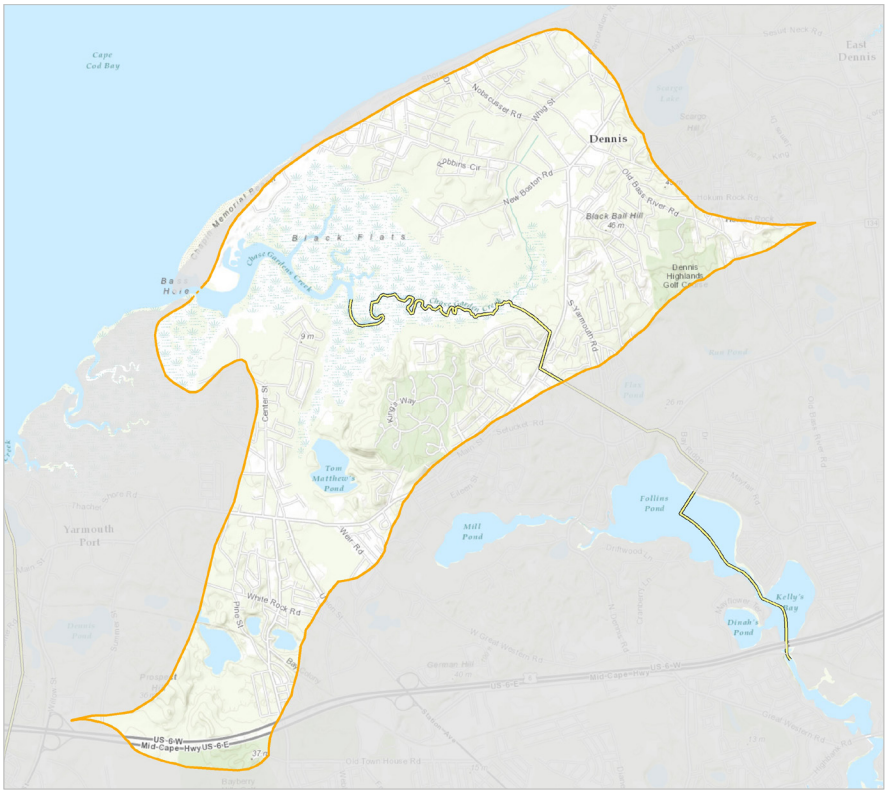
WATERSHED REPORT: MID CAPE

Chase Garden Creek

DENNIS & YARMOUTH

WATER THREAT LEVEL

LOW



Chase Garden Creek 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.

WATERSHED REPORT: MID CAPE

Chase Garden Creek

DENNIS & YARMOUTH

WATER THREAT LEVEL

LOW

The Chase Garden Creek estuary and embayment system has shoreline located entirely in the Town of Yarmouth. It receives tidal flow from Cape Cod Bay that has a 9 foot fluctuation and extends approximately 1.5 miles to the groundwater fed drainage streams that comprise its headwaters. The Creek is almost totally flushed during the tidal cycle and supports a variety of recreational uses including boating, swimming, shell fishing and fin fishing.

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 will not be developed for the Chase Garden Creek watershed and other Cape watersheds where nitrogen is not believed to be a critical issue due to tidal flushing, low intensity development, or geomorphology.

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

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:** 262 MGY (million gal per year)
  - Treated Wastewater: 24 MGY
  - Septic Flow: 238 MGY
- **TOTAL UNATTENUATED NITROGEN LOAD:** 30,558 Kg/Y (kilograms per year)
- **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.

- **DENNIS:** 52%
- **YARMOUTH:** 48%

CHASE GARDEN CREEK ESTUARY

- **EMBAYMENT AREA:** 93 acres
- **EMBAYMENT VOLUME:** Unknown
- **2014 INTEGRATED LIST STATUS:** Category 4a for fecal coliform
  - Category 4a: TMDL is completed
  - www.mass.gov/eea/docs/dep/water/resources/07v5/14list2.pdf

CHASE GARDEN CREEK WATERSHED

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

- **ACRES:** 4,514
- **PARCELS:** 3,512

- % DEVELOPED RESIDENTIAL PARCELS: 84%
- PARCEL DENSITY: 1.3 acres per parcel (approx.)

Freshwater Sources

PONDS

- IDENTIFIED SURFACE WATERS: 13
- NUMBER OF NAMED FRESHWATER PONDS: 5
- PONDS WITH PRELIMINARY TROPHIC CHARACTERIZATION: 4
- 2014 INTEGRATED LIST STATUS: None listed

Dennis and Yarmouth have participated in the Pond and Lake Stewardship (PALS) program that has helped establish baseline water quality. Trophic characterizations are based on most recent Commission staff assessment.

STREAMS

- SIGNIFICANT FRESHWATER STREAM OUTLETS: 2

  White Brook
  - Average Flow: Not Assessed
  - Average Nitrate Concentrations: Not Assessed

  Chase Garden Creek
  - Average Flow: Not Assessed
  - Average Nitrate Concentrations: 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: 2
  - Yarmouth Water Department
  - Dennis Water District
- GRAVEL PACKED WELLS: 1
  - 1 has nitrate concentrations between 1 and 2.5 mg/L
- SMALL VOLUME WELLS: 0

Degree of Impairment and Areas of Need

Since there is no evidence of water quality impairment at this time, wastewater needs are determined based upon other factors, such as Title5 compliance.

The 2014 Integrated List of Impaired Waters lists Chase Garden Creek as being a Category 4a impaired water body for fecal coliform.

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Town of Dennis Local Progress

In August 2015, Dennis, led by its Comprehensive Wastewater Management Task Force (CWMTF) and its consultant (CDM Smith), completed its Water Quality Evaluation and Mitigation Alternative Study Final Report. The report provides an updated needs assessment, as well as potential nitrogen management scenarios. The scenarios include locations and layouts of offsite wastewater solutions and other non-traditional nitrogen management technologies. Four scenarios were chosen for more detailed comparison and analysis. During the fall of 2015 and winter of 2016, Dennis evaluated these four scenarios, as well as additional community partnership scenarios with the neighboring Towns of Harwich and Yarmouth. The Massachusetts Estuaries Project (MEP) nitrogen reduction goals were the primary factor in the scenarios, but economic development goals and protection of non-nitrogen areas of concerns also shaped the chosen scenario (scenario 6A from the Water Quality Evaluation and Mitigation Alternative Study Final Report). This recommended plan proposes to include a minimum of six phases and will occur over a 30-year period.

All proposed scenarios in Dennis, including scenario 6A, include combinations of traditional sewering methods with centralized treatment facilities, as well as non-traditional nitrogen management options including aquaculture, and permeable reactive barriers (PRB). Furthermore, the baseline of each scenario is the assumption that Dennis will implement stormwater and fertilizer management programs. As suggested in the 208 Plan Update, up to a 25% nitrogen reduction credit can be obtained by towns that implement stormwater and fertilizer management programs to reduce nitrogen contributions to each watershed. In addition to implementing the stormwater and fertilizer management program, scenario 6A includes a hybrid sewer collection system with a mix of gravity, pressure and vacuum sewers and one centralized wastewater treatment facility. The recommended plan meets the MEP nitrogen reduction goals and also provides sewers to all of Dennis' planning districts and several areas of concern (AOCs). It also allows flexibility to implement partnership options. In the future, Dennis may implement sewering in additional areas identified under Scenario 7A in the Water Quality Evaluation and Mitigation Alternative Study.

Since submission of the 208 Plan Update, the Town of Dennis and CDM Smith has met with Cape Cod Commission staff to discuss potential watershed scenarios and the use of the decision support tools generated through the 208 planning process. Cape Cod Commission staff participated in a November 2015 wastewater forum planned by the town and sponsored by the Board of Selectmen and CWMTF, to promote an understanding of the wastewater issues in Dennis, what is being done and what needs to be done. The forum was geared toward the local Financial Committee, Capital Committee, Planning Board, Conservation Commission, Economic Development Committee, Water Quality Advisory Committee and any interested citizen. It is anticipated the town will submit a plan for regulatory review this year.

In June 2016, Dennis received $15,000 from the Commission to evaluate effluent recharge sites and possible community partnerships. An additional $35,000 was provided for the Towns of Dennis, Harwich and Yarmouth for a regional treatment facility cost study. Funding was part of $142,149 in local grants made by the Commission in support of 208 Plan implementation.

At the Spring 2017 Town Meeting, Dennis voted to transfer $300,000 from the Solar Special Revenue Fund to the Wastewater Stabilization Fund and to appropriate $125,000 to establish a Swan Pond Shellfish Program.

In June 2017, Dennis submitted their CWMP to the Massachusetts Environmental Policy Act Office for review.

Town of Yarmouth Local Progress

In 2010, the Town of Yarmouth submitted its Comprehensive Wastewater Management Plan (CWMP) as a Draft Environmental Impact Report (DEIR). The draft CWMP targeted areas that would require wastewater collection to restore water quality in the Lewis Bay and Parkers River watersheds and deal with the Title 5 constraints on economic redevelopment in the area of Route 28. The town's plan included approximately 125 miles of sewer lines and the collection of 2.75 million gallons per day (MGD) of wastewater to be treated at a single facility in the Parkers River watershed. The project would ultimately serve 9,580 properties by 2035. Phase 1 of the plan would begin with the treatment facility and main trunk line sewer to serve Route 28 and portions of the Parkers River and Lewis Bay watershed.

The plan relies on gravity, pressure, and vacuum sewers. The MEP nitrogen reduction goals were the primary factor in choosing sewering locations. The phasing of these sewered areas also takes the town's economic goals into consideration.

The town submitted its Final Environmental Impact Report (FEIR) and received Massachusetts Environmental Policy Act (MEPA) approval in July 2011, but did not complete the Cape Cod Commission Development of Regional Impact (DRI) process before going to September 2011 Town Meeting to seek Phase 1 design and construction funds. Phases 1 through 5 were scheduled to be implemented over a 25-year period. The estimated cost of the total plan was $275 million. The first phase had an estimated cost of $55 million. Town Meeting did not approve the expenditure. The town withdrew the CWMP from the DRI review process.

Wastewater planning in the community had effectively come to a stop prior to the development of the 208 Plan Update.

In January 2016 town staff met with the Board of Selectmen to discuss a new financing plan for implementation of a program that would meet water quality standards in all of their watersheds.

The recommended plan includes a combination of traditional sewering methods with centralized treatment facilities as well as non-traditional nitrogen management options including a permeable reactive barrier (PRB) at the Buck Island Road effluent recharge site. The Town of Yarmouth is proposing a phased wastewater program that includes a collection system, a conveyance system and a centralized treatment facility, each constructed over several years. In addition to the proposed sewering, the recommended plan involves public outreach to promote nitrogen reduction and to prevent sewer system inflow, zoning modifications for growth management and establishment of the activity centers, development of sewer ordinances, and continued maintenance of Title 5 and I/A systems in the northern and western areas of the town that will not be served by the proposed wastewater collection system. The town also plans to implement stormwater and fertilizer improvement programs. As suggested in the 208 Plan Update, up to a 25% nitrogen reduction credit can be obtained by towns that implement stormwater and fertilizer management programs to reduce nitrogen contributions to each watershed.

During the spring 2016 town meeting, the town approved $200,000 for additional CWMP planning.

In April 2016, Yarmouth submitted a request for assistance to continue CWMP development and town staff met with the Commission to discuss the request in early May.

In June 2016, Yarmouth received $35,000 from the Commission for the Towns of Dennis, Harwich and Yarmouth for a regional treatment facility cost study. Funding was part of $142,149 in local grants made by the Commission in support of 208 Plan implementation.

At the Spring 2017 Town Meeting appropriated $200,000 for wastewater planning and engineering services including engineering studies and evaluation of recharge sites; updating, modification, and pre-implementation services for the Comprehensive Wastewater Management Plan and support for related filings with the Massachusetts Environmental Policy Act office and the Cape Cod Commission.

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.

TOTAL UNATTENUATED NITROGEN LOAD VALUES (FROM WMVP)

Chase Garden Creek Nitrogen Sources	Total Unattenuated Watershed Nitrogen Load (kg-N/yr)
Wastewater[1]	24,612
Fertilizer[2]	2,492
Stormwater	2,598
Other[3]	875
TOTAL WATERSHED LOAD	30,558
Total Watershed Threshold[4]	22,919
TOTAL UNATTENUATED LOAD TO BE REMOVED	7,640

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. Assumes 25% reduction is needed, as no MEP report has been completed for this watershed and no threshold has been established.

Traditional & Non-Traditional Scenarios

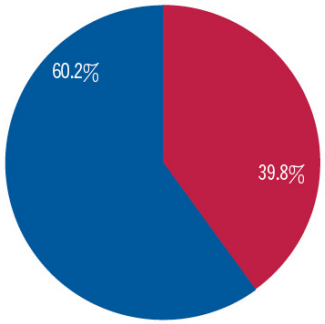
Non-Traditional

UNIT OF APPLIED TECHNOLOGY	ATTENUATED NITROGEN REMOVED IN KG/Y
25 % Nitrogen Reduction - Fertilizer Management	623
25 % Nitrogen Reduction - Stormwater Mitigation	649
6,200 Linear Feet - Permeable Reactive Barrier (PRB) (Capture load calculated by wMVP: 7,758.6 kg/Y)	5,625
150 Acres - Fertigation - Turf	600
60 Units - Ecotoilets (UD & Compost)	150
TOTAL	**7,647**

A summary of the approach and methodology that was applied using non-traditional technologies follows at the end of this report.

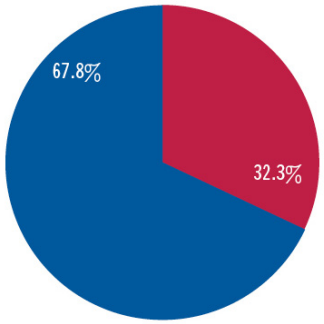
Traditional

CENTRALIZED TREATMENT WITH DISPOSAL INSIDE THE WATERSHED

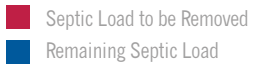


Assumes load to be collected and treated is disposed in the watershed, requiring additional collection to offset the load.

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.



Methodology for Selecting Non-Traditional Technology Scenarios

This section summarizes the approach and methodology that was applied during the 208 Update to develop plans for reducing nitrogen loading to estuaries using non-traditional (NT) technologies. It includes descriptions of regional credits for stormwater and fertilizer reductions, regional screening for potential sites for several technologies, and site-specific analyses for others. Nitrogen attenuation rates for each technology were derived from the Technologies Matrix. The nitrogen thresholds for each embayment were determined from the Massachusetts Estuaries Project (MEP).

This section summarizes the approach and methodology that was applied during the 208 Update to develop plans for reducing nitrogen loading to estuaries using non-traditional (NT) technologies. It includes descriptions of regional credits for stormwater and fertilizer reductions, regional screening for potential sites for several technologies, and site-specific analyses for others. Nitrogen attenuation rates for each technology are noted below, based on the Technologies Matrix or newer data. The nitrogen thresholds for each embayment were determined from the Massachusetts Estuaries Project (MEP).

Regional credits were developed for potential stormwater retrofits and fertilizer reductions. They were calculated as a percent reduction of existing nitrogen loads as identified in the MEP reports and updated GIS data developed by the Cape Cod Commission.

- **STORMWATER MANAGEMENT:** Most Cape communities have already begun the process of identifying significant untreated stormwater discharges and developing appropriate mitigation projects. With the prospect of the MS4 regulatory requirements it was assumed that additional mitigation efforts would be implemented. Based upon the evidence developed by the University of New Hampshire Stormwater Center that several vegetated stormwater management practices (including bioretention and constructed wetlands) are able to achieve nitrogen reductions of 50% or more and the assumption that only a portion (estimated at 50%) of identified sites would be retrofitted a 25% nitrogen reduction credit was assumed for each watershed. Specific locations and number of locations were not identified; this was deferred to individual towns to consider as part of the suite of nitrogen management strategies.
- **FERTILIZER REDUCTIONS:** Based upon the success of most Cape Cod towns to implement either regulatory or non-regulatory fertilizer management programs and the efforts of the Cape Cod Extension Service in educating homeowners a 25% reduction in fertilizer applications was assumed for each watershed.

Regional GIS screening methods were developed to identify locations for some non-traditional technologies. A GIS viewer was developed as an on-line tool for staff and consultants to utilize during the watershed planning process.

- **CONSTRUCTED WETLANDS/ PHYTOREMEDIATION:** A GIS-based screening method was developed by the Cape Cod Commission to identify and rank parcels of land that have potential for the location of constructed wetlands and phytoremediation. The ranking utilized parcel size and ownership, depth to groundwater, suitable soils, distance from wetlands, and undeveloped parcels. A nitrogen removal rate of 500 kg/Y/acre and 532 kg/Y/acre was used for Constructed Wetlands and Phytoremediation, respectively.
- **PERMEABLE REACTIVE BARRIERS (PRBS):** A GIS-based screening method was developed to identify existing roads that are proximate to receiving waters, downgradient of high density development, run perpendicular to groundwater flow (to have the highest potential to intercept nutrients in groundwater), and where the depth to groundwater is relatively shallow to maximize the area of saturated thickness treated in the aquifer.

Methodology for Selecting Non-Traditional Technology Scenarios

- **FERTIGATION WELLS:** Golf courses were mapped to identify areas where fertigation wells could be utilized to recapture nitrogen-enriched groundwater and re-apply it to the managed turf areas to serve both irrigation and fertilization needs. Most golf courses were assumed to be eighteen holes with a fertilized area of 75 acres. Fertigation water was assumed to have an average concentration of 5 mg/liter. An uptake/attenuation rate of 80% was applied resulting in an assumed nitrogen reduction of 300 kg/year for each golf course with effectively located fertigation wells. In some cases other irrigated areas (such as athletic fields and cemeteries) were identified as potential fertigation locations. A nitrogen removal rate of 4 kg/Y/acre was used.

The MVP tool and other site-specific tools were utilized to quantify nitrogen load reductions for several potential NT interventions.

- **PERMEABLE REACTIVE BARRIERS:** for each PRB that was identified during the prior GIS-screening process an approximate capture area was identified using available water table maps and the wMVP tool. Upgradient contributing areas were digitized within wMVP and the nitrogen load was calculated. A nitrogen reduction of 72.5% was applied (calculated as an average of the reported attenuation range from the Technologies Matrix).
- **CONSTRUCTED WETLANDS (WITH COLLECTION):** Constructed wetlands were considered as a tertiary, polishing treatment for existing wastewater treatment plants. This included small-scale wastewater treatment systems. A nitrogen removal rate of 500 kg/Y/acre was used.
- **AQUACULTURE/OYSTER REEFS:** Potential areas for aquaculture and/or oyster reef restoration were considered based upon discussions with town representatives and review of maps to identify potential areas for these operations without significant conflicts to navigation. In some cases actual recent aquaculture expansions were included where they were developed after the MEP reports were prepared. An assumption of 1 million oysters per acre was used with a nitrogen removal rate of 250 kg/Y/acres.
- **FLOATING CONSTRUCTED WETLANDS:** Potential areas for floating wetlands were considered in areas where no conflicts with navigation or swimming areas were identified. A nitrogen removal rate of 0.4 kg/Y/sq foot was used.
- **INLET WIDENING AND COASTAL HABITAT RESTORATION:** Only considered in areas where these projects were identified by towns or state agencies and where detailed hydrologic investigations and modeling had been performed due to wide variations in nitrate load reduction, flushing impacts, impacts on flooding, and costs (dredging only, replacing infrastructure, removing and replacing roadways or bridges, etc.). Nitrogen removal rates were based on MEP or other studies.
- **INNOVATIVE & ALTERNATIVE SEPTIC SYSTEMS AND ECOTOILETS:** In most cases specific locations for these technologies were not identified. Rather general estimates for the percent adoption were provided based upon discussions with the stakeholder groups and their views on potential adoption rates. In some watersheds a 5% adoption rate was included based upon this stakeholder input. In a limited number of instances specific locations for these technologies were included based upon town input and suggestions. A nitrogen removal rate of 1.658 kg/Y for each system was used for I&A Septic Systems, and 2.984 kg/Y for enhanced I&A systems. A removal rate of 2.542 kg/Y was used for each home installation of an Ecotoilet, and 0.467 kg/Y for installation of urine diversion toilets in public settings.

Finally, the locations of specific technologies were discussed during the 208 stakeholder engagement process. Stakeholders across the Cape 'groundtruthed' potential NT locations and NT scenarios were adjusted accordingly.