

Popponesset Bay & Waquoit Bay 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

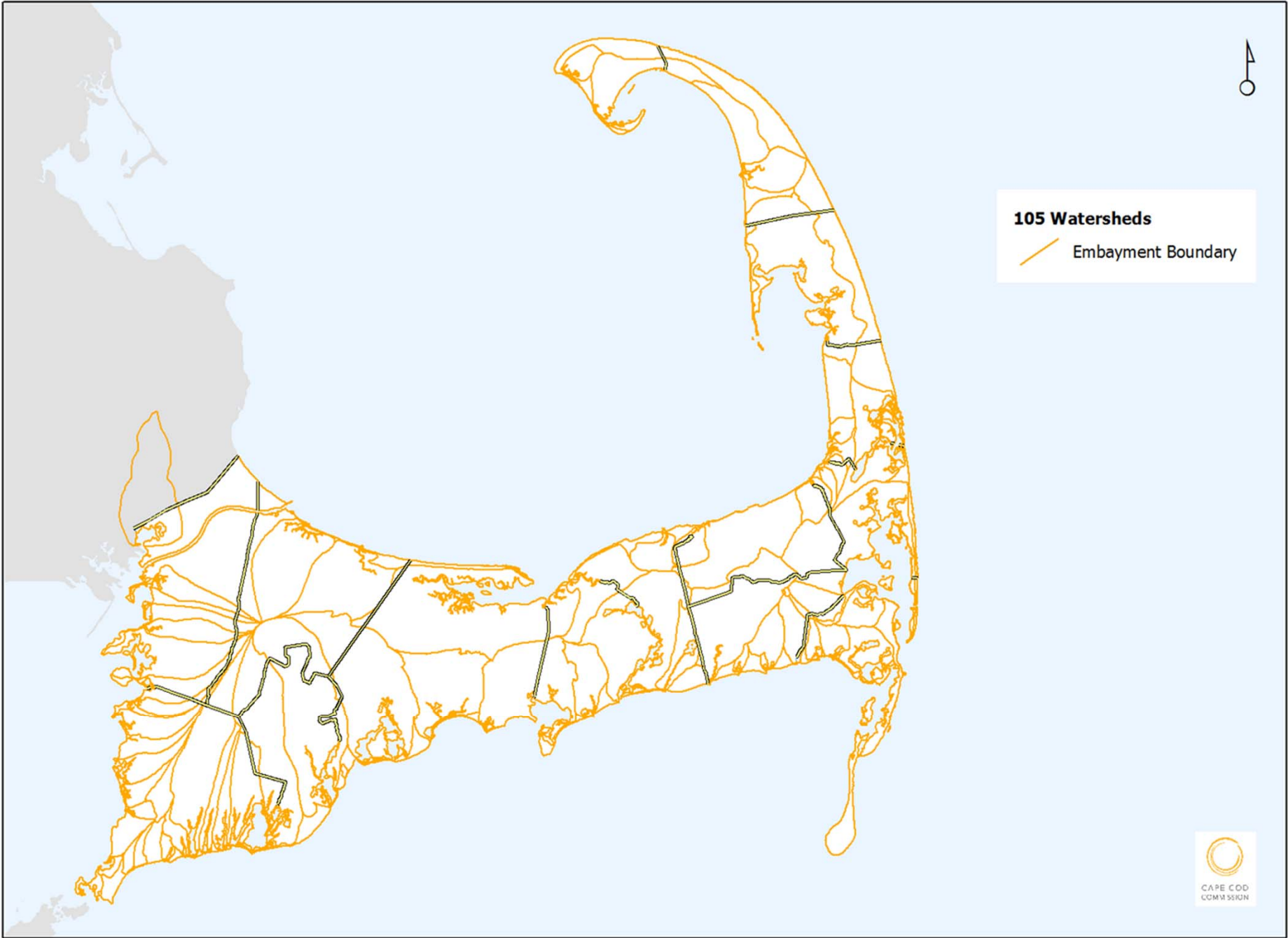
Focus on 21st Century Problems



Nitrogen:
Saline Waters

Phosphorus:
Fresh Waters

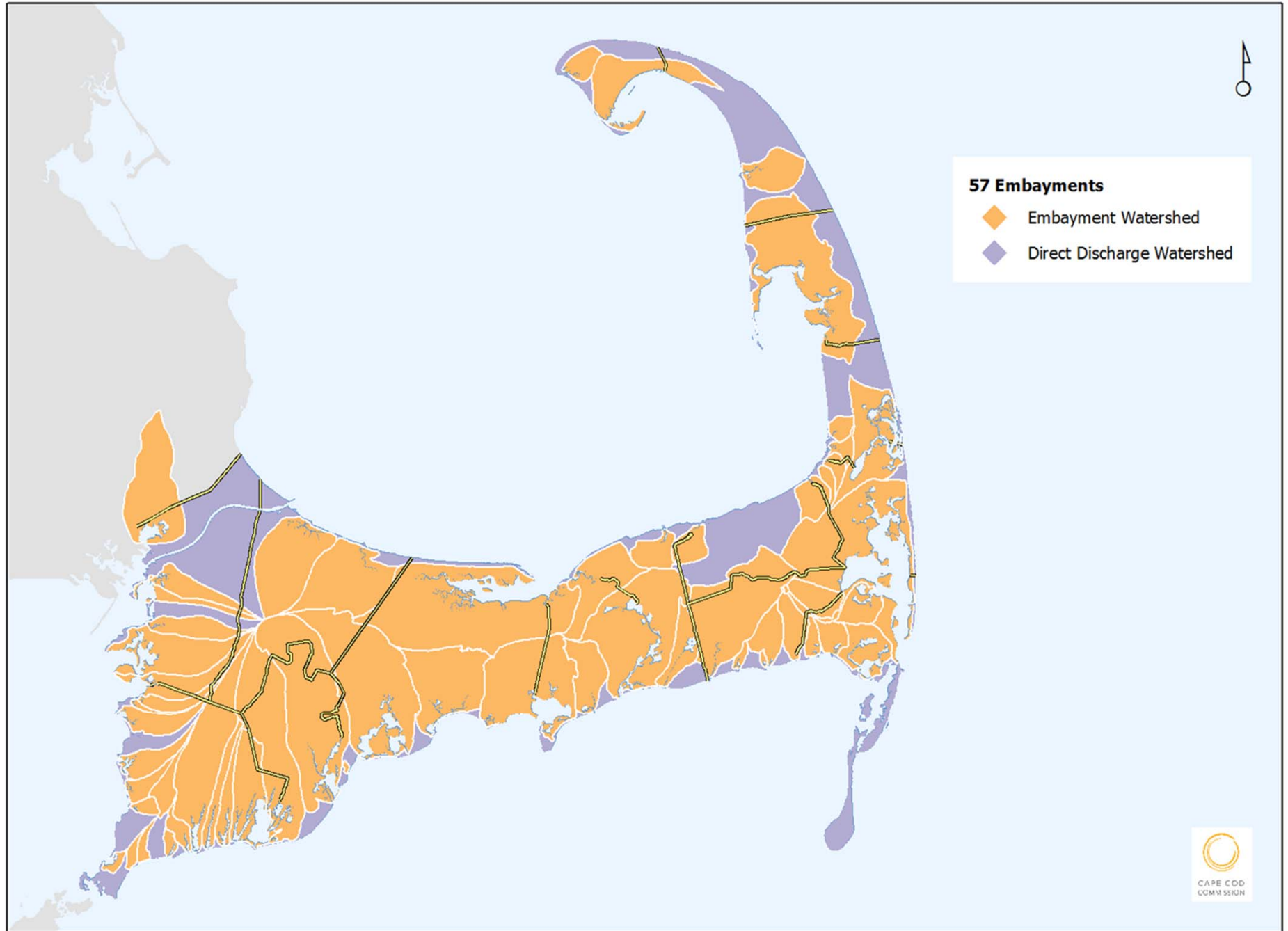
Growth &
Title 5
Limitations



105 Watersheds

— Embayment Boundary

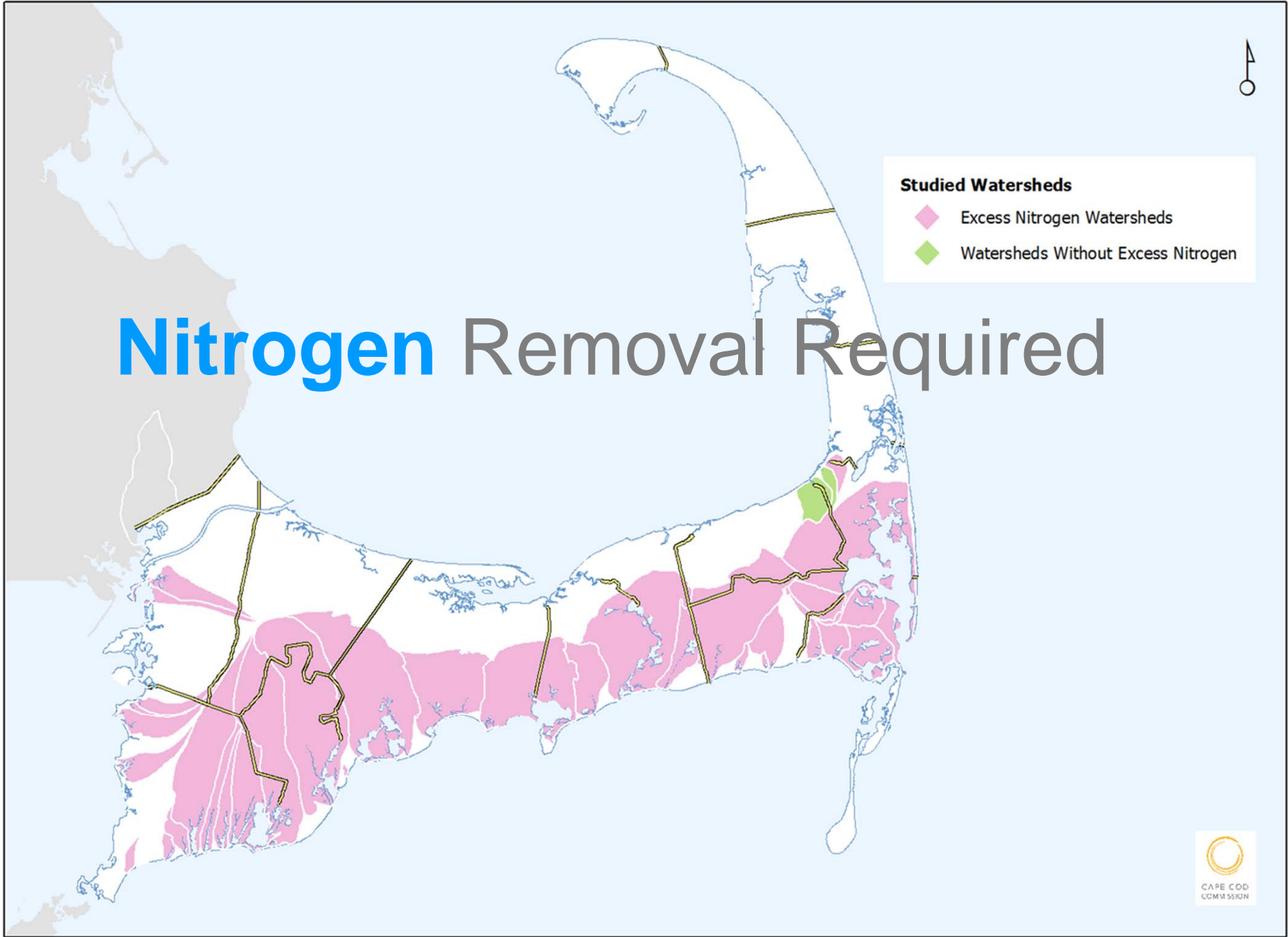


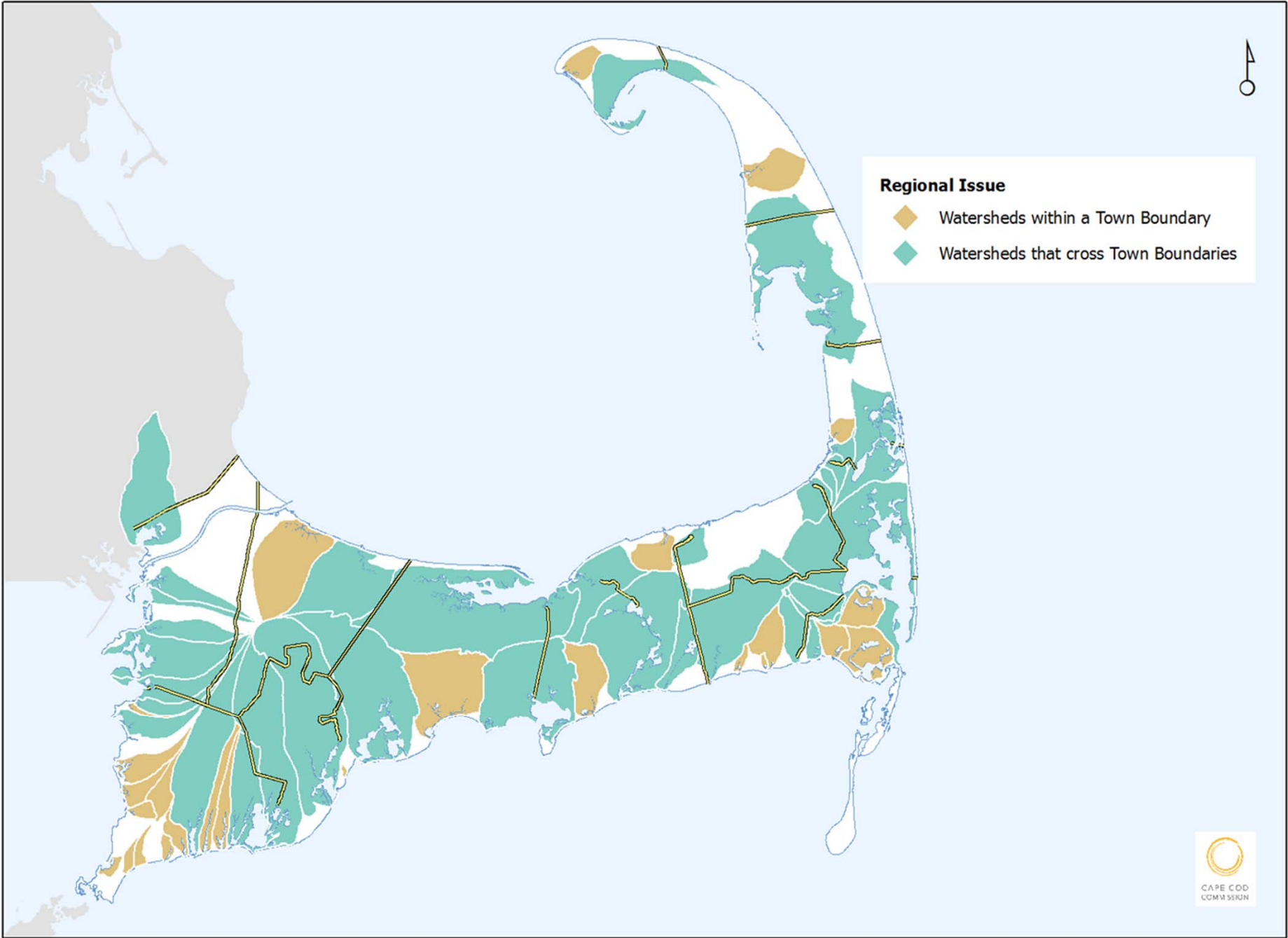


Nitrogen Removal Required

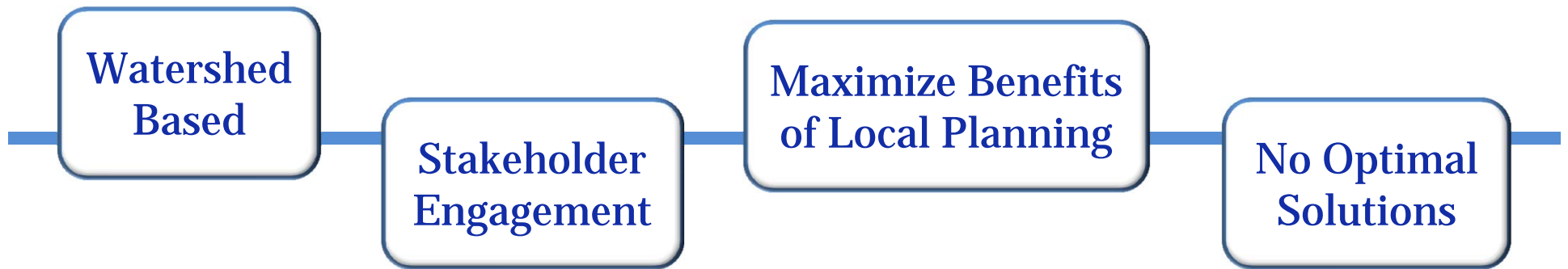
Studied Watersheds

- ◆ Excess Nitrogen Watersheds
- ◆ Watersheds Without Excess Nitrogen





Approach to the 208 Plan Update

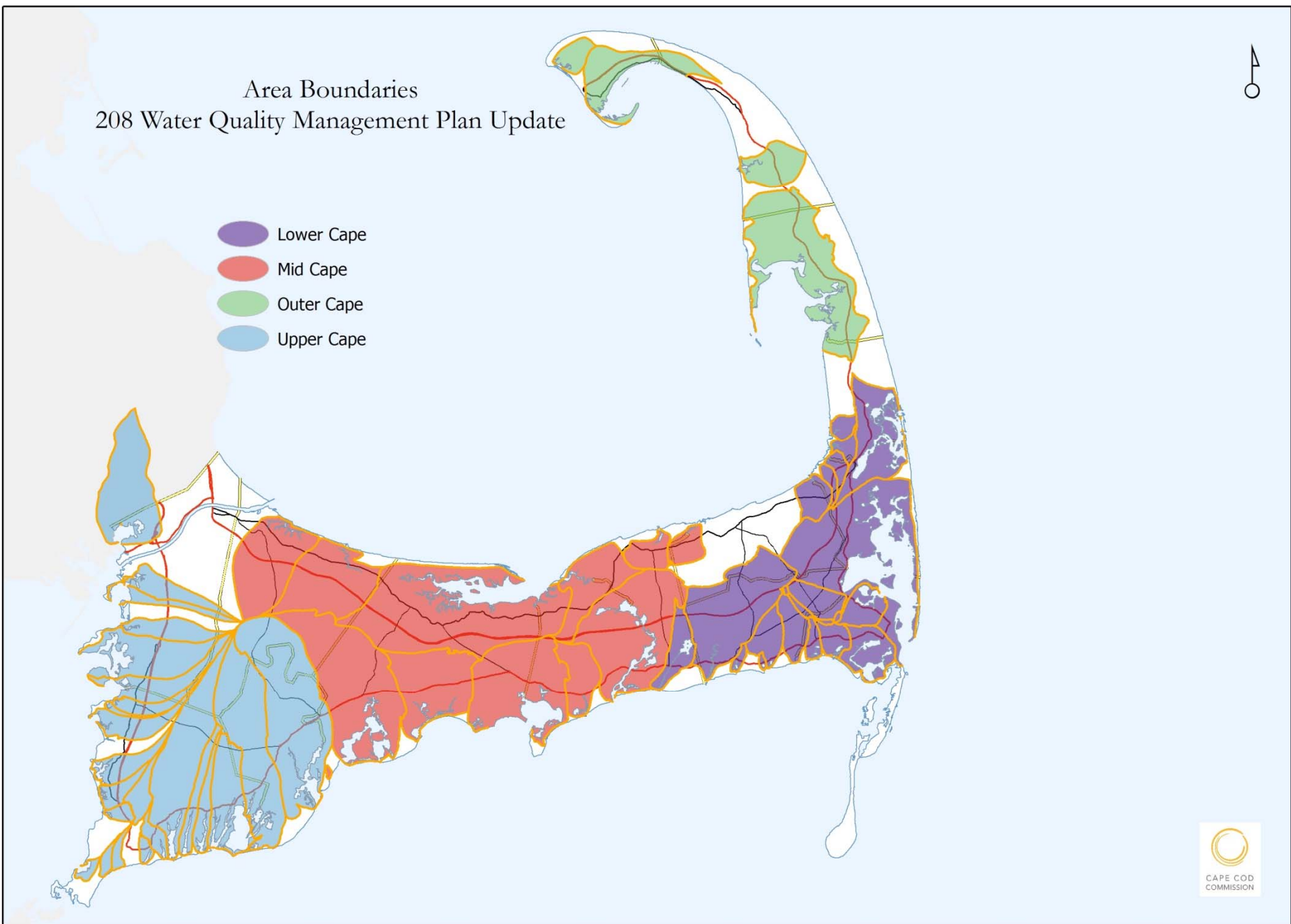


Goal:

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

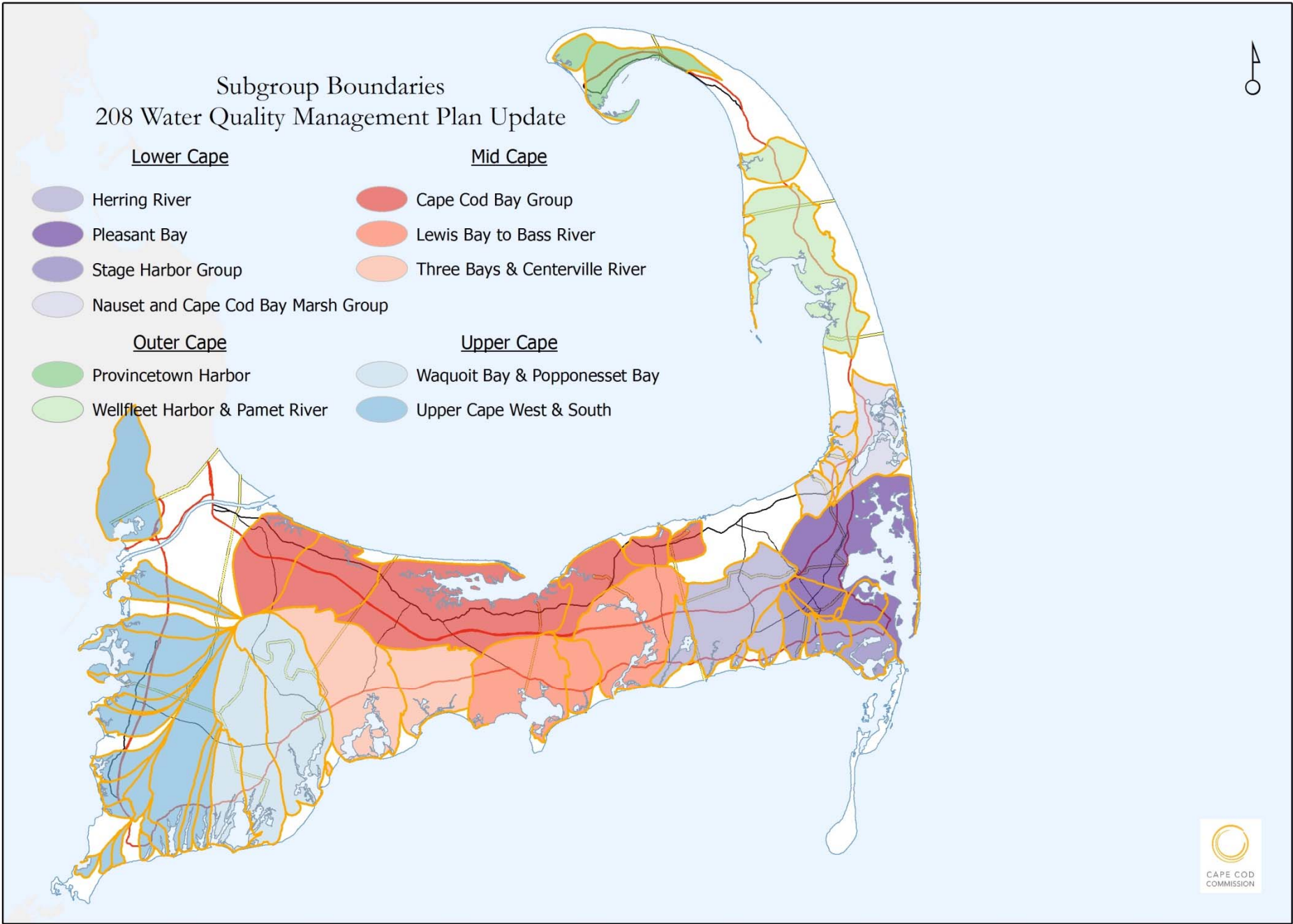
- Cape Cod Bay Group
- Lewis Bay to Bass River
- Three Bays & Centerville River

Outer Cape

- Provincetown Harbor
- Wellfleet Harbor & Pamet River

Upper Cape

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



What is the stakeholder process?

Public Meetings

Watershed Working Groups



July

August

September

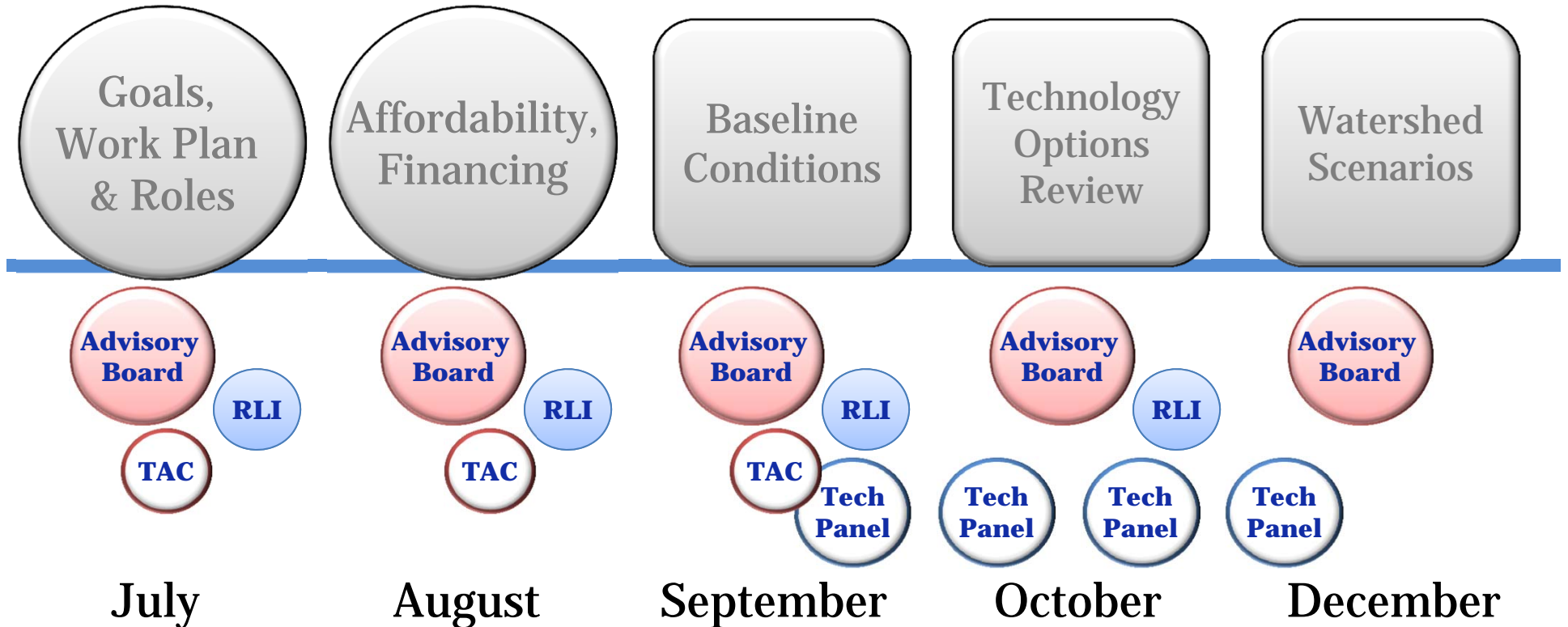
October

December

208 Planning Process

Public Meetings

Watershed Working Groups



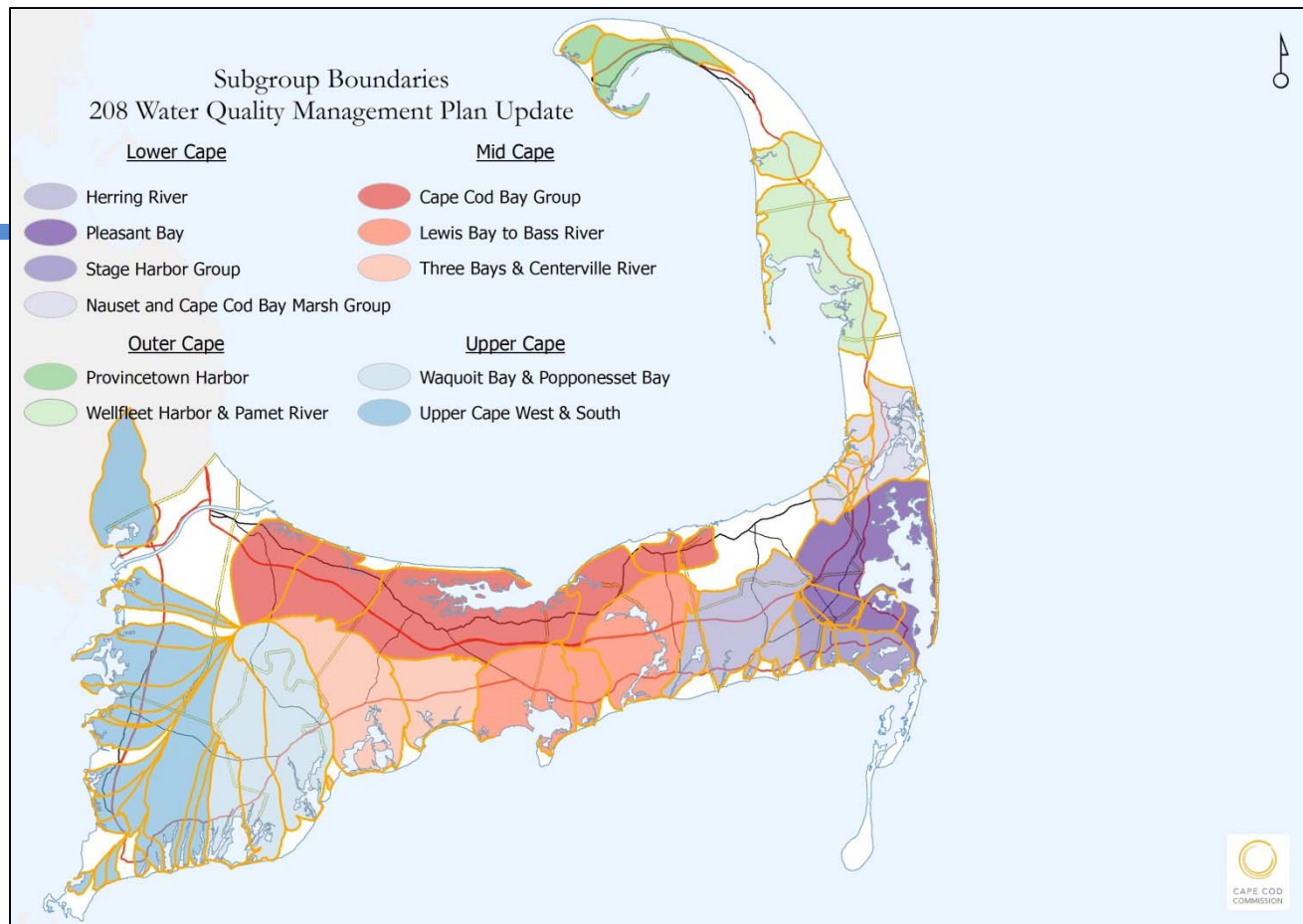
RLI Regulatory, Legal & Institutional Work Group

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

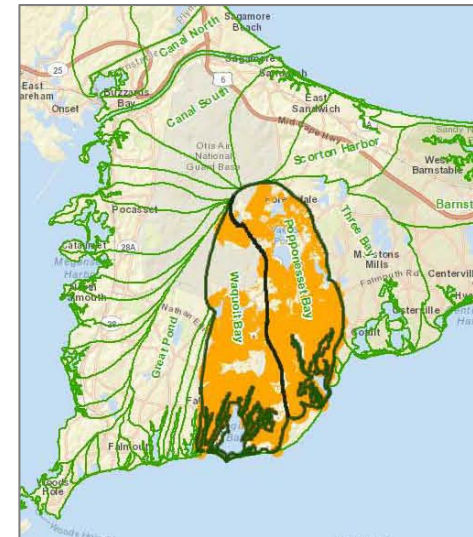
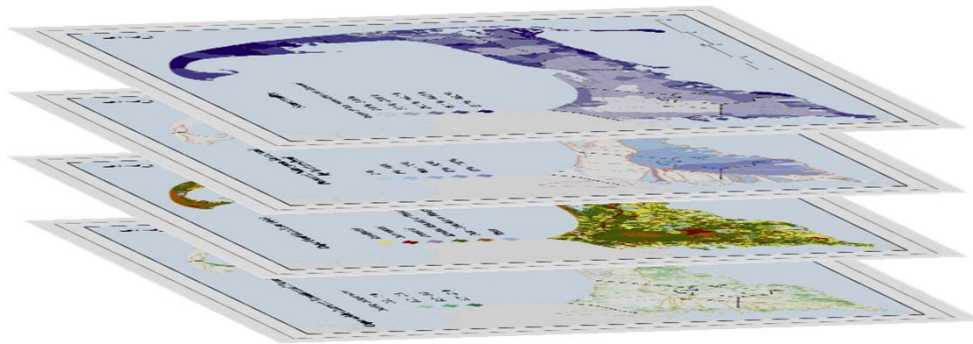
11 Working
Group Meetings:
Sept 18-27

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:

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



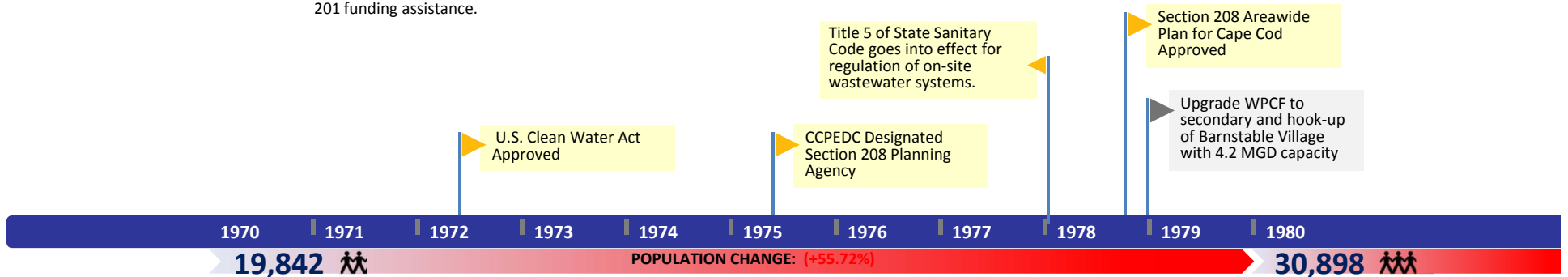
Popponeset Bay
Waquoit Bay

Barnstable: 1970-2013

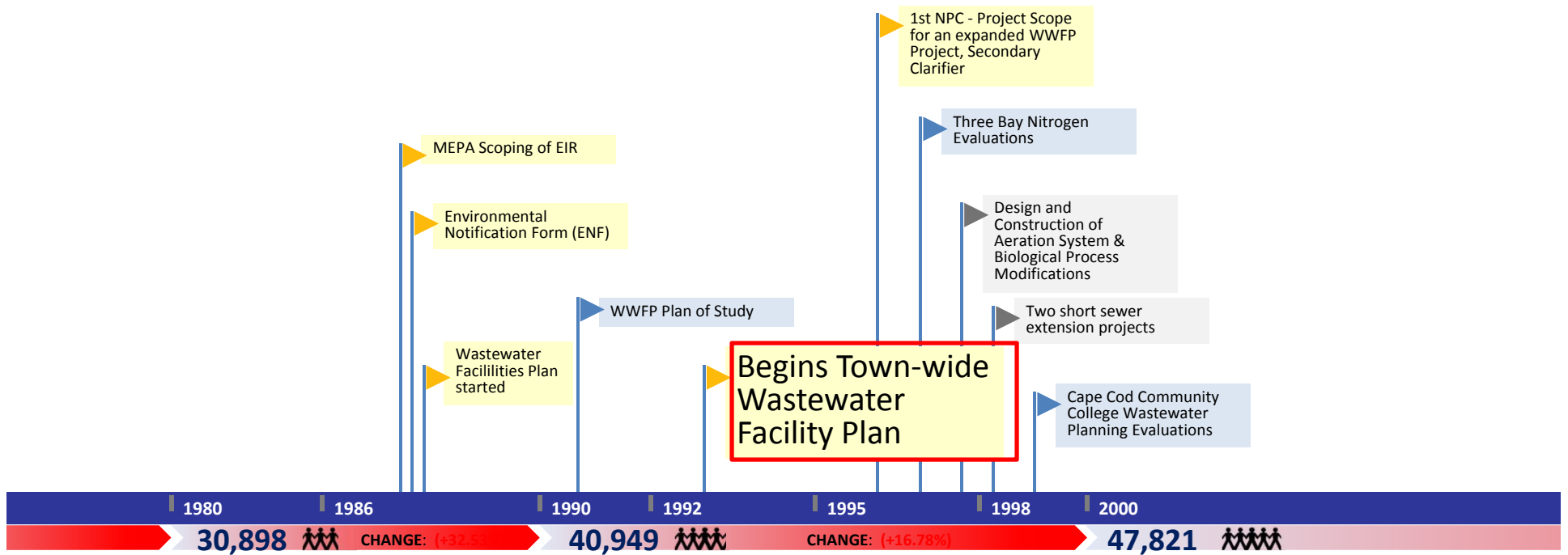
From 1978 Section 208 Plan

- ▶ 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.

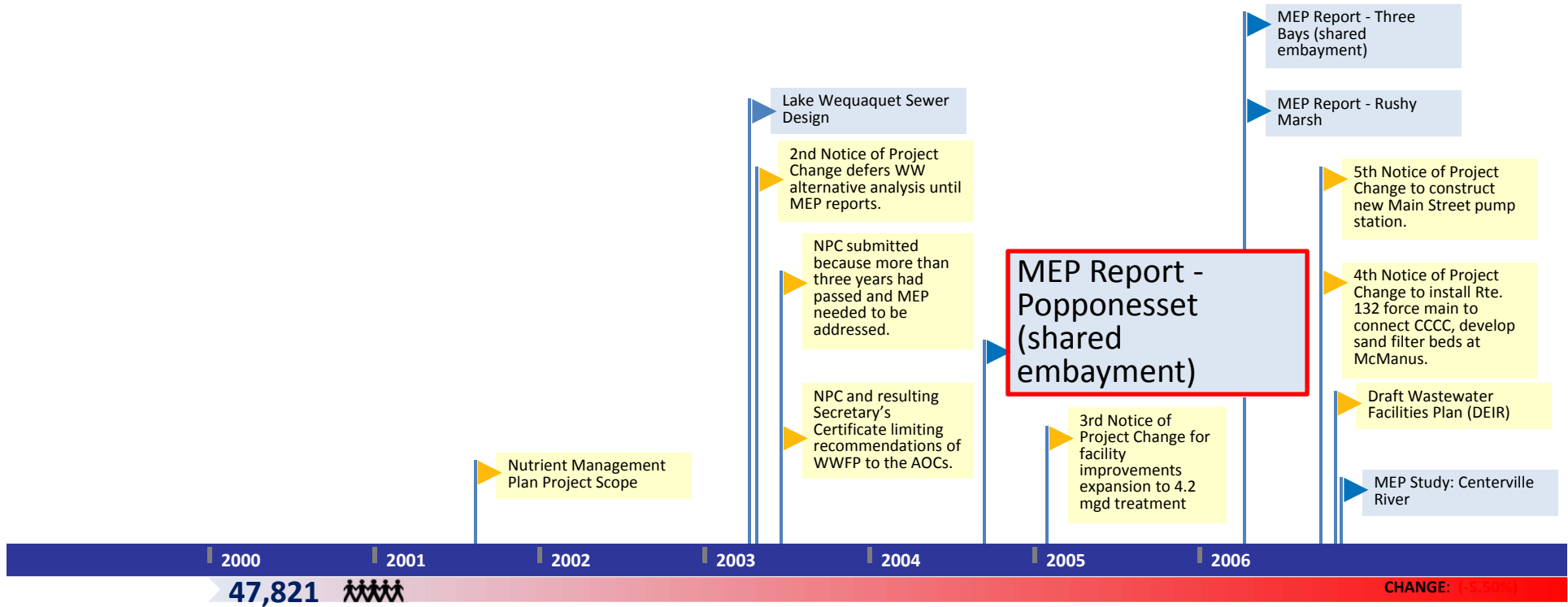
- ▶ The present Hyannis treatment plant has the necessary capacity to handle all sewer service area needs in Hyannis. Should the town want to expand the collection system beyond these sewer service areas, 201 funds will not be available for these expansions or for an additional treatment plant.
- ▶ The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



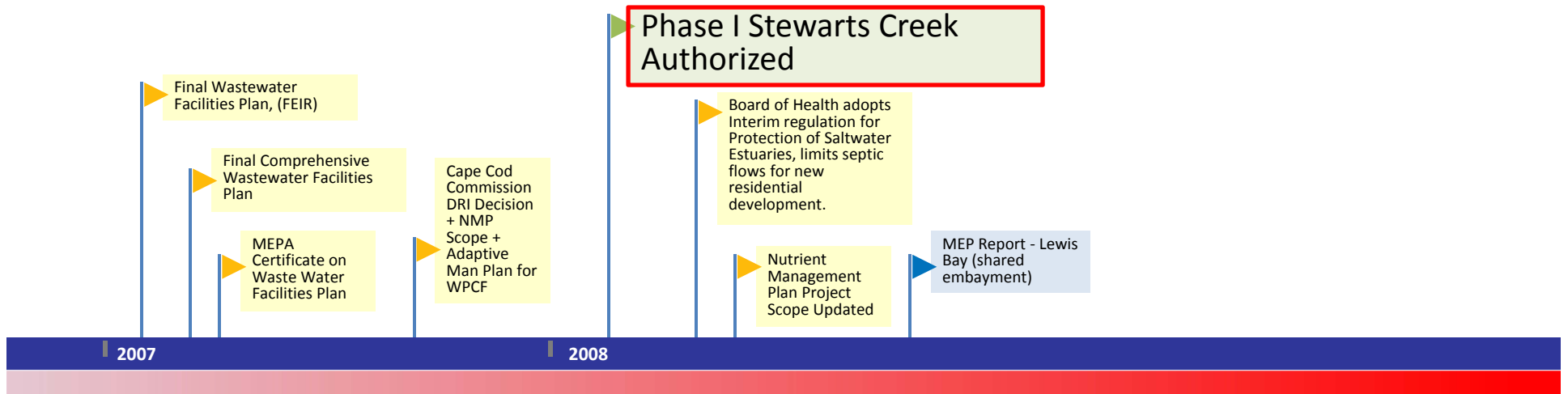
Barnstable: 1970-2013



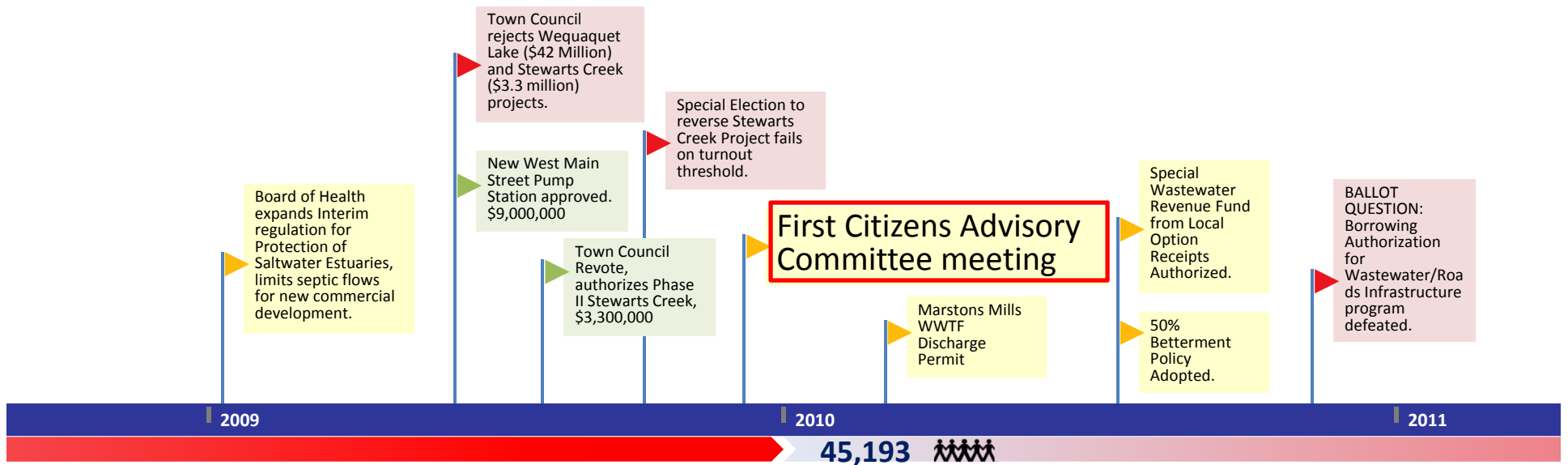
Barnstable: 1970-2013



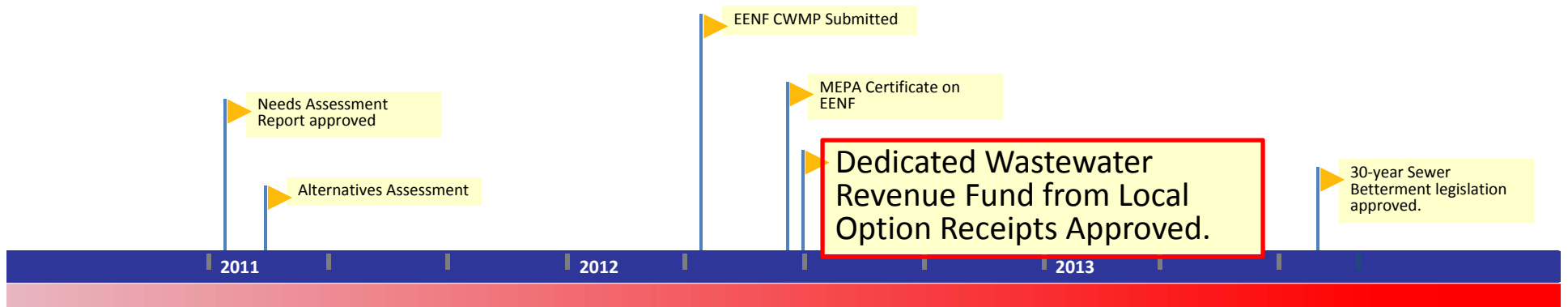
Barnstable: 1970-2013



Barnstable: 1970-2013



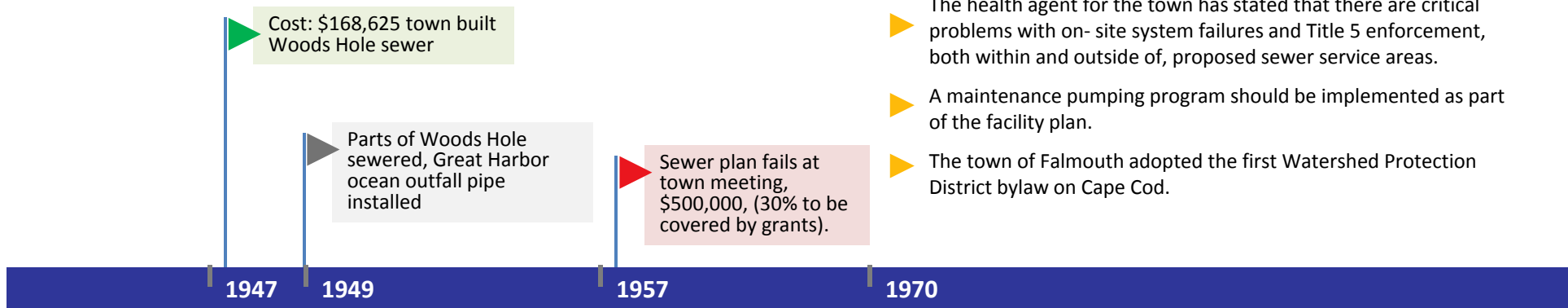
Barnstable: 1970-2013



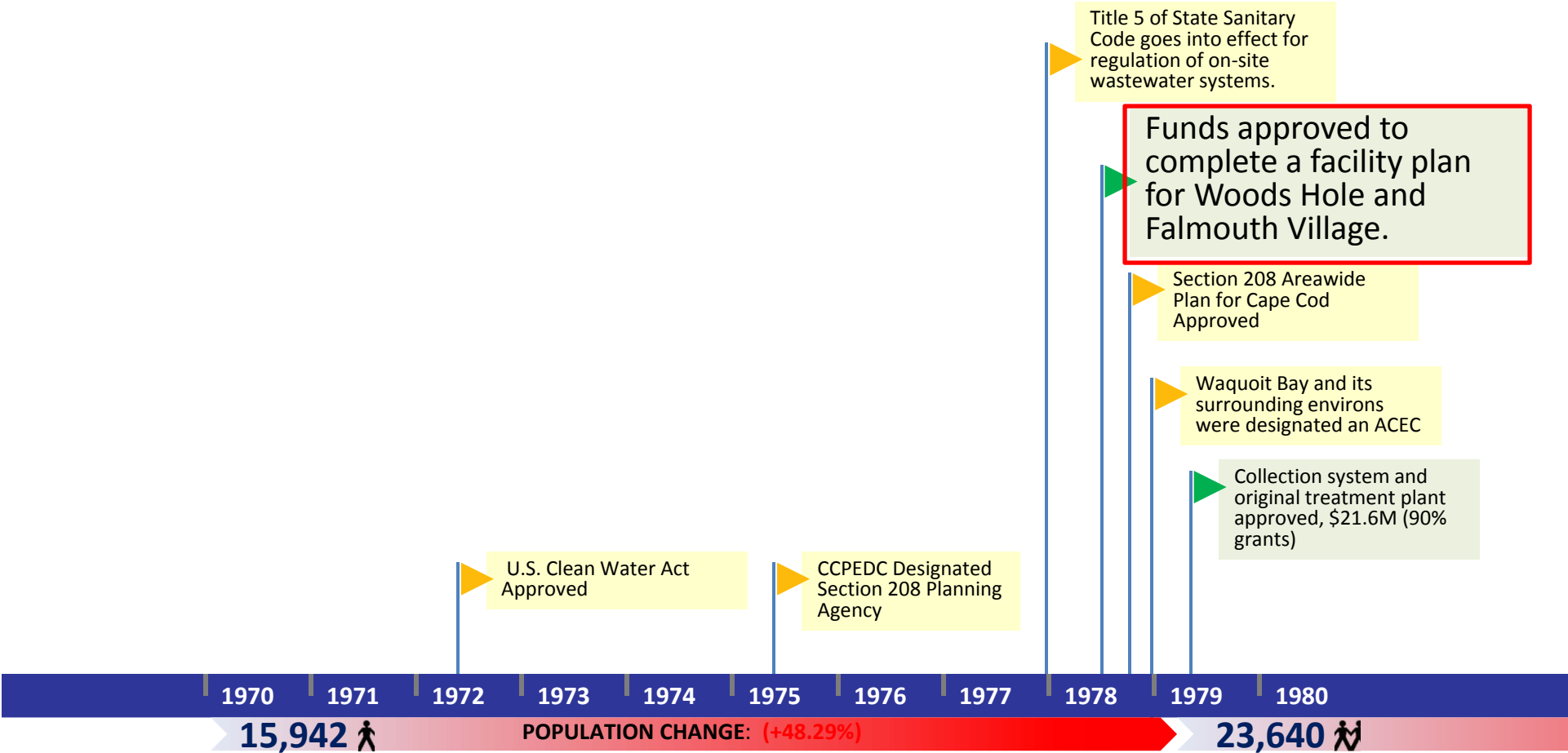
Falmouth

From 1978 Section 208 Plan

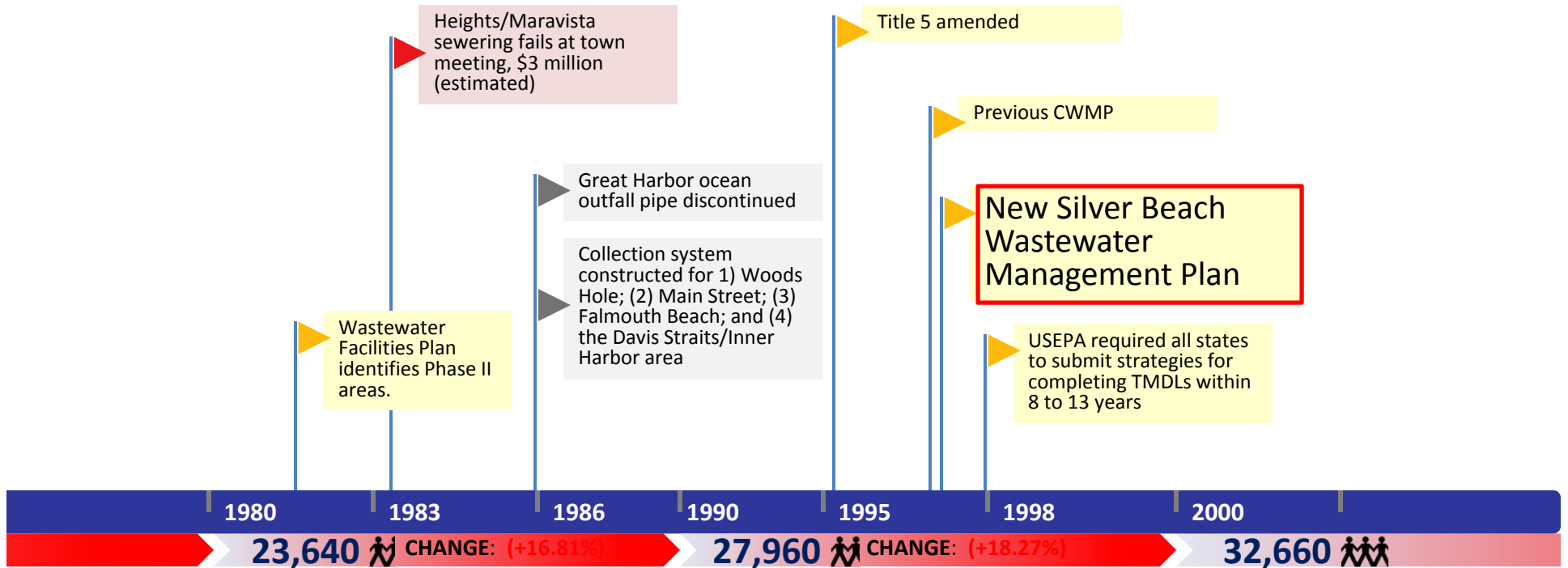
- ▶ Falmouth's difficulties with sewer system planning and construction have a 30 year history. It is strongly recommended that the town appoint a water quality advisory committee.
- ▶ A survey of residents and potential sewer users was conducted in the summer of 1978 to determine whether they would be willing to pay for sewers.
- ▶ The DWPC ordered the town to take immediate action to complete a facility plan for Woods Hole or to begin construction of sewers in downtown Falmouth. Town meeting voted on September 27, 1978 to appropriate additional funds to complete a facility plan for both Woods Hole and Falmouth Village. The plan recommended that DWPC not prosecute the town as long as it is moving in a positive direction towards completion of a comprehensive plan.
- ▶ The plan also recommended that if town meeting action is not taken expeditiously on the final plan recommendations, the DWPC and DEQE should pursue regulatory actions.
- ▶ The health agent for the town has stated that there are critical problems with on- site system failures and Title 5 enforcement, both within and outside of, proposed sewer service areas.
- ▶ A maintenance pumping program should be implemented as part of the facility plan.
- ▶ The town of Falmouth adopted the first Watershed Protection District bylaw on Cape Cod.



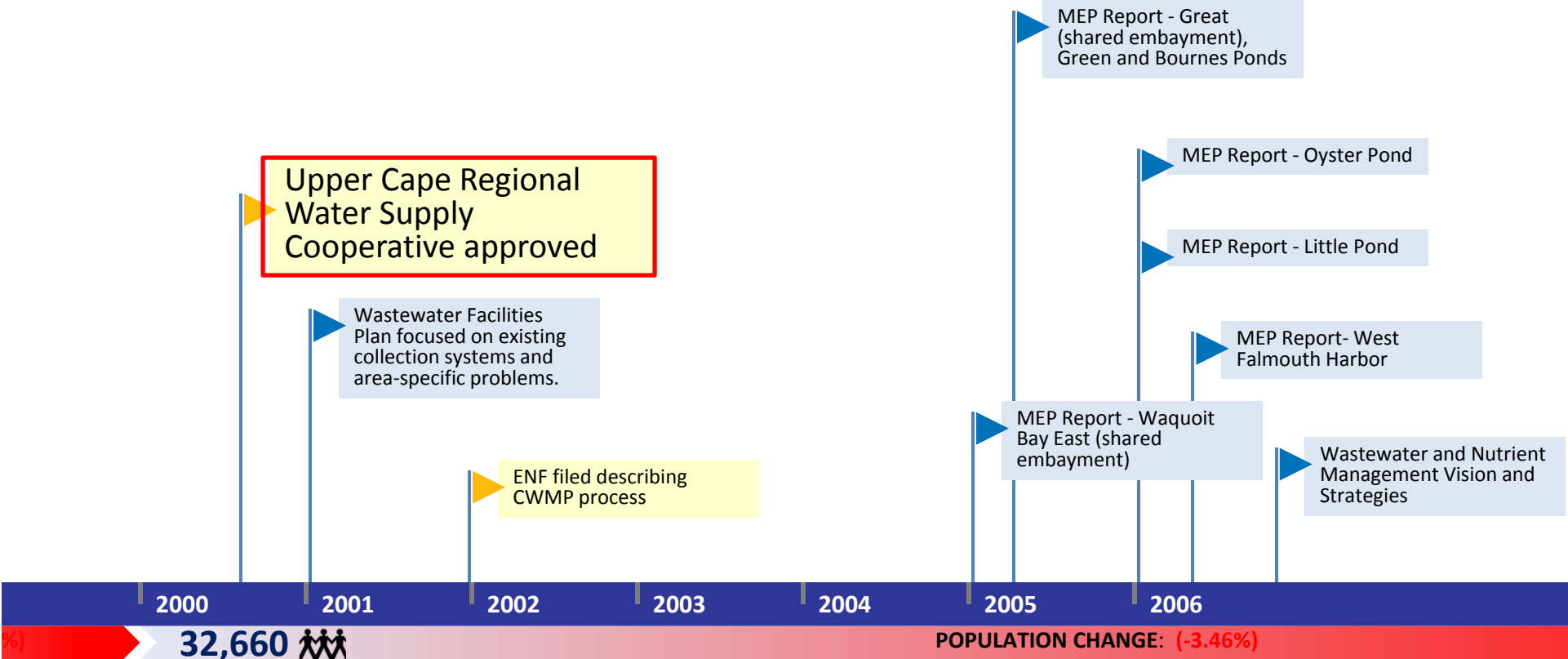
Falmouth: 1947-2013



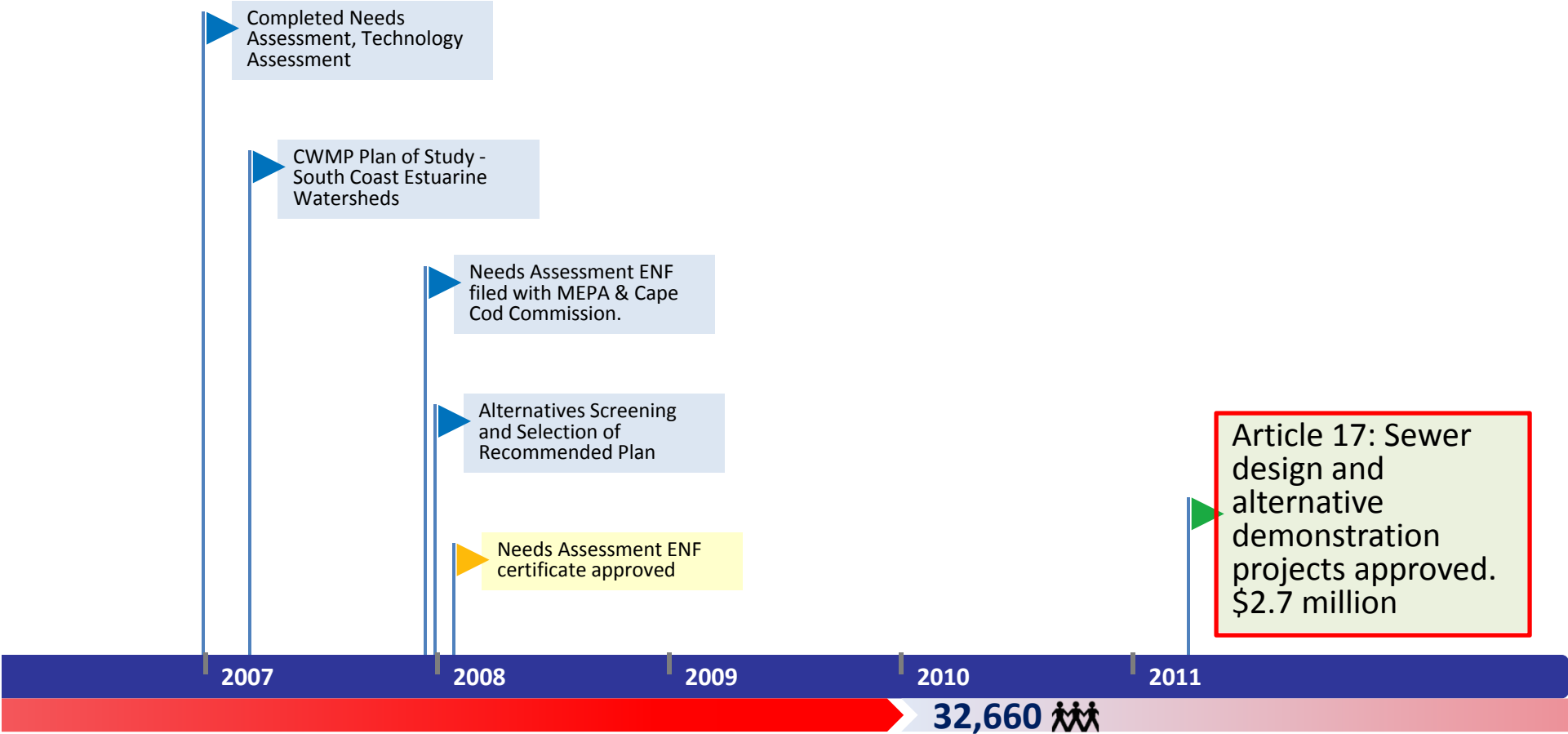
Falmouth: 1947-2013



Falmouth: 1947-2013



Falmouth: 1947-2013



Falmouth: 1947-2013

MEP Report - Wild Harbor
(shared embayment)

MEP Report - Fiddlers
Cove/Rands Harbor
(shared embayment)

MEP Report - Waquoit
Bay West (shared
embayment)

MEP Report - Quissett
Harbor

MEP Report - Falmouth
Inner Harbor

Local Order of Conditions
approved for Shellfish
Demonstration Project

Spring TM approved the
funding for final design of
the following:

Fertilizer Bylaw passed
with legislative approval

Little Pond System Design
approved, \$5.6 million

AG disapproves fertilizer
bylaw as preempted

Town installs oysters in
Little Pond for first year
of Demonstration Project

Town Meeting votes
to evaluate
environmental
impacts of discharge
at Site 7, including
Crocker Pond

Town Meeting
Adopts Nitrogen
Control Bylaw for
fertilizer

State deems Draft
CWMP adequate

Oyster Pond
CWMP
commenced

MEPA Certificate issued
with comments for
FEIR/DRI.

DEIR/DRI filed through
MEPA

Falmouth,
MassDEP, Buzzards
Bay Coalition
Settlement
Agreement over
Groundwater
Discharge Permit.

2012

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.

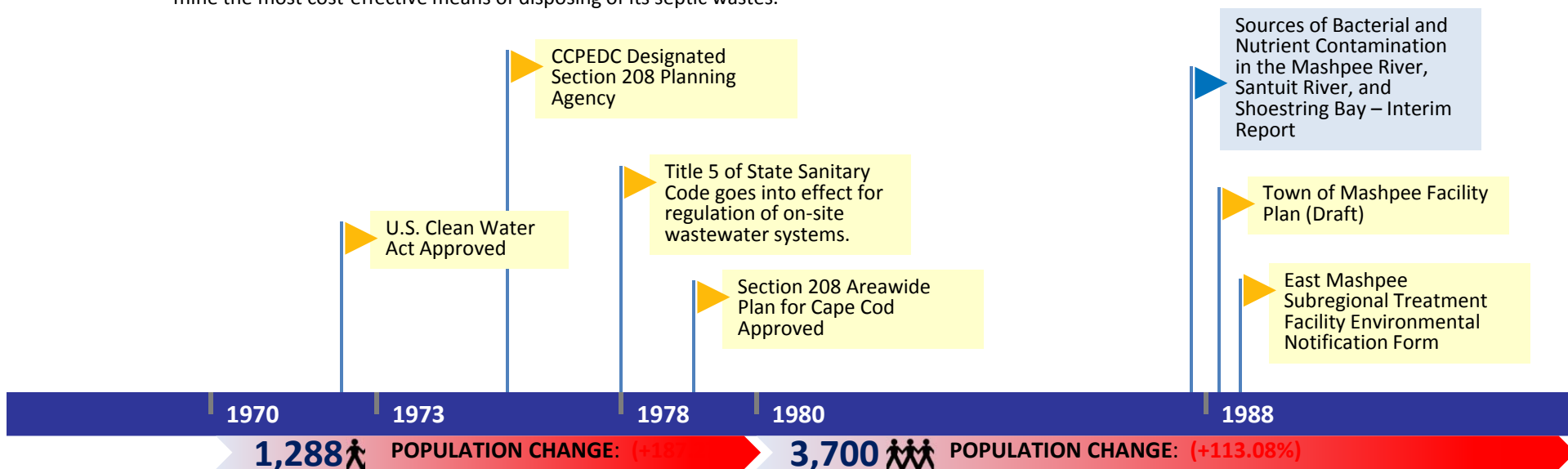
Mashpee should participate in regional septage planning with neighboring towns (Sandwich, Falmouth and Barnstable) to determine the most cost-effective means of disposing of its septic wastes.

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.

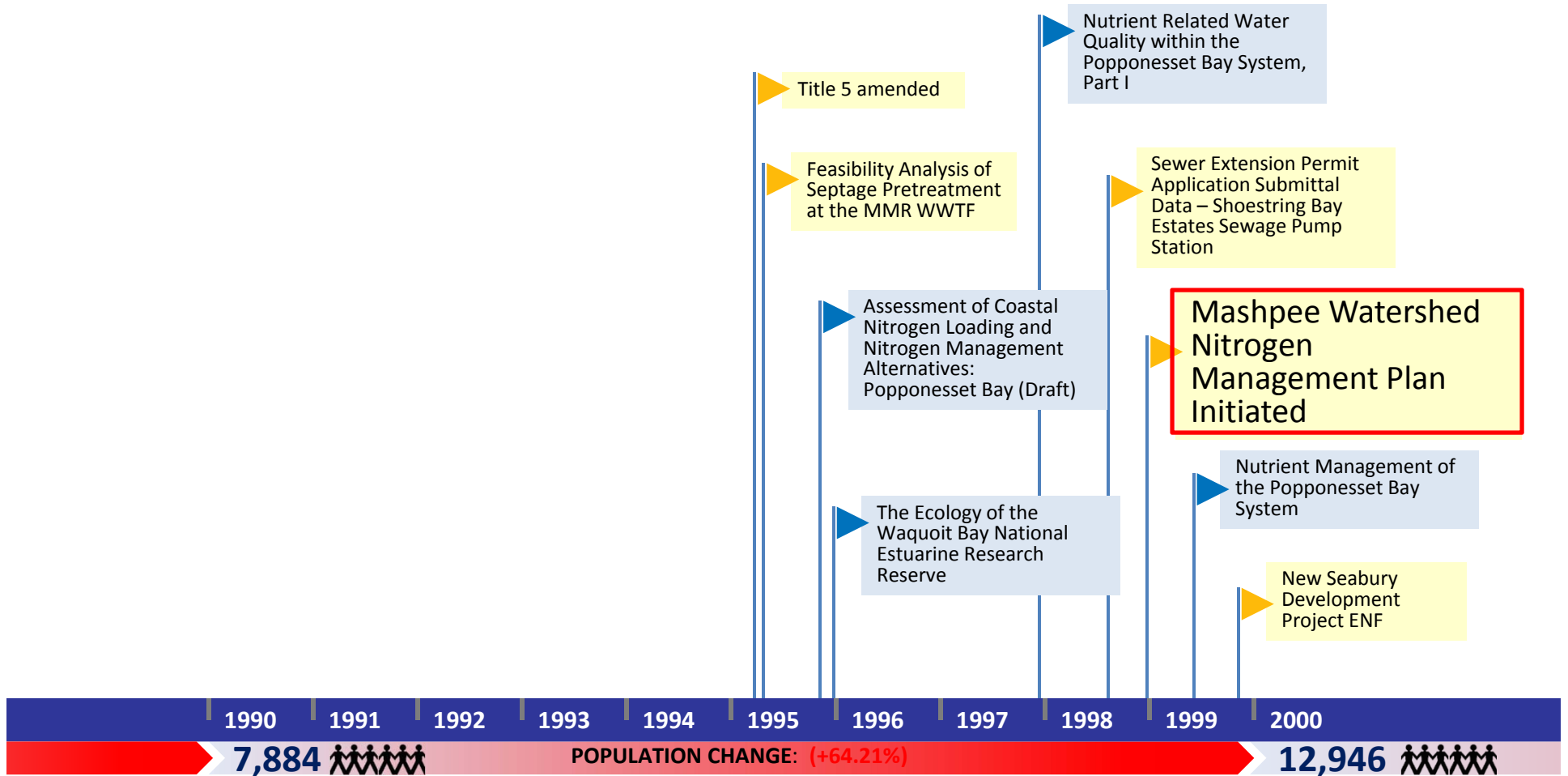
It is further suggested that the town adopt a "Great Pond Protection District" as part of its zoning by-laws to begin such a management program.

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.

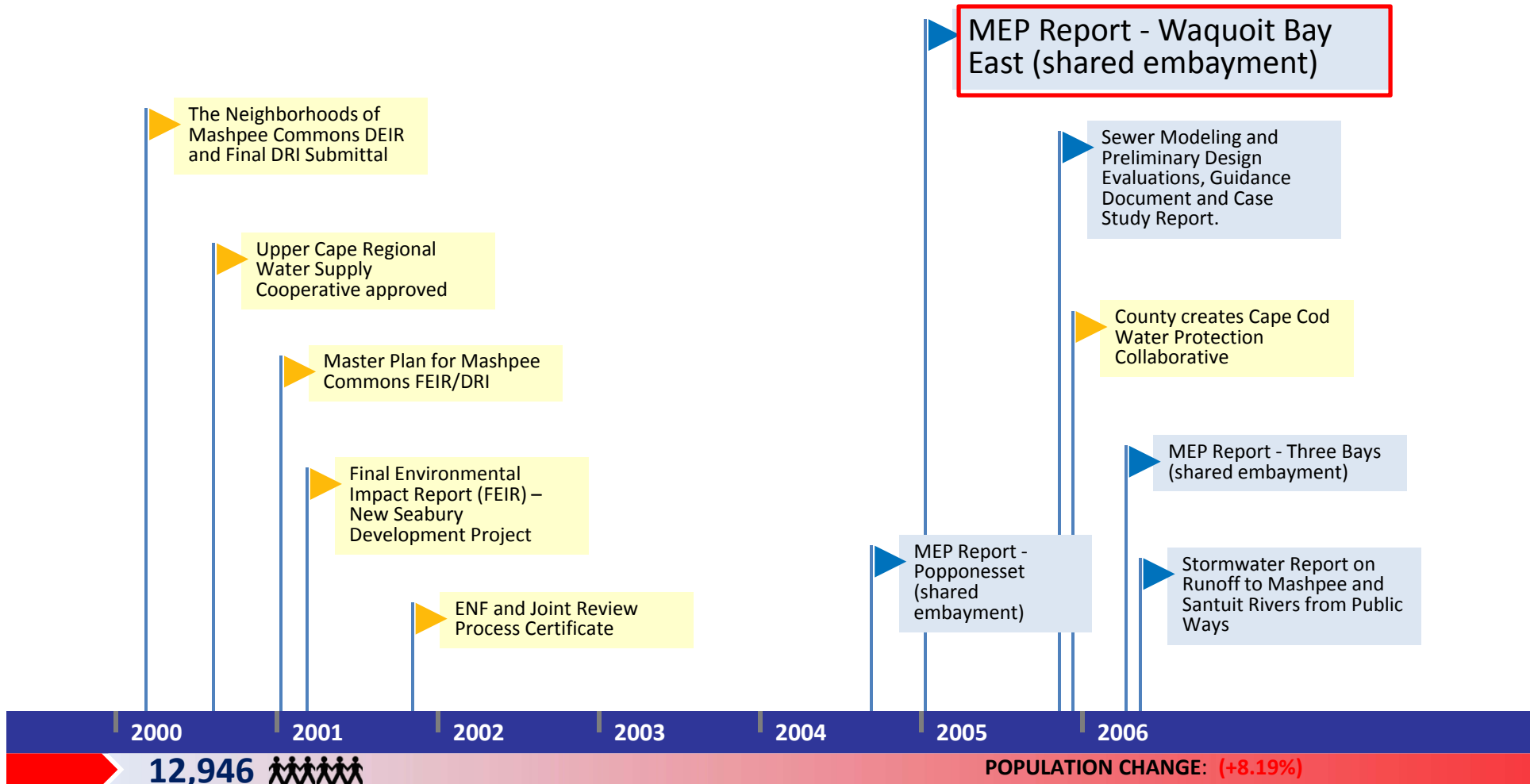


POPULATION: 7,884
(+113.08%)

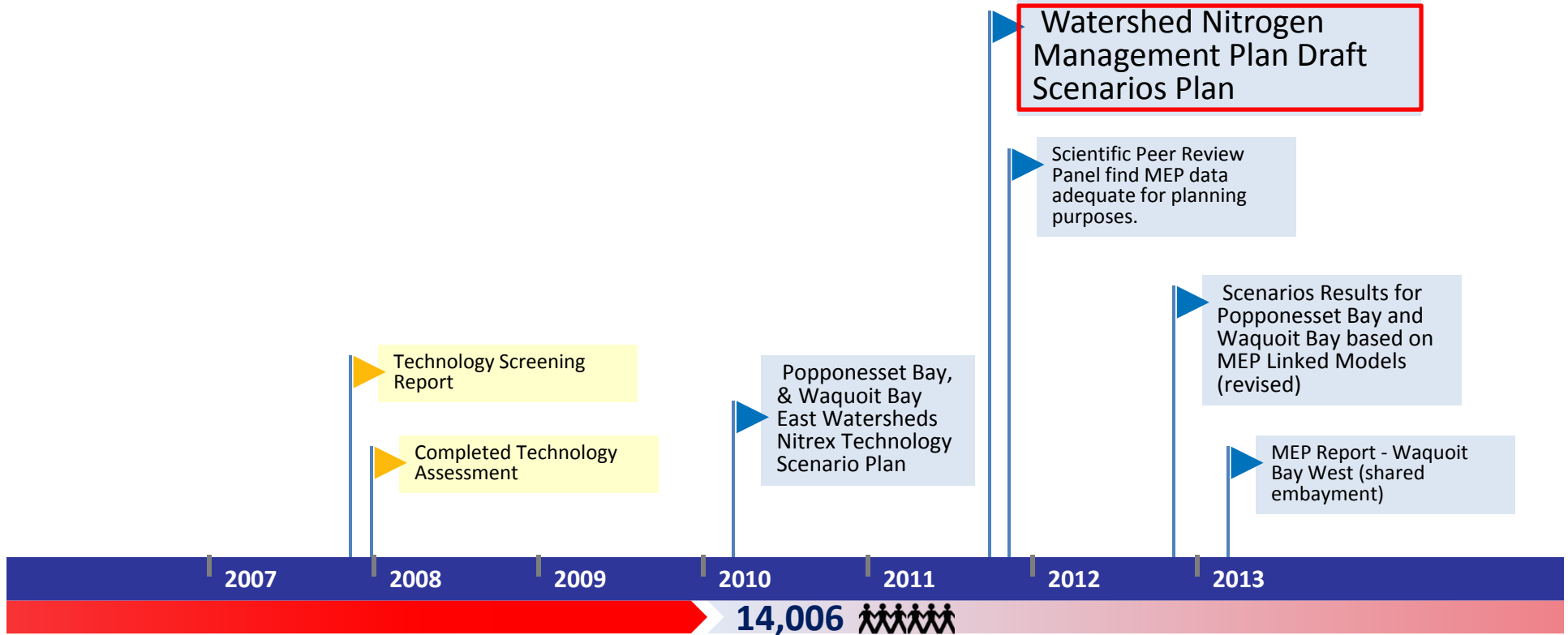
Mashpee: 1970-2013



Mashpee: 1970-2013



Mashpee: 1970-2013



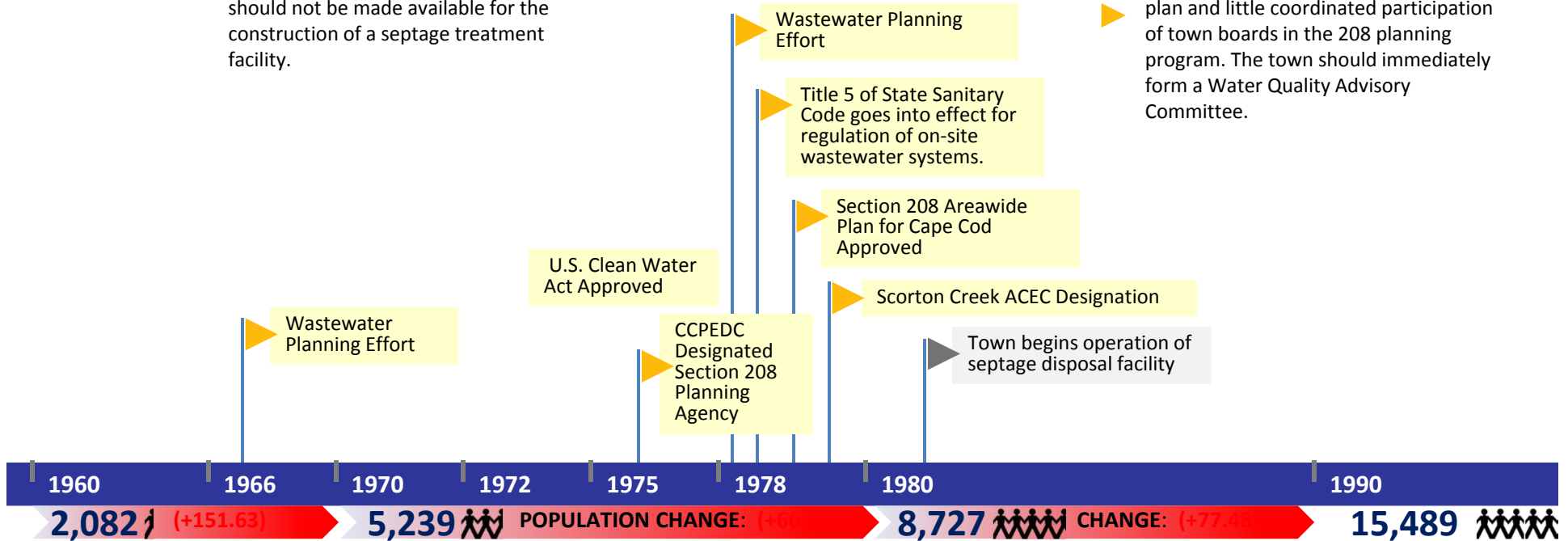
Sandwich

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.

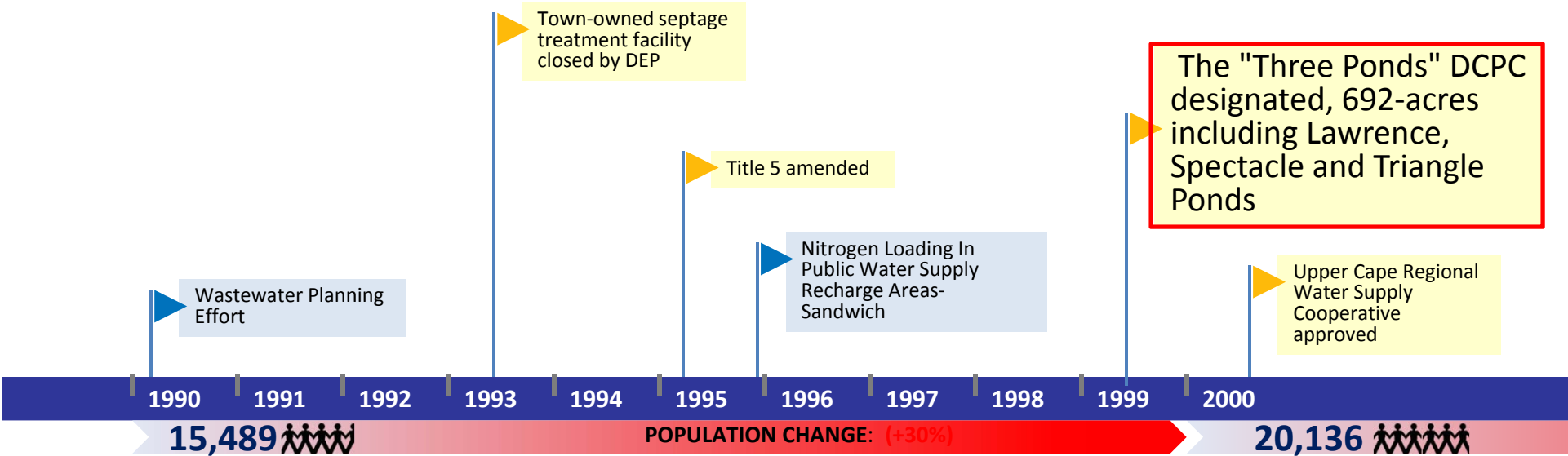
- ▶ The town health agent should strictly enforce Title 5 and should seek additional qualified personnel to implement the 208 recommended on-site systems management program.
- ▶ The town has taken progressive steps to increase lot sizes to at least one acre in most areas of town. The town has indicated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

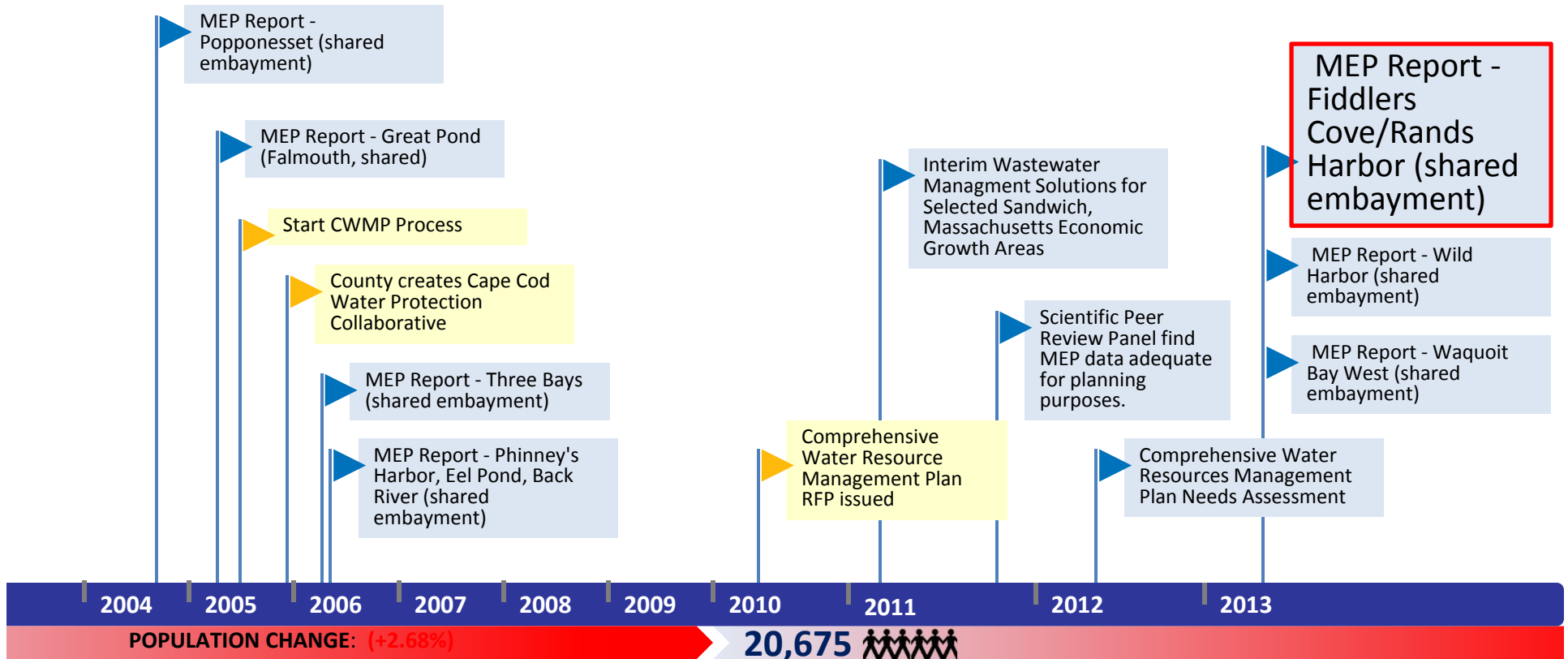


1960 2,082 (+151.63) 1970 5,239 POPULATION CHANGE: (+60.0%) 1980 8,727 CHANGE: (+77.4%) 1990 15,489

Sandwich: 1960-2013



Sandwich: 1960-2013

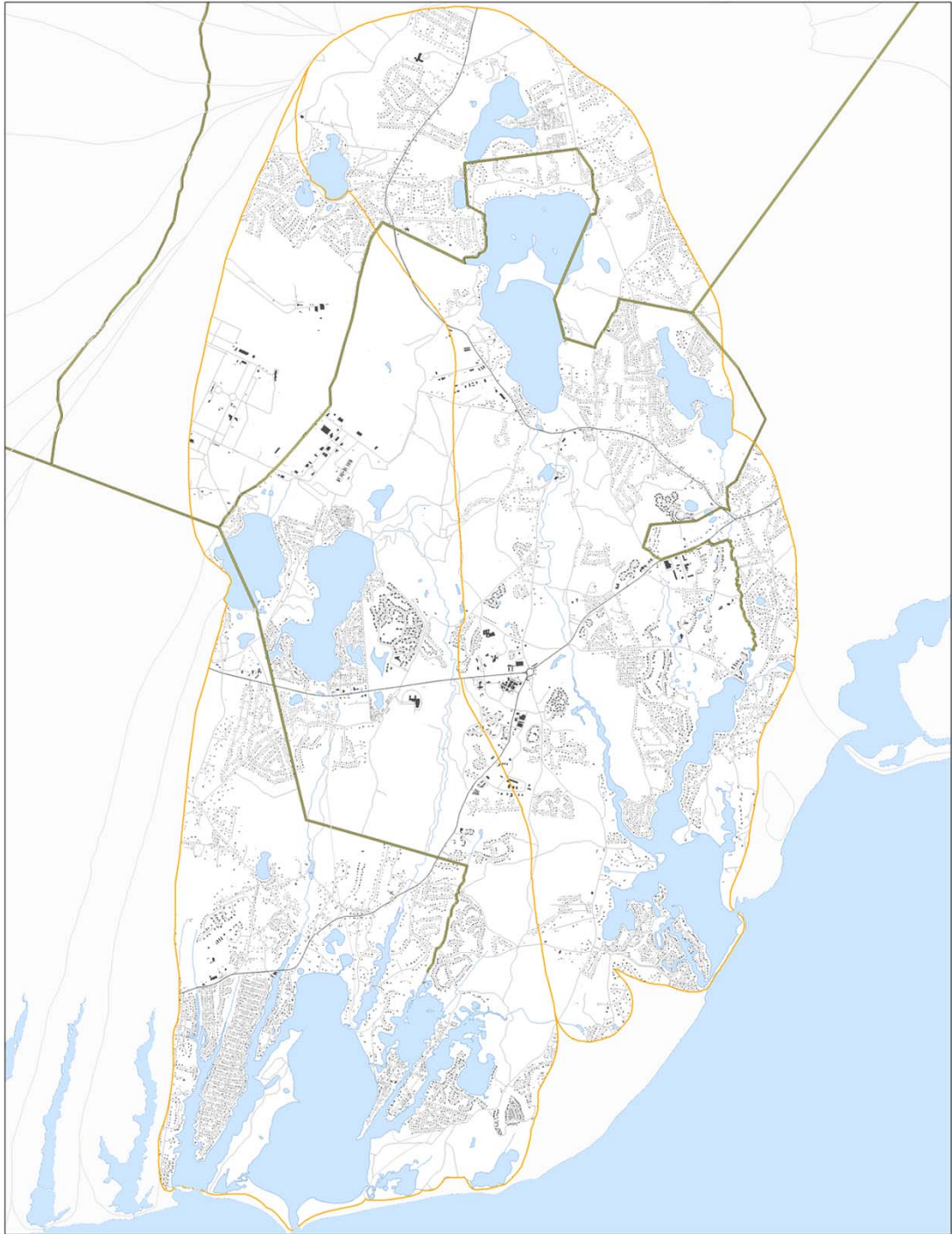


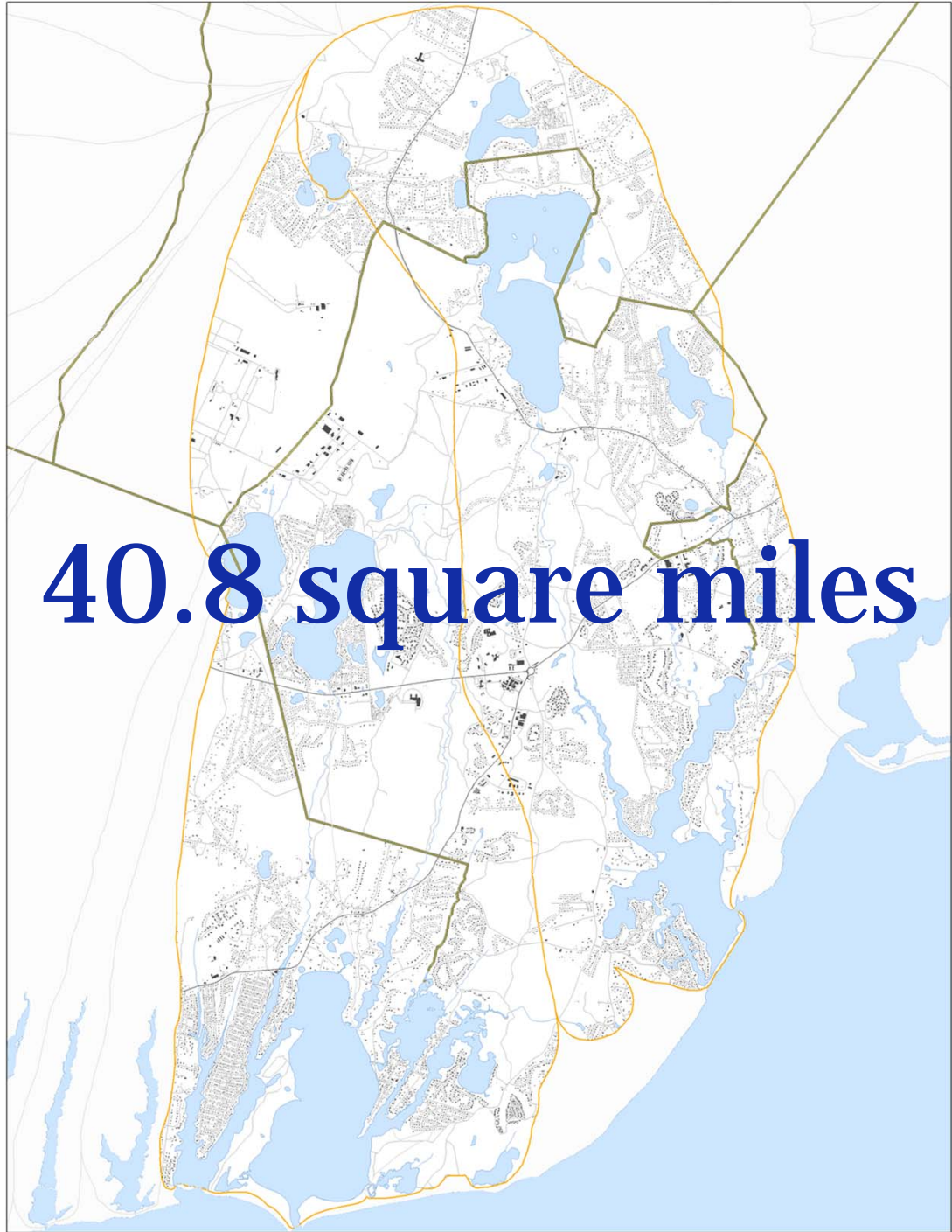
Did we miss anything?

Your Watersheds

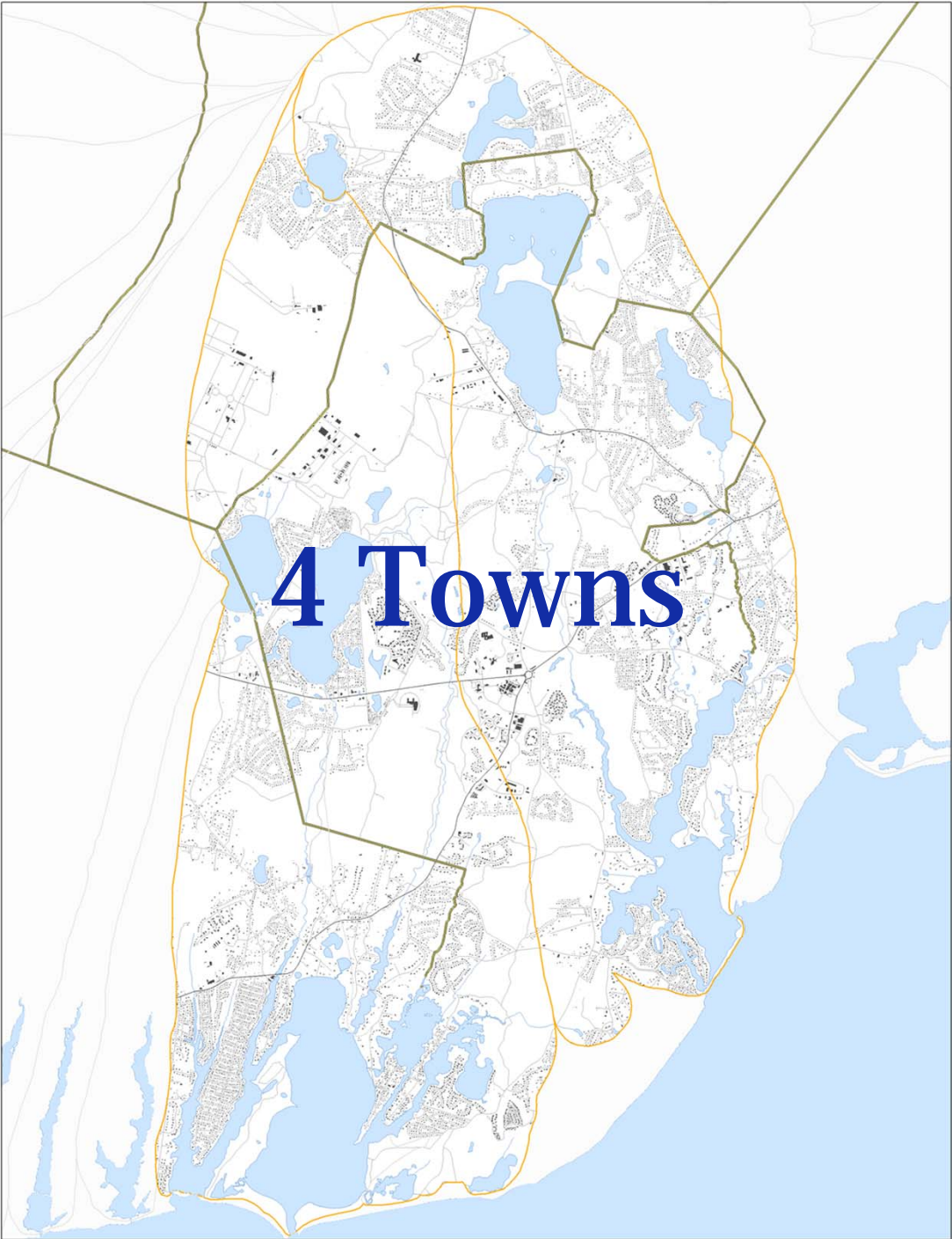


**Popponesset Bay
Waquoit Bay**






40.8 square miles




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

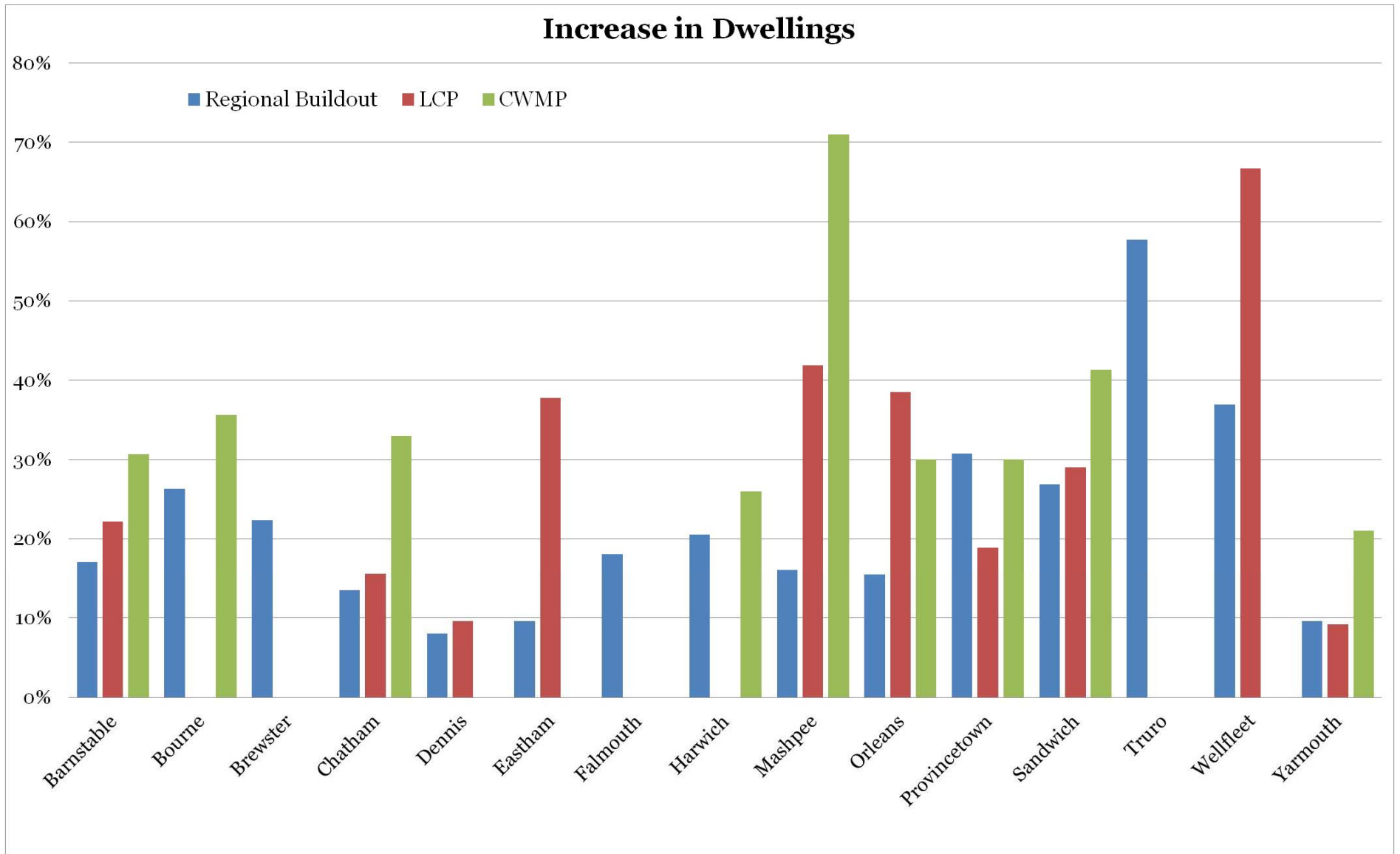
 Open - Disturbed or Managed

 Water

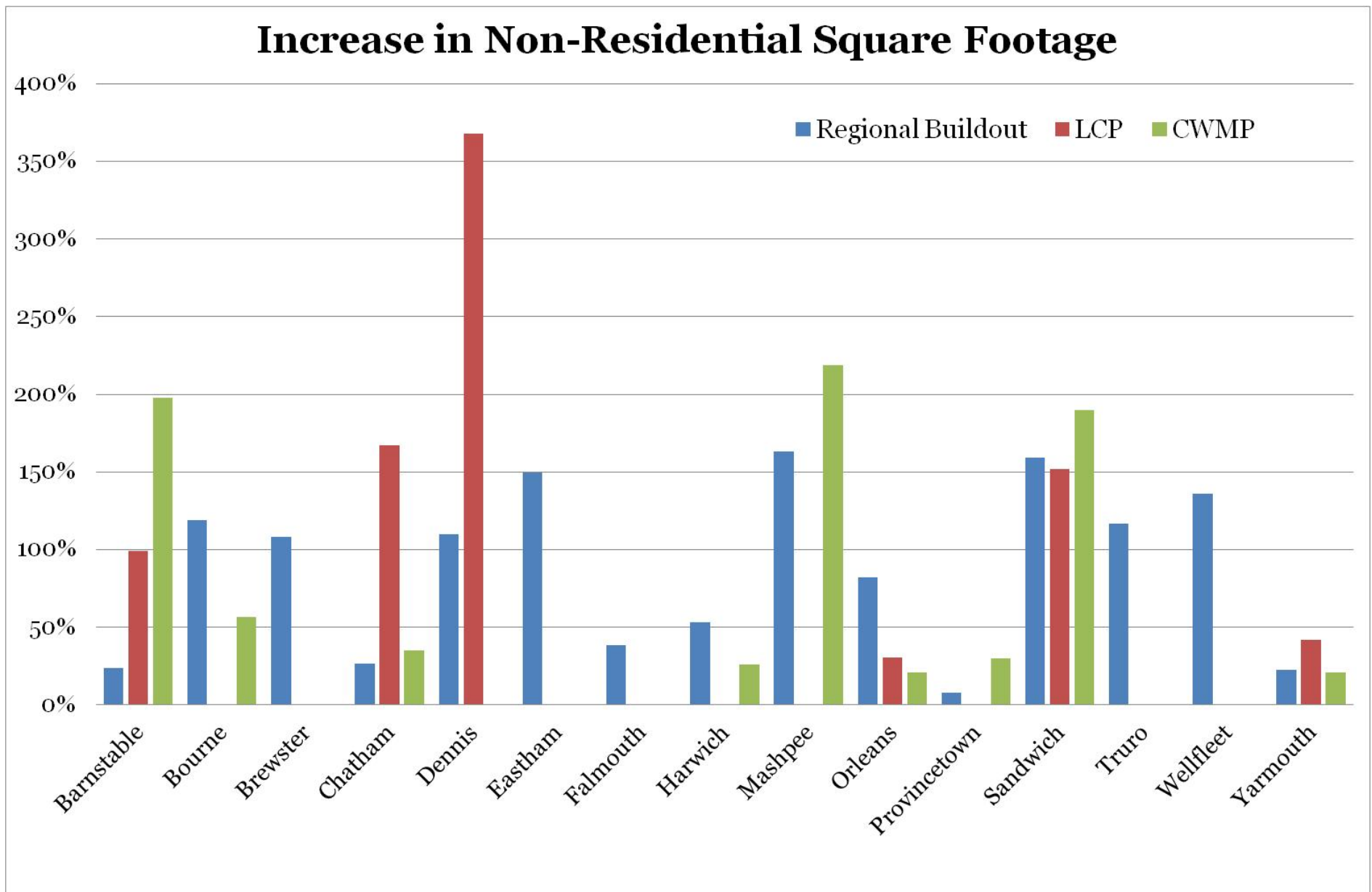
Density

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

Buildout



Buildout

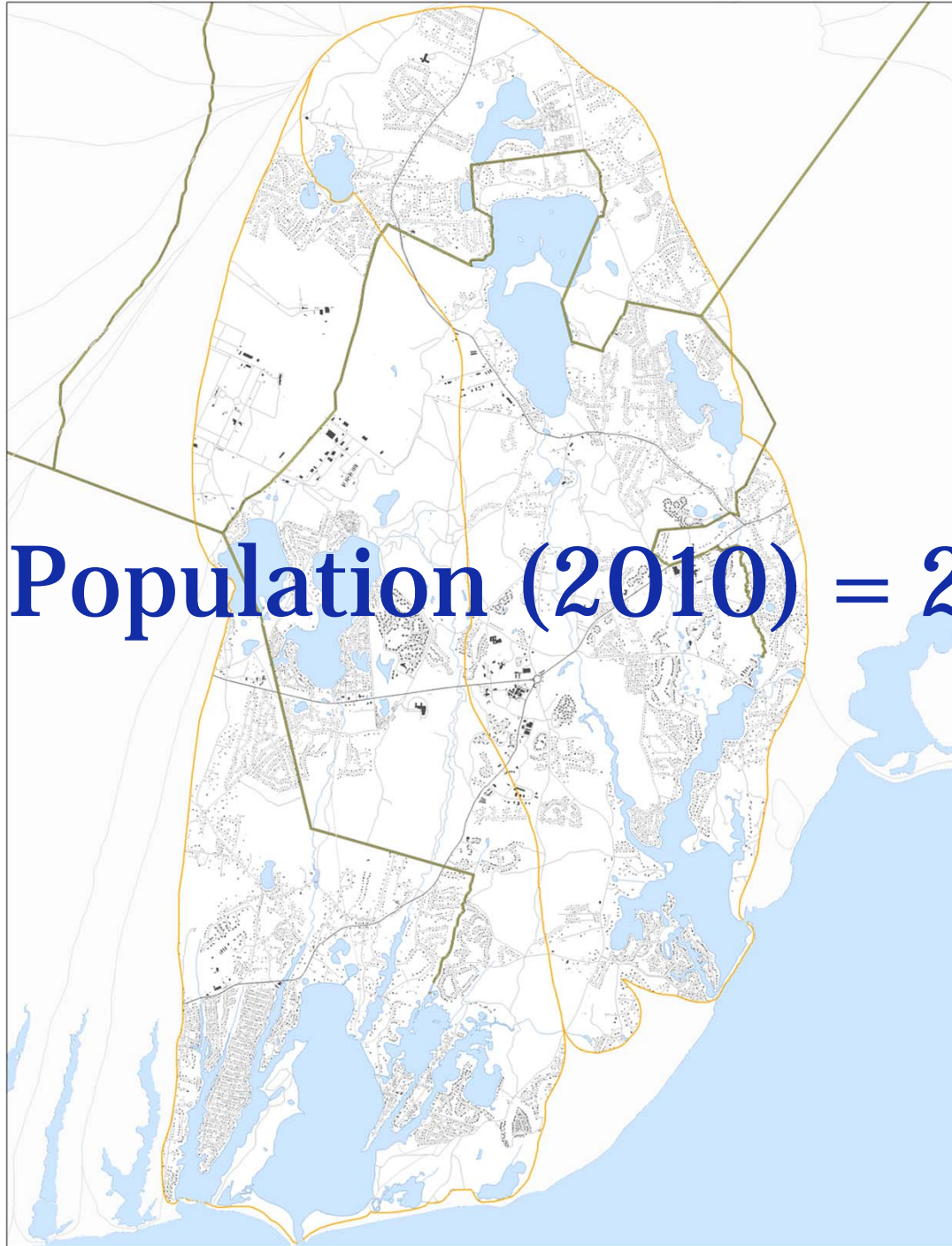


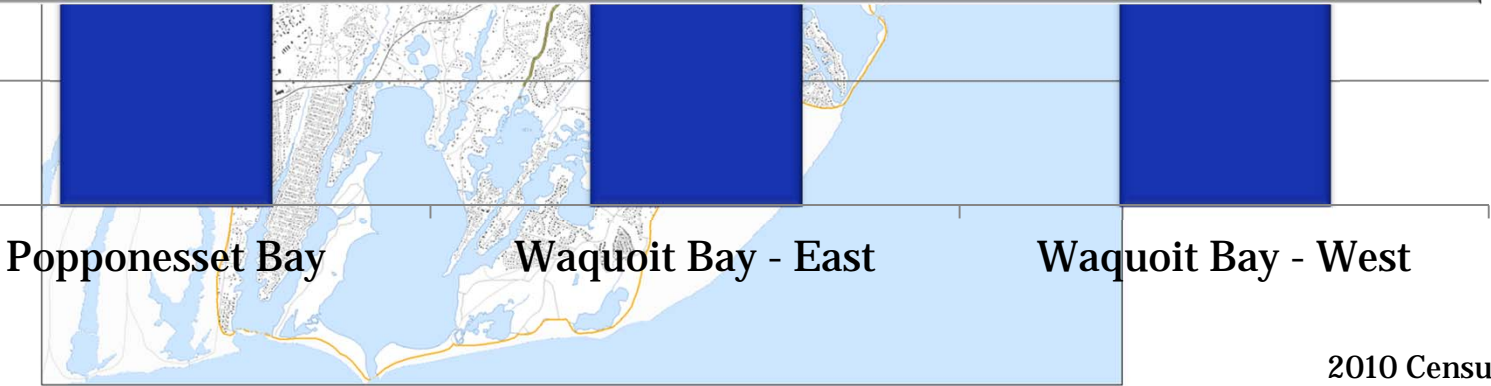
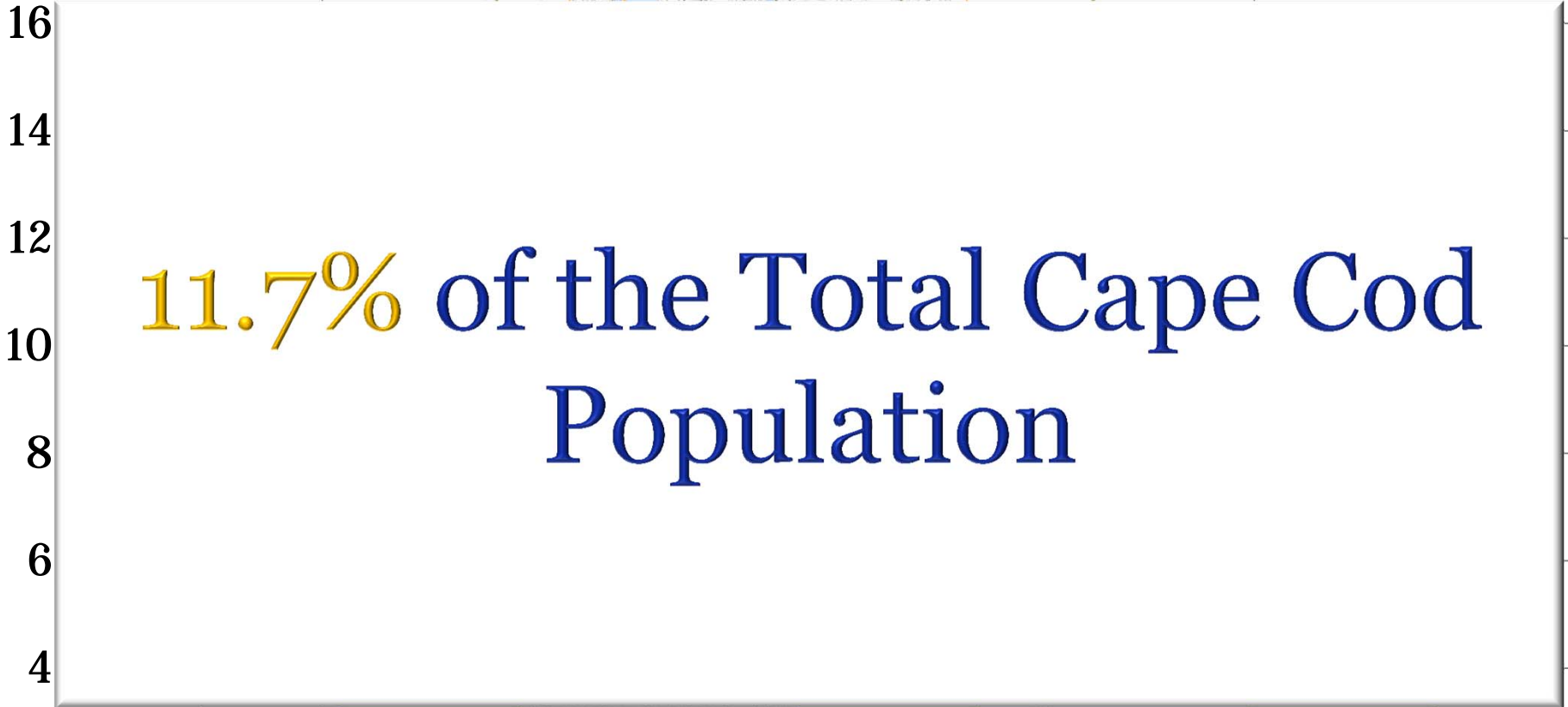
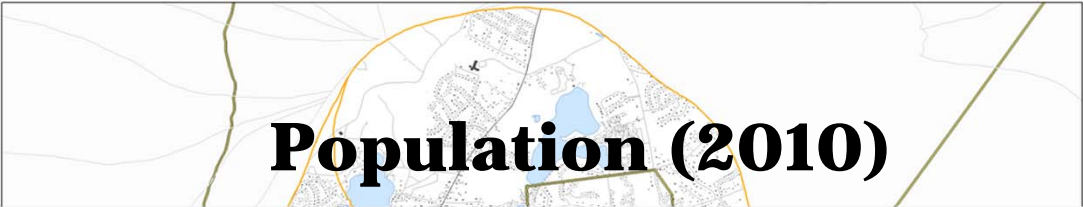
The People



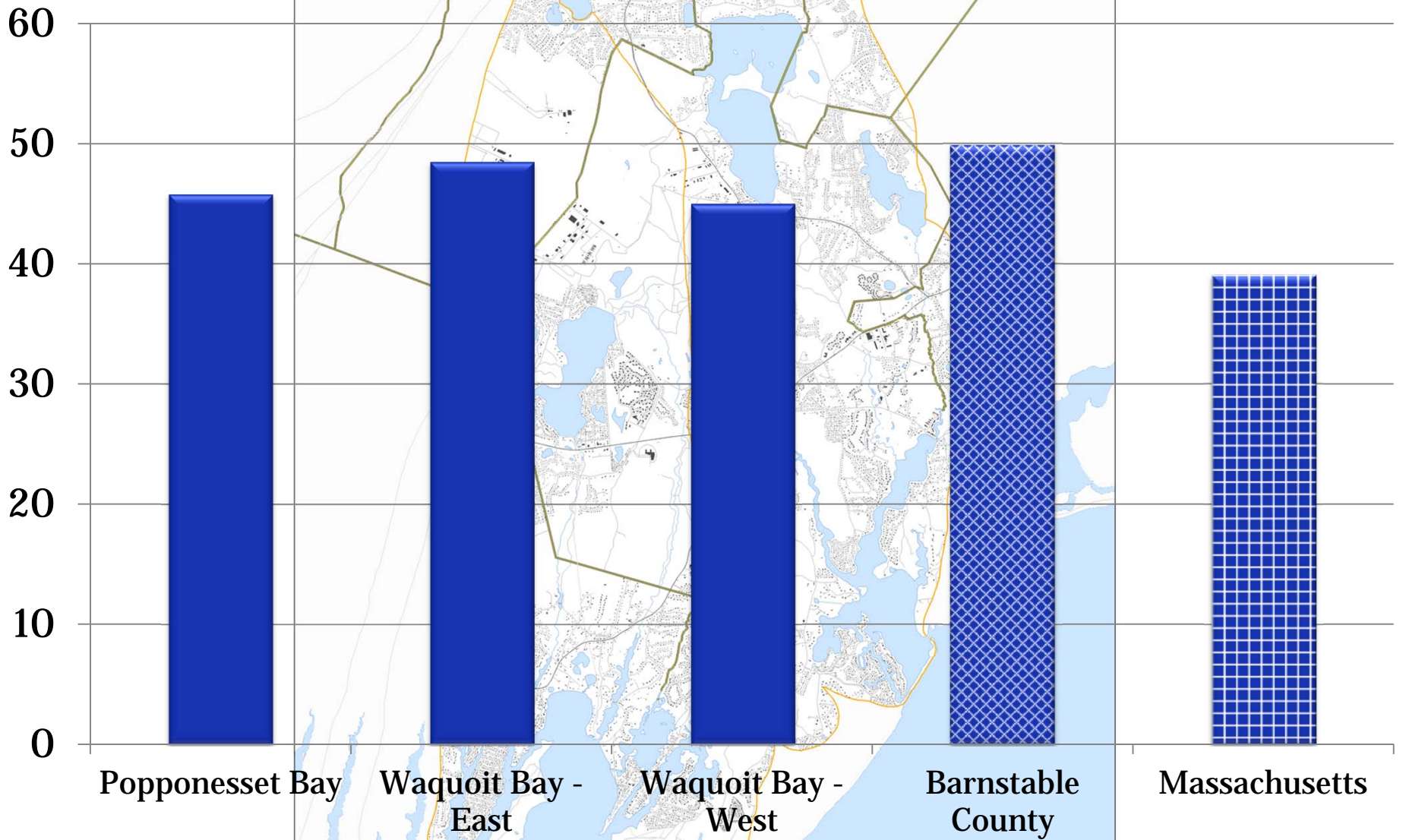
**Popponeset Bay
Waquoit Bay**

Total Population (2010) = 25,273

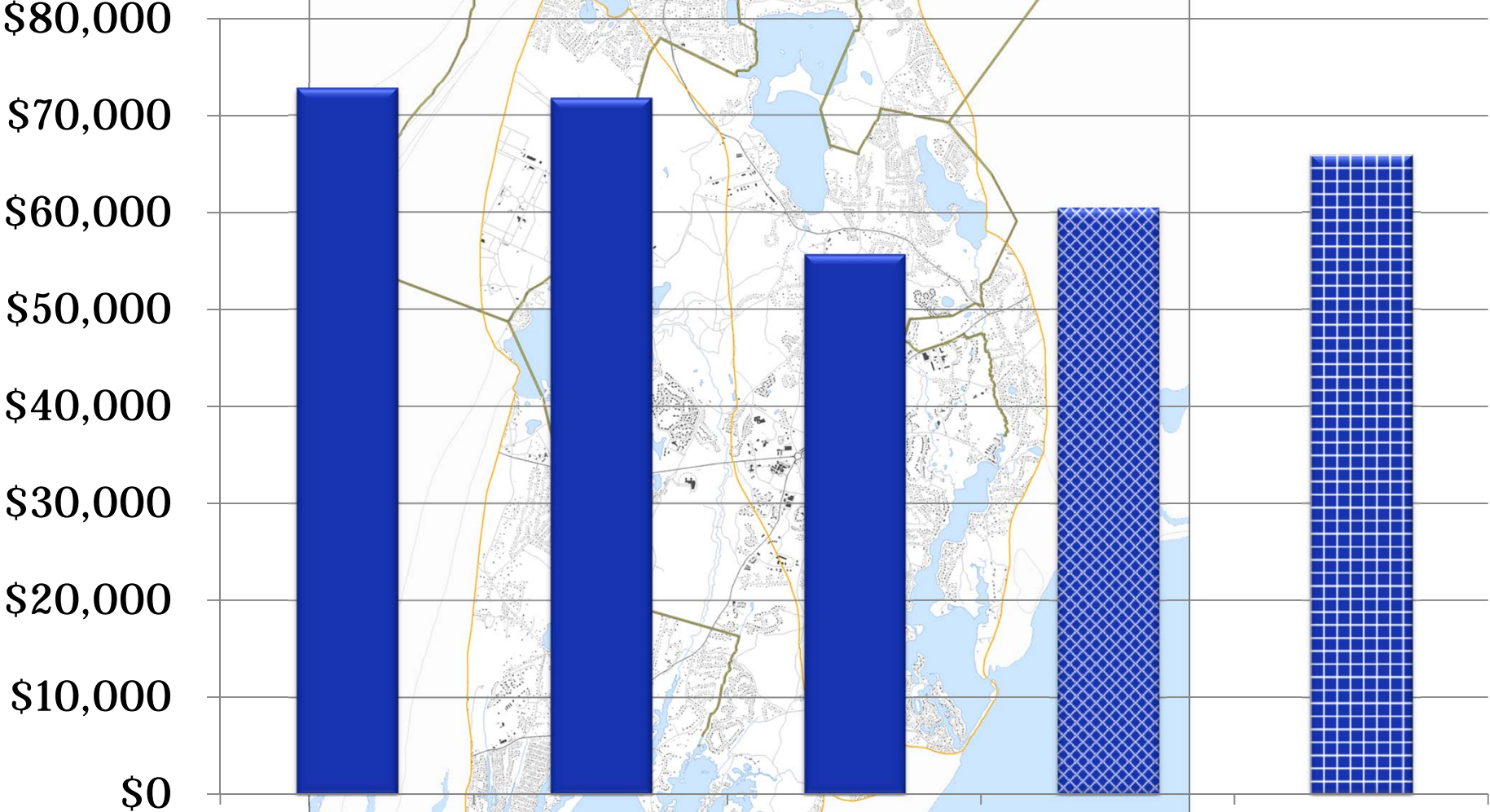




Median Age (2010)

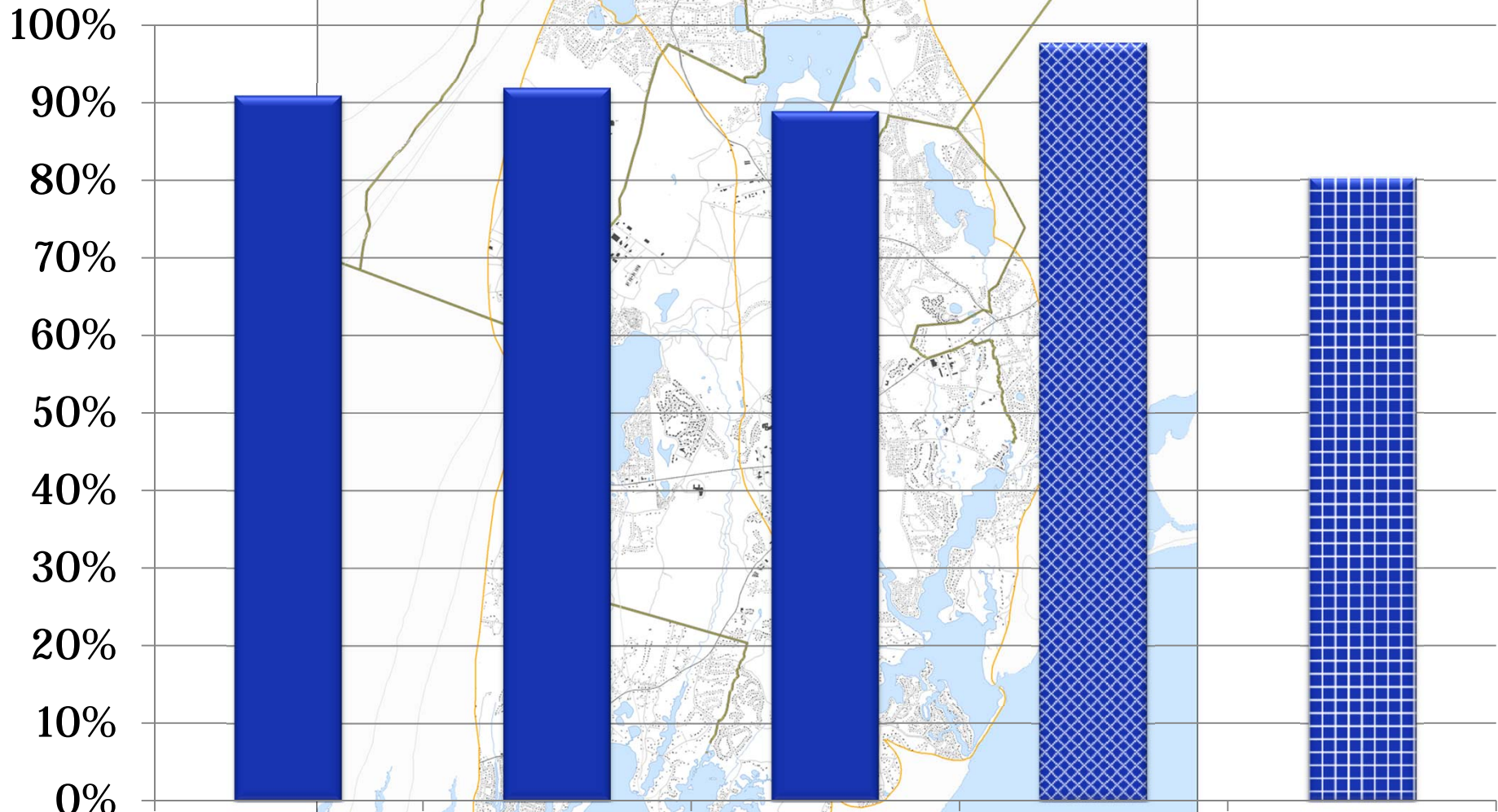


Median Income (2010)



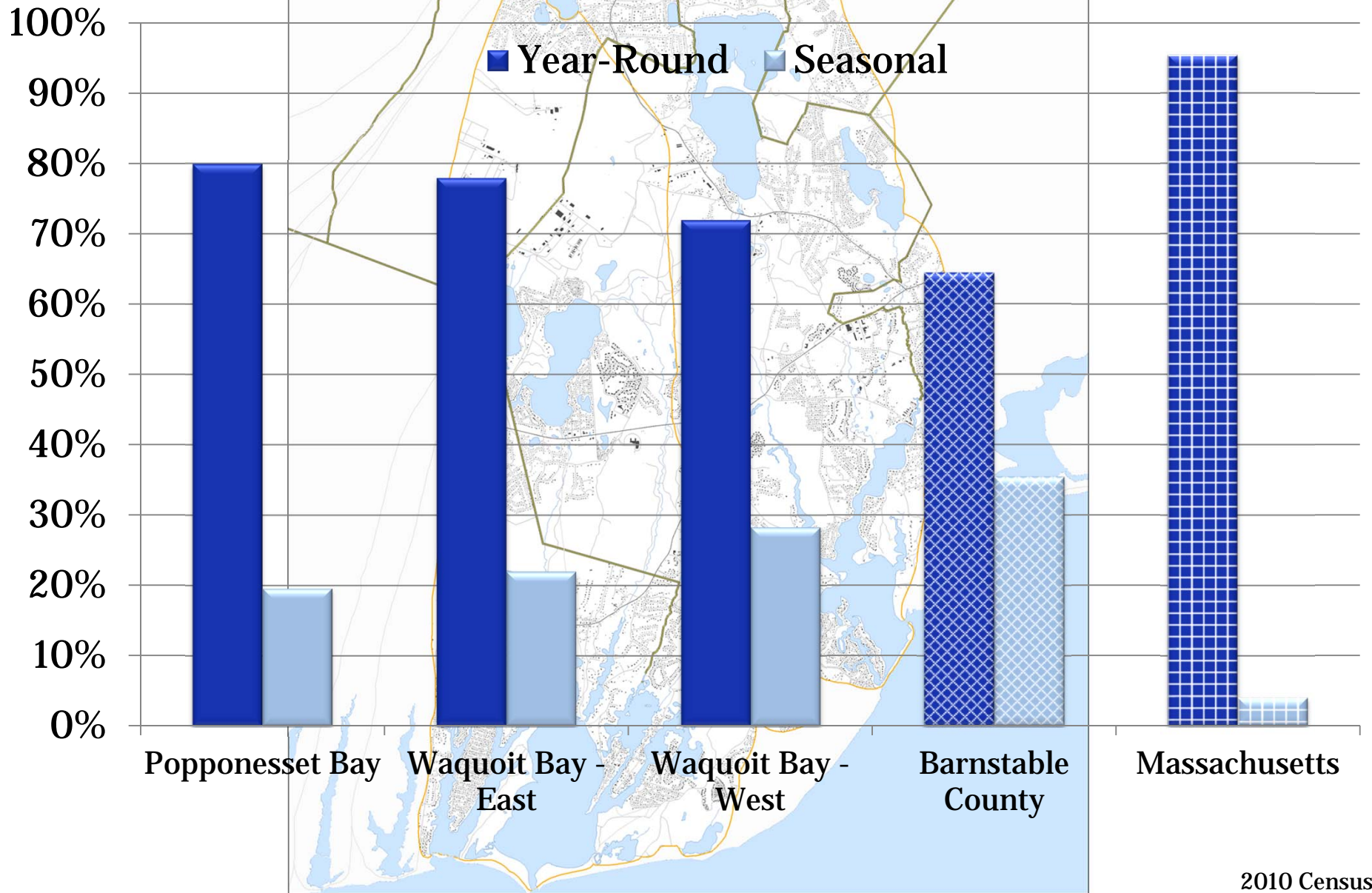
Popponesset Bay Waquoit Bay - East Waquoit Bay - West Barnstable County Massachusetts

Race - % White (2010)



Popponesset Bay Waquoit Bay - East Waquoit Bay - West Barnstable County Massachusetts

Seasonal vs. Year Round Housing (2010)



Average Assessed Home Value (2010)

\$700,000

\$600,000

\$500,000

\$400,000

\$300,000

\$200,000

\$100,000

Total Assessed Value of Residential Homes =

\$5,019,677,059

\$0

Popponesset Bay

Waquoit Bay - East

Waquoit Bay - West

Barnstable County

Massachusetts

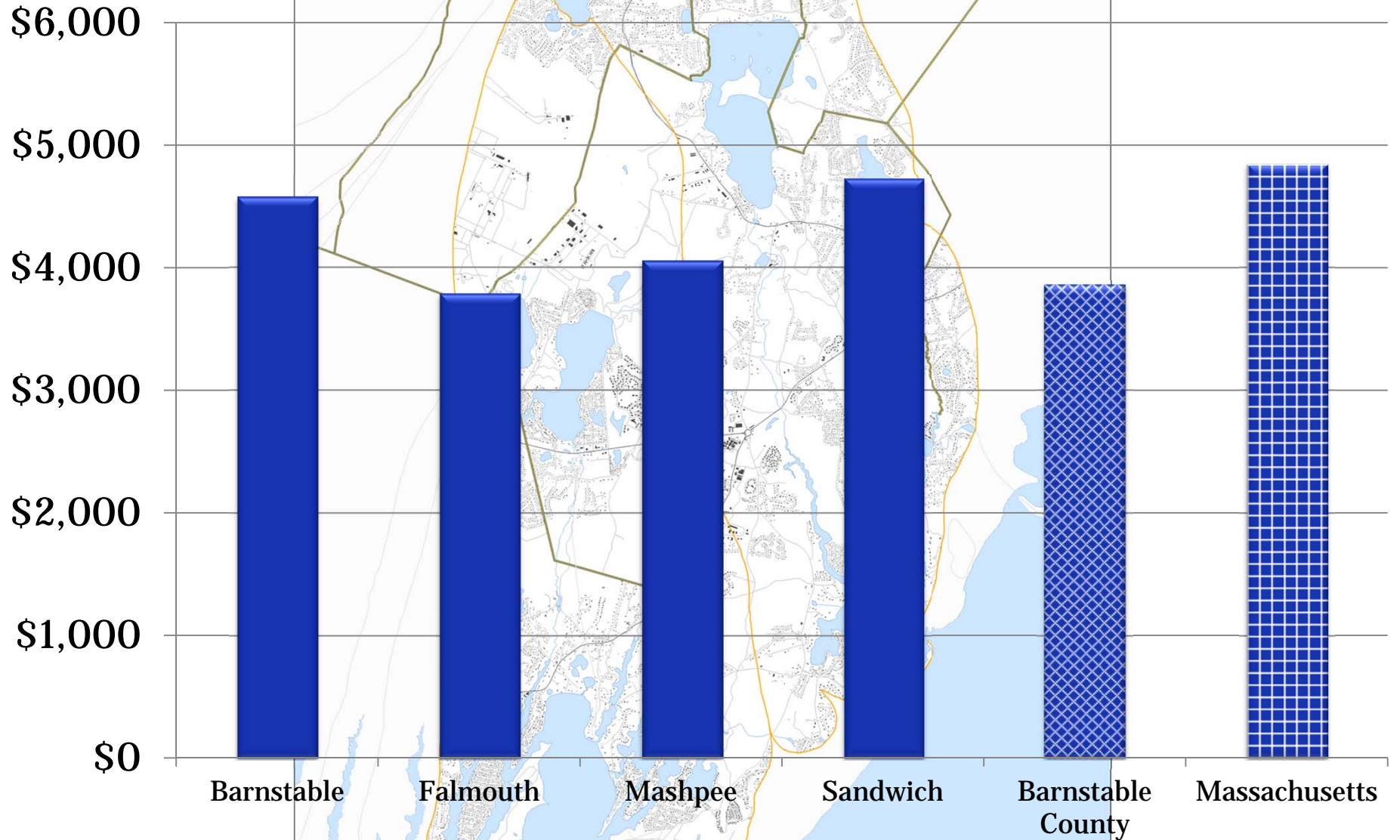
Your Government & Taxes



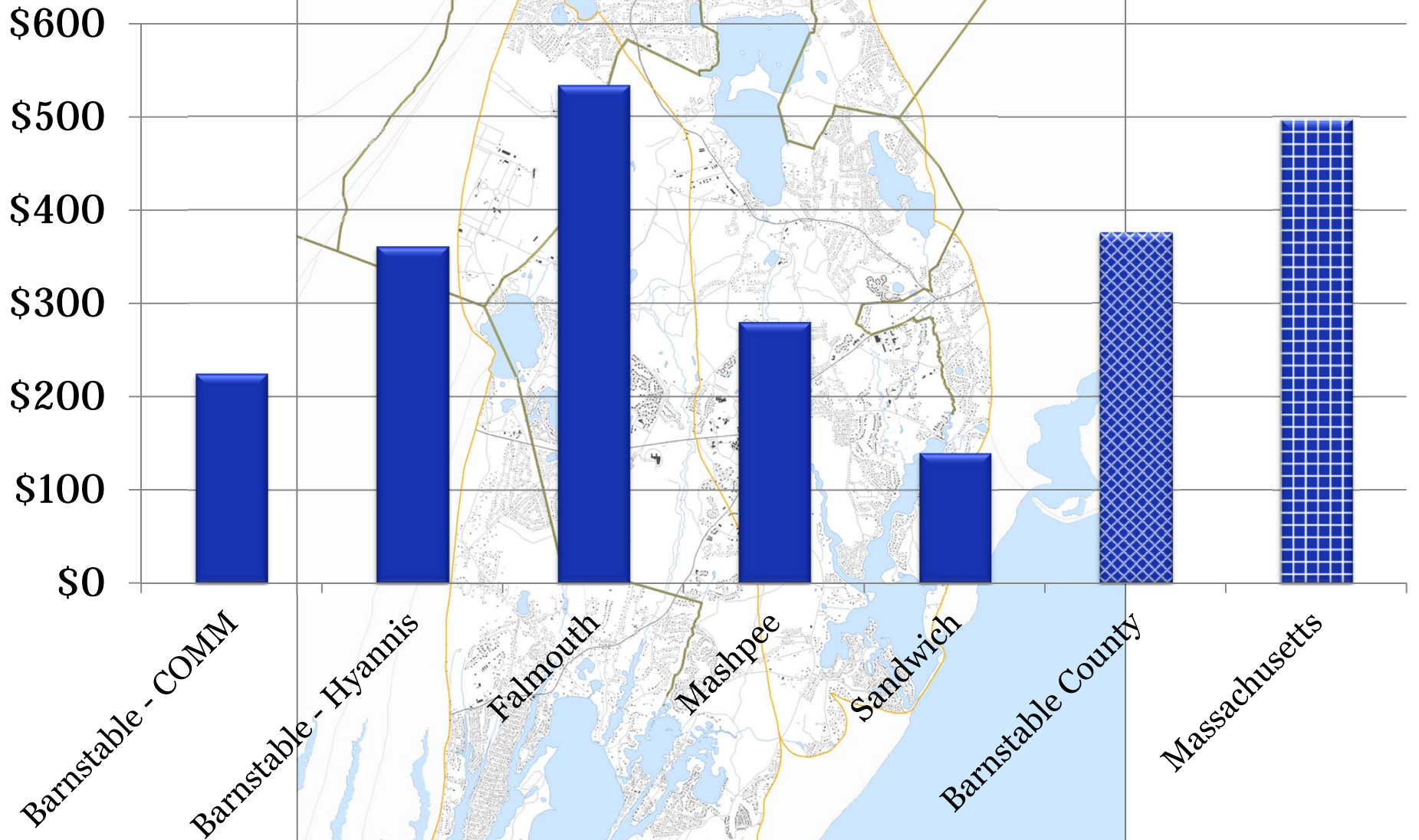
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**Popponeset Bay
Waquoit Bay**

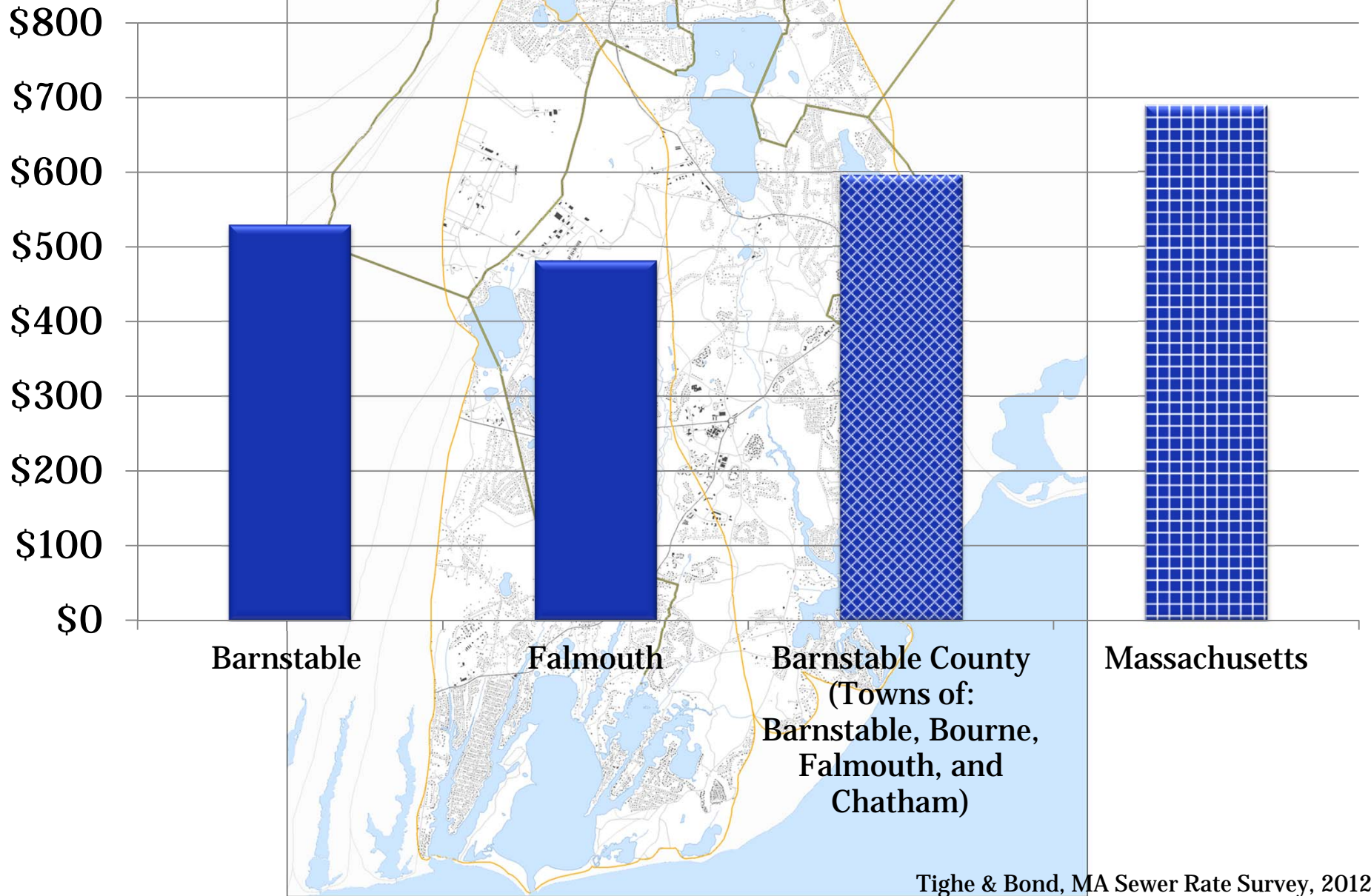
Average Single Family Property Tax Bill (2013)



Average Annual Water Bill (2012)



Average Annual Sewer Bill (2012)



The Problem



Popponesset Bay
Waquoit Bay



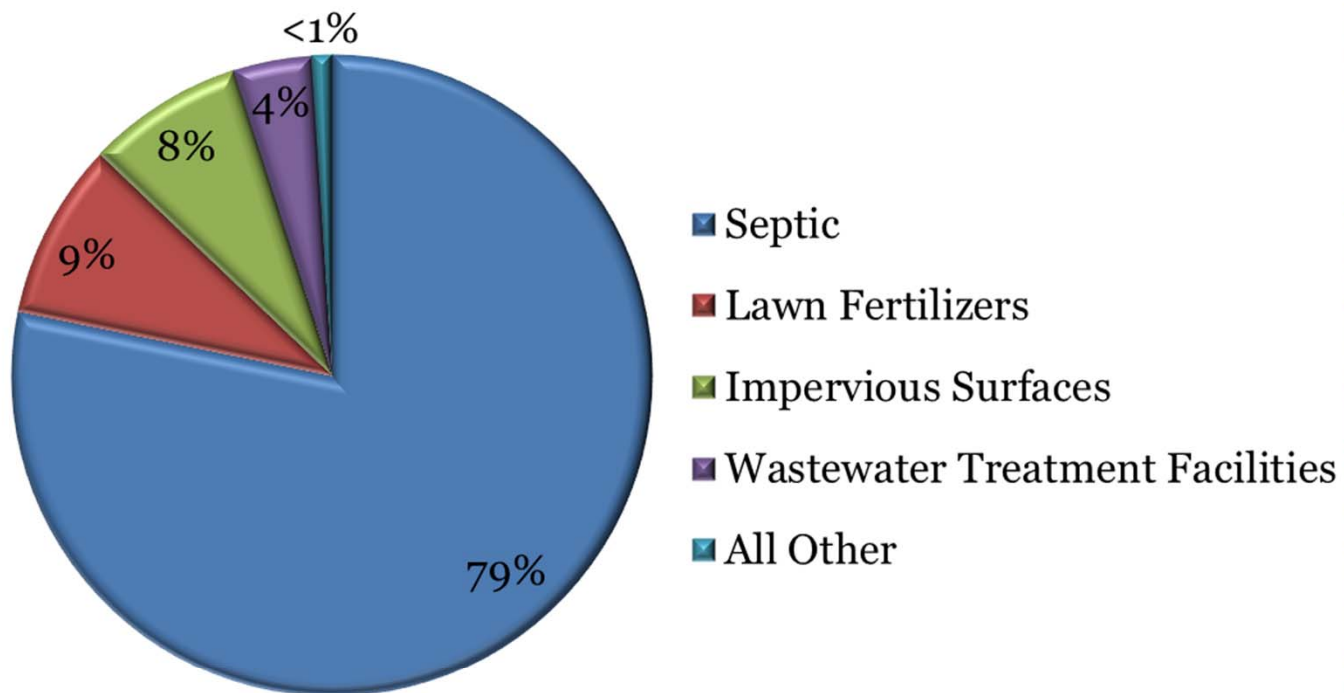
Photo credit: Waquoit Bay Reserve



Massachusetts Estuaries Project

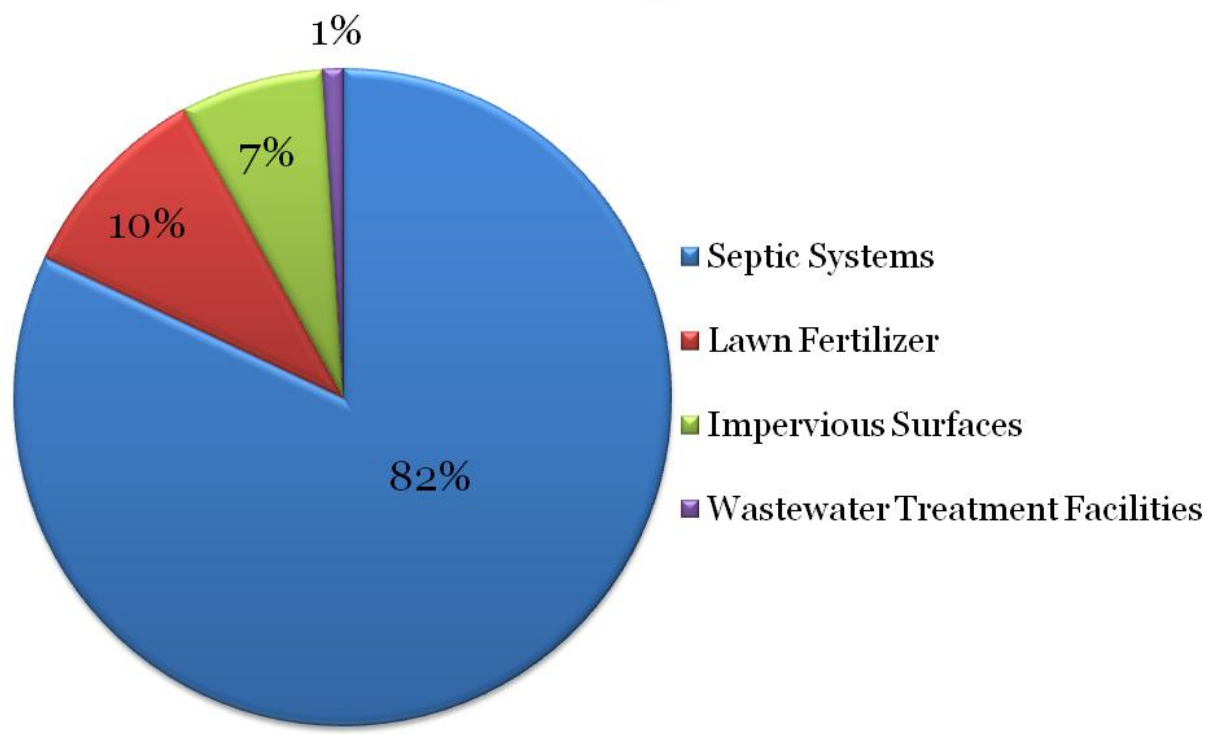
- Opportunity for towns to obtain independent analysis of nitrogen loading and its impact on water quality
- Provides water quality, nutrient loading, and hydrodynamic information
- Water quality monitoring – minimum of 3 years of data for each embayment
- Watershed model links water quality data to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

Cape-Wide Controllable Nitrogen Loads



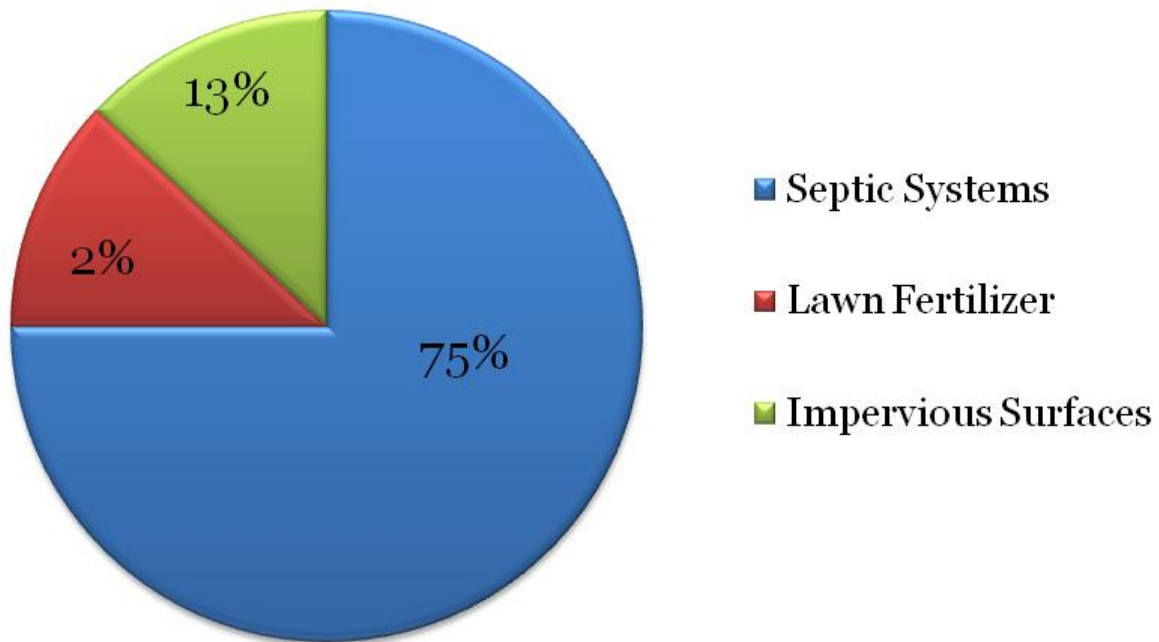
Note: Data averaged from existing Massachusetts Estuaries Project Reports

Popponesset Bay Controllable Nitrogen Loads



Massachusetts Estuaries Project, Sept 2004


Waquoit Bay Controllable Nitrogen Loads



Massachusetts Estuaries Project, May 2012


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


-  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

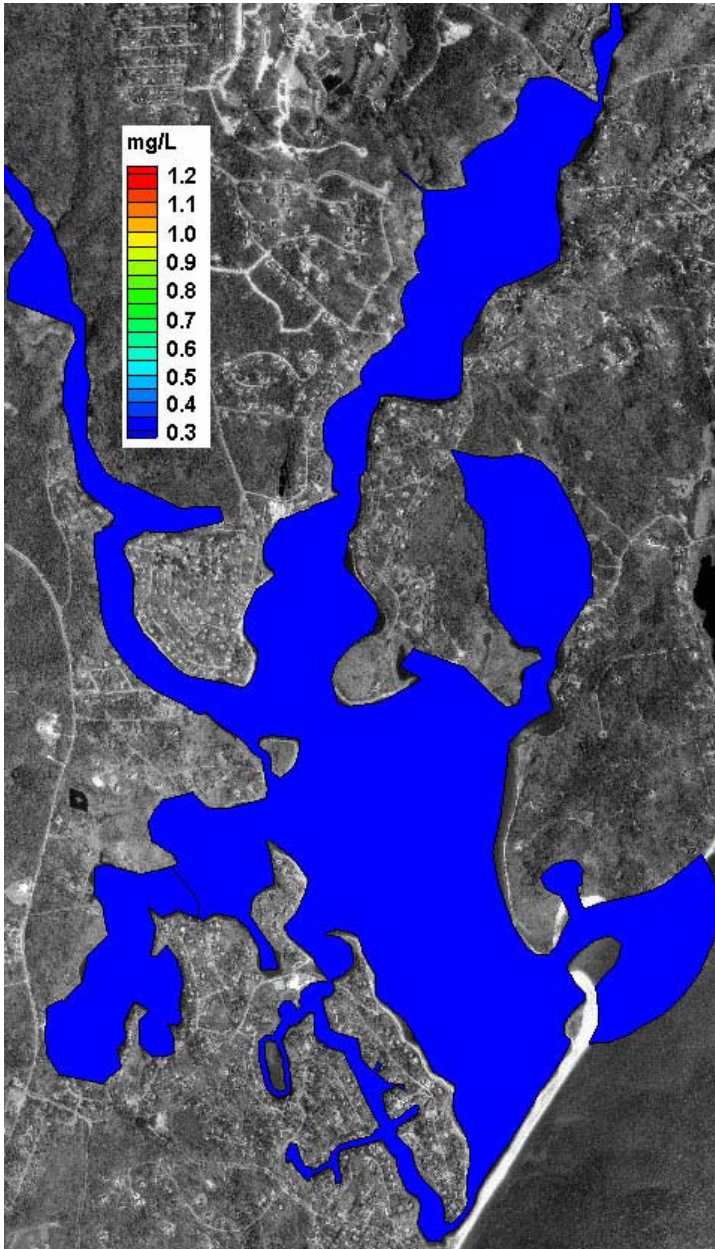
 0.1 % - 9%

 9.1 % - 38 %

 38.1 % - 62 %

 62.1 % - 86 %

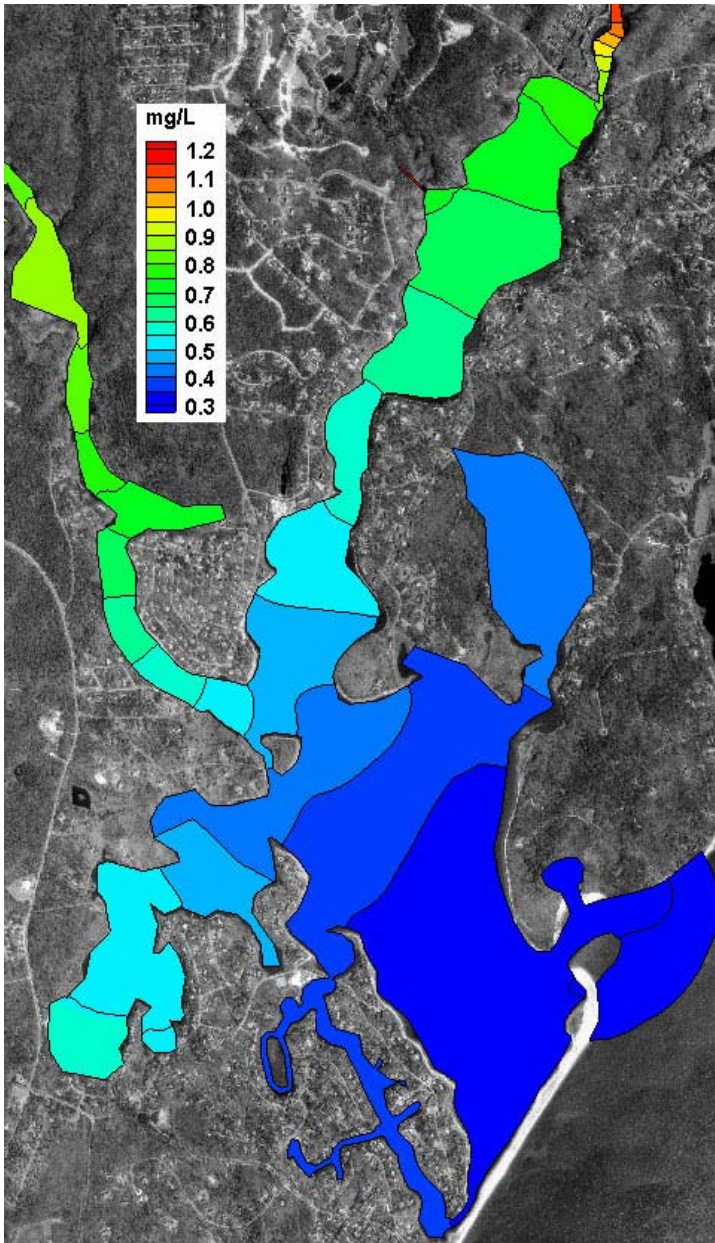
 86.1 % - 100%



Contour Plot of **modeled total nitrogen concentrations (mg/L)** in Popponesset Bay, for no anthropogenic loading conditions.

(Source: MEP 2004)

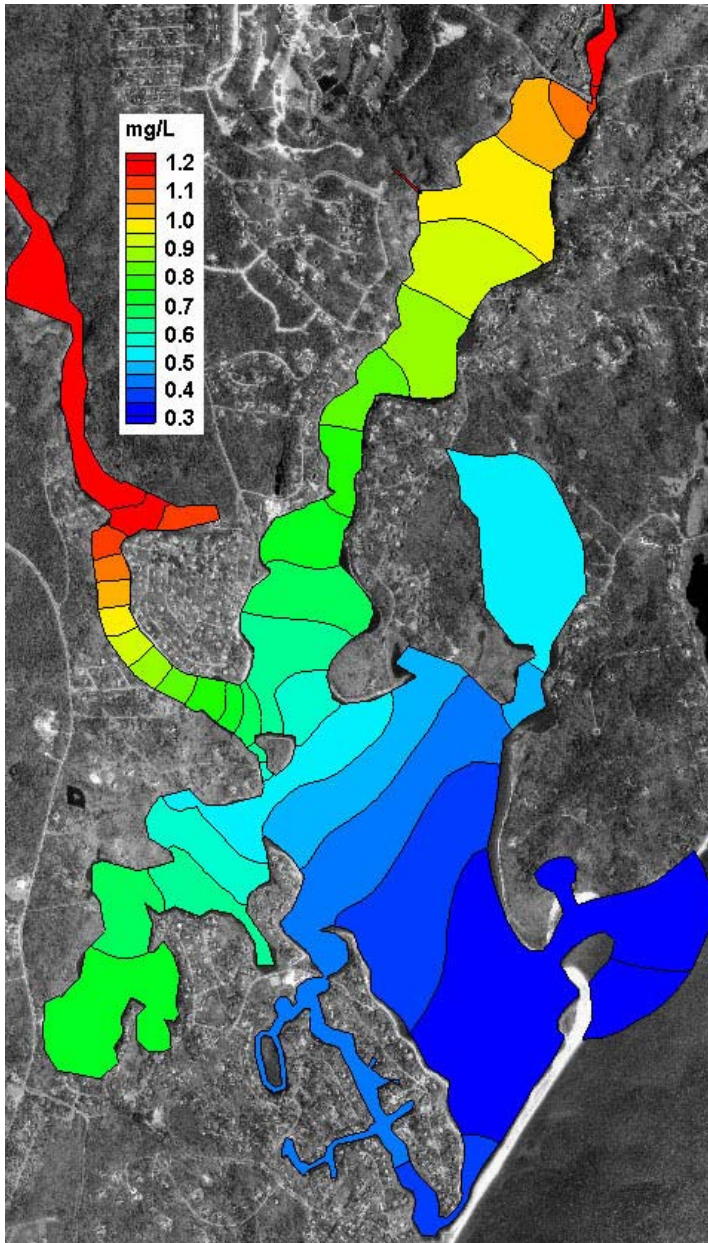
Pre-Colonial Conditions: Popponesset Bay



Contour plot of **average total nitrogen concentrations** from results of the present conditions loading scenario, for Popponesset Bay.

(Source: MEP 2004)

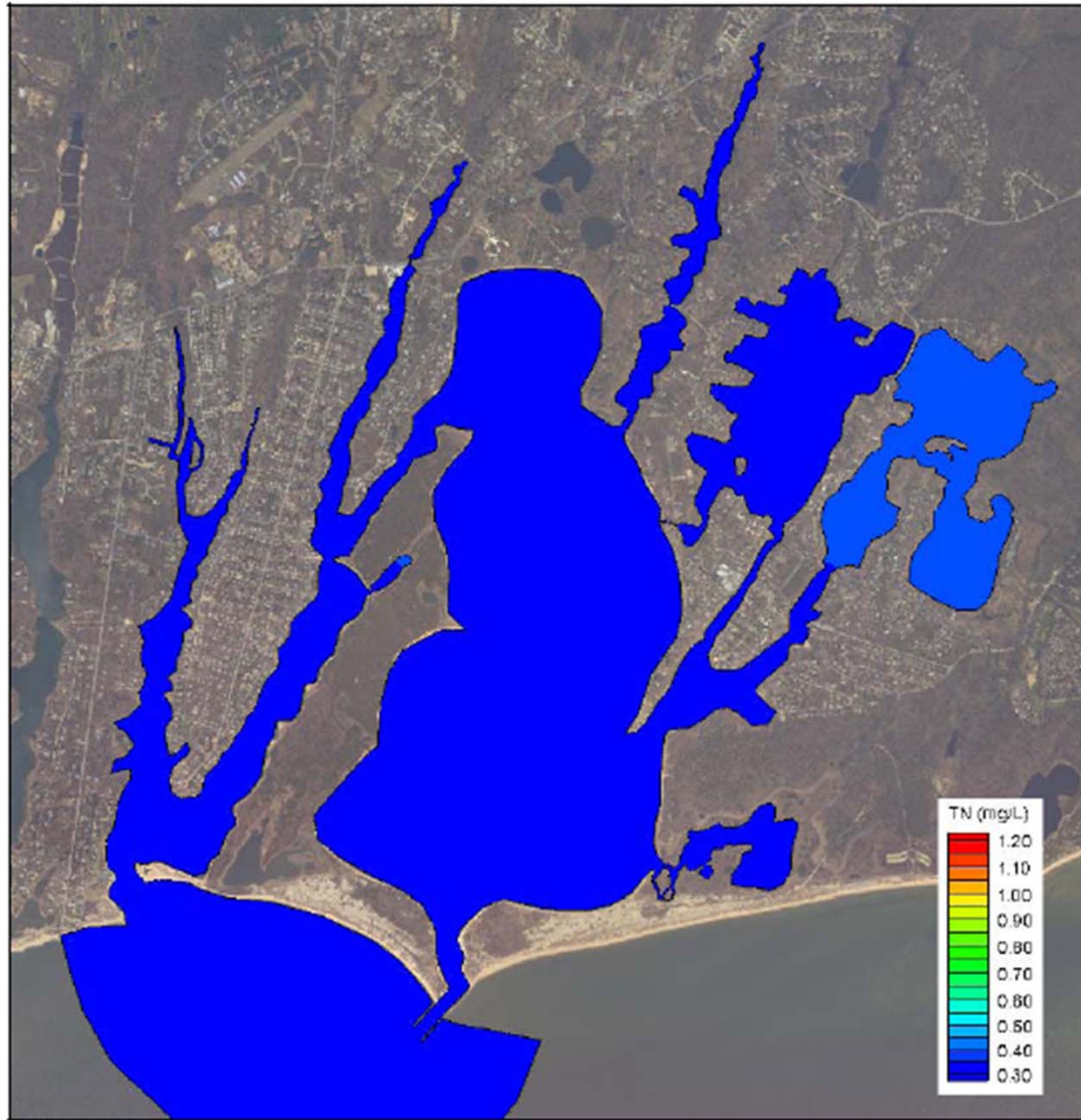
Present Conditions: Popponesset Bay



Contour Plot of **modeled total nitrogen concentrations (mg/L)** in Popponesset Bay, for projected build out loading conditions.

(Source: MEP 2004)

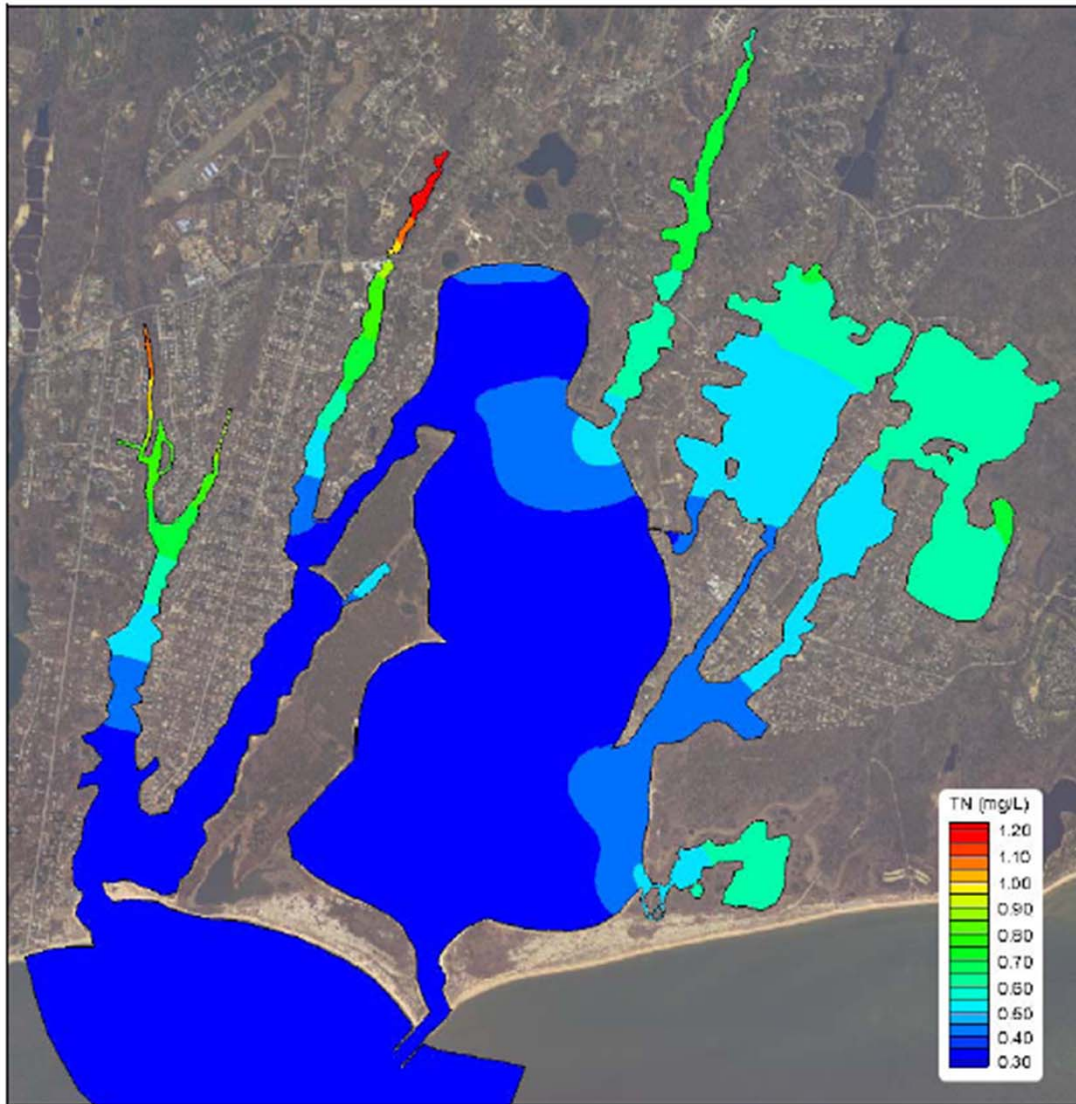
Buildout Conditions: Popponesset Bay



Contour plots of **modeled total nitrogen concentrations (mg/L)** in Waquoit Bay system, for no anthropogenic loading conditions, and bathymetry.

(Source: MEP 2012)

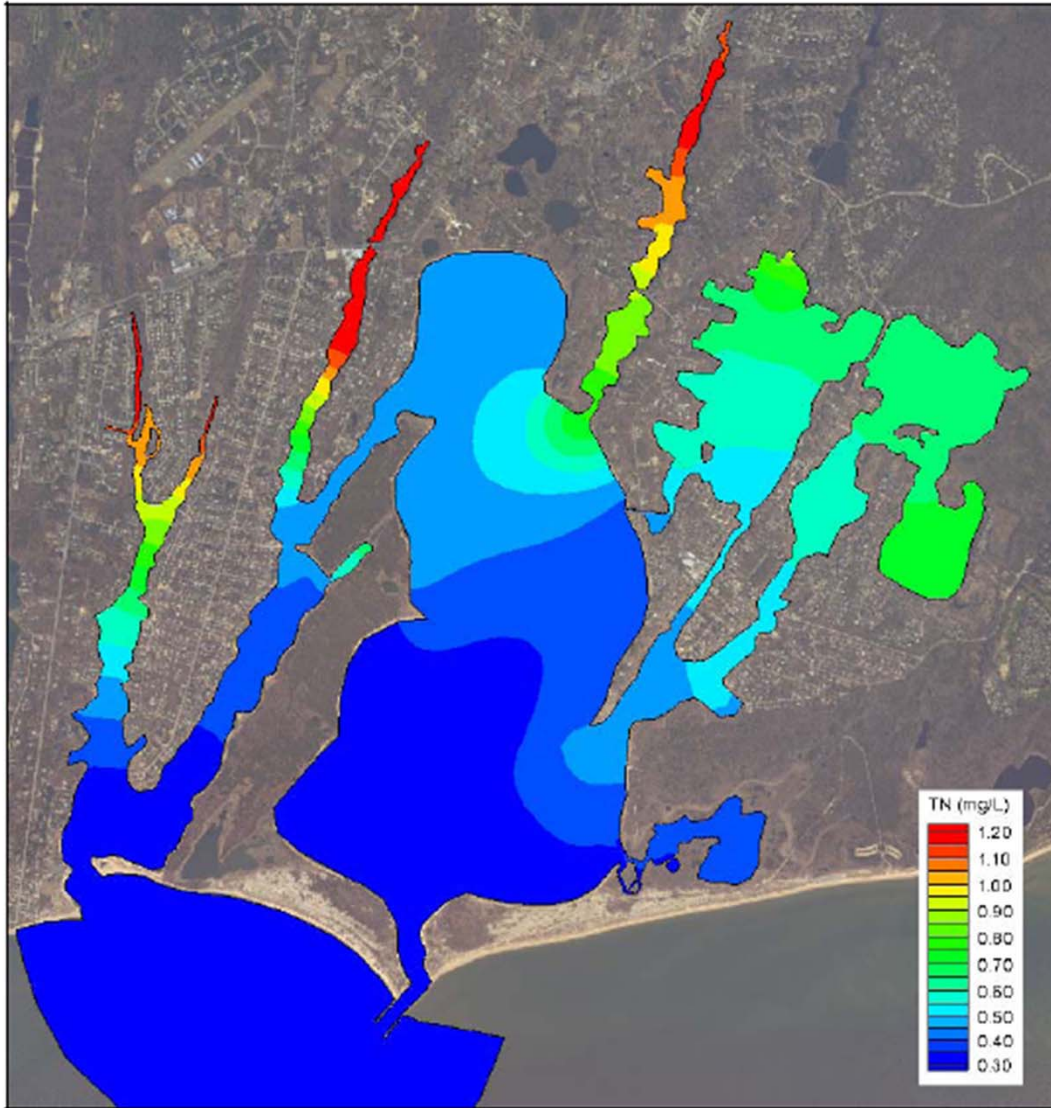
Precolonial Conditions: Waquoit Bay



Contour plots of **average total nitrogen concentrations** from results of the present conditions loading scenario, for the Waquoit Bay system.

(Source: MEP 2012)

Present Conditions: Waquoit Bay




Contour plots of **modeled total nitrogen concentrations (mg/L)** in Waquoit Bay system, for projected build-out loading conditions, and bathymetry.

(Source: MEP 2012)

Buildout Conditions: Waquoit Bay


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


-  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%


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



**Popponesset Bay
Waquoit Bay**


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

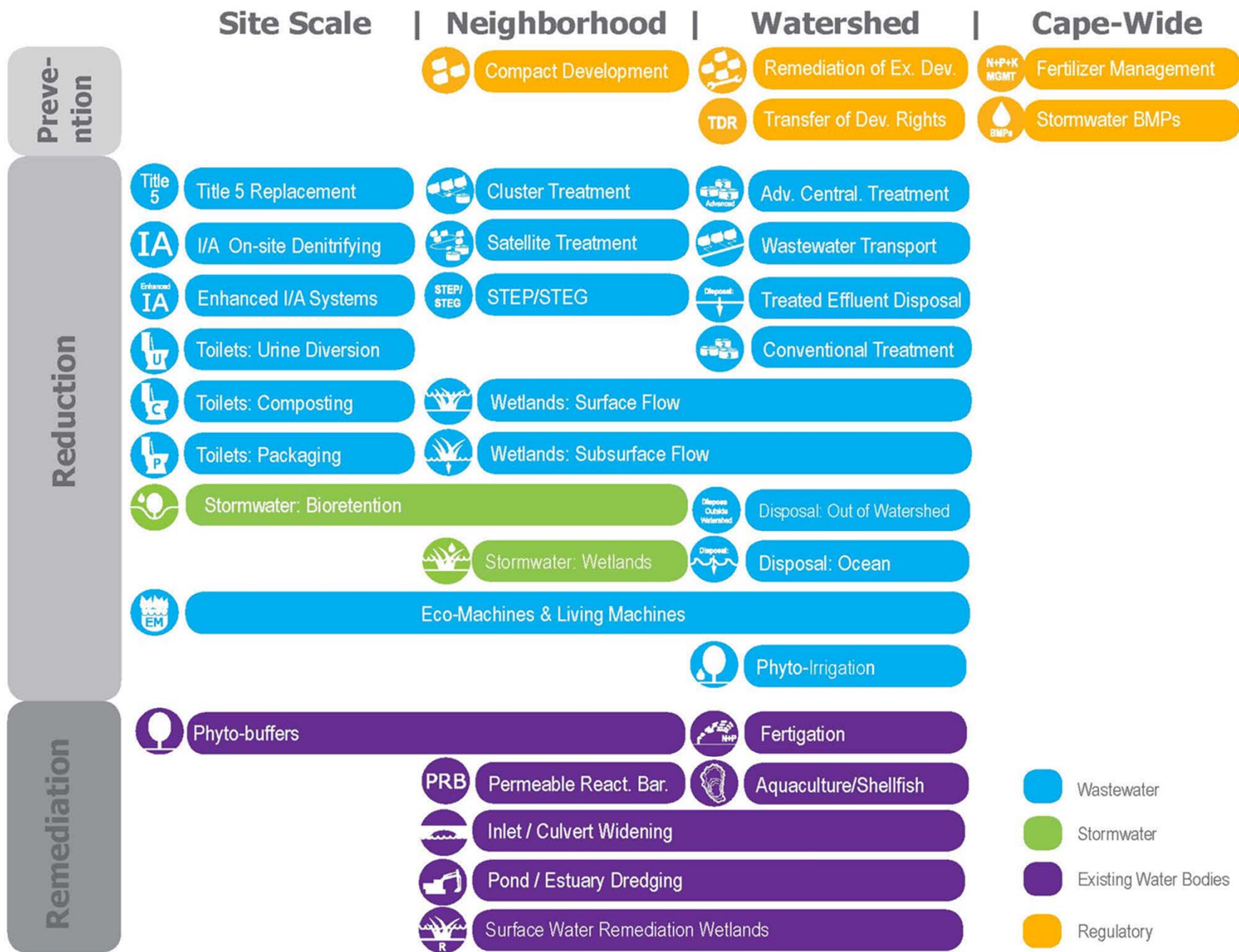
 2031 - 2040

 2041 - 2050



Framework for Addressing Solutions Moving Forward

Popponeset Bay
Waquoit Bay



- 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 Popponesset Bay
and Waquoit Bay Group will be available on the Cape
Cod Commission website:**

<http://watersheds.capecodcommission.org/index.php/watersheds/upper-cape/waquoit-popponesset>

Popponesset Bay
Waquoit Bay