Appendix A

Public Outreach

CDM Smith worked with the town of Harwich's Water Quality Management Task Force and the Wastewater Management Subcommittee through a series of meetings to complete this CWMP. This section summarizes public presentations and community meetings held from 2007 to 2013. A recent copy of the towns Frequently Asked Questions related to wastewater management is also included in this section.

- Public Presentations
- Community Meetings 1 -6
- Frequently Asked Questions

Public Presentations

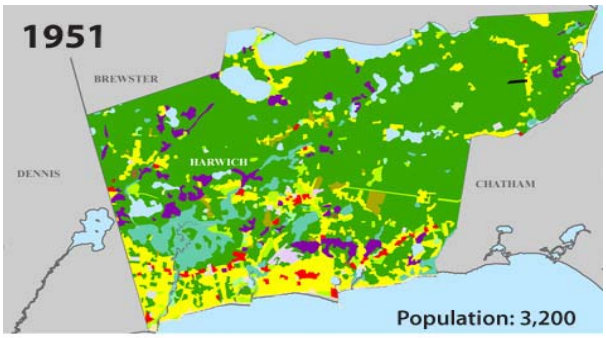
Summary of Harwich Utility

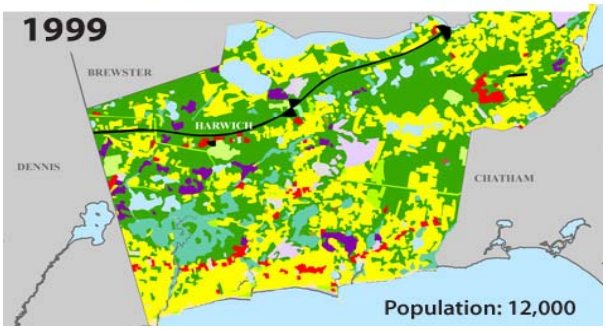
- 180 Miles of Utility Pipes
- 5 Pumping Stations
- 3 Storage Tanks
- Treatment Facility
- Administration Offices and Maintenance Garages
- 40+ Year Program
- Capital Cost Range (Today's Dollars):

$215 to $255 Million

Harwich Land Use Development 1951 and 1999

- **400% population growth from 1951 to 1999**

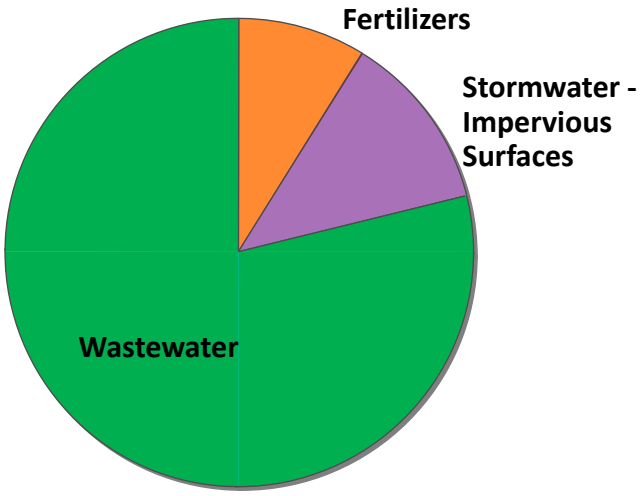




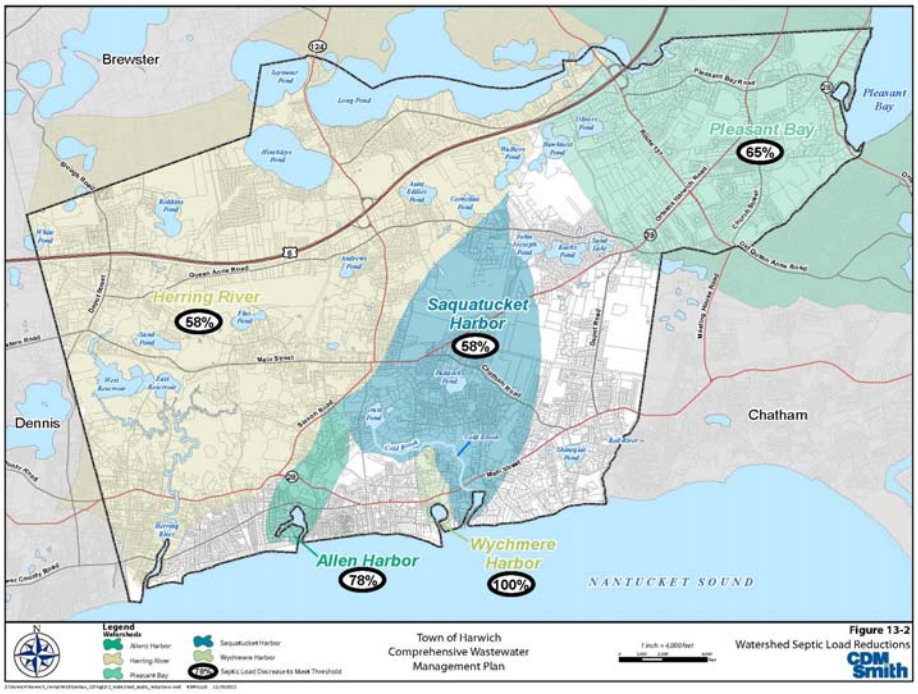
Allen Harbor Algae Bloom

Summer 2007

Controllable Sources of Nitrogen

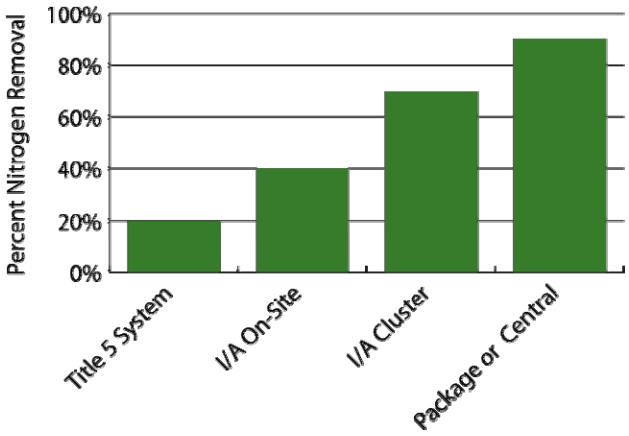


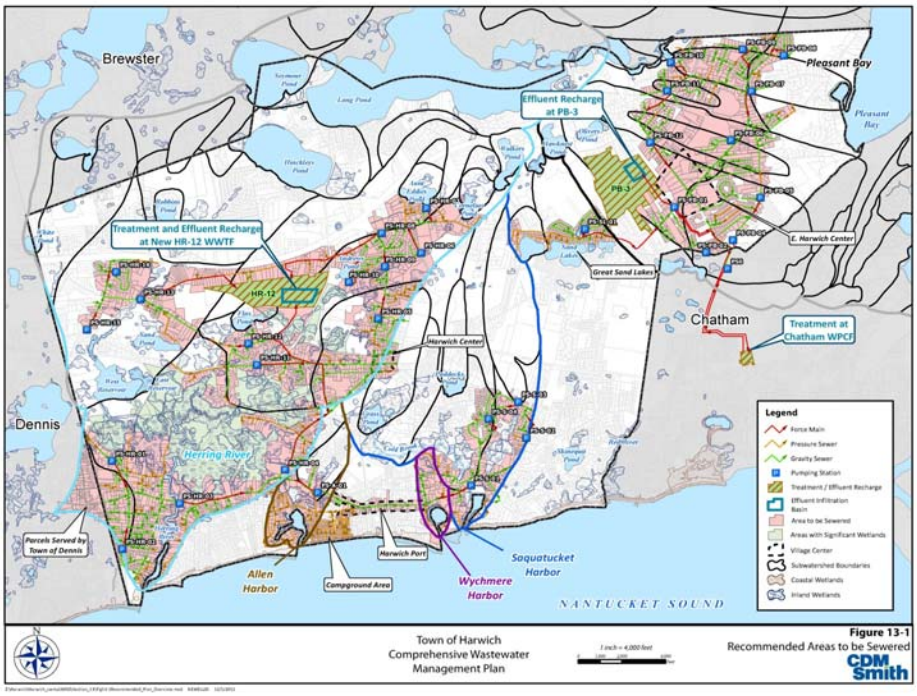
Local Control - Typical



Nitrogen Removal By Technology

Effluent Nitrogen Levels of Treatment





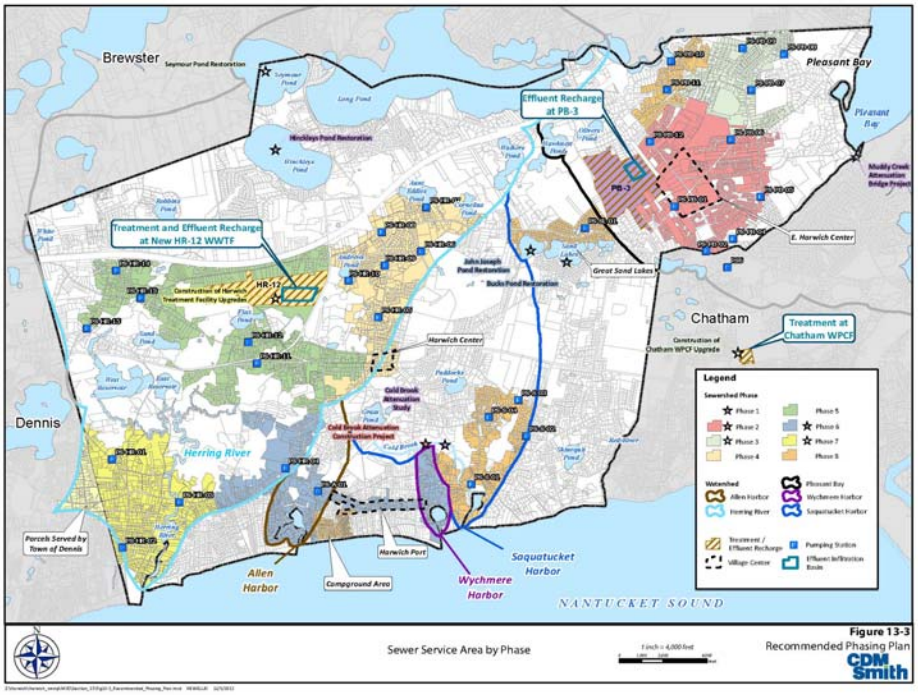


Figure 13-3
Recommended Phasing Plan

Recommended Program – Scenario 5A With Updates

- **Two Treatment Plants**
- **First phases utilize regional solution by using Chatham wastewater plant to treat Harwich flows from Pleasant Bay watershed**
- **Future phases utilize Harwich treatment plant built at landfill site to treat and recharge wastewater from other four watersheds**
- **Program built in eight phases over 40 years**
- **Includes 23 % growth at build-out**
- **Capital costs range $180 to $230 Million**

Recommended Program – Scenario 5A With Updates

- Non-infrastructure Components
  - Public Outreach
  - Fertilizer Management Education
  - Stormwater Best Management Practices
  - Freshwater Pond Evaluations and Restoration
  - Land Use Planning/ Zoning/ Acquisition
  - Other
- Adaptive Management Process

CWMP Schedule

- November 2012 – WQMTF Wastewater Management Subcommittee endorsed recommended program
- January 2013 - Board of Selectmen endorse filing of recommended Draft CWMP program - ?
- February 2013 - Begin year long State and County permitting review of Draft CWMP
- Spring 2013 Town Meeting actions
  - Fund remainder of CWMP
  - Fund Phase 1 of recommended program

Summary

- This is a complex planning process – one that will continue indefinitely – as things will change – adaptive management process
- The CWMP is intended to be a living document that will adapt depending on results of earlier implementation phases
- Most properties in town contribute to the problem – not just those along a water body or those proposed for sewering
- All benefit from improved water quality

Community Meeting 1

Harwich, Massachusetts

Comprehensive Wastewater Management Plan (CWMP)

Community Meeting
Harwich Community Center
7:00PM September 27, 2007

Welcome by:
Harwich Wastewater Management Subcommittee (WMS)

- Larry Ballantine
- Dr. Stanley Kocot
- George Myers
- Robert Owens
- Frank Sampson (Chair)

Town Staff Advisors

- Paula Champagne (Board of Health)
- Sue Leven (Town Planner)
- Heinz Proft (Assistant Harbormaster)
- Craig Wiegand (Water Department)

- Jim Merriam (Town Administrator)
- Ed McManus (Selectmen's liaison)

- Town Consultant – CDM

Meeting Purpose

- Provide an overview of CWMP development process and schedule
- Review why Harwich is undertaking this important program
- Notify local residents and business owners of the importance for them to participate and how they can do so.

Need for Citizen's Advisory Committee (CAC)

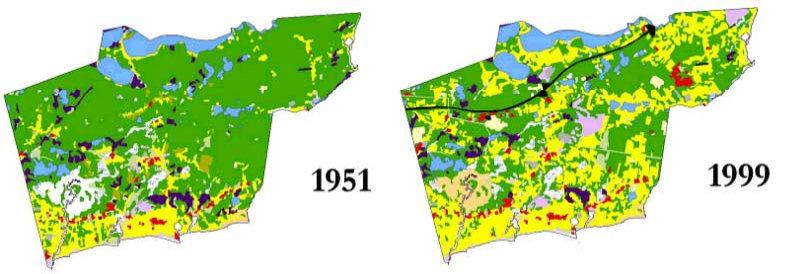
- Information exchange between residents and Wastewater Management Subcommittee
- Active involvement to help formulate the "right" plan for Harwich

Presentation Overview

- Principal members – CDM Project Team
- Discuss what is a Comprehensive Wastewater Management Plan (CWMP)
- Describe the planning process
- Review the project schedule
- Discuss the opportunities for public input
- Questions and comments

Challenges for Harwich

- Growth controls / planned growth
- Protection of water supplies
- Surface water and groundwater quality
- Massachusetts Estuaries Project (MEP)



Why we are doing a CWMP?

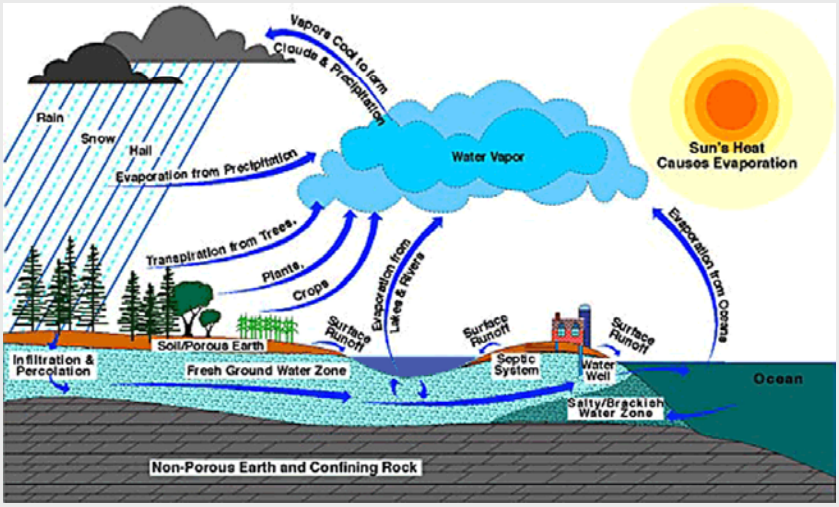
- Develop a dynamic and formal program for wastewater (and nitrogen) management to meet future needs of community
- Preserve water resources
- Address the MEP nitrogen reduction goals
- Meet DEP requirements to address nitrogen issues
- Provide for "Smart" or planned growth (Village Centers initiative)

Comprehensive Wastewater Management Plan

A CWMP Includes:

- A comprehensive wastewater needs evaluation
- Development of Wastewater management alternatives to meet those needs
- A careful consideration and evaluation of alternative plans
- A planning process "standardized" by DEP
- Continuous public participation

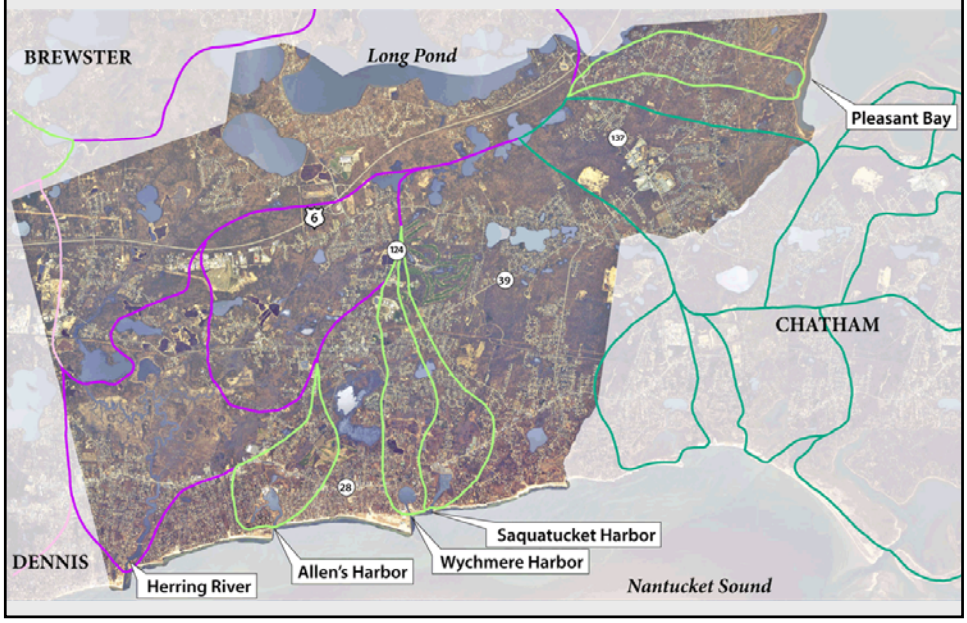
Conceptual Water Cycle



MEP Status

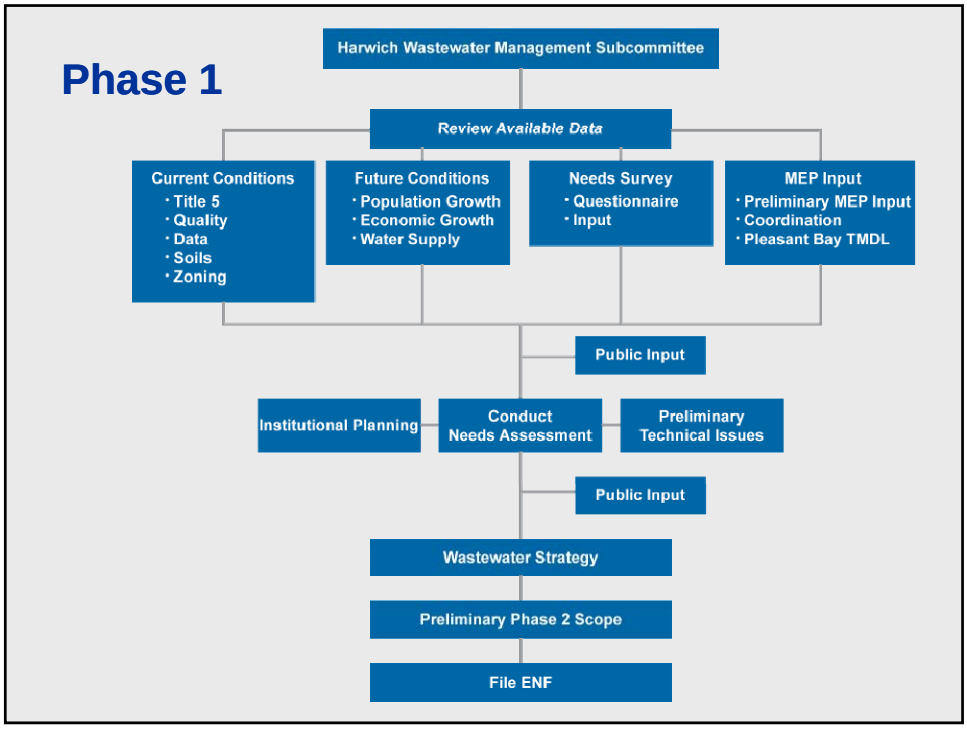
- Project on schedule
- Final results due in 2008
- Harwich embayments
  - Pleasant Bay
  - Allen's Harbor
  - Saquatucket Harbor
  - Wychmere Harbor
  - Herring River

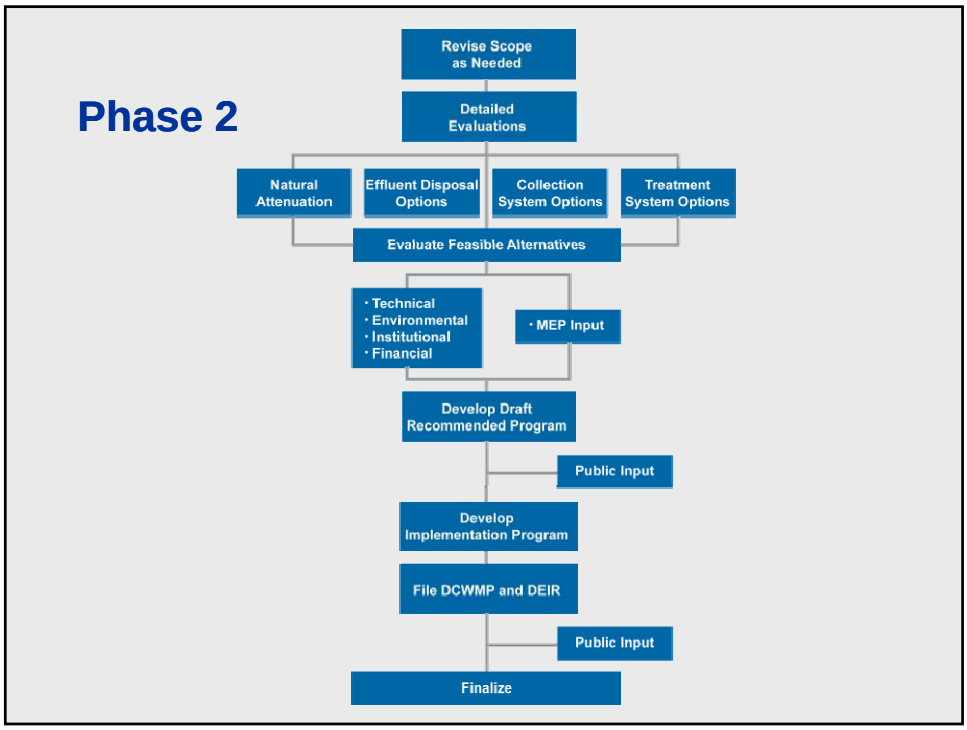
Harwich MEP Embayments



The CWMP Planning Process

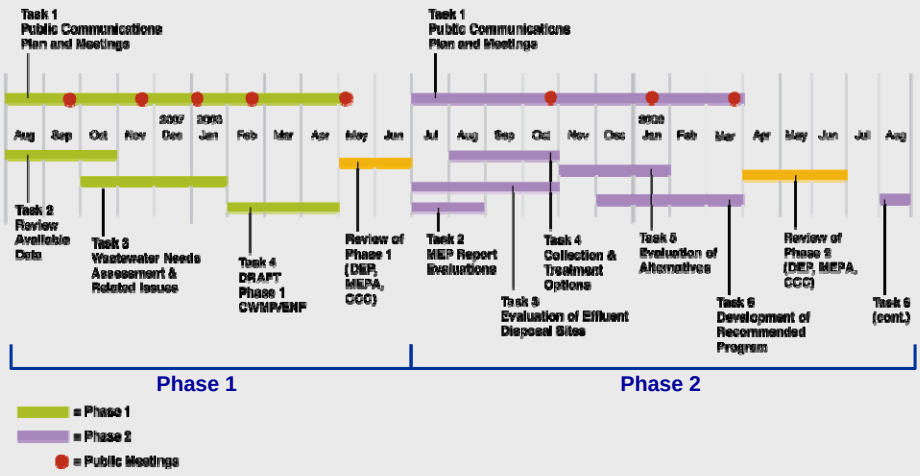
- Wastewater Management Subcommittee
- Project scope
  - Phase 1
  - Phase 2
- Public involvement
- Regulatory / environmental review


Phase 1
Harwich Wastewater Management Subcommittee
Review Available Data
Current Conditions
· Title 5
· Quality
· Data
· Soils
· Zoning
Future Conditions
· Population Growth
· Economic Growth
· Water Supply
Needs Survey
· Questionnaire
· Input
MEP Input
· Preliminary MEP Input
· Coordination
· Pleasant Bay TMDL
Public Input
Institutional Planning
Conduct Needs Assessment
Preliminary Technical Issues
Public Input
Wastewater Strategy
Preliminary Phase 2 Scope
File ENF

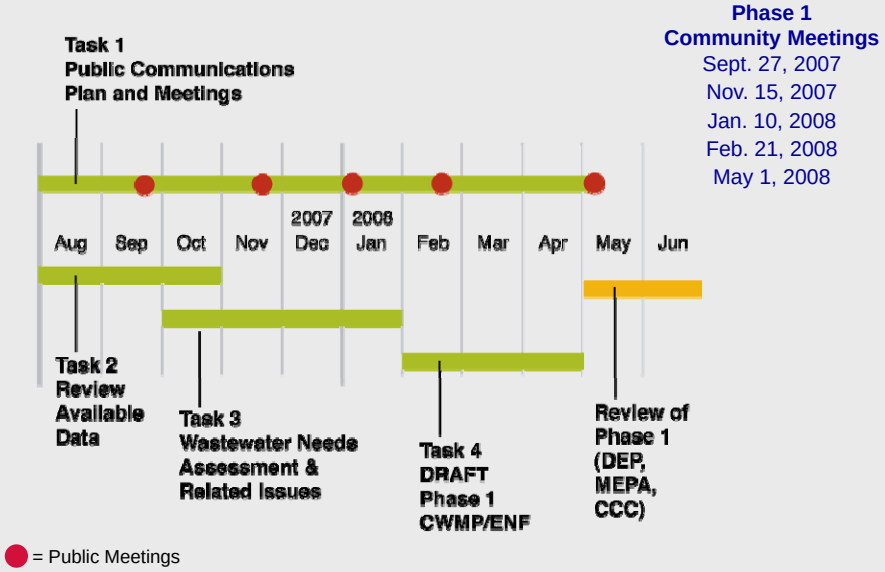

Phase 2
Revise Scope as Needed
Detailed Evaluations
Natural Attenuation
Effluent Disposal Options
Collection System Options
Treatment System Options
Evaluate Feasible Alternatives
· Technical
· Environmental
· Institutional
· Financial
· MEP Input
Develop Draft Recommended Program
Public Input
Develop Implementation Program
File DCWMP and DEIR
Public Input
Finalize

Iterative Process

Schedule



Phase 1



Phase 1
Community Meetings
Sept. 27, 2007
Nov. 15, 2007
Jan. 10, 2008
Feb. 21, 2008
May 1, 2008

● = Public Meetings

Opportunities for Public Participation

- **CAC involvement**
- **Community meeting participation**
- **Website—hwqtf.com**
- **Cable TV**

Town Web Site

HWQTF Web Site

Next Community Meeting

Save the date: **November 15, 2007**

Topic: **Summary of Existing Conditions**

Contacts:

- **WMS Chairperson – Frank Sampson**
  - **mailbox at Town Hall – hwqtf-wms**
  - **Email: sampscape@capecod.net**

Community Meeting 1

Massachusetts Estuaries Project
Estuarine Restoration and Management

Estuaries of the Town of Harwich: Present Health and Steps Toward Restoration

Brian L. Howes, Technical Director
DEP/SMAST Massachusetts Estuary Project
Director, Coastal Systems Program
School for Marine Science & Technology – UMassD

Town of Harwich & CDM
January 10,2008

FOCUS: Major Problems Facing Embayments Throughout SE Mass

- ***The 2 primary issues:***

→increased nutrient loading to the estuary, resulting in wholesale decline in estuarine health from shifting land-use.

--> bacterial contamination resulting in shellfish bed closures.

Embayment Nutrient Related Health:

Degradation of Estuaries and Bays by nutrient enrichment is primarily through Nitrogen from surrounding watersheds.

Over-Fertilization results in declining health:

- *Phytoplankton Blooms and turbid waters*
- *Loss of eelgrass beds*
- *Decline in benthic animal populations, fish & shellfish*
- *Low Oxygen in bay waters, fish kills, possibly odors*
- *Macro-algal accumulations*
- *At highest levels → loss of aesthetics*

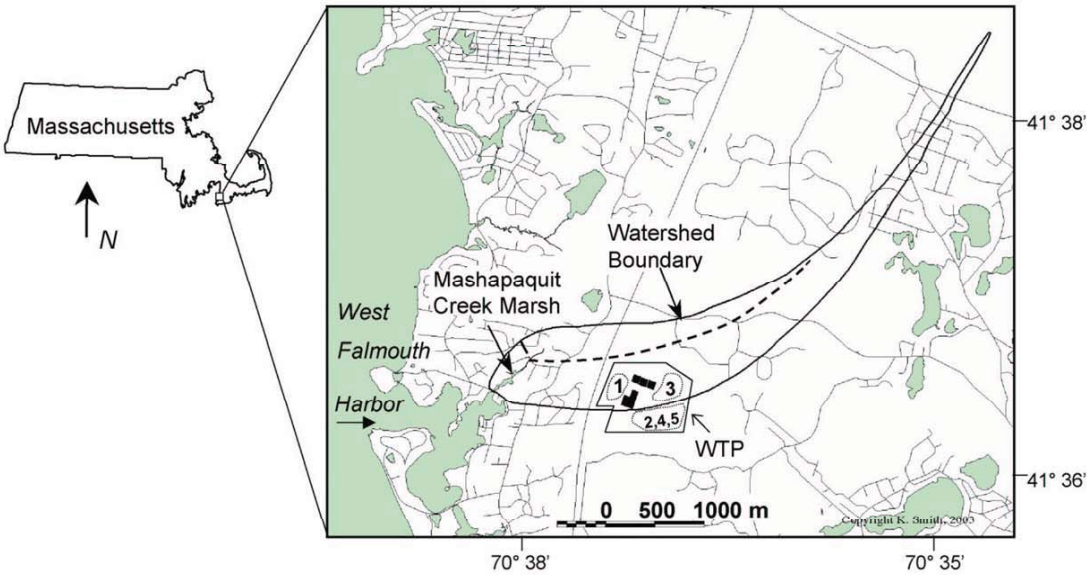
Nitrogen Enrichment -->Habitat Decline
Example: Eelgrass Loss

Low Nitrogen Loading, Healthy Eelgrass and Diverse Animal Communities

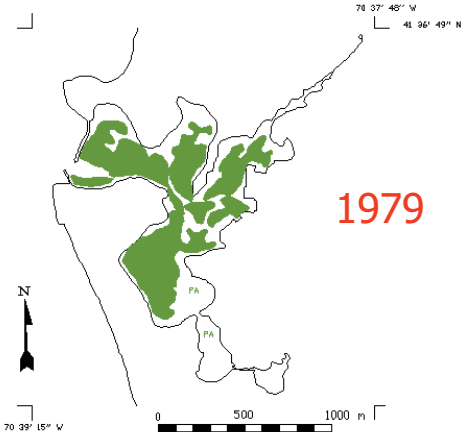
High Nitrogen Loading, Macroalgae Replacing Eelgrass, Declining Animal Communities

Very High Nitrogen Loading Macroalgae Replaces Eelgrass and Smothers Animal Communities, Declines in Fisheries

West Falmouth Harbor Wastewater Treatment Facility
Effluent Groundwater Discharge Plume

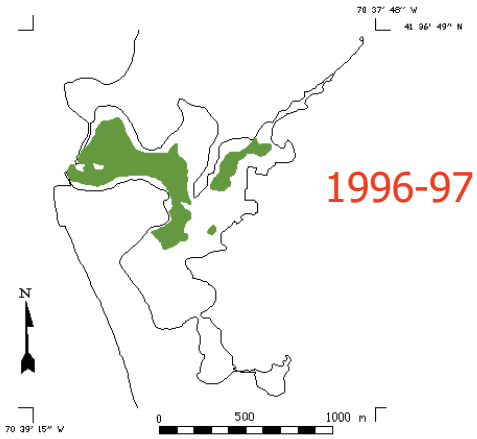


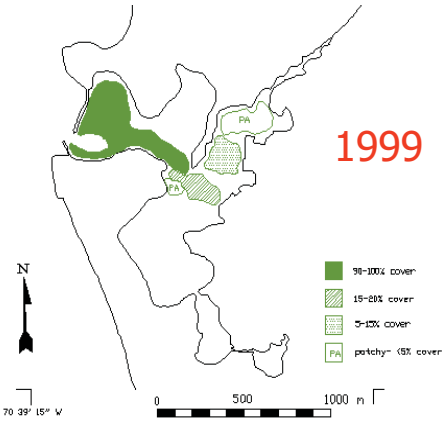
Over a ~1 yr period (1993-94) the watershed nitrogen load to the Harbor <u>more than doubled.</u>



Falmouth WWTF Nitrate Plume reached West Falmouth Harbor in 1993-94, doubling the Total Input of Watershed Nitrogen.

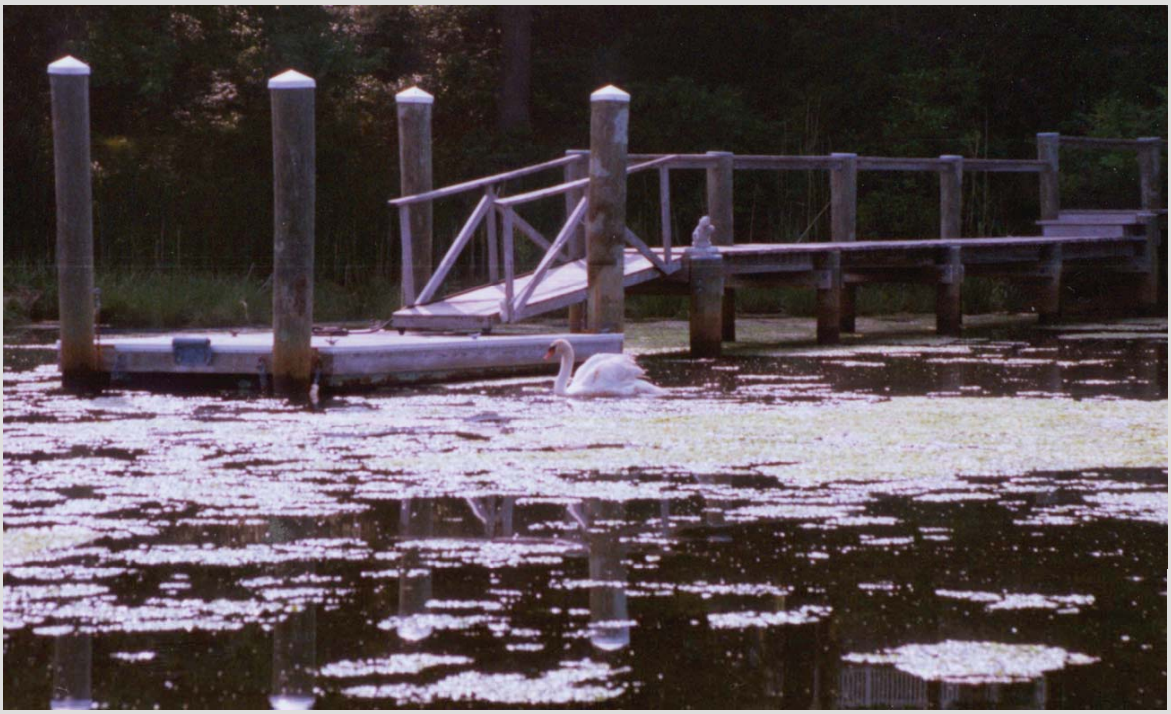
>50% eelgrass loss in 5 yrs





Embayment Response to Nitrogen Over-Enrichment: Three Bays, Cape Cod

Embayment Response to Nitrogen Over-Enrichment



What is needed to restore and protect our estuaries?

→ Nitrogen management is the only way to restore degraded estuarine habitat and to prevent future habitat degradation.

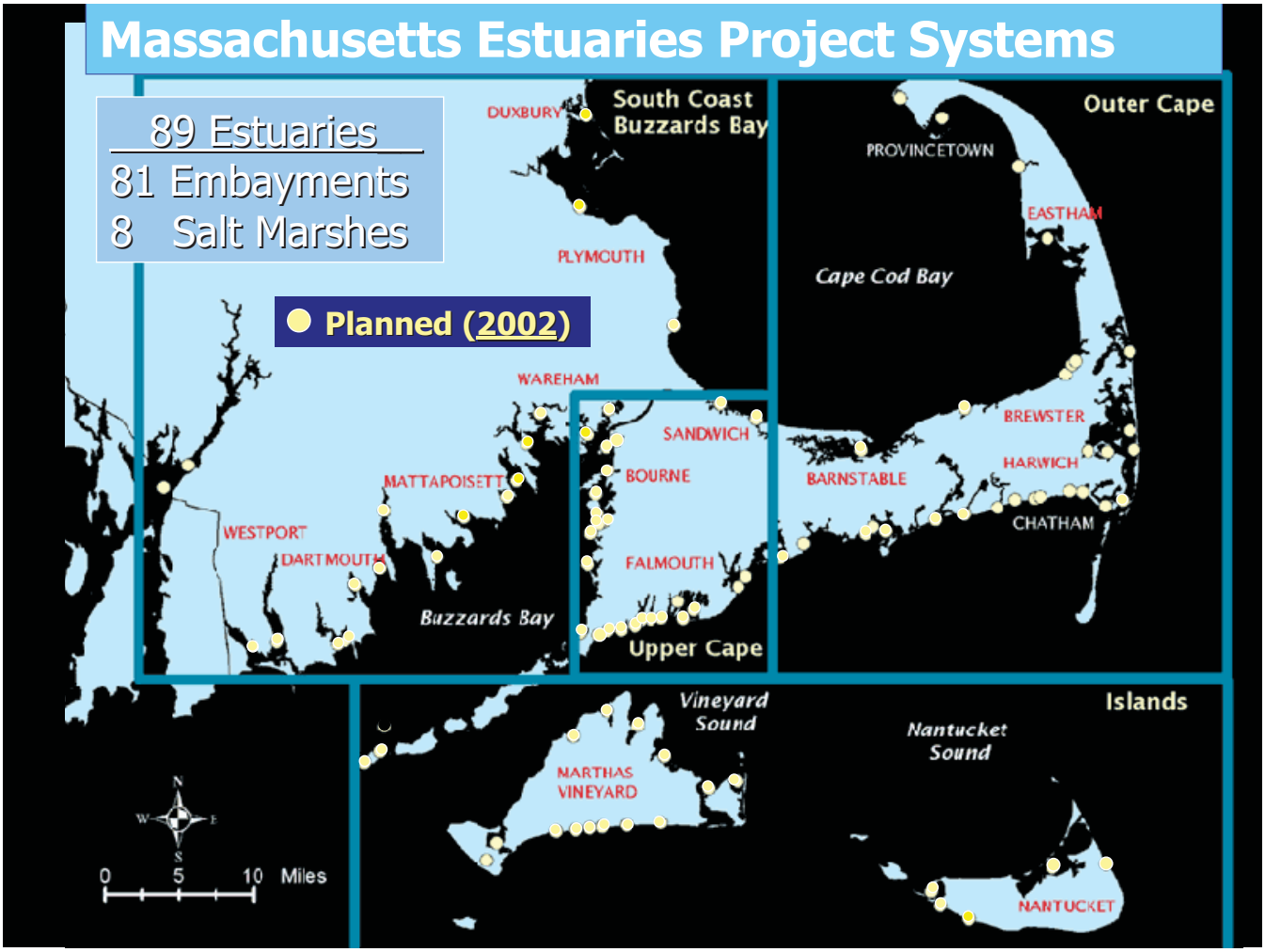
→ Nitrogen management must focus primarily on control of watershed nitrogen inputs and maximizing tidal flushing.

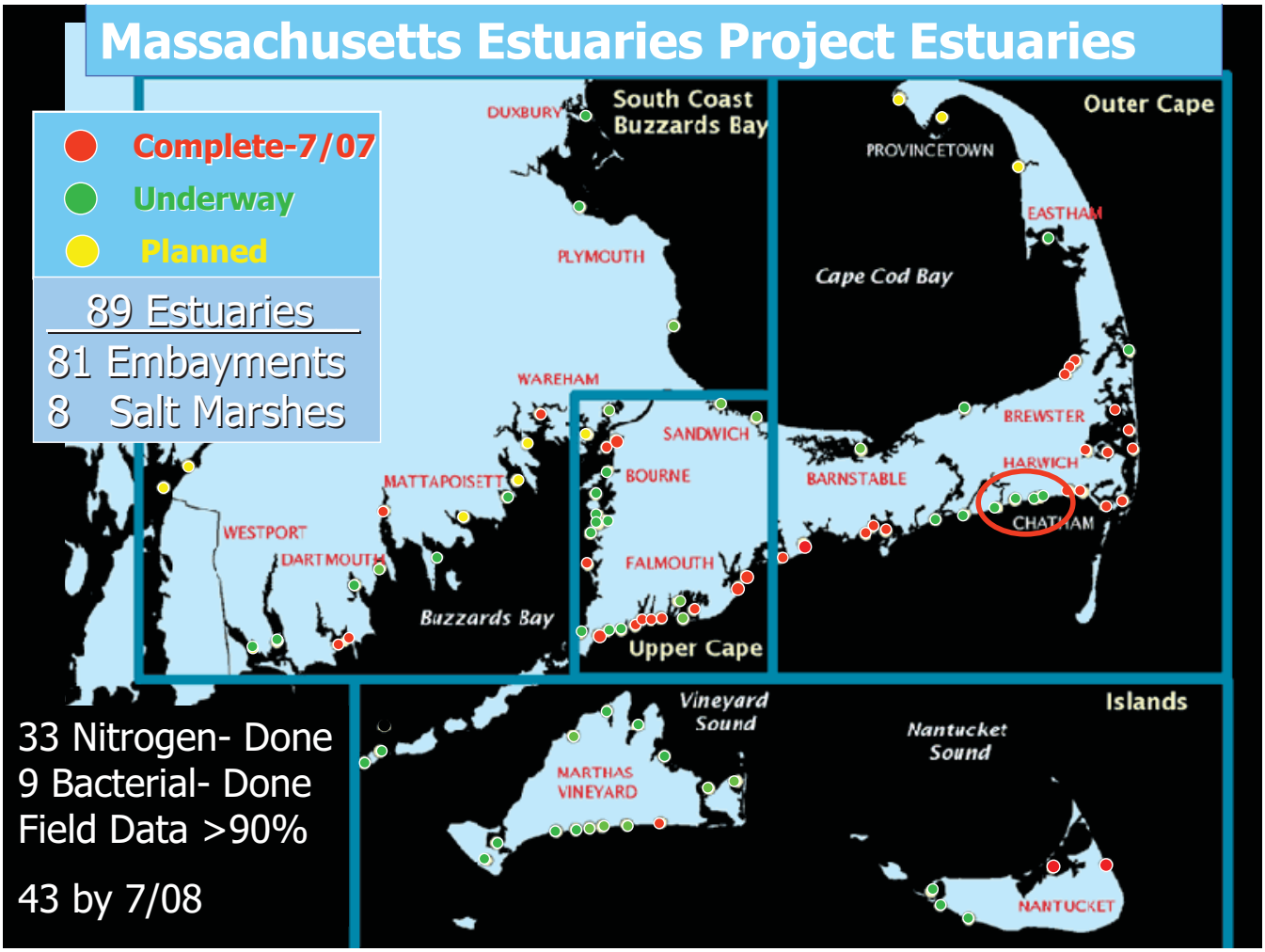
SMAST/DEP Massachusetts Estuaries Project

- A partnership between
  - –DEP/EOEA (regulatory, TMDL's)
  - –SMAST/UMassD (science, assessment & modeling)
  - – with S.E. Mass. Municipalities, Barnstable County, Cape Cod Commission, MVCommission, SRPEDD, USGS, EPA, DMF
- Purpose:
  - – to develop nitrogen thresholds and target loads for the embayments of southeastern Massachusetts
  - – to bring new approaches & tools to watershed nitrogen management for estuarine restoration

Regulatory Framework for MEP

- Federal Clean Water Act
- States classify all aquatic resources as to their highest and best use.
- Waters failing to meet their classification require restoration plans (TMDLs).
- Estuaries Project provides the scientific basis for all of the estuaries in s.e. MA.

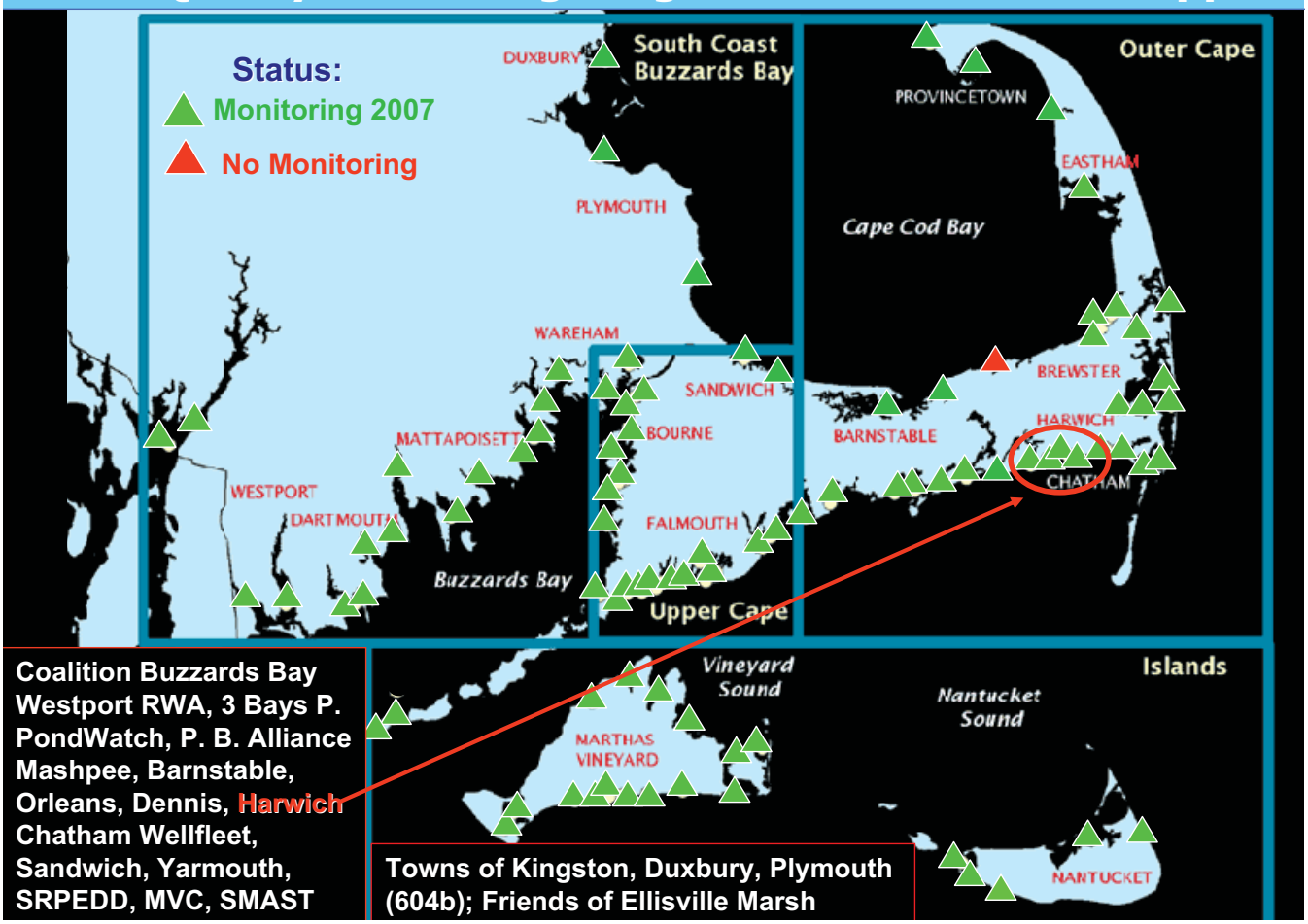




Watershed Nitrogen Management for Embayment Protection/Restoration

- ✓ **Phase I:** Monitoring of Embayment Nutrient Related Health
- ✓ **Phase II:** Quantitative Watershed-Embayment Assessment & Modeling
- ➢ **Phase III:** Implementation-Design, use of Validated Watershed-Embayment Model to Prioritize Management Options, cost/benefit
- • **Phase IV:** Engineering Design & Implementation of Selected N Management Alternatives
- • **Phase V:** Embayment Monitoring to support Adaptive Management

Water Quality Monitoring Programs – SMAST Tech Support



Coalition Buzzards Bay
Westport RWA, 3 Bays P.
PondWatch, P. B. Alliance
Mashpee, Barnstable,
Orleans, Dennis, Harwich
Chatham Wellfleet,
Sandwich, Yarmouth,
SRPEDD, MVC, SMAST

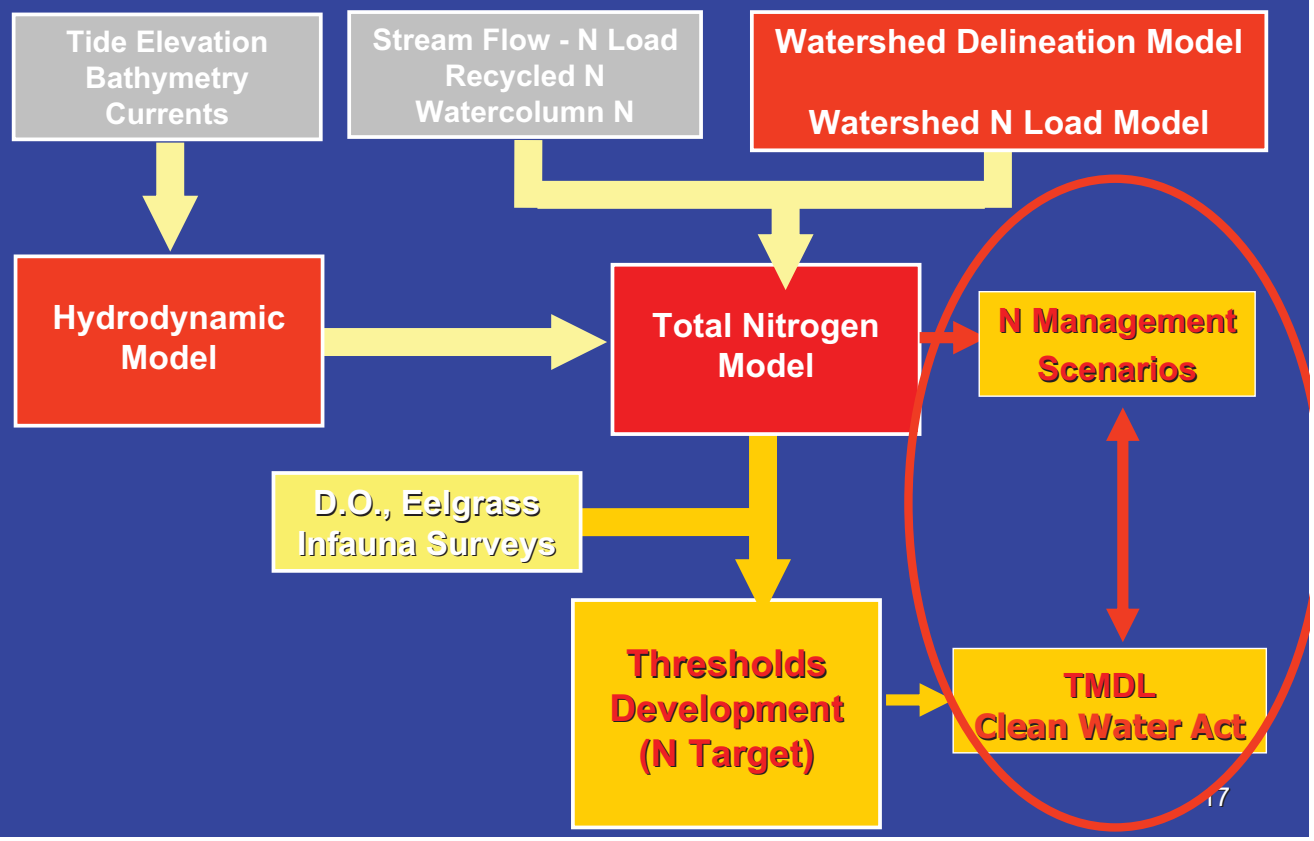
Towns of Kingston, Duxbury, Plymouth
(604b); Friends of Ellisville Marsh

Estuaries Project Approach:

Site-specific Integrated N Model based upon the watershed and embayment conditions REQUIRING:

- Data collection
- Assessment
- Model Construction, Calibration & Validation
- N Management Alternatives Analysis

MA Estuaries Project: Linked Watershed-Embayment Approach



Why is the Commonwealth using the Estuaries Project Approach for Estuaries?

Uncertainty costs $$

- Provides the most accurate linkage of watershed N loads to estuarine health.
- Determines the site-specific N Threshold level for sustaining a healthy estuarine system
- Creates a tool for quantitative Management Alternatives Analysis

Massachusetts Estuaries Project Restoration Analysis

Status of MEP Analysis:

Allens Harbor
Saquatucket Harbor
Wychmere Harbor
Herring River

Town of Harwich – Massachusetts Estuaries Project Partnership for the Nitrogen Management of the Herring River, Wychmere Harbor, Allens Harbor & Saquatucket Harbor

Hydrodynamic Modeling
Bathymetric Survey: All 4 Estuaries – Complete
Tides, salinity & flow validation: All 4 Estuaries – Complete
Hydro Model & Validation: All 4 Estuaries – Complete

Watershed Nitrogen Loading
Delineation and incorporation into GIS: All 4 Estuaries – Complete
Stream flow & N load: All streams - Complete
Validation of watershed using streams - Complete 1/08
Land-Use Analysis: In Progress for Completion <6/08
Watershed Nitrogen Model: In Progress for Completion <6/08

Quantitative Linked Watershed-Embayment Nitrogen Model
Nitrogen regeneration within embayments - Complete
System predictive model & validation : In Progress for Completion <6/08

Town of Harwich – Massachusetts Estuaries Project
Partnership for the Nitrogen Management of the
Herring River, Wychmere Harbor, Allens Harbor & Saquatucket Harbor

Habitat Assessment

Dissolved oxygen (high frequency measures in targeted areas): **Complete**
Eelgrass & macroalgae Surveys+ historical analysis - **Complete**
Benthic Animal Communities (indicators of stress): **Complete**

Nitrogen Threshold Analysis – Restoration Targets

- determination of embayment nitrogen loading tolerances (spatially)
- projection of embayment health at build-out & best case potential loadings
-evaluation of soft and hard nitrogen management options (initial screening)

Allens, Wychmere and Saquatucket Harbors → In Progress for Completion 6/08
Herring River → In Progress for Completion 9/08

Estuaries of the Town of Harwich

Present Nutrient Related Health of:

Allens Harbor
Saquatucket Harbor
Wychmere Harbor
Herring River

Allens Harbor
Nutrient Related Water Quality

Estuarine Quality Index

Red = Poor

Yellow = Moderate

Blue = High

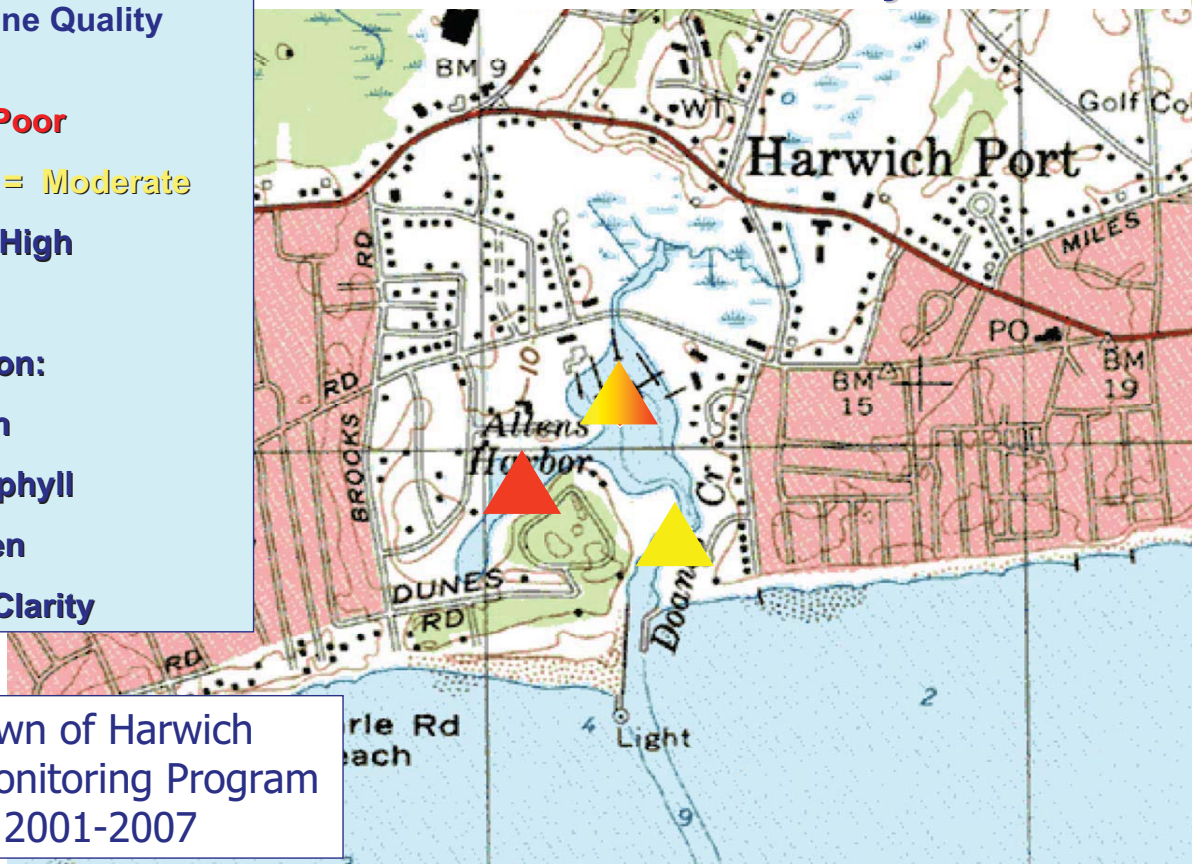
based on:

Oxygen

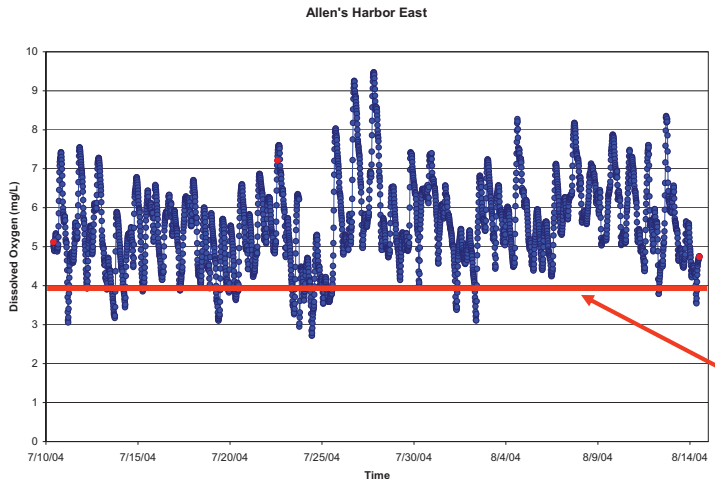
Chlorophyll

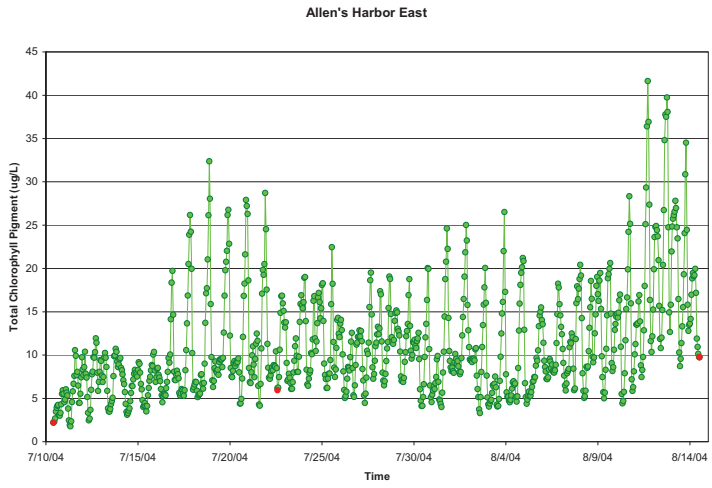
Nitrogen

Water Clarity



Town of Harwich
WQ Monitoring Program
2001-2007

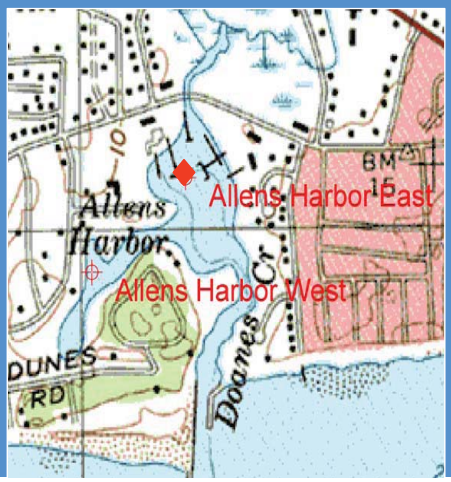


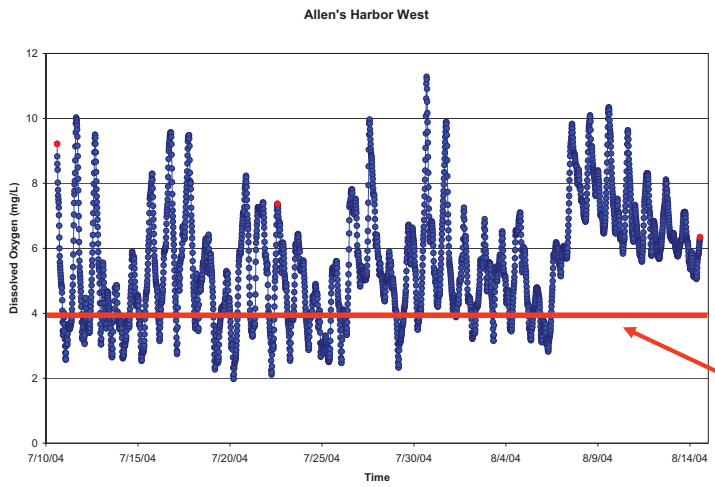


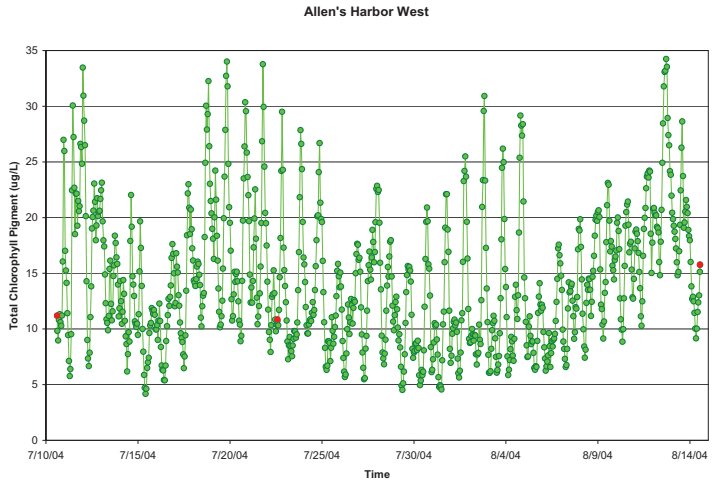
Allens Harbor East Summer 2004

- **Dissolved Oxygen**
- **Chlorophyll-a**

Critical DO Level indicative of Habitat Impairment





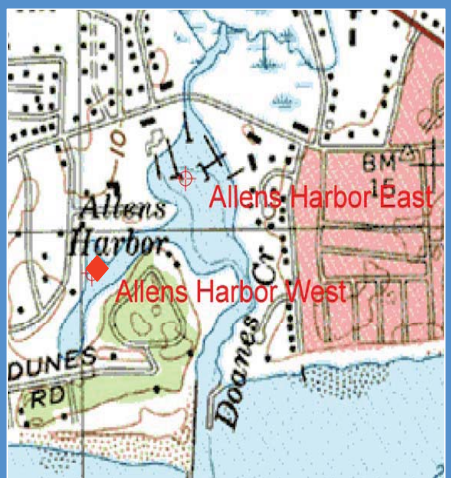


Allens Harbor West [Oyster Creek]

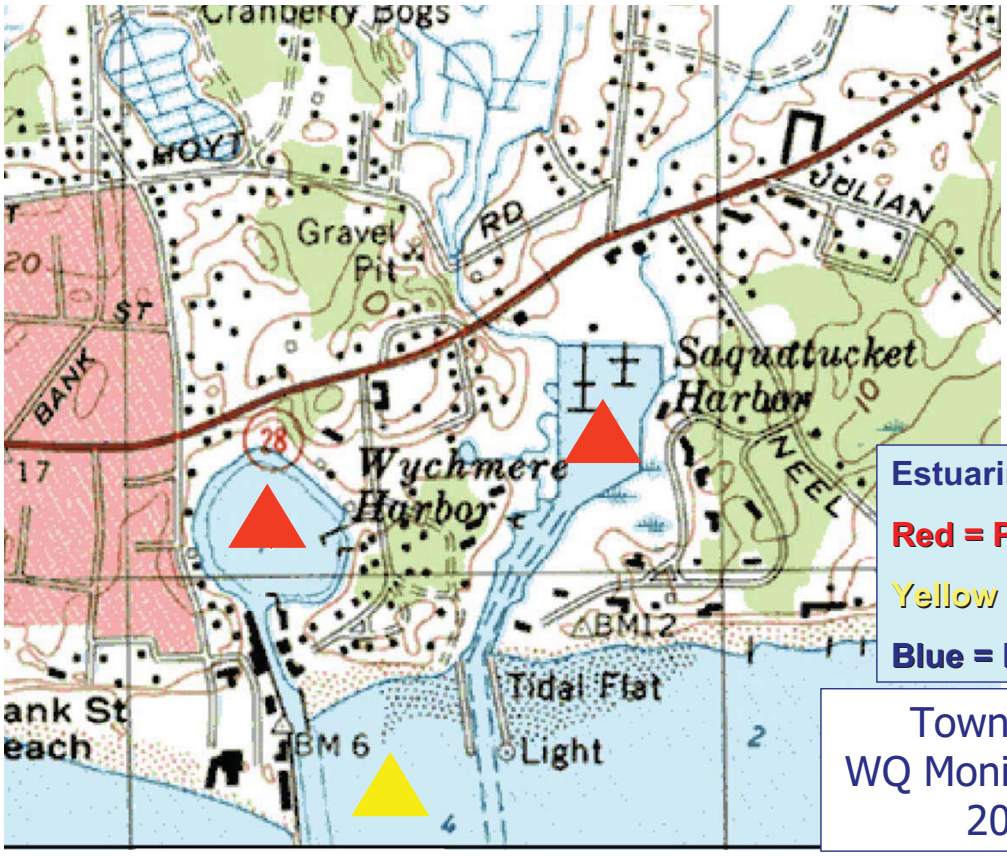
Summer 2004

- Dissolved Oxygen
- Chlorophyll-a

Critical DO Level indicative of Habitat Impairment



Wychmere and Saquatucket Harbors Nutrient Related Water Quality



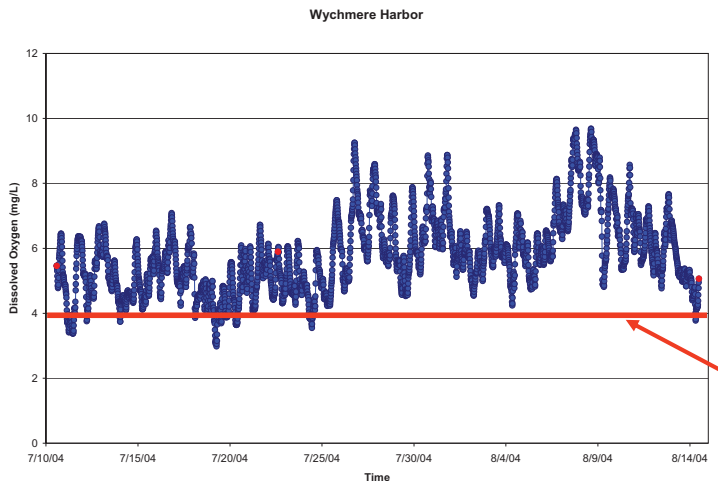
Estuarine Quality Index

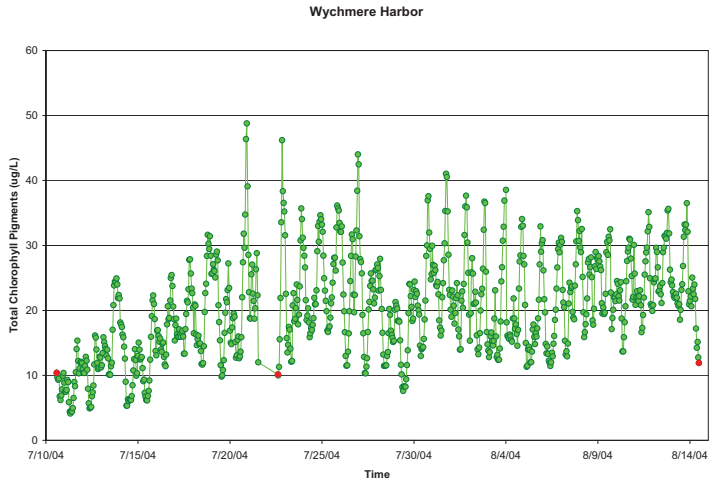
Red = Poor

Yellow = Moderate

Blue = High

Town of Harwich
WQ Monitoring Program
2001-2007

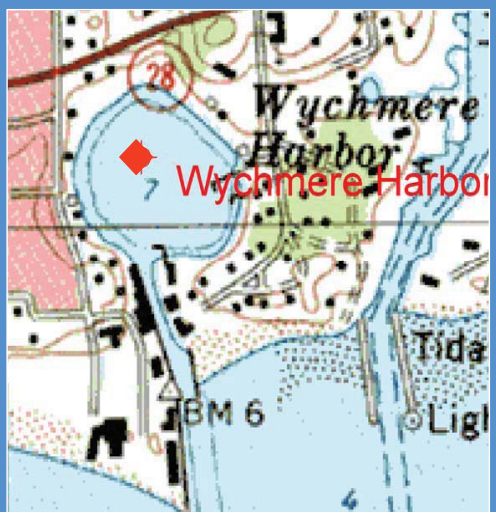


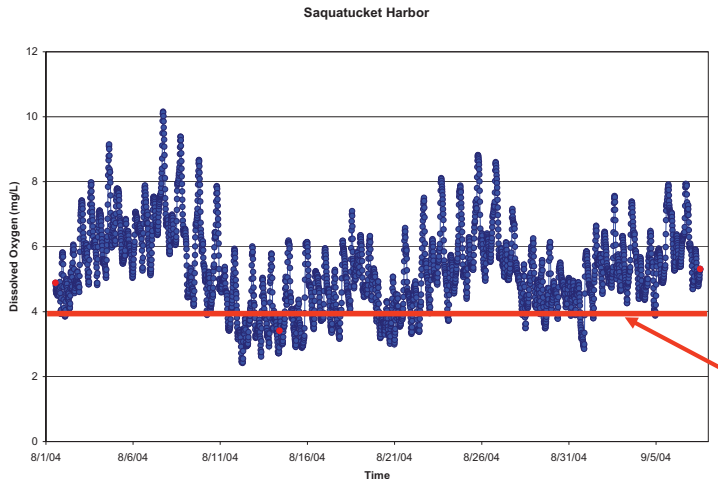


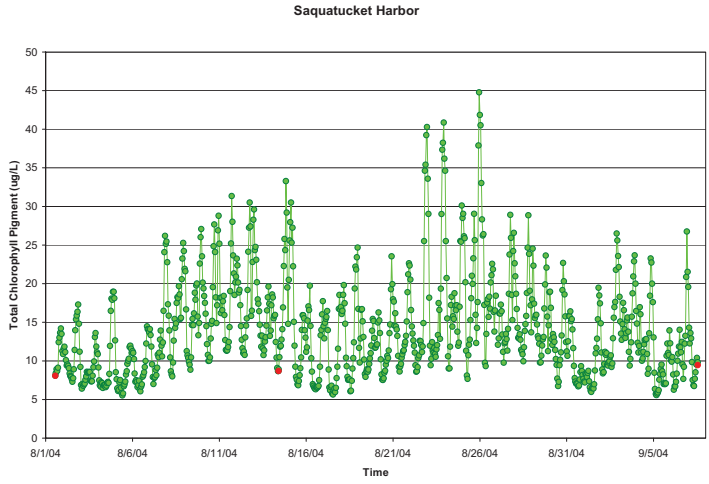
Wychmere Harbor Summer 2004

- Dissolved Oxygen
- Chlorophyll-a

Critical DO Level indicative of Habitat Impairment



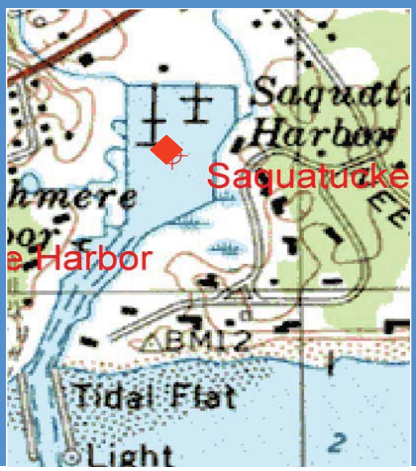




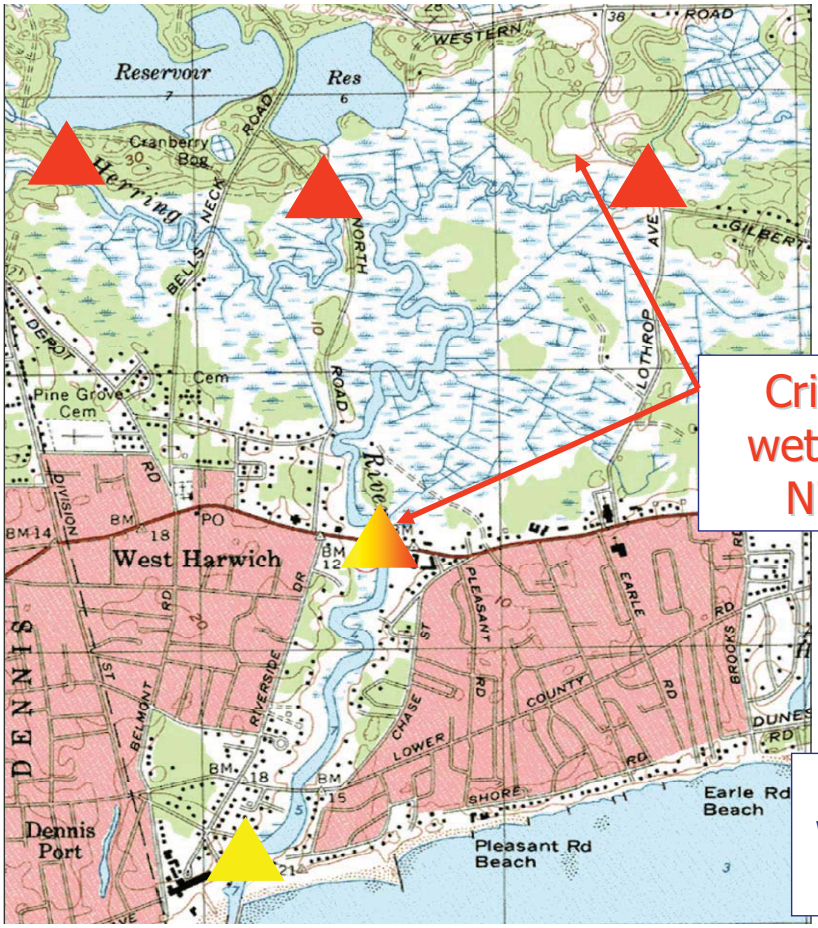
Saquatucket Harbor Summer 2004

- Dissolved Oxygen
- Chlorophyll-a

Critical DO Level indicative of Habitat Impairment



Herring River Nutrient Related Water Quality



Estuarine Quality Index

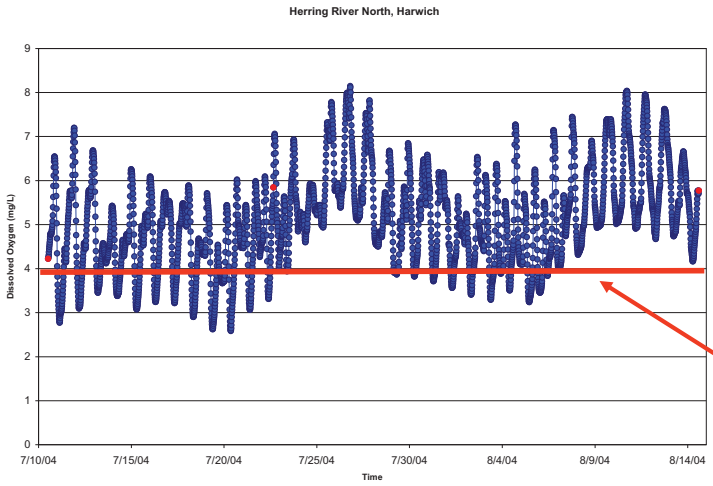
Red = Poor

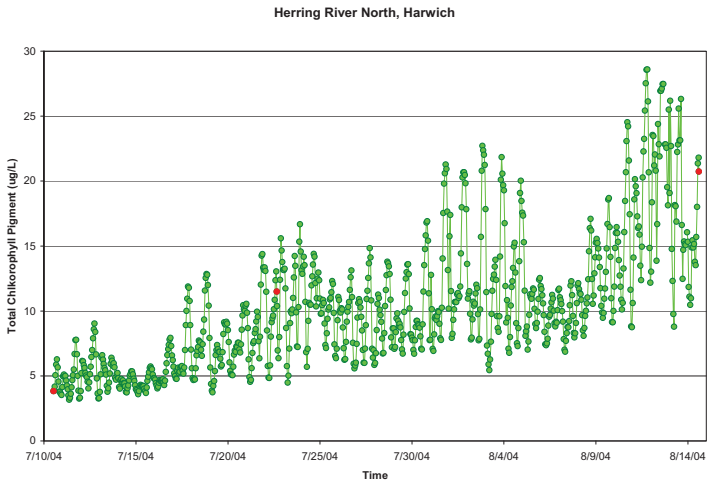
Yellow = Moderate

Blue = High

Critical to account for wetland vs embayment Nitrogen Sensitivity

Town of Harwich
WQ Monitoring Program
2001-2007

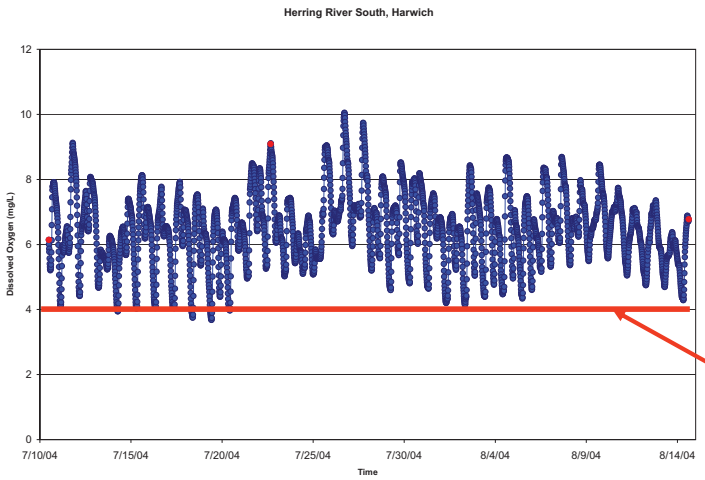


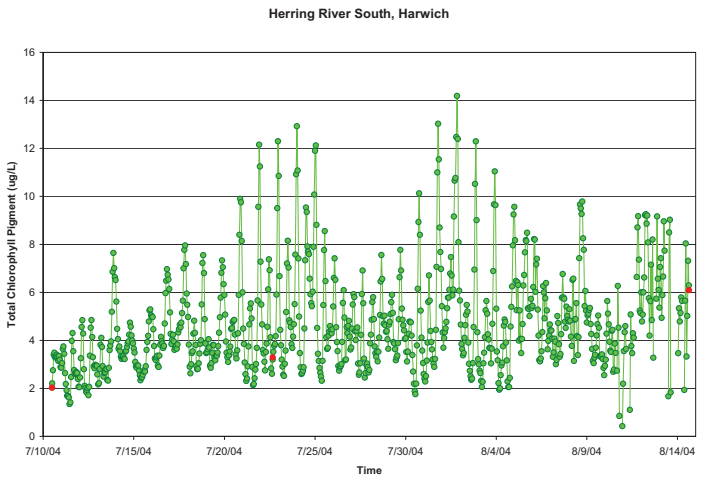


Herring River North [Upper River] Summer 2004

- **Dissolved Oxygen**
- **Chlorophyll-a**

Critical DO Level indicative of Habitat Impairment





Herring River South [Lower River] Summer 2004

- Dissolved Oxygen
- Chlorophyll-a

Critical DO Level indicative of Habitat Impairment

Eelgrass Distribution 1995 and 2001

2001 ONLY
1995 AND 2001
1995 ONLY
Limits of Project
Municipal Boundary
Limited Access Highway
Multilane Highway

MEP Bathymetry Transects
(depth in meters)

Harwich Estuaries
Present Nutrient Related Health

Allens, Wychmere, Saquatucket Harbors:

Nitrogen enriched –>

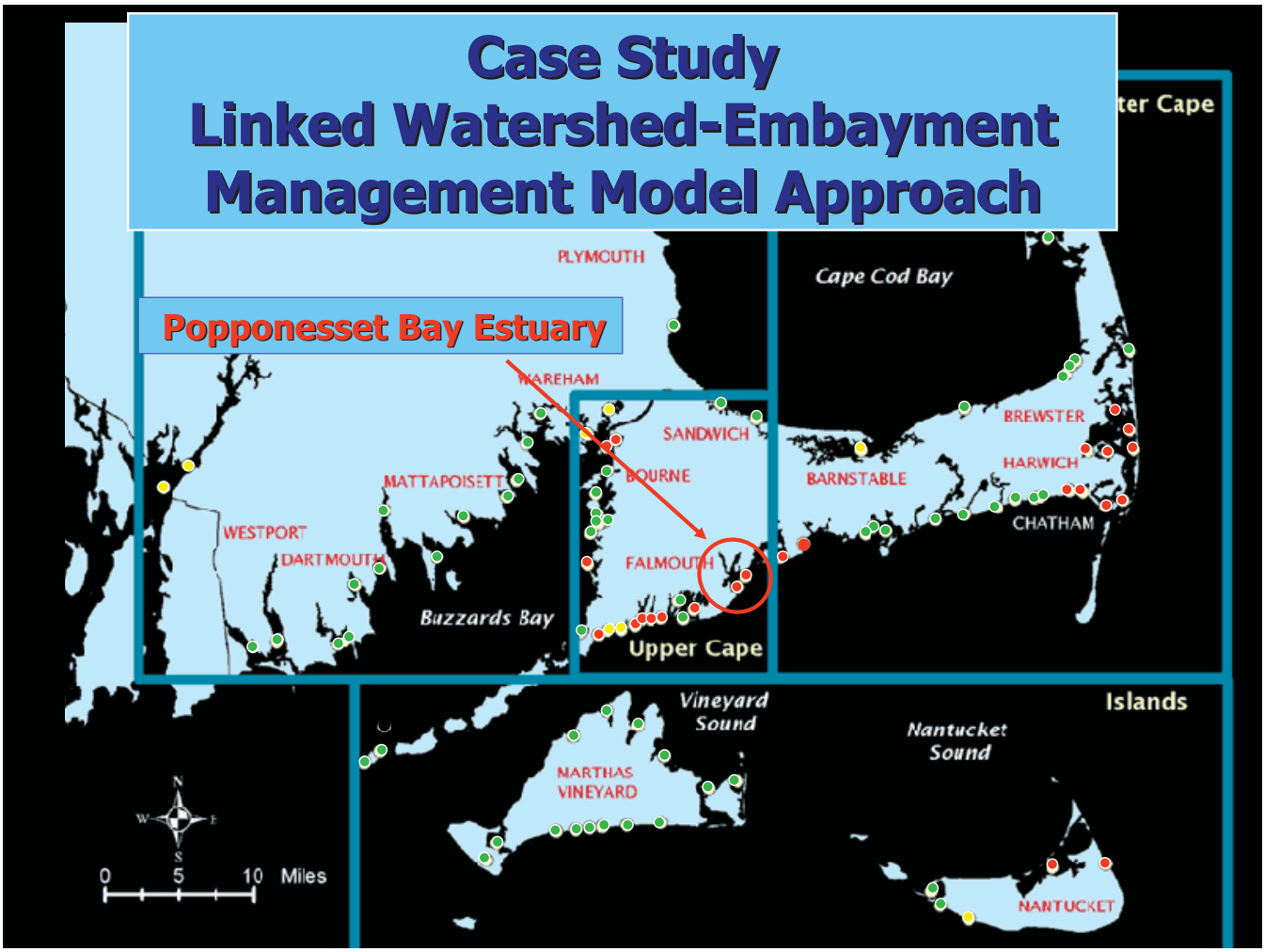
Significantly Impaired Habitat

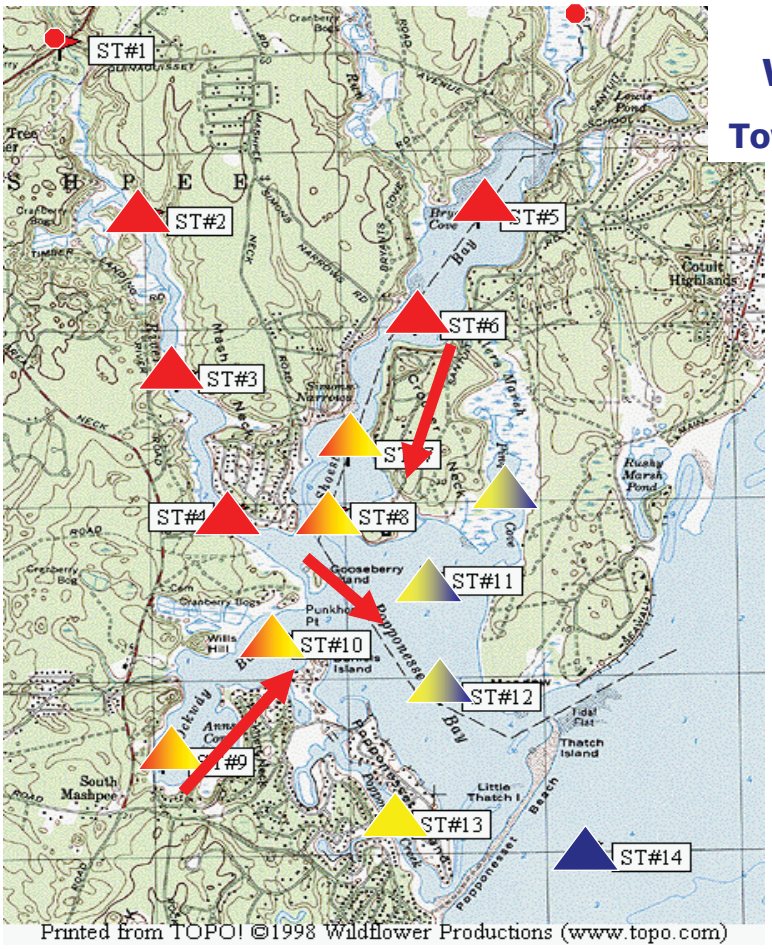
Herring River:

Upper Wetland Reach: Healthy

Lower Reach: Generally Healthy

Case Study
Linked Watershed-Embayment Management Model Approach





Nutrient Related Water Quality Monitoring

Towns of Mashpee & Barnstable

Popponesset Bay 1999-2005

Estuarine Quality Index

Red = Poor

Yellow = Moderate

Blue = High

Watershed N Loading to Estuary

- **Watershed N Load to Bay = N Sources - N Sinks + N Storage**

  -- **Sources:** wastewater, fertilizers, agriculture, impermeable surfaces, etc.

  -- **Sinks:** denitrification within wetlands, aquifer transport, surface water ecosystems, well withdrawals

  -- **Storage:** sorption, aquifer transport, biomass accumulation, etc.

Map #	Sub Embayment Name
1	Snake Pond
2	Pimlico Pond
3	Peters Pond
4	Mashpee Wakeby Pond
5	Santuit Pond
6	Upper Mashpee River
7	Lower Mashpee River
8	Quaker Run
9	Santuit River
10	Shoestring Bay
11	Pinquickset Cove
12	Ockway Bay
13	Popponesset Creek
14	Popponesset Bay
15	Quaker Run Well
16	Cotuit Well #5

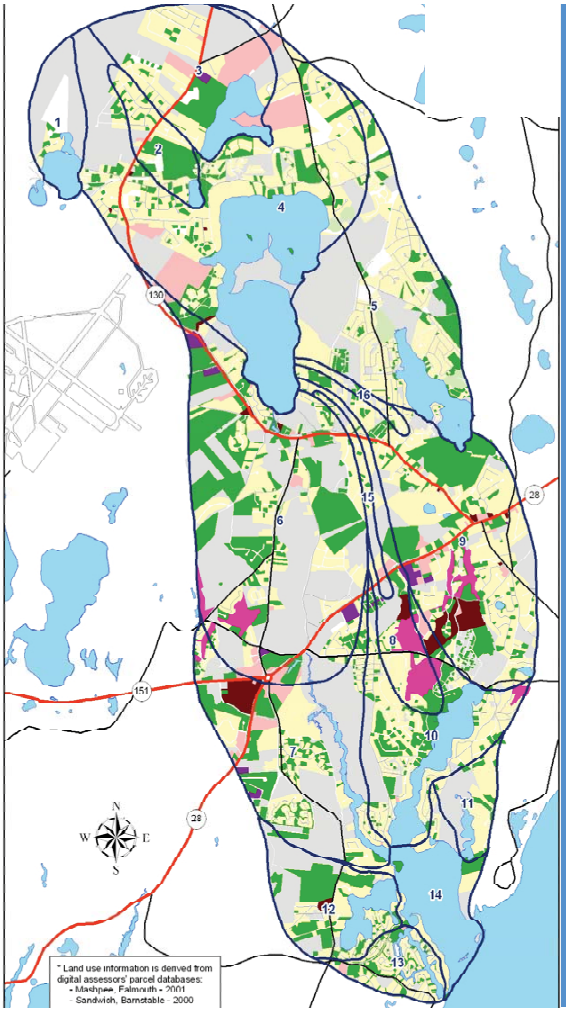
0 0.5 1 Miles

Legend

- MEP Watersheds
- Major Roads
- Numbered Routes
- Other Roads
- Bodies of Water

Land Use

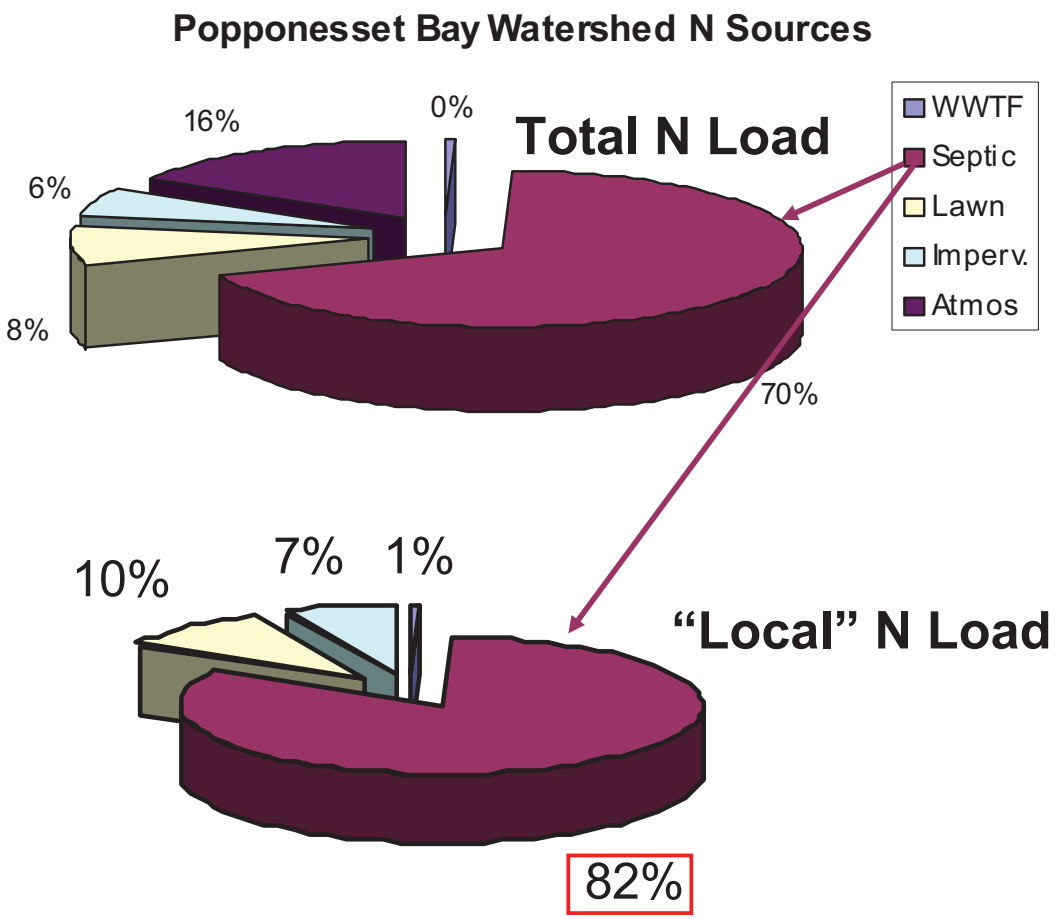
- Mixed Use
- Residential
- Commercial
- Industrial
- Undeveloped
- Agricultural
- Golf Course
- Public Service

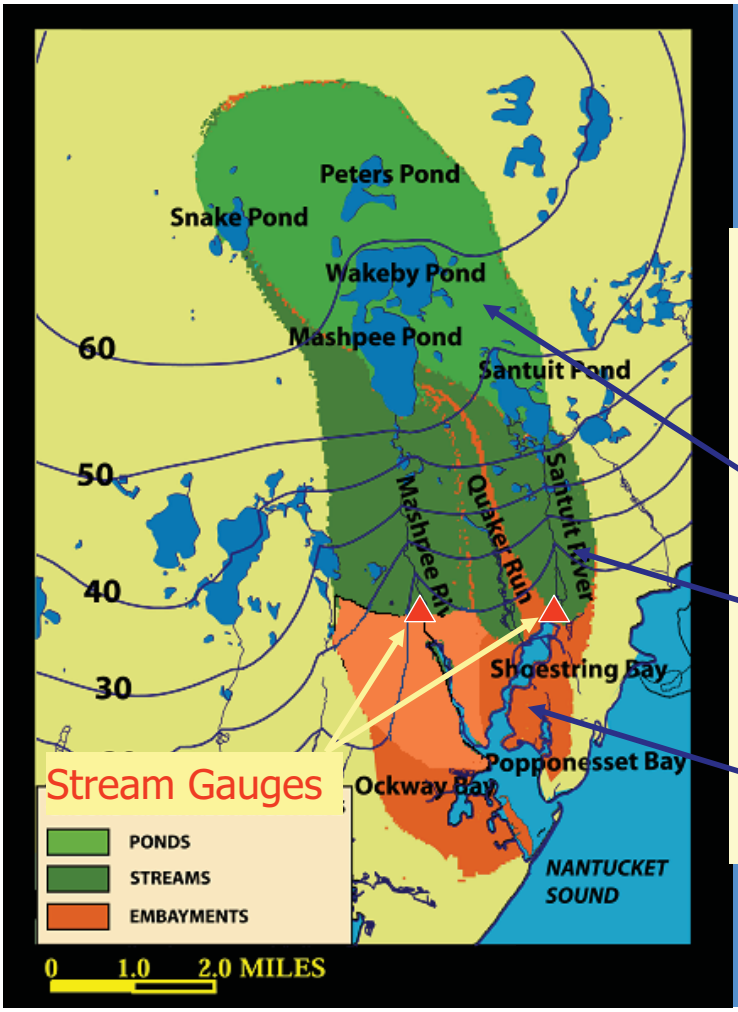


Popponesset Bay System

Parcel by parcel analysis of existing land-uses to develop present N loading

Water-use based Septic N Loading Analysis



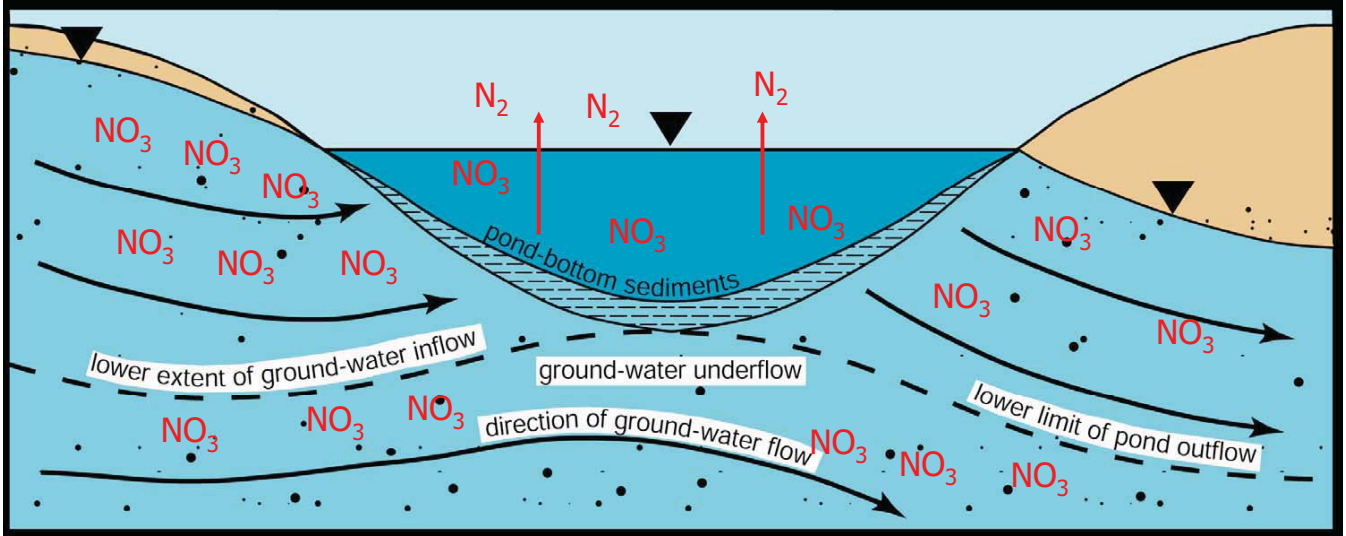


Popponesset Bay Recharge Area

Popponesset Bay: 45.5 ft³/s

Pathway	% Discharge
Ponds:	*40%*
Streamflow:	*79%*
Ground Water:	*21%*

Nitrogen Attenuation:
Ground Water Flow-Through Pond

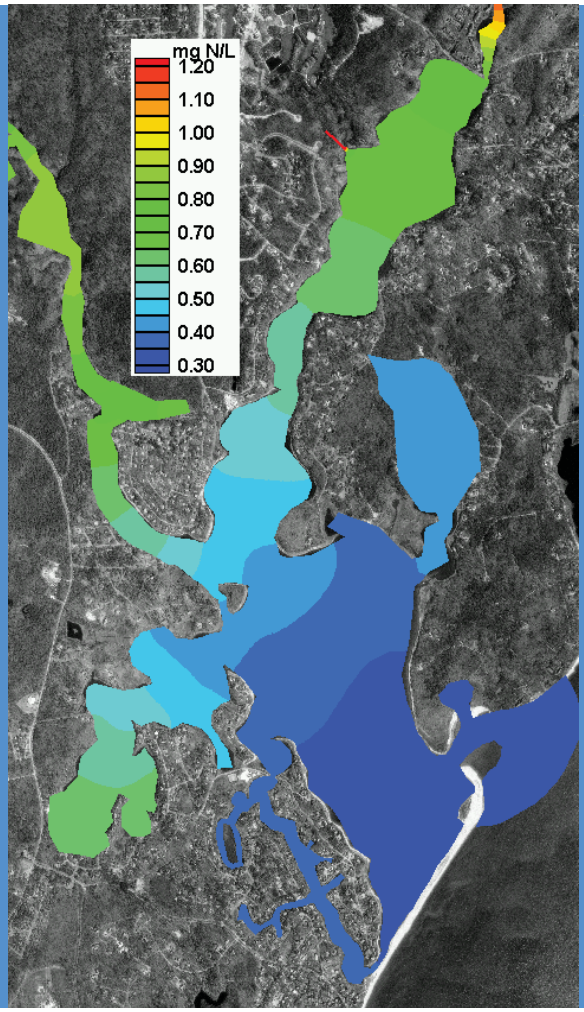


USGS

MEP Measured Natural N Attenuation

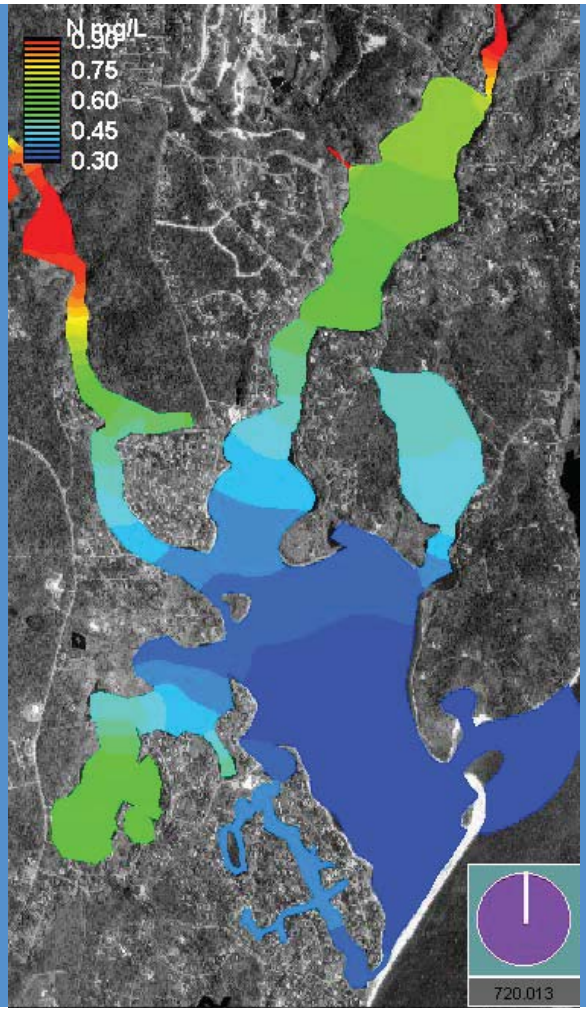
"Not all Nitrogen discharged to watershed gets to bay"

Cape Cod Estuaries	Nitrogen Loads (kg N yr -1)			
	Watershed Loading	Discharge to Estuary	Natural Attenuation	% Attenuation
Falmouth Salt Ponds				
Coonamesset River (Great Pond)	20601	8260	12341	60%
Backus Brook (Green Pond)	3719	1391	2328	63%
Bournes Brook (Bournes Pond)	3201	1201	2000	62%
Waquoit Bay System				
Quashnet River	12290	7541	4749	39%
Popponesset Bay System				
Mashpee River	19671	7989	11682	59%
Santuit River	11693	5687	6006	51%
Phinney's Harbor System				
Back River	1018	498	520	51%
Three Bays System				
Marstons Mills Pond/River	14,539	5,299	9,238	64%
Little River	2,932	1,446	1,486	51%



Popponesset Bay
Average total nitrogen concentrations
Present N Loading

Model is <u>Calibrated</u> with site-specific data and then Independently <u>Validated</u>



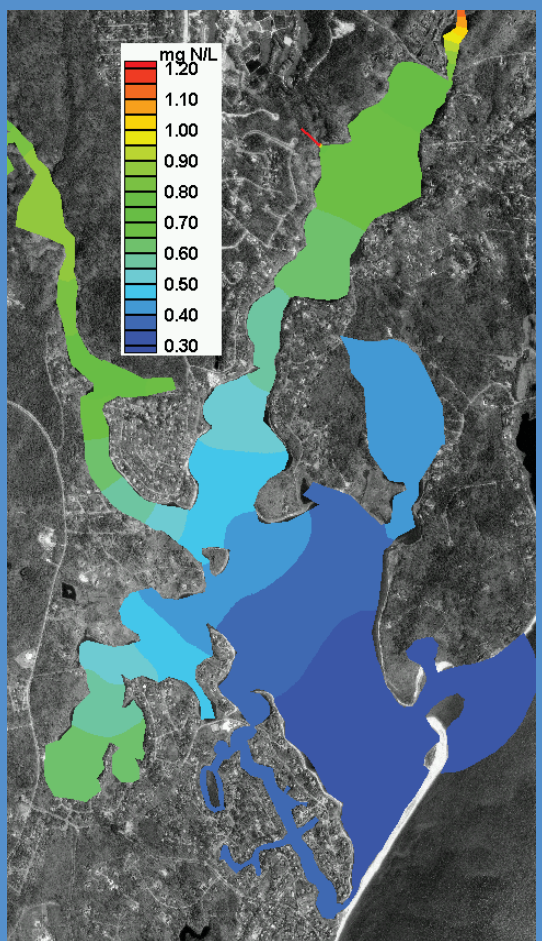
Popponesset Bay System

MEP
Watershed-Embayment
Nitrogen Model

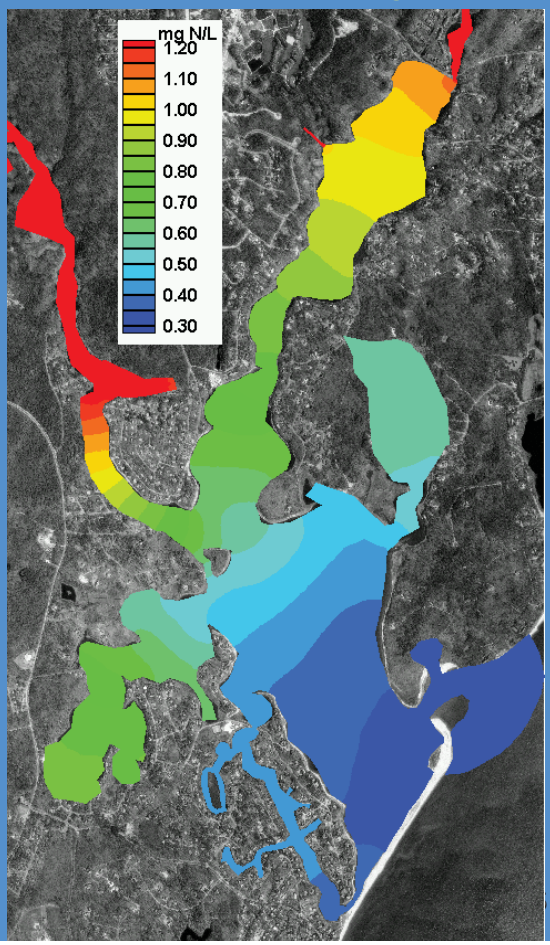
Present Conditions

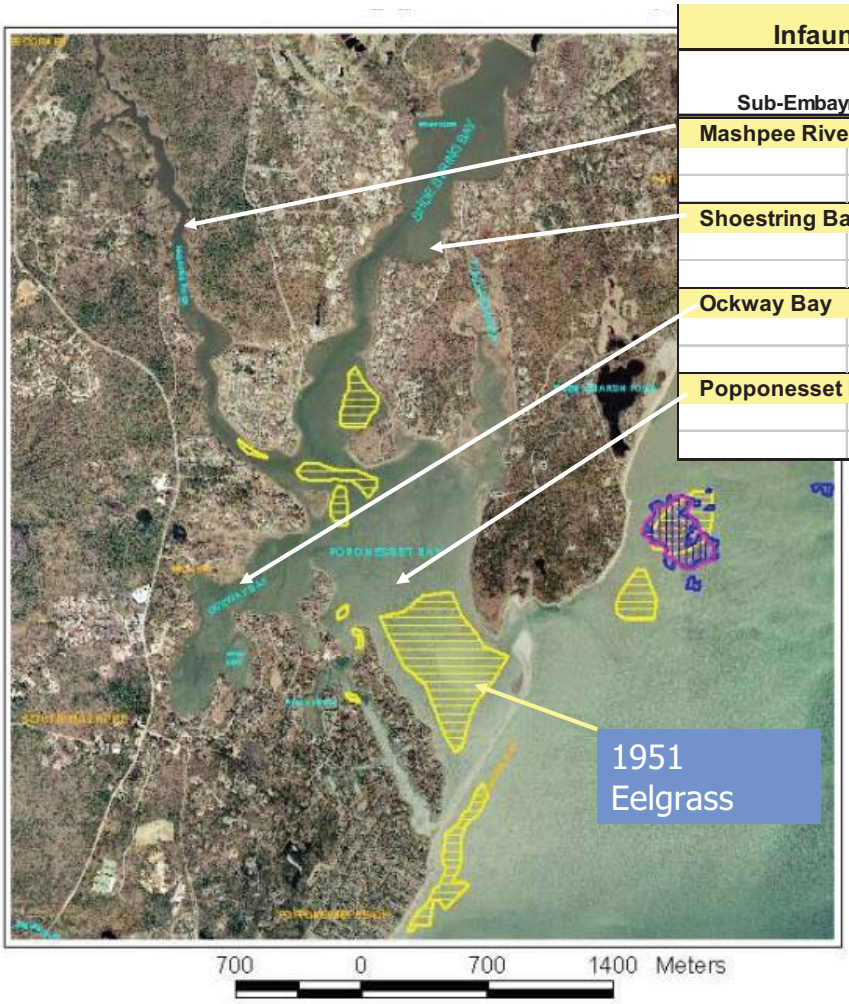
Variation in Nitrogen Gradients through a Tidal Cycle

Present Condition Loading Scenario



Build-out Condition Loading Scenario



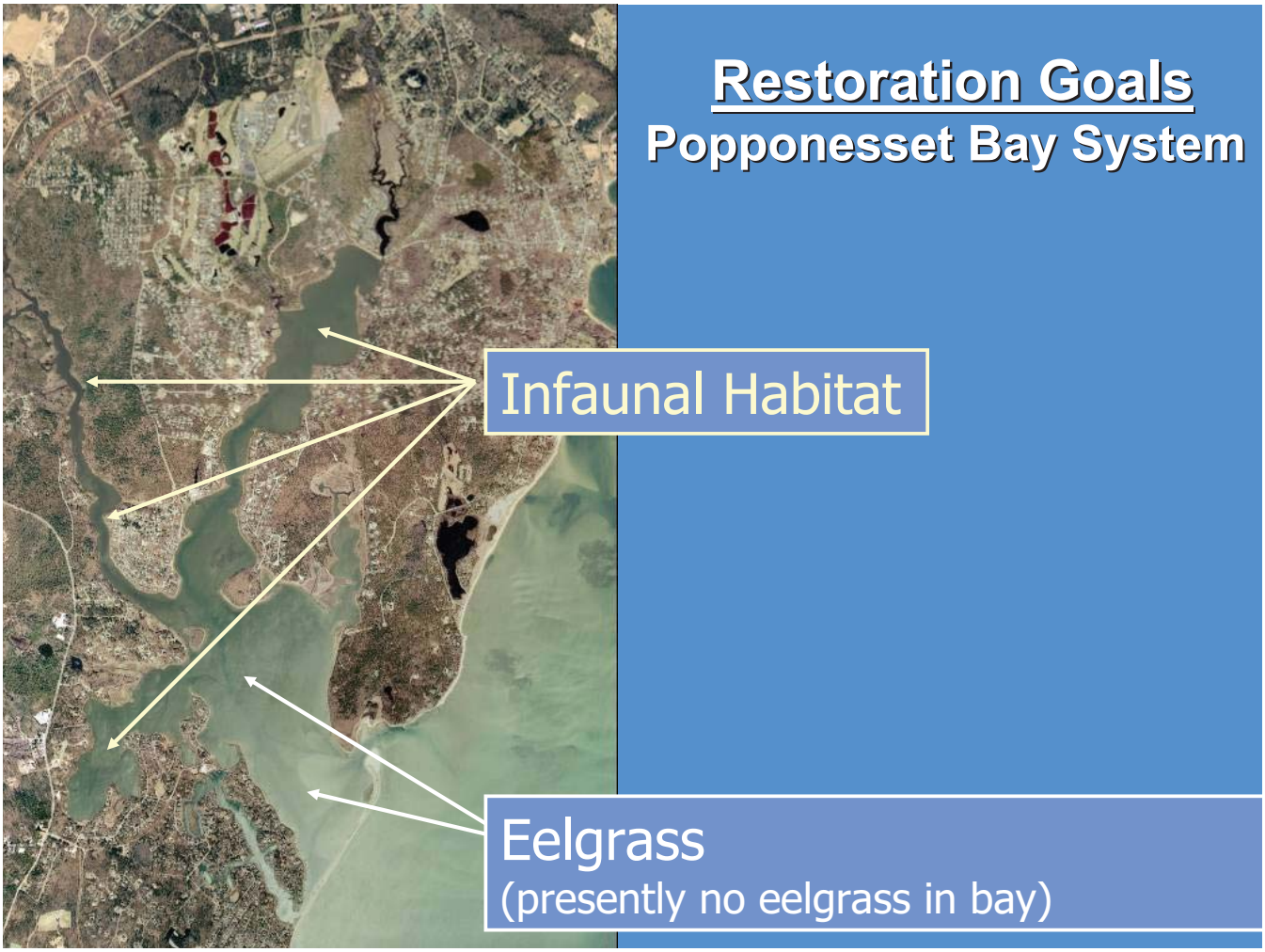


Infaunal Animal Communities

Sub-Embayment		Average # Species	Average # Individuals
Mashpee River			
	Mid	7	147
	Lower	12	223
Shoestring Bay			
	Inner	16	595
	Outer	15	534
Ockway Bay			
	Inner	2	16
	Mid	14	98
Popponesset Bay - Main Basin			
	Upper	9	548
	Lower	31	489

Historical Eelgrass Beds

Status: currently no beds in System

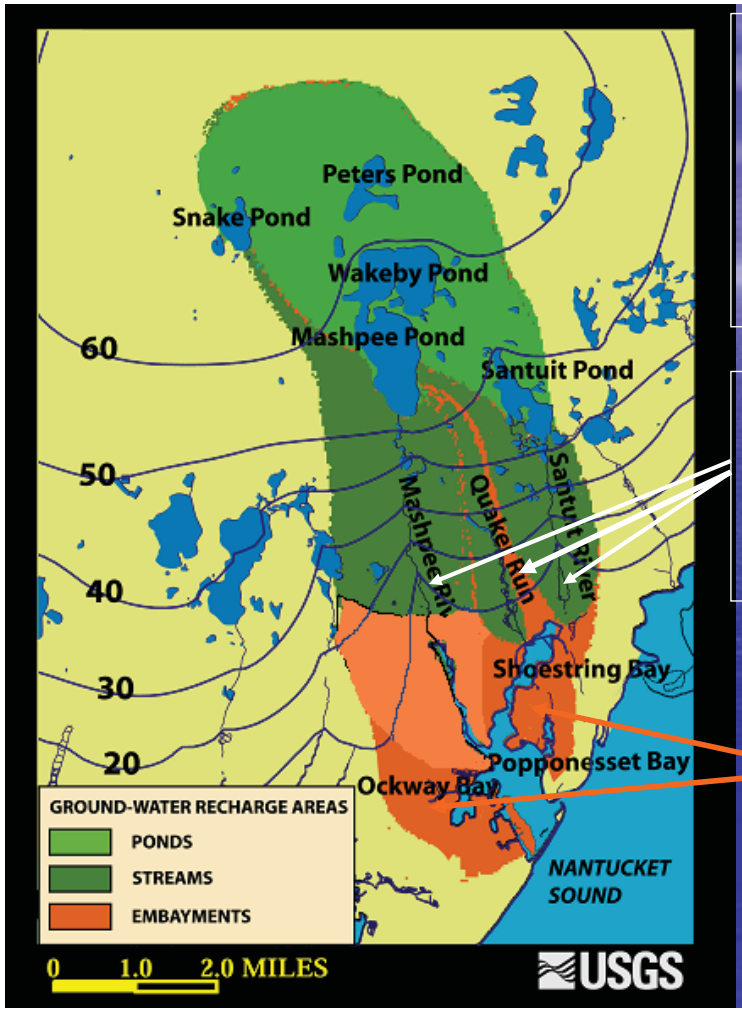


Nitrogen Management Options for Estuaries Generally via CWMP and TMDL Processes:

- Hydrodynamic options
  - Tidal flushing/circulation enhancement & management
- Natural attenuation options
  - Nitrogen source location to maximize natural attenuation
  - Wetland/riparian zone restoration to increase attenuation
  - Pond restoration to create zones of natural attenuation
- Nitrogen source reductions
  - Fertilizer education
- Wastewater options (what, where, how much)
  - Centralized and decentralized systems

MEP Restoration Approach
for Development of Nitrogen Management Alternatives:

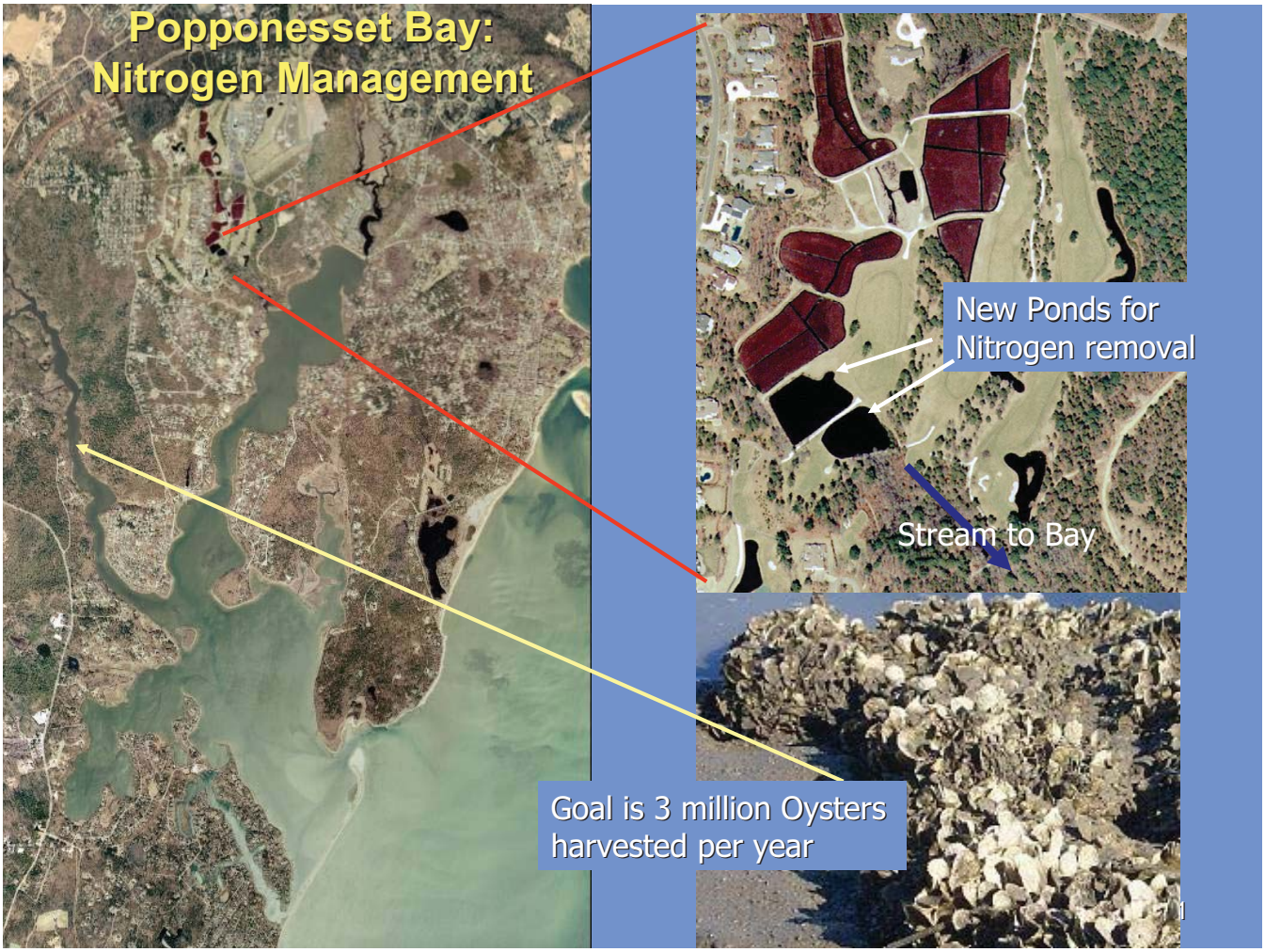
- **First** - maximize the hydrodynamics (Flushing)
- **Second** - maximize natural nitrogen removal processes within watershed and estuary
- **Third** - source reduction through education
- **Last** - targeted nitrogen removal through wastewater treatment systems



Popponesset Bay Nitrogen Management Alternative

Enhanced Attenuation (26% removal or ½ Nitrate Load in Rivers)

91% Septic Removal (sewers)



How long does restoration take?

- Recovery of estuarine systems is relatively rapid. Significant recovery of animal populations and habitat and water quality within 3-5 years.
- Implementation is a local and municipally driven effort, which requires significant funding. Time-line?

Community Meeting 3

Welcome by Harwich Wastewater Management Subcommittee (WMS)

Larry Ballantine
Dr. Stanley Kocot
George Myers
Robert Owens
Frank Sampson (Chair)

Town Staff Advisors to WMS
Paula Champagne (Board of Health)
Sue Leven (Town Planner)
Heinz Proft (Natural Resources Officer)
Craig Wiegand (Water Department)

Citizens Advisory Committee

- Dana DaCosta
- Kathy Green
- Christopher Harlow
- James Mangan
- Matt McCaffery
- Allin Thompson (Chair)
- John Webby

Other Key Players

- Town CWMP Consultant – CDM
- Town Administrator – Jim Merriam
- Selectmen Liaison – Ed McManus

- School of Marine Science and Technology – SMAST
- Department of Environmental Protection – DEP
- Cape Cod Commission – CCC

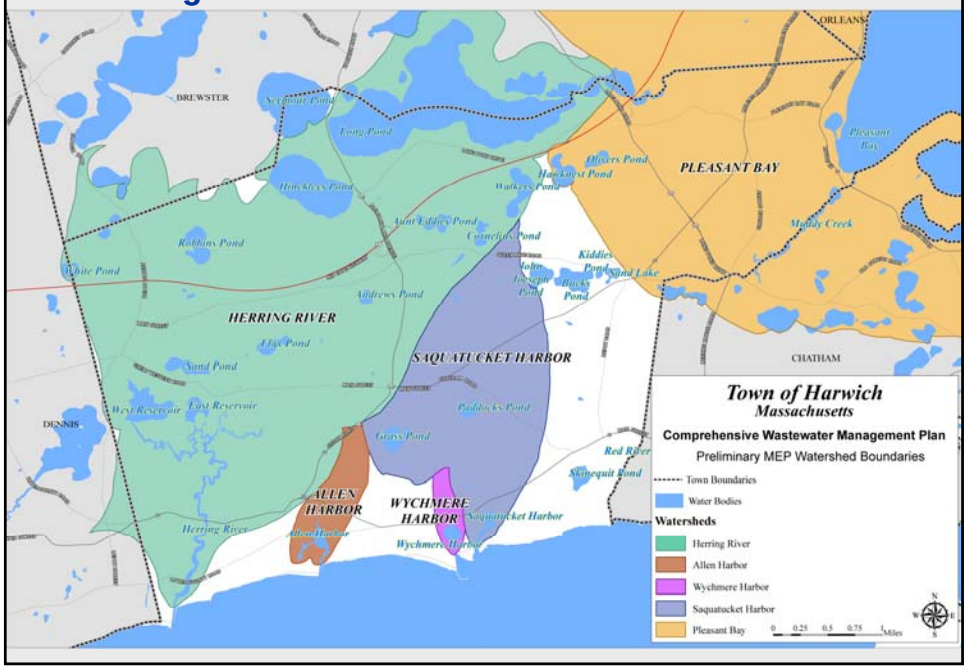
Meeting Purpose

- Provide a progress update on the Comprehensive Wastewater Management Plan (CWMP)
- Review Existing Conditions in context of CWMP
- Discuss Preliminary Wastewater Needs
- Reinforce the importance of local residents and business owners to participate in the process

Presentation Overview

- Project Drivers – Massachusetts Estuaries Project (MEP)
- Existing Conditions in Context of the CWMP
- Preliminary Wastewater Management Needs
- Next Steps in Process
- Review Project Schedule
- Discuss Opportunities for Public Input
- Questions and Comments

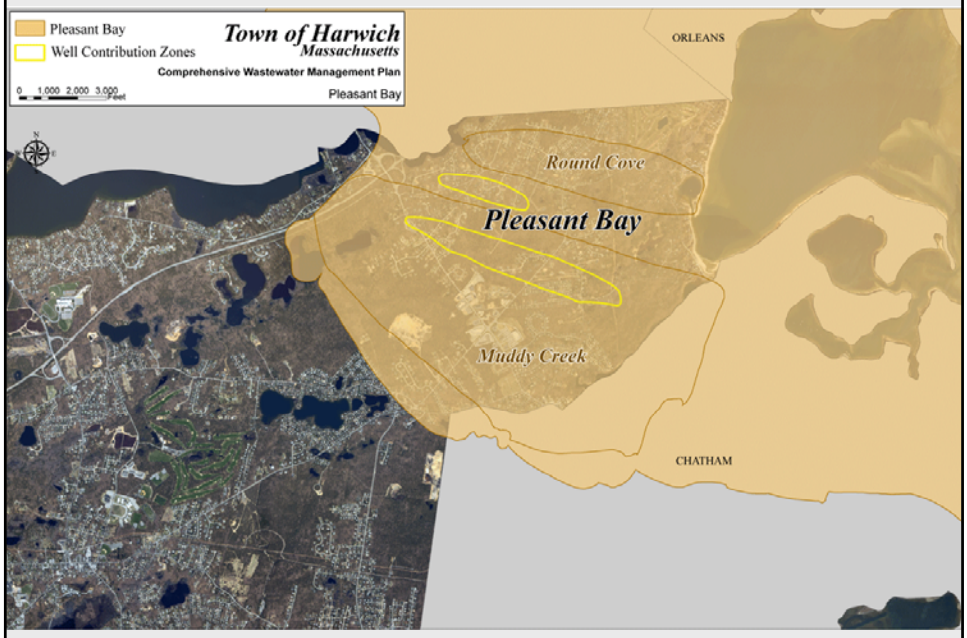
Existing Conditions – MEP Watersheds



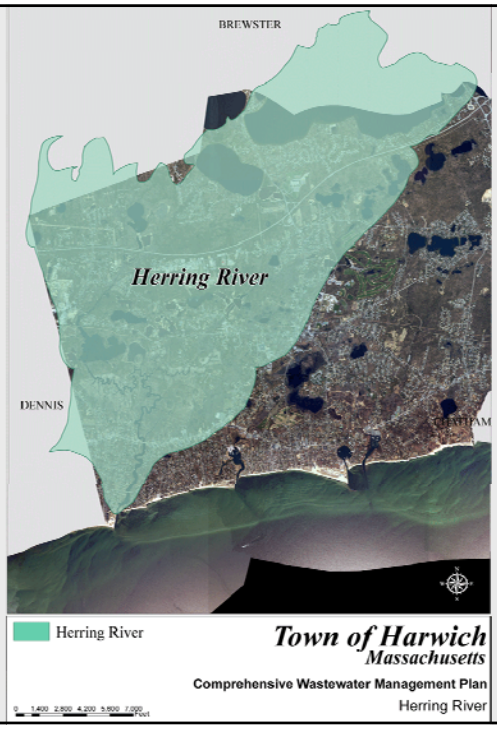
Existing Conditions – MEP Watersheds

- Status of MEP Watersheds
- Pleasant Bay – Complete
- Southern embayments (Herring River, Allen Harbor, Wychmere Harbor and Saquatucket Harbor) are preliminary as of 2/28/08 and may be further refined during MEP evaluation/analysis

Existing Conditions – Pleasant Bay Watershed



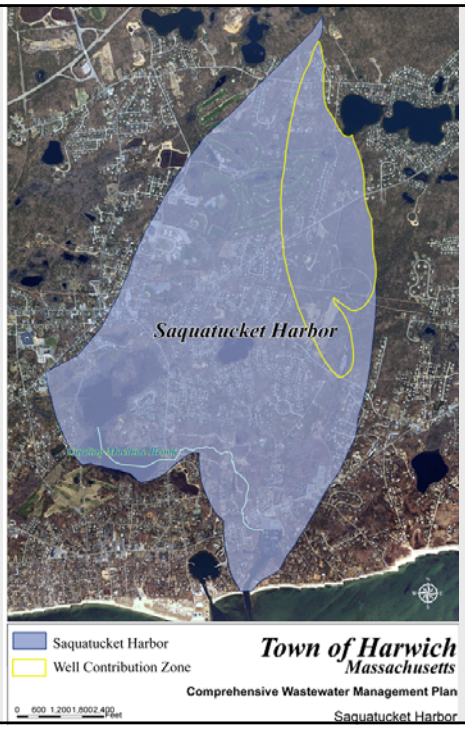
Existing Conditions – Herring River Watershed



Existing Conditions – Allen Harbor Watershed

Existing Conditions – Wychmere Harbor Watershed

Existing Conditions – Saquatucket Harbor Watershed



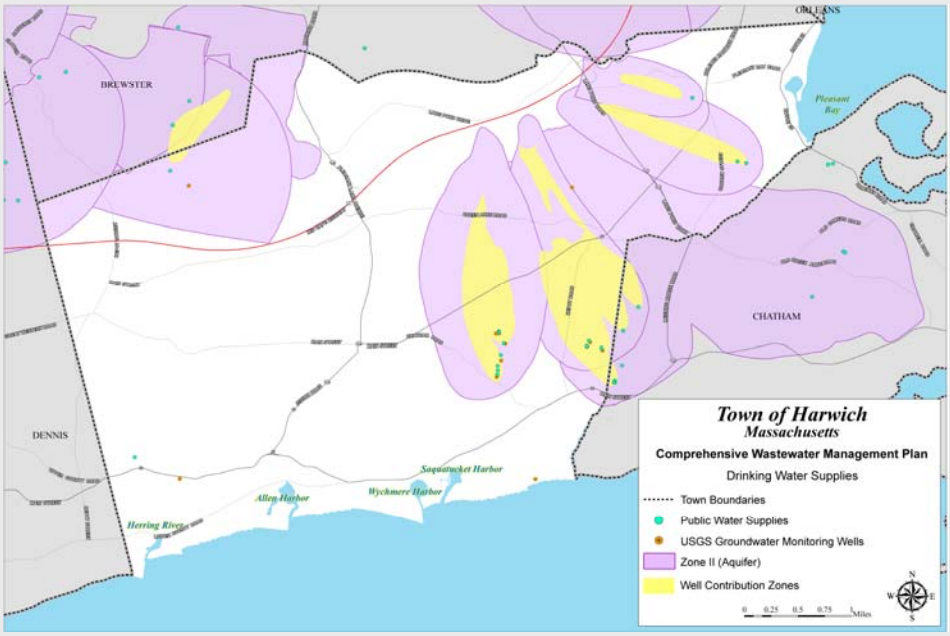
Existing Conditions – Estuaries Water Quality

- Initial MEP Findings:
  - Pleasant Bay – Poor Quality
  - Herring River – High to Moderate Quality
  - Allen Harbor – Poor Quality
  - Wychmere Harbor – Poor Quality
  - Saquatucket Harbor – Poor Quality

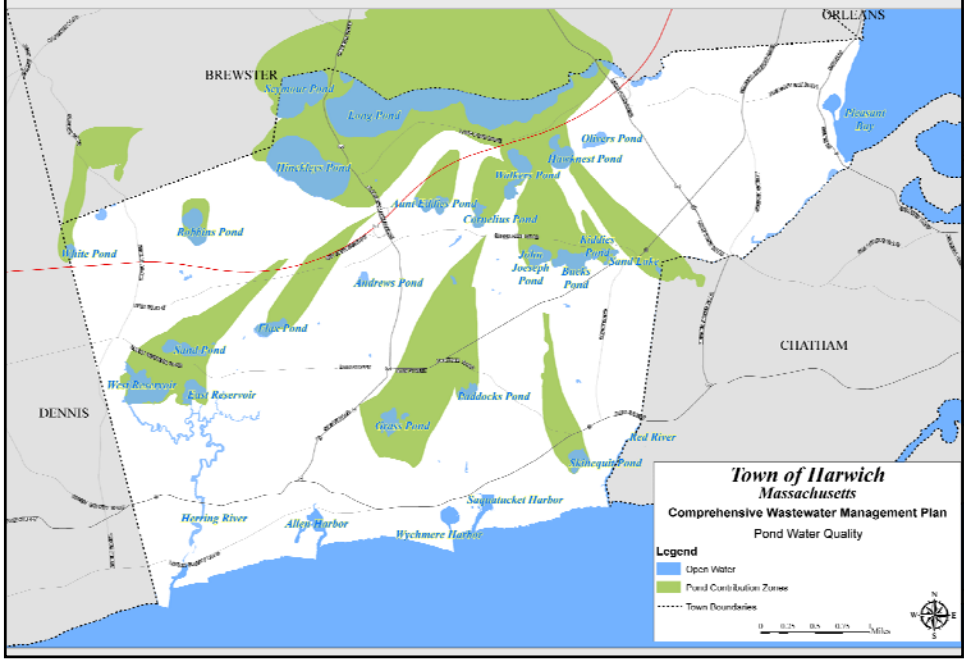
Key Existing Conditions Reviewed

- Drinking Water Supplies
- Ponds Water Quality
- On-site System Performance (Title 5)
  - Soils – Surficial Geology
  - Depth to Groundwater
  - Existing Development Lot Density
- Package Treatment Systems
- Town Open Space
- Defined Wetlands
- Zoning Map
- Land Areas to be Developed
- Harwich development from 1951 to 1999

Existing Conditions – Drinking Water Supplies



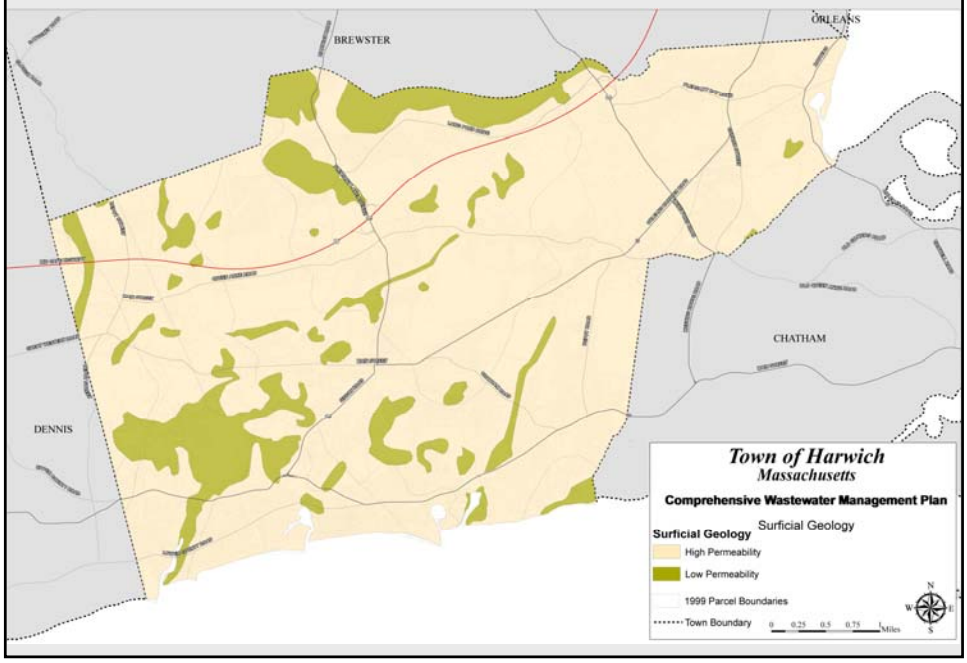
Existing Conditions – Ponds Water Quality



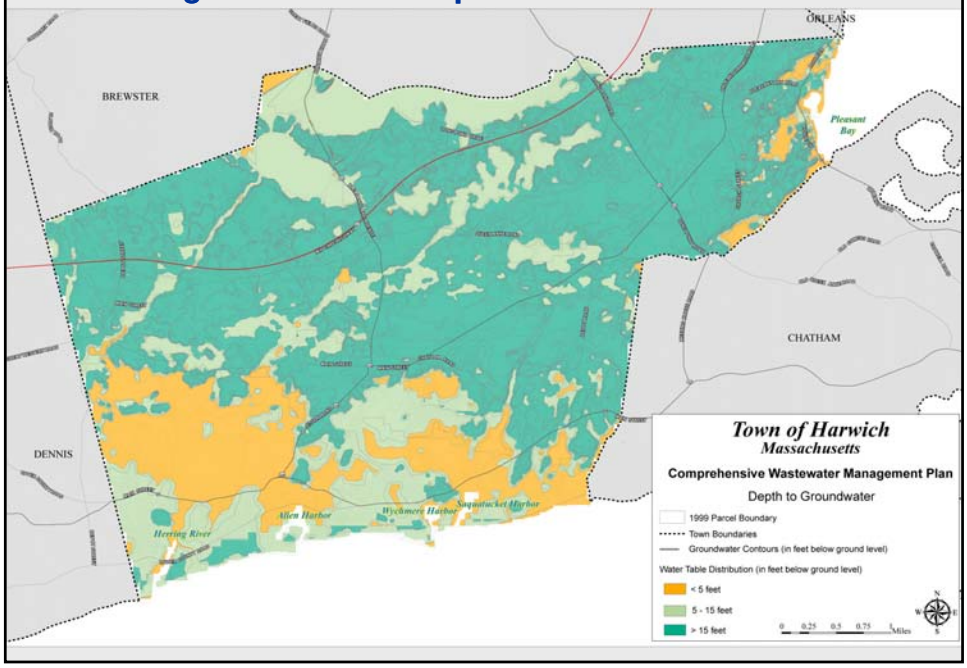
Existing Conditions – Ponds Water Quality

- **Phosphorus (P) is the nutrient of concern in most fresh water ponds; not nitrogen.**
- **To date Town has utilized or studied in-pond, neighborhood and sewering options to help address.**
- **Several ponds have not been analyzed and need further assessment to evaluate best means of addressing P.**

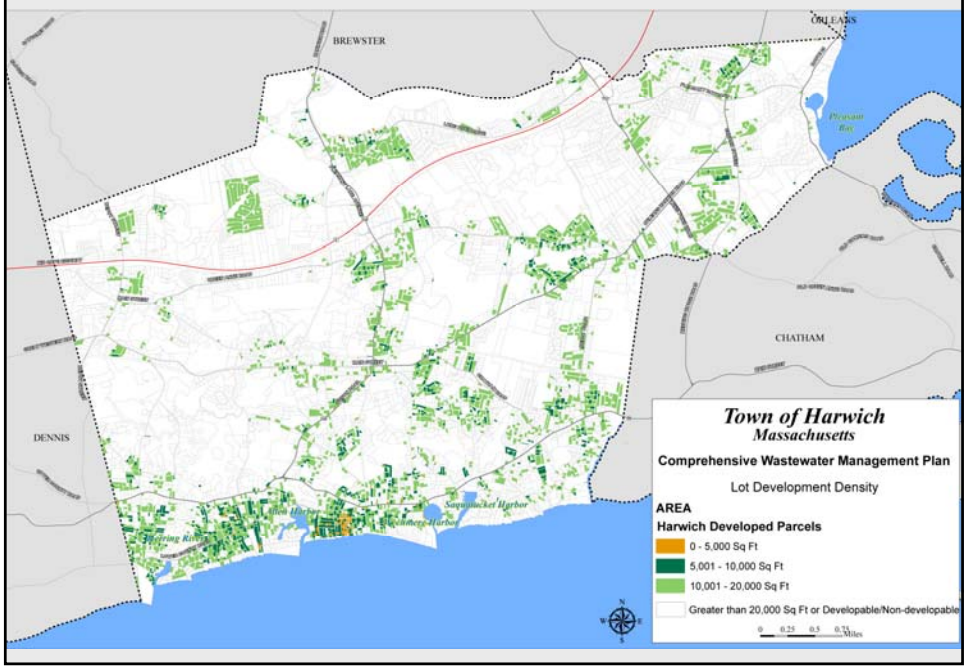
Existing Conditions – Surficial Geology



Existing Conditions – Depth to Groundwater



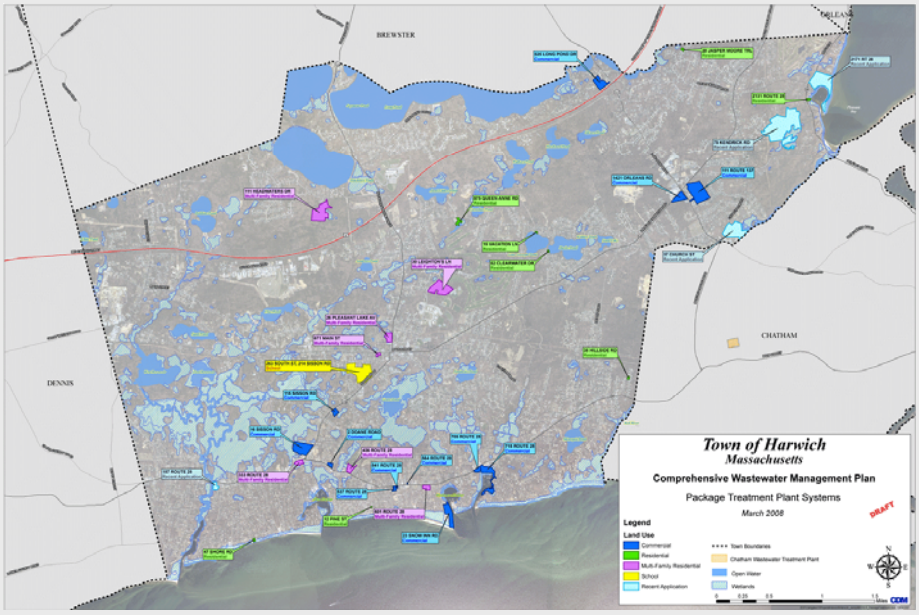
Existing Conditions – Lot Development Density



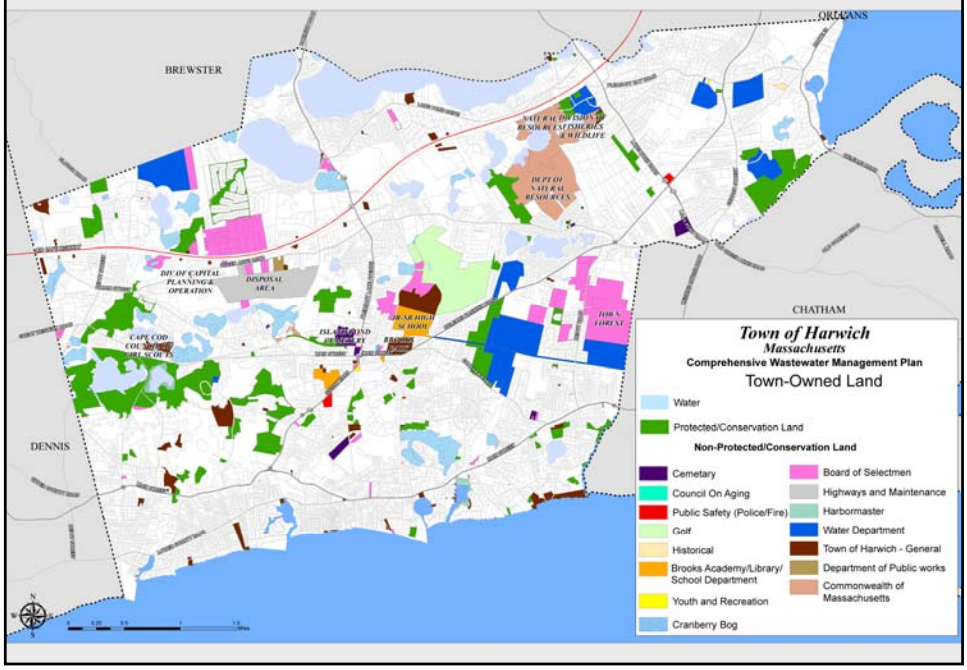
Existing Conditions – On-site System Performance (Title 5)

- Harwich predominantly has well draining soils
- Most areas have sufficient depth to groundwater or have mounded systems
- Densely developed areas have history of Title 5 waivers for setback requirements or deed restrictions limiting size

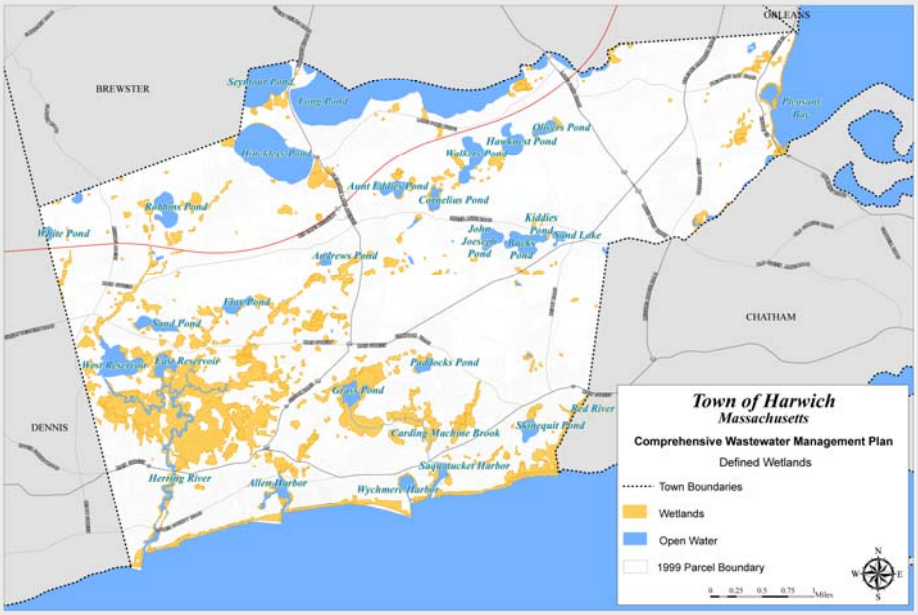
Existing Conditions – Package Treatment Systems



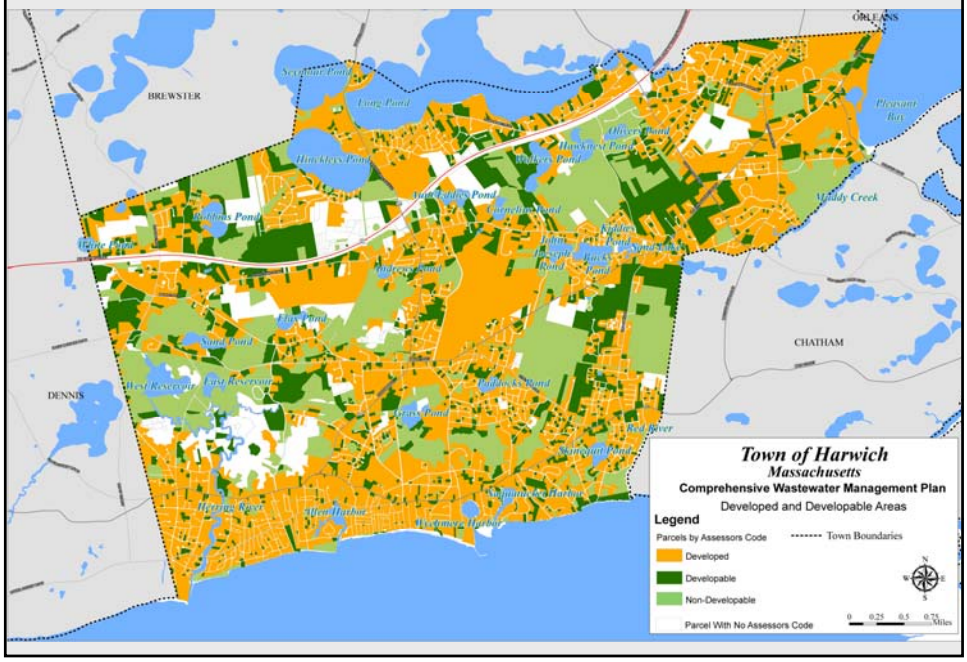
Existing Conditions – Open Space



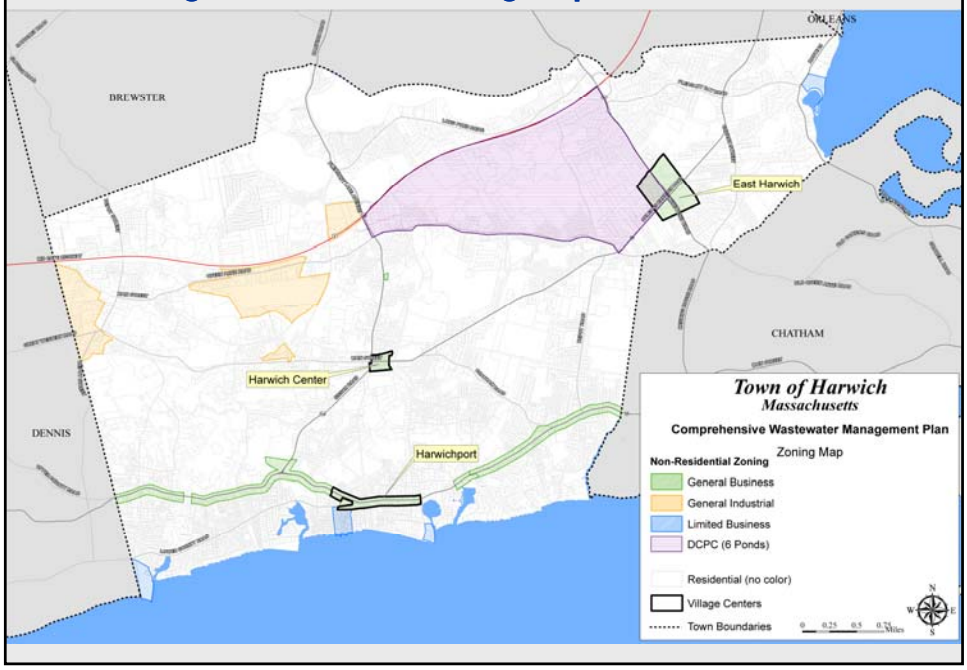
Existing Conditions – Defined Wetlands



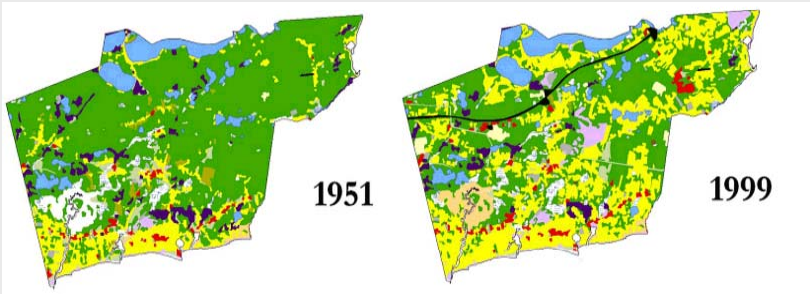
Existing Conditions – Land Areas to be Developed



Existing Conditions – Zoning Map



Extent of Development



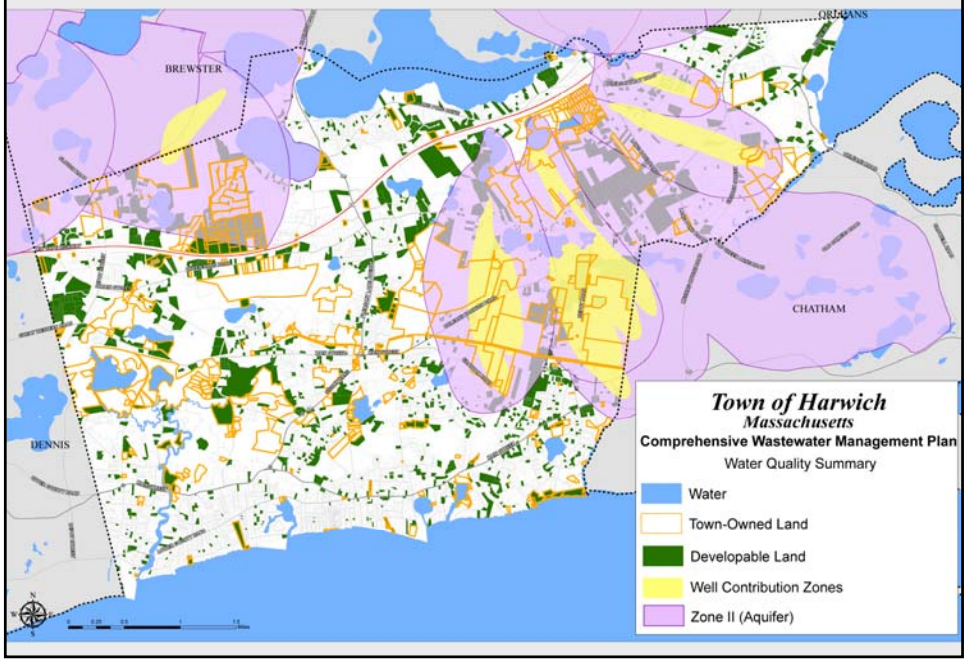
Wastewater Management Needs

- Drinking Water
- Pond Water Quality
- Title 5 Issues
- Nitrogen Management
- Socio- Economic

Drinking Water

- Drinking water quality does not appear to be a driver for sewers based on existing conditions.
- Majority of proposed development is not in well protection areas.
- Nitrate concentrations at wells are low.

Water Quality Summary



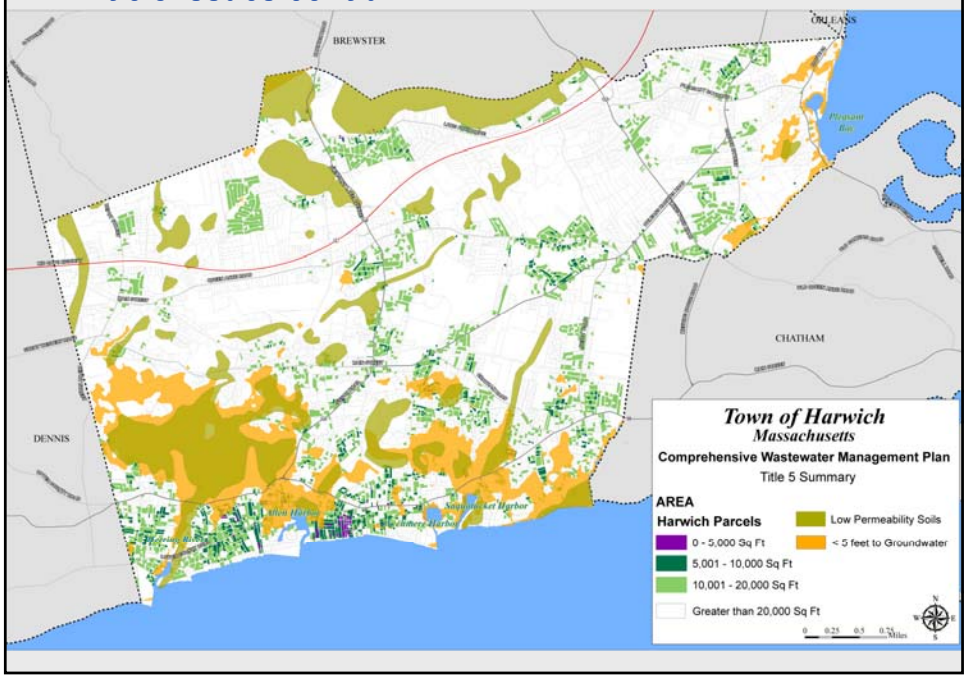
Ponds Water Quality

- **Main concern is from Phosphorus loading versus Nitrogen**
- **Some ponds such as Great Sand Lakes area may need sewers to address up-gradient loading to ponds**
- **Several ponds may require further assessment based on minimal existing data to evaluate.**

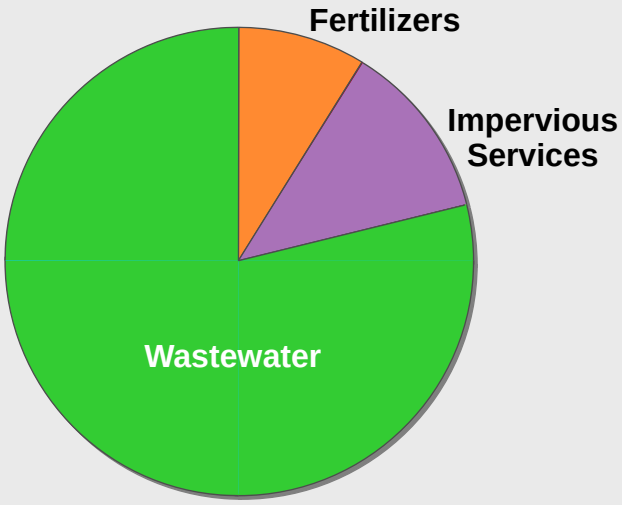
Title 5 Issues

- Title 5 does not appear to be a driver for sewers based on existing conditions.
- Some areas may continue to require waivers for setbacks.
- Some areas may still require mounded systems.
- Some areas could be sewered to eliminate waivers and mounded systems.

Title 5 Issues cont'd



Nitrogen Management



Local Control – Muddy River

Nitrogen Management cont'd

- MEP results to date indicate significant nitrogen removal will be required in 4 of the 5 estuaries/ watersheds.
- Stormwater best management practices (BMPs) are important but have less impact
- Fertilizer management and education about use / impacts is important but also has less impact.

Future Conditions (Build-Out)

Number of Properties needing Nitrogen Removal

MEP Watershed	*Number of Developed Properties @ Build-Out*	*Nitrogen (NNÓ Removal rates from Wastewater to meet TMDL*	*Number of MEP Watershed Properties needing Nitrogen Removal*
Herring River	3,500	0 to 10 %	0 - 350
Allen Harbor	300	75 - 100 %	225 - 300
Wychmere Harbor	100	75 - 100 %	75 - 100
Saquatucket Harbor	1,200	50 - 75 %	600 - 900
Pleasant Bay	2,100	80 %	1,700
MEP Watershed Subtotal	**7,200**		**2,600 Š 3,350**
Total Town-wide	**10,000**		

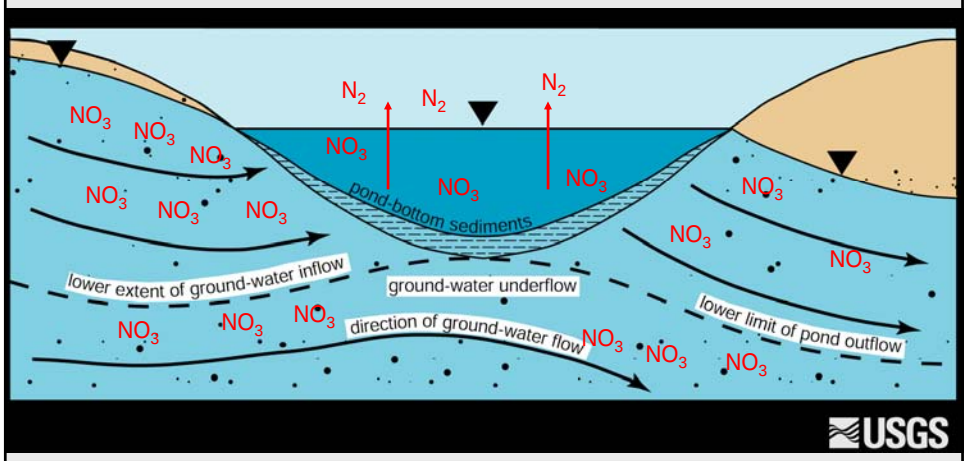
Wastewater Needs Categories

1. **Area needs an off-site solution due to MEP N-removal requirements, socio-economic requirements or other reasons.**
2. **Area can remain with on-site systems using nonstructural nutrient management solutions**

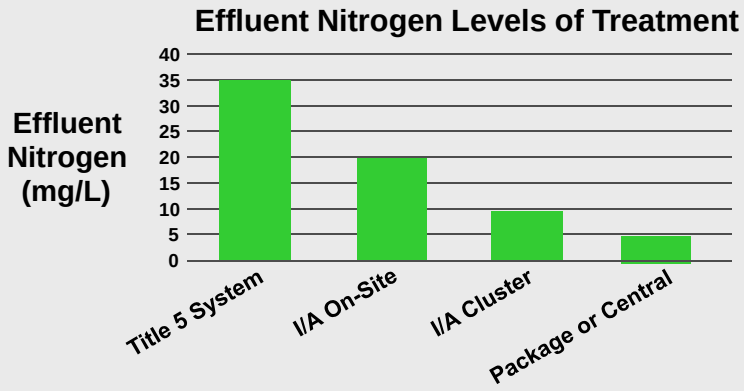
Nitrogen Reduction

- Natural attenuation (Muddy Creek, Bogs)
- Nitrogen treatment levels with available technologies

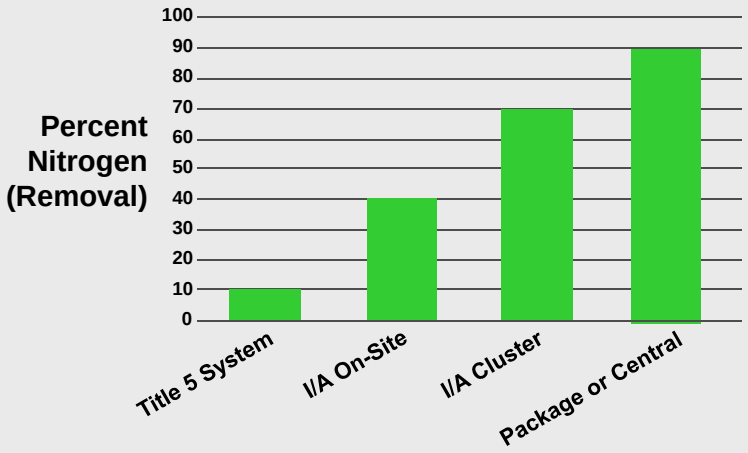
Nitrogen Attenuation: Ground Water Flow-Through Pond



Nitrogen Treatment Levels Suggest Most Likely Solutions



Nitrogen Treatment Levels Suggest Most Likely Solutions



Next Steps

- Develop criteria and ratings system to prioritize wastewater needs
- Conduct site screening review for potential effluent recharge sites
- Develop Feasible Alternatives
- Evaluate Nitrogen reducing technologies and off-site or regional options
- Identify Potential Effluent Recharge Sites

Key Project Dates

- Community Meeting No. 4 – July 2008
  - Review wastewater needs and preliminary alternatives to be evaluated
- Community Meeting No. 5 – September 2008
  - Finalize recommended projected wastewater needs and recommended alternatives for evaluation in Phase 2.
- Submit Phase 1 CWMP in October 2008

How to get involved ?

- Water Quality Task Force – Wastewater Management Subcommittee
- Citizens Advisory Committee
- Website
  - Meeting Schedule and Meeting Minutes (see website, Calendar of Events, etc.)
- Channel 18
  - Postings
- email
  - sign-ups

Community Meeting 4

TOWN OF HARWICH

Comprehensive Wastewater Management Plan (CWMP)

Community Meeting No. 4
Harwich Town Hall

7:00PM
April 21, 2011

CDM

Meeting Purpose

- Present and Discuss Site Screening Process to Identify Effluent Recharge Sites

Goal of Site Screening Process

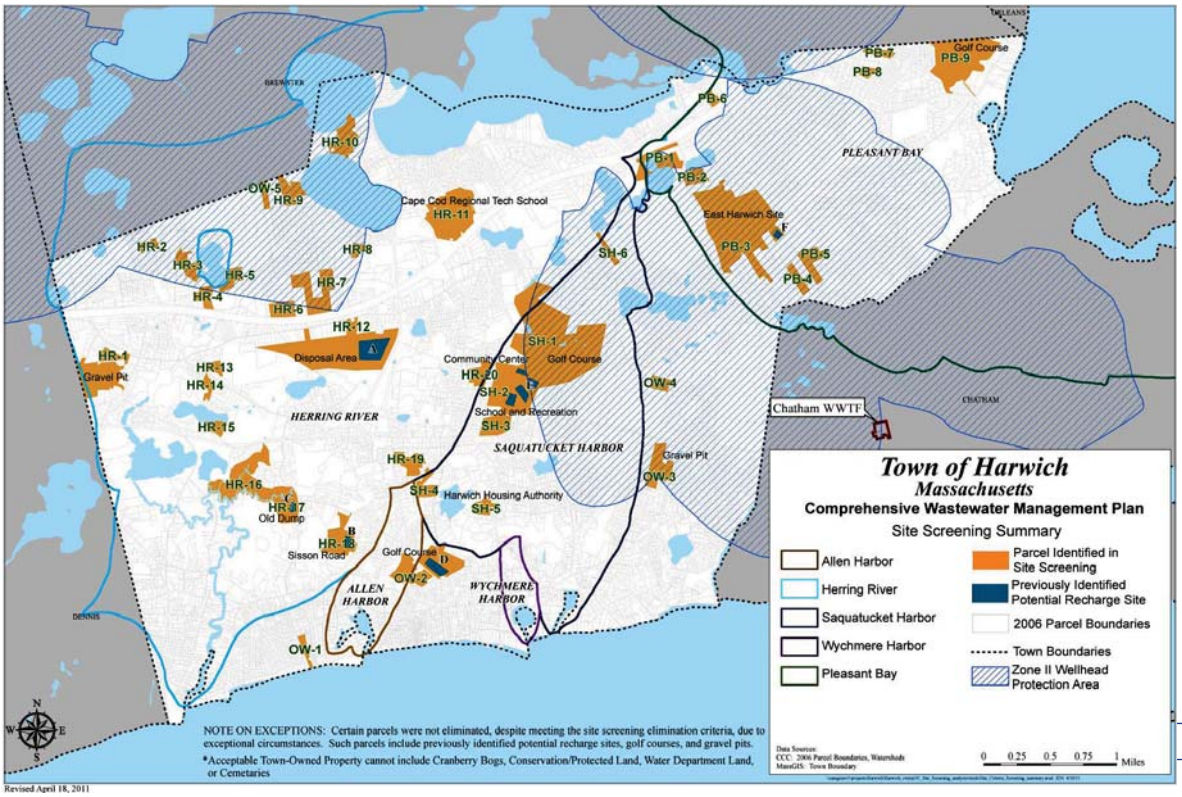
- Goal – Analyze the Whole Town to Identify the Best Candidate Sites Across Town That Offer the Potential for Effluent Recharge.

Site Screening Process

Site Screening – Ten Criteria

- Outside of a Well Contribution Zone
- Parcel Size Greater than 5 Acres
- Outside of a 100-Year Floodplain Zone
- Sites With Permeable Soils
- Undeveloped Property
- Parcels Outside of Wetlands
- Favorable Depth to Groundwater
- Outside Priority Habitat
- Outside Municipal Wellhead Protection Zone II
- Town-Owned Property

Initial Site Screening Results

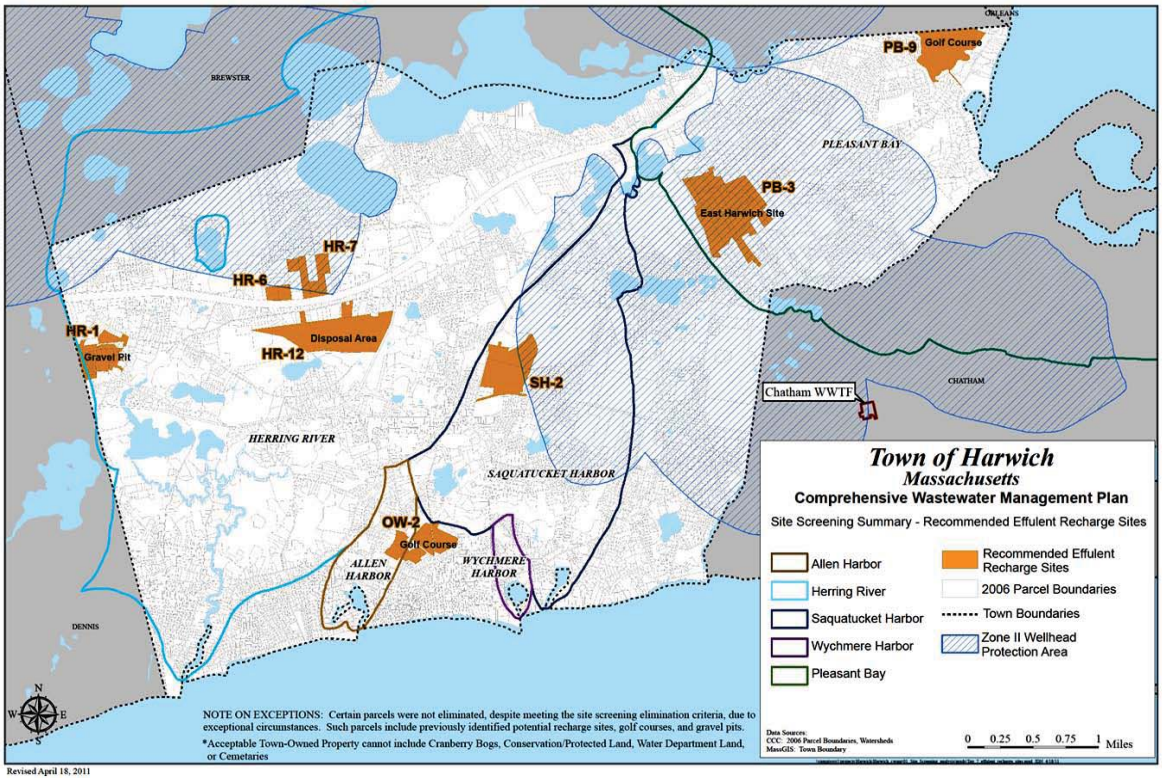


Second Step of Site Screening Process (continued)

Site Screening Results

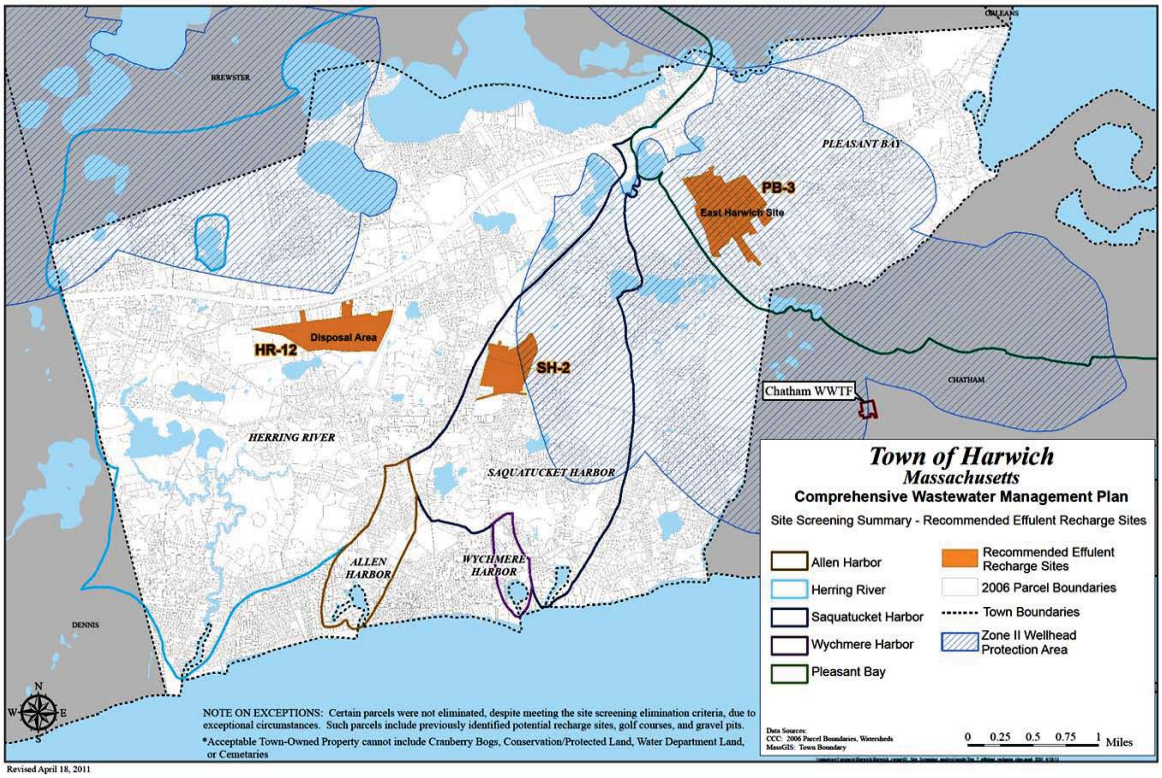
- 40 Sites reduced to 7 Sites (10 Sites Combined to 7)
- Most of the Sites Meet 8 or More Criteria
- Specific Emphasis On:
  - Town Owned Sites
  - Larger Sites
  - Multiple Watersheds
- Weighted Criteria Based on CWMP Committee Input:
  - 8 to 9 Criteria With One From Each Watershed

Site Screening
7 Recommended Sites



CDM

Site Screening
Selected Sites For Field Work



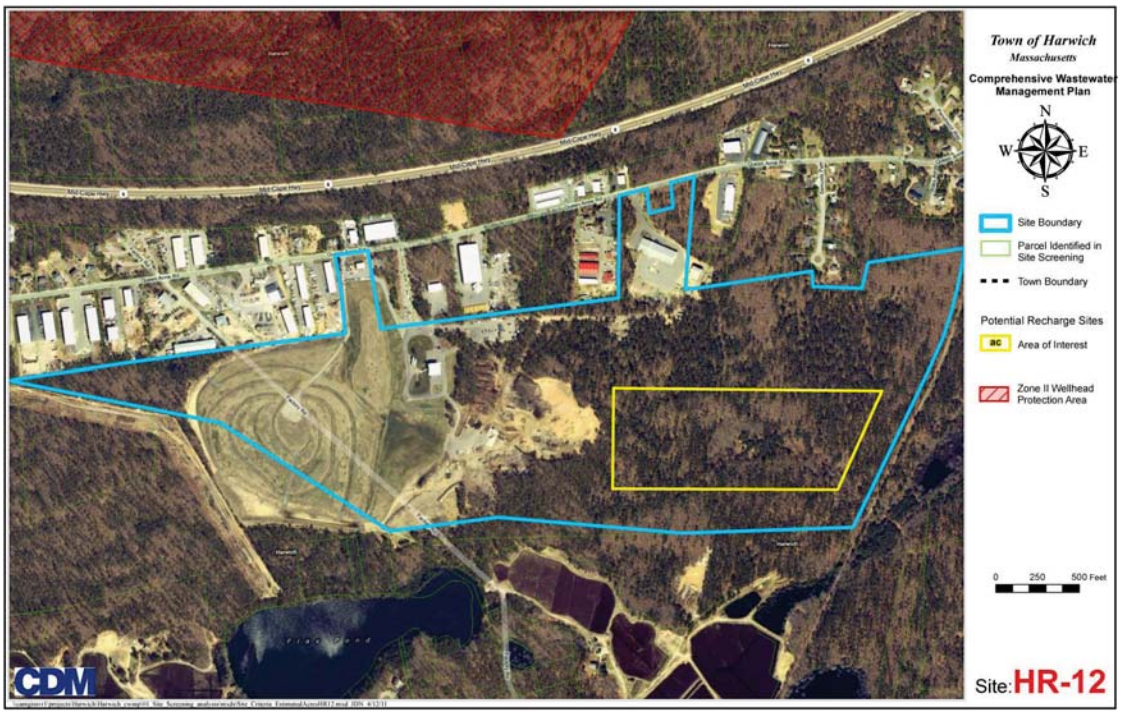
CDM

Next Steps

SH-2 – The High School Saquatucket Harbor Watershed

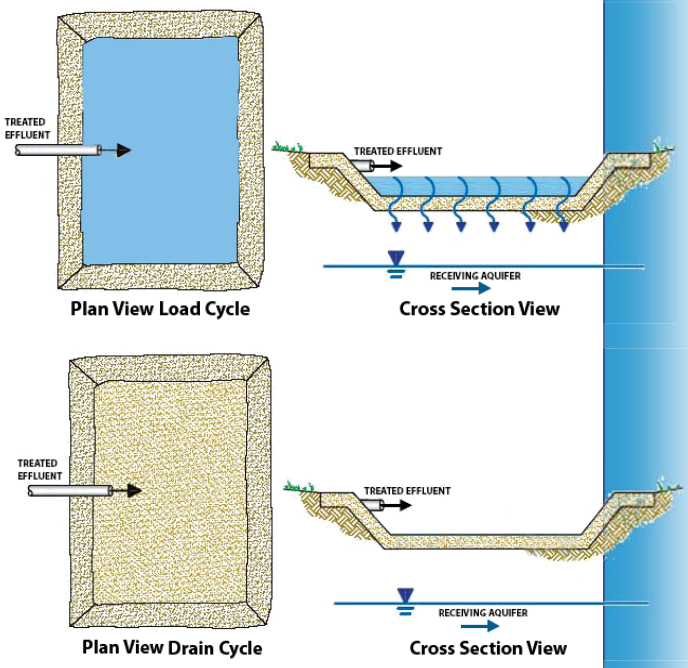
PB-3 – Privately Owned Gravel Pit in the Pleasant Bay Watershed

HR-12 – Adjacent to Former Town Landfill in the Herring River Watershed



Infiltration Basins for Effluent Recharge

- Infiltration Basins allow for additional land treatment and recharge of wastewater effluent
- Applied wastewater percolates through the soil and the treated effluent drains to ground water or surface water
- Simple design and operation (rotated on/off)
- Relatively easy to maintain
- Higher loading rates compared with other subsurface wastewater effluent recharge technologies (3-5 gallons per day per square foot)



Infiltration Basin Drying – Bourne, Massachusetts

Otis Air National Guard Base

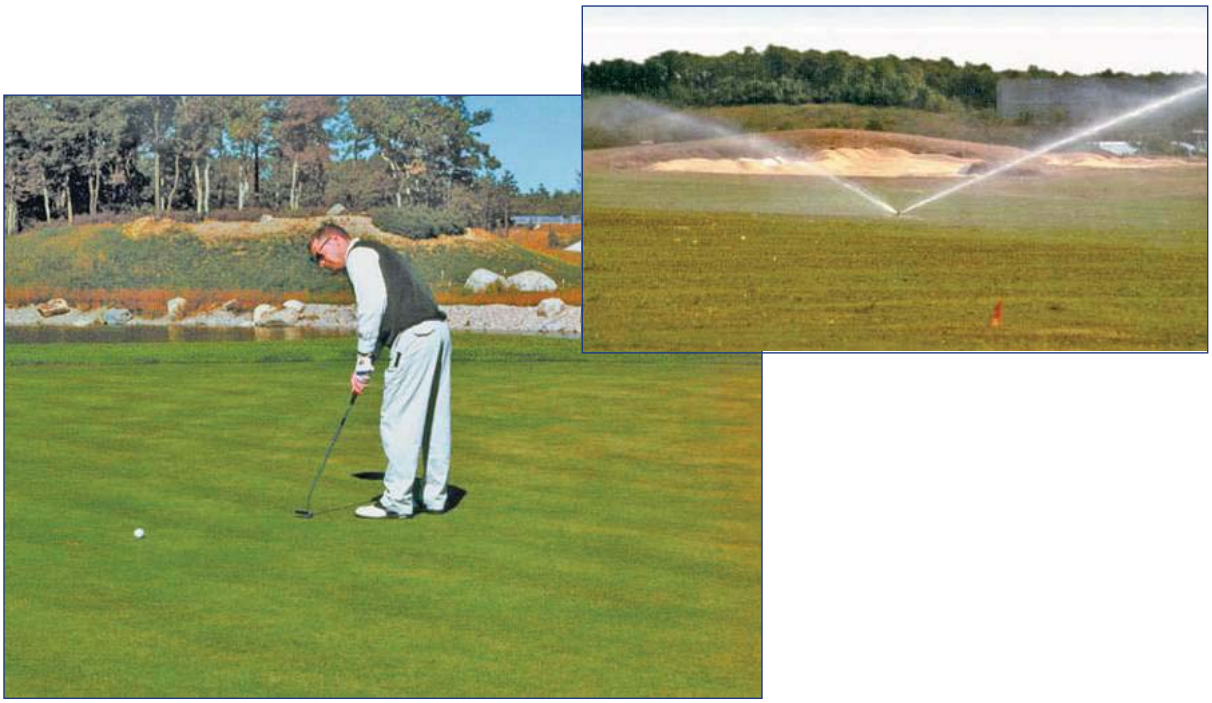
Infiltration Basins

Water Reuse – Kingston, Massachusetts

Indian Pond Golf Course – 300,000 gpd effluent recharge site

Water Reuse – Yarmouth, Massachusetts

Links at Bayberry Hills Golf Course Irrigation



Community Meeting 5

Welcome by Harwich Wastewater Management Subcommittee (WMS)

- Peter de Bakker (Chair)
- Brad Chase
- Dr. Stanley Kocot
- George Myers
- Robert Owens

and by Harwich Water Quality Management Task Force (WQMTF)

- Danette Gonsalves
- Ray Gottwald
- Tony Piro
- Bob Sarantis

Town Staff Advisors to WMS

- Bob Cafarelli (Town Engineer)
- Paula Champagne (Board of Health)
- Heinz Proft (Environmental Science Director)
- David Spitz (Town Planner)
- Amy Usowski (Conservation Commission)
- Craig Wiegand (Water Department)

Citizens Advisory Committee

- Ted Borman
- Dana DaCosta
- Christopher Harlow
- Bill Lean
- Gerry Loftus
- James Mangan
- Matt McCaffery
- Val Peter
- Allin Thompson (Chair)

Other Key Players

- Selectmen Liaison – Larry Ballantine
- Town Administrator – Jim Merriam
- Town CWMP Consultant – CDM Smith

- School of Marine Science and Technology – SMAST
- Department of Environmental Protection – DEP
- Cape Cod Commission – CCC

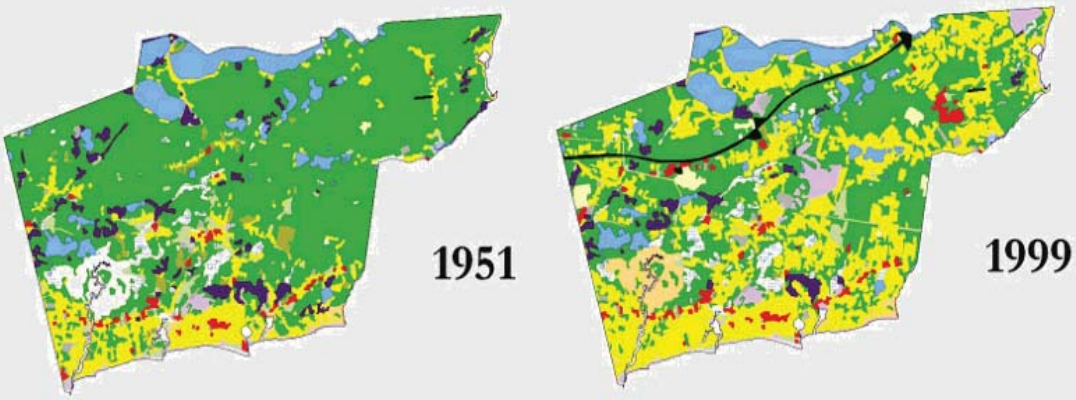
Meeting Purpose

- Provide progress update on Comprehensive Wastewater Management Plan (CWMP)
- Discuss preliminary wastewater needs
- Show possible sites of wastewater treatment facilities
- Present final three scenarios under evaluation
- Reinforce the importance of local residents and business owners to participate in the process

Presentation Outline

Needs + Sites = Scenarios

Extent of Development



Harwich Needs to Control Nitrogen

Water Quality

Drinking Water

Nitrogen Impacts

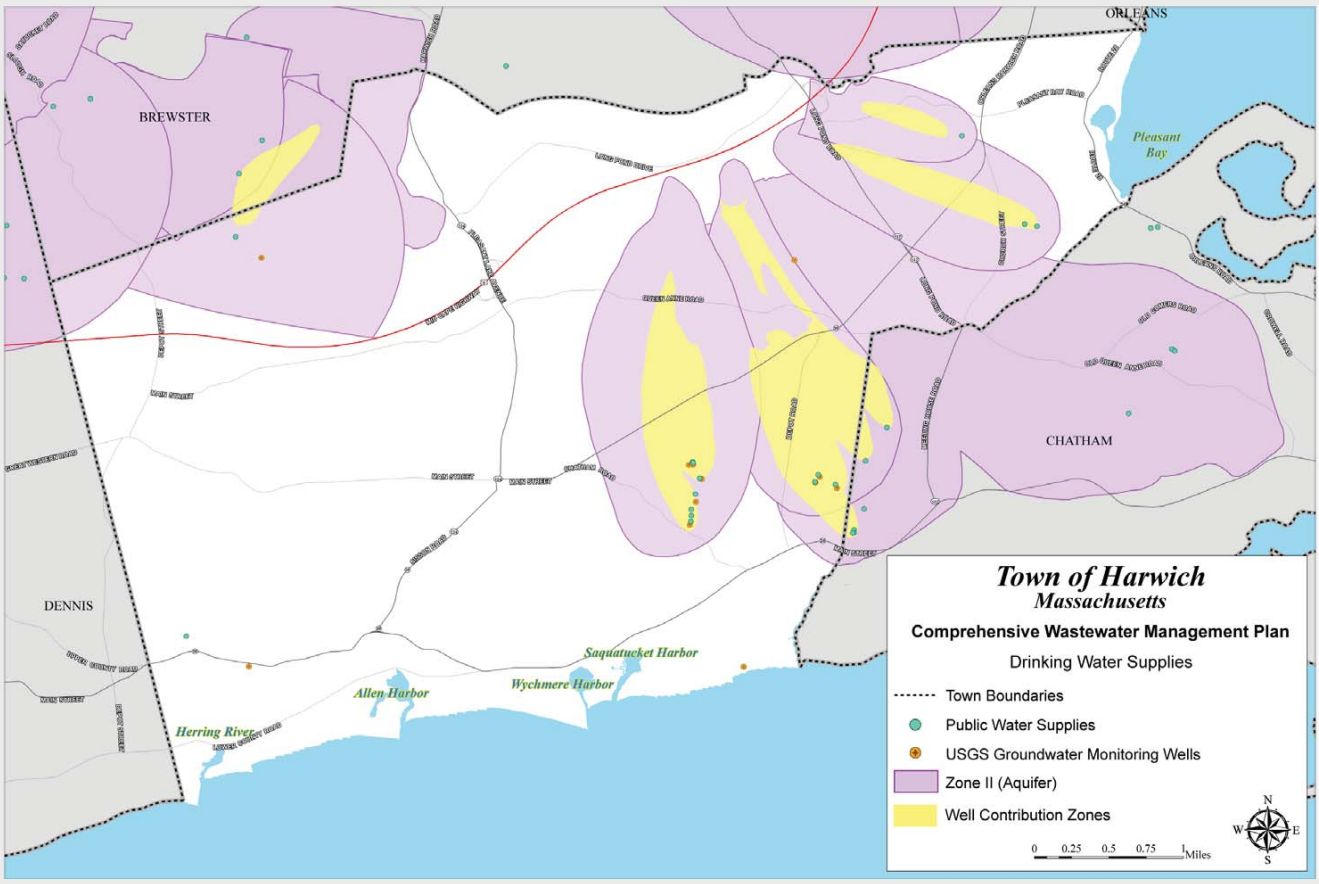
Economic Development

Beaches & Harbors

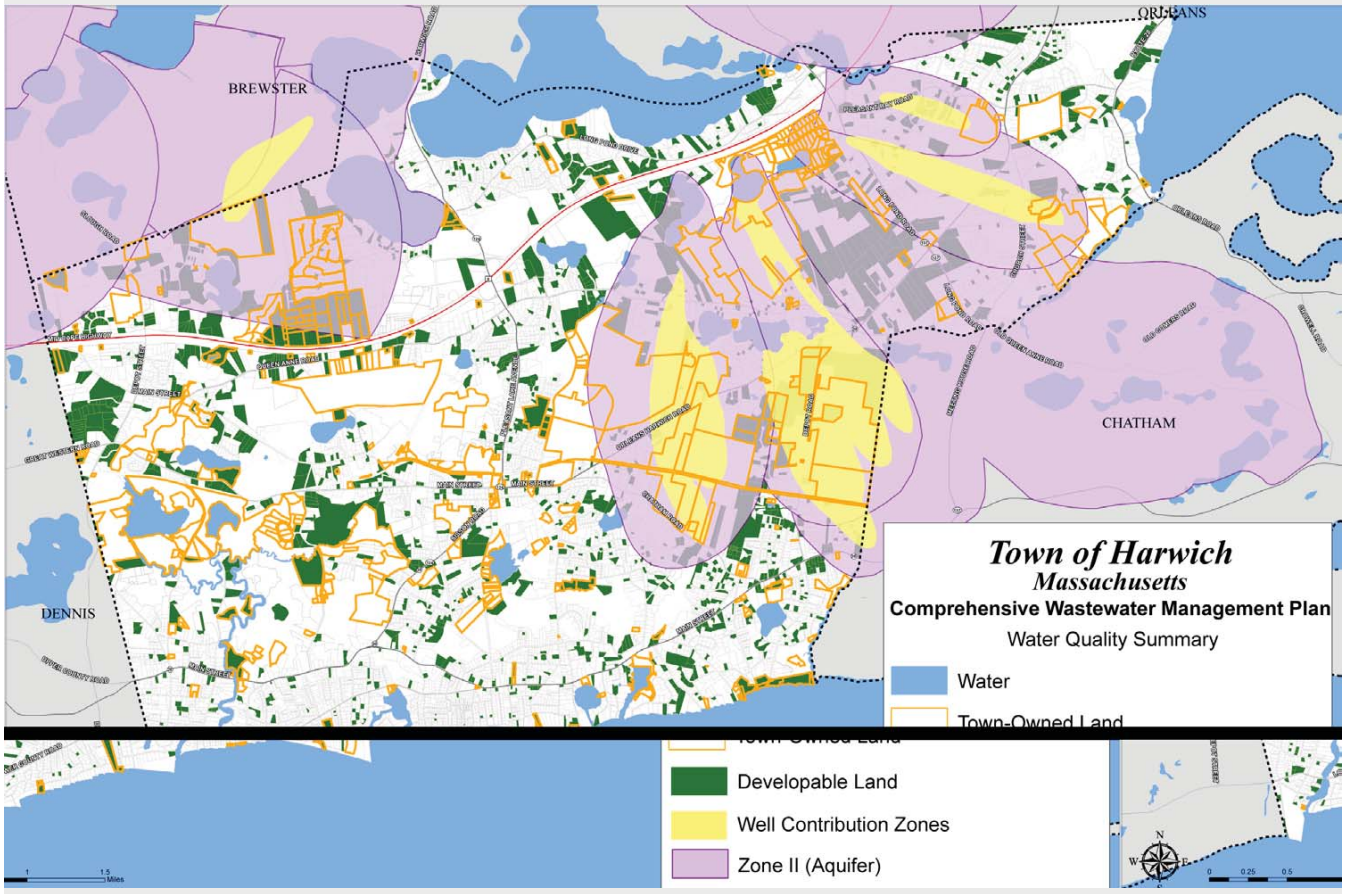
Presentation Outline

Needs + Sites = Scenarios

Existing Conditions – Drinking Water Supplies



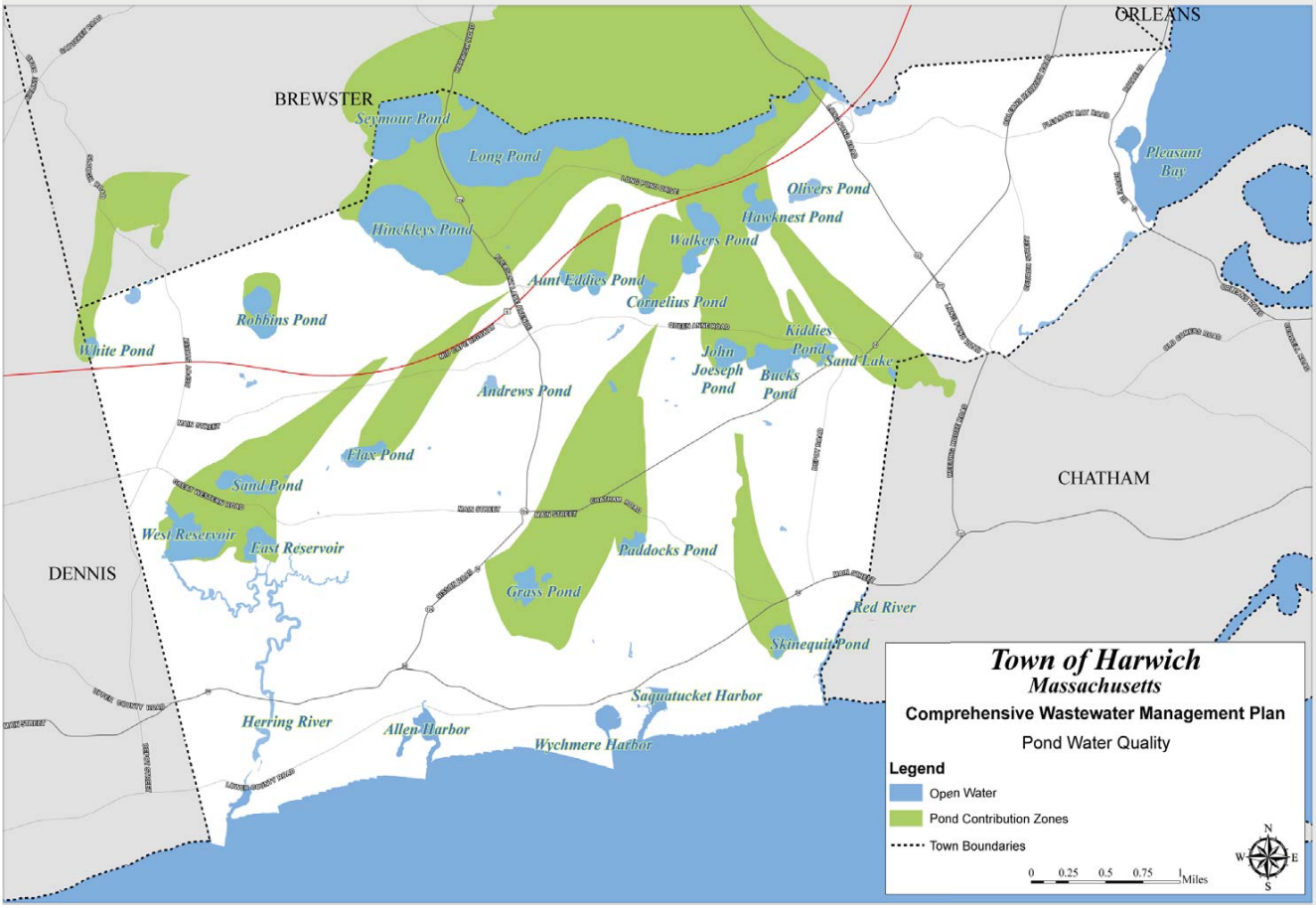
Water Quality Summary



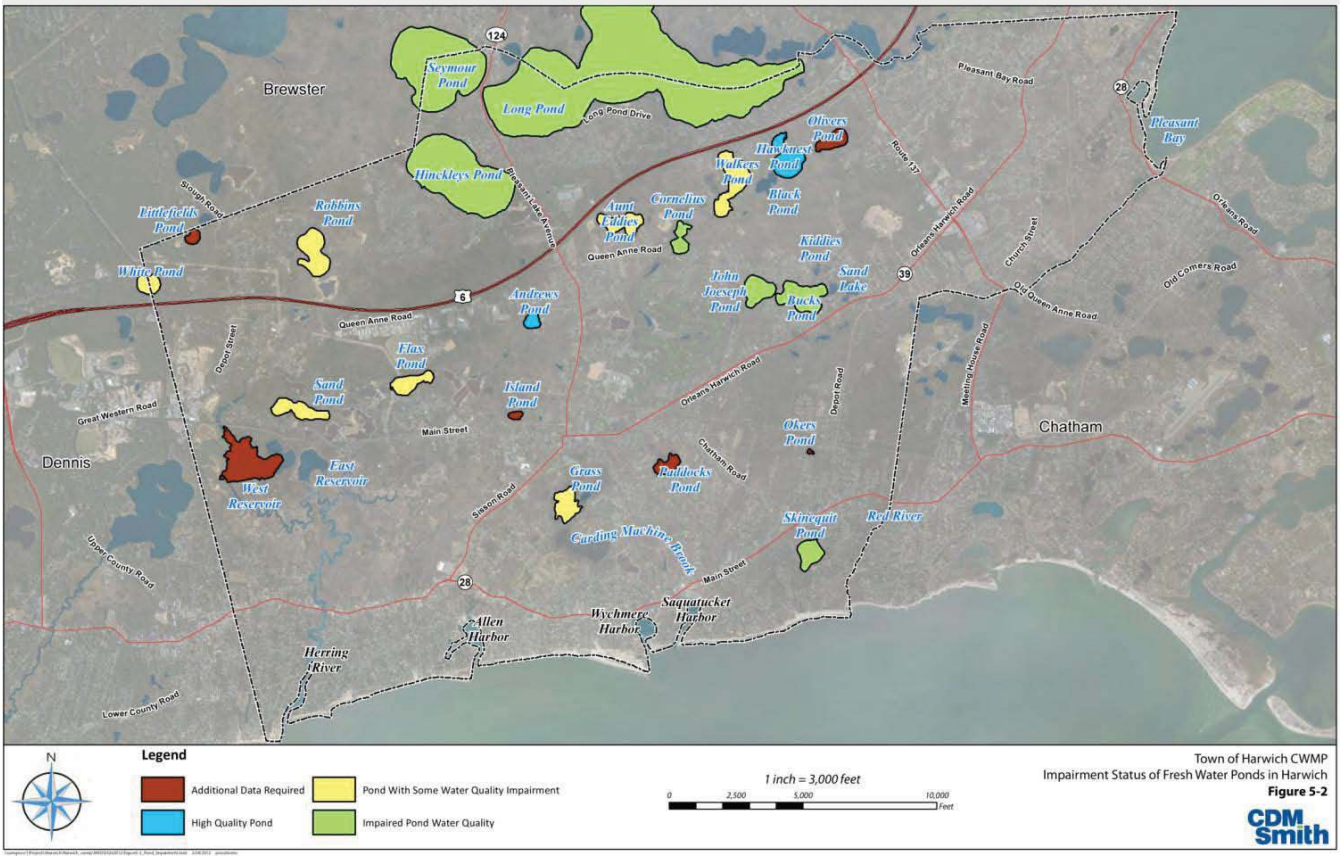
Existing Conditions Assessment - Drinking Water Supplies

- Nitrate concentrations at wells are (typically <1.0 mg/l) below drinking water standard of 10 mg/l
- Drinking water quality does not appear to be a driver for sewers based on existing conditions
- Majority of proposed development is not in well protection areas (Zone II's)

Existing Conditions – Ponds Water Quality



Impaired Fresh Water Ponds in Harwich

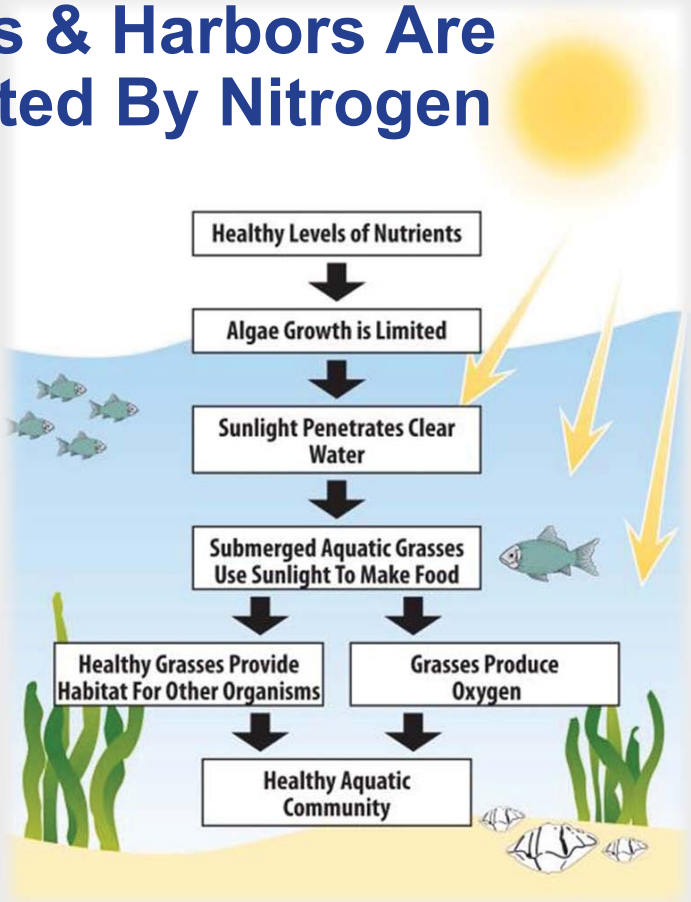


Existing Conditions Assessment – Ponds Water Quality

- **Phosphorus (P) is the nutrient of concern in most fresh water ponds; not nitrogen.**
- **To date Town has utilized or studied in-pond, neighborhood and sewering options to help address.**
- **Some ponds such as Great Sand Lakes area may need sewers to address up-gradient loading to ponds**
- **Several ponds have not been analyzed and need further assessment to evaluate best means of addressing P.**

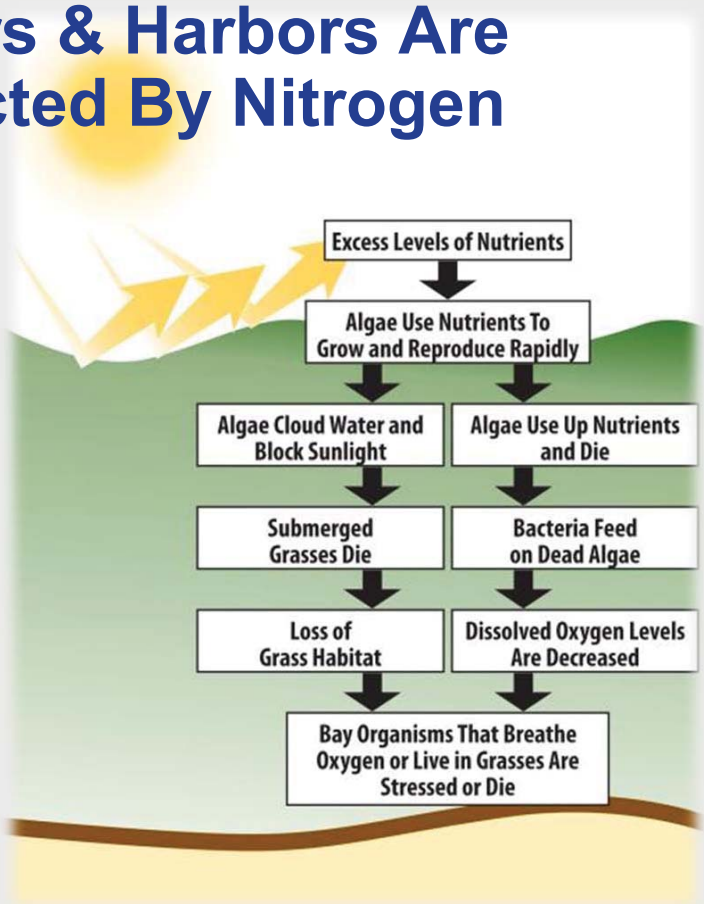
Beaches, Rivers & Harbors Are Severely Impacted By Nitrogen

Healthy Nitrogen Levels

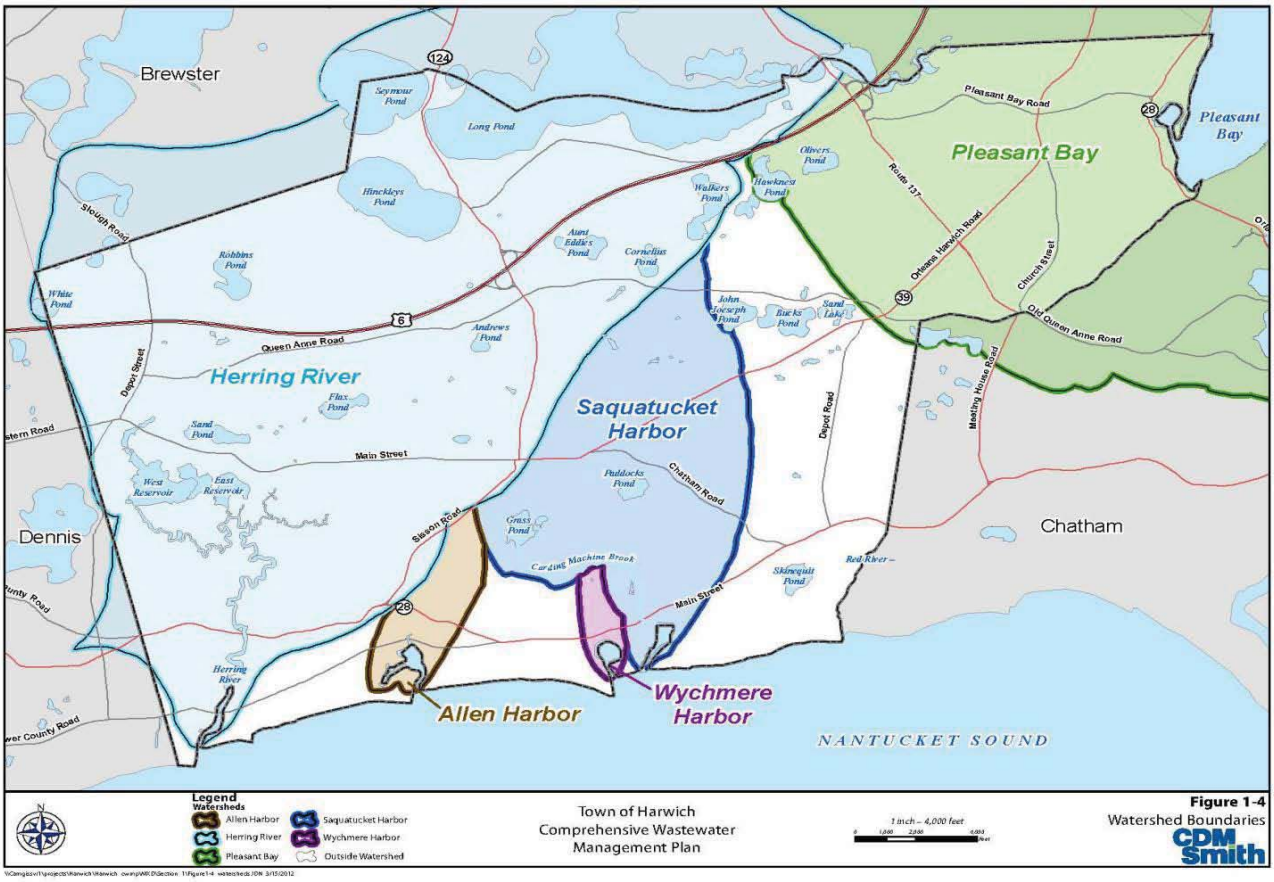


Beaches, Rivers & Harbors Are Severely Impacted By Nitrogen

Unhealthy Nitrogen Levels



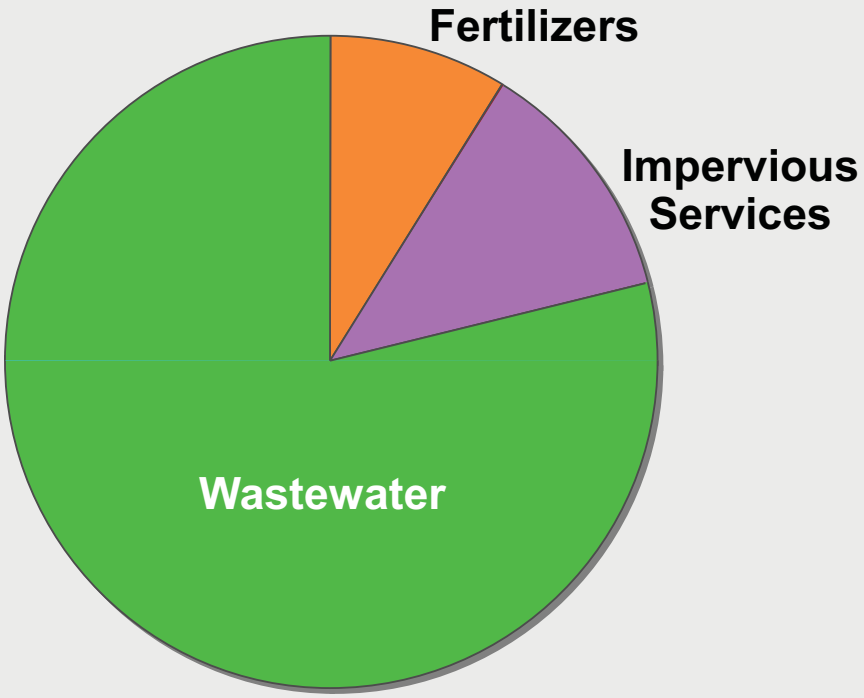
Existing Conditions – MEP Watersheds



Goals for CWMP

Harwich MEP Watershed	*Septic Nitrogen ("N") Removal Rates from Wastewater to Meet TMDL*
Herring River	25% (to be confirmed)
Allen Harbor	70-90 %
Wychmere Harbor	100 %
Saquatucket Harbor	70-90 %
Pleasant Bay	70-80%

Nitrogen Management

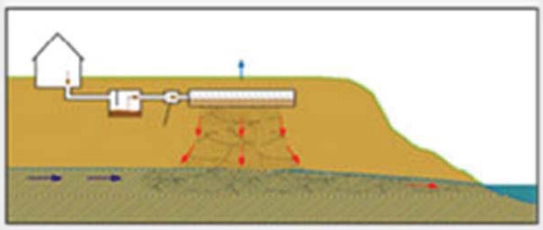


Local Control – Muddy Creek

Nitrogen From Septic Systems Is Our Biggest Issue

Septic Systems Permit Nitrogen to:

- Invade Our Ground Water
- Travel with Groundwater to the Beaches & Rivers

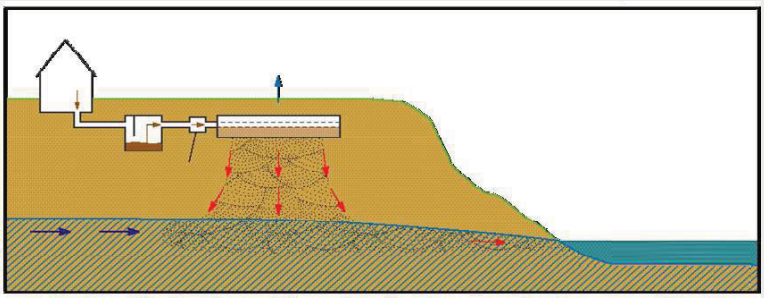


Nitrogen Management Is the Priority

- MEP results to date indicate significant nitrogen removal will be required in 4 of the 5 estuaries/ watersheds.
- Stormwater best management practices (BMPs) are important but have less impact
- Fertilizer management and education about use / impacts is important but also has less impact

Existing Conditions Assessment – Septic Systems (Title 5)

- Harwich predominantly has well draining soils
- Most areas have sufficient depth to groundwater or have mounded systems
- Densely developed areas have history of Title 5 waivers for setback requirements or deed restrictions limiting size



Septic System (Title 5) Issues

- Title 5 does not appear to be a driver for sewers based on existing conditions.
- Some areas may continue to require waivers for setbacks.
- Some areas may still require mounded systems.
- Some areas could be sewered to eliminate waivers and mounded systems.

Overall Areas Fall into 2 Wastewater Categories

- Area needs an off-site solution due to MEP N-removal requirements, socio-economic requirements or other reasons.
- Area can remain with on-site systems using nonstructural nutrient management solutions

How Do We Solve?

Protect Beaches, Rivers & Harbors

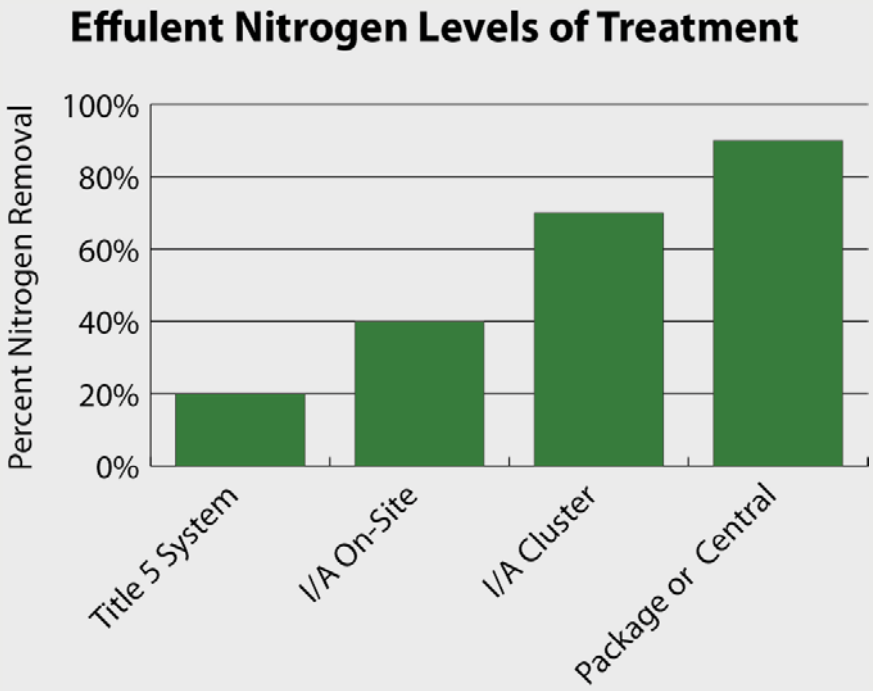
Protect Drinking Water

Encourage Economic Revitalization

Nitrogen Reduction by Nature

- **Natural attenuation at Muddy Creek and Cold Brook Bogs**
- **Nitrogen treatment levels vary with available technologies**

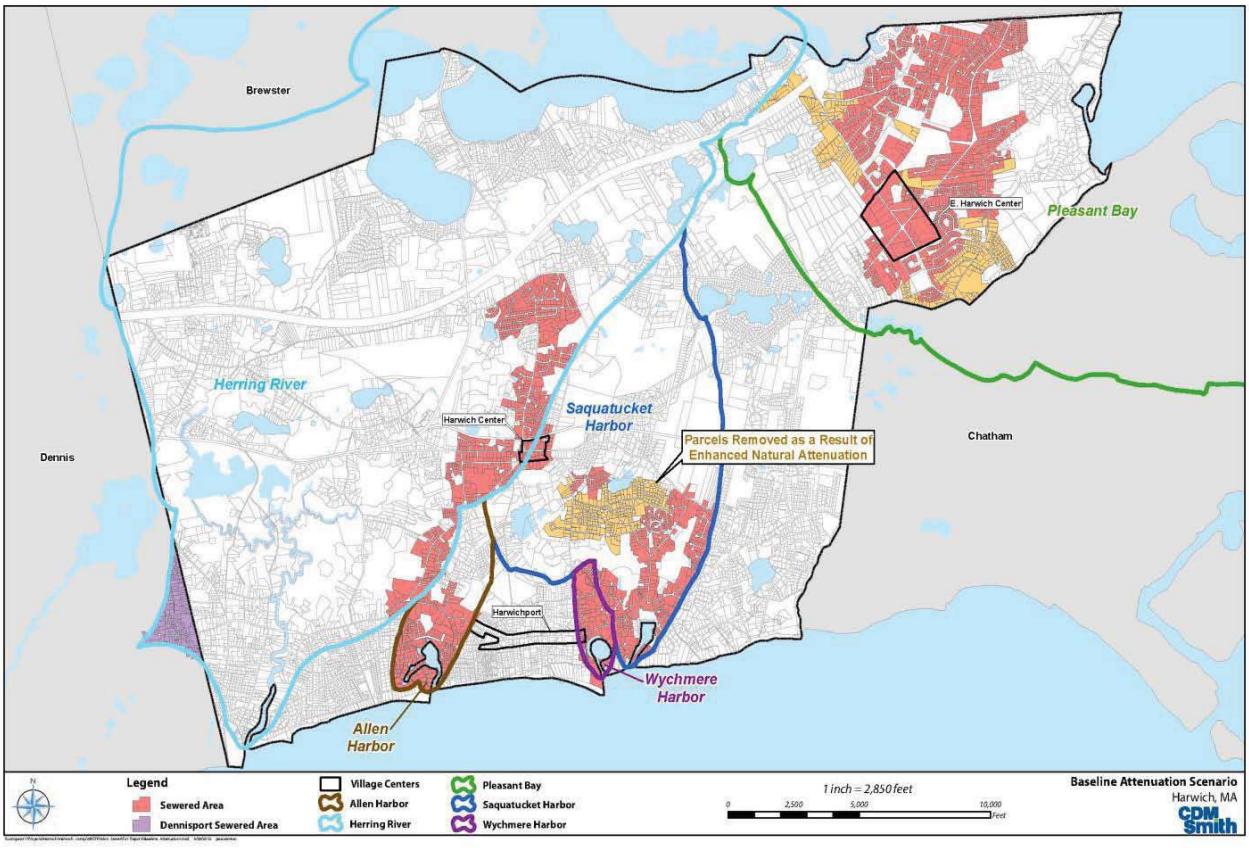
Nitrogen Removal By Technology



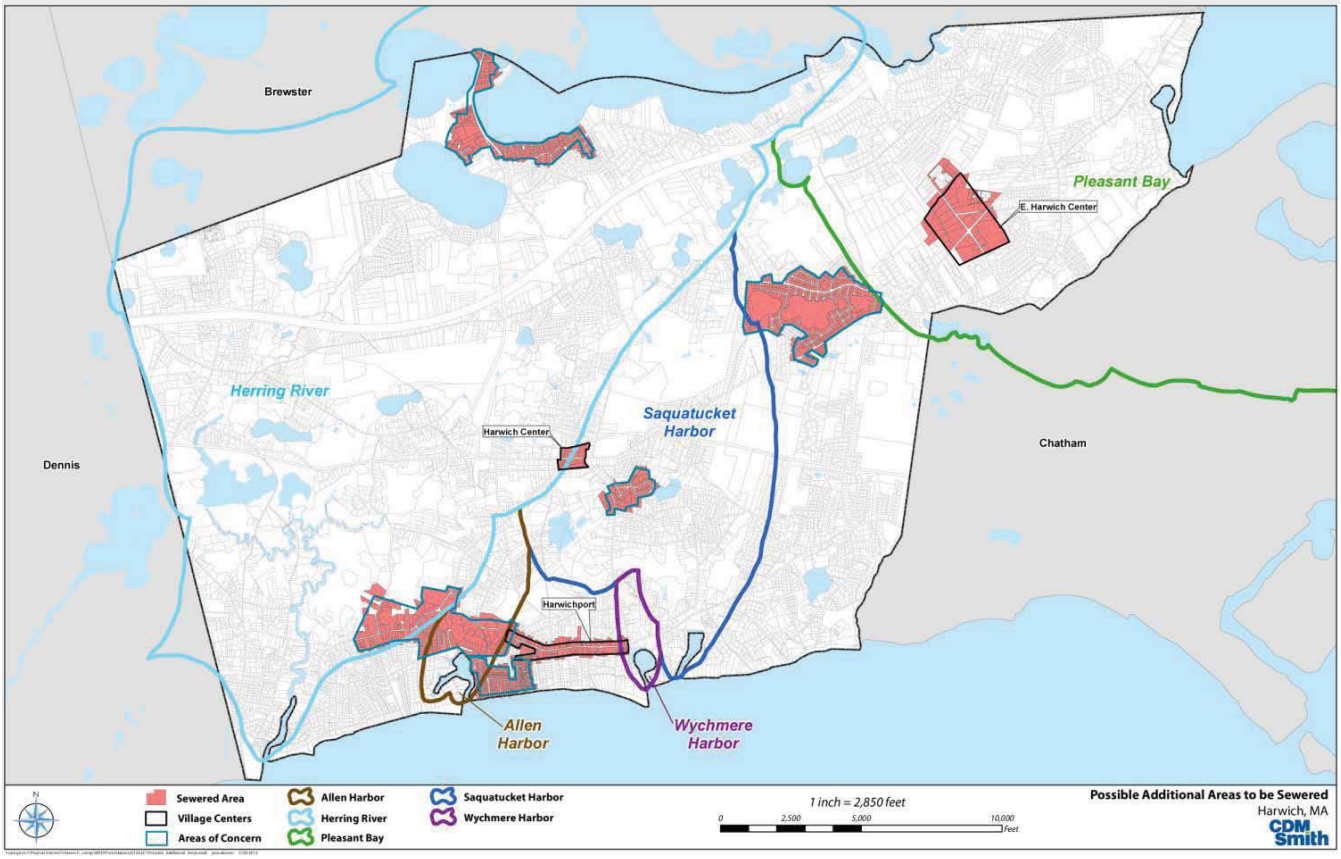
Harwich Properties Needing Nitrogen Removal

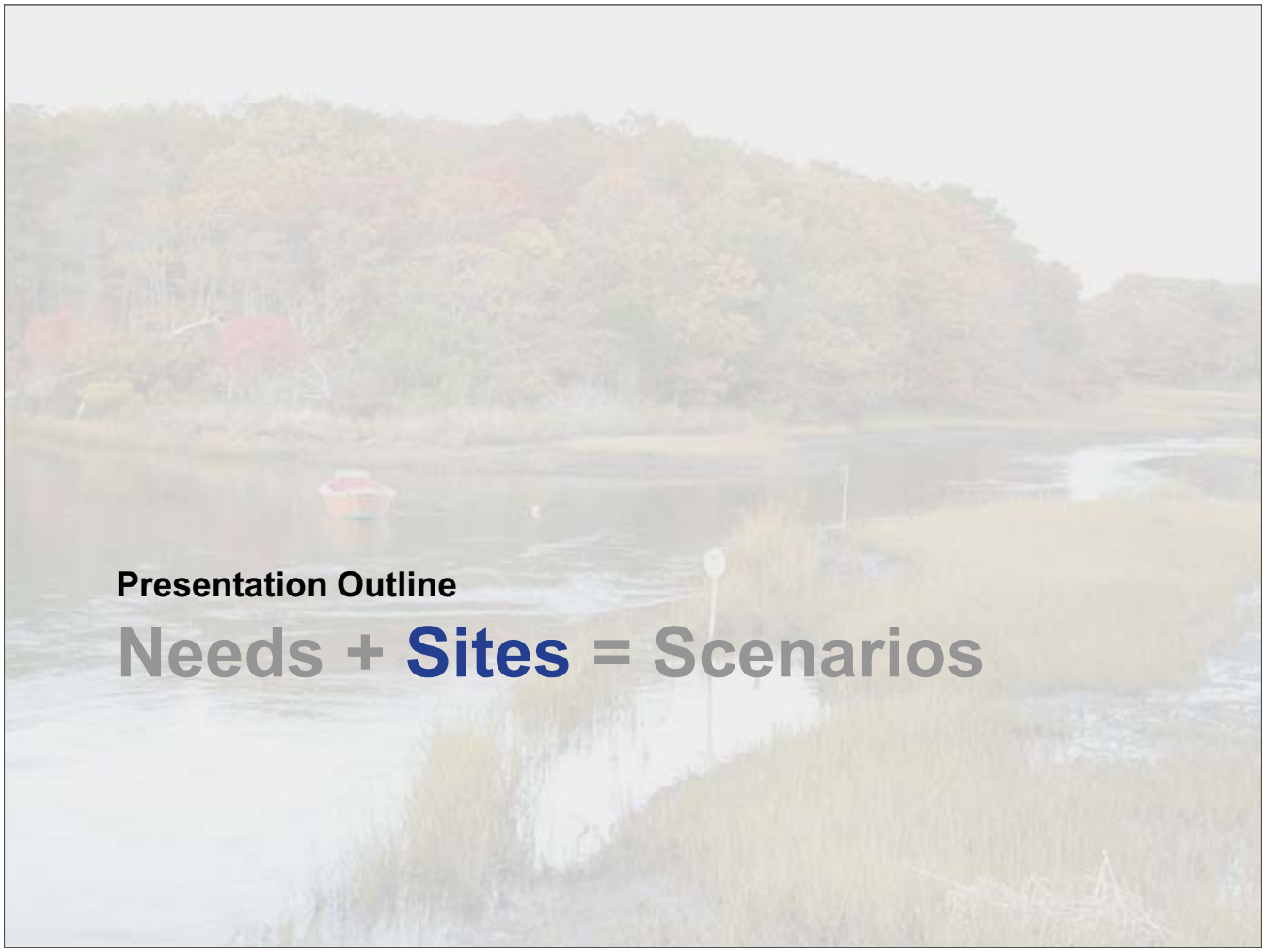
MEP Watershed	*Number of Developed Properties @ Build-Out*	*Nitrogen ("N") Removal rates from Wastewater to meet TMDL*	*Number of MEP Watershed Properties needing Nitrogen Removal*
Herring River	3,500	25 % (est.)	1,100
Allen Harbor	350	70-90 %	230
Wychmere Harbor	120	100 %	120
Saquatucket Harbor	1,400	70-90 %	400
Pleasant Bay	1,900	70-80 %	1,300
MEP Watershed Subtotal	**7,300**		**3,150**
Total Town-wide	**10,000**		

Minimum Sewer Service Areas to Meet Requirements = 30% of Town



Potential Areas Needing Treatment Include:



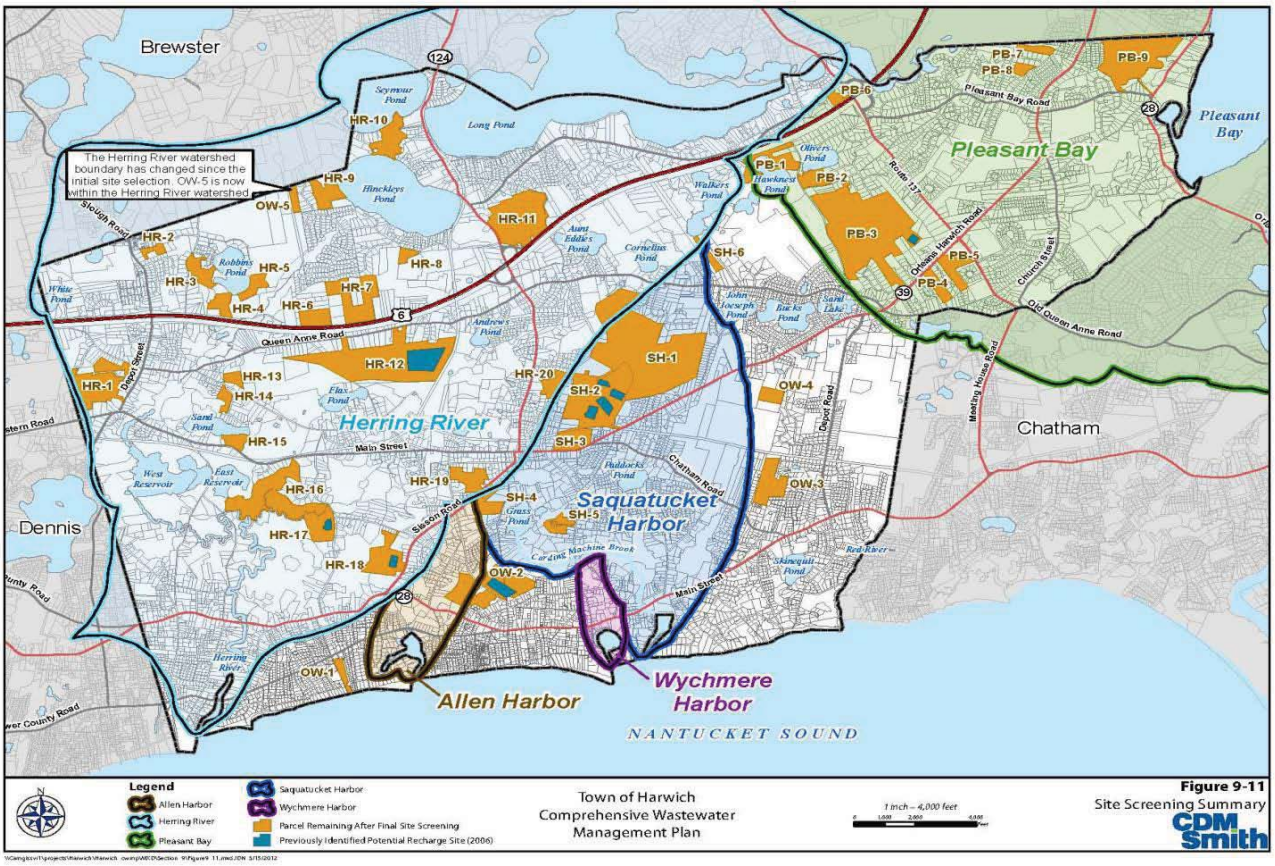


Treatment Site Screening Process

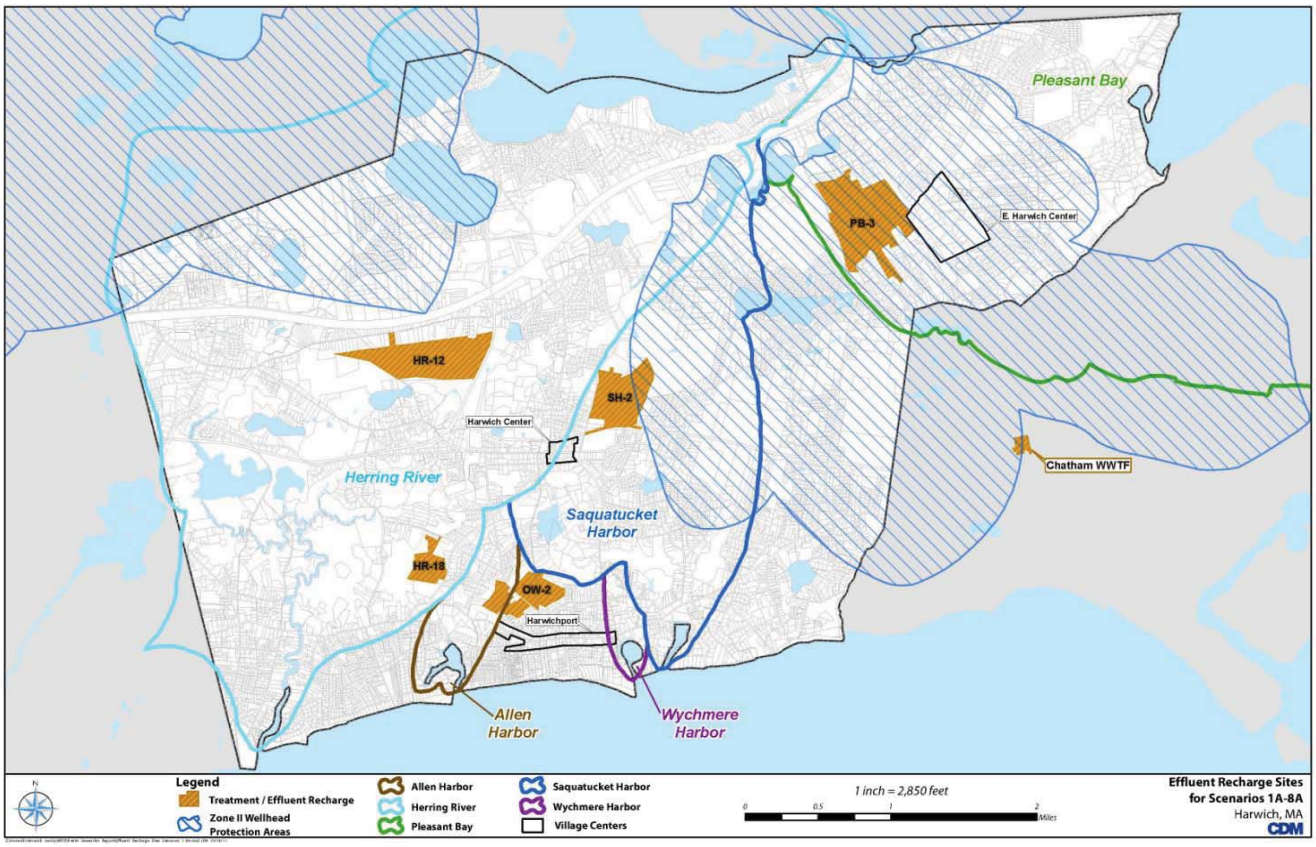
Treatment Site Screening Criteria

1. Outside of a Well Contribution Zone
2. Parcel Size Greater than 5 Acres
3. Outside of a 100-Year Floodplain Zone
4. Sites With Permeable Soils
5. Undeveloped Property
6. Parcels Outside of Wetlands
7. Favorable Depth to Groundwater
8. Outside Priority Habitat
9. Outside Municipal Wellhead Protection Zones
10. Town-Owned Property

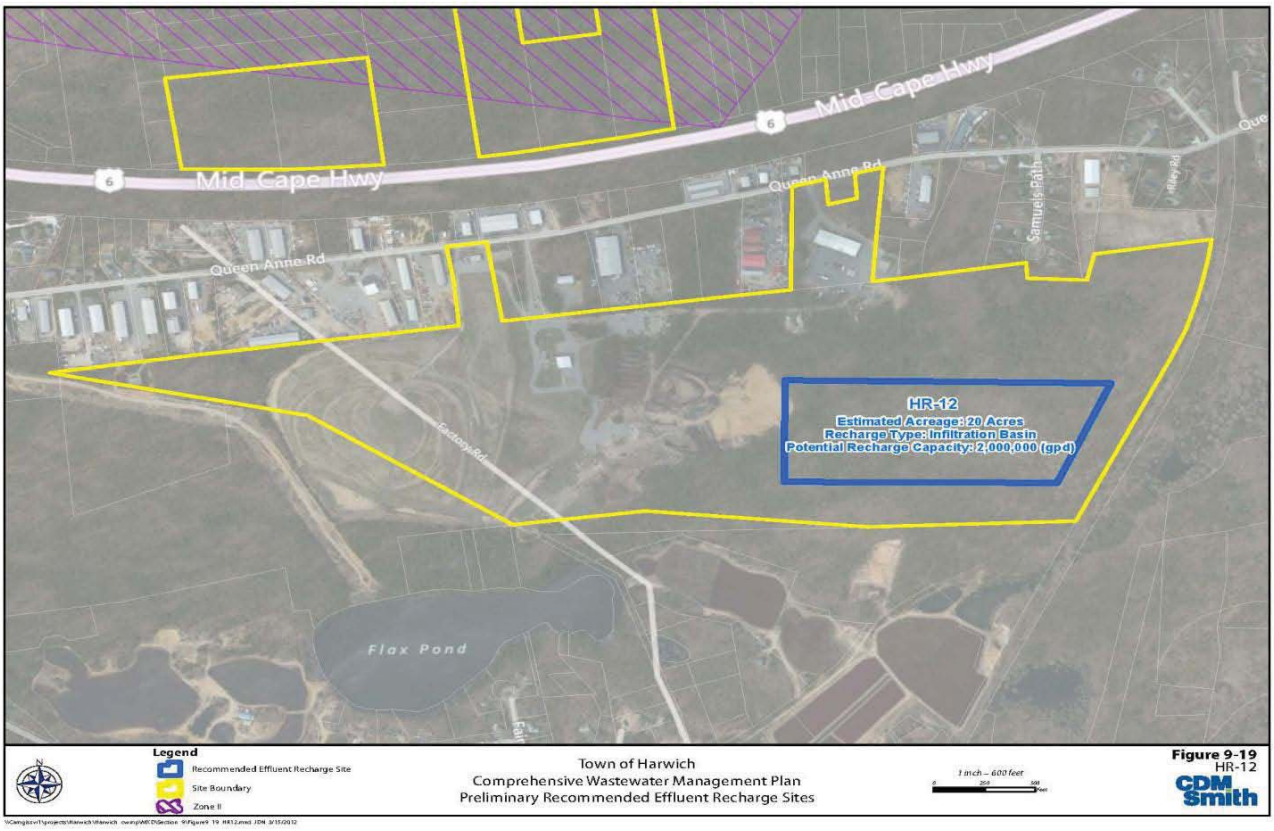
Site Screening Summary



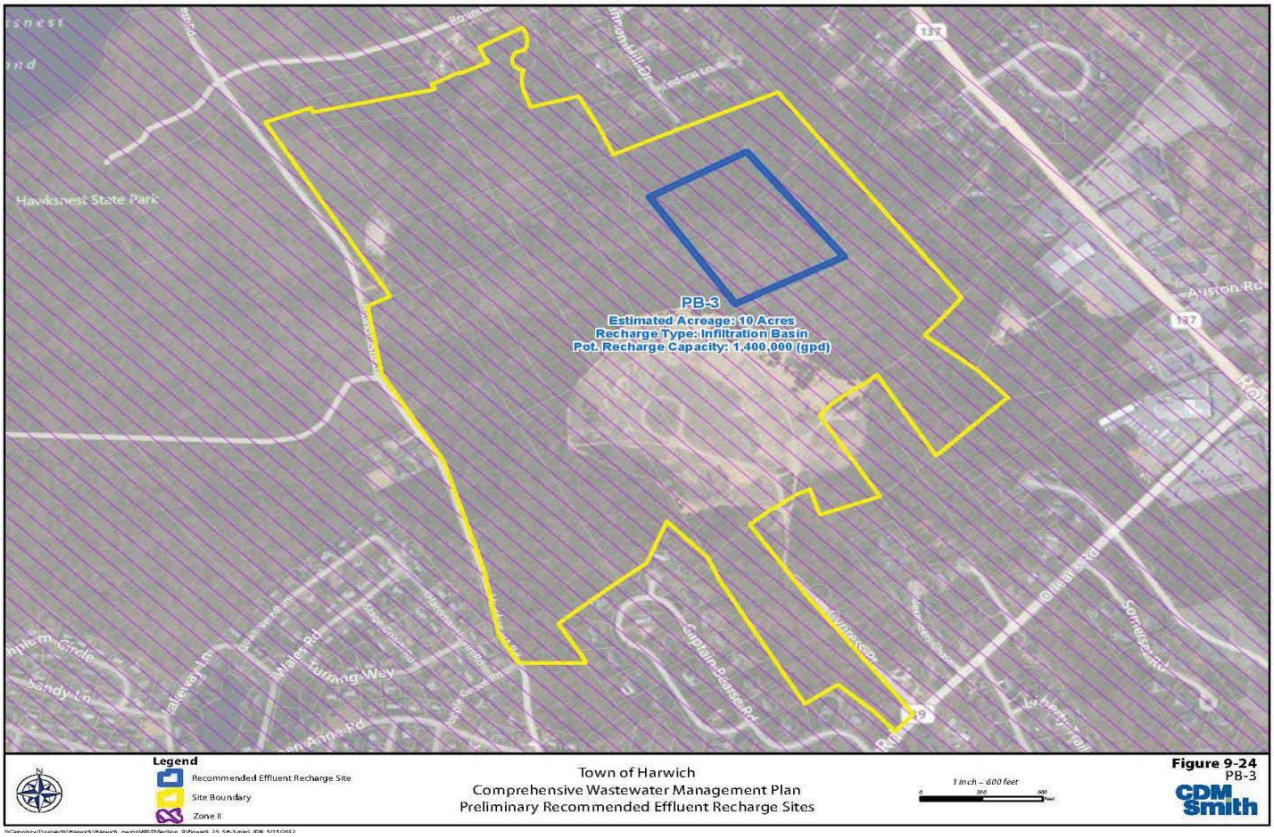
Site Screening
Final Recommended Sites



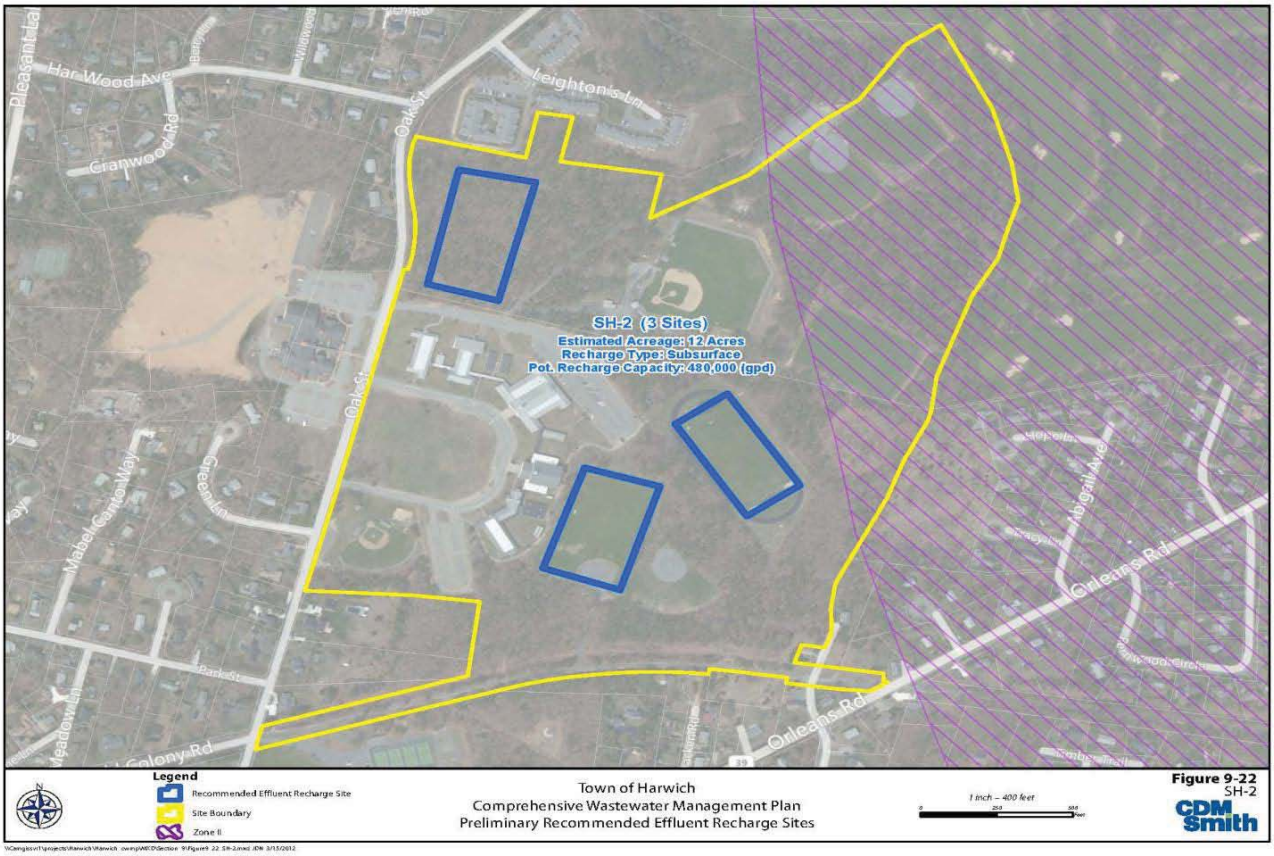
HR-12 – Adjacent to Former Town Landfill
In the Herring River Watershed



PB-3 – Privately Owned Gravel Pit In the Pleasant Bay Watershed



SH-2 – The High School Saquatucket Harbor Watershed



Chatham Wastewater Treatment Plant

Infiltration Basins

Water Reuse - Kingston Massachusetts

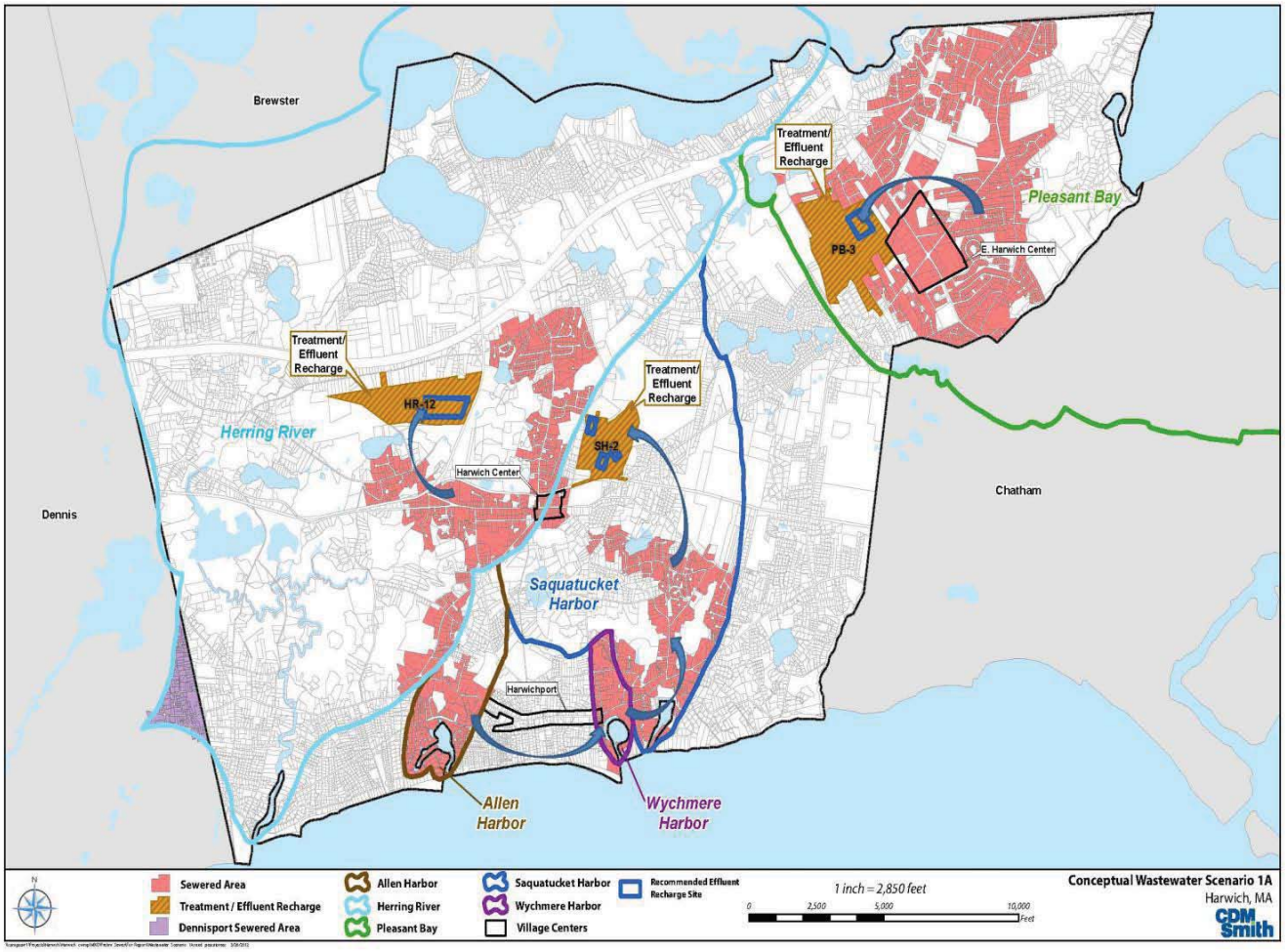
Indian Pond Golf Course – 300,000gpd effluent recharge site

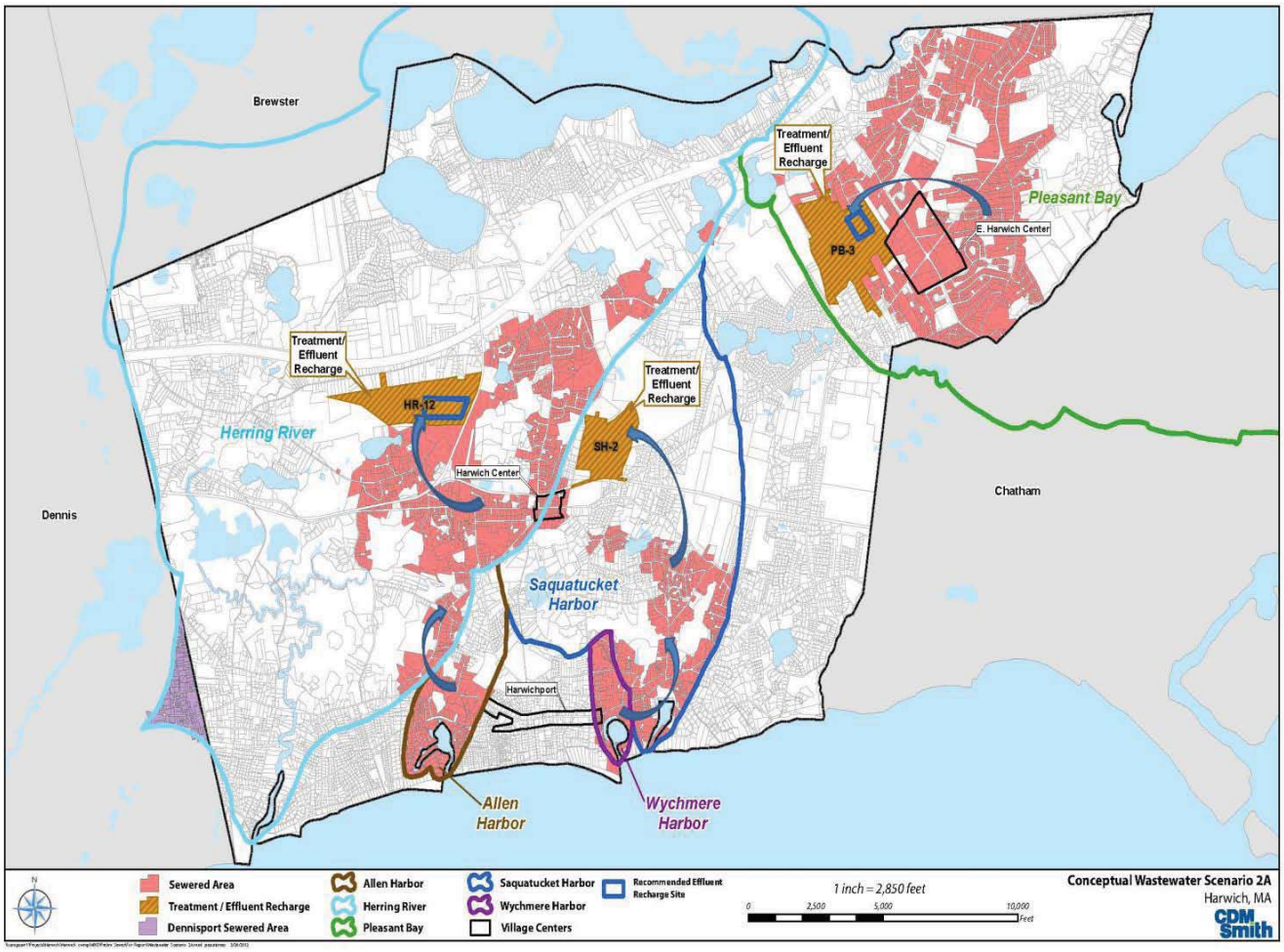
Presentation Outline

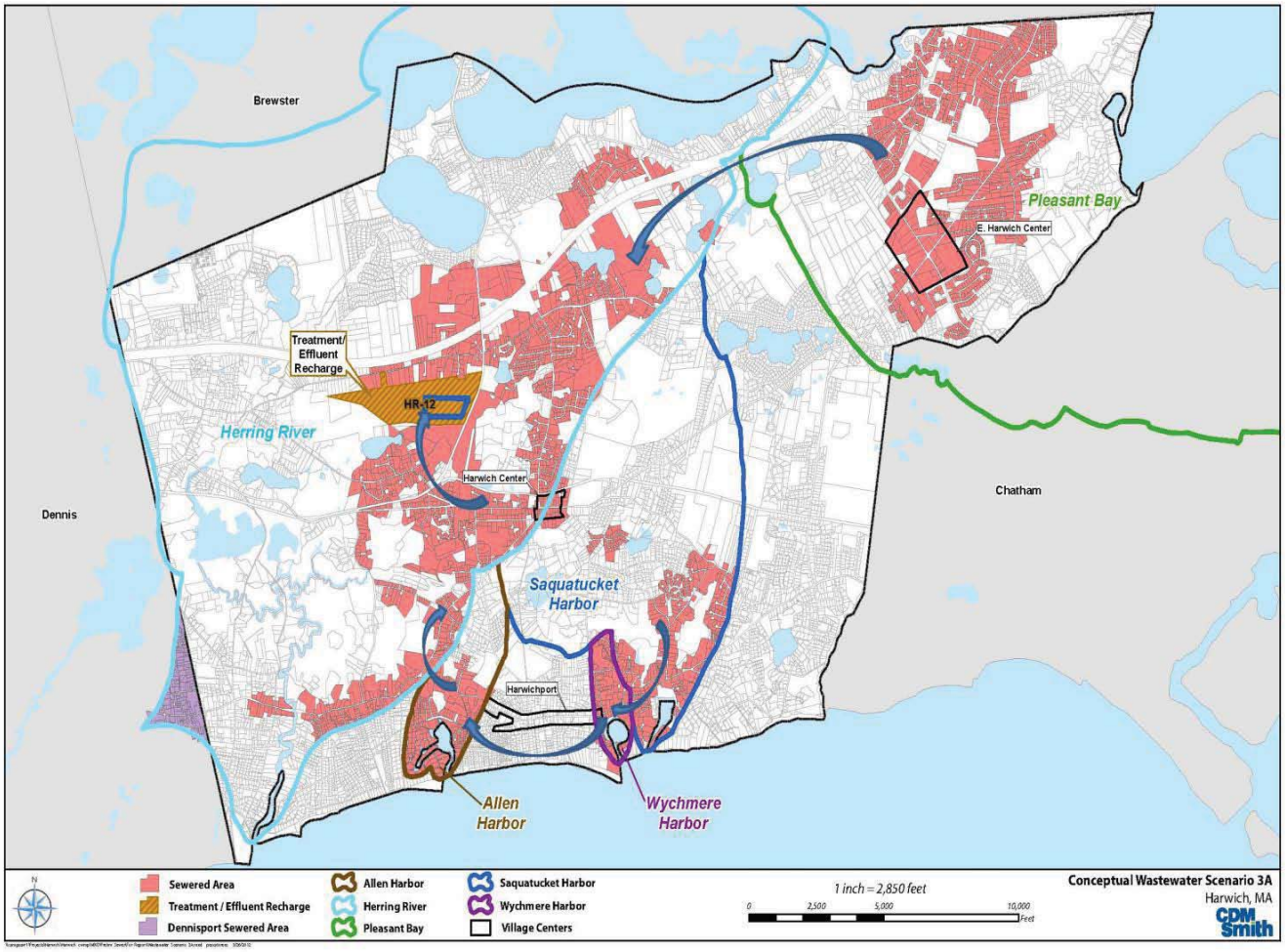
Needs + Sites = Scenarios

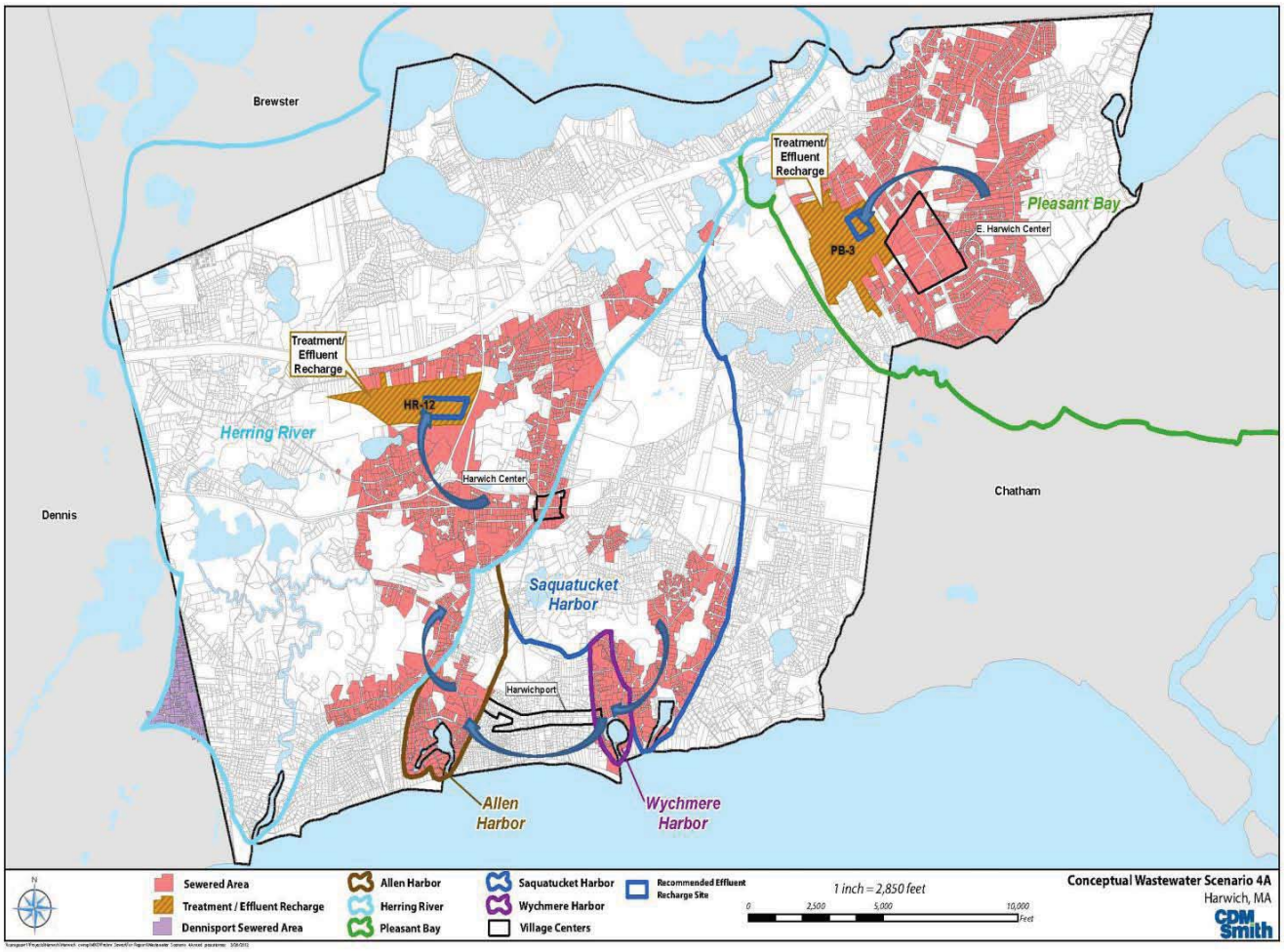
Summary of Wastewater Scenarios and Effluent Recharge Sites

Wastewater Service	Herring River Recharge Site	Saquatucket Harbor Recharge Site	Pleasant Bay Recharge Site	Outside MEP Watershed Recharge Site	Treatment Only At HR-18 : Ocean Used for Recharge
Scenario	HR-12	SH-2	PB-3	OW-2	Outfall
1A	x	x	x		
2A	x	x	x		
3A	x				
4A	x		x		
5A	x		x		
6A	x	x	x	x	
7A	x	x	x	x	
8A					x




Brewster
Treatment/
Effluent
Recharge
Pleasant Bay
E. Harwich Center
PB-3
Treatment/
Effluent
Recharge
HR-12
Herring River
Treatment/
Effluent
Recharge
SH-2
Harwich Center
Dennis
Chatham
Saquatucket
Harbor
Harwichport
Allen
Harbor
Wychmere
Harbor
Sewered Area
Treatment / Effluent Recharge
Dennisport Sewered Area
Allen Harbor
Herring River
Pleasant Bay
Saquatucket Harbor
Wychmere Harbor
Village Centers
Recommended Effluent
Recharge Site
1 inch = 2,850 feet
0
2,500
5,000
10,000
Feet
Conceptual Wastewater Scenario 2A
Harwich, MA
CDM
Smith


Brewster
Pleasant Bay
E. Harwich Center
Treatment/
Effluent
Recharge
HR-12
Herring River
Harwich Center
Dennis
Chatham
Saquatucket
Harbor
Harwichport
Allen
Harbor
Wychmere
Harbor
Sewered Area
Treatment / Effluent Recharge
Dennisport Sewered Area
Allen Harbor
Herring River
Pleasant Bay
Saquatucket Harbor
Wychmere Harbor
Village Centers
1 inch = 2,850 feet
0
2,500
5,000
10,000
Feet
Conceptual Wastewater Scenario 3A
Harwich, MA
CDM
Smith


Brewster
Treatment/
Effluent
Recharge
Pleasant Bay
E. Harwich Center
PB-3
Treatment/
Effluent
Recharge
HR-12
Herring River
Harwich Center
Dennis
Chatham
Saquatucket
Harbor
Harwichport
Allen
Harbor
Wychmere
Harbor
Sewered Area
Treatment / Effluent Recharge
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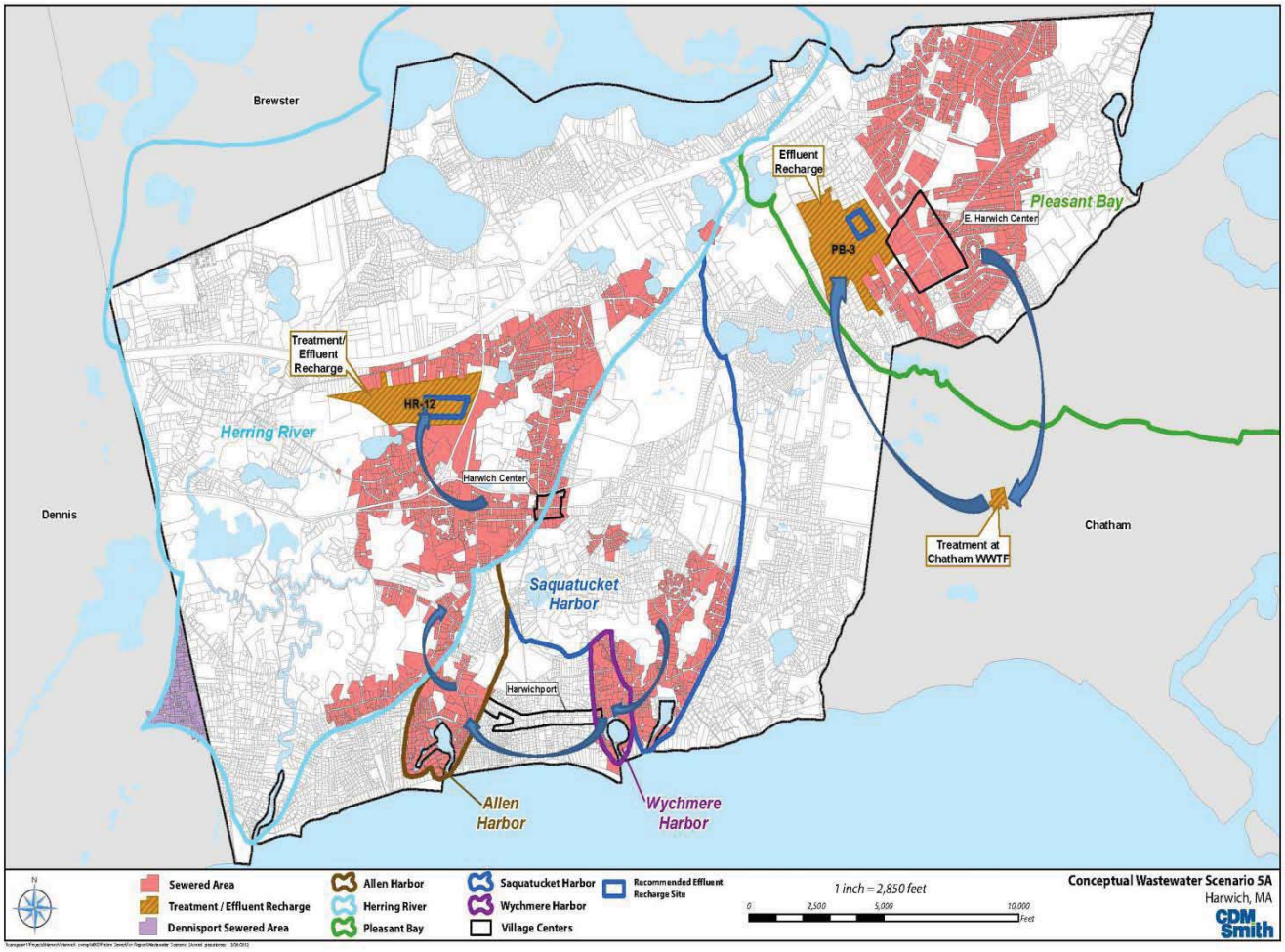
Allen Harbor
Herring River
Pleasant Bay
Saquatucket Harbor
Wychmere Harbor
Village Centers
Recommended Effluent
Recharge Site
1 inch = 2,850 feet
0
2,500
5,000
10,000
Feet
Conceptual Wastewater Scenario 4A
Harwich, MA
CDM
Smith


Brewster
Effluent
Recharge
Pleasant Bay
E. Harwich Center
PB-3
Treatment/
Effluent
Recharge
HR-12
Herring River
Harwich Center
Dennis
Chatham
Treatment at
Chatham WWTF
Saquatucket
Harbor
Harwichport
Allen
Harbor
Wychmere
Harbor
Sewered Area
Treatment / Effluent Recharge
Dennisport Sewered Area
Allen Harbor
Herring River
Pleasant Bay
Saquatucket Harbor
Wychmere Harbor
Village Centers
Recommended Effluent
Recharge Site
1 inch = 2,850 feet
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2,500
5,000
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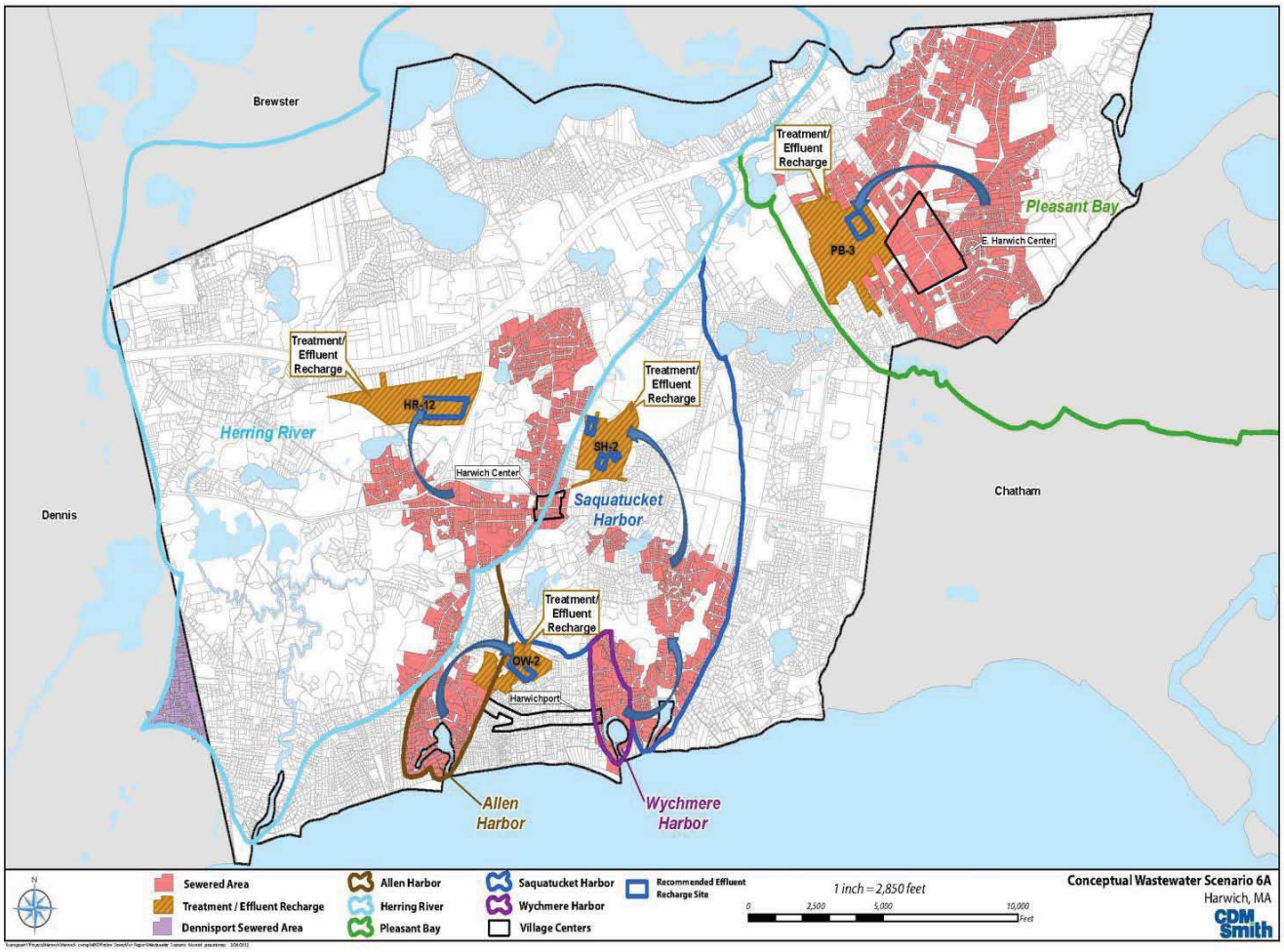
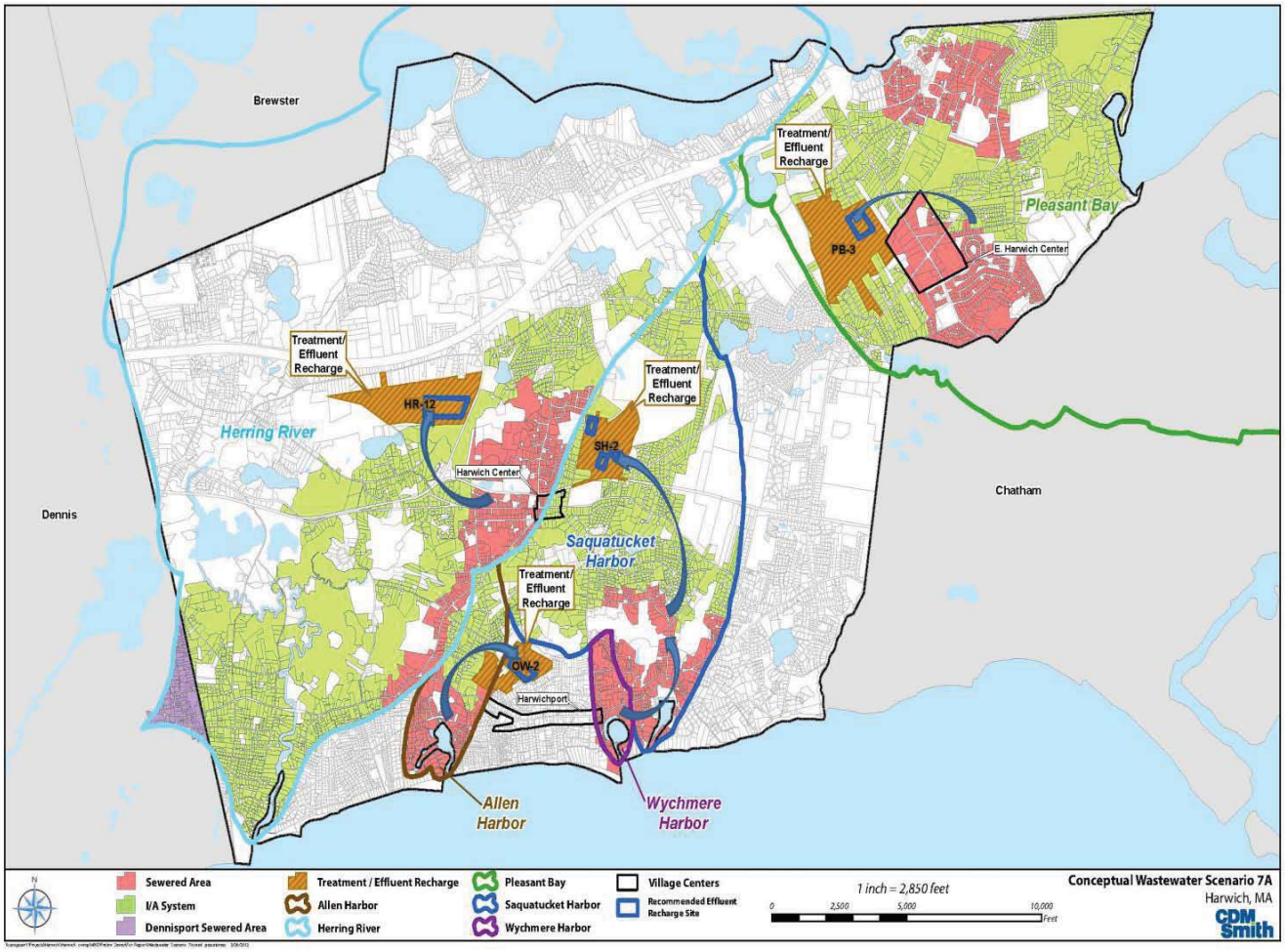
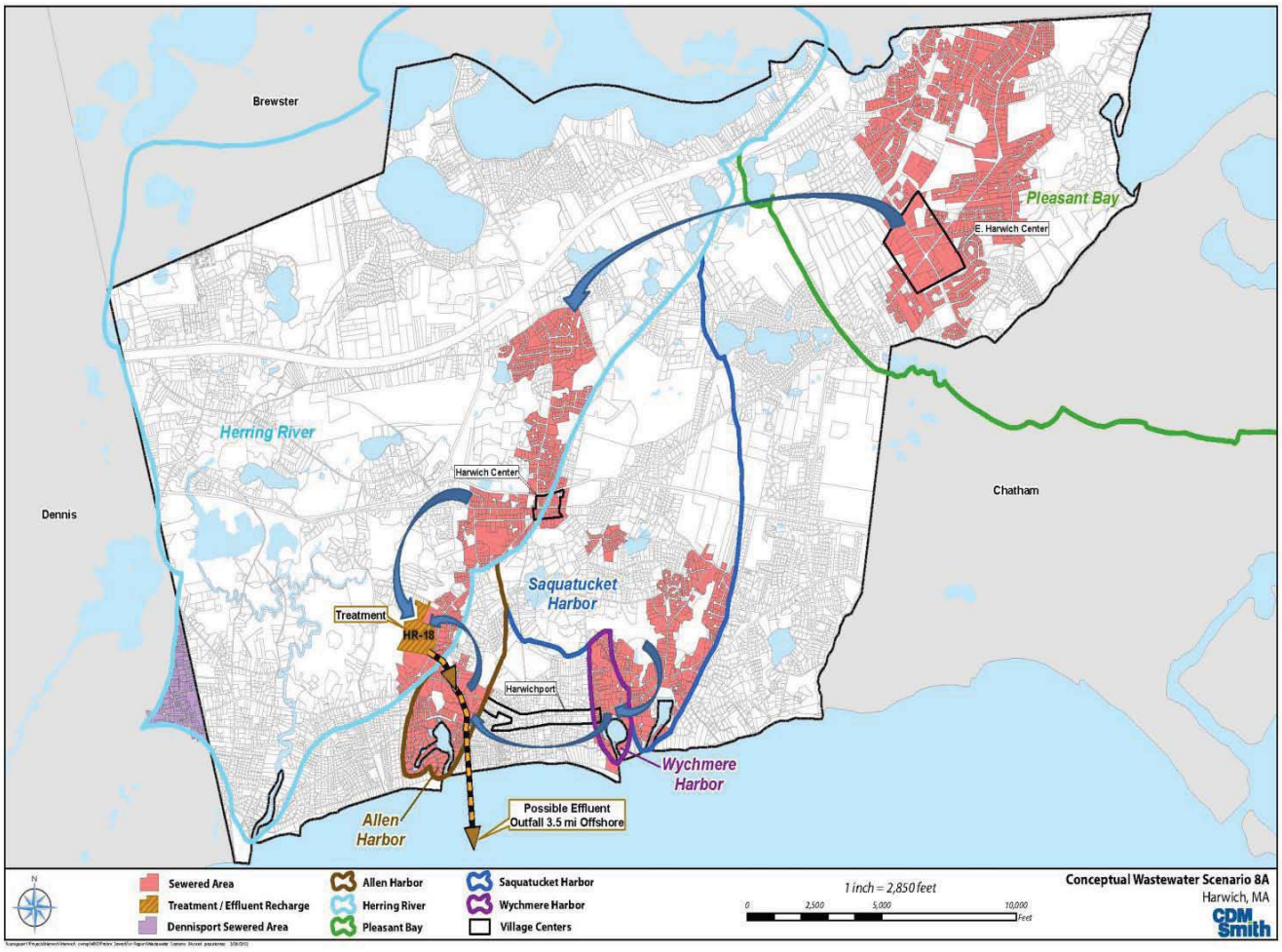
Feet
Conceptual Wastewater Scenario 5A
Harwich, MA
CDM
Smith


Brewster
Dennis
Chatham
Treatment/ Effluent Recharge
PB-3
Pleasant Bay
E. Harwich Center
Treatment/ Effluent Recharge
HR-12
Herring River
Treatment/ Effluent Recharge
SH-2
Harwich Center
Saquatucket Harbor
Treatment/ Effluent Recharge
OW-2
Harwichport
Allen Harbor
Wychmere Harbor
Sewered Area
Treatment / Effluent Recharge
Dennisport Sewered Area
Allen Harbor
Herring River
Pleasant Bay
Saquatucket Harbor
Wychmere Harbor
Village Centers
Recommended Effluent Recharge Site
1 inch = 2,850 feet
0
2,500
5,000
10,000
Feet
Conceptual Wastewater Scenario 6A
Harwich, MA
CDM Smith


Brewster
Dennis
Chatham
Treatment/ Effluent Recharge
PB-3
Pleasant Bay
E. Harwich Center
Treatment/ Effluent Recharge
HR-12
Herring River
Treatment/ Effluent Recharge
SH-2
Harwich Center
Saquatucket Harbor
Treatment/ Effluent Recharge
OW-2
Harwichport
Allen Harbor
Wychmere Harbor
Sewered Area
I/A System
Dennisport Sewered Area
Treatment / Effluent Recharge
Allen Harbor
Herring River
Pleasant Bay
Saquatucket Harbor
Wychmere Harbor
Village Centers
Recommended Effluent Recharge Site
1 inch = 2,850 feet
0
2,500
5,000
10,000
Feet
Conceptual Wastewater Scenario 7A
Harwich, MA
CDM Smith



Results of Scenario Screening

Evaluation of Alternatives - Harwich CWMP Wastewater Scenarios								
Scenarios	1A	2A	3A	4A	5A	6A	7A	8A
TOTAL WITH WEIGHTING	270	266	145	223	204	321	402	366

Rankings Are Based On The Following Four Criteria:

1. Relative Costs
2. Technical Criteria
3. Institutional Criteria
4. Environmental Criteria

Summary of Final Recommended Wastewater Scenarios and Effluent Recharge Sites

- 3A – Single Treatment Plant
- 4A – Two Treatment Plants
- 5A – Two Treatment Plants: Includes Regional Solution with Chatham

Wastewater Service	*Herring River Recharge Site*	*Pleasant Bay Recharge Site*
Scenario	*HR-12*	*PB-3*
3A	x	
4A	x	x
5A	x	x

Next Steps

- Finalize effluent recharge modeling and evaluate potential impacts
- Evaluate collection system types and treatment technologies
- Develop life cycle costs for each scenario
- Develop criteria and ratings system to prioritize three final wastewater scenarios

CWMP Schedule

- April - June 2012 – Develop Draft Recommended Wastewater Program
- June 2012 – Community meeting to present recommended wastewater program
- July – August 2012 – Begin State and County permitting review of Draft CWMP

How to get involved?

- Contact Committees
  - Water Quality Management Task Force – Wastewater Management Subcommittee
  - Citizens Advisory Committee
  - Wastewater Implementation Advisory Committee
- Go to Website - Meeting Schedule and Meeting Minutes (Calendar of Events, etc.)
- Watch Channel 18 - Postings
- Join email – see sign-up sheet

Summary

- This is a complex planning process – one that will continue indefinitely – as things will change – adaptive management
- The CWMP is intended to be a living document that will adapt depending on results of earlier implementation phases
- Most properties in town contribute to the problem – not just those along a water body or those proposed for sewering
- All benefit from improved water quality

Community Meeting 6

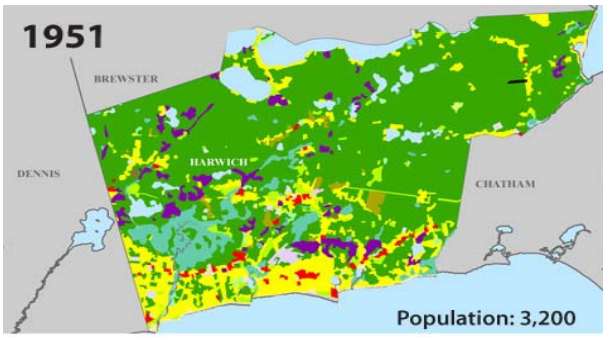
Summary of Harwich Utility

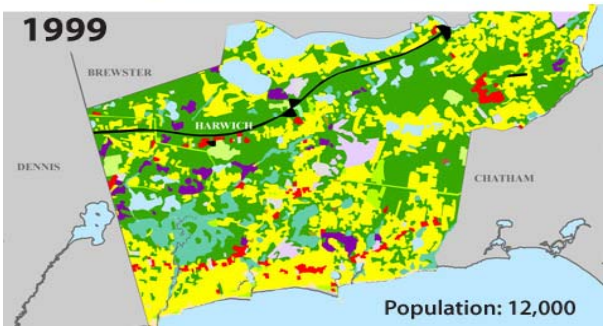
- 180 Miles of Utility Pipes
- 5 Pumping Stations
- 3 Storage Tanks
- Treatment Facility
- Administration Offices and Maintenance Garages
- 40+ Year Program
- Capital Cost Range (Today's Dollars):

$215 to $255 Million

Harwich Land Use Development 1951 and 1999

- **400% population growth from 1951 to 1999**

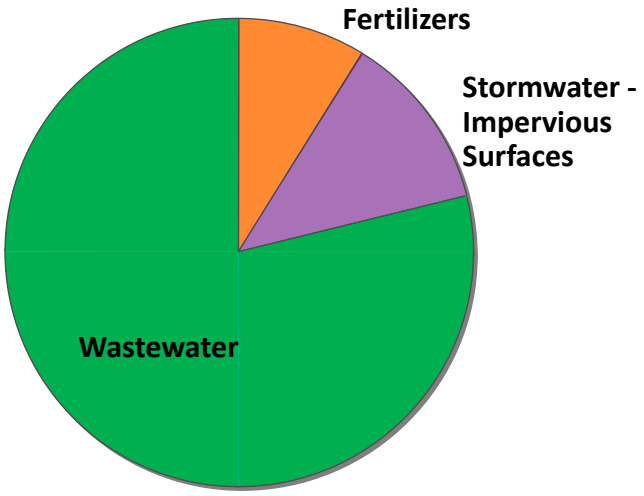




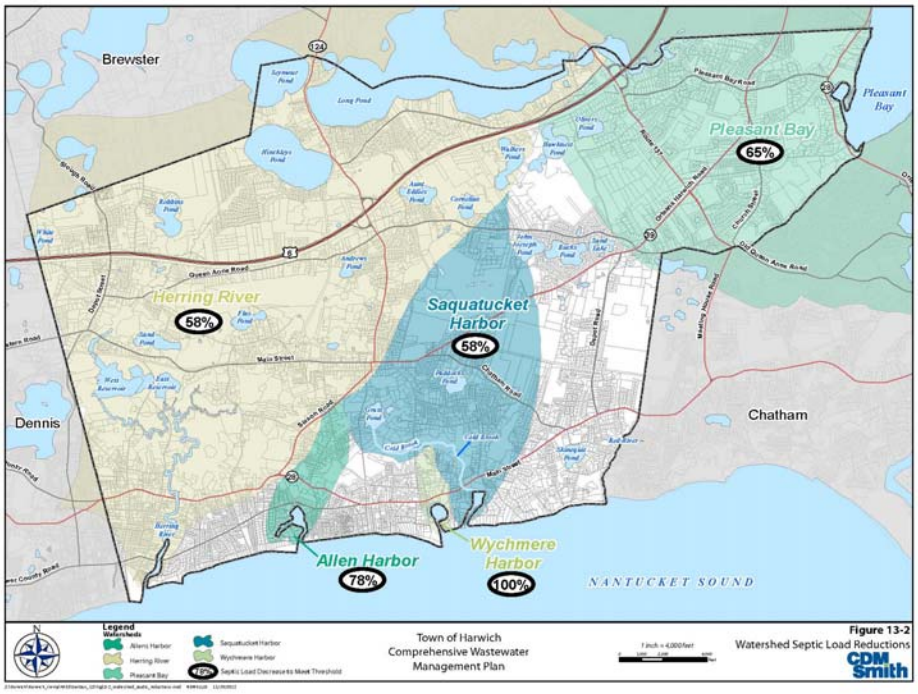
Allen Harbor Algae Bloom

Summer 2007

Controllable Sources of Nitrogen

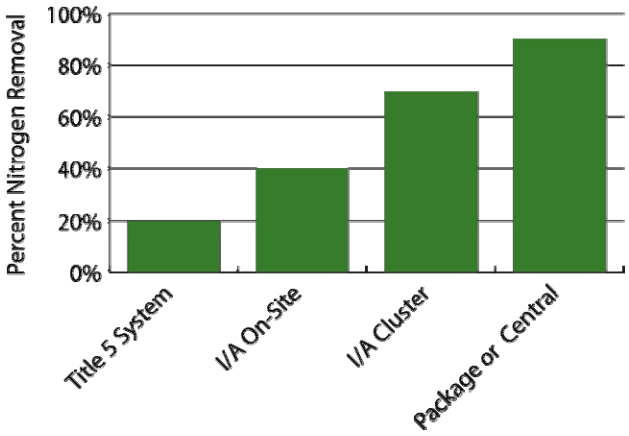


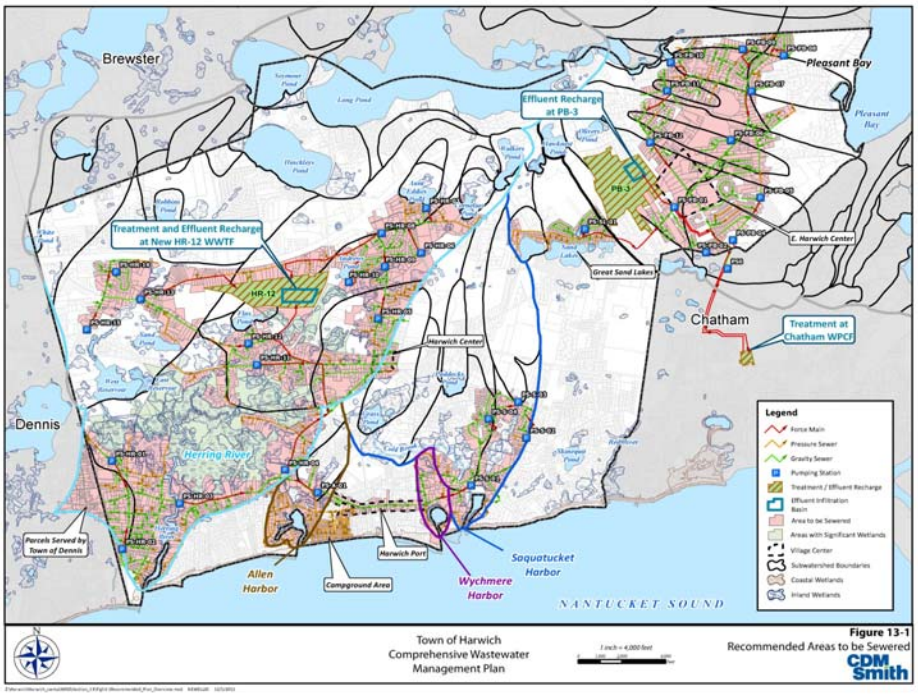
Local Control - Typical



Nitrogen Removal By Technology

Effluent Nitrogen Levels of Treatment





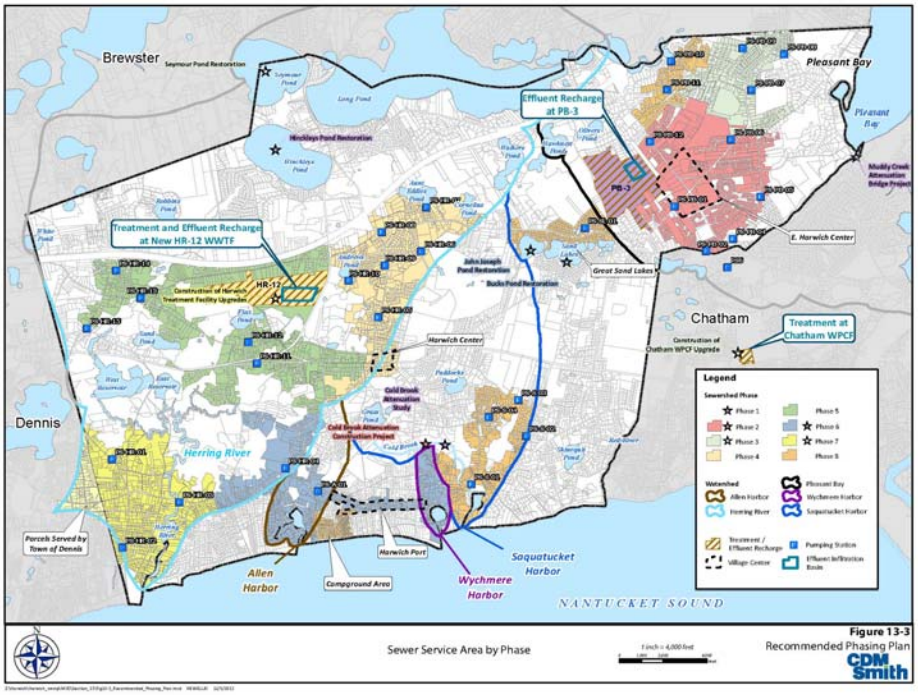


Figure 13-3
Recommended Phasing Plan

Recommended Program – Scenario 5A With Updates

- **Two Treatment Plants**
- **First phases utilize regional solution by using Chatham wastewater plant to treat Harwich flows from Pleasant Bay watershed**
- **Future phases utilize Harwich treatment plant built at landfill site to treat and recharge wastewater from other four watersheds**
- **Program built in eight phases over 40 years**
- **Includes 23 % growth at build-out**
- **Capital costs range $180 to $230 Million**

Recommended Program – Scenario 5A With Updates

- Non-infrastructure Components
  - Public Outreach
  - Fertilizer Management Education
  - Stormwater Best Management Practices
  - Freshwater Pond Evaluations and Restoration
  - Land Use Planning/ Zoning/ Acquisition
  - Other
- Adaptive Management Process

CWMP Schedule

- November 2012 – WQMTF Wastewater Management Subcommittee endorsed recommended program
- January 2013 - Board of Selectmen endorse filing of recommended Draft CWMP program - ?
- February 2013 - Begin year long State and County permitting review of Draft CWMP
- Spring 2013 Town Meeting actions
  - Fund remainder of CWMP
  - Fund Phase 1 of recommended program

Summary

- This is a complex planning process – one that will continue indefinitely – as things will change – adaptive management process
- The CWMP is intended to be a living document that will adapt depending on results of earlier implementation phases
- Most properties in town contribute to the problem – not just those along a water body or those proposed for sewering
- All benefit from improved water quality

Frequently Asked Questions

Harwich Comprehensive Wastewater Management Plan
Frequently Asked Questions - Update January 28, 2013

The Town of Harwich (the Town) is developing a town-wide Comprehensive Wastewater Management Plan (CWMP) to address long-term wastewater needs and restore and maintain the quality of all of the town's water resources. The CWMP will provide the flexibility to create a lasting solution by addressing the existing sources of pollution within a given watershed as well as potential sources of pollution posed by changing development patterns. The CWMP will seek to balance water quality needs with the ability to finance necessary improvements. Priorities will be set and an implementation schedule established to maximize the effect of any public improvements within a watershed and between watersheds.

A Draft CWMP is currently available and posted on the Town's website. A workshop to review and discuss this Draft was held on January 19, 2013 at the Harwich Community Center from 9:00 am to 11:00 am. The Board of Selectmen is approved the filing of the Draft CWMP on January 28, 2013. The document will be filed with state agencies in February, 2013 which begins about a one year approval process.

Q1. What is the current status of the Comprehensive Wastewater Management Plan (CWMP)?

A1. After a delay of over a year, while the Town awaited the results of the Massachusetts Estuaries Project (MEP) evaluation of the Town water quality in the five embayments, the Town has received the information required to move the project forward. Thus, a Draft CWMP is now available for review and comment.

Q2. What is the purpose of this project?

A2. The CWMP is an integral part of the planning process to address Harwich's long-term wastewater and water resource needs over the next 30 to 40 years. These critical needs include:

- Addressing existing nitrogen issues that are degrading the water quality of the harbors and estuaries along the Harwich shore
- Maintaining the excellent drinking water quality in the Town's 14 municipal groundwater supply wells
- Preserving the valuable fresh water pond resources in town
- Providing future utilities for Harwich to implement smart growth via its Village Centers Initiatives
- Meeting acceptable wastewater management practices either through continued use of on-site Title 5 subsurface disposal systems and/or an offsite treatment and disposal system

By addressing these needs Harwich will remain a vibrant tourist community that provides a desired quality of life for year-round and seasonal residents.

Q3. Will wastewater treatment lead to explosive growth and development, including condominium developments, large apartment complexes, strip malls, and such. What will happen to the "villages" of Harwich?

A3. The plan addresses existing needs and future desired needs. Existing land use controls are being evaluated and will be revised accordingly to ensure only planned growth occurs.

Q4. What does this Project involve?

A4. This project consists of two main elements. One is to address the MEP identified nitrogen reductions required in each of the five embayments. The second is a comprehensive review of wastewater management practices in Harwich to evaluate how those reductions can best be realized. Using available information and planning projections, the future needs of the Town were assessed, and alternatives to address those needs were fully evaluated for effectiveness, implementabability and cost.

Q5. Who is involved in this Project?

A5. Several groups are involved at both the local and the state level. Locally, the Water Quality Management Task Force (WQMTF) Wastewater Management Subcommittee (WMS) is coordinating the CWMP. This subcommittee is working with town staff, a Citizens Advisory Committee (CAC), a Wastewater Implementation Advisory Committee (WIAC), the Board of Selectmen (BOS), consultants and many other stakeholders. At the state level the Massachusetts Department of Environmental Protection (MassDEP) is overseeing the MEP, which is being prepared by the School for Marine Science and Technology (SMAST), the Cape Cod Commission (CCC), the United States Geological Survey (USGS), and several other advisory or peer review groups. The WMS is the lead group for the Town, and it contracted with engineering consultant CDM Smith for technical guidance during this process. Coordination among all the groups will be crucial to developing an implementable program that meets Harwich's needs now and into the future. The WMS has been working on this project since 2007.

Q6. Will the Harwich wastewater plan be managed by current town departments or will a new organization need to be created?

A6. The Town currently does not have a wastewater department. Thus the Town is conducting an evaluation of how best to integrate this department into its organization structure.

Q7. Isn't wastewater a single Cape-wide problem which requires a single Cape-wide solution? Shouldn't the county address this problem and not individual towns? Does the Commonwealth of Massachusetts know about the challenges of wastewater on the Cape? What about the federal government?

A7. Wastewater Management is an issue being addressed by every town on Cape Cod. While nitrogen coming from septic systems and entering estuaries resulting in degrading water quality is a common theme in the communities, the variables and solutions are different in each community. The nitrogen in groundwater flows by watersheds, not town boundaries. Thus communities are evaluating regional solutions and the County is assisting in that process. Whether a local or regional solution, each town will want to implement an environmentally sound solution for the least cost. Both the MassDEP and the federal Environmental Protection Agency (EPA) are well aware of the wastewater issues facing Cape Cod.

Q8. What is the MEP?

A8. The MEP is a program to evaluate the nitrogen impacts on up to 89 embayments in the southeastern part of the state, including all of Cape Cod. The MEP is funded by the communities and by the state. The SMAST is conducting the program in partnership with the local communities, the CCC, the USGS and the MassDEP. The MEP includes five Harwich embayments: Pleasant Bay, Allen, Wychmere and Saquatucket Harbors and Herring River.

The purpose of the MEP is to provide an analytical means to quantify and evaluate nitrogen entering the embayment and develop nitrogen thresholds for each embayment that will restore or maintain healthy water quality. Ultimately, the MEP will develop an acceptable Total Maximum Daily Load (TMDL) for nitrogen that can enter each of the embayments. Under the Federal Clean Water Act, the EPA and MassDEP have the authority to require communities contributing nitrogen to the particular embayment to meet the TMDL.

Q9. Why is nitrogen an issue?

A9. Nitrogen deposited in an estuary or embayment acts as a fertilizer and stimulates the over production of algae in the salt water. The algae can become so dense that desirable eel grass beds, shellfish resources, and overall water quality (as well as boating, swimming and overall aesthetics) are negatively affected. Also, reduced light penetration affects healthy plant growth, and decaying plants and algae settle to the bottom, using up oxygen in the water, often resulting in fish kills and odors. If nitrogen is allowed to continue to flow to the embayments at excessive levels, the embayments will become severely degraded.

Nitrogen enters the embayments from several sources, including wastewater effluent from on-site Title 5 septic systems, leaching from lawn and garden commercial fertilizers, stormwater run-off from pavements and roofs, and atmospheric deposition. Nitrogen from these sources enters the groundwater or surface waters that ultimately discharge to the embayments. The first three sources are considered to be controllable while the direct atmospheric deposition is not. A standard Title 5 septic system only removes about 10 to 20 percent of the nitrogen entering it while more sophisticated on-site nutrient removal systems can remove up to about 50 percent nitrogen. Studies on the Cape have shown that nitrogen entering the embayments from septic systems account for 75 to 85 percent of the controllable source while fertilizers and stormwater run-off each account for about 7 to 8 percent.

Q10. This whole wastewater issue has been around for decades, why is it a big deal now?

A10. The Cape has experienced significant residential growth over the past 50 years and transitioned to an increased year round population. The result is more nitrogen entering the groundwater from the septic systems resulting in excessive nitrogen flowing to the estuaries.

Q11. Why does Harwich have to do this?

A11. Harwich representatives and residents understand the need to address this nitrogen issue to maintain the quality of life in town. MassDEP will also be establishing a TMDL for each embayment once the MEP reports are finalized. That will require the Town to implement a plan to remove the required amount of nitrogen to restore the water quality of the particular embayment. The Town is moving forward now with the CWMP so it can develop the appropriate plan on its own timeline rather than on a MassDEP mandated schedule. The abutting towns of Chatham, Orleans, Brewster and Dennis are all in various stages of completing CWMPs to address the nitrogen issues in their communities. All the other Cape Cod communities are doing similar CWMPs. Some watersheds are shared by communities such as Pleasant Bay and will require a joint effort to meet the TMDL for that embayment.

Q12. What are the lessons that Harwich has learned from studying the activities of other Cape towns?

A12. Each community is different but educating the public and receiving input from them is crucial to developing an implementable program. Developing a program that is flexible and can adapt to changes and feedback while being implemented is crucial.

Q13. We've heard solving our wastewater problem will cost tens of millions of dollars. Is that true? Who will pay for this? How will they pay?

A13. The overall cost of the Harwich recommended wastewater program is estimated to be in the $180 to $230 Million range implemented over a 40 year period. The WIAC is currently evaluating cost recovery methods to be used in developing a recommended finance plan. However, this overall program is very similar in cost and implementation timeframe to our current municipal water system.

Q14. Can Harwich afford not to do this?

A14. No. We are all living here because of the beautiful beaches, the active and convenient waterways, the high-quality drinking water, and general access to several recreational activities, all of which lead to a desired quality of life. Our economy is based around tourism for those same reasons. Even if the MassDEP did not regulate implementation of a plan to meet the TMDLs for each embayment, we must maintain the tourism economy and our quality of life.

Q15. Harwich is helping to pay for an expensive new regional school system. Can the Town really afford to fund both schools and wastewater at the same time?

A15. Both are being done to maintain our wonderful quality of life, now and in the future.

Q16. Won't the cost of wastewater treatment be so expensive that modest income taxpayers will be forced out of town?

A16. Multiple cost recovery options are being evaluated now with the goal that no single group is negatively impacted. Several entities are also pursuing potential outside funding sources and Harwich will do everything it can to make sure it qualities for those funding sources should they become available. This is in part also why a 40 year implementation timeframe has been recommended.

Q17. Are neighboring communities participating where watersheds are shared between adjacent communities?

A17. Yes, Harwich is participating in a collaborative effort that has been ongoing (Pleasant Bay Alliance) for the Pleasant Bay Watershed. Harwich is one of four communities along with Brewster, Chatham, and Orleans that share this watershed. Small portions of the Herring River Watershed are shared with Dennis and Brewster who will participate in some manner. The watersheds for Allen, Wychmere, and Saquatucket Harbors are all within Harwich.

Q18. Why not have Harwich pipe its wastewater to the facilities of neighboring towns (like Chatham), and pay them to clean our wastewater?

A18. The recommended wastewater alternative includes treatment of the Harwich wastewater collected from the Pleasant Bay Watershed at the Chatham wastewater facility with treated effluent recharged in Chatham or back in Harwich.

Q19. If impacts are affecting estuaries, are the groundwater wells protected?

A19. Fresh water bodies and groundwater supply wells are more resilient to nitrogen impacts than salt water embayments. Salt water is much more sensitive to elevated nitrogen levels, since the recommended limits to the estuaries are less than 1.0 mg/L, and limits for drinking water are 10 mg/L. There is an order-of-magnitude higher sensitivity to estuary systems. The most recent five-year average of nitrogen sampling in

the Harwich water system is about 0.77 mg/l (Nitrate), indicating the Zone of Contribution to the Town's wells have limited development and are sufficiently protected.

Q20. As a Harwich resident, what can I do to reduce my nitrogen contribution?

A20. While septic systems contribute 75 to 85 percent of the controllable nitrogen, residents can minimize the remaining contribution sources. Education on the use and types of fertilizers can help. Using slow release fertilizers and not applying commercial fertilizers before a rainstorm (where it can run-off) would help. Also, using alternative landscapes that do not require as much fertilizer would have a positive impact. Channeling run-off from paved surfaces or roofs onto grasses for nitrogen uptake will help compared with direct discharge into a surface water or coarse sand where it enters the groundwater table. The run-off from these areas or stormwater contains the nitrogen from atmospheric deposition. Although these actions alone will not meet the nitrogen removal recommended in the MEP reports for embayments in Harwich, they will potentially help reduce the amount of sewering required.

Q21. If home septic systems are the main problem, why not just restrict the number of bathrooms and kitchens in all renovations and new construction?

A21. Much of the Town of Harwich is already built out.

Q22. Wouldn't this wastewater problem be solved if all homes and businesses restricted the use of detergents, lawn fertilizers, and toxic chemicals?

A22. Reducing those controllable nitrogen sources will certainly help but they only account for about 7 to 8 percent of the controllable nitrogen.

Q23. Will all of the wastewater within the MEP watersheds need to be conveyed out of the watersheds to achieve the desired levels of nitrogen removal?

A23. Not necessarily. Although nitrogen reduction is required for each MEP watershed, the amount in each watershed varies between 58 and 100 percent. A watershed requiring 100 percent nitrogen reduction will require sewering and recharge of the treated effluent outside that watershed. However, a watershed requiring 70 percent nitrogen reduction could sewer a higher percentage than that (say 80 percent) since the septic system effluent contains nitrogen with around 26 to 35 mg/l and treatment plant effluent contains around 3 to 5 mg/l or about 90 percent nitrogen removal. In this case 72 percent of the nitrogen would be removed from the area sewered, allowing the effluent to be recharged in the watershed. Combined with fertilizer and stormwater management programs the Town could attain acceptable nitrogen removal levels.

Q24. Does wastewater include the water which goes into storm drains? Is rain runoff a problem?

A24. Wastewater is separate from stormwater in new systems built today. Both contain nitrogen, however stormwater collects atmospheric nitrogen deposited on roof tops and pavement and can also collect fertilizers. Thus stormwater should be diverted to vegetative areas instead of directly to water bodies.

Q25. What is the timeline of the Project?

A25. Development of the CWMP began in earnest in August, 2007. Water quality sampling for the MEP began a few years before. Originally the program was divided into two phases. Phase 1 of the CWMP (Existing Data Review and Needs Analysis) was originally scheduled for completion in late 2008. Phase 2 of the CWMP (Alternatives Evaluation and Recommended Plan) was scheduled for completion in mid 2009.

However, a delay in receiving the MEP reports resulted in a corresponding delay in the original schedule for completing Phase 1 and 2. Thus the decision was made to combine both phases into one document which resulted in the development of the current Draft CWMP. Implementation of the recommended plan will occur over a 40 year period once the Town endorses and the MassDEP approves the recommended plan.

Q26. Will this plan result in sewers for the entire Town of Harwich?

A26. No. Based on the MEP report results sewers are recommended as part of the overall strategy to address nitrogen impacts to our estuaries. This recommendation was developed after evaluating several alternatives that would meet the percent nitrogen removals required. However, only specific portions of Harwich are planned to have a new sewer collection system and the areas outside those will remain with on-site septic systems. Approximately 60 percent of the Town will be sewered.

Q27. We pump our home septic system as required and never have problems. Why can't we just leave things as they are? Aren't our beaches and harbors pretty good as is?

A27. Pumping a septic system removes the solids and should be done approximately every 3 years to keep it in good working order. However the nitrogen is mainly contained in the liquid that leaves the system daily and exists in groundwater ultimately surfacing in our estuaries and harbors which has shown signs of degradation.

Q28. If wastewater treatment facilities are recommended to be built, will they be an eyesore?

A28. Through careful planning and site selection the treatment facilities will be designed to be harmonious with the architectural style within the community and employ property-screening techniques to minimize visual and other aesthetic impacts. Also, state-of-the-art odor control measures will address potential odor issues.

Q29. As a Harwich property owner, will my property values be decreased?

A29. Projects in other communities have demonstrated that sewers and/or enhanced wastewater management actually may increase property values. Improving wastewater management procedures will restore water quality in the embayments and protect the other water resources so that the tourist economy continues to flourish and the quality of life is maintained. All these factors combine to preserve property values. If nothing is done, property values likely would decrease.

Q30. Can the wastewater just be piped out into the ocean like in Boston?

A30. No, environmental regulations (Massachusetts Ocean Sanctuaries Act) prohibit new wastewater outfalls (discharge pipes) to the ocean. Some communities such as Boston and Plymouth already had an ocean discharge prior to this regulation being implemented. Thus, they were allowed to continue to use it but only after significantly increasing the treatment level of the effluent and/or relocating the pipe several miles further out into the ocean.

Q31. We have the entire Atlantic Ocean on our doorstep, can the ocean be used in some way?

A31. The Ocean Sanctuaries Act prevents new outfalls. The water quality of the receiving ocean waters and the tidal flushing characteristics have been factored into the MEP modeling which determined the amount of nitrogen to be removed.

Q32. How can I get more information, or contact the WMS, CAC or WIAC to get my opinions heard?

A32. An important element of this project includes public outreach. The CAC has been formed to provide for an exchange of information. Moreover, community meetings are scheduled to keep residents and business owners informed about the progress, and the Harwich WQMTF has a website (www.hwqtf.com). Copies of the meeting schedule and other project documents are available at Town Hall and the public library. The WMS also has a mailbox at Town Hall. WMS meetings and community meetings are listed on the calendar on the Town's website, and all are welcome. Lastly, the WIAC is seeking input on the cost recovery model to recommend and their meetings which are also posted on the Town's website are open to the public.