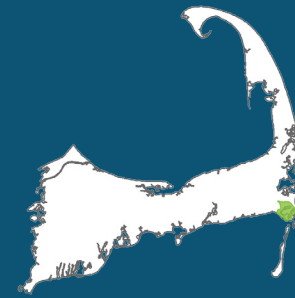


Stage Harbor

CHATHAM

HIGH



Stage Harbor Watershed

Introduction to the Watershed Reports

In 2001, the Massachusetts Estuaries Project (MEP) was established to evaluate the health of 89 coastal embayment ecosystems across southeastern Massachusetts. A collaboration between coastal communities, the Massachusetts Department of Environmental Protection (MassDEP), the School of Marine Science and Technology (SMAST) at the University of Massachusetts-Dartmouth, the US Environmental Protection Agency (US EPA), the United States Geological Survey (USGS), the Massachusetts Executive Office of Energy and Environmental Affairs (EEA), and the Cape Cod Commission, the purpose of the MEP is to identify nitrogen thresholds and necessary nutrient reductions to support healthy ecosystems.

The Cape Cod 208 Plan Update, certified and approved by the Governor of the Commonwealth of Massachusetts and the US EPA in 2015, provides an opportunity and a path forward to implement responsible plans for the restoration of the waters that define Cape Cod.

On Cape Cod there are 53 embayment watersheds with physical characteristics that make them susceptible to nitrogen impacts. In its 2003 report, “The Massachusetts Estuaries Project – Embayment Restoration and Guidance for Implementation Strategies”, MassDEP identifies the 46 Cape Cod embayments included in the

MEP. Thirty-three embayments studied to date require nitrogen reduction to achieve healthy ecosystem function. A Total Maximum Daily Load (TMDL) has been established (or a draft load has been identified and is under review) for these watersheds. For those embayments not studied, the 208 Plan Update recommends planning for a 25% reduction in nitrogen, as a placeholder, until information becomes available.

The 208 Plan Update directs Waste Treatment Management Agencies (WMAs) to develop watershed reports within 12 months of certification of the Plan Update. The Watershed Reports outline potential “bookend” scenarios for each watershed that include two scenarios to meet water quality goals in the watershed – a traditional scenario, which relies completely on the typical collection and centralized treatment of wastewater, and a non-traditional scenario, which uses remediation, restoration, and on-site reduction techniques to remove nutrients from raw and treated wastewater, groundwater and affected waterbodies.

The intent of the Watershed Reports is to outline two distinct approaches for addressing the nutrient problem. The reports are not intended to identify preferred and detailed plans for each watershed, but to facilitate discussions regarding effective and efficient solutions, particularly in watersheds shared by more than one town. In some cases, towns have provided information on collection areas and non-traditional technologies that have been specifically considered by that town.

The 208 Update developed a regionally consistent database of the nitrogen load entering each watershed. This data set includes estimates of wastewater, stormwater and fertilizer loads - similar to methodologies used by the MEP. Using this regionally consistent database, the Watershed MVP tool (wMVP) was developed so that different strategies (i.e., bookend scenarios) to reduce excess nitrogen load

could be evaluated. The Watershed Reports use the MEP recommendations for the required nitrogen load reductions necessary to meet the threshold loads (that serve as the basis for nitrogen management), and then use the wMVP and the regionally consistent database values to develop bookend scenarios. There are variations of load between the MEP and wMVP, primarily due to differences in comparing older and newer databases.

Terms Defined

Total nitrogen load: the nitrogen load from the watershed contributed by septic, wastewater, fertilizer, stormwater, golf course, landfill, and natural sources.

Attenuated nitrogen load: the nitrogen load from the watershed that reaches the embayment after the effect of natural attenuation in wetlands, ponds or streams.

Threshold: the amount of nitrogen that a water body can receive from its watershed and still meet water quality goals; this number is based on MEP technical reports or Total Maximum Daily Load (TMDL) reports.

Reduction target: an approximation of the amount of nitrogen that needs to be removed from the watershed to achieve the threshold; this number is calculated by subtracting the threshold number from the attenuated total watershed load, and is for planning purposes only.

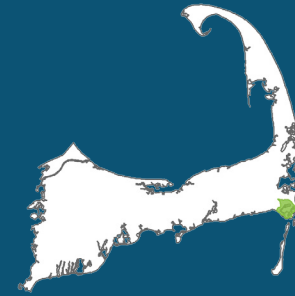
Percent contribution: the percent of attenuated nitrogen load that a town contributes to the watershed.

Kilogram responsibility: is calculated by applying the percent contribution to the reduction target and indicates the amount of nitrogen, in kg, that a community is responsible for addressing.

Total Maximum Daily Load: a regulatory term in the Clean Water Act, describing a value of the maximum amount of a pollutant that a body of water can receive while still meeting water quality standards. Establishing a TMDL is necessary when a water body has been listed on the 303D list of impaired waters.

Stage Harbor

CHATHAM



WATER THREAT LEVEL

HIGH

Stage Harbor is a large embayment system with shoreline located in the Town of Chatham and with outlets to Nantucket Sound. The estuary supports a variety of recreational uses including boating, swimming, shell fishing, and fin fishing.

The Problem

The Massachusetts Estuaries Project (MEP) technical report (available at <http://www.mass.gov/eea/agencies/massdep/water/watersheds/the-massachusetts-estuaries-project-and-reports.html>) indicates that the Stage Harbor system exceeds its critical threshold for nitrogen, resulting in impaired water quality. A MEP technical report has been completed and a Total Maximum Daily Load (TMDL) for nitrogen has been developed and approved.

- **MEP TECHNICAL REPORT STATUS:** Final
- **TMDL STATUS:** Final TMDL

Watershed nitrogen load characteristics were published in the 2003 MEP report for Stage Harbor, reflecting current conditions at the time of writing:

- **TOTAL ATTENUATED NITROGEN LOAD (MEP CHAPTER VIII):** 13,527 kg/Y
- **SOURCES OF ATTENUATED WATERSHED NITROGEN LOAD:**
 - 89% Septic Systems
 - 6% Fertilizer
 - 5% Stormwater from Impervious Surfaces

Since the MEP report, the Commission compiled the following updated water use and nitrogen loads using the regional wMVP

database, enabling a more current estimate of nitrogen loading (see figure on page 1 for watershed boundary delineation):

- **TOTAL WASTEWATER FLOW:** 79 MGY
 - Treated Wastewater Flow: 0 MGY
 - Septic Flow: 79 MGY
- **TOTAL ATTENUATED NITROGEN LOAD (wMVP):** 10,512 kg/Y

CONTRIBUTING TOWNS

Percent contributions listed below are the aggregate sub-embayment contributions identified in Appendix 8C of the Cape Cod Section 208 Plan Update (contributions are based on attenuated load where available). See Appendix 8C for detailed town allocations by sub-embayment.

- **CHATHAM:** 100%

THE MEP RESTORATION SCENARIO

- **WATERSHED TOTAL ATTENUATED NITROGEN REDUCTION TARGET:** 72%
- **WATERSHED SEPTIC REDUCTION TARGET:** 85%
(The scenario represents the aggregated sub-embayment percent removal targets from the MEP technical report)

STAGE HARBOR ESTUARY

- **EMBAYMENT AREA:** 609 acres
- **EMBAYMENT VOLUME:** 143 million cubic feet
- **2014 INTEGRATED LIST STATUS:** Category 4a for nitrogen and fecal coliform
 - Category 4a: TMDL is completed
 - www.mass.gov/eea/docs/dep/water/resources/07v5/14list2.pdf

STAGE HARBOR WATERSHED

General watershed characteristics according to the current wMVP regional database (see figure on page 1 for watershed boundary) follow.

- **WATERSHED CHARACTERISTICS**
 - Acres: 2,176
 - Parcels: 2,035
 - % Developed Residential Parcels: 76%
 - Parcel Density: 1.1 acres per parcel (approx.)

Freshwater Sources

PONDS

- **IDENTIFIED SURFACE WATERS:** 111
- **NUMBER OF NAMED FRESHWATER PONDS:** 5
- **PONDS WITH PRELIMINARY TROPHIC CHARACTERIZATION:** 3
- **2014 INTEGRATED LIST STATUS:** None listed

Chatham has participated in the Pond and Lake Stewardship (PALS) program that has helped establish baseline water quality.

STREAMS

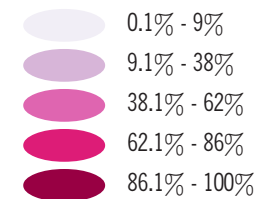
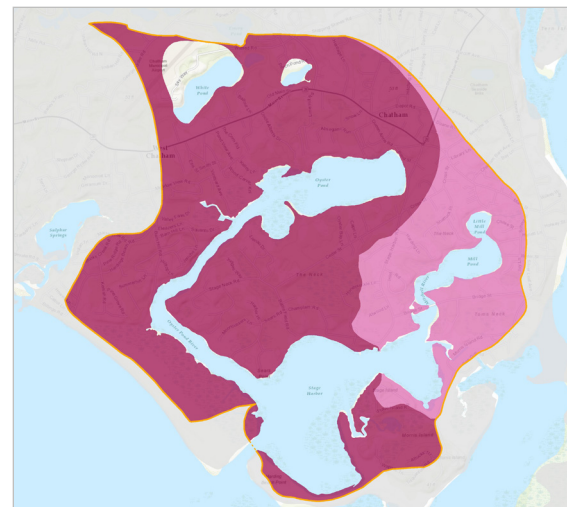
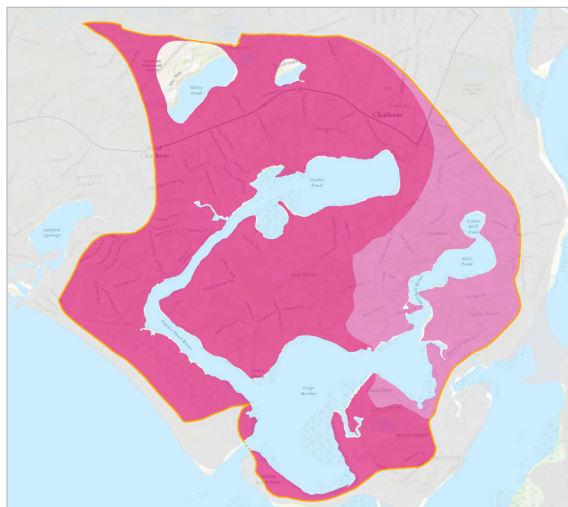
- **SIGNIFICANT FRESHWATER STREAM OUTLETS:** 0

Stream data from MEP technical report.

DRINKING WATER SOURCES

- **WATER DISTRICTS:** 1
 - Chatham Water Department
- **GRAVEL PACKED WELLS:** 1
 - 1 has nitrate concentrations between 1 and 2.5 mg/L
- **SMALL VOLUME WELLS:** 0

Drinking water data from Cape Cod Commission and MassDEP data sources – nitrate values obtained from drinking water wells are from 2009-2012. The state and federal drinking water limit for nitrate is 10 mg/L. The Cape Cod Commission nitrate loading standard is 5 mg/l.



Subwatersheds with Total Attenuated Watershed Removal Targets

(Left) Benthic and atmospheric loads directly on embayments are not included.

Subwatersheds with Septic Attenuated Nitrogen Removal Targets

(Right)

Degree of Impairment and Areas of Need

For the purposes of the Section 208 Plan Update, areas of need are primarily defined by the amount of nitrogen reduction required as defined by the TMDL and/or MEP technical report. The MEP technical report also provides a specific targeted amount of nitrogen reduction required by subwatershed (see the figures: Subwatersheds with Total Attenuated Watershed Removal Targets and Subwatersheds with Septic Attenuated Nitrogen Removal Targets).

The nitrogen load from the watershed exceeds the threshold or TMDL for Stage Harbor, resulting in impaired water quality. While geospatially referenced ecological indicators are not available for these watersheds, an overall ecological assessment is provided.

MEP ECOLOGICAL CHARACTERISTICS AND WATER QUALITY

The MEP report provides the following characterization of the estuary's health:

- **OVERALL ECOLOGIC CONDITION:** Poor to Moderate-Fair/Decline
- **SENTINEL STATION:**
 - Total Nitrogen Concentration Threshold: 0.38 mg/L
 - Total Nitrogen Concentration Existing: 0.47 mg/L
(As reported at the MEP sentinel water-quality monitoring station)

Traditional & Non-Traditional Scenarios

SCENARIO DEVELOPMENT

Through the 208 Stakeholder process, the Commission developed “bookend” scenarios – one looking at a possible solution using traditional collection and treatment, the other examining a possible suite of non-traditional technologies – to address the nitrogen management needs in each watershed. These bookend scenarios provide guidance for communities as they continue to discuss alternatives, priorities, and opportunities for identifying well-considered solutions that will address communities’ needs and interests.

REGIONAL DATA

In preparation for this effort, the Commission collected regionally consistent data for the purposes of watershed scenario development. Both parcel data and water use data was identified and collected for the entire region. While the scientific basis for planning is the thresholds identified in the MEP technical reports, each report uses data from different years, and in some cases the MEP data used are 10 or more years old. In addition, there are watersheds on Cape Cod without the benefit of an MEP report; therefore, similar data was not available for planning purposes.

The updated regional data set was used to estimate wastewater, stormwater and fertilizer loads, using the same methodologies as the MEP. This approach allows for a reevaluation of existing development, which may have changed

in the last 10 years. Parcel data included in the regional database is from 2010-2012 and water use data is from 2008-2011, depending on the water supplier and based on best available data. This approach allows for regionally consistent watershed scenario development.

WATERSHED SCENARIOS

The watershed scenarios that follow outline possibilities for the watershed. A series of non-traditional technologies that might be applicable are included, as well as the amount of residential load that would need to be collected if a traditional collection system and treatment facility was implemented. The pie charts show the load to be collected for treated effluent disposal both inside and outside the watershed.

Site specific analyses of collection areas may result in the need to collect wastewater from more or fewer parcels to meet the nitrogen reduction target. The scenarios presented are conceptual and are meant to inform discussions regarding effective and efficient solutions; they are not specific recommendations and should be viewed as resource information for additional and more detailed wastewater management planning.

In Stage Harbor, the Town of Chatham has requested that their Comprehensive Waste Management Plan (CWMP) be presented. In the last section of this report is a description of their efforts, along with details of plans developed to date.

TOTAL ATTENUATED NITROGEN LOAD VALUES (FROM WMVP)

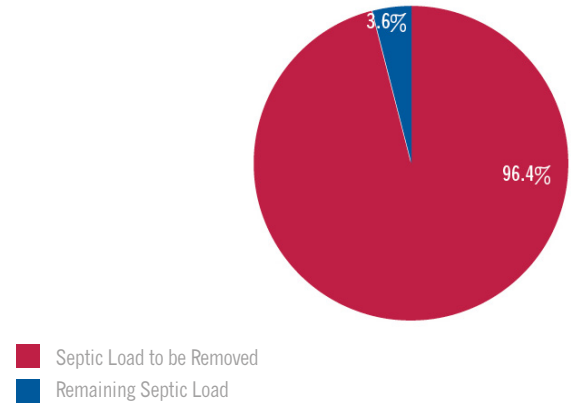
Stage Harbor Nitrogen Sources	Total Attenuated Watershed Nitrogen Load (kg-N/yr)
Wastewater ¹	6,977
Fertilizer ²	970
Stormwater	2,139
Other ³	427
TOTAL WATERSHED LOAD	10,512
Total Watershed Threshold	3,794
TOTAL ATTENUATED LOAD TO BE REMOVED	6,718

1. Includes nitrogen loads from septic systems and wastewater treatment facilities.
2. Includes nitrogen loads from lawns, cranberry bogs, and golf courses.
3. Includes nitrogen loads from landfills and atmospheric deposition to vacant land.

Traditional Scenario

Traditional

 CENTRALIZED TREATMENT WITH DISPOSAL OUTSIDE THE WATERSHED



Assumes that the load to be collected and treated is removed from the watershed so no offset is required.

Town of Chatham Local Progress

The Chatham Comprehensive Wastewater Management Plan (CWMP) of 2009 is the first town-wide plan on Cape Cod to be completed that incorporates the state and federal total maximum daily loads (TMDLs) to restore coastal water quality for several large coastal embayments. The town completed the necessary treatment facility upgrades in 2010 and the main sewer trunk line construction in 2012. Phase II sewer expansions into the Stage Harbor watershed system were completed in Fall 2015.

The Chatham Wastewater Treatment Facility (WWTF), located on an 80-acre parcel on Sam Ryder Road, recently underwent a major upgrade as part of phase 1 of the CWMP. The facility has a permitted capacity of 1.0 million gallons per day (MGD) (annual average) and 2.3 MGD (peak day) and four sand beds. Two sand beds were constructed during the major upgrade and two were existing sand beds that were rehabilitated as part of the upgrade. The permit requires a discharge limit of 10 milligrams per liter (mg/L) with an annual limit of 9.132 pounds/year, which corresponds to an annual average discharge of 3 mg/L.

The upgrade to the WWTF included several improvements to its sludge processing capabilities. Dewatered sludge is discharged and taken off site for disposal. The site also accepts septage collected from Chatham parcels only.

In 2013 Chatham signed an agreement with the Town of Harwich to further evaluate the possibility of using a portion

of the treatment capacity in Chatham to serve the eastern portion of Harwich, which is part of the shared Pleasant Bay watershed. The potential sharing of the facility is allowed by condition in the Development of Regional Impact (DRI) approval of the Chatham CWMP.

In the fall of 2014, Chatham adopted local nitrogen-oriented fertilizer management regulations consistent with the Cape-wide Fertilizer Management District of Critical Planning Concern (DCPC).

Chatham has also been a lead town, along with Harwich, in the effort to improve circulation in Muddy Creek with a culvert-widening project that would likely reduce nitrogen removal requirements. The project received local, state, and federal support and was completed in May 2016. In addition, the town was a recipient of a technical assistance grant through the Southeast New England Coastal Watershed Restoration Program (SNEP) and a stormwater best management practice (BMP) was constructed in the Oyster Pond watershed in 2016.

At the Spring 2017 Town Meeting, Chatham voted to fund design and construction of phase 1D of the CWMP, a cost of \$31,000,000, and to execute an IMA with the Town of Harwich to accept wastewater flow from Harwich to be treated at the Chatham WWTF.

Town of Chatham Watershed Scenario Details

Stage Harbor	CREDITS		REDUCTION TECHNOLOGIES			REMEDIATION AND RESTORATION TECHNOLOGIES			REMOVAL
NAME OF TECHNOLOGY	% Nitrogen Reduction	Load Reduction (kg-N/yr)	# Properties / Units	Flow Collected (gpd)	Load Reduction (kg-N/yr)	# Units Proposed	Unit Metric	Load Reduction (kg-N/yr)	Total Scenario Load Reduction (kg-N/yr)
Traditional Scenario									6,940
Centralized Sewer (With Disposal Outside the Watershed)			2,050	194,477	6,940				





NOTES: The load reduced reflects sewerage proposed by the Chatham CWMP. The proposed sewerage was assessed using wMVP and the scenario shown above reflects that assessment.

Scenario Maps

Stage Harbor Watershed Scenario CHATHAM

Representative locations of conceptually proposed infrastructure

Legend

-  Town Lines
-  Sewered Areas
-  Embayment Watersheds
-  Proposed Sewershed

