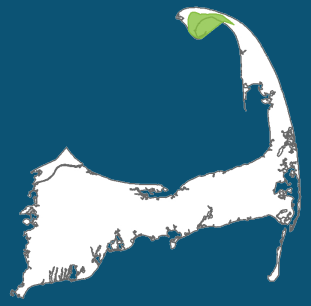
WATERSHED REPORT: OUTER CAPE

Provincetown Harbor

PROVINCETOWN & TRURO



WATER THREAT LEVEL

LOW

Provincetown 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.

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The Provincetown Harbor Embayment system is located primarily in the Town of Provincetown with contributing areas located in Truro. Portions of Provincetown Harbor are located within the Cape Cod National Seashore/National Park Service (NPS) boundary. Provincetown Harbor is a multi-use harbor supporting recreational and commercial uses year round.

The Problem

For the purposes of the Section 208 Plan Update, areas of wastewater need are primarily defined by the amount of nitrogen reduction required as defined by the Total Maximum Daily Load (TMDL) and/or Massachusetts Estuaries Project (MEP) technical report. An MEP report has not been completed for the Provincetown Harbor watershed.

- **MEP TECHNICAL REPORT STATUS:** Not Being Studied
- **TMDL STATUS:** Not Being Studied

The Towns of Truro and Provincetown conducted estuarine water quality sampling in the Provincetown Harbor system, among others, in 2007, 2008, and 2009, under the Estuarine Water Quality (604b) Grant. The final report was completed in September 2010 and indicates that the Provincetown Harbor system maintains low nutrient levels and generally high water quality, but should continue to be monitored.

The Commission compiled the following updated water use and nitrogen loads using the regional wMVP database (see page 2), enabling a current estimate of nitrogen loading.

- **TOTAL WASTEWATER FLOW:** 154 MGY (million gal per year)
  - Treated Wastewater Flow: 55 MGY
  - Septic Flow: 99 MGY
- **TOTAL UNATTENUATED NITROGEN LOAD:** 11,938 kilograms per year (kg/Y)
- **ATTENUATED NITROGEN LOAD:** Not assessed

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.

A portion of the land area in this watershed is within the boundaries of the Cape Cod National Seashore and any nitrogen load that results from Seashore controlled property is not within control of the towns.

- **PROVINCETOWN:** 93%
- **TRURO:** 7%

PROVINCETOWN HARBOR ESTUARY

- **EMBAYMENT AREA:** 3,523 acres
- **EMBAYMENT VOLUME:** Unknown

- **2014 INTEGRATED LIST STATUS:** Category 4a for fecal coliform
  - Category 4a: TMDL completed
  - www.mass.gov/eea/docs/dep/water/resources/07v5/14list2.pdf

PROVINCETOWN HARBOR WATERSHED

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

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- **WATERSHED CHARACTERISTICS:**
  - Acres: 4,203
  - Parcels: 2,524
  - Percent Residential Parcels: 72%
  - Parcel Density: 1.7 acres per parcel (approx.)

Freshwater Sources

PONDS

- **IDENTIFIED SURFACE WATERS:** 31
- **NUMBER OF NAMED FRESHWATER PONDS:** 10
- **PONDS WITH PRELIMINARY TROPHIC CHARACTERIZATION:** 5
- **2014 INTEGRATED LIST STATUS:** 1 listed
  - Clapps Pond; Category 3: No uses assessed

Provincetown and Truro have participated in the Pond and Lake Stewardship (PALS) program, that has helped establish baseline water quality, and the National Park Service has a regular monitoring program for its water resources that has helped establish baseline pond water quality data throughout Cape Cod. Trophic characterizations are based on most recent Commission staff assessment.

STREAMS

- **SIGNIFICANT FRESHWATER STREAM OUTLETS:** Not assessed

Nitrate concentrations higher than 0.05 mg/L background concentrations, evident in public supply wells located in pristine areas, provide evidence of the impact of non-point source pollution on the aquifer and receiving coastal water bodies.

DRINKING WATER SOURCES

- **WATER DISTRICTS:** 1
  - Provincetown Water Department
- **GRAVEL PACKED WELLS:** 0
- **SMALL VOLUME WELLS:** 0

In 1908, Provincetown was given legislative authority to use the Pamet Lens in Truro due to the naturally high iron and manganese of the Pilgrim Lens.

Drinking water data from Cape Cod Commission and MassDEP data sources.

Degree of Impairment and Areas of Need

As an MEP report has not been developed for Provincetown Harbor, wastewater needs are determined based upon other factors, such as Title5 compliance.

An existing wastewater treatment facility and excellent tidal fluctuation contribute to the lack of eutrophication in these watersheds. Beach closures have been attributed to bacteriological contamination, both through the use of private septic systems and stormwater runoff. Both sewer expansions and innovative stormwater management techniques, such as porous pavement on Commercial Street, have contributed to fewer beach closures in recent years. The Provincetown Harbor Stormwater Mitigation Project report (2011) identifies 25 ocean outfalls conveying untreated stormwater runoff into the Harbor. The report provides descriptions and remediation status for a number of the outfalls and has prioritized them in order of need. To date, more than a dozen of the outfalls are in various states of final design, implementation or have been completed to mitigate stormwater runoff. With the design assistance from the University of New Hampshire Stormwater Center, a leader in porous pavement design and monitoring, Provincetown has successfully installed a porous pavement stormwater best management practice (BMP) on Commercial Street. While at the time of this report the system has been installed for less than one calendar year, preliminary data shows a marked reduction in beach closures dates.

Provincetown Harbor is listed on the 2014 Integrated List of Impaired Waters as a Category 4a impaired water body for fecal coliform.

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Town of Provincetown Local Progress

Provincetown completed a wastewater facilities plan (WWFP) in 2001. The plan dealt with the public health issues of failing septic systems and inadequate infrastructure for its commercial downtown area. The comprehensive plan was approved by state agencies through the Massachusetts Environmental Policy Act (MEPA) and by the Cape Cod Commission through Development of Regional Impact (DRI) review in 2001. The wastewater facility and phase 1 and 2 areas were subsequently built and are performing well. The plan included a number of innovative aspects, including a lot-by-lot assessment of Title 5 systems, use of the Route 6 median and right-of-way for effluent disposal, combination of force mains, conventional gravity and vacuum sewers, and "checkerboard" sewer areas. The plan included three phases. The town is presently expanding sewers into the Phase 3 area and is upgrading the facility to its planned capacity. During this implementation, the town was able to use measured wastewater flow to compare to the design capacity and to negotiate the use of that excess capacity for new wastewater flow.

The Provincetown wastewater treatment facility (WWTF) is an advanced secondary treatment plant that is capable of treating a maximum daily flow (MDF) of 650,000 gallons per day (GPD), with discharge to four subsurface disposal beds at six locations along Route 6. Additional upgrades may be required to increase the capacity to allow a MDF of 750,000 in the future, and will occur when required.

AECOM is currently under a 20-year design-build-operate (DBO) agreement with the town of Provincetown to design, permit, construct and operate its wastewater collection, treatment, and disposal systems.

The current sludge management plan includes periodic removal from the Sequencing Batch Reactors (SBRs), storage for aeration and mixing, and hauling by a contractor for disposal at a facility in Cranston, RI.

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

Town of Truro Local Progress

The town of Truro approved funds for an Integrated Water Resources Management Plan (IWRMP), acknowledging that protection of private-well drinking water is of paramount importance, and established a water resources oversight committee. The IRWMP kicked off in 2012 with a focus on septic systems and stormwater runoff and their impact on drinking water and embayment water quality. The planning process seeks to assemble existing data, and develop a GIS program to evaluate land and water data, historic septic-system management information and key areas for further analysis and characterization.

The Water Resource Oversight Committee (WROC) and their consultant completed Phase I of the IWRMP in October 2014. Phase I of the report concluded that water samples from local wells show nitrogen levels are within safe levels. But some neighborhoods show concentrations have risen above the typical amount found in Truro. Phase II of the IWRMP began in March 2015. The focus of Phase II is to define potential threats to groundwater quality and solutions to protect against these threats. The WROC is also developing a presentation on Truro's water quality and groundwater protection as part of the Public Education and Outreach aspect of the IWMRP. The consultant presented the findings of the Collected Water Flow Data from Beach Point to the Board of Selectmen at their February 28, 2017 meeting. Based on the data collected and modeling, groundwater is mostly moving towards East Harbor, not Cape Cod Bay as previously studied. In June 2016, Truro received $9,400 from the Commission to design stormwater rain gardens adjacent to the Truro Library. Funding was part of $142,149 in local grants made by the Commission in support of 208 Plan implementation.

The proposed project comprises site survey and final design of a stormwater treatment and infiltration project. The project will rely on enhanced soils and plantings to reduce nitrate transported by stormwater runoff before it percolates to the local aquifer.

Following construction, the WROC will sample water quality at or near the Library facility on an annual basis to monitor any changes in nitrate levels in groundwater. From these or other potential sources, the WROC would obtain annual samples from at least one (1) nearby well on an annual basis for analysis for nitrate.

In June 2016, the Town signed an Agreement for a Project Management Plan (Scope of Work) with the US Army Corps of Engineers (USACE) that will build upon a study conducted in 1998 that evaluated restoring tidal flow within the Pamet River. The updated study will supplement the prior investigation by providing numerical model predictions to further define potential impacts with reintroducing tidal flow to the upper portion of the Pamet River. The goal of this study is to recommend an alternative that will restore flushing while avoiding impacts to residential septic systems, drinking water well and generalized flooding. Data Collection and groundwater sampling began in late Fall 2016 and is expected to continue through late Spring 2017.

At the Spring 2017 Town Meeting, Truro appropriated $3,700,000 for the repair and replacement of the culvert which connects Cape Cod Bay with East Harbor ('Pilgrim Lake') in North Truro, including design, permitting and construction. The project has environmental benefits such as increasing tidal flushing to improve water quality, wetland restoration, as well as minimizing potential threats to road utilities and infrastructure.

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

Watershed scenarios outline possibilities for the watershed. A series of non-traditional technologies that might be applicable, as well as the amount of residential load that would need to be collected if a traditional collection system and treatment facility was implemented are typically included in watershed reports. 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.

For watersheds with no MEP technical report, the 208 Plan Update recommends a 25% reduction in nitrogen as a placeholder. No 25% placeholder is applied to Provincetown Harbor because the existing treatment facility already collects and treats wastewater from the majority of the densely developed areas. The sewering already implemented removes more than 25% of the nitrogen load from the watershed and there is no MEP report indicating additional nitrogen removal is necessary.

TOTAL UNATTENUATED NITROGEN LOAD VALUES (FROM WMVP)

Provincetown Harbor Nitrogen Sources	Total Unattenuated Watershed Nitrogen Load (kg-N/yr)
Wastewater[1]	**11,939**
Fertilizer[2]	**1,174**
Stormwater	**2,929**
Other[3]	**503**
TOTAL WATERSHED LOAD	**16,544**
Total Watershed Threshold[4]	**Not applicable**
TOTAL UNATTENUATED LOAD TO BE REMOVED[4]	**Not applicable**

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. 4. No threshold has been established and the 25% removal placeholder has not been applied to Provincetown Harbor because the existing treatment facility already collects and treats wastewater from the majority of the densely developed areas. See the Watershed Scenario section for more detail.