

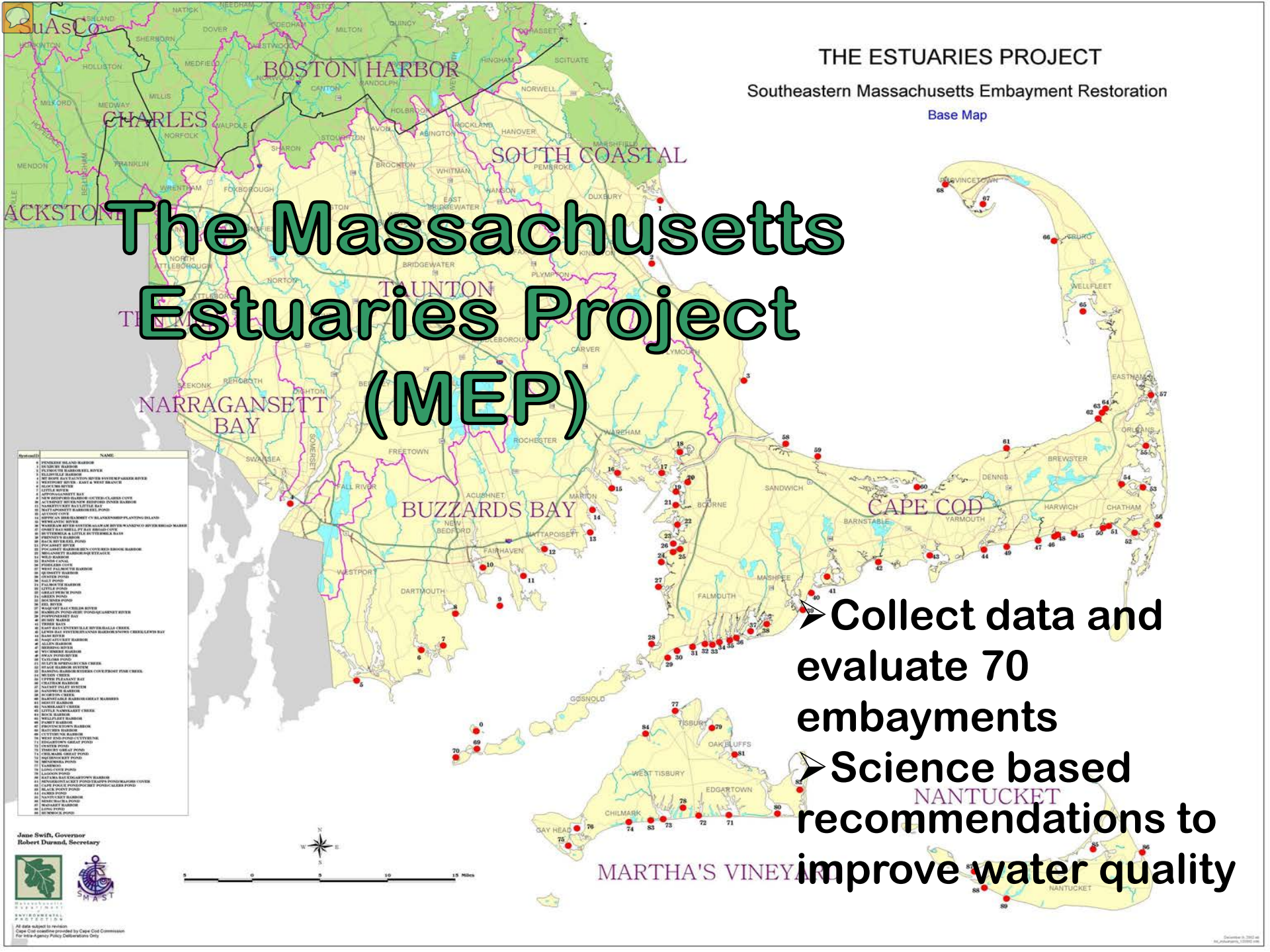


**Total Maximum Daily Loads (TMDL)  
Restoring and Preserving Water Quality  
through  
Nitrogen Control Strategies**

**Chilmark Pond  
Estuarine System**

**MassDEP  
April 2, 2019**





THE ESTUARIES PROJECT

Southeastern Massachusetts Embayment Restoration

Base Map

# The Massachusetts Estuaries Project (MEP)

Embayment	NAME
1	PENDERIS ISLAND BARRAGE
2	PLYMOUTH BARRAGE
3	PLYMOUTH BARRAGE DELIVER
4	WATERBURY BARRAGE
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➤ Collect data and evaluate 70 embayments

➤ Science based recommendations to improve water quality

The background of the slide is a photograph of a coastal landscape. In the foreground, there is a sandy area with some sparse green vegetation. A wooden fence runs across the middle ground, separating the foreground from the ocean. The ocean is visible in the background, with a cloudy sky above it.

# Information Sources and Participants

- **Town of Chilmark**
- **UMASS Dartmouth School of Marine Science & Technology (SMAST)**
- **Applied Coastal Research and Engineering, Inc.**
- **Martha's Vineyard Commission**
- **USGS**
- **US EPA**
- **MA Division of Marine Fisheries**
- **MassDEP**

# Massachusetts Estuary Project



**Integrates data on  
water quality with  
nutrient loading and  
hydrodynamics**

**Data collected:  
2003-2005, 2010, 2012**

**SMAST completed  
Technical Report in  
2015**

**Technical Report  
becomes basis for  
TMDL**



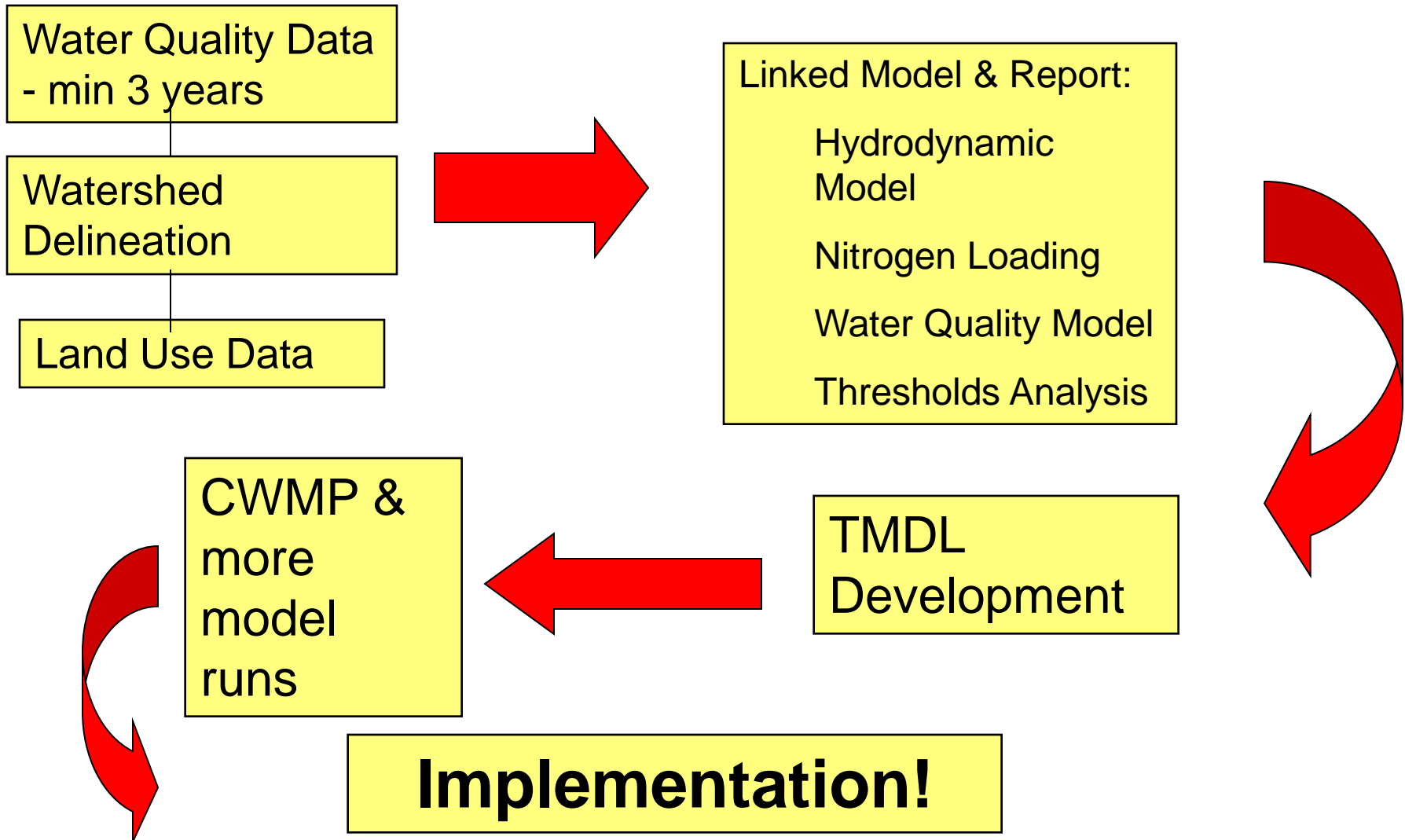


# MEP Goals

**Determine: Nitrogen Loading Limits that are specific to individual estuarine systems in Southeastern Massachusetts**

**Provide: Nitrogen Management Strategies to achieve these limits**


# The Process



# Tech Report Characterizes Present Conditions


- Nitrogen Loading to Groundwater
- Groundwater Flow to Estuaries
- Estuary Circulation, Tides & Currents
- Nitrogen Concentrations in Estuaries
- Estuary Habitat Health





# **SMAST's Linked Model Establishes Target Threshold Nitrogen Concentration:**

**Is the average nitrogen  
concentration in the water  
column that will support the  
habitat quality goal.**





# Sentinel Station

- Located at or near a long term monitoring station
- Location based on historic eel grass and macroinvertebrate information
- Target threshold nitrogen concentration applied at sentinel station





# Achieving the Target Threshold N Concentration at the *Sentinel Station* will result in:

- **Possible Eelgrass Restoration**
- **Reduced Algal Blooms**
- **Improved Dissolved Oxygen Concentration**
- **Healthy Benthic Animal Assemblages**



**EPA requires states to  
set limits on pollutants**

**Total Maximum Daily Load  
(TMDL)**



# Total Maximum Daily Load

*Maximum amount of a pollutant that can enter a water body and still meet water quality standards*





# TMDL for Chilmark Pond Embayment System

- Based on the MEP Technical Report
- Documents the basis for the TMDL number
- Establishes a nutrient loading threshold which will restore water quality and benthic habitat and support eelgrass.







# Why do we need TMDLs for Estuaries?

**Declining coastal habitat quality due to increased nitrogen loading resulting from changes in watershed land uses**



The background image shows a body of water with a boat on the left and a white boat in the foreground. The water is blue with some green algae blooms. The text is overlaid on the image.

# Effects of Excess Nitrogen

**Algae Blooms**

**Loss of Eelgrass**

**Increased Macro-Algae**

**Low Dissolved Oxygen**

**Organic Enrichment of Sediments**

**Lack of Plant & Animal Diversity**

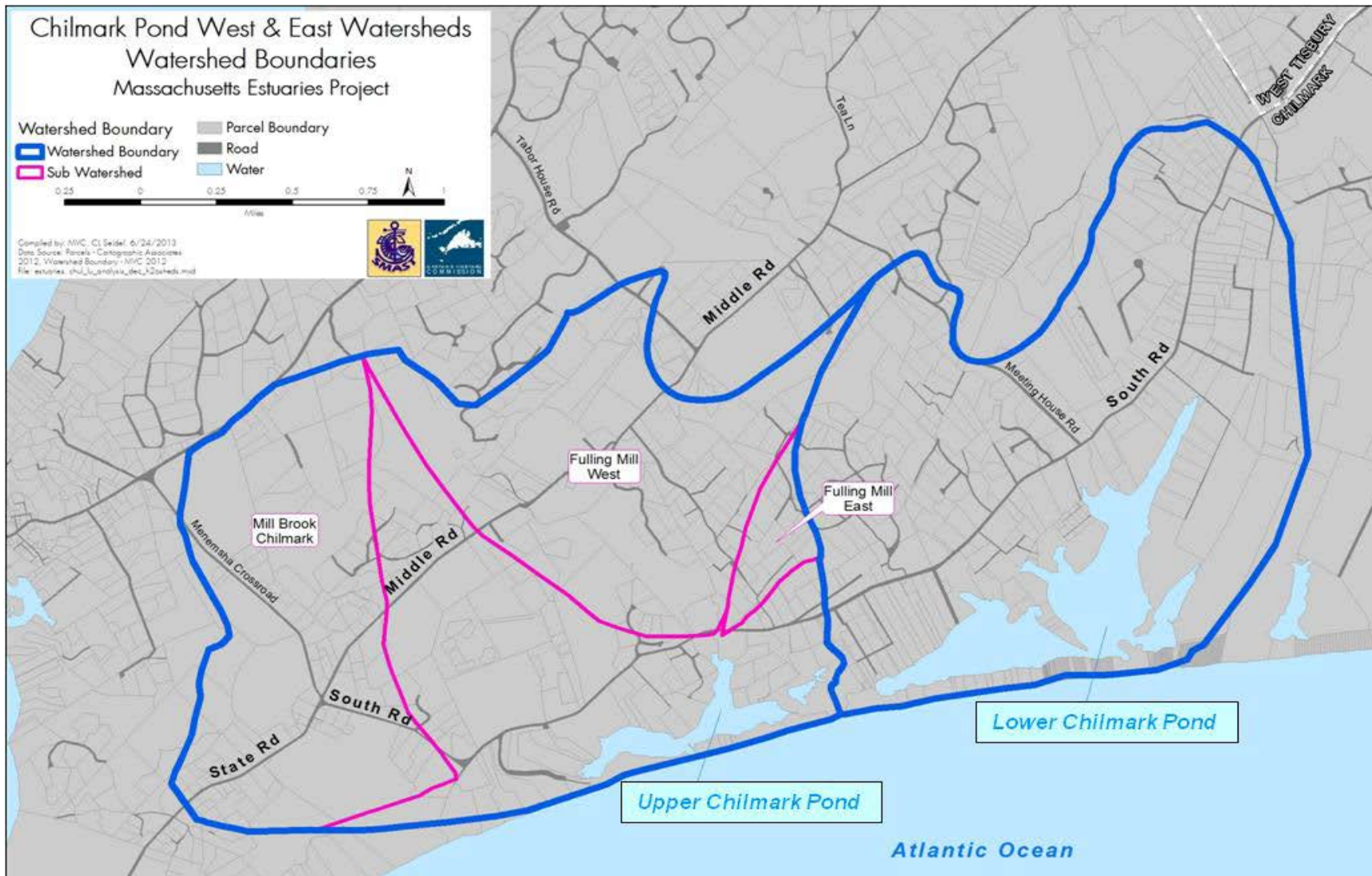
**Fish Kills**



# CHILMARK POND Embayment system



# Watershed Delineations





# Water Quality Sampling Stations in Chilmark Pond Estuarine System



5 years of  
data  
between  
2003-2005  
and  
2010,2012

Target  
Threshold =  
0.50 mg/L

## Impairments:

- Elevated nutrients
- Low dissolved oxygen levels
- Slightly elevated chlorophyll-*a* levels
- Benthic habitat degradation.

The primary ecological threat to the Chilmark Pond Estuarine System is degradation resulting from nutrient enrichment.

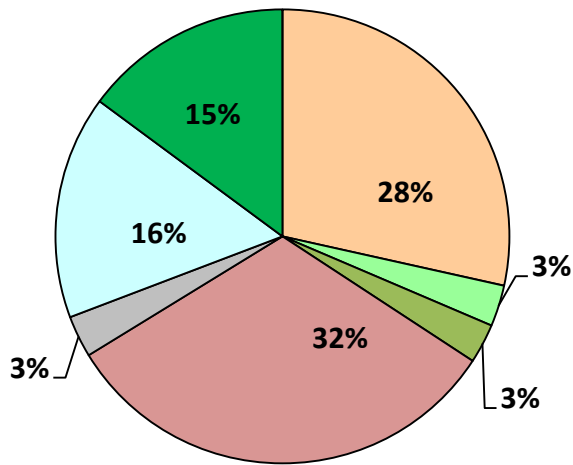




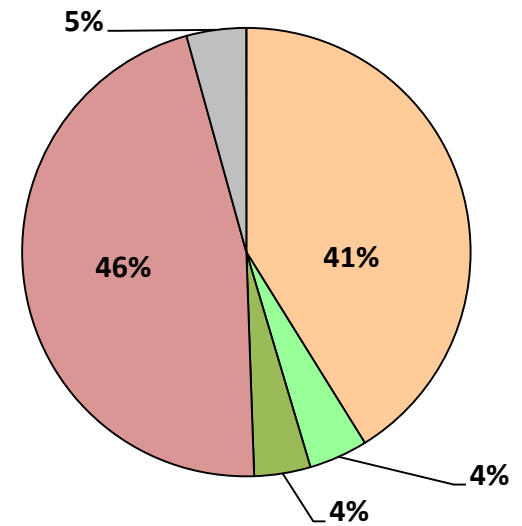


# Contributions of All Nitrogen Sources to Chilmark Pond Estuarine System

- Wastewater
- Turf Fertilizers
- Agricultural Fertilizers
- Agricultural Animals
- Impervious Surfaces
- Water Body Surface Area
- "Natural" Surfaces



*Overall Load*



*Controllable Load*



# Present Nitrogen Concentrations and Sentinel Station Target Threshold Nitrogen Concentrations

Sub-embayment	Station	Mean Observed Nitrogen Concentration (mg/L)	Target Threshold Nitrogen Concentration (mg/L)
Chilmark Pond East		0.61	0.50
Chilmark Pond West		--	--



# The Total Maximum Daily Loads (TMDL)

Sub-embayment	Target Threshold Watershed Load <sup>1</sup> (kg N/day)	Atmospheric Deposition (kg N/day)	Sediment Flux Net <sup>2</sup> (kg N/day)	TMDL <sup>3</sup> (kg N/day)
Lower Chilmark Pond	4.255	3.260	0	7.515
Upper Chilmark Pond	10.540	0.655	0	11.195
System Total	14.795	3.915	0	<b>18.71</b>



# Total Watershed Nitrogen Load, Target Threshold Load, and Percent Reduction Needed to Meet the Target Threshold Load

Sub-embayment System	Present Total Watershed Load <sup>1</sup> (kg/day)	Target Watershed Load <sup>2</sup> (kg/day)	Percent Watershed Load Reductions Needed to Achieve Target
Chilmark - East	5.485	4.255	22.4%
Chilmark - West	11.614	10.540	9.2%
Total	17.099	14.795	13.5%





# Modeling the Options for Achieving the Target Threshold Nitrogen Concentration

## *Conventional Approaches:*

- Sewering/denitrifying systems
- Stormwater controls
- Fertilizer use reduction bylaws

## *Non-traditional Approaches:*

- Improved flushing
- Enhanced natural attenuation
- Aquaculture

# Comprehensive Water Resource Management Planning (CWRMP)

- Based on acceptable nitrogen loading
- Identifies wastewater management options
- Schedules implementation
- Watershed-wide approach







# Technical Approaches

- **Enhanced Wastewater Treatment**
- **Storm Water Runoff Control & Treatment**
- **Flushing Enhancements**
- **Enhanced Nitrogen Attenuation**
- **Permeable Reactive Barriers**



# Planning Approaches

## Local Zoning (guided development)

- Bylaws

## Financing Opportunities

- State Revolving Fund (SRF) can cover planning & construction
- USDA Rural Development Grants
- SRF Points for a Wastewater Management District

# MassDEP

## Implementation Guidance Manual

- **Companion to technical reports**
- **Provides an overview of tools that can be used**
- **Looks at technical and institutional options**

<https://www.mass.gov/guides/the-basics-of-total-maximum-daily-loads-tmdls#tmdls-and-permitting>

<https://www.mass.gov/files/documents/2019/02/21/chilmark-pond-draft-tmdl-2019-03.pdf>





# Where Do We Go From Here?

- **Public/Towns: Submit comments to DEP on draft TMDLs by May 3, 2019**
- **DEP: Revise TMDL Document (based on public input)**
- **DEP: Submit TMDL to EPA**
- **Towns: Continue Comprehensive Water Resources Management Planning**



# Questions/Comments on TMDLs

*Written comments due by Friday,*

*May 3, 2019 at 5:00 pm*

Send to:

barbara.kickham @mass.gov

MassDEP

Division of Watershed Management

8 New Bond Street

Worcester, MA 01606

Attention: Barbara Kickham