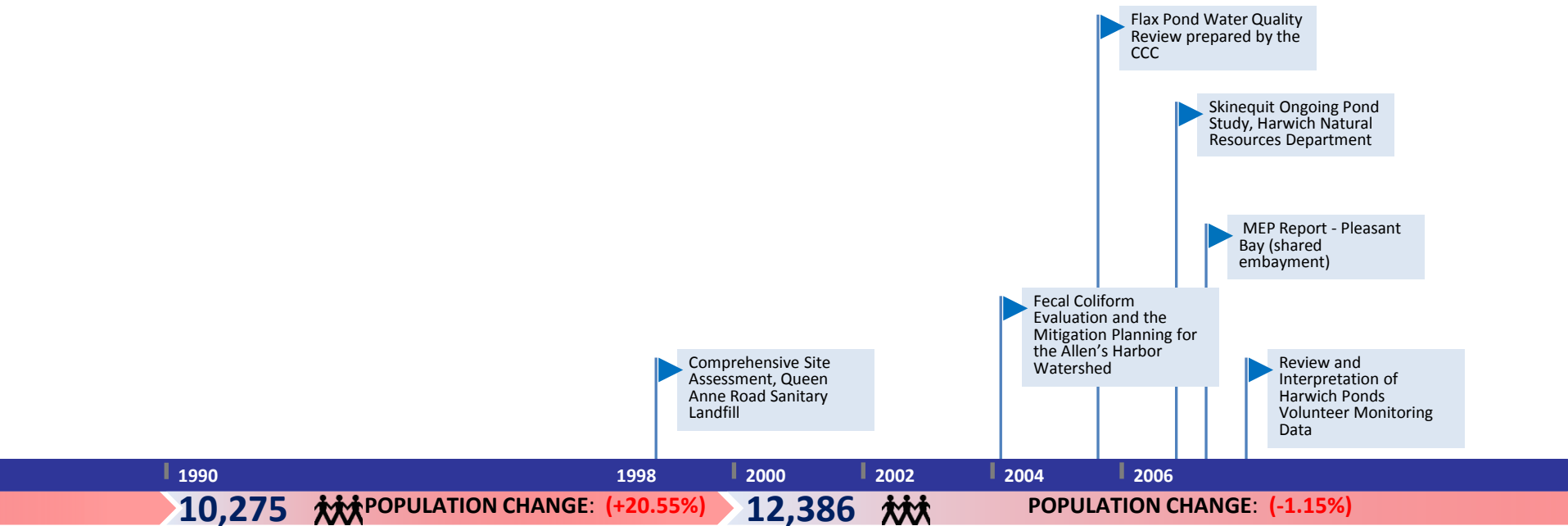
# Harwich: 1970-2013

## From 1978 Section 208 Plan

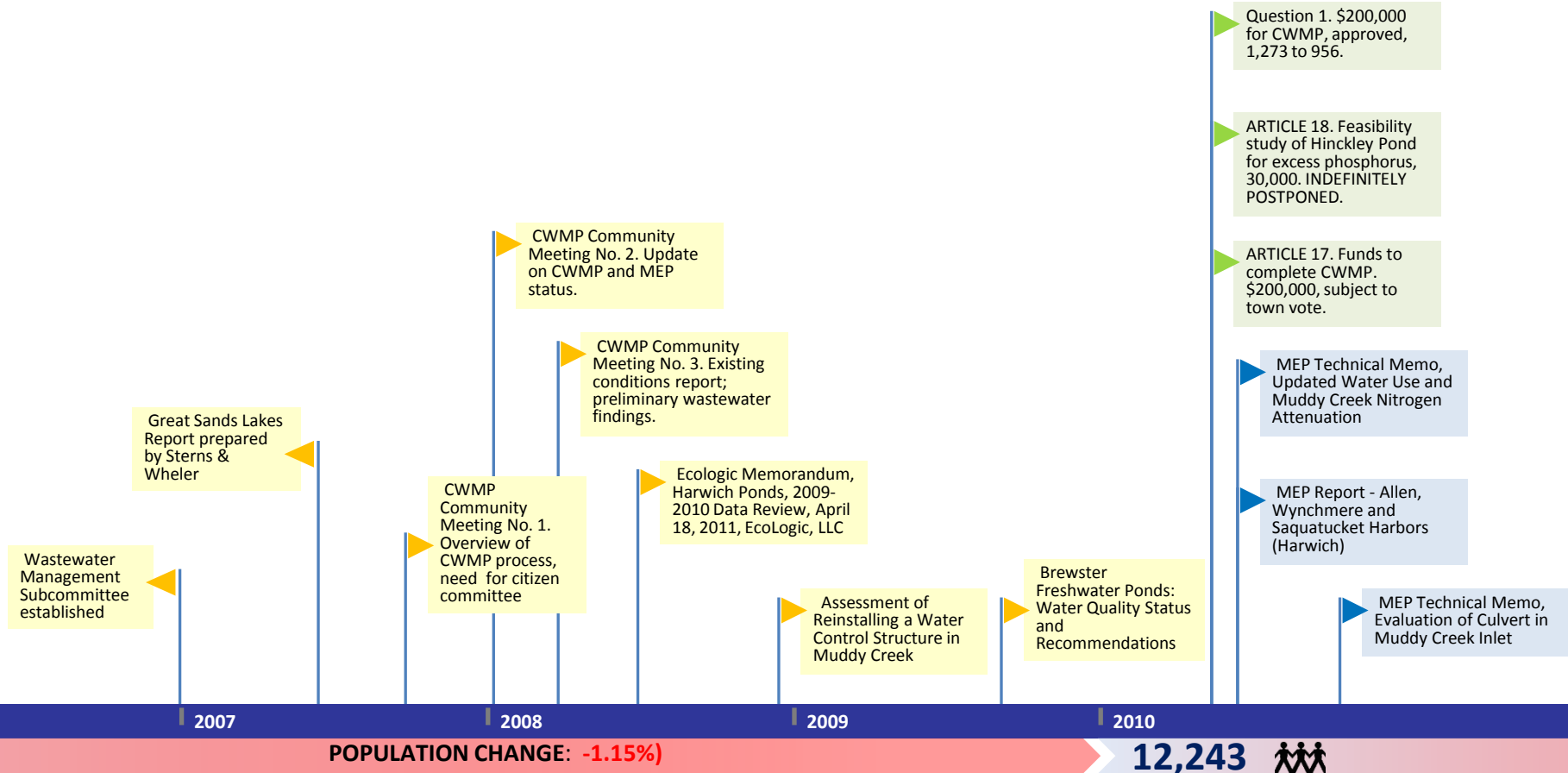
- ▶ That the town recognize that the Category 2 problem areas on the south side of town need special attention.
- ▶ It is also suggested that the town consider establishing "Seasonal Residential Districts" in this area to control the conversion of seasonal dwellings to year-round occupancy.
- ▶ The 208 plan does not indicate a sewer need in Harwich.
- ▶ This means that the town will not be eligible for a major central collection system for twenty years.
- ▶ New wastewater management problems created by the town's failure to take recommended actions for on-site system management will not be eligible for future 201 construction funds.
- ▶ While Harwich presently has a state approved interim lagoon, the town should not view this system as a long-term solution to its septage treatment problems.
- ▶ There has been considerable concern raised over the possible development of a large subdivision and golf course upgradient of the town's wellfield.
- ▶ The town should also consider purchasing additional areas to protect the town wells.



# Harwich: 1970-2013

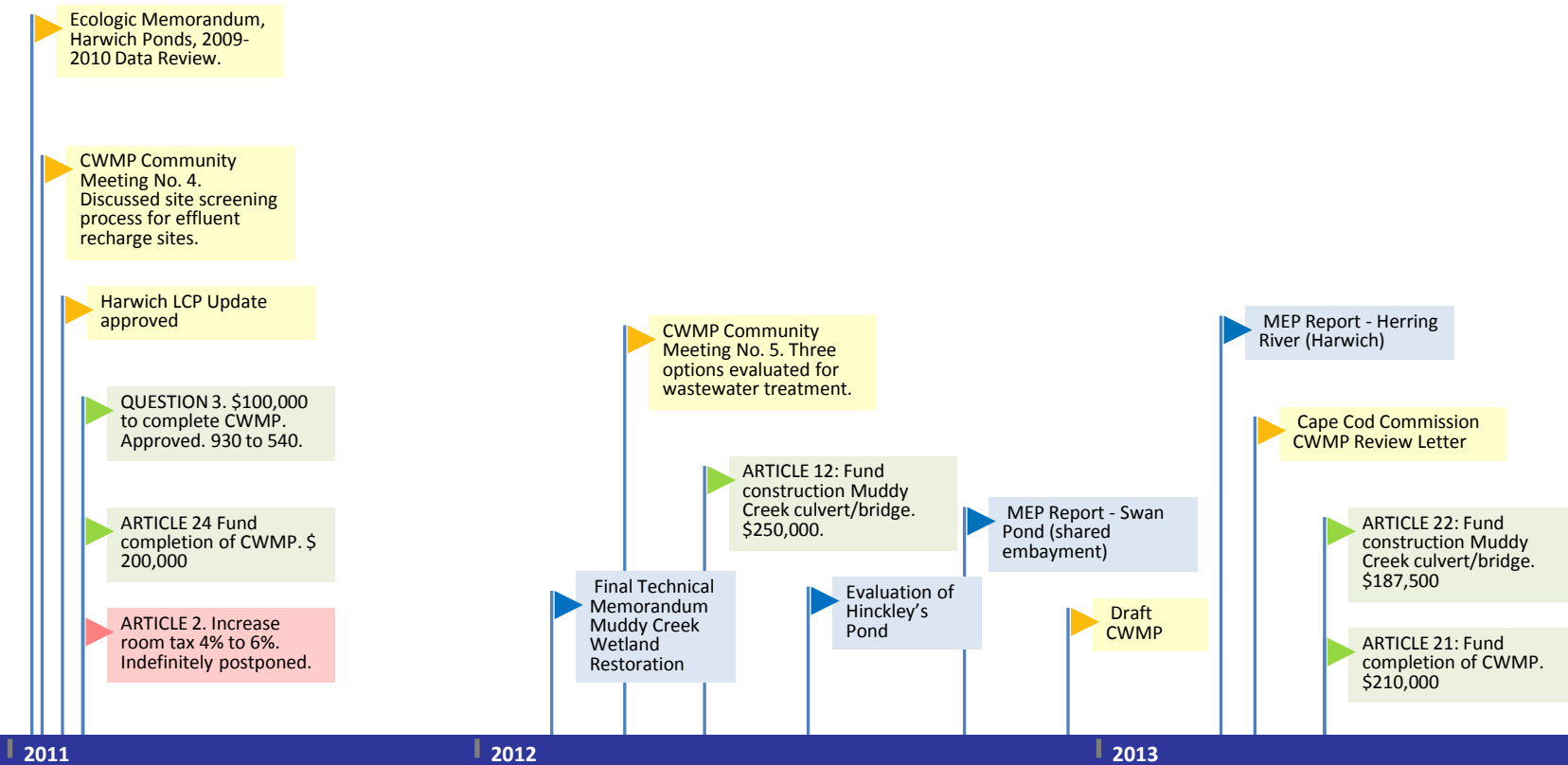


# Harwich: 1970-2013





# Harwich: 1970-2013



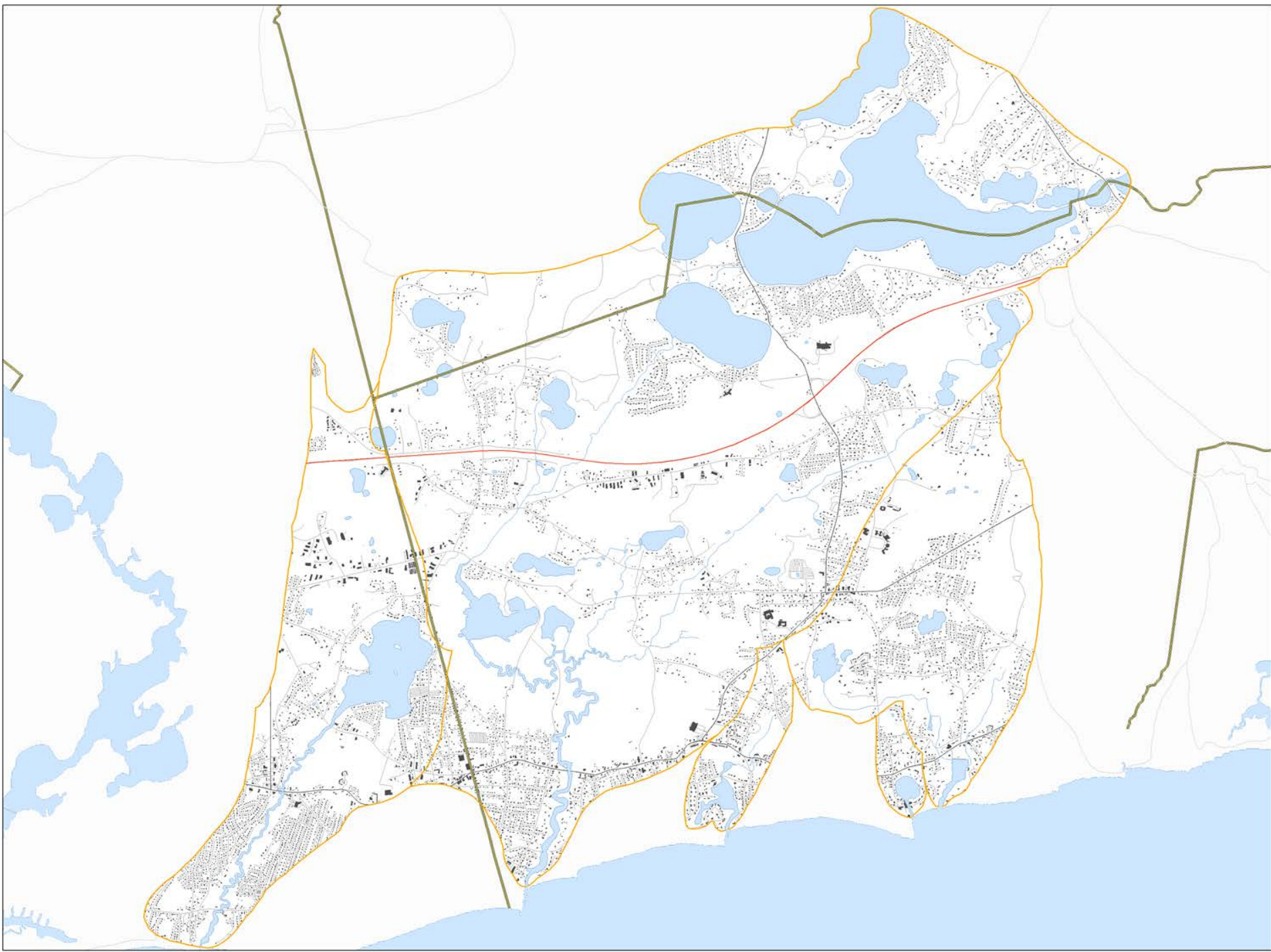
**Did we miss anything?**

---

# **Your Watersheds**



Allen Harbor  
Herring River  
Saquatucket Harbor  
Swan Pond River  
Wychmere Harbor

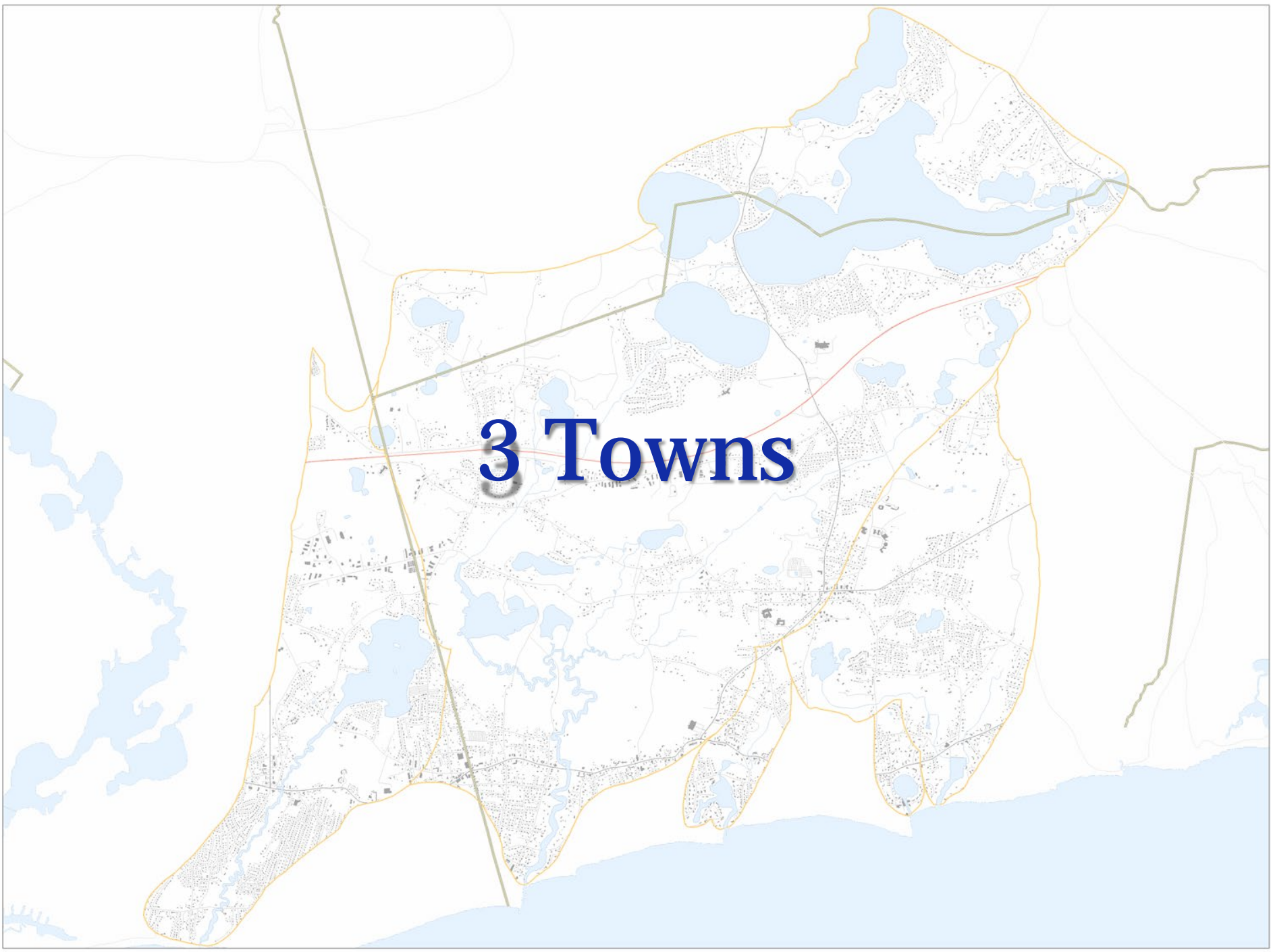


A map of a coastal region, possibly a town or county, with a boundary highlighted in orange. The map shows a network of roads, several large bodies of water (lakes or ponds) in light blue, and a coastline at the bottom. A green line represents a major road or boundary line. The text "21.2 square miles" is overlaid in the center in a large, blue, serif font.

**21.2 square miles**




**3 Towns**




# Natural Features


## Base Map

 Town Lines


 Rivers


## Embayment Boundary

 On Land


 On Sea

## Major Roads

 US Highway


 State Highway


 Roads


 Structures

 Ponds


## Natural Areas


 Natural Heritage & Endangered Species Program (NHESP) Certified Vernal Pools

 Water Table Contours

 Cranberry Bogs


 Wetlands

 Sea, Lake, & Overland Surges from Hurricanes (SLOSH) Update 2013

 Preliminary FEMA Flood Insurance Rate Map (FIRM) Zones 2013


# Managed Surfaces


## Base Map

 Town Lines


 Rivers


## Embayment Boundary

 On Land


 On Sea

## Major Roads

 US Highway


 State Highway


 Roads


 Structures


 Ponds

## Managed Surfaces

 Approximate Managed Ground Surfaces

 Approximate Residential Managed Lawns


 Approximate Managed Golf Courses

 Approximate Municipal Managed Natural Surfaces




# Regulatory


## Base Map

 Town Lines


 Rivers


## Embayment Boundary

 On Land


 On Sea

## Major Roads

 US Highway


 State Highway


 Roads


 Structures

 Ponds


## Regulatory


 Areas of Critical Environmental Concern

 DEP Approved Wellhead Protection Areas (Zone IIs)

 Growth Incentive Zone


## OpenSpace: Level of Protection


 In Perpetuity

 Limited


 None


## Landuse Vision Map


 Economic Center

 Industrial and Service Trade Area

 Village


 Resource Protection Area

 Other

 Undesignated


# Land Use Change


## Base Map

 Town Lines


 Rivers


## Embayment Boundary

 On Land


 On Sea

## Major Roads

 US Highway


 State Highway


 Roads


 Structures


 Ponds


## LandUse Change

 Residential

 Commercial

 Industrial

 Wooded, Natural, or Wetlands

 Open - Disturbed or Managed

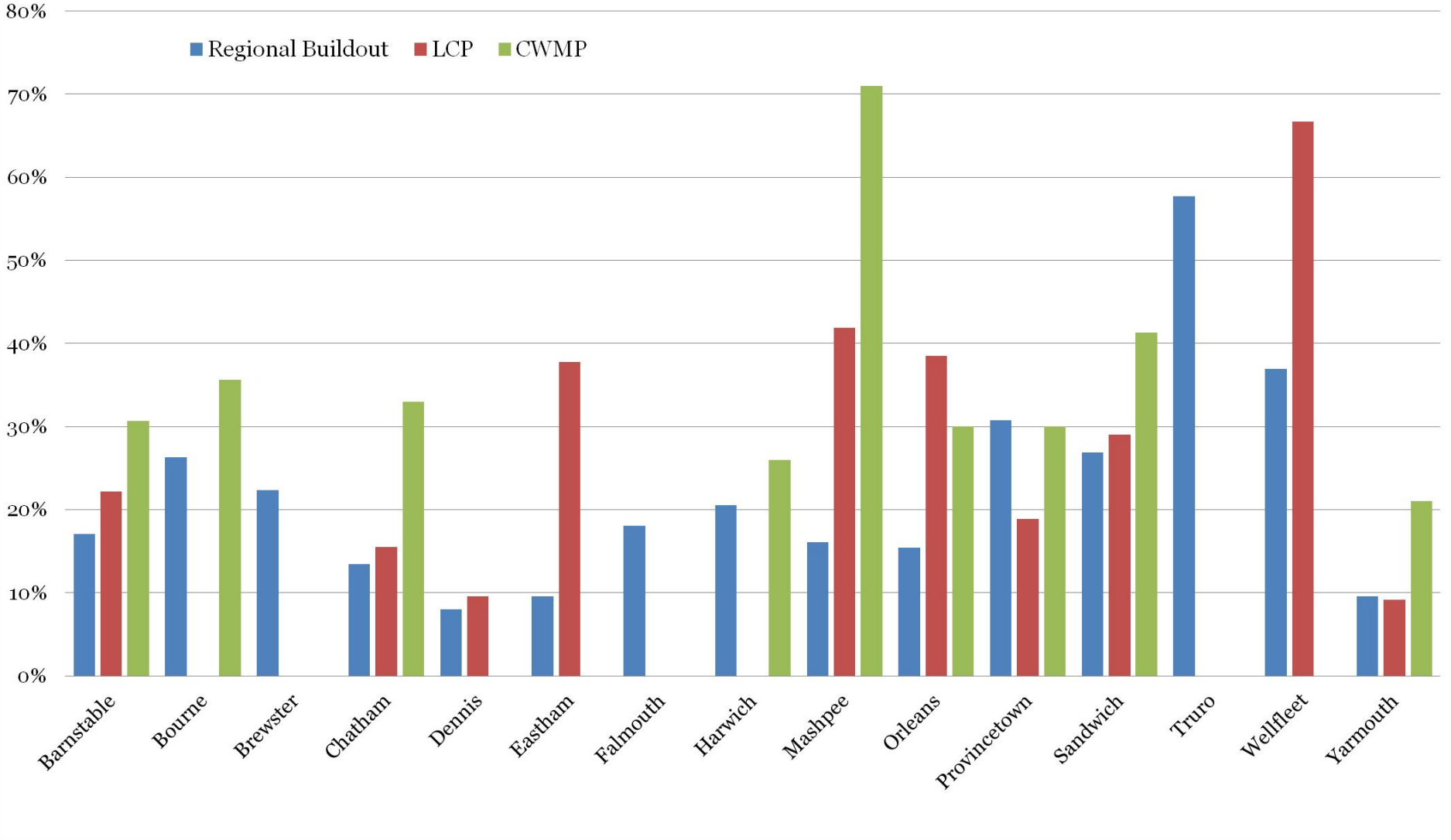
 Water

**Cape Wide Cost Estimate:  
30% growth will increase  
capital costs by 40%**

# Buildout

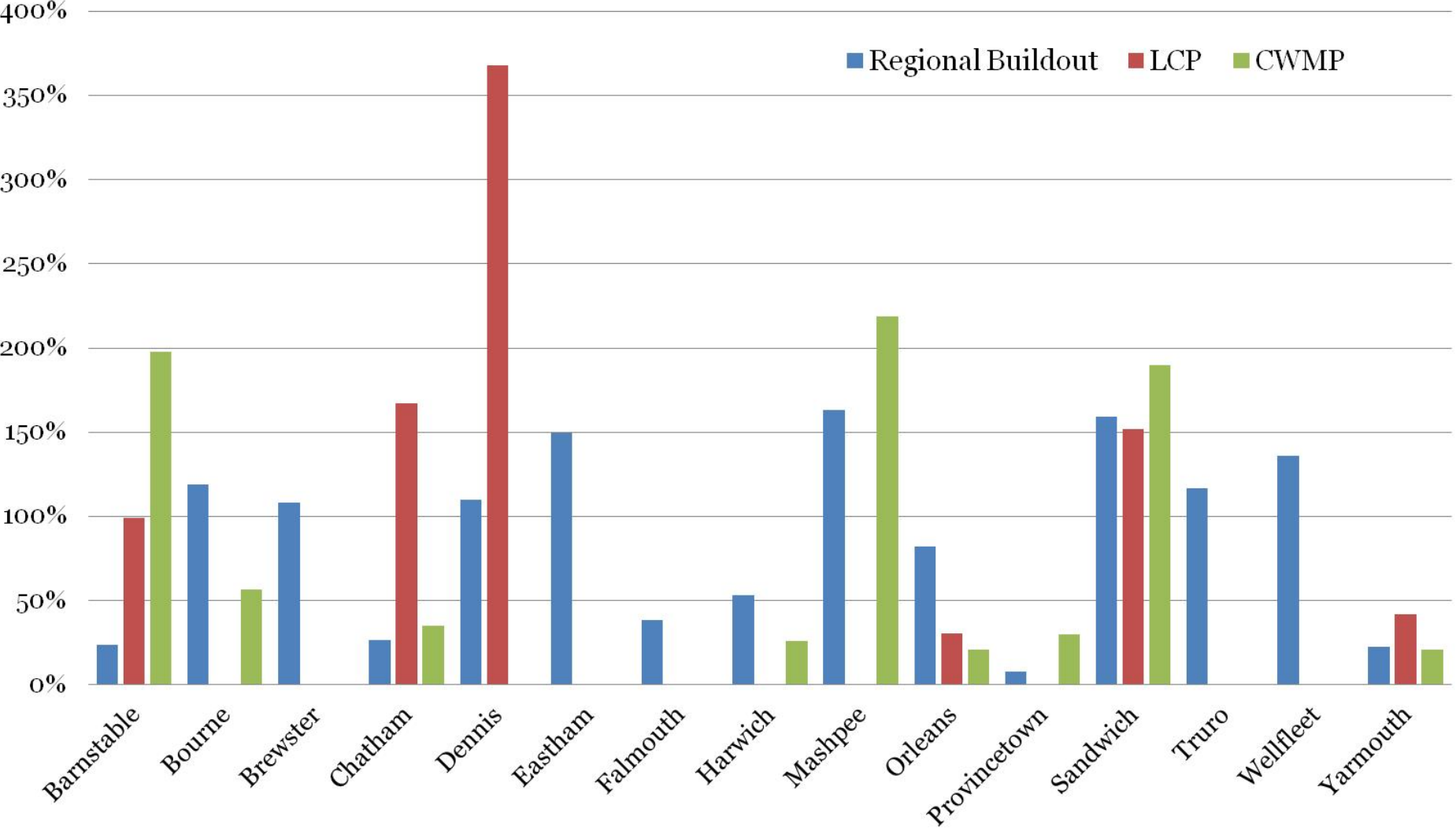
### Increase in Dwellings

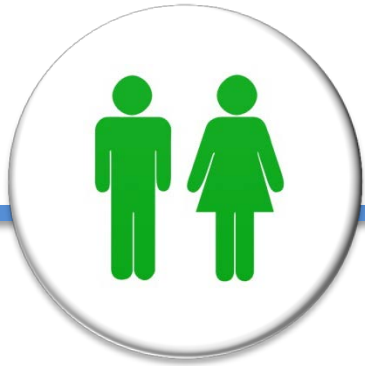
■ Regional Buildout ■ LCP ■ CWMP



# Buildout

## Increase in Non-Residential Square Footage





# The People

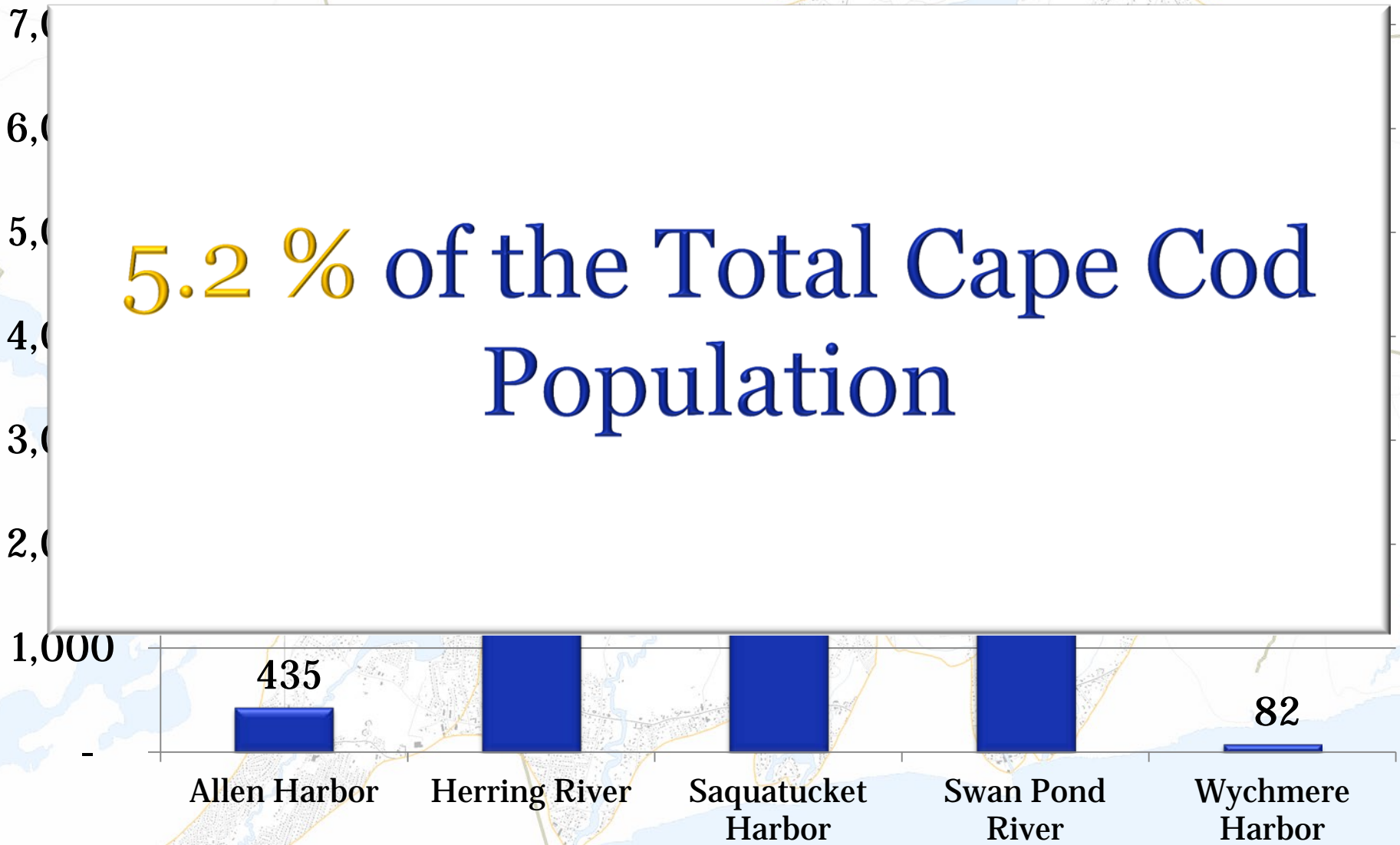
Allen Harbor  
Herring River  
Saquatucket Harbor  
Swan Pond River  
Wychmere Harbor

A map of a coastal region, possibly a town or city, showing a network of roads and numerous small blue areas representing water bodies. A thick orange line outlines the main landmass, and a brown line indicates a specific boundary or district. The text 'Total Population (2010) = 11,163' is overlaid in a large, bold, blue serif font across the center of the map.

**Total Population (2010) = 11,163**

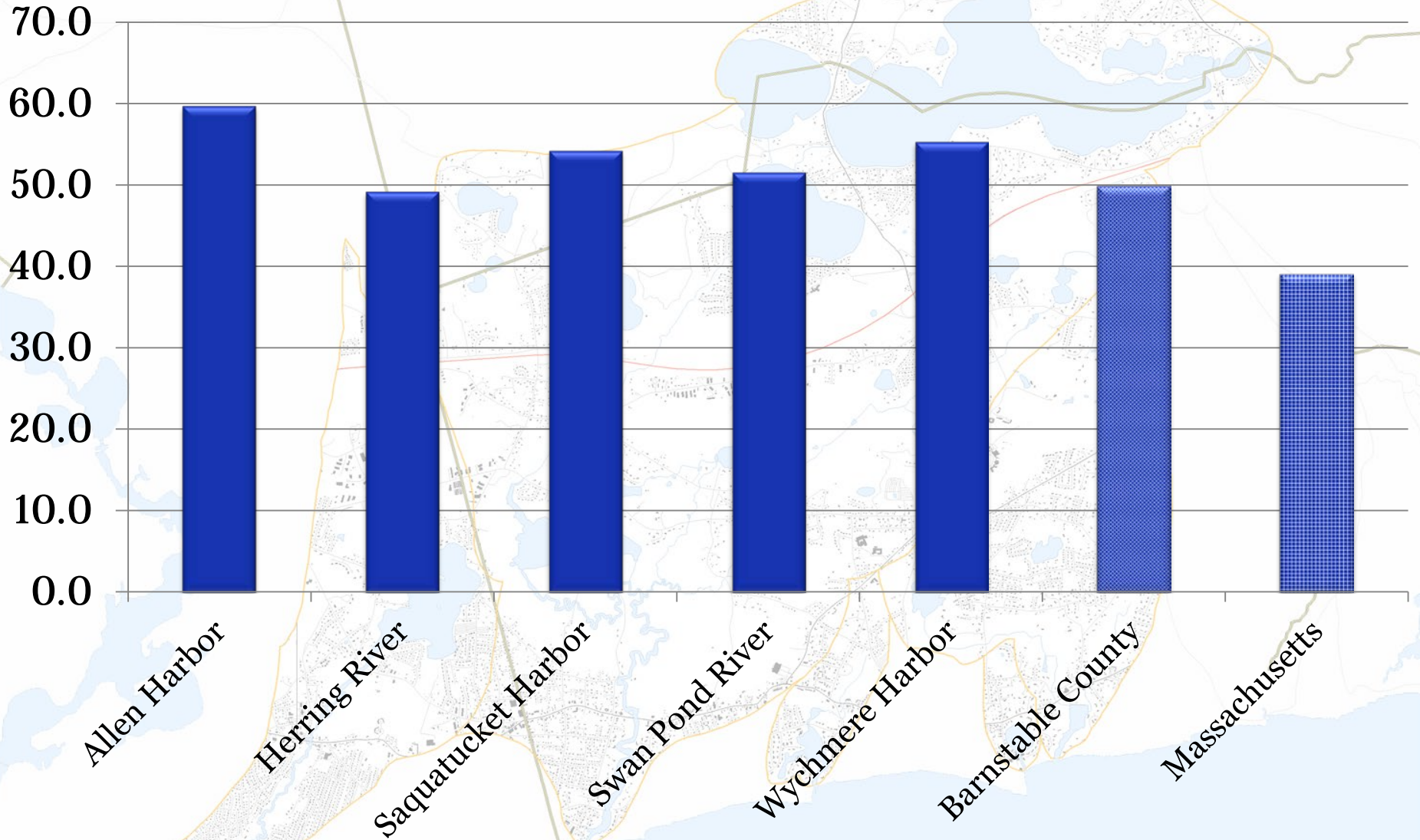
# Population (2010)

5.2 % of the Total Cape Cod Population

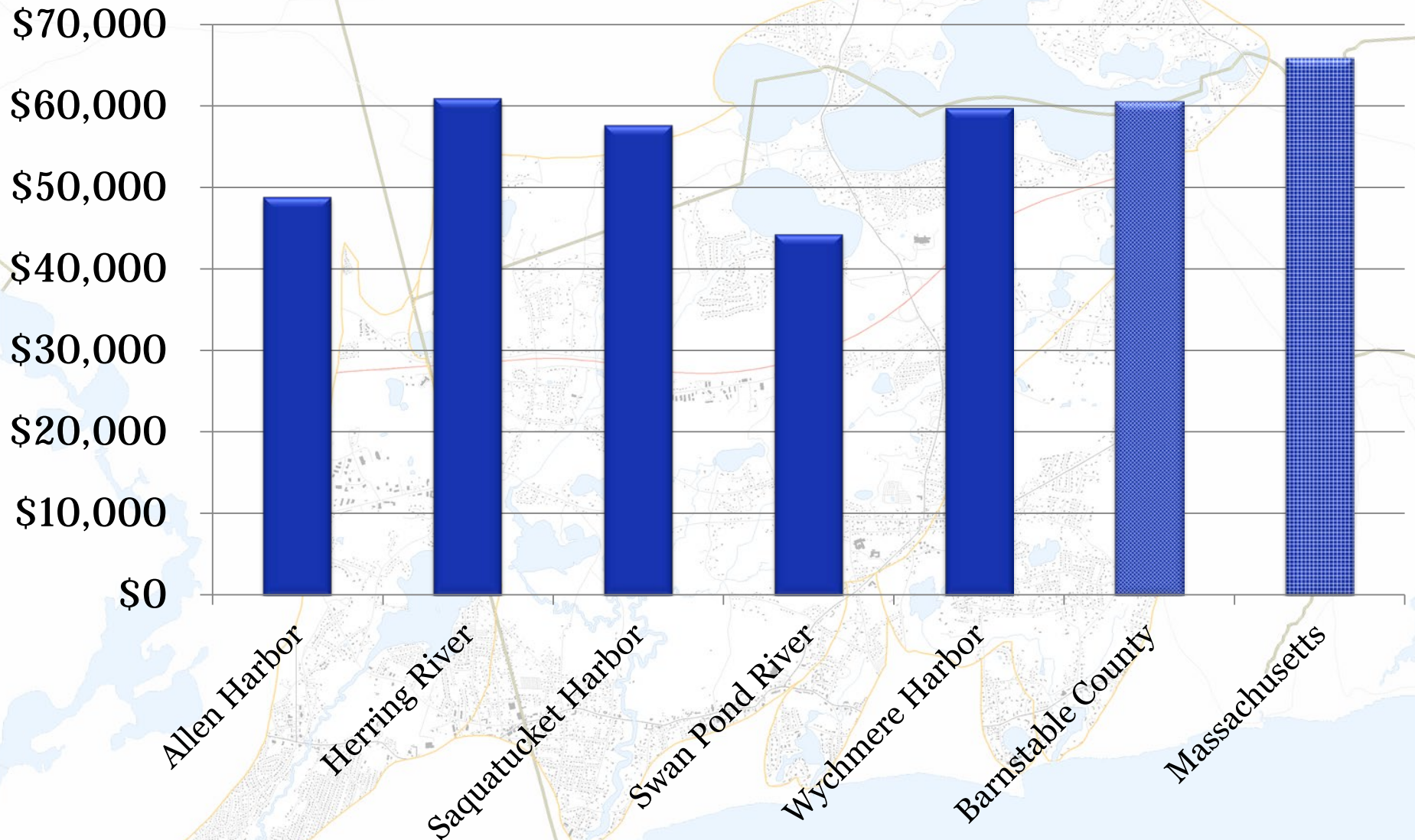




# Median Age (2010)

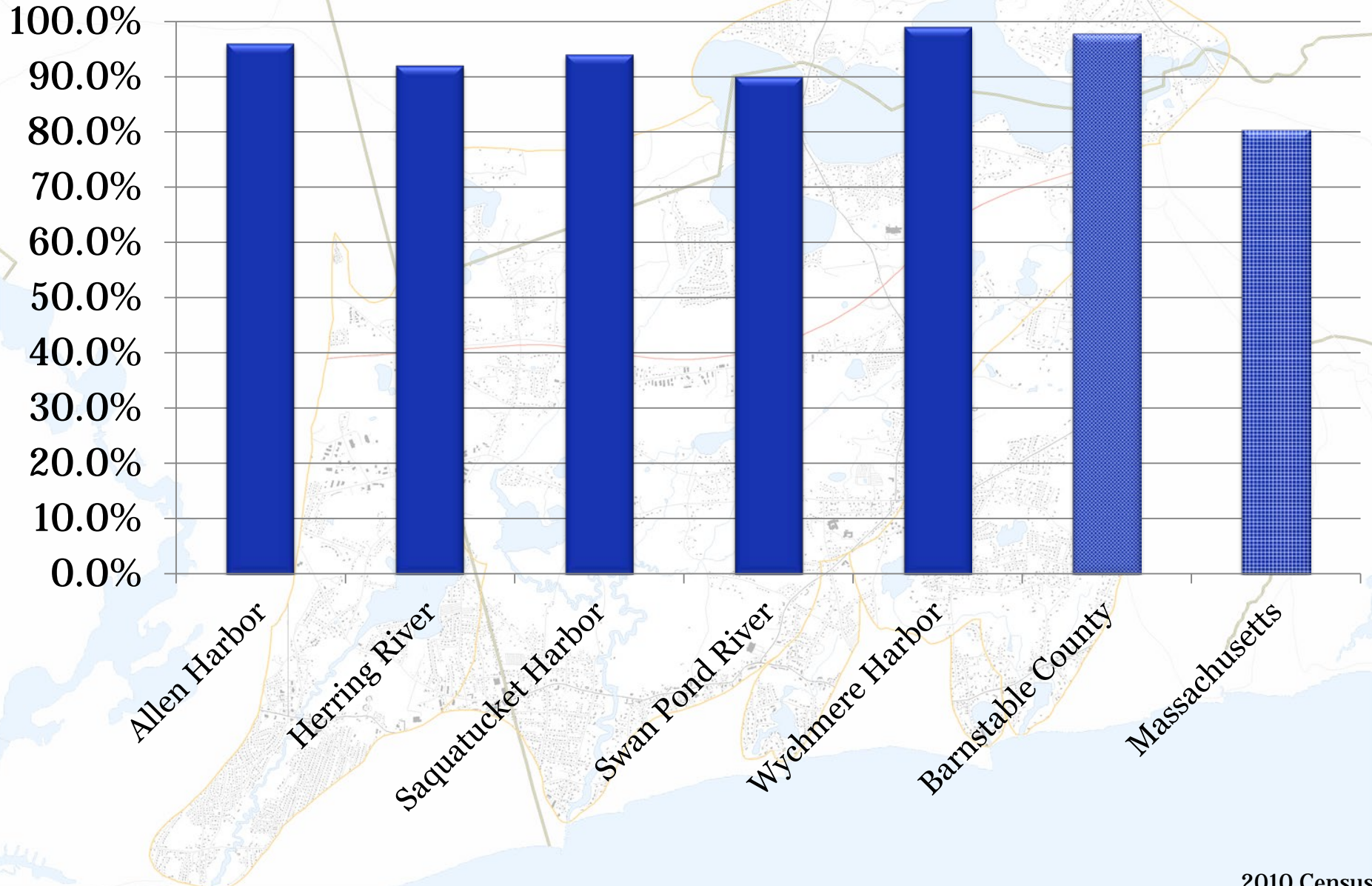


# Average Median Income (2010)

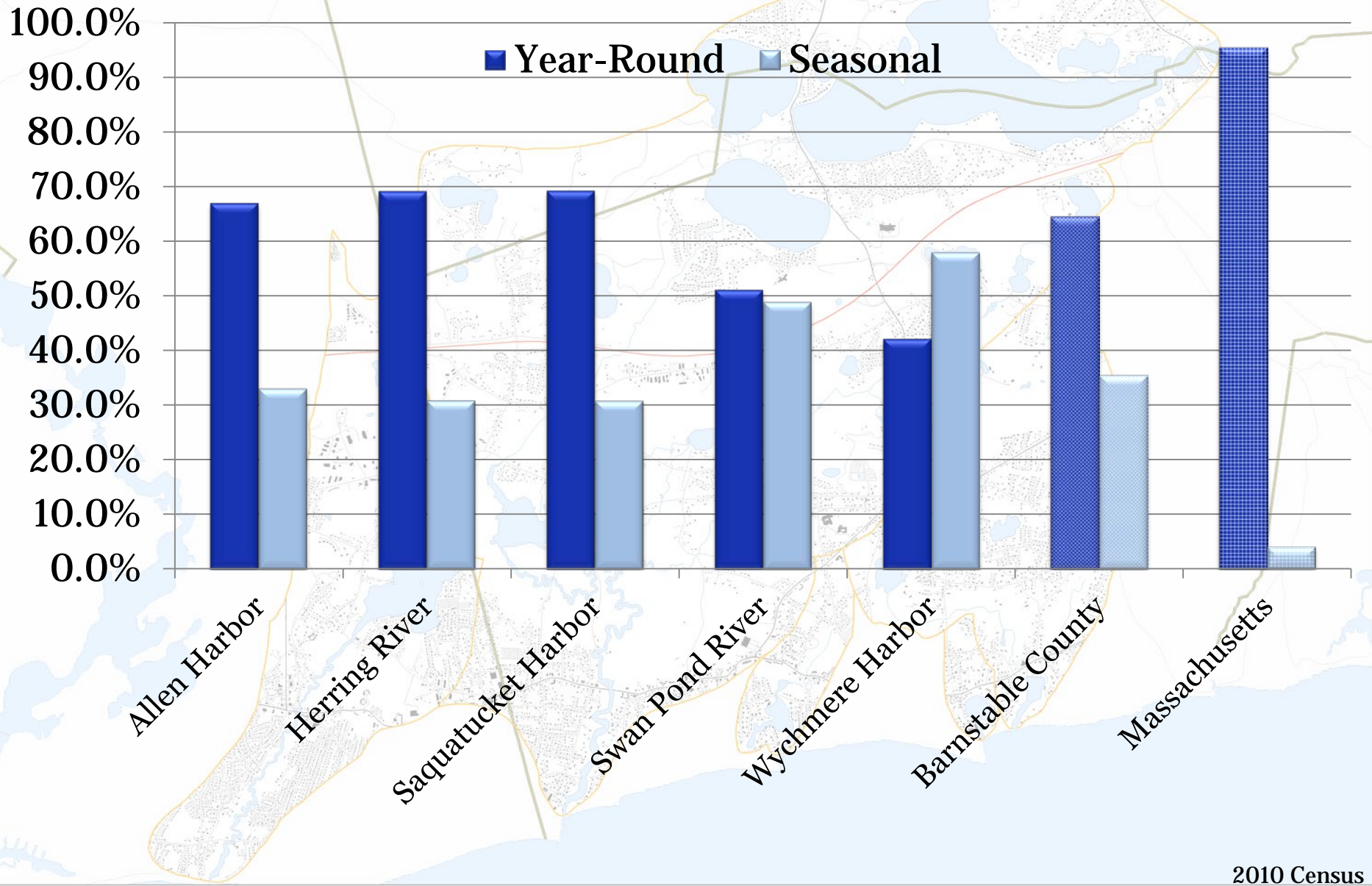




# Race - % White (2010)



# Seasonal vs. Year Round Housing (2010)



# Average Assessed Home Value (2010)

Total Assessed Value of  
Residential Homes=  
**\$2,723,874,350**

Allen Harbo

Herring River

Saquatucket Harbo

Swan Pond River

Wychmere Harbo

Barnstable Count

Massachuset

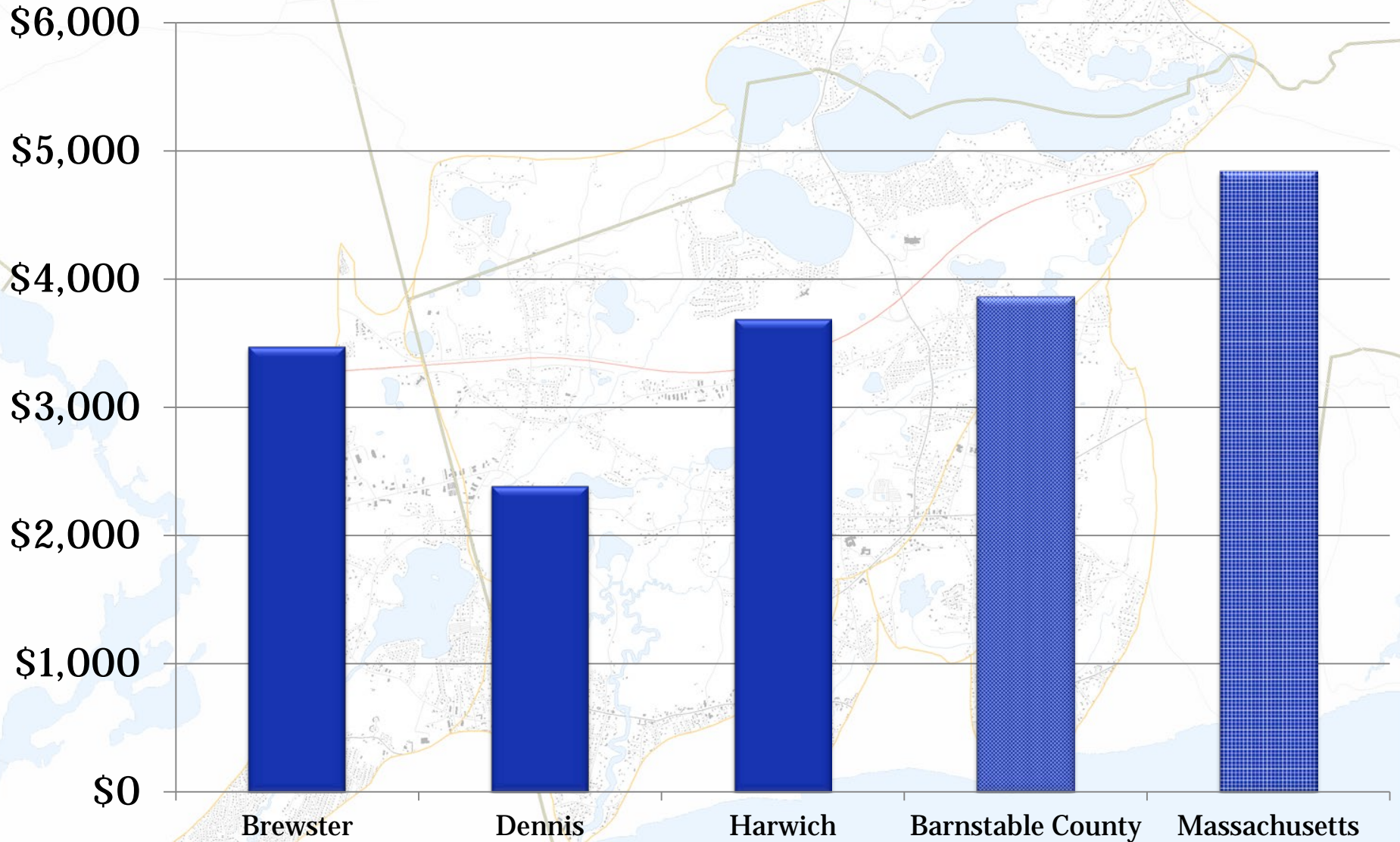
# **Your Government & Taxes**



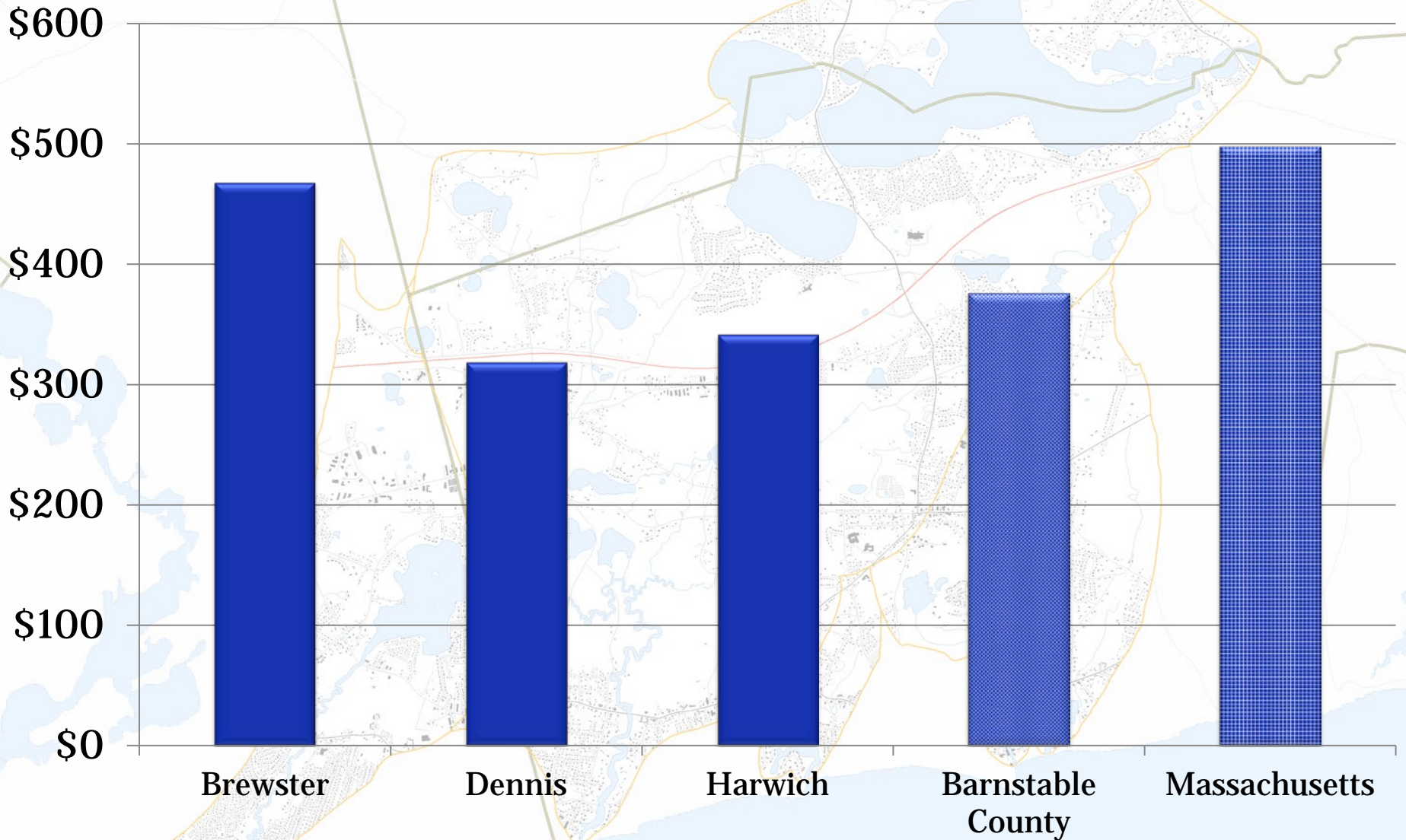
Allen Harbor  
Herring River  
Saquatucket Harbor  
Swan Pond River  
Wychmere Harbor



# Average Single Family Property Tax Bill (2013)

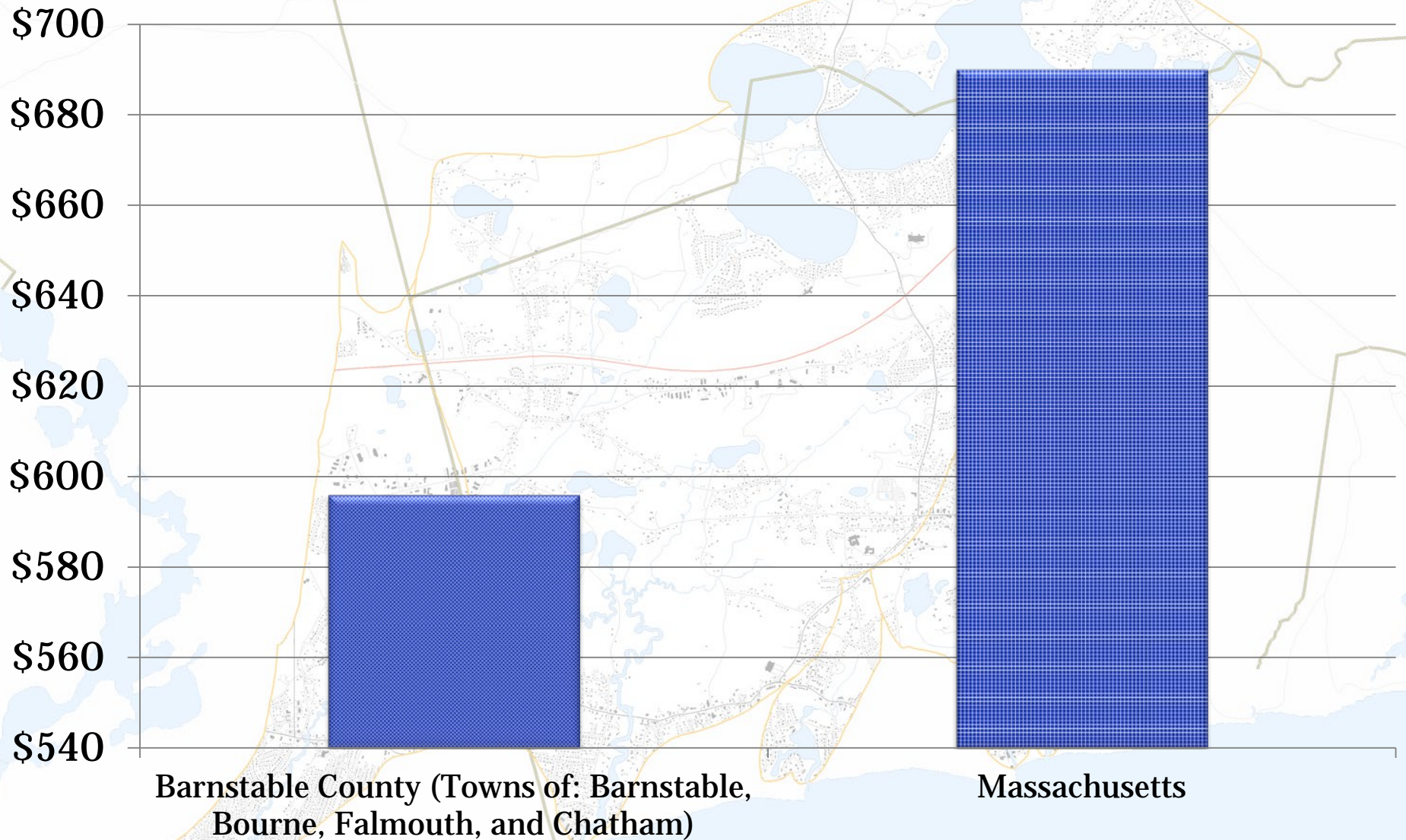


# Average Annual Water Bill (2012)





# Average Annual Sewer Bill (2012)





# The Problem

Allen Harbor  
Herring River  
Saquatucket Harbor  
Swan Pond River  
Wychmere Harbor





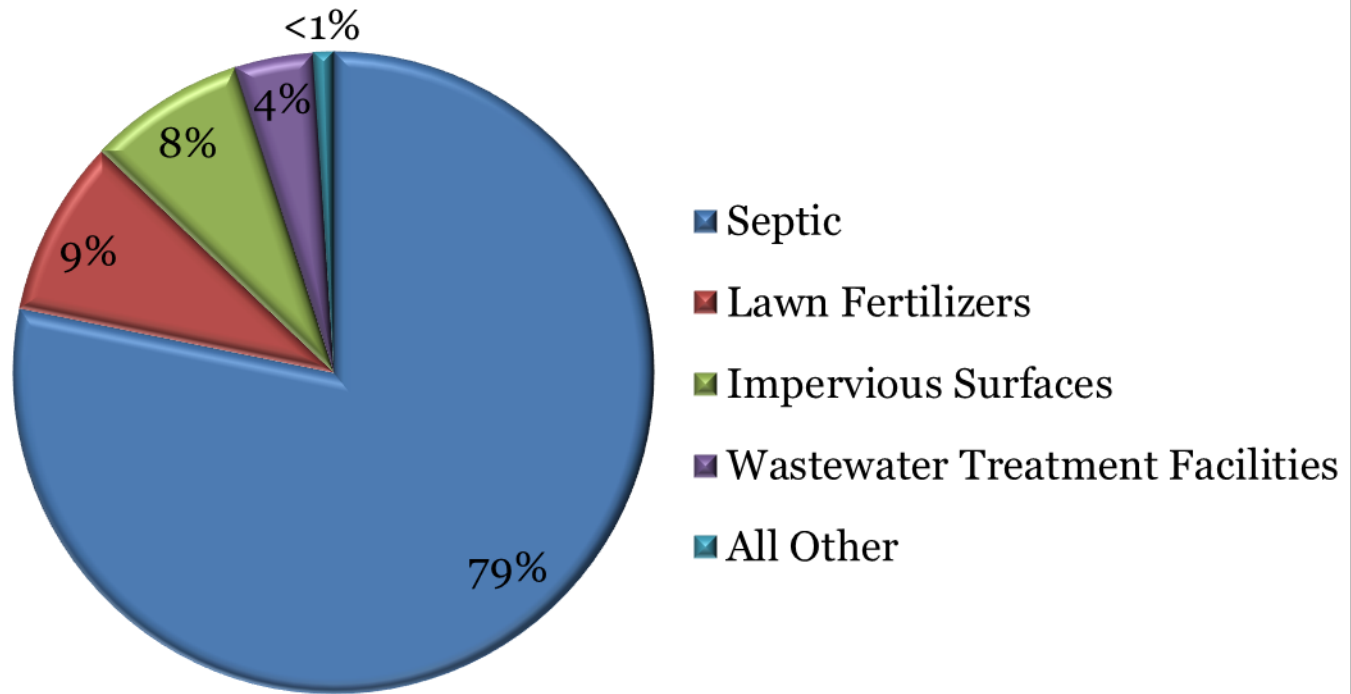
Photo credit: Stephanie Foster, Americorps Cape Cod



# Massachusetts Estuaries Project

- Opportunity for towns to obtain independent analysis of nitrogen loading and its impact on water quality
- Provides water quality, nutrient loading, and hydrodynamic information
- Water quality monitoring – minimum of 3 years of data for each embayment
- Watershed model links water quality data to nitrogen loads

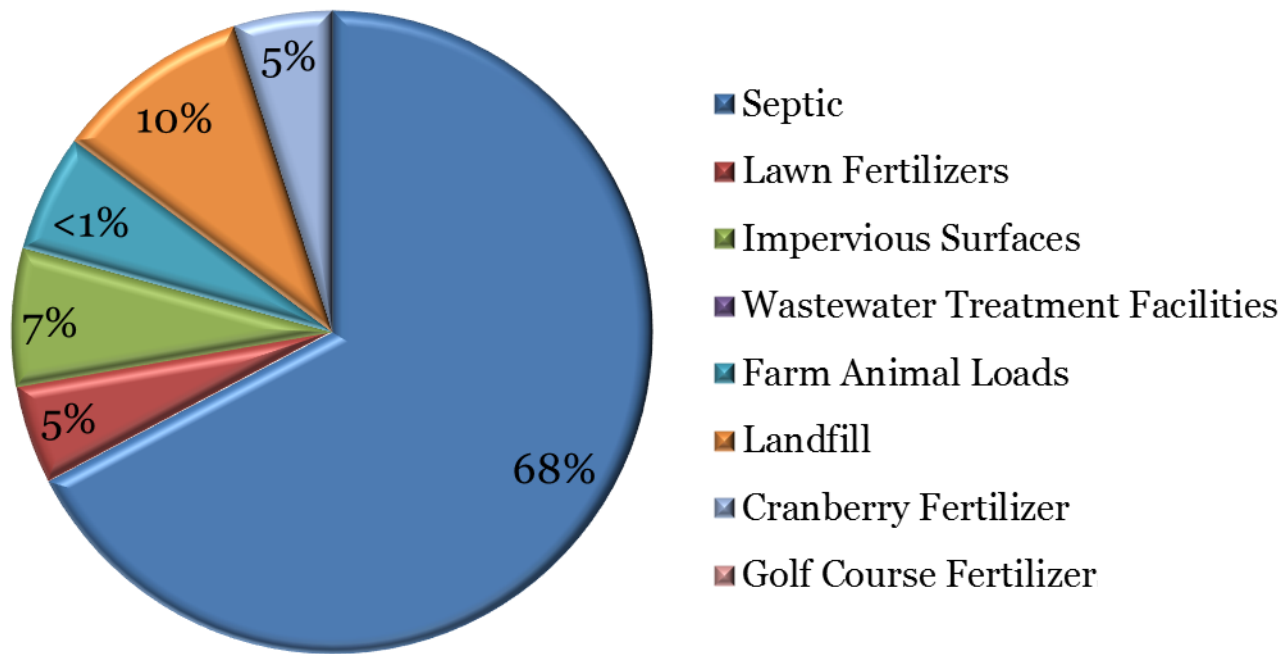
## Cape-Wide Controllable Nitrogen Loads



Note: Data averaged from existing Massachusetts Estuaries Project Reports

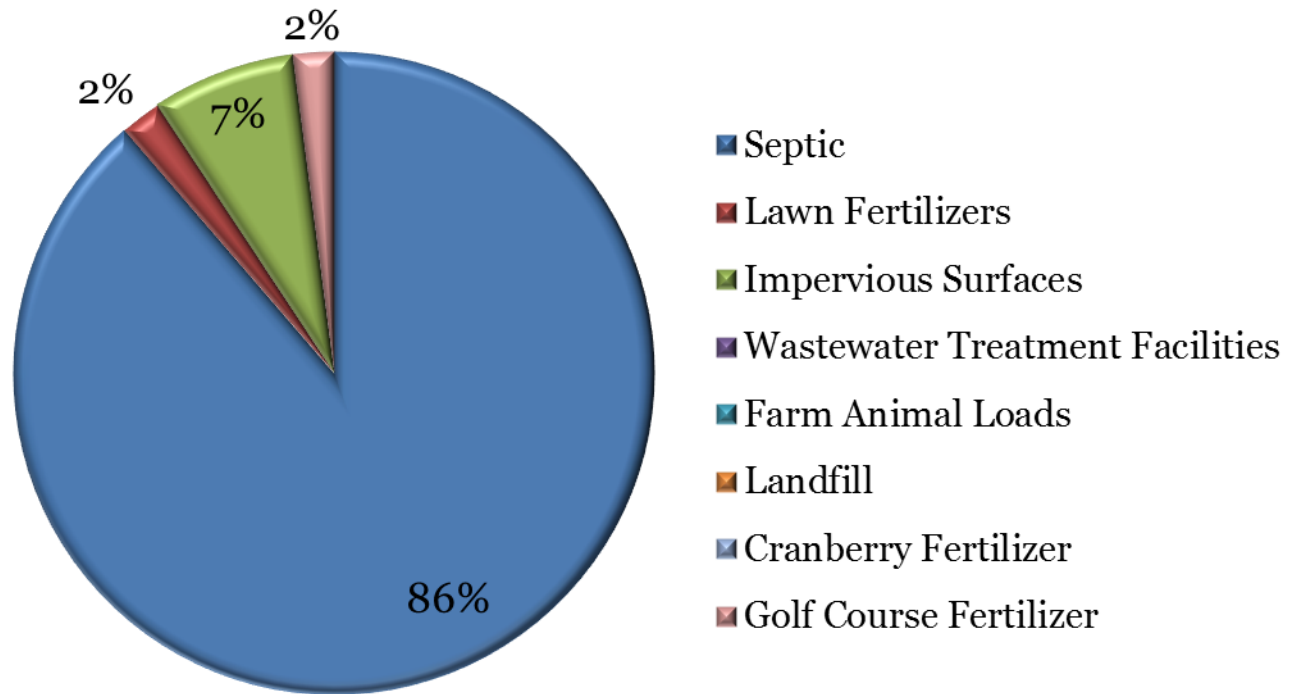


## Herring River Controllable Nitrogen Loads



Massachusetts Estuaries Project, Mar 2013

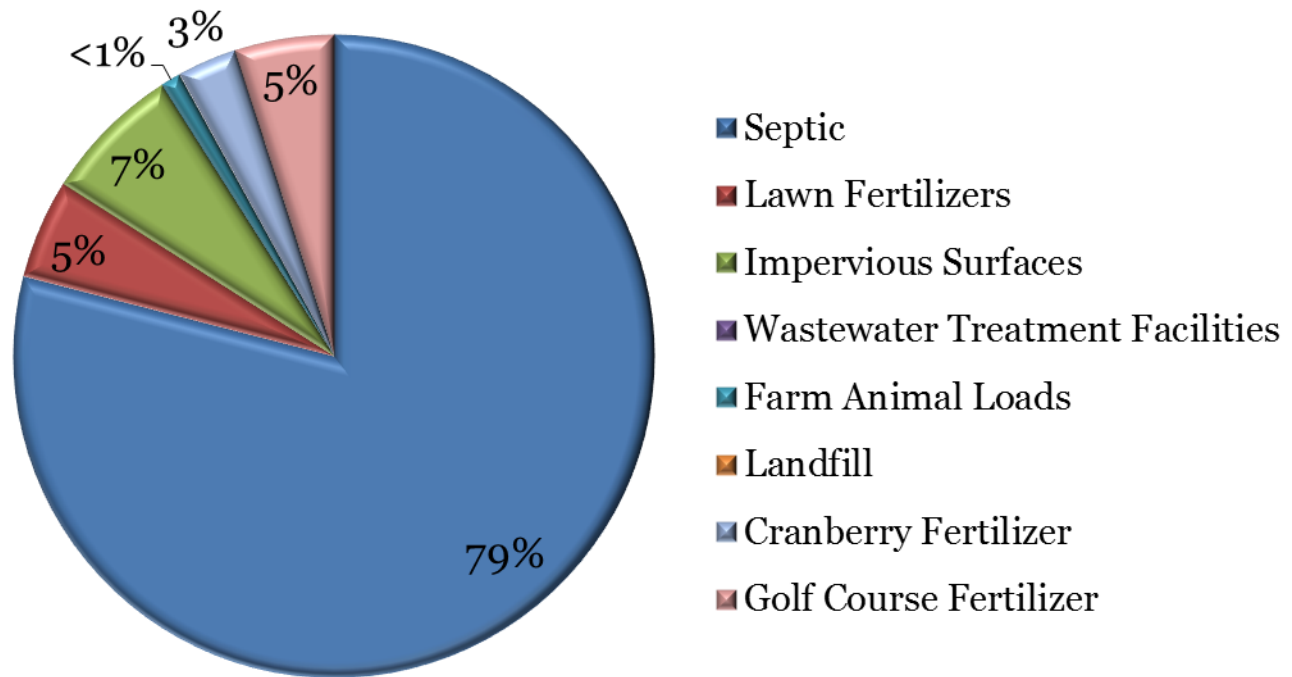
## Allen Harbor Controllable Nitrogen Loads



Massachusetts Estuaries Project, 2010



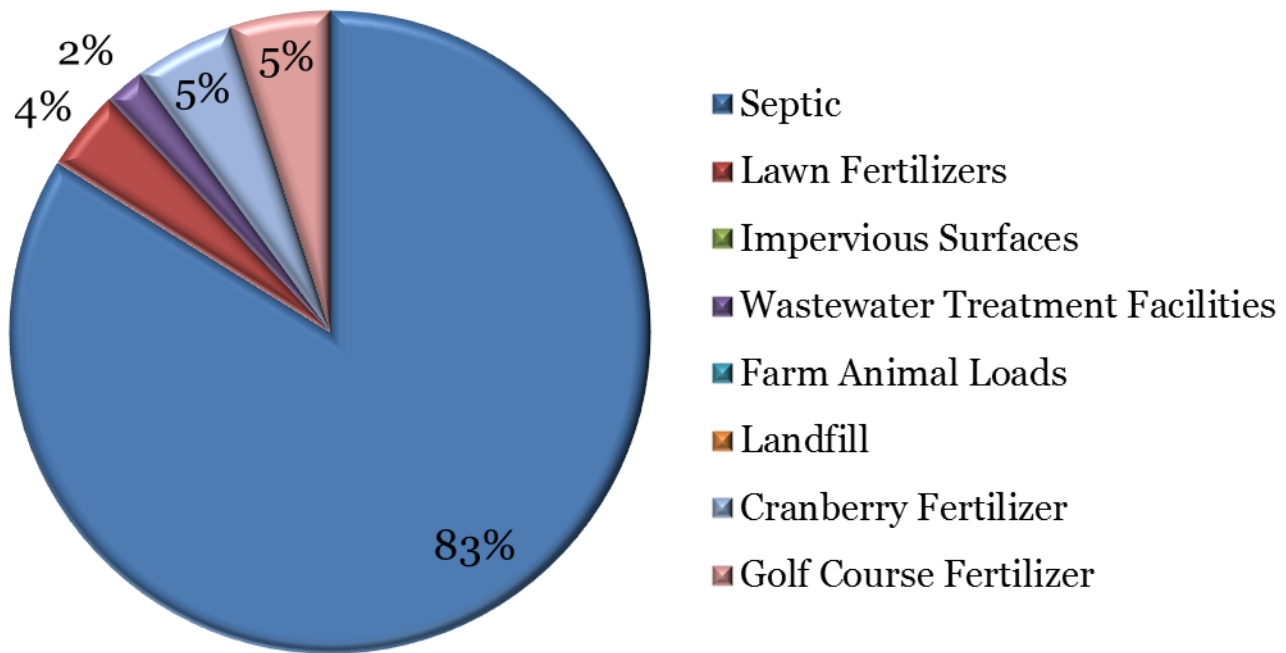
## Saquatucket Harbor Controllable Nitrogen Loads



Massachusetts Estuaries Project, 2010

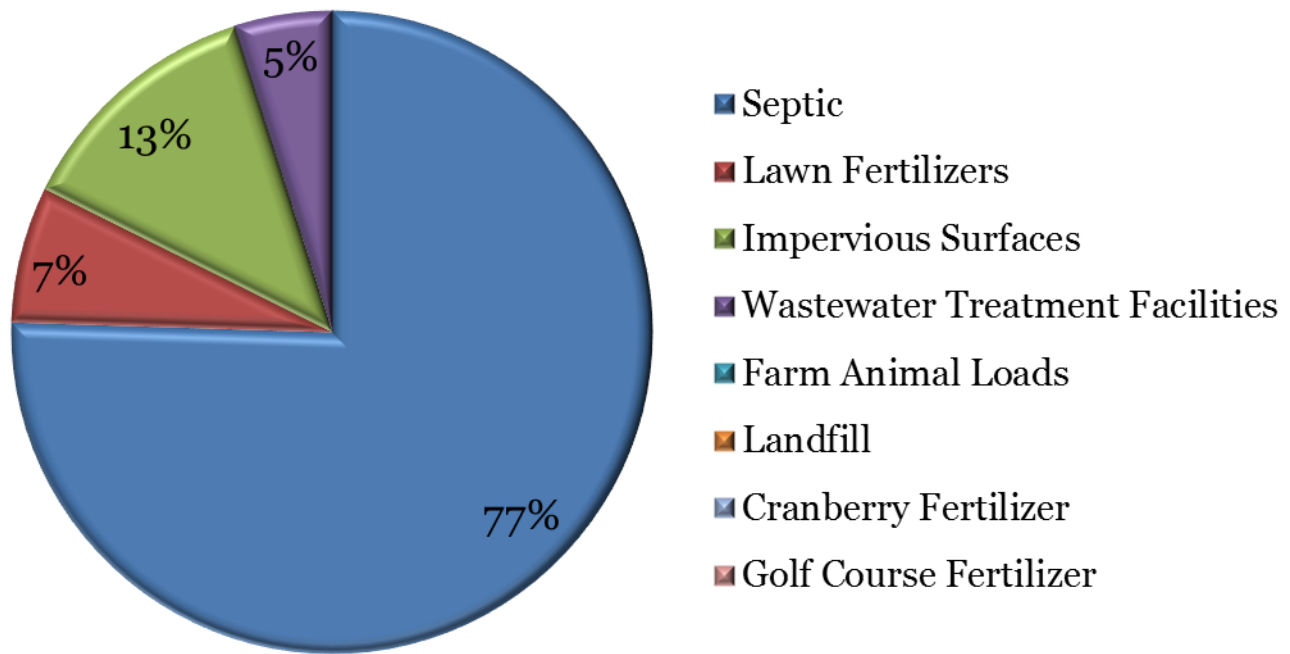


## Wychmere Harbor Controllable Nitrogen Loads



Massachusetts Estuaries Project, 2010


## Swan Pond River Controllable Nitrogen Loads



Massachusetts Estuaries Project, 2012


# Nitrogen Problem


## Base Map

 Town Lines


 Rivers


## Embayment Boundary

 On Land


 On Sea

## Major Roads

 US Highway

 State Highway








 Roads

 Structures





 Ponds

## Nitrogen

### Water Quality Stations






-  Healthy
-  Healthy/Moderately Impacted
-  Healthy/Significantly Impacted
-  Moderately Impacted
-  Moderately Impacted/Significantly Impacted
-  Significantly Impacted
-  Significantly Impacted/Significantly Degraded
-  Significantly Degraded

### Yearly Nitrate Concentration Averages

-  0 - 0.5 mg/l **in Public Water Supply Wells**
-  0.5 - 1 mg/l
-  1 - 2.5 mg/l
-  2.5 - 5 mg/l






### Embayments with Removal Target

Total NLoad Percent Removal

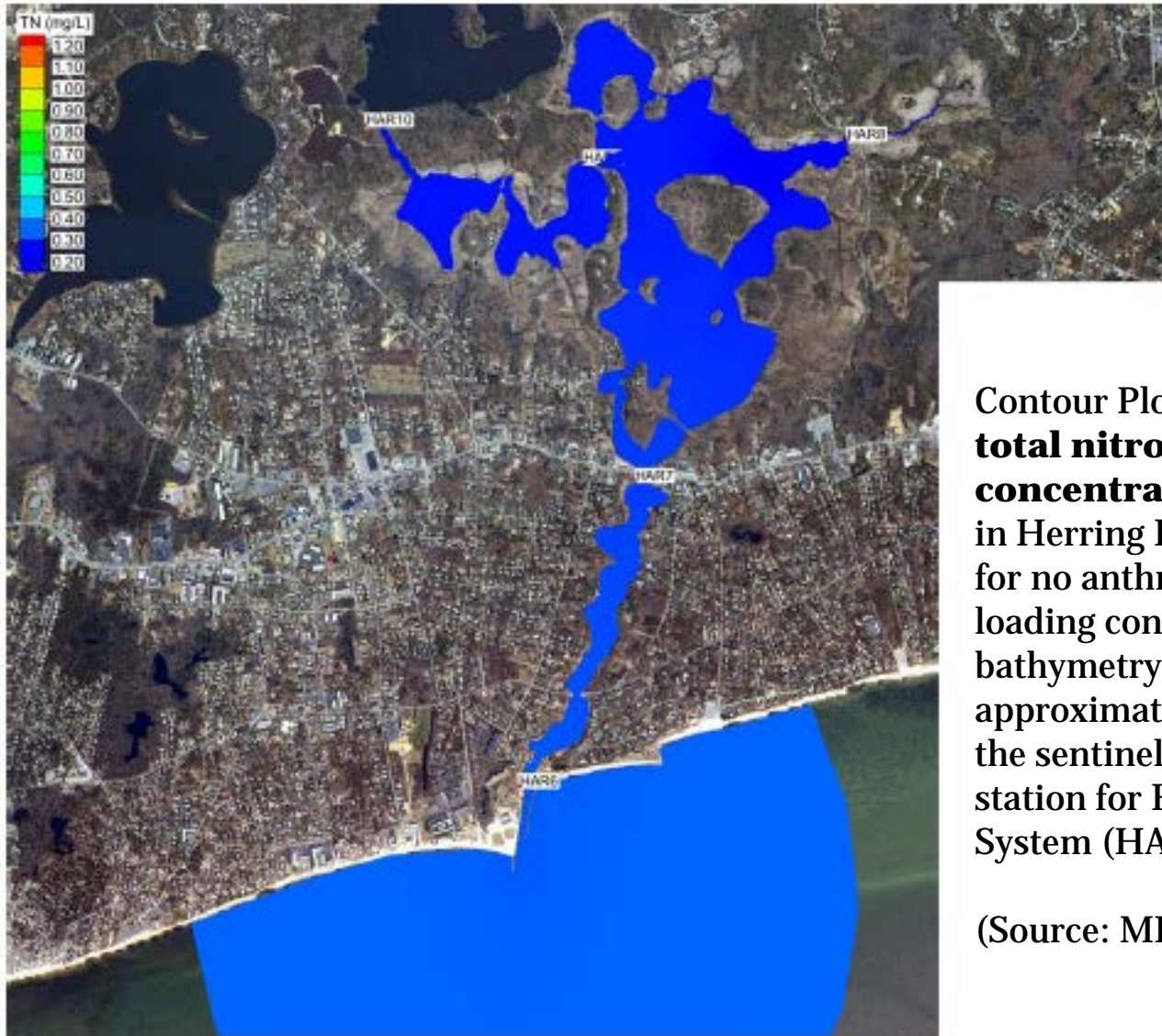
-  0 %
-  1 - 52 %
-  53 - 72 %
-  73 - 86 %
-  87 - 100 %

### Subwatersheds with Removal Target

Total NLoad Percent Removal

-  0.1 % - 9%
-  9.1 % - 38 %
-  38.1 % - 62 %
-  62.1 % - 86 %
-  86.1 % - 100%

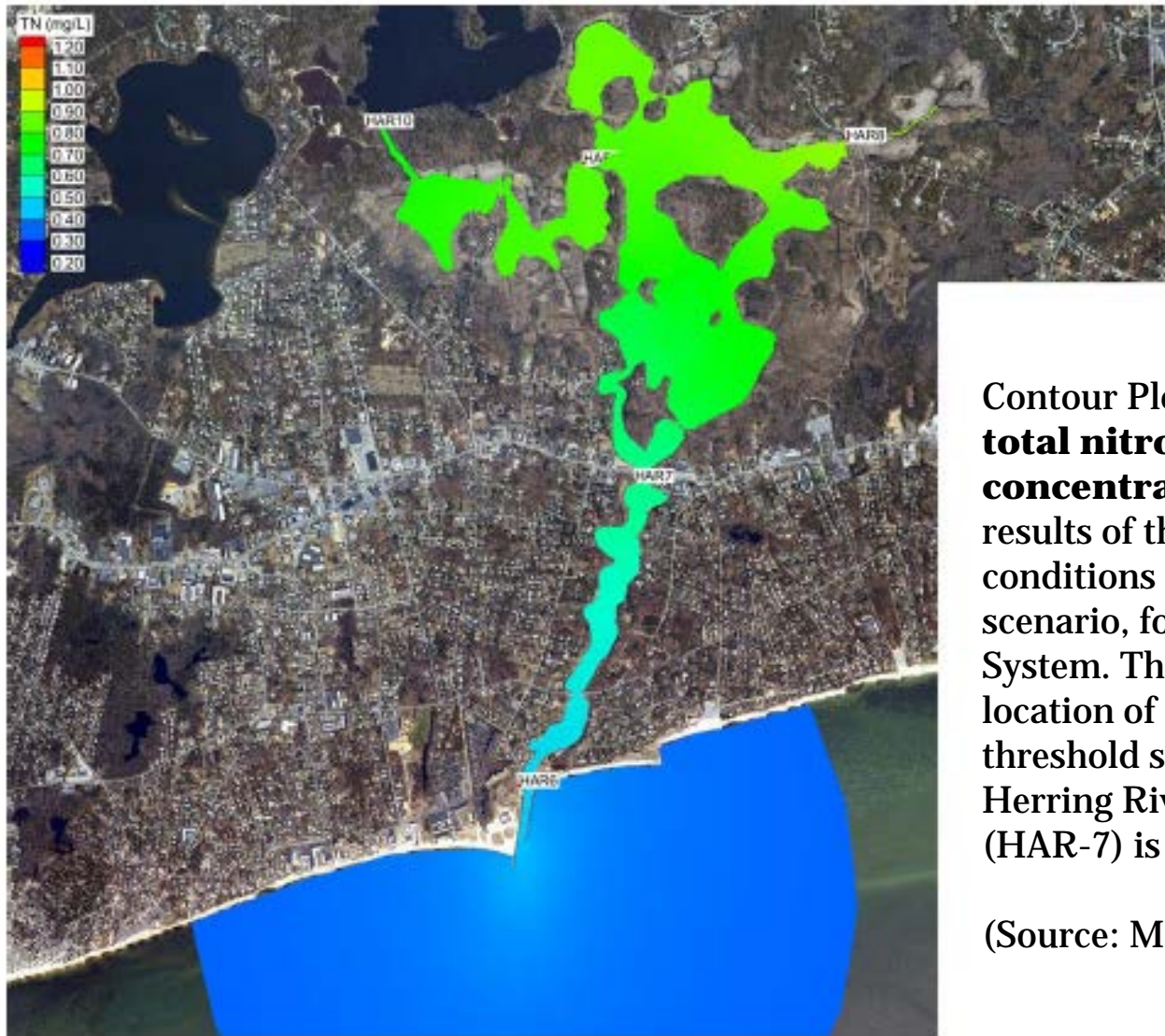




Contour Plot of **modeled total nitrogen concentrations (mg/L)** in Herring River System, for no anthropogenic loading conditions, and bathymetry. The approximate location of the sentinel threshold station for Herring River System (HAR-7) is shown.

(Source: MEP 2013)

## Pre-Colonial Conditions: Herring River

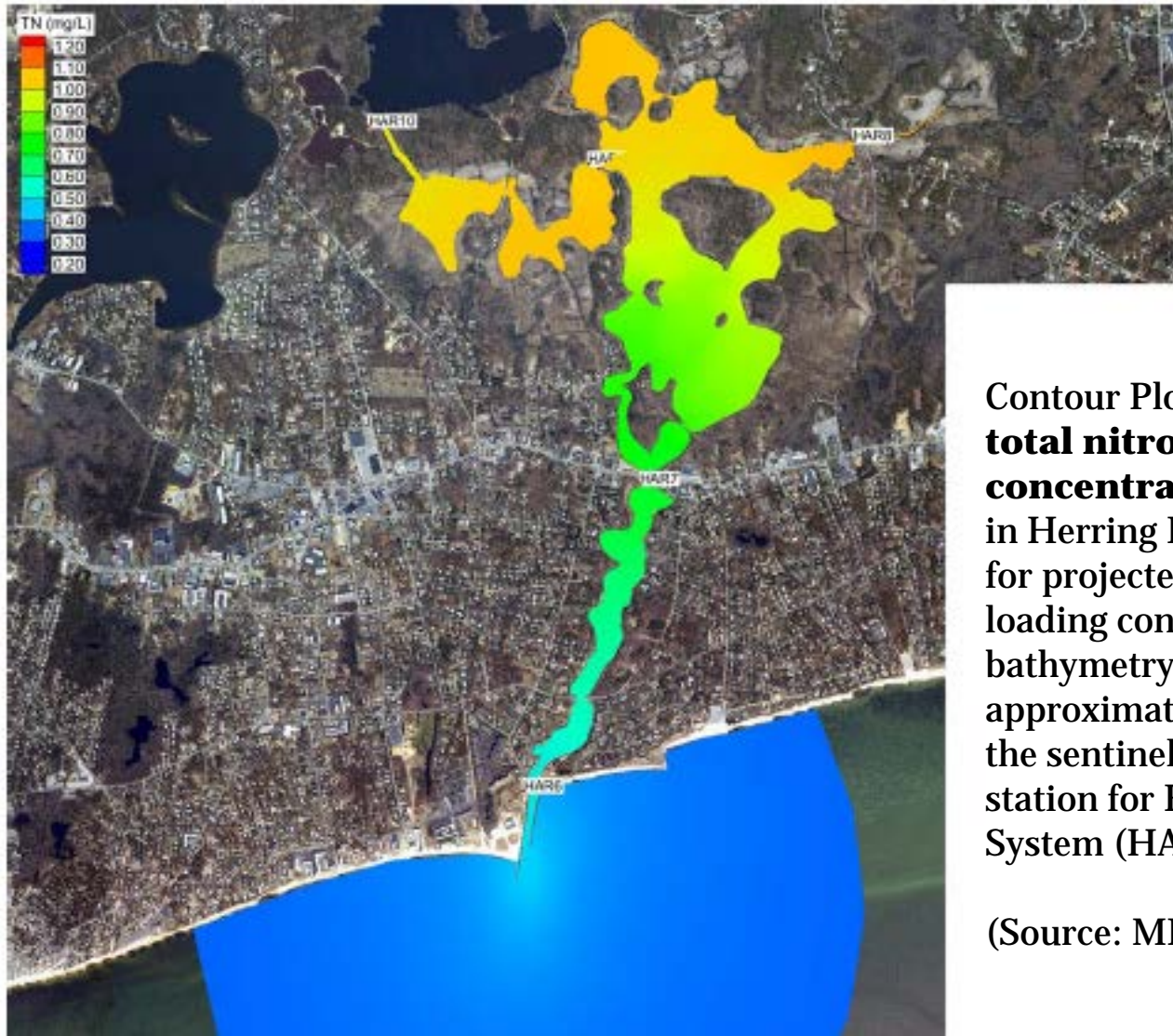


Contour Plot of **average total nitrogen concentrations** from results of the present conditions loading scenario, for Herring River System. The approximate location of the sentinel threshold station for Herring River System (HAR-7) is shown.

(Source: MEP 2013)

**Present Conditions: Herring River**





Contour Plot of **modeled total nitrogen concentrations (mg/L)** in Herring River System, for projected build-out loading conditions, and bathymetry. The approximate location of the sentinel threshold station for Herring River System (HAR-7) is shown.

(Source: MEP 2013)

## Build-out Conditions: Herring River



Contour Plots of **modeled total nitrogen concentrations (mg/L)** in the Allen Harbor, Wychmere Harbor and Saquatucket Harbor estuarine systems, for no anthropogenic loading conditions and bathymetry. The approximate location of the sentinel threshold stations for Allen Harbor (HAR-4), Wychmere Harbor (HAR-3), and Saquatucket Harbor (HAR-2) are shown.

(Source: MEP 2010)

**Pre-Colonial Conditions: Allen Harbor, Saquatucket Harbor, & Wychmere Harbor**





Contour plots of **average total nitrogen concentrations** from results of the present conditions loading scenario, for Allen Harbor, Wychmere Harbor and Saquatucket Harbor estuarine systems.

(Source: MEP 2010)

**Present Conditions: Allen Harbor, Saquatucket Harbor, & Wychmere Harbor**

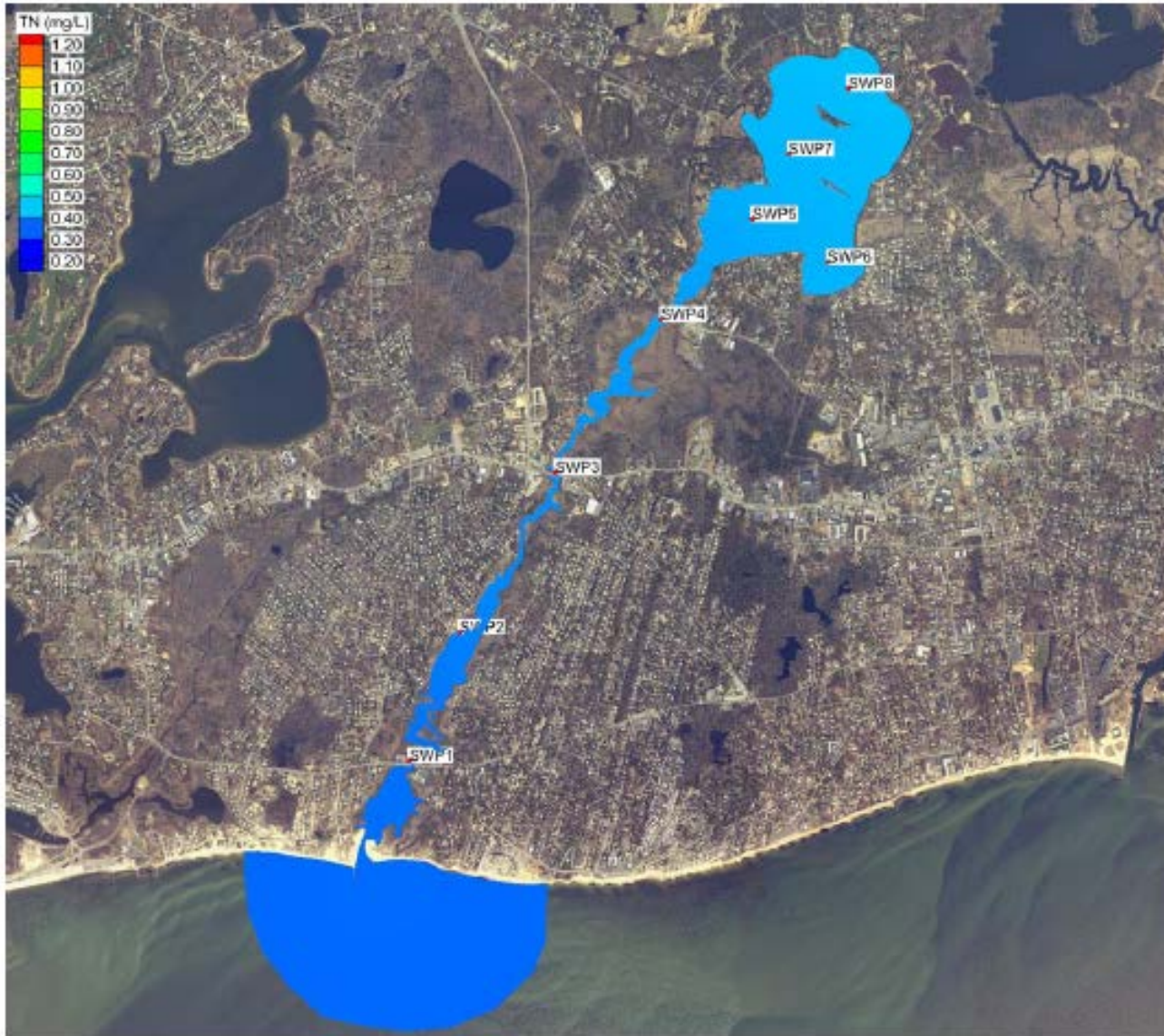




Contour plots of **modeled total nitrogen concentrations (mg/L)** in Allen Harbor, Wychmere Harbor and Saquatucket Harbor estuarine systems, for projected build-out loading conditions. The approximate location of the sentinel threshold stations for Allen Harbor (HAR-4), Wychmere Harbor (HAR-3), and Saquatucket Harbor (HAR-2) are shown.

(Source: MEP 2010)

## Buildout Conditions: Allen Harbor, Saquatucket Harbor, & Wychmere Harbor



Contour Plot of **modeled total nitrogen concentrations (mg/L)** in Swan Pond River system, for no anthropogenic loading conditions, and bathymetry. The approximate location of the sentinel threshold station for Swan Pond River system (SWP-2) is shown.

(Source: MEP 2012)

**Pre-Colonial Conditions: Swan Pond River**





Contour Plot of **average total nitrogen concentrations (mg/L)** from the results of the present conditions loading scenario, for Swan Pond River system. The approximate location of the sentinel threshold station for Swan Pond River system (SWP-2) is shown.

(Source: MEP 2012)

## Present Conditions: Swan Pond River






Contour plots of **modeled total nitrogen concentrations (mg/L)** in Swan Pond River system, for projected build-out loading conditions, and bathymetry. The approximate location of the sentinel threshold station for Swan Pond River System (SWP-2) is shown.

(Source: MEP 2012)

## Build-out Conditions: Swan Pond River


# Nitrogen Problem


## Base Map

 Town Lines


 Rivers


## Embayment Boundary


 On Land


 On Sea


## Major Roads

 US Highway

 State Highway







 Roads

 Structures





 Ponds

## Nitrogen

### Water Quality Stations


-  Healthy
-  Healthy/Moderately Impacted
-  Healthy/Significantly Impacted
-  Moderately Impacted
-  Moderately Impacted/Significantly Impacted
-  Significantly Impacted
-  Significantly Impacted/Significantly Degraded
-  Significantly Degraded


### Yearly Nitrate Concentration Averages


-  0 - 0.5 mg/l **in Public Water Supply Wells**
-  0.5 - 1 mg/l
-  1 - 2.5 mg/l
-  2.5 - 5 mg/l


### Embayments with Removal Target


Total NLoad Percent Removal

 0 %

 1 - 52 %


 53 - 72 %


 73 - 86 %


 87 - 100 %


### Subwatersheds with Removal Target


Total NLoad Percent Removal

 0.1 % - 9%

 9.1 % - 38 %


 38.1 % - 62 %

 62.1 % - 86 %

 86.1 % - 100%


# Eelgrass Extent


## Base Map

 Town Lines


 Rivers


## Embayment Boundary

 On Land


 On Sea

## Major Roads

 US Highway


 State Highway

 Roads

 Structures


 Ponds

## Eelgrass

 Eelgrass Extent


# Phosphorus Problem


## Base Map

 Town Lines


 Rivers


## Embayment Boundary

 On Land


 On Sea

## Major Roads

 US Highway

 State Highway

 Roads

 Structures


 Ponds


## Phosphorus


### Priority Ponds

Trophic Status

 Eutrophic *Most Impacted*


 Mesotrophic

 Oligotrophic *Least Impacted*

 Not Interpreted


# Title 5 Compliance Issues


## Base Map

 Town Lines


 Rivers


## Embayment Boundary

 On Land


 On Sea

## Major Roads

 US Highway


 State Highway


 Roads

 Structures


 Ponds


## Existing Conditions

 Approx. Locations of Loans Issued for Title 5 Repair

 Potential Title 5 Compliance Issues

 Wastewater Treatment Facility

 Groundwater Discharge Points

 Sewered Parcels




# Existing & Proposed Solutions



Allen Harbor  
Herring River  
Saquatucket Harbor  
Swan Pond River  
Wychmere Harbor


# Existing Infrastructure


## Base Map

 Town Lines


 Rivers


## Embayment Boundary

 On Land


 On Sea

## Major Roads

 US Highway


 State Highway


 Roads


 Structures


 Ponds


## Existing Conditions

 Approx. Locations of Loans Issued for Title 5 Repair

 Potential Title 5 Compliance Issues


 Wastewater Treatment Facility

 Groundwater Discharge Points


 Sewered Parcels

## Enhanced Attenuation Sites


 Pipe


 Stormwater


## Public Supply Wells

 Public Water Supply Well

 Small Volume Wells, Non-Transient

 Proposed Public Water Supply Well

 Surface Water Supply

 Small Volume Wells, Transient


# Proposed Infrastructure


## Base Map

 Town Lines


 Rivers


## Embayment Boundary

 On Land


 On Sea


## Major Roads

 US Highway

 State Highway

 Roads


 Structures

 Ponds

## Proposed Conditions


### Natural Attenuation Sites

 Bridge

 Culvert


 Inlet

 Pipe


 Sewer Alternatives


 Stormwater


### CWMP Sewershed Phasing


 No Date Set


#### Phase Date

 2001 - 2010

 2011 - 2020

 2021 - 2030

 2031 - 2040

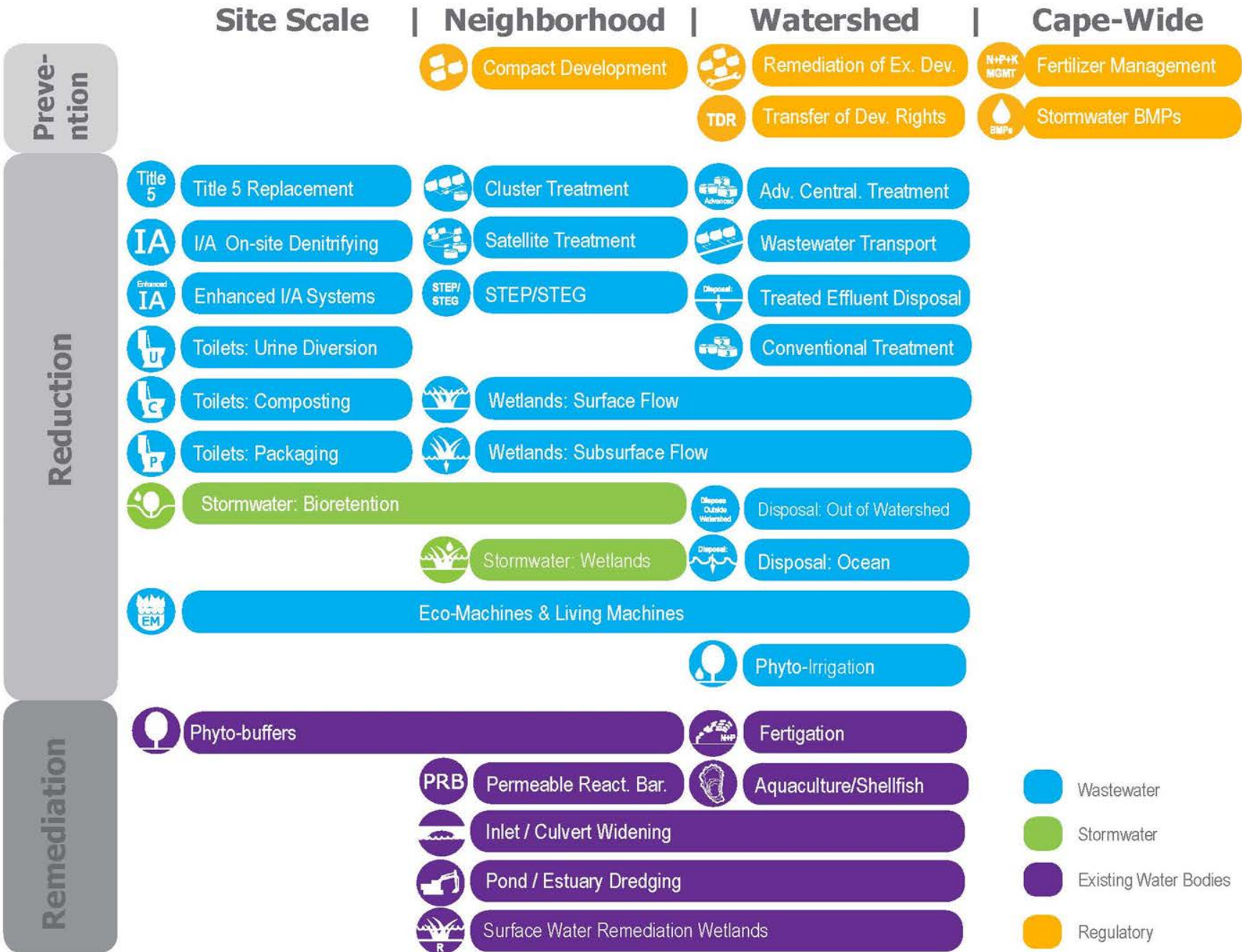
 2041 - 2050



# **Framework for Addressing Solutions Moving Forward**

---

Allen Harbor  
Herring River  
Saquatucket Harbor  
Swan Pond River  
Wychmere Harbor



- Wastewater
- Stormwater
- Existing Water Bodies
- Regulatory

# Alternatives: Screening Method

1  
2  
3  
4  
5  
6  
7



Wastewater



Existing Water Bodies



Regulatory

## Targets/ Goals

**Present Load:**

X kg/day



**Target:**

Y kg/day



**Reduction Required:**

N kg/day

## Composite Target Areas

- A. High Nitrogen Reduction Areas
- B. Pond Recharge Areas

- C. Title 5 Problem Areas

## Low Barrier to Implementation

- A. Fertilizer Management
- B. Stormwater Mitigation



## Watershed/Embayment Options

- A. Permeable Reactive Barriers
- B. Inlet/Culvert Openings

- C. Constructed Wetlands
- D. Dredging



## Alternative On-Site Options

- A. Eco-toilets (UD & Compost)
- B. I/A Technologies

- C. Enhanced I/A Technologies
- D. Shared Systems



## Priority Collection/High-Density Areas

- A. Greater Than 1 Dwelling Unit/acre
- B. Village Centers

- C. Economic Centers
- D. Growth Incentive Zones



STEP/  
STEG



## Supplemental Sewering



**All materials and resources for the Herring River Group will be available on the Cape Cod Commission website:**

<http://watersheds.capecodcommission.org/index.php/watersheds/lower-cape/herring-river>

---

Allen Harbor  
Herring River  
Saquatucket Harbor  
Swan Pond River  
Wychmere Harbor