

# **Three Bays & Centerville River Group**



## **Baseline Conditions & Needs Assessment**

# **What is the 208 Plan?**

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# Clean Water Act Section 208



The Commission was directed to update the 1978 Plan

The Commonwealth provided \$3 million to fund the project

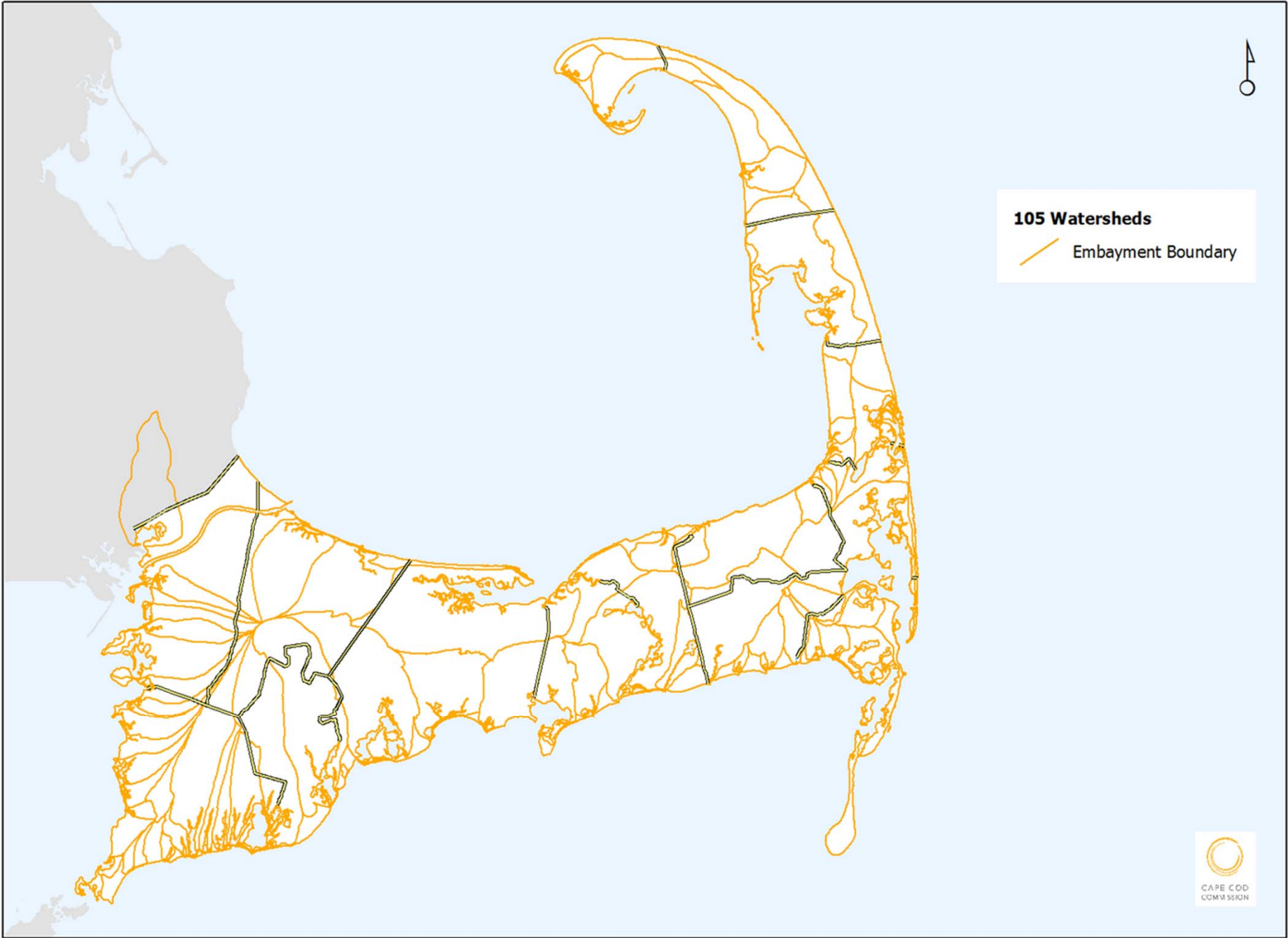
# Focus on 21<sup>st</sup> Century Problems



Nitrogen:  
Saline Waters

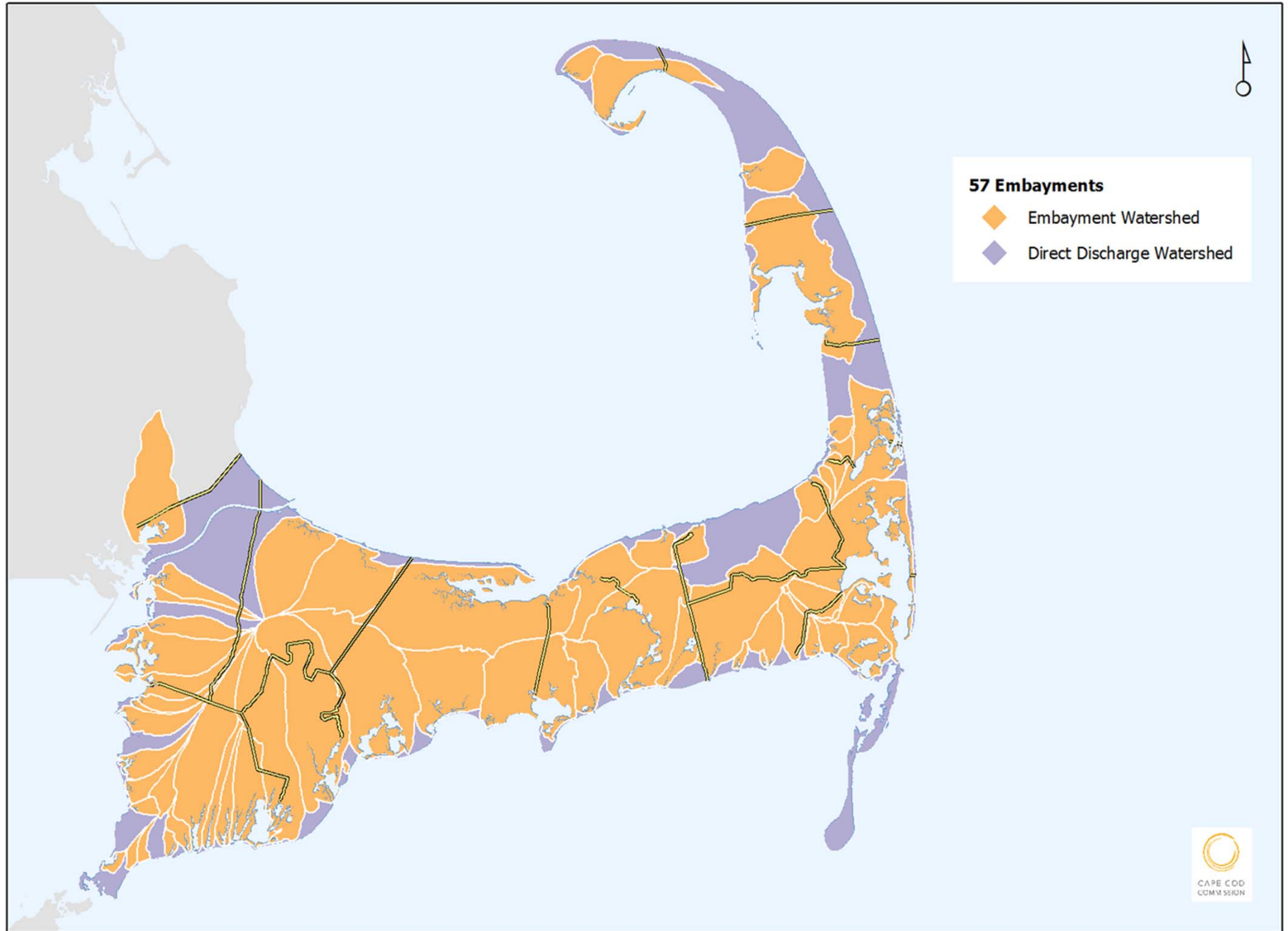
Phosphorus:  
Fresh Waters

Growth &  
Title 5  
Limitations



**105 Watersheds**  
— Embayment Boundary

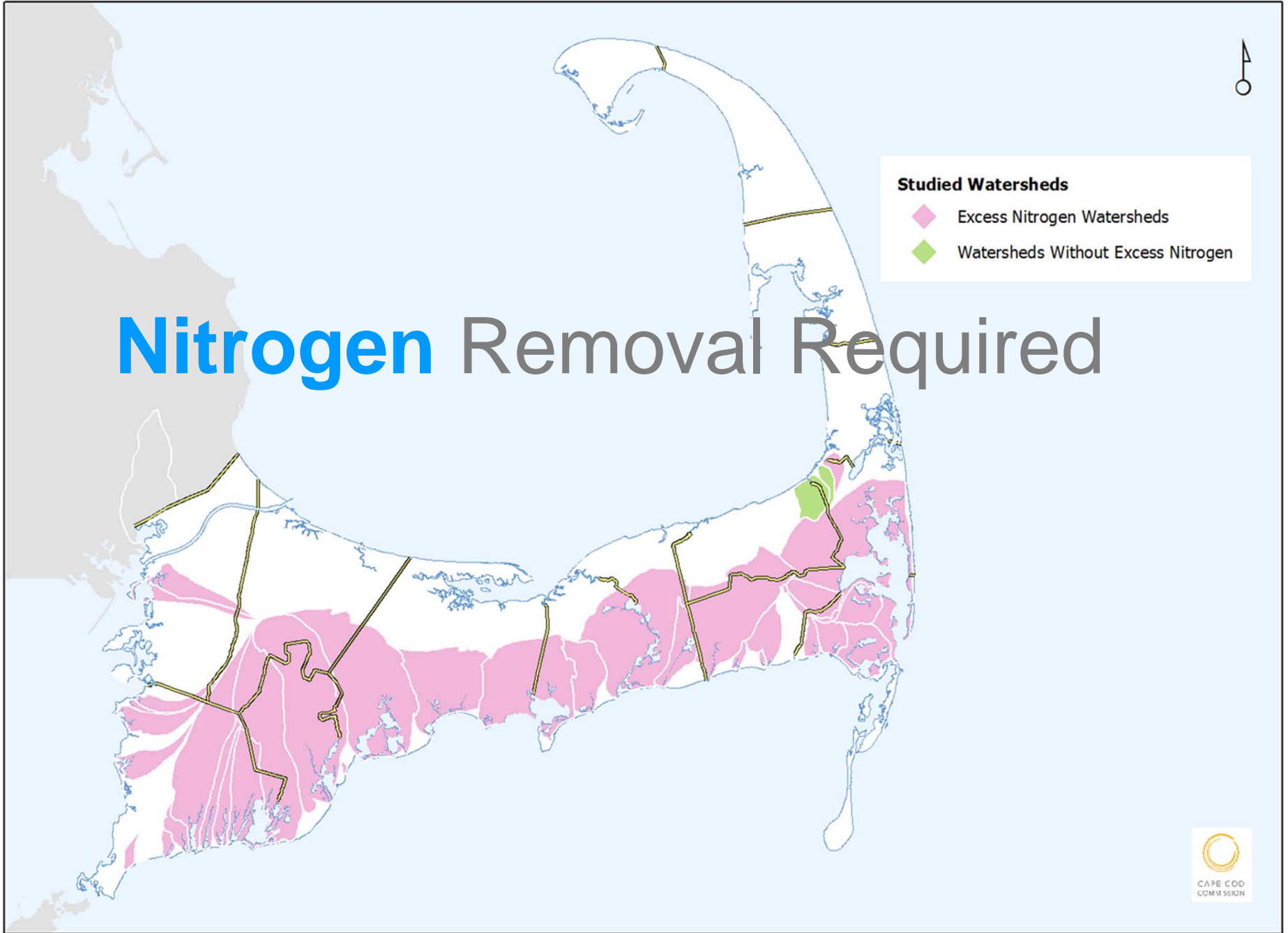


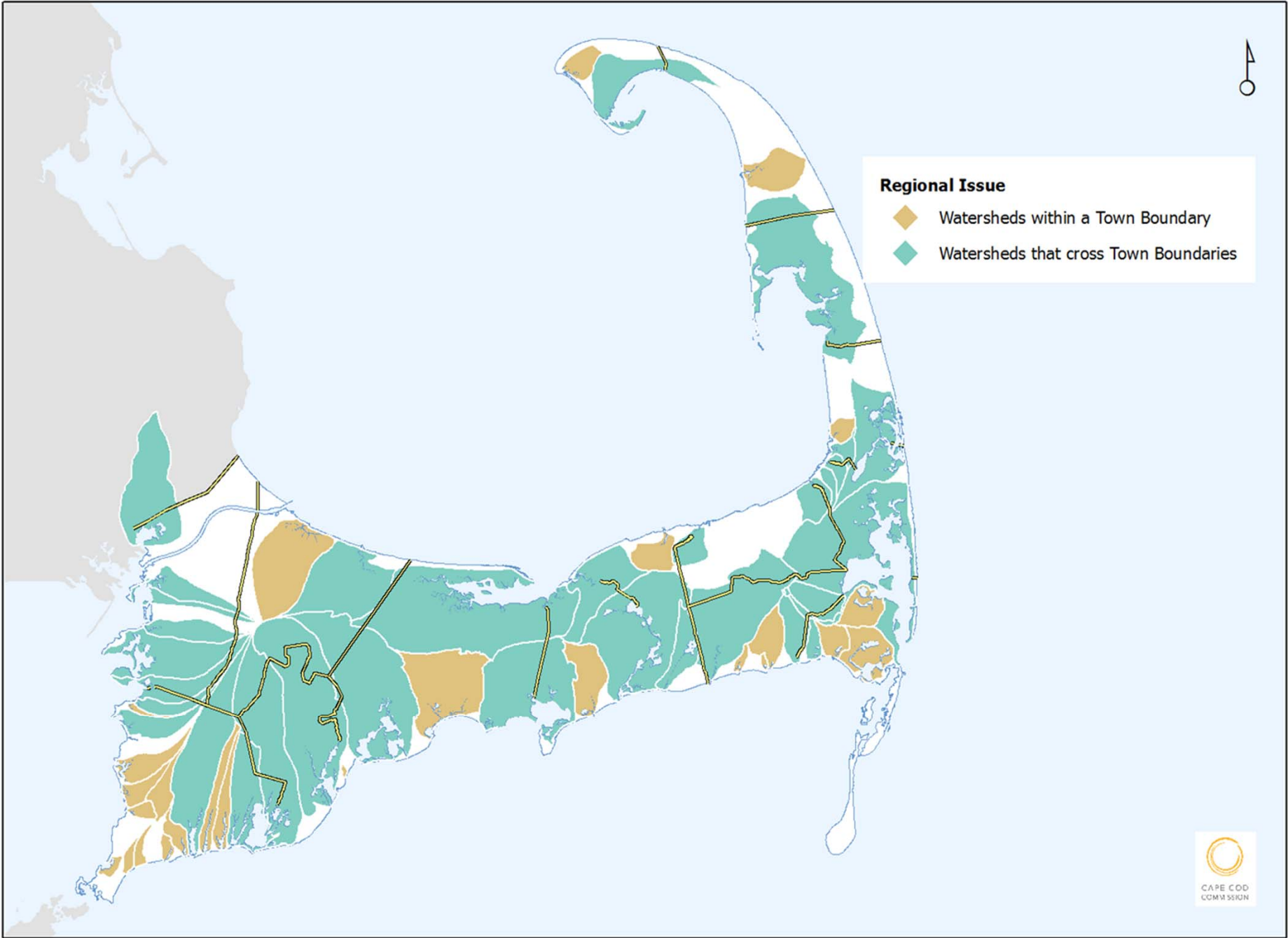


# Nitrogen Removal Required

## Studied Watersheds

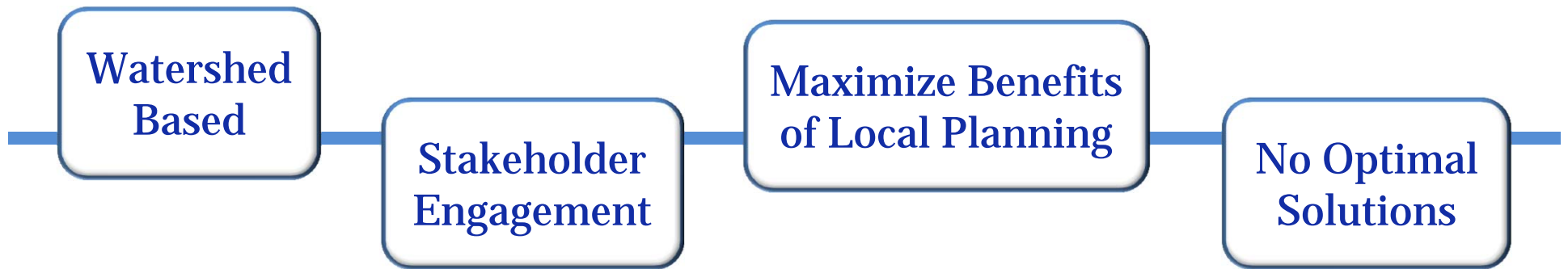
- ◆ Excess Nitrogen Watersheds
- ◆ Watersheds Without Excess Nitrogen







# Approach to the 208 Plan Update

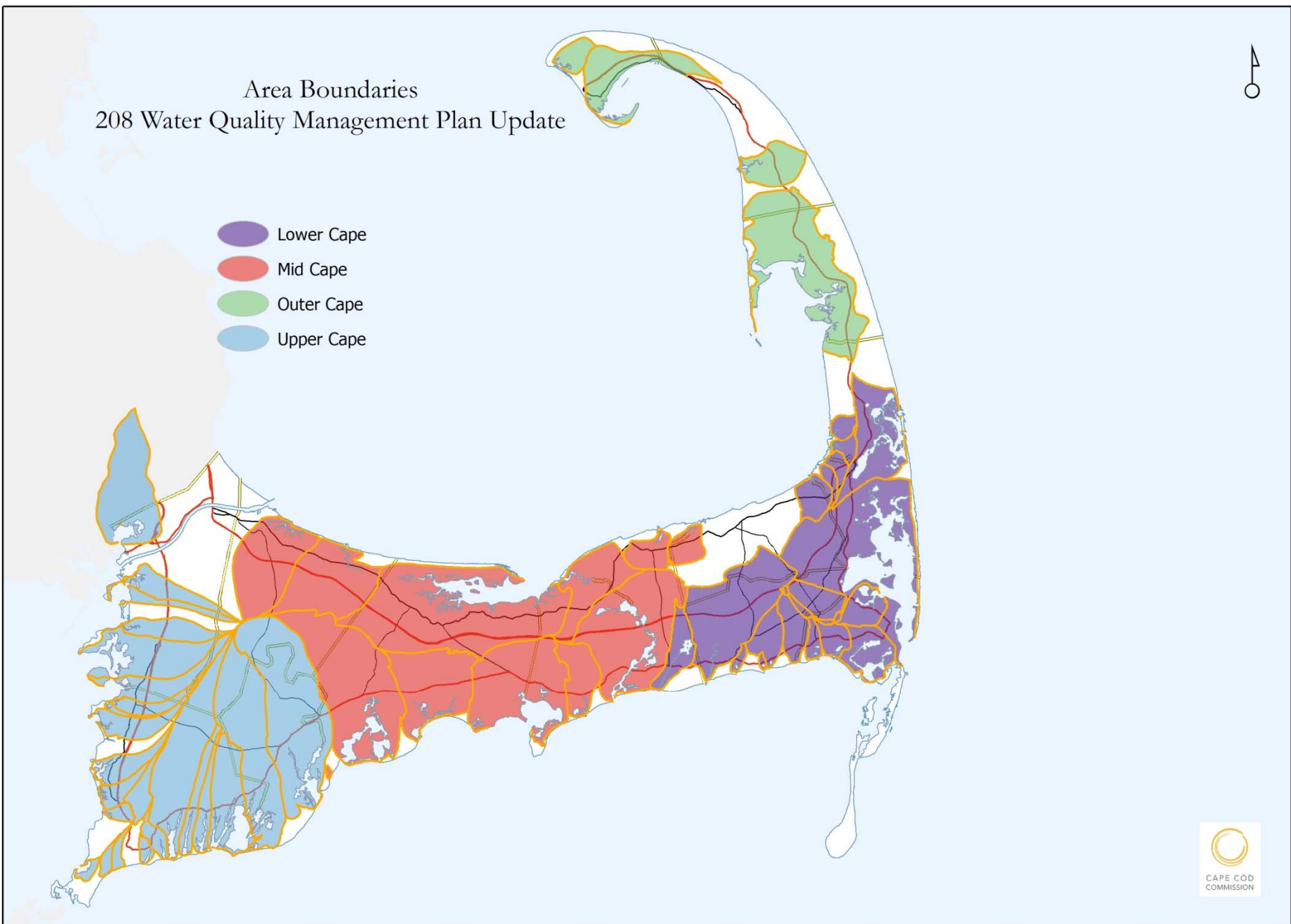


## **Goal:**

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

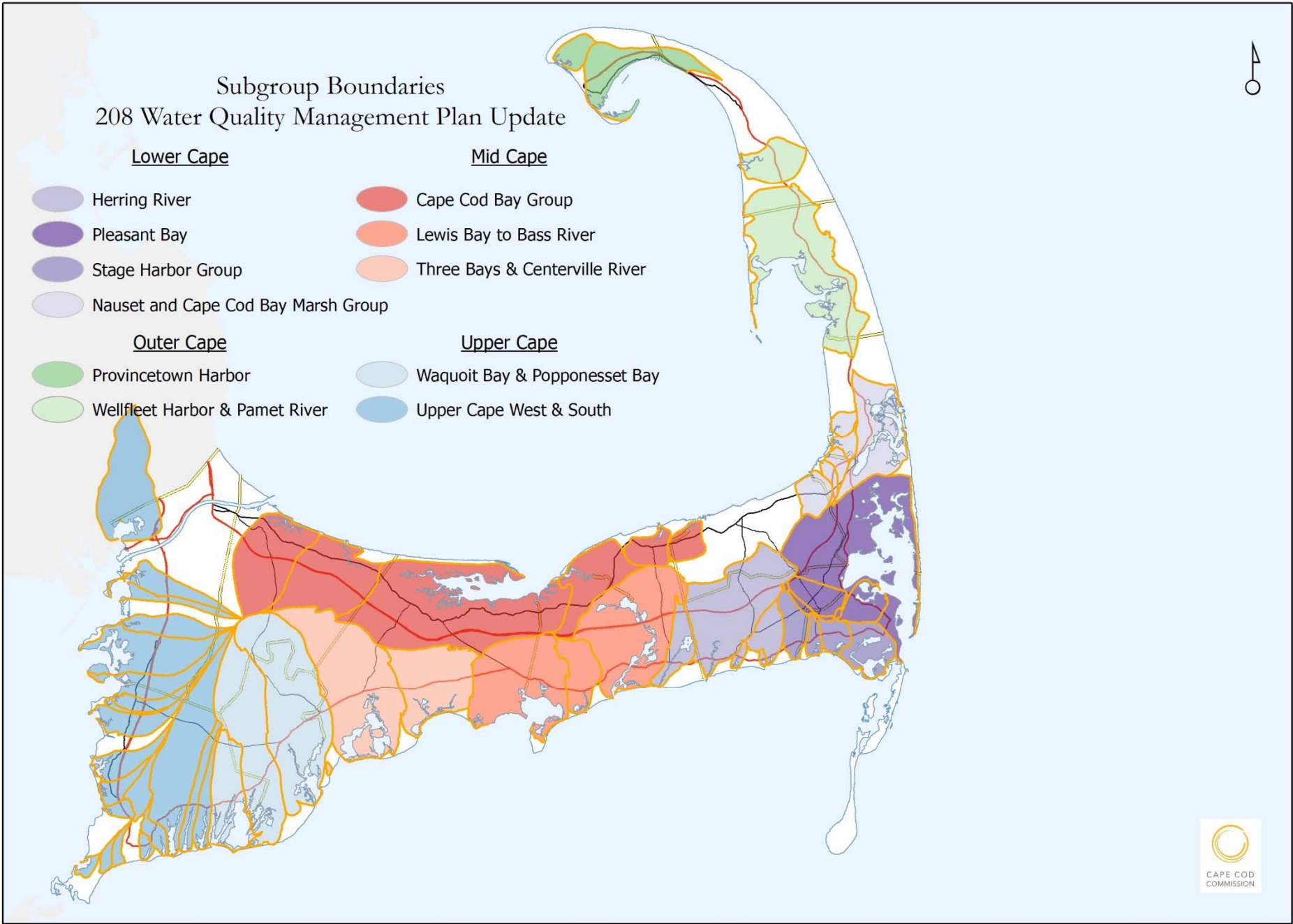
- Cape Cod Bay Group
- Lewis Bay to Bass River
- Three Bays & Centerville River

## Outer Cape

- Provincetown Harbor
- Wellfleet Harbor & Pamet River

## Upper Cape

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



**What is the stakeholder process?**

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## Public Meetings

## Watershed Working Groups



July

August

September

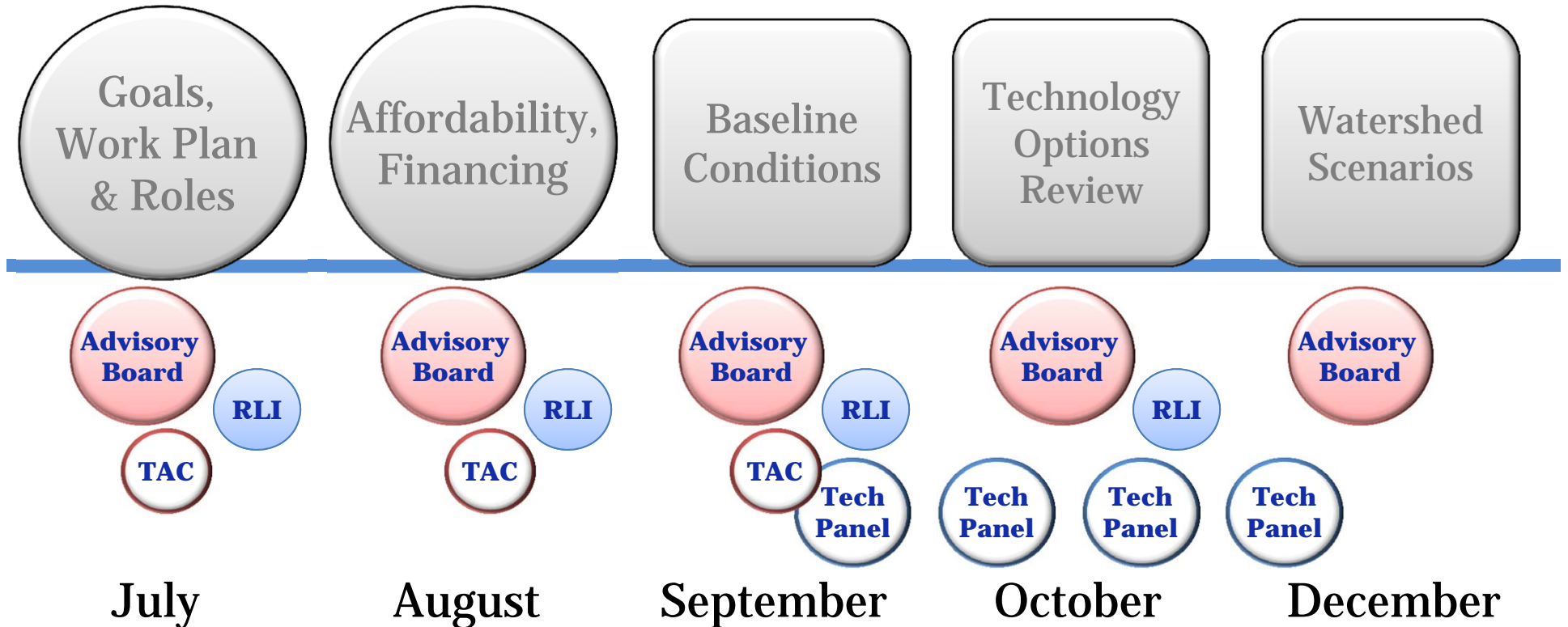
October

December

**208 Planning Process**

## Public Meetings

## Watershed Working Groups



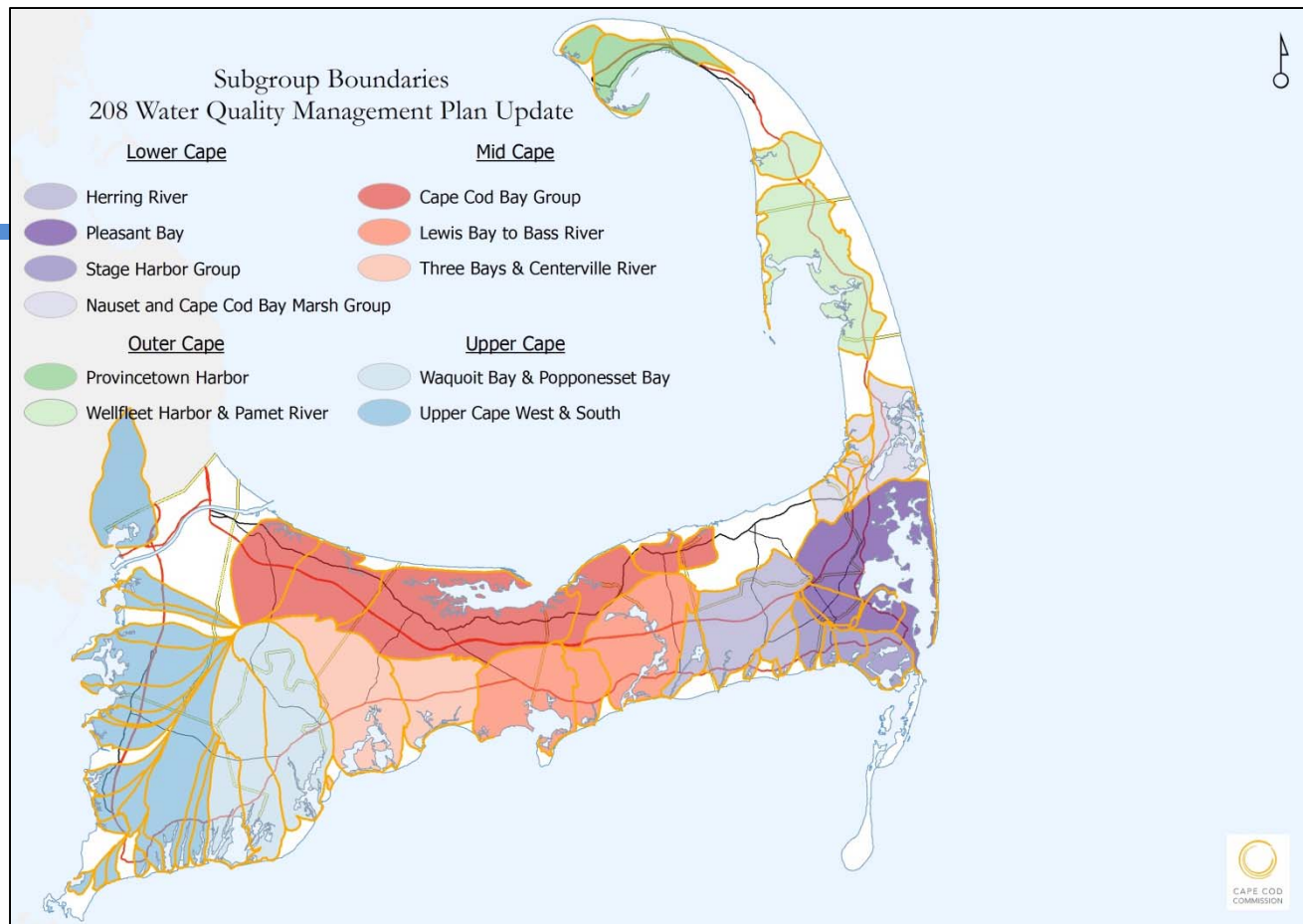
**RLI** Regulatory, Legal & Institutional Work Group

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

# 208 Planning Process

# Baseline Conditions

11 Working  
Group Meetings:  
Sept 18-27



## 208 Planning Process

**Baseline Conditions**

11 Working Group Meetings:  
Sept 18-27

**Technology Options Review**

11 Working Group Meetings:  
Oct 21-Nov 5



- Wastewater
- Stormwater
- Existing Water Bodies
- Regulatory

# 208 Planning Process



Baseline  
Conditions

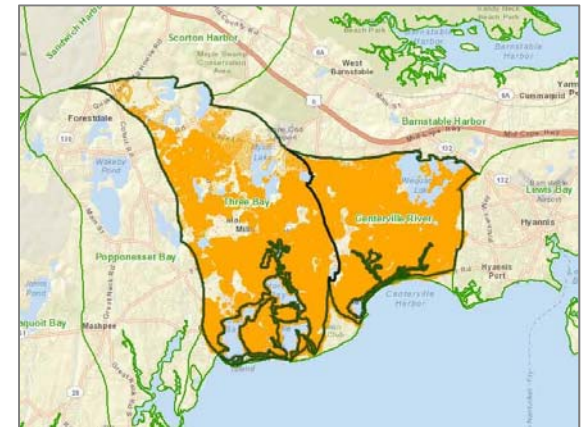
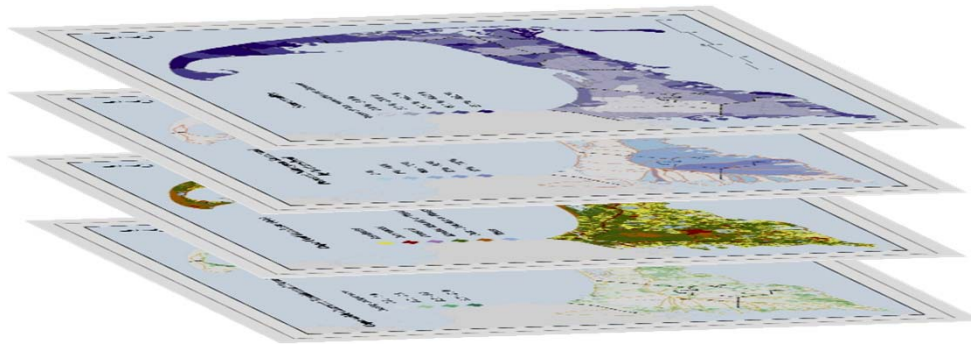
11 Working  
Group Meetings:  
Sept 18-27

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:**

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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

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Centerville River  
Rushy Marsh  
Three Bays

# Barnstable: 1970-2013

## From 1978 Section 208 Plan

- ▶ The major 208 concern for Barnstable is the protection of its public water supply wells.
- ▶ **The Planning Board appears to be interested in water supply protection as indicated by its recent zoning proposals. The coordination of town boards and the water utilities is essential to the success of this effort in Barnstable.**
- ▶ Possible consolidation of the water utilities or some formal coordinative mechanism should be seriously considered to insure efficient and effective protection of the town's water resources.
- ▶ While the town is presently constructing an expansion of the sewage treatment plant and collection system with EPA 201 funds, it has not addressed all of the wastewater management problem areas in the town. Additional 201 facilities planning must be carried out to demonstrate a sewer need exists under present EPA criteria.
- ▶ Certain problem areas are included as future phases of the sewer collection system expansion in the "Sewer Service Areas" delineated in the 208 plan and would be eligible for 201 funding assistance.

The present Hyannis treatment plant has the necessary capacity to handle all sewer service area needs in Hyannis. Should the town want to expand the collection system beyond these sewer service areas, 201 funds will not be available for these expansions or for an additional treatment plant.



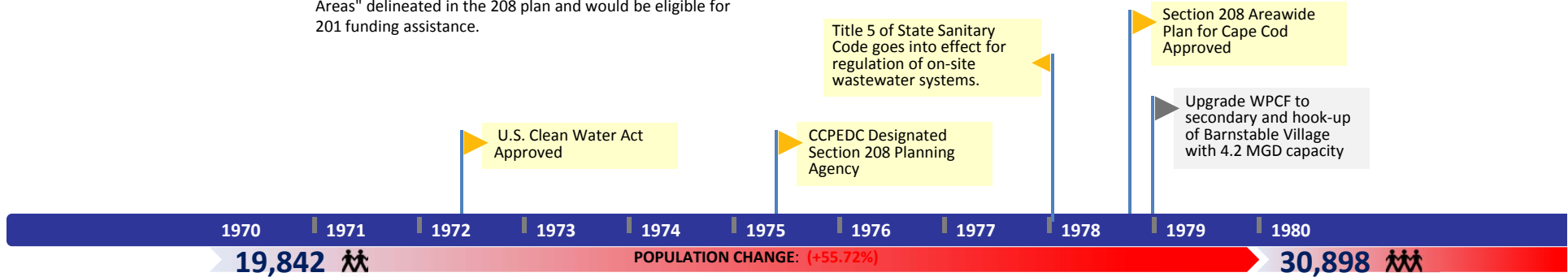
The need for collection system expansion in the Hyannis area should be carefully considered in assessing the plant's ability to accept wastewater from Yarmouth since the Hyannis treatment plant cannot be expanded beyond its present capacity.



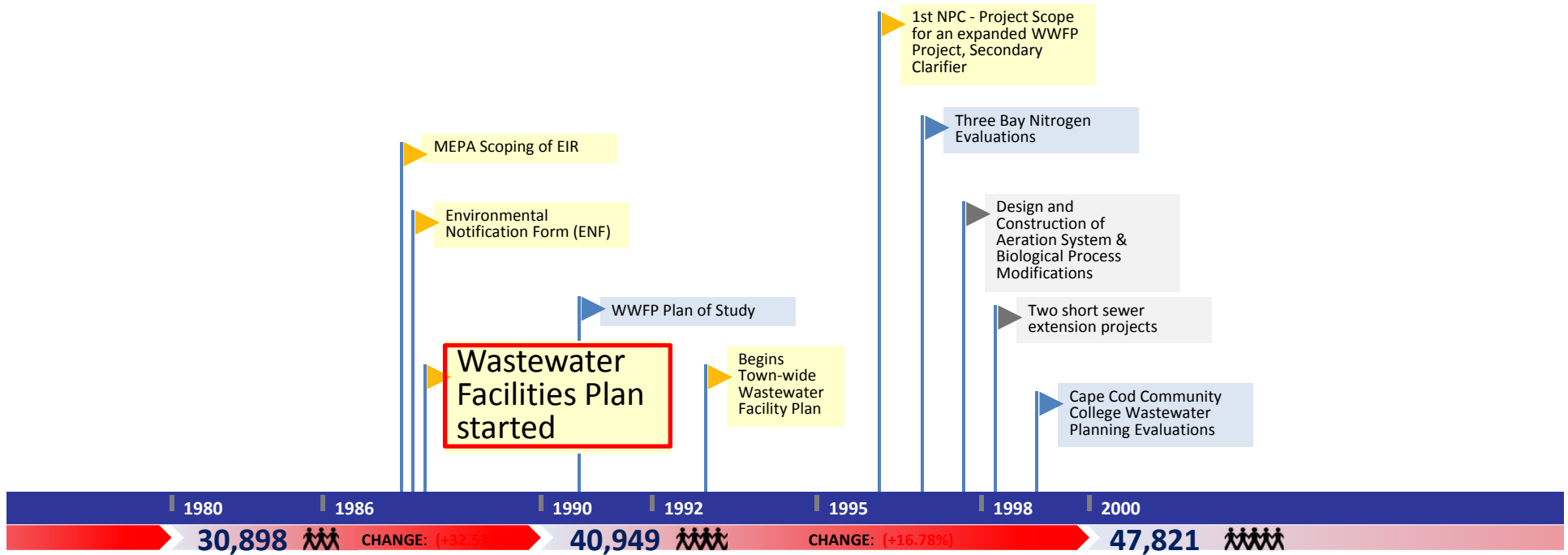
The town should consider, in the near future, entering into a 201 facilities plan to resolve the present Category 2 problem areas possibly through decentralized solutions.



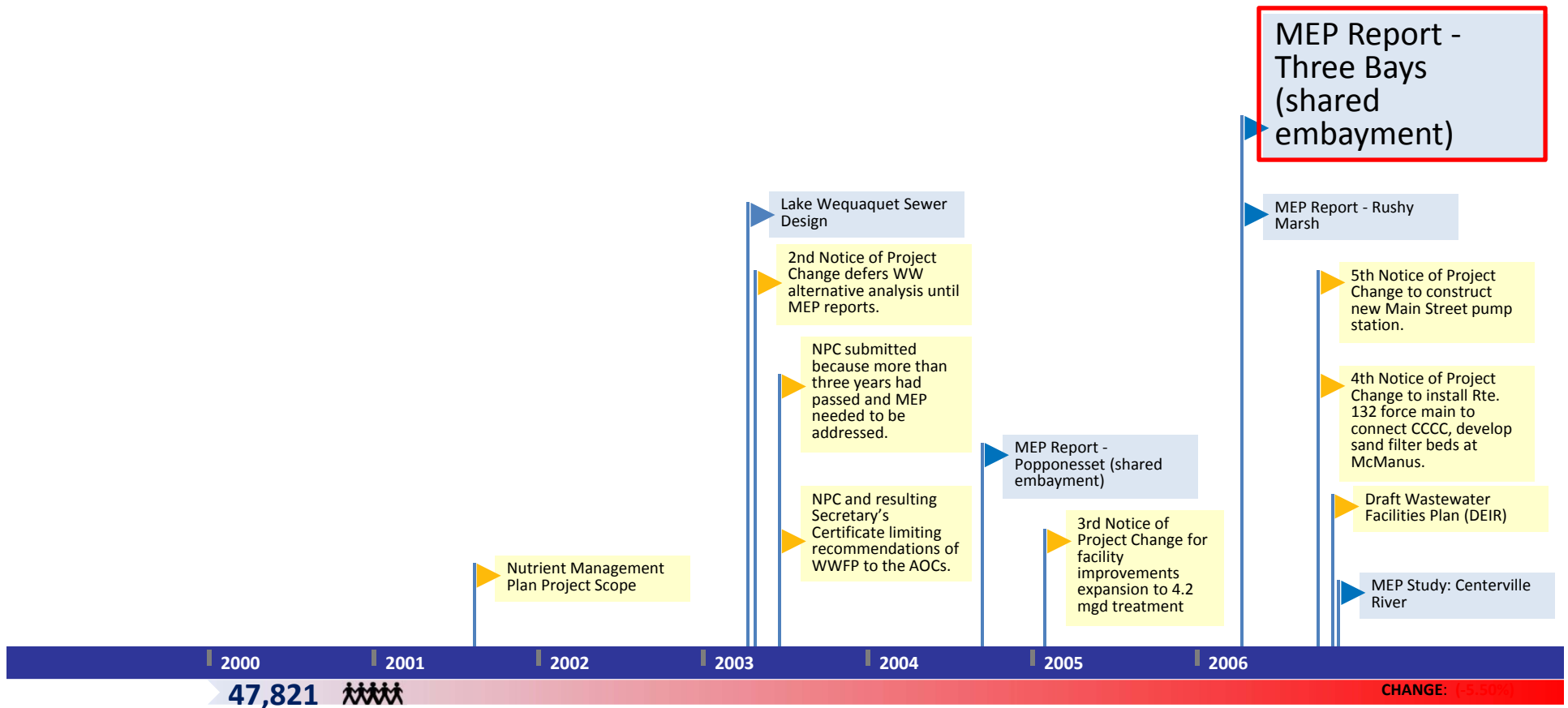
The 201 study and efforts of town board should address the coastal water quality problems of the town, particularly Lewis Bay.



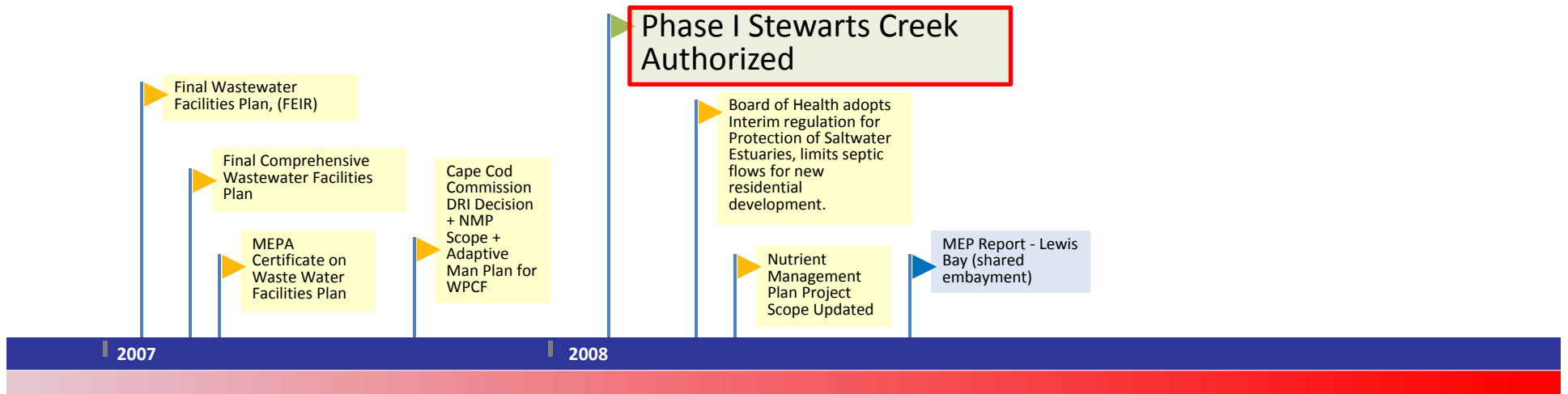
# Barnstable: 1970-2013



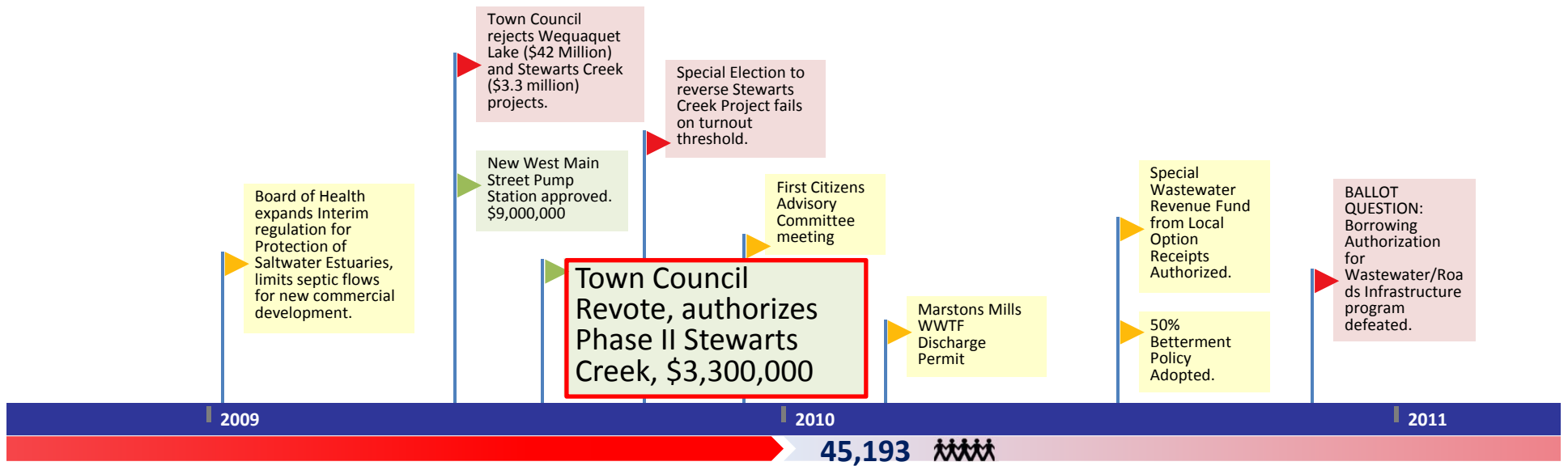
# Barnstable: 1970-2013



# Barnstable: 1970-2013

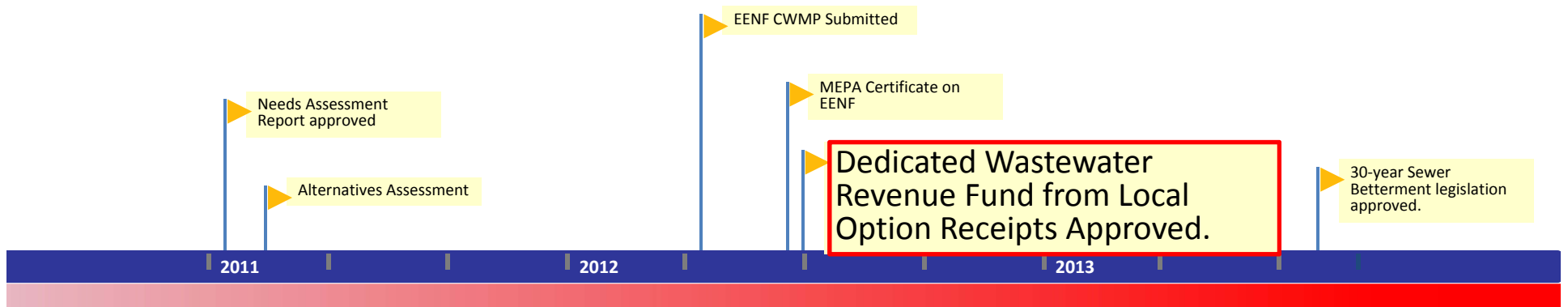


# Barnstable: 1970-2013





# Barnstable: 1970-2013



# Mashpee

## From 1978 Section 208 Plan

- ▶ While there does not appear to be any major wastewater management problem areas, pond water quality has been a problem of concern to the town for a number of years.

The town should protect the future water supply development area, once defined, with a Watershed Protection District.

- ▶ Non-structural solutions, including careful management of on - site systems, water conservation and innovative options should be adequate to avoid creation of future sewer needs.

- ▶ Mashpee is not highly developed and is in an excellent position to plan development and manage subsurface disposal to avoid future problems.

- ▶ Mashpee should participate in regional septage planning with neighboring towns (Sandwich, Falmouth and Barnstable) to determine the most cost-effective means of disposing of its septic wastes.

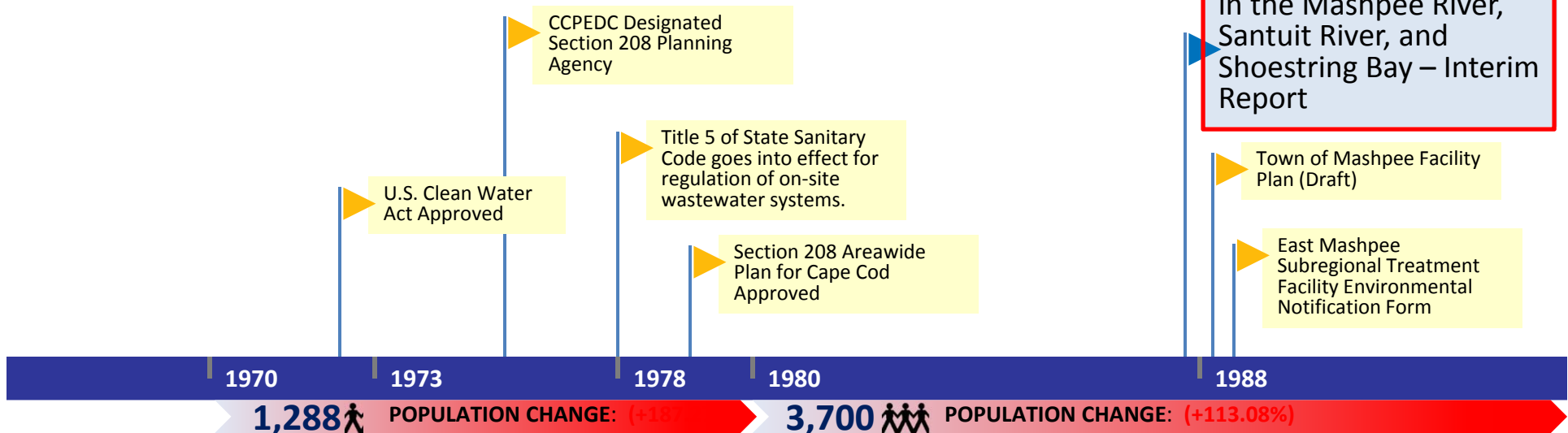
- ▶ The town has been concerned about the condition of recreational ponds that have significant development around them, particularly Johns and Ashumet Ponds.

- ▶ Extensive water quality testing has been conducted on Johns Pond, and the town is interested in implementing a Pond Management program.

- ▶ It is further suggested that the town adopt a "Great Pond Protection District" as part of its zoning by-laws to begin such a management program.

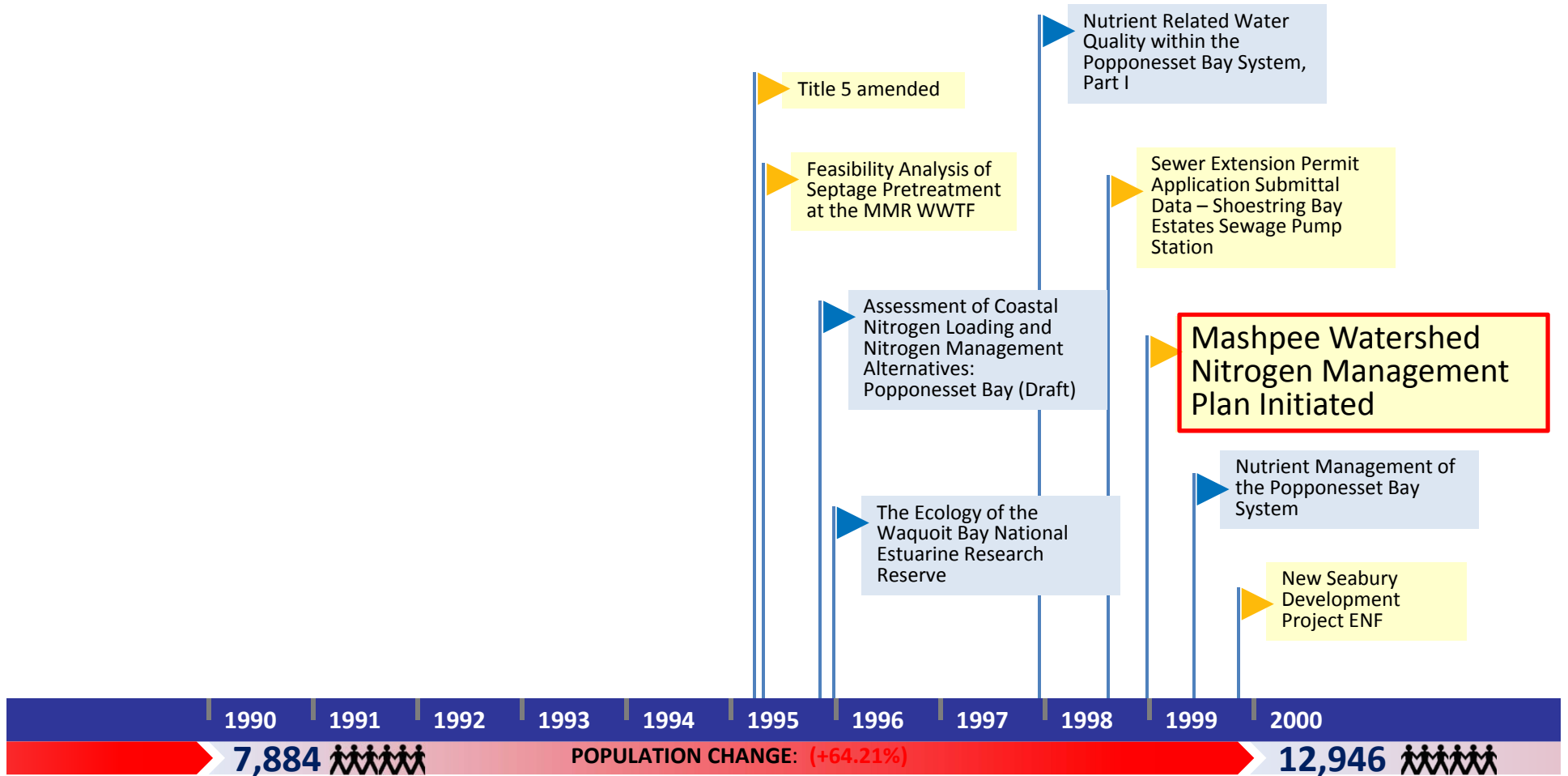
- ▶ The landfill plume may be flowing towards the Mashpee River. If private wells are found to be down gradient there may be a need for town water service to the area.

Sources of Bacterial and Nutrient Contamination in the Mashpee River, Santuit River, and Shoestring Bay – Interim Report

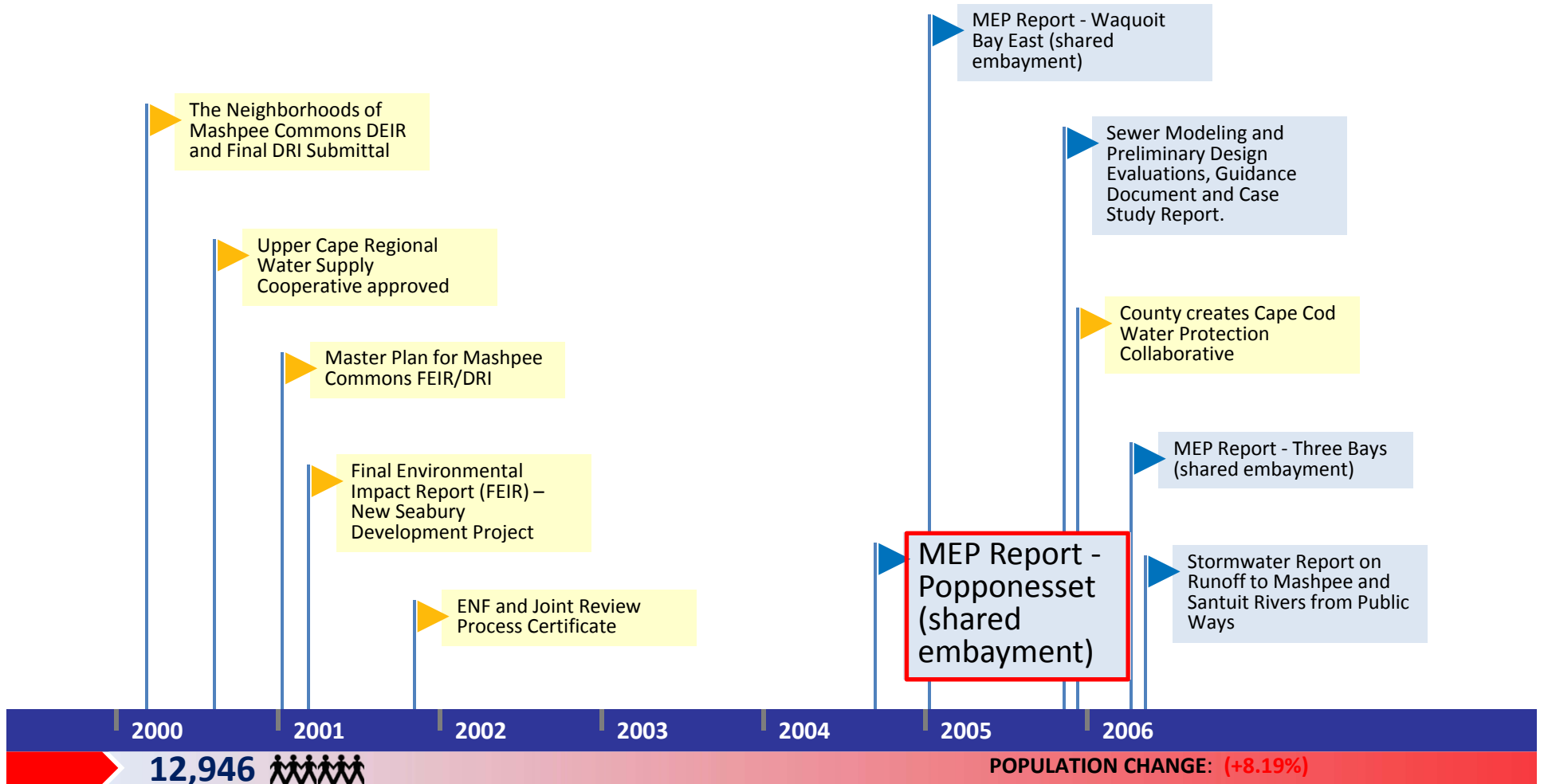


POPULATION: 7,884 (+113.08%)

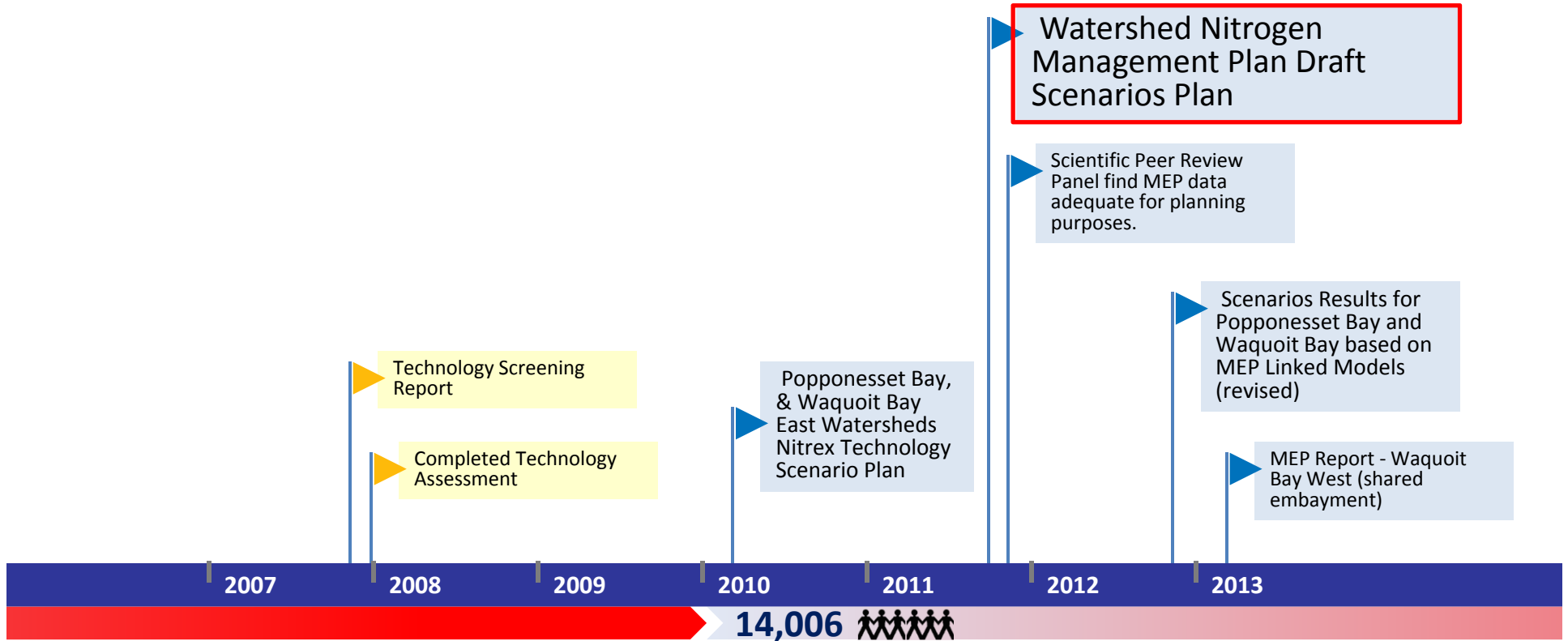
# Mashpee: 1970-2013



# Mashpee: 1970-2013



# Mashpee: 1970-2013



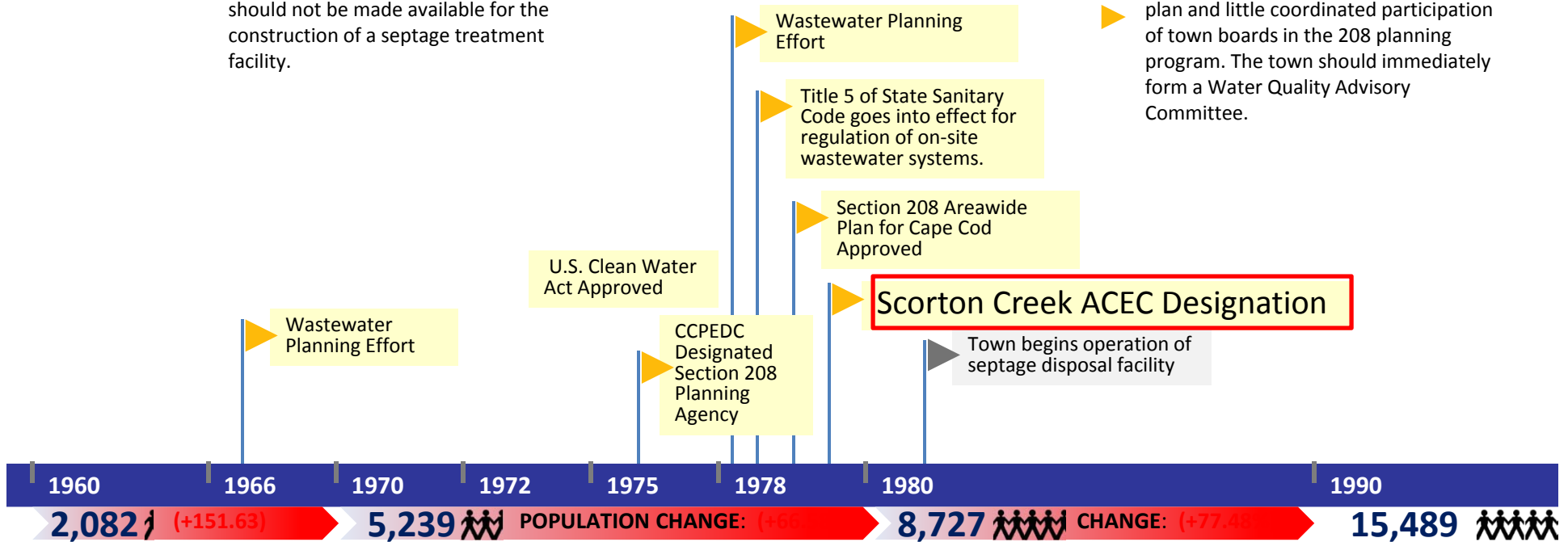
# Sandwich

## From 1978 Section 208 Plan

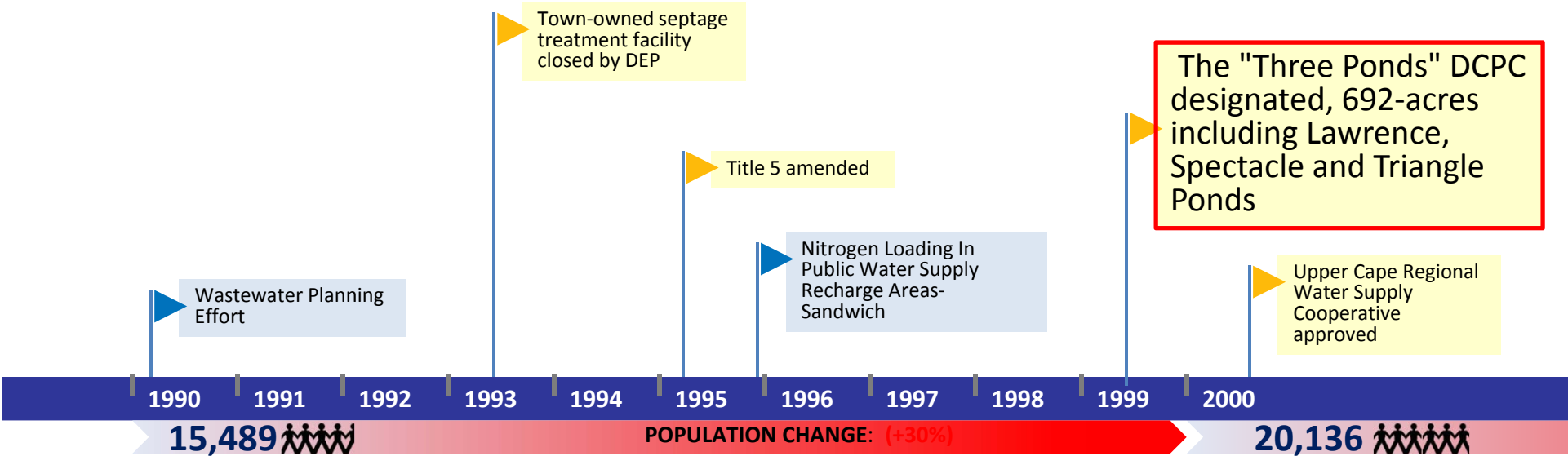
- ▶ A sewer facilities plan was completed for Sandwich in 1978. The plan calls for a small outfall into the Cape Cod Canal, which now could only be allowed through a special act of the legislature.
- ▶ Should the town fail to act by 1980, a DEQE investigation of Title 5 violations should be initiated.
- ▶ A septage treatment facility would not provide a comprehensive solution and could not be considered to be consistent with the 208 plan. Funds should not be made available for the construction of a septage treatment facility.

- ▶ The town health agent should strictly enforce Title 5 and should seek additional qualified personnel to implement the 208 recommended on-site systems management program.
- ▶ The town has taken progressive steps to increase lot sizes to at least one acre in most areas of town. The town has indicated willingness to cooperate with the 208 staff in delineating watershed areas and in adopting Watershed Protection Districts.

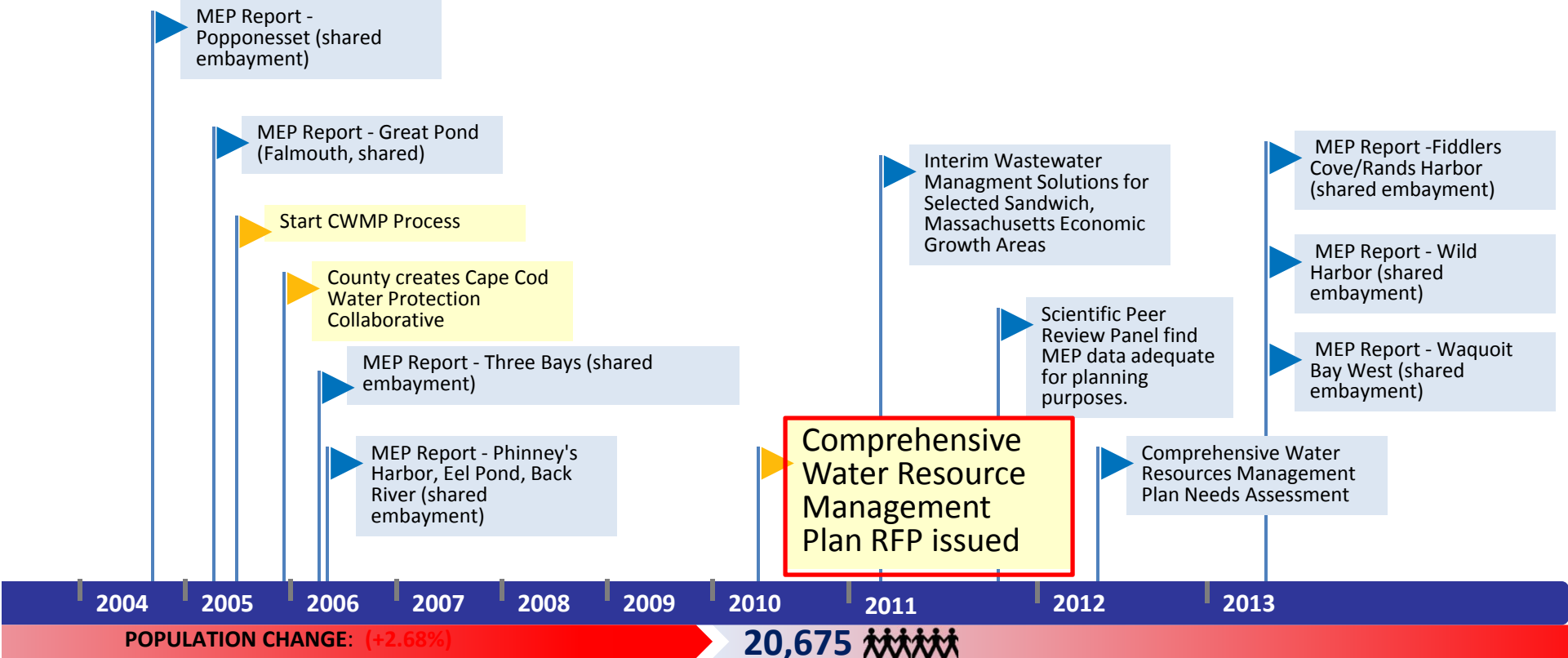
- ▶ The problem of the State Fish Hatchery discharging over half a million gallons of fresh water must be addressed by the Department of Fisheries and Wildlife as recommended in the "Water Conservation" section of the final plan.
- ▶ The town should actively participate in regional solid waste planning to develop a long-range solution to its solid waste management problems.
- ▶ There has been a serious delay in action on the town's proposed sewer facility plan and little coordinated participation of town boards in the 208 planning program. The town should immediately form a Water Quality Advisory Committee.



# Sandwich: 1960-2013



# Sandwich: 1960-2013





**Did we miss anything?**

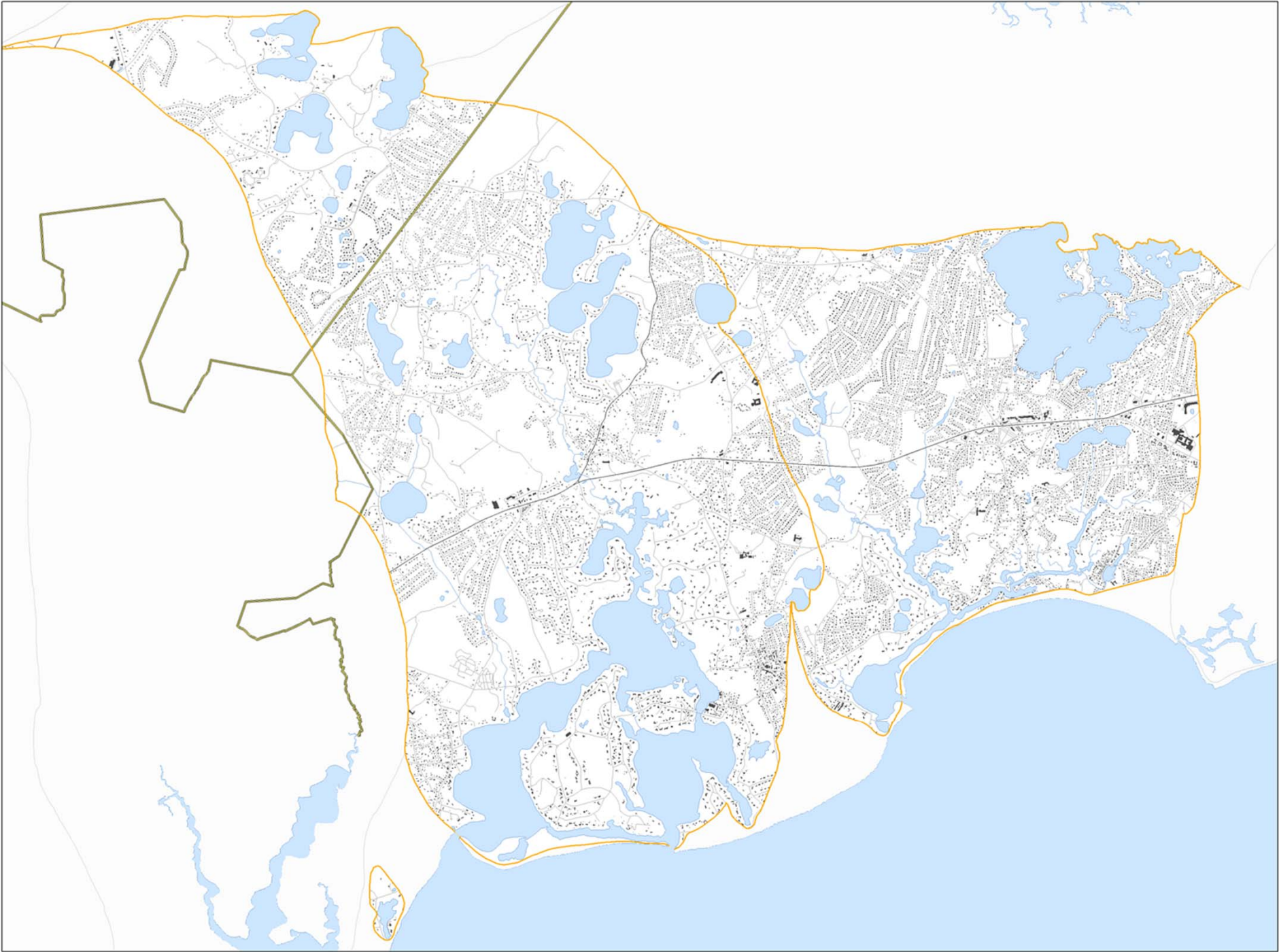
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# **Your Watersheds**

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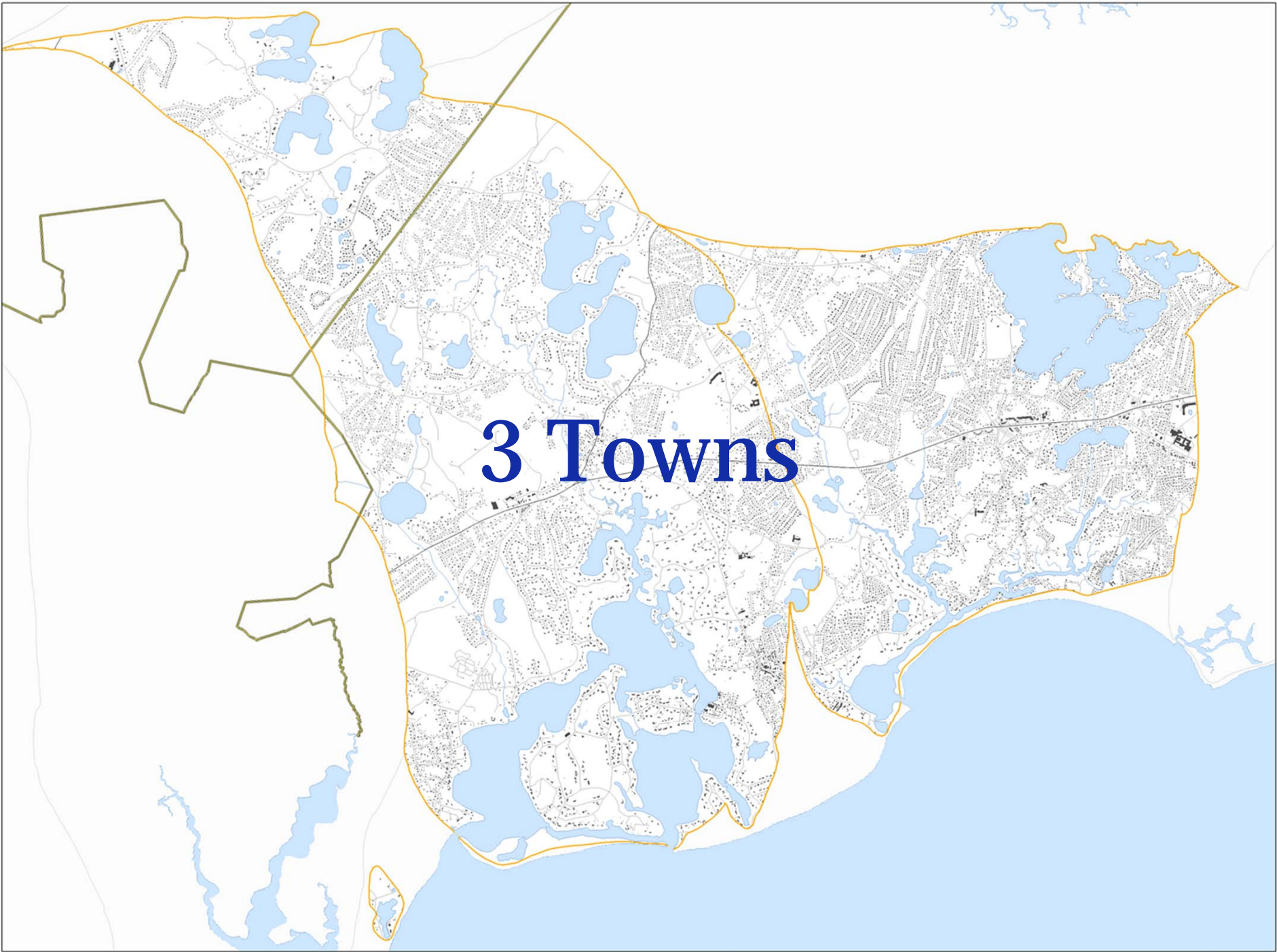


**Centerville River  
Rushy Marsh  
Three Bays**



A map showing a large, irregularly shaped area outlined in yellow. The area is densely packed with small black dots, representing a high density of points or buildings. Several large, irregularly shaped blue areas are scattered throughout the yellow-outlined region, representing water bodies or lakes. The map is set against a white background. A green line runs diagonally across the upper left portion of the map. The text "30 square miles" is overlaid in the center in a large, blue, serif font.


**30 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

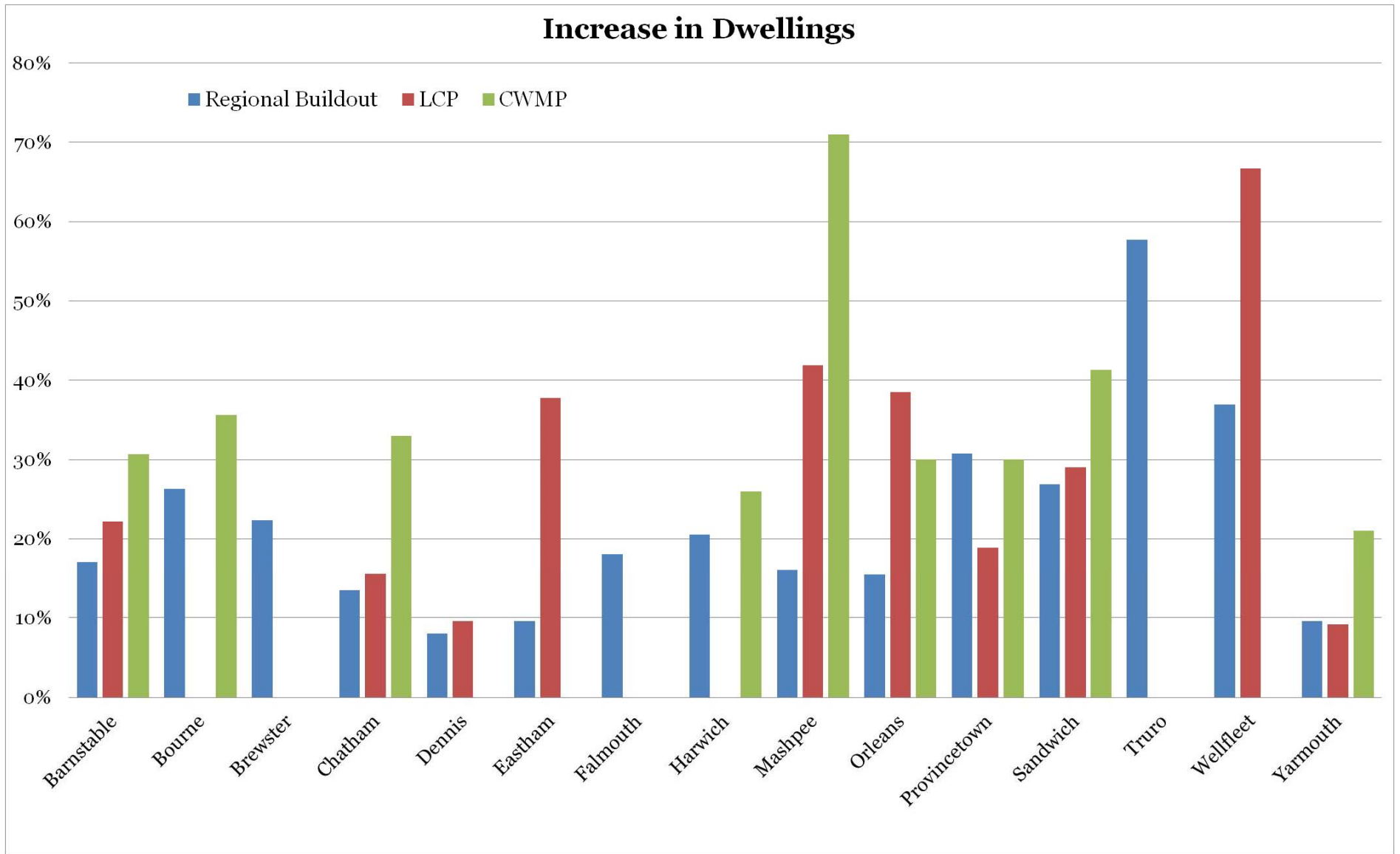
 Open - Disturbed or Managed

 Water

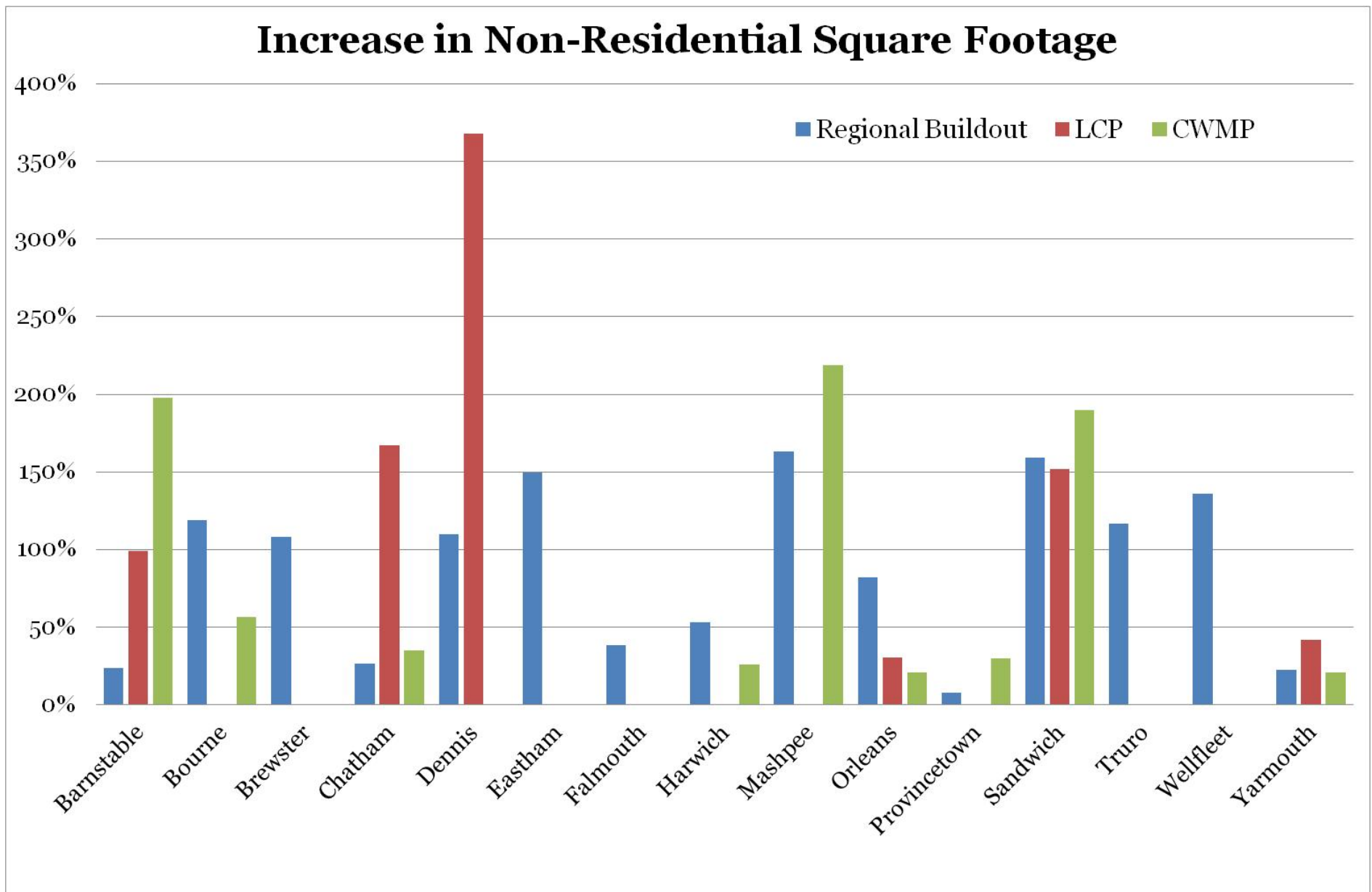
# Density

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

# Buildout



# Buildout



# **The People**



Centerville River  
Rushy Marsh  
Three Bays

A map of a coastal region, likely a city or county, showing a dense network of roads and numerous blue water bodies (lakes, ponds, and a large bay or ocean area). A thick orange line outlines a specific geographic boundary. A green line, possibly representing a major road or administrative boundary, crosses the orange boundary. The text 'Total Population (2010) = 25,658' is overlaid in the center of the map in a large, bold, blue serif font.

**Total Population (2010) = 25,658**

## Population (2010)

14,000

13,163

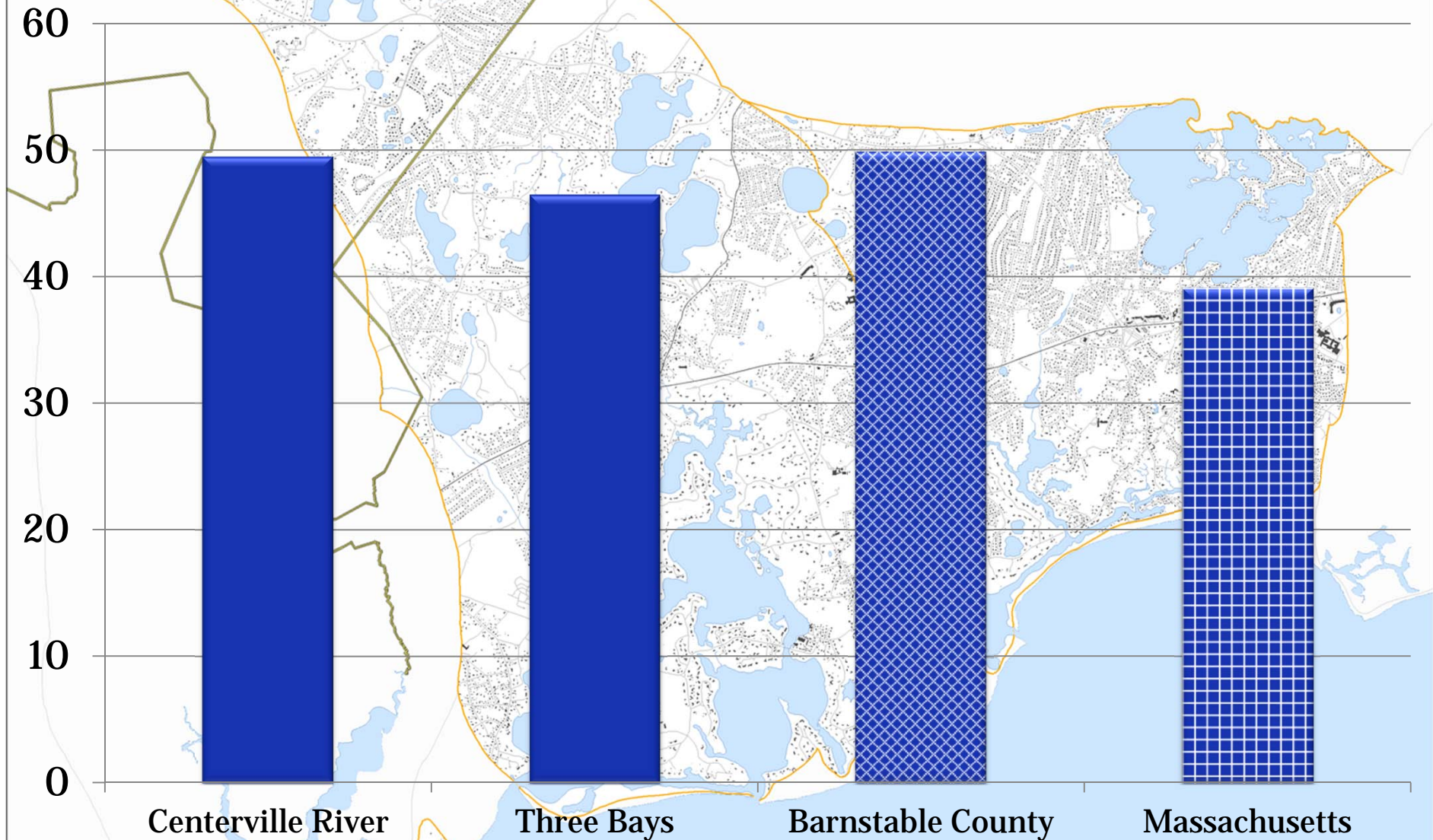
11.9% of the Total Cape Cod  
Population

Centerville River

Rushy Marsh

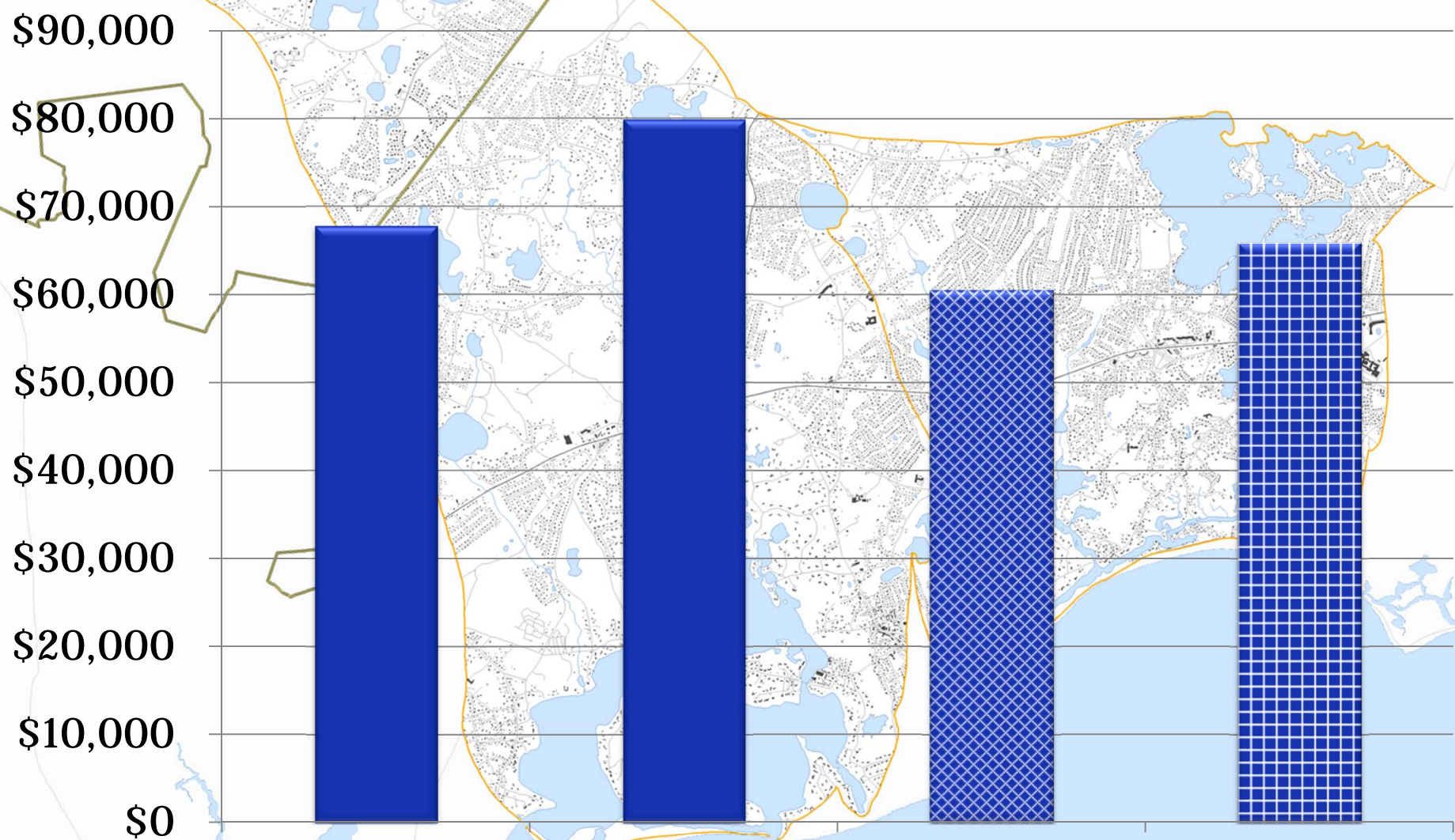
Three Bays

# Median Age (2010)



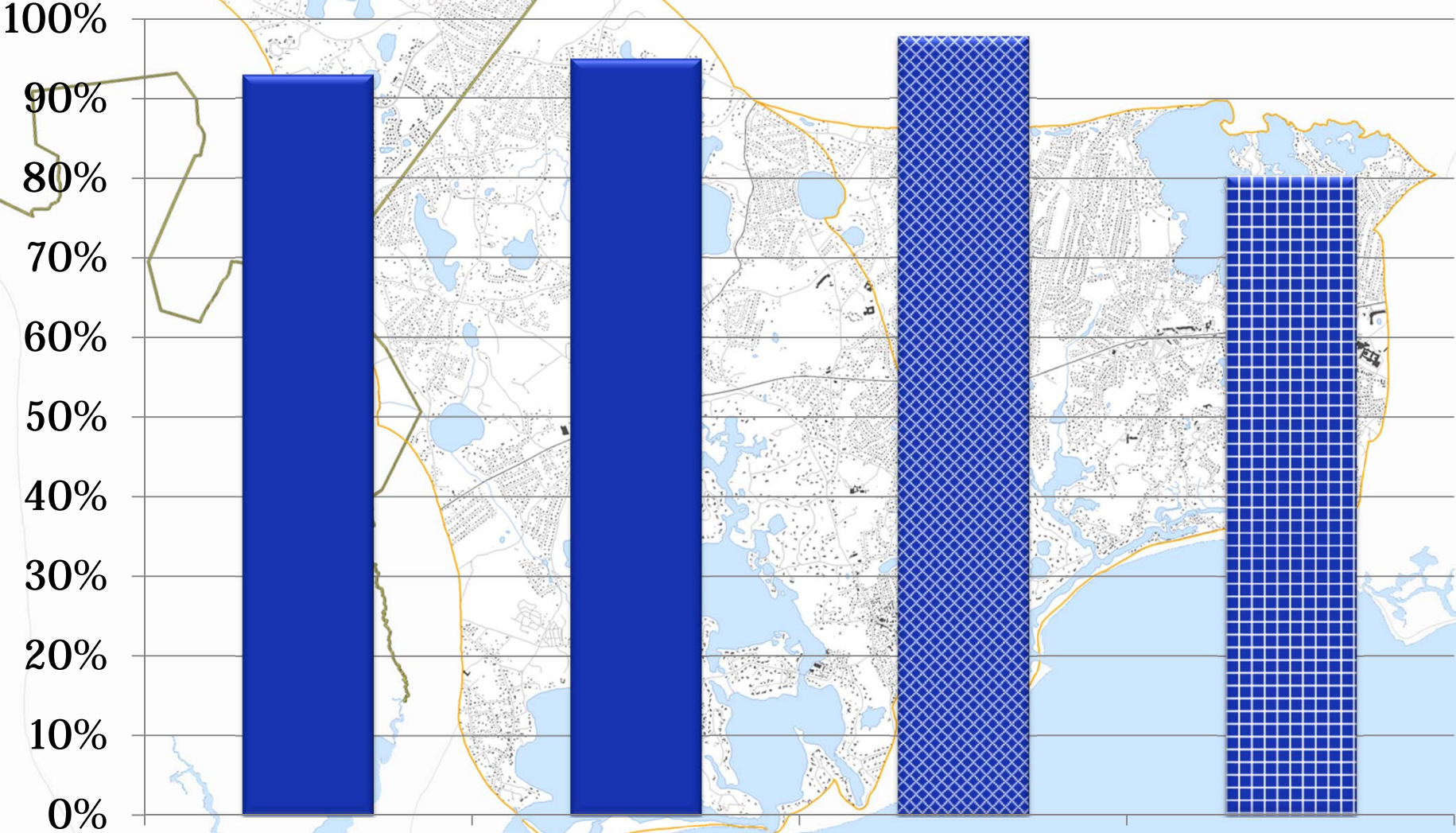


# Median Income (2010)



Centerville River      Three Bays      Barnstable County      Massachusetts

# Race - % White (2010)



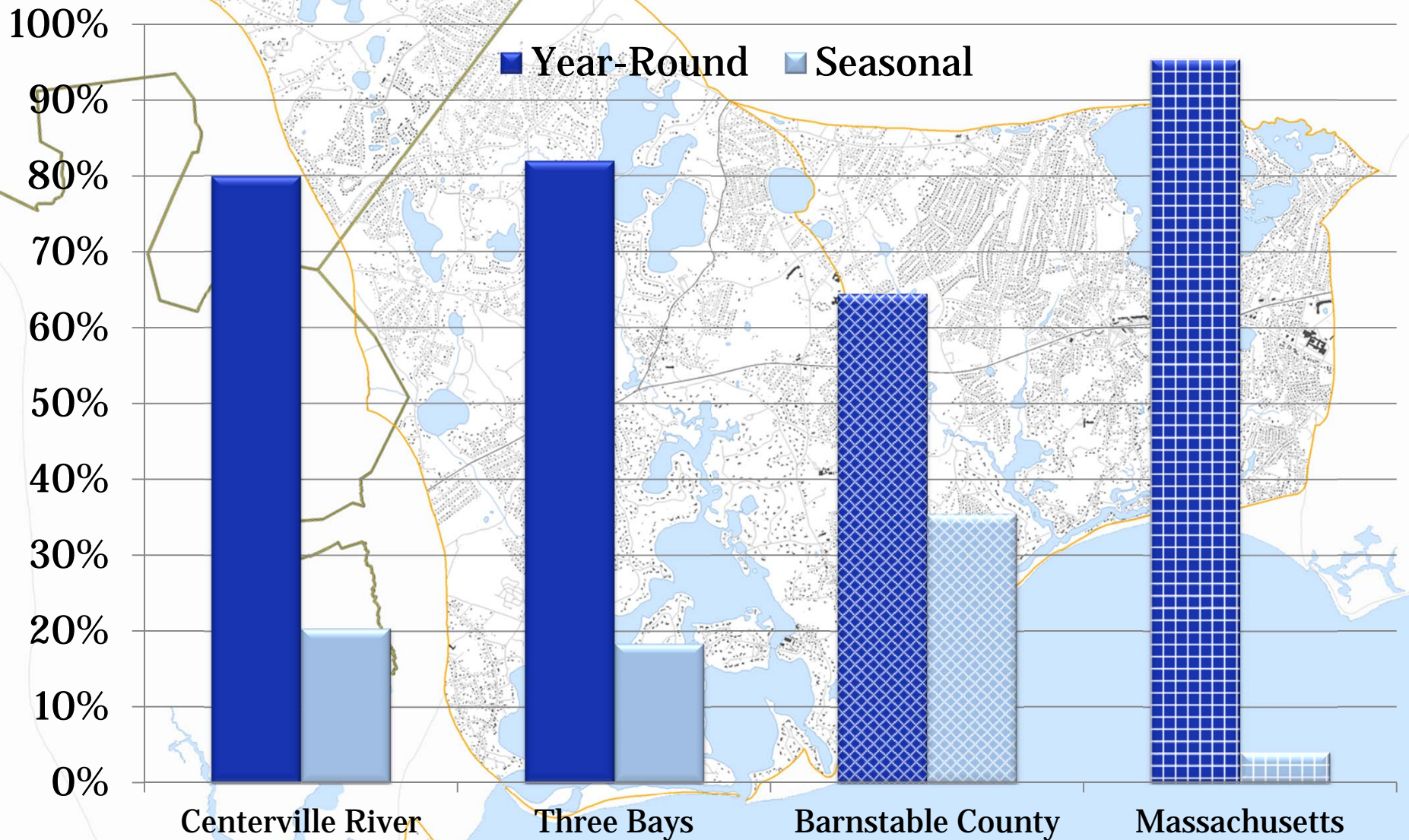
Centerville River

Three Bays

Barnstable County

Massachusetts

# Seasonal vs. Year Round Housing (2010)



## Average Assessed Home Value (2010)

\$3,000,000

\$2  
\$2  
\$1  
\$1  
\$0

Total Assessed Value of  
Residential Homes=  
**\$6,578,290,000**

\$0

Centerville  
River

Rushy Marsh

Three Bays

Barnstable  
County

Massachusetts

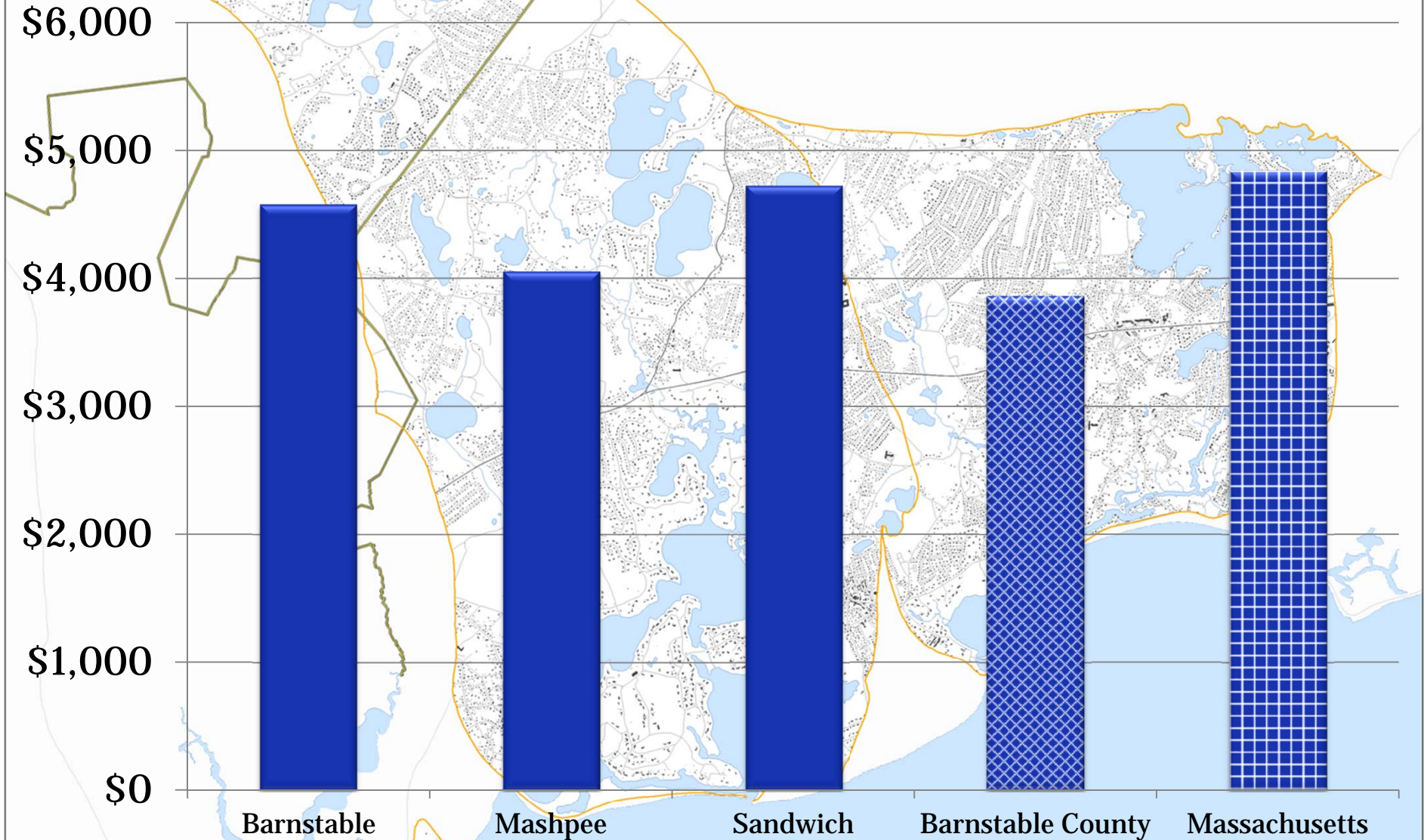
# **Your Government & Taxes**



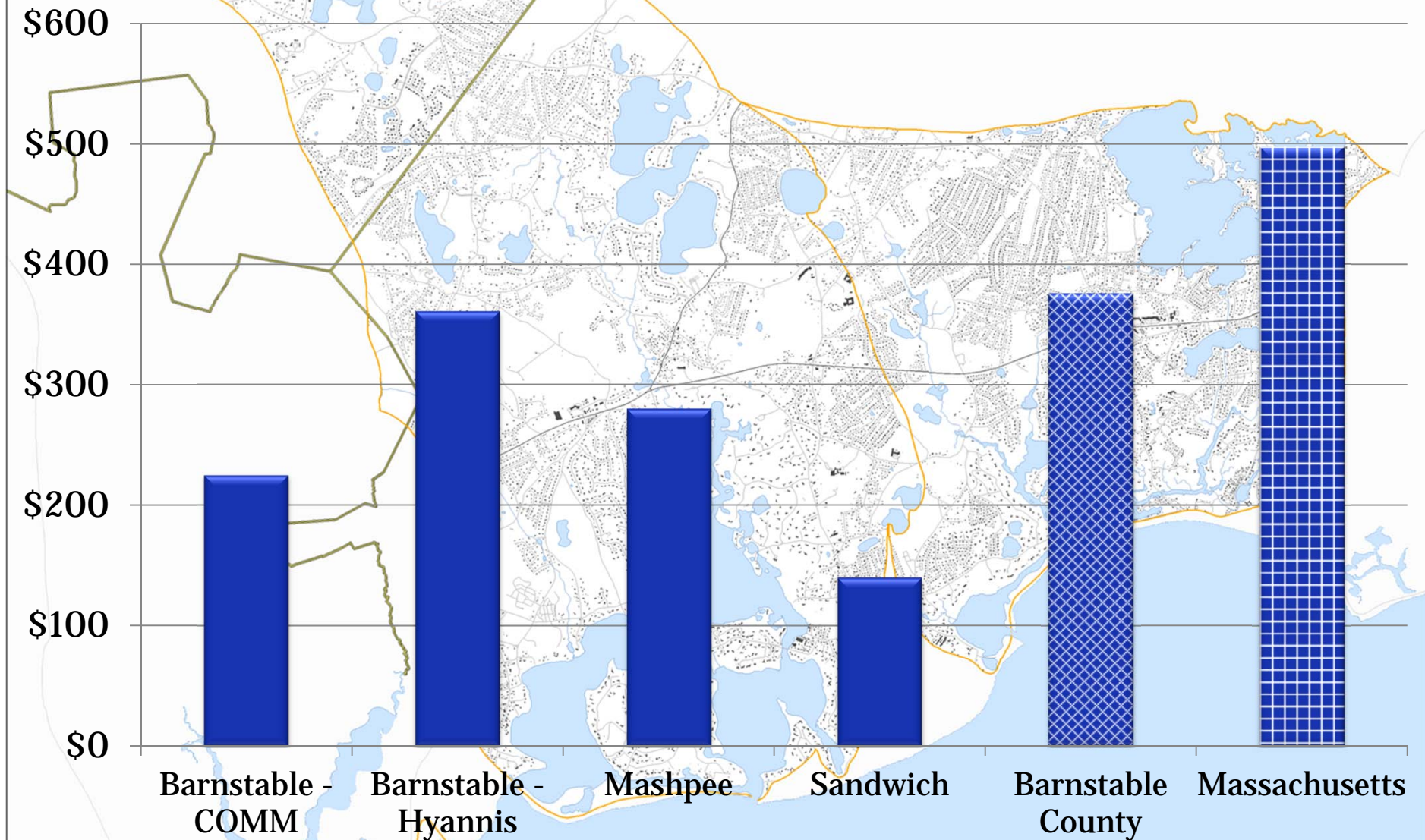
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**Centerville River  
Rushy Marsh  
Three Bays**

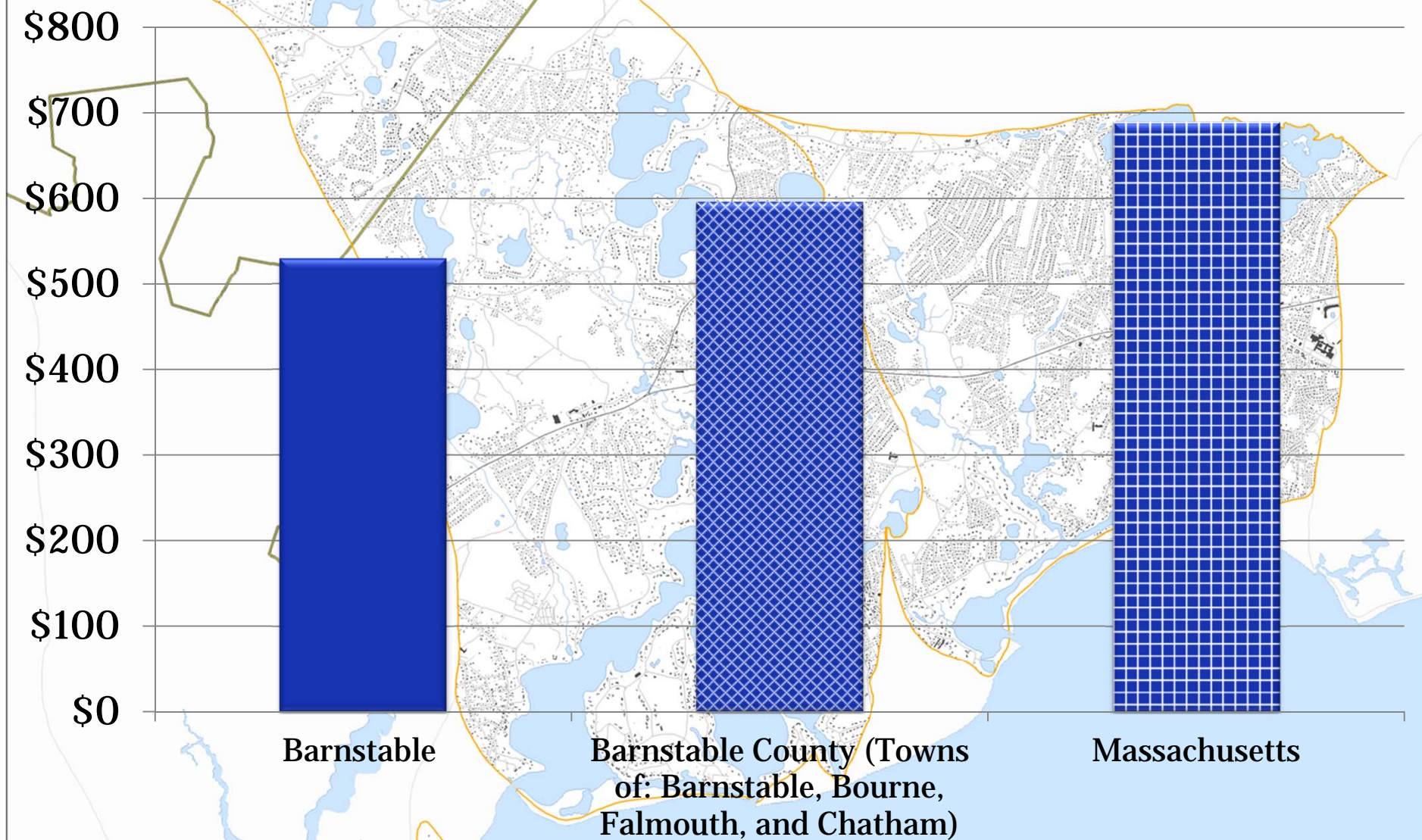
# Average Single Family Property Tax Bill (2013)



# Average Annual Water Bill (2012)



# Average Annual Sewer Bill (2012)





# **The Problem**



**Centerville River  
Rushy Marsh  
Three Bays**

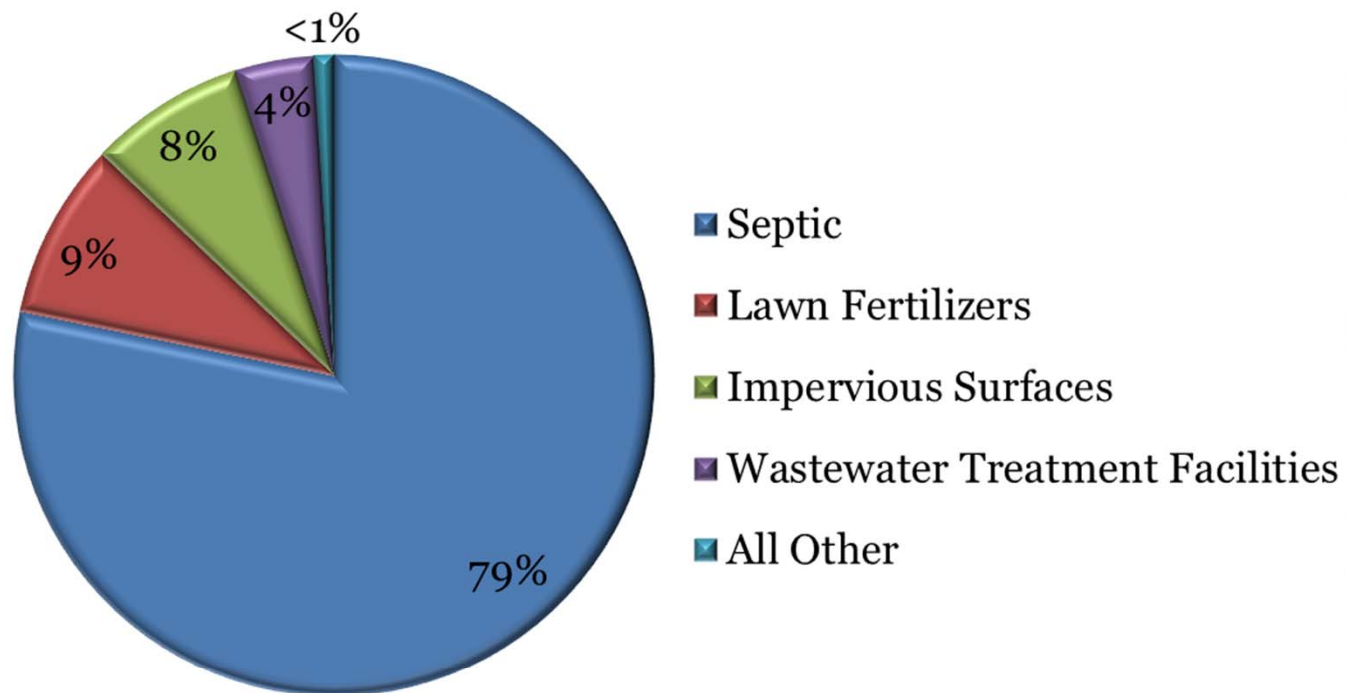




## Massachusetts Estuaries Project

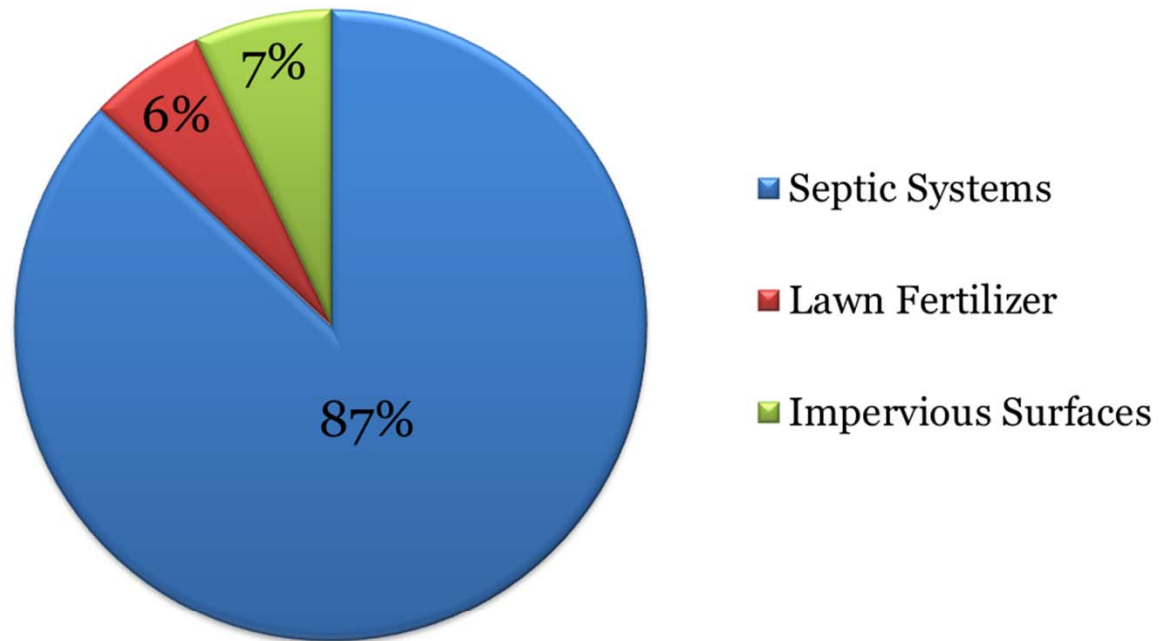
- Opportunity for towns to obtain independent analysis of nitrogen loading and its impact on water quality
- Provides water quality, nutrient loading, and hydrodynamic information
- Water quality monitoring – minimum of 3 years of data for each embayment
- Watershed model links water quality data to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

## Cape-Wide Controllable Nitrogen Loads



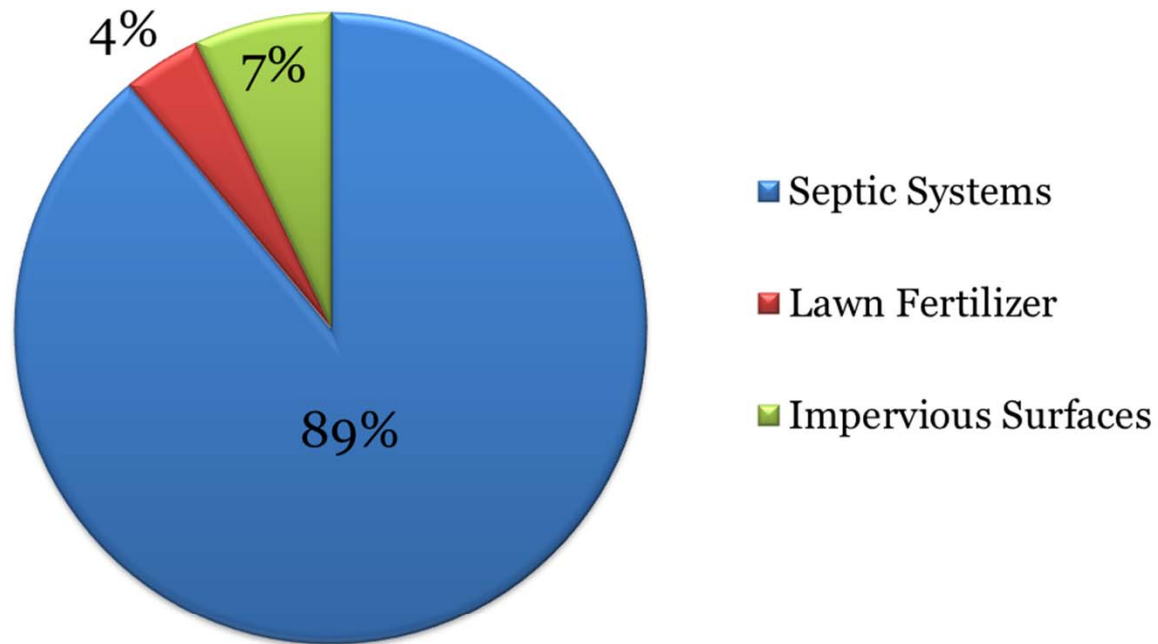
Note: Data averaged from existing Massachusetts Estuaries Project Reports

## Centerville River Controllable Nitrogen Loads



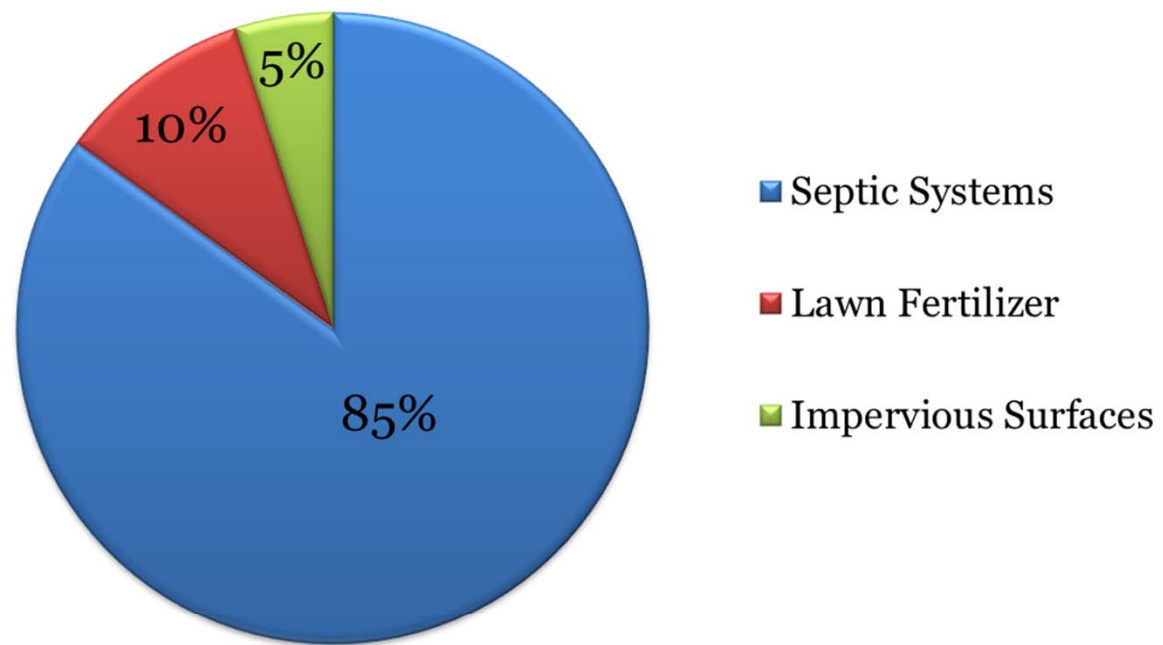
Massachusetts Estuaries Project, Nov 2006

## Rushy Marsh Controllable Nitrogen Loads



Massachusetts Estuaries Project, April 2006


## Three Bays Controllable Nitrogen Loads



Massachusetts Estuaries Project, April 2006


# Nitrogen Problem


## Base Map

 Town Lines


 Rivers


## Embayment Boundary

 On Land


 On Sea

## Major Roads

 US Highway

 State Highway

 Roads

 Structures

 Ponds

## Nitrogen

### Ecological Indicators

-  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 in Public Supply Wells


-  0 - 0.5 mg/l
-  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%

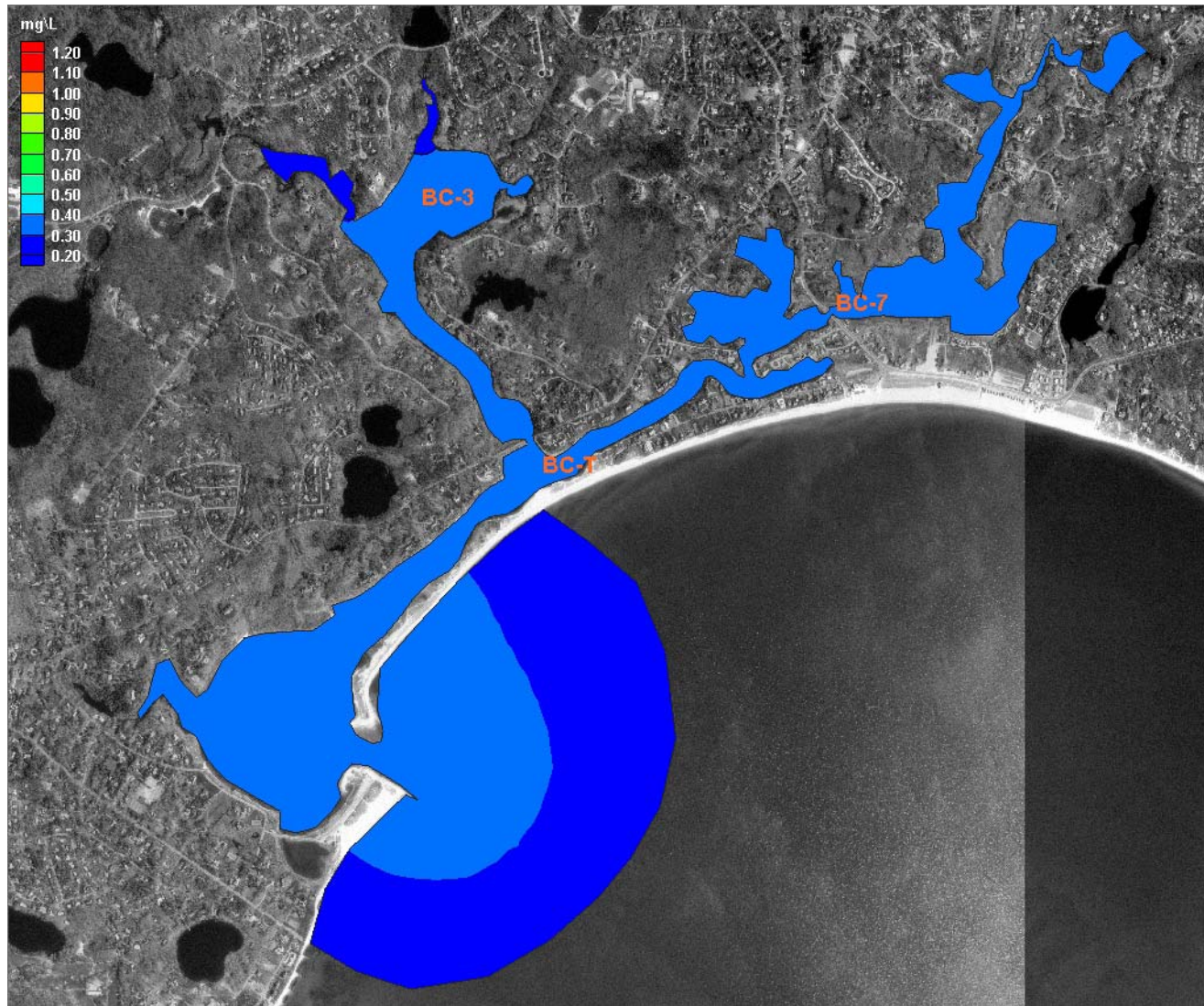
 9.1 % - 38 %

 38.1 % - 62 %

 62.1 % - 86 %

 86.1 % - 100%

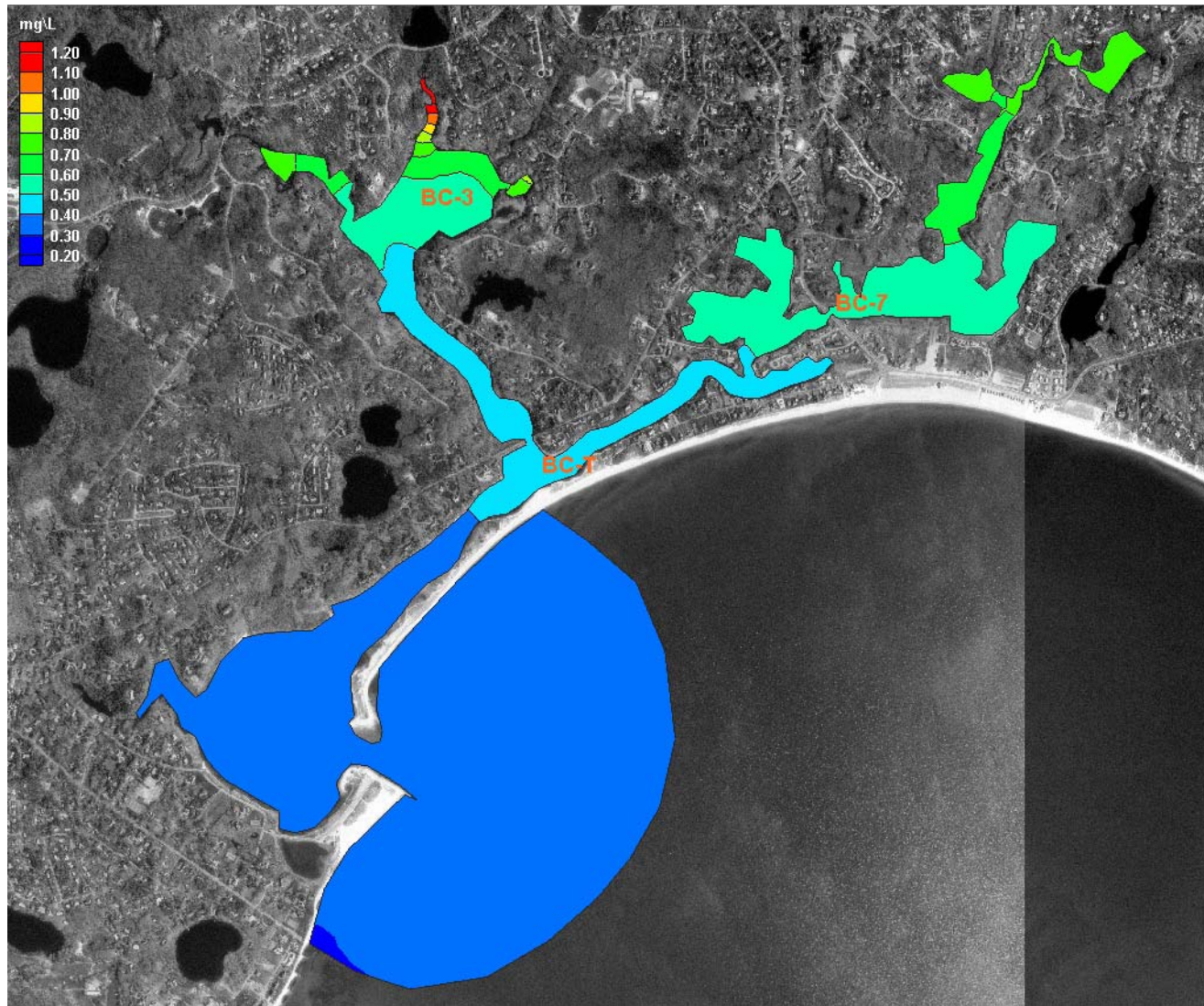




Contour plots of **modeled total nitrogen concentrations (mg/L)** in Centerville River System, for no anthropogenic loading conditions, and bathymetry. The approximate location of the sentinel threshold station for Centerville River System (BC-T) is shown.

(Source: MEP 2006)

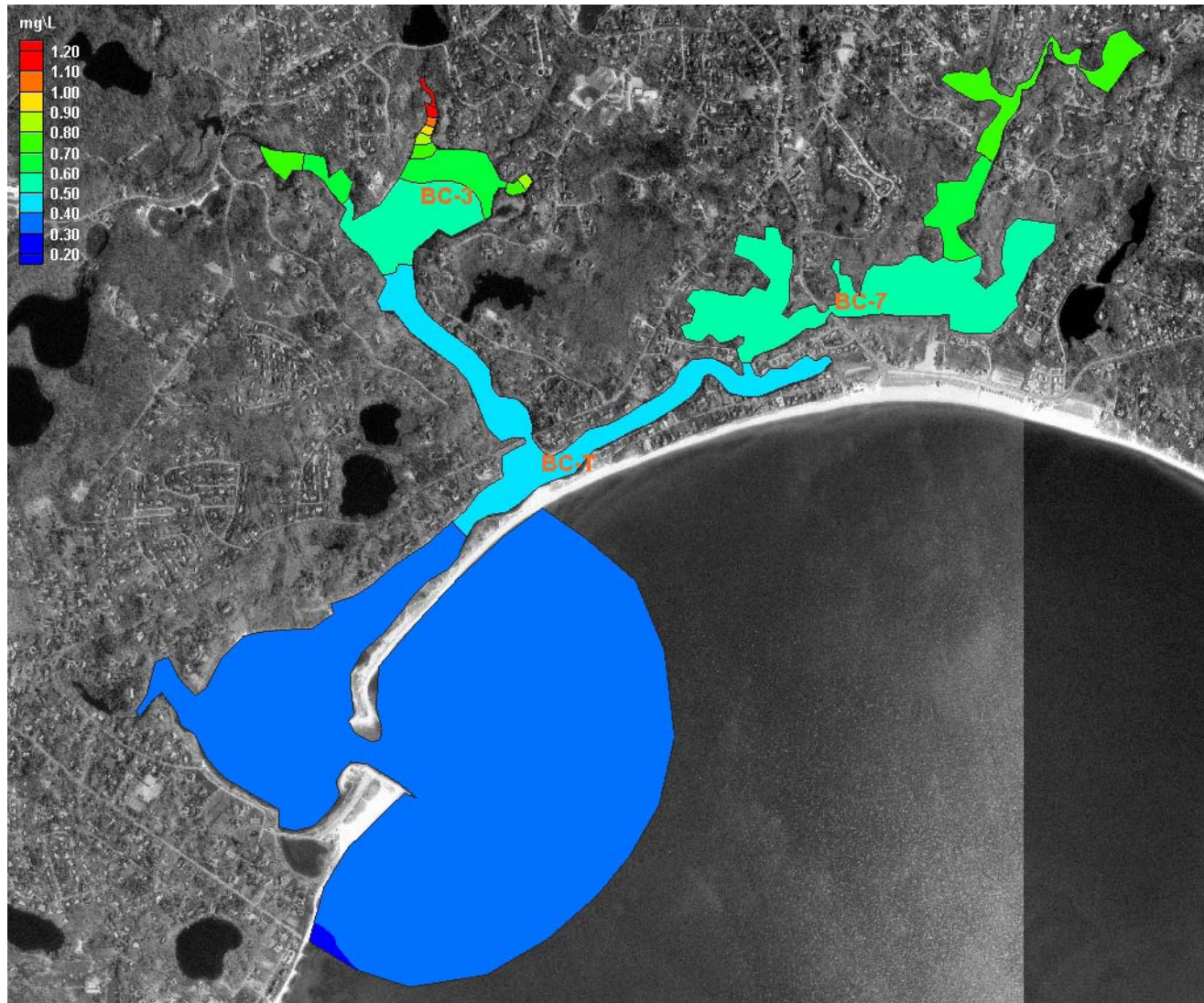
**Pre-Colonial Conditions: Centerville River**



Contour plots of **average total nitrogen concentrations** from results of the present conditions loading scenario, for Centerville River System. The approximate location of the sentinel threshold station for Centerville River System (BC-T) is shown.

(Source: MEP 2006)

## Present Conditions: Centerville River



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

(Source: MEP 2006)

## Build-out Conditions: Centerville River



Contour plots of **modeled total nitrogen concentrations (mg/L)** in Rushy Marsh, for no anthropogenic loading conditions, and bathymetry. The approximate location of the sentinel threshold station for Rushy Marsh (RM2) is shown.

(Source: MEP 2006)

**Pre-Colonial Conditions: Rushy Marsh**



Contour plots of **average total nitrogen concentrations** from results of the present conditions loading scenario and the bathymetry, for Rushy Marsh. The approximate location of the sentinel threshold station for Rushy Marsh (RM2) is shown.

(Source: MEP 2006)

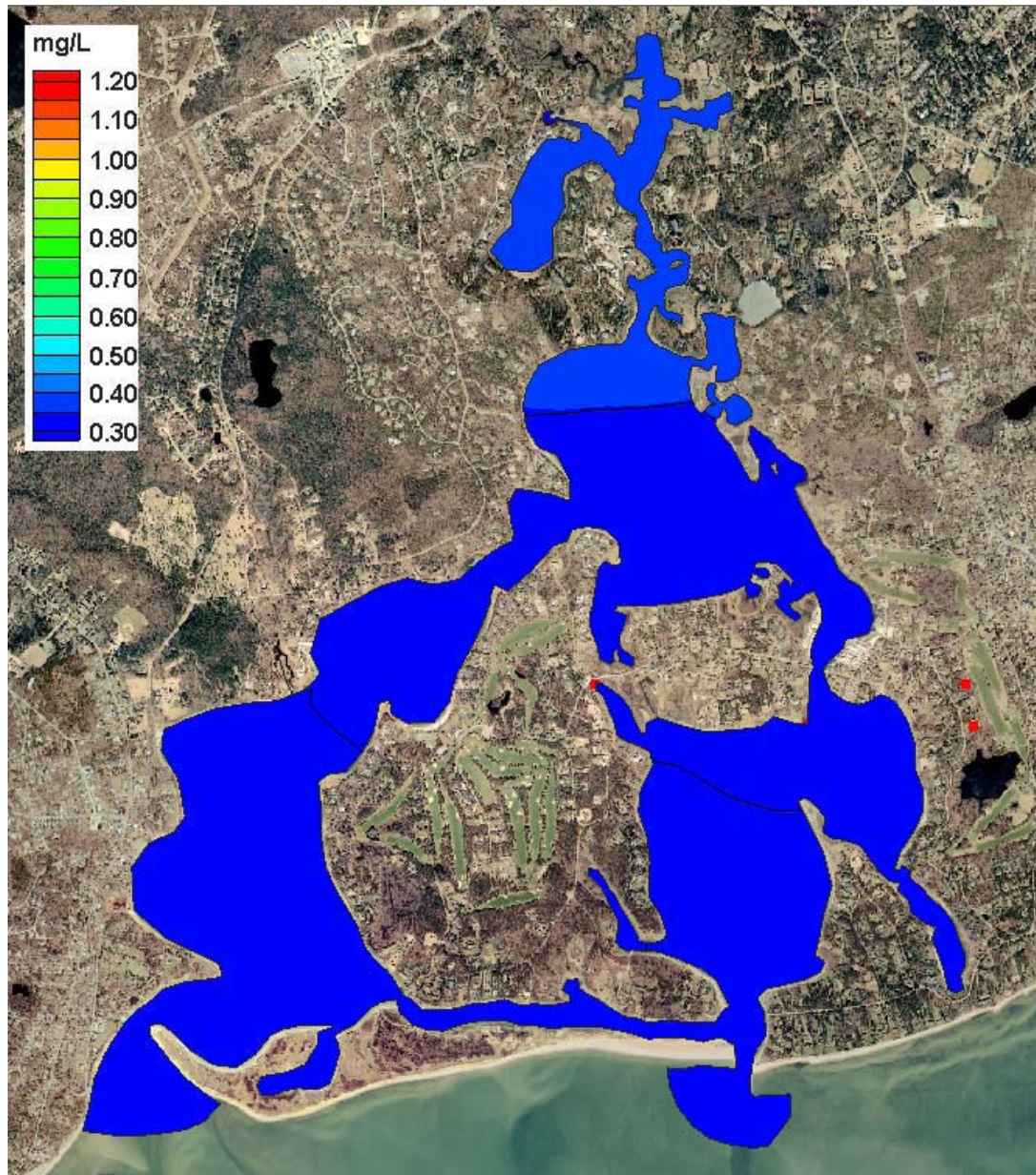
**Present Conditions: Rushy Marsh**



Contour plots of **modeled total nitrogen concentrations (mg/L)** in Rushy Marsh, for projected build-out loading conditions, and bathymetry. The approximate location of the sentinel threshold station for Rushy Marsh (RM2) is shown.

(Source: MEP 2006)

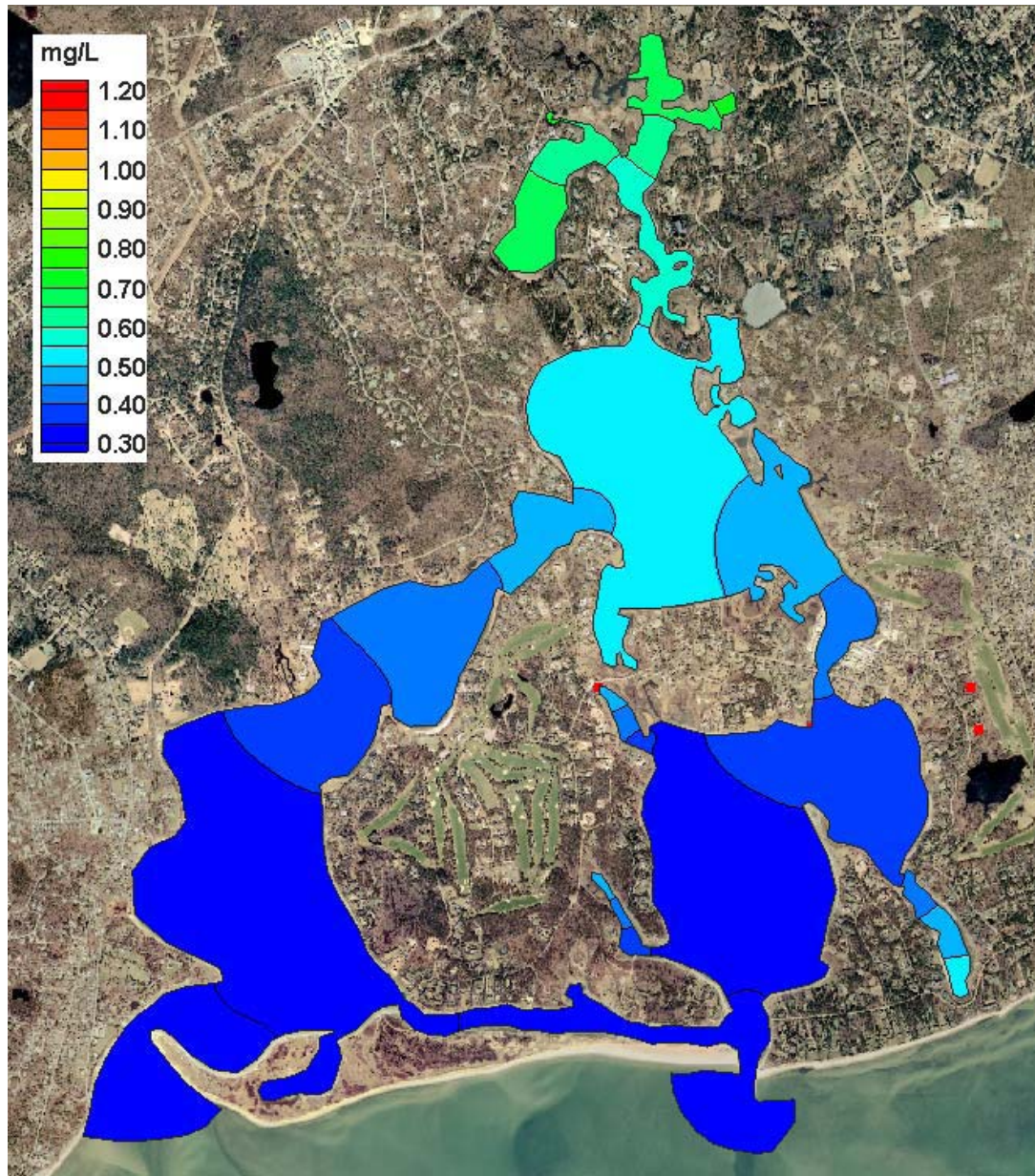
**Build-out Conditions: Rushy Marsh**



Contour plot of **modeled total nitrogen concentrations (mg/L)** in Three Bays, for no anthropogenic loading conditions.

(Source: MEP 2006)

**Pre-Colonial Conditions: Three Bays**

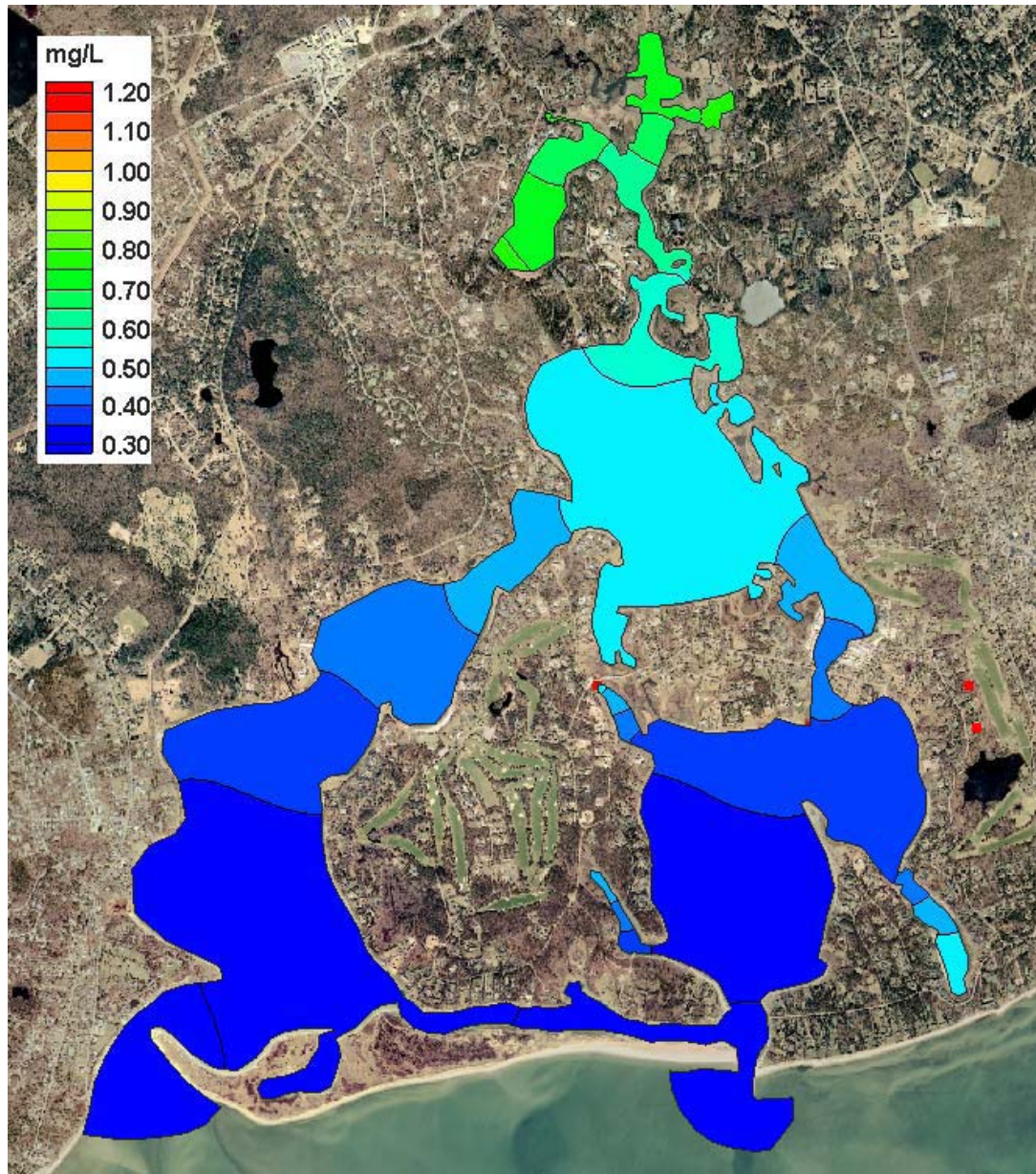


Contour plot of **average total nitrogen concentrations** from results of the present conditions loading scenario, for the Three Bays system.

(Source: MEP 2006)

Present Conditions: Three Bays






Contour plot of modeled **total nitrogen concentrations (mg/L)** in the Three Bays system, for projected build-out loading conditions.

(Source: MEP 2006)

Build-out Conditions: Three Bays


# Nitrogen Problem


## Base Map

 Town Lines


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## Embayment Boundary


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## Major Roads

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## Nitrogen

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-  Significantly Degraded

### Yearly Nitrate Concentration Averages

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






### Embayments with Removal Target

Total NLoad Percent Removal

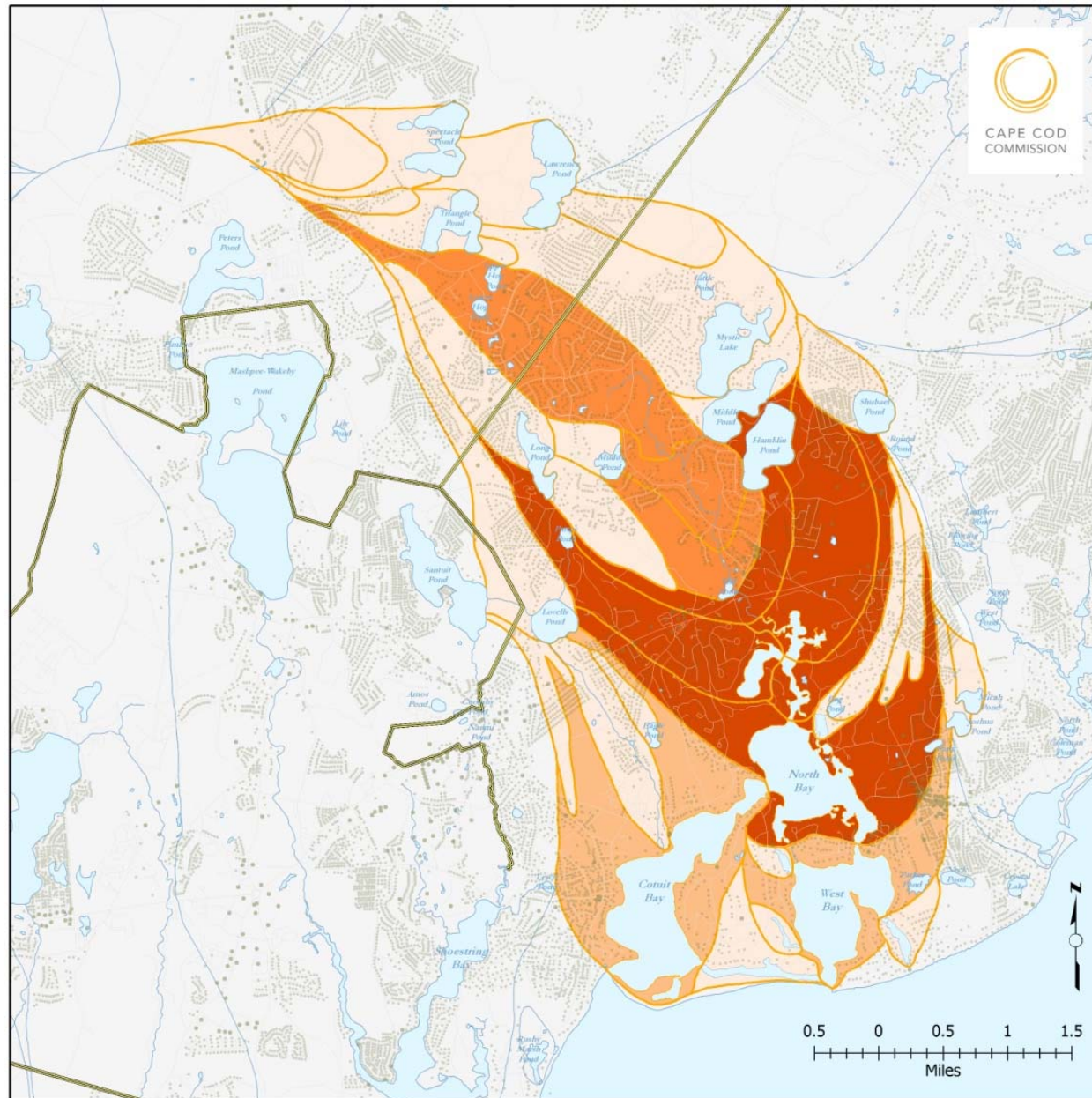
-  0 %
-  1 - 52 %
-  53 - 72 %
-  73 - 86 %
-  87 - 100 %

### Subwatersheds with Removal Target

Total NLoad Percent Removal

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

# Nitrogen Problem




**100% Removal**  
**25% Removal**  
**20% Removal**

Sources: MEP


# 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**




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Centerville River  
Rushy Marsh  
Three Bays


# 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

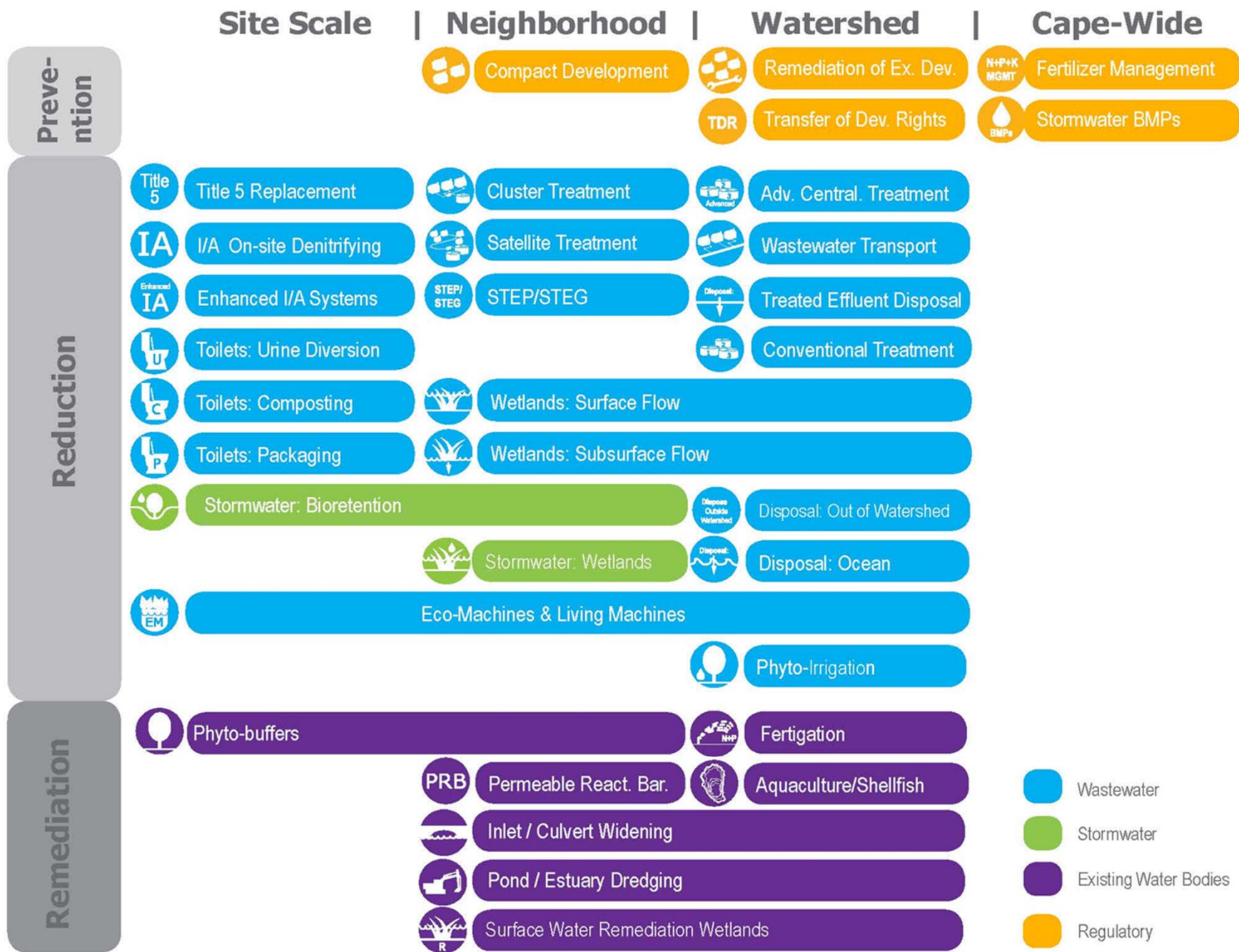
 2041 - 2050



# Framework for Addressing Solutions Moving Forward

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Centerville River  
Rushy Marsh  
Three Bays



- 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



## Supplemental Sewering



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

<http://watersheds.capecodcommission.org/index.php/watersheds/mid-cape/three-bays-centerville-river>

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Centerville River  
Rushy Marsh  
Three Bays