

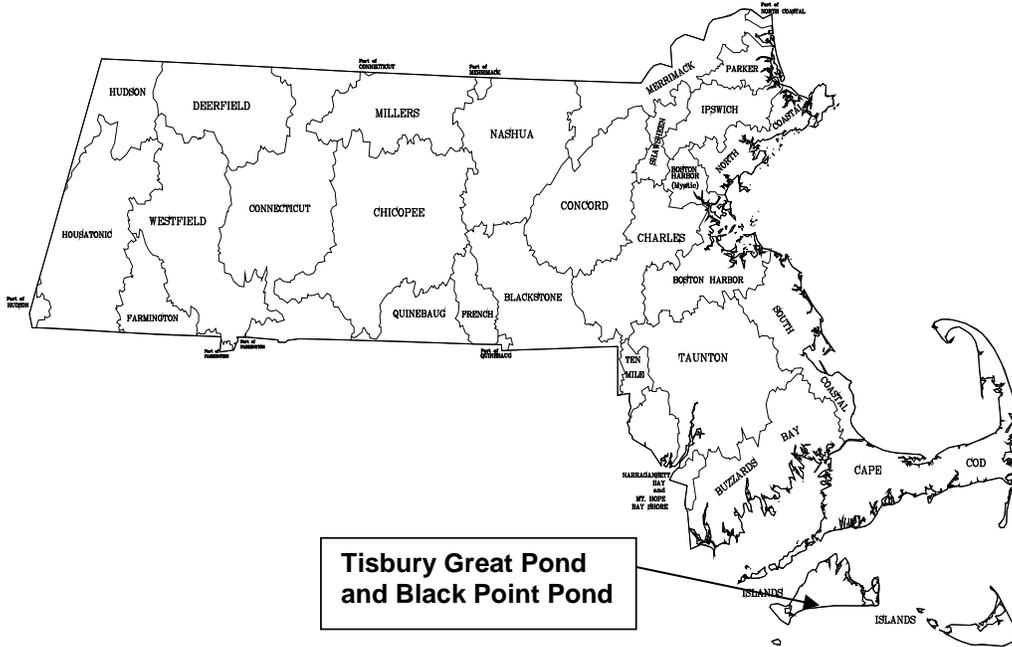
**Final  
Tisbury Great Pond  
Black Point Pond Estuarine System  
Total Maximum Daily Load  
For Total Nitrogen  
(CN 398.1)**



**COMMONWEALTH OF MASSACHUSETTS  
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**July 2019**

# Final Tisbury Great Pond/Black Point Pond System Total Maximum Daily Loads For Total Nitrogen



- Key Feature:** Total Nitrogen TMDLs for the Tisbury Great Pond/Black Point Pond Estuarine System
- Location:** EPA Region 1
- Land Type:** New England Coastal
- 303d Listing:** Tisbury Great Pond was impaired for bacteria, Category 5, on the 2014 Integrated List. This waterbody (Segment #MA97-18) was found to be impaired for nutrients during the MEP study. This segment will be evaluated for nutrient impairment in a future 303(d) listing. Tisbury Great Pond includes Town Cove, Muddy Cove, Pear Tree Cove, Short Cove, Tiah Cove, Tississa Pond, Deep Bottom Cove, and Thumb Cove, in Chilmark/West Tisbury, Martha's Vineyard. (There is no listing for Black Point Pond.)
- Data Sources:** University of Massachusetts – Dartmouth/School for Marine Science and Technology (SMAST); US Geological Survey; Applied Coastal Research and Engineering, Inc.
- Data Mechanism:** Massachusetts Surface Water Quality Standards, Ambient Data, and Linked Watershed Model
- Monitoring Plan:** Town of Chilmark monitoring program (technical assistance from SMAST) and Town of West Tisbury monitoring program (technical assistance from SMAST)
- Control Measures:** Sewering, Agricultural BMPs, Stormwater Management, Attenuation by Freshwater Waterbodies, Fertilizer Use By-laws, Landfill Management

## **Executive Summary**

### **Problem Statement**

The enclosed embayment structure and excessive nitrogen (N) originating from a range of sources has added to the impairment of the environmental quality of the Tisbury Great Pond/Black Point Pond estuarine system. Excessive N is indicated by:

- Undesirable increases in macro algae
- Periodic extreme decreases in dissolved oxygen concentrations that threaten aquatic life
- Reductions in the diversity of benthic animal populations
- Reduction or elimination of eel grass
- Periodic algal blooms

With proper management of N inputs these trends can be reversed. Without proper management more severe problems might develop, including:

- Periodic fish kills
- Unpleasant odors and scum
- Benthic communities reduced to the most stress-tolerant species, or in the worst cases, near loss of the benthic animal communities

Coastal communities rely on clean, productive, and aesthetically pleasing marine and estuarine waters for tourism, recreational swimming, fishing, and boating, as well as for commercial fin fishing and shellfishing. Failure to reduce and control N loadings could result in an overabundance of macro-algae, a higher frequency of extreme decreases in dissolved oxygen concentrations and fish kills, widespread occurrence of unpleasant odors and visible scum, and loss of benthic macro-invertebrates throughout most of the embayments. Additionally, the number and duration of pond openings play a fundamental role in the maintenance of nutrient related water quality and habitat health throughout this estuary. As a result of these environmental impacts, commercial and recreational uses of the Tisbury Great Pond/Black Point Pond estuarine system will be greatly reduced.

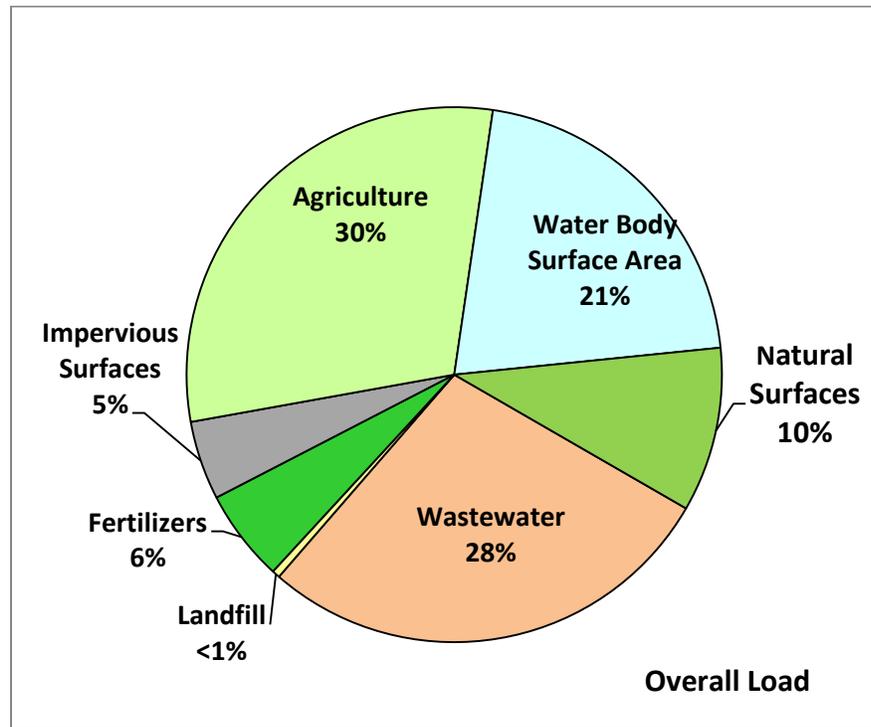
### **Sources of Nitrogen**

Nitrogen enters the waters of coastal embayments from the following sources:

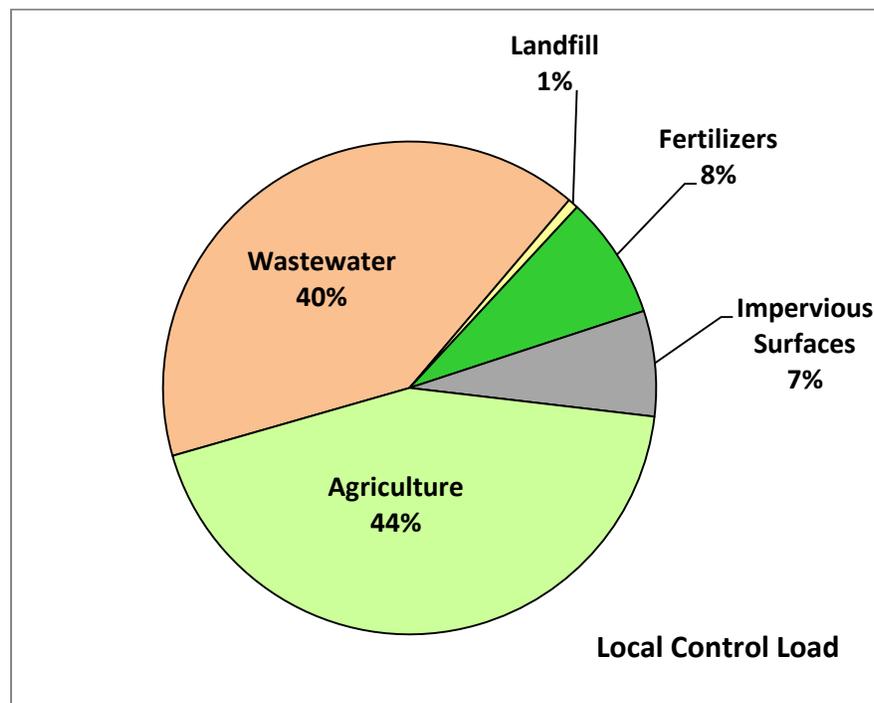
- The watershed
  - Natural background
  - Septic Systems
  - Runoff
  - Fertilizers
  - Landfills
  - Agricultural activities
  - Wastewater treatment facilities
- Atmospheric deposition
- Nutrient-rich bottom sediments in the embayments

Figure ES-A and Figure ES-B illustrate the percent contribution of all watershed sources of N and the controllable N sources to the estuary system, respectfully. Values are based on Table IV-3 and Figure IV-7 from the Massachusetts Estuaries Project (MEP) Technical Report (Howes *et al* 2013). As evident, most of the present *controllable* load to this system comes from agriculture and septic systems.

**Figure ES-A: Percent Contributions of All Watershed Nitrogen Sources to the Tisbury Great Pond/Black Point Pond Estuarine System**



**Figure ES-B: Percent Contributions of Controllable Nitrogen Sources to the Tisbury Great Pond/Black Point Pond Estuarine System**



## **Target Threshold Nitrogen Concentrations and Loadings**

Tisbury Great Pond/Black Point Pond estuarine system is made up of three units: main Tisbury Great Pond basin, approximately six (6) tributary coves and Black Point Pond. One of the coves, Town Cove, receives nitrogen loadings from two subwatersheds; Tiasquam River and Mill Brook. The total nitrogen loading (N) to the estuarine system is 72.26 kg N/day (Tables ES-1 and IV-2 of the MEP) including contributions from natural surfaces, atmospheric deposition, pond sediments, fertilizer, stormwater runoff, and septic system loadings. This total nitrogen load to Tisbury Great Pond/Black Point Pond system includes direct atmospheric deposition to the estuary surface (11.3 kg N/day) and net benthic flux (14.98 N/day) estimates, as well. The average annual surface water concentrations of N in Tisbury Great Pond ranged from 0.41 – 0.51 mg/L in the main basin and 0.42 mg/L - 0.79 mg/L in the tributary coves. These ranges represent the average annual mean concentrations collected from 10 stations between 1995 and 2007, and 2011, as reported in Table VI-1 of the MEP Technical Report (Howes *et al* 2013) and included in Appendix B of this report.

Eelgrass has not generally existed in Tisbury Great Pond throughout the past several decades. There is historical evidence of eelgrass distribution along the shallow margins of the main Tisbury Great Pond basin. (Figure VII-15, 1951 eelgrass, photo interpretation, Howes *et al* 2013) and anecdotally supported by reports from long-time residents. Based on this, return of sparse eelgrass habitat and improved benthic habitat restoration are the nitrogen management goals for Tisbury Great Pond Estuarine System. Improved conditions for eelgrass will necessarily produce supportive conditions for improved benthic habitat restoration.

In order to restore and protect this estuarine system, N loadings, and subsequently the concentrations of N in the surface water, must be reduced to levels below those that cause the observed environmental impacts. This N concentration will be referred to as the *target threshold N concentration*. The Massachusetts Estuaries Project (MEP) has determined from modeling that by achieving a time averaged N concentration of 0.46 mg/L within the main basin of Tisbury Great Pond near sentinel station TGP-7 will result in restoration of eelgrass habitat along the shallow margins of the main basin. The target sentinel station concentration of 0.46 mg/L is higher than typically observed in other estuaries for eelgrass restoration (0.3 to 0.35 mg/L) given the bathymetry of the main basin and limited area in which eelgrass was previously assumed to occur.

A secondary target of 0.48 mg/L was established within the tributary coves for infaunal habitat restoration near sentinel stations of TGP-4, TGP-5, and TGP-6. (See Figure 5 for sentinel station locations). The mechanism for achieving the target threshold N concentrations is to reduce the N loadings to the watershed and to increase flushing of the estuarine system. Based on the sampling and modeling analyses and the Technical Report, the MEP study has determined that the Total Maximum Daily Load (TMDL) of N that will meet the target threshold N concentrations of 0.46 and 0.48 mg/L at the sentinel stations identified above is 64.12 kg/day total N. To meet the TMDL the MEP report indicates that a 25.3% reduction of the total nitrogen load for the entire system along with an additional 17-day mid-summer breach of Tisbury Great Pond to allow mixing of the Atlantic Ocean waters will be required to meet the target threshold concentrations. (The additional 17-day breach was one scenario used for modeling purposes. Two or more breaches with a total of 17 days would approximate the original model results. Additional modeling of other scenarios may be completed as part of the Comprehensive Water Resources Planning. The 17-day mid-summer breach is in addition to breaches conducted through-out the remainder of year.)

This document presents the TMDLs for the Tisbury Great Pond/Black Point Pond estuarine system and provides guidance to the watershed communities of West Tisbury and Chilmark on possible ways to reduce the N loadings to meet the recommended TMDL and protect the waters of this estuarine system.

## **Implementation**

The primary goal of TMDL implementation will be a combination of reducing the loadings from any and all sources of N in the watershed, and maintaining at least a 17-day breach in the barrier beach to increase flushing in the Tisbury Great Pond main basin. The MEP Technical Report for the Tisbury Great Pond/Black Point Pond Estuarine System indicated that by reducing watershed loads by 18.6% from Mill Brook and by 36.8% in Tiasquam River (both in the Town Cove sub-watershed) and a 23.2% reduction in Tisbury Great Pond's main basin, the target thresholds can be met. In evaluating septic loads alone (in addition to the breaching of the barrier beach), a 70% reduction in the Mill Brook and Tiasquam River sub-watersheds and an 80% reduction in the main basin would meet the target threshold water quality concentrations.

Agricultural load contributes the largest controllable N load (44%) to this system therefore it is recommended that the watershed communities also implement agricultural BMPs throughout the watershed with a goal of reducing N contribution from agricultural sources by 10% watershed-wide. The towns of West Tisbury and Chilmark should consider requesting an additional model run from SMAST that evaluates a scenario that includes recommendations for reductions in agriculture N loads, as well as, septic loads from the various subembayments. This will help focus agricultural BMP implementation activities to areas that will most effectively reduce N loads and perhaps reduce the need for sewerage. In particular, reductions in N use on agricultural land located immediately adjacent to Town Cove, Pear Tree Cove and Tiah Cove would provide improvements to water quality. Massachusetts Department of Agricultural Resources, Plant Nutrient Application Requirements, 330 CMR 31.00, became effective December 2015. These regulations require basic plant nutrient applications for 10 or more acres and adherence to application and seasonal restrictions.

Current management of Tisbury Great Pond is coordinated by the Riparian Owners of Tisbury Great Pond Association (ROA). A number of considerations are taken into account; pond water level, fish spawning, salinity, nitrogen, turbidity, tidal cycles, shoaling, weather and nesting shore birds. Typically a trench is excavated through the barrier beach every 3 months to allow tidal exchange with the Atlantic Ocean. Records kept between 1993 and 2011 indicate the breach is typically opened three times each year with an average cumulative total of 144 open days per year. The average duration of all openings in the record was 42 days. Breaching of the pond is undertaken in part as a means of controlling salinity levels in the pond and as a flood control measure to keep groundwater levels low enough to prevent flooding of basements in homes bordering the pond. The threshold modeling assumptions included a mid-summer breach to remain open for 17 days, in addition to the quarterly breaches and typical spring breach that now occurs. More details may be found in the MEP Technical Report (Howes et al 2013). The length of time that each breach in the barrier beach actually remains open, varies widely due to the complexity of ocean currents, winds and weather patterns.

Local officials can explore other loading reduction scenarios through additional modeling as part of their Comprehensive Water Resources (or Wastewater) Management Plan (CWRMP). Implementing best management practices (BMPs) to reduce N loadings from fertilizers and runoff where possible will also help to lower the total N load to the system. There are other loading reduction scenarios that could achieve the target threshold N concentrations and could be verified through additional modeling.

Methods for reducing N loadings from these sources are explained in detail in the “MEP Embayment Restoration Guidance for Implementation Strategies” which is available on the MassDEP website <https://www.mass.gov/files/documents/2016/08/rz/mepmain.pdf>. Agricultural nutrient management techniques are available from the Natural Resources Conservation Service (NRCS) website <http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/landuse/crops/npm/>.

The appropriateness of any of the alternatives will depend on local conditions and will have to be determined on a case-by-case basis using an adaptive management approach. Finally, growth within the communities of West Tisbury and Chilmark which would exacerbate the problems associated with N loading should be guided by considerations of water quality-associated impacts.

# Table of Contents

Executive Summary .....	ii
List of Figures .....	viii
List of Tables .....	viii
Introduction.....	1
Description of Water Bodies and Priority Ranking .....	2
Problem Assessment .....	7
Pollutant of Concern, Sources, and Controllability .....	10
Description of Applicable Water Quality Standards .....	12
Methodology – Linking Water Quality and Pollutant Sources.....	13
Application of the Linked Watershed-Embayment Model.....	15
Total Maximum Daily Loads.....	21
TMDL Values for the Tisbury Great Pond/Black Point Pond Estuarine System .....	28
Implementation Plans.....	29
Monitoring Plan .....	33
Reasonable Assurances.....	34
References.....	35
Appendix A: Overview of Applicable Water Quality Standards.....	36
Appendix B: Summary of the Nitrogen Concentrations for Tisbury Great Pond/Black Point Pond Estuarine System.....	40
Appendix C: The Tisbury Great Pond and Black Point Pond Estuarine System estimated waste load allocation (WLA) from runoff of all impervious areas within 200 feet of its waterbodies. ....	41
Appendix D: Tisbury Great Pond/Black Point Pond Estuarine System Total Nitrogen TMDLs (One TMDL for Restoration, Three Protective TMDLs) .....	42

## List of Figures

Figure ES-A: Percent Contributions of All Watershed Nitrogen Sources to the Tisbury Great Pond/Black Point Pond Estuarine System .....	iii
Figure ES-B: Percent Contributions of Controllable Nitrogen Sources to the Tisbury Great Pond/Black Point Pond Estuarine System .....	iii
Figure 1: Watershed Delineations for the Tisbury Great Pond/Black Point Pond Estuarine System.....	3
Figure 2: Map of the Tisbury Great Pond/Black Point Pond Estuarine System .....	5
Figure 3: Resident Population for West Tisbury and Chilmark .....	8
Figure 4: Percent Contribution of Nitrogen Sources to the Tisbury Great Pond/Black Point Pond Estuarine System.....	12
Figure 5: Water Quality Sampling Stations in the Tisbury Great Pond/Black Point Pond Estuarine System.....	18
Figure 6: Tisbury Great Pond/Black Point Pond Estuarine System Locally Controllable N Sources (Unattenuated N).....	24

## List of Tables

Table 1: Comparison of MassDEP and SMAST Impaired Parameters for the Tisbury Great Pond/Black Point Pond Estuarine System .....	6
Table 2: General Summary of Conditions Related to the Major Indicators of Habitat Impairment Observed in the Lake Tashmoo System (excerpted Howes et. al. 2013, pg. 145) .....	9
Table 4: Present Nitrogen Concentrations and Sentinel Station Target Threshold Nitrogen Concentrations for the Tisbury Great Pond/Black Point Pond Estuarine System .....	16
Table 5: Present Attenuated Nitrogen Loadings to the Tisbury Great Pond/Black Point Pond Estuarine System.....	20
Table 6: Present Watershed Nitrogen Loading Rates, Calculated Loading Rates that are Necessary to Achieve Target Threshold Nitrogen Concentrations, and the Percent Reductions of the Existing Loads Necessary to Achieve the Target Threshold Loadings* .....	21
Table 7: The Total Maximum Daily Loads (TMDL) for the Tisbury Great Pond/Black Point Pond Estuarine System. Represented as the Sum of the Calculated Target Threshold Loads, Atmospheric Deposition and Sediment Load .....	28
Table 8: Summary of the Present Septic System Loads and the Loading Reductions Necessary to Achieve the TMDL by Reducing Septic System Loads and Breaching the Inlet.....	30

## Introduction

Section 303(d) of the Federal Clean Water Act requires each state (1) to identify waters that are not meeting water quality standards and (2) to establish Total Maximum Daily Loads (TMDLs) for such waters for the pollutants of concern. The TMDL allocation establishes the maximum loadings of these pollutants of concern, taking into consideration all contributing sources to that water body, while allowing the system to meet and maintain its water quality standards and designated uses, including compliance with numeric and narrative standards. The TMDL development process may be described in four steps, as follows:

1. Determination and documentation of whether or not a water body is presently meeting its water quality standards and designated uses.
2. Assessment of present water quality conditions in the water body, including estimation of present loadings of pollutants of concern from both point sources (discernable, confined, and concrete sources such as pipes) and non-point sources (diffuse sources that carry pollutants to surface waters through runoff or groundwater).
3. Determination of the loading capacity of the water body. EPA regulations define the loading capacity as the greatest amount of loading that a water body can receive without violating water quality standards. If the water body is not presently meeting its designated uses, then the loading capacity will represent a reduction relative to present loadings.
4. Specification of load allocations, based on the loading capacity determination, for non-point sources and point sources that will ensure that the water body will not violate water quality standards.

After public comment and final approval by the EPA, the TMDL will serve as a guide for future implementation activities. The MassDEP will work with the towns of West Tisbury and Chilmark to develop specific implementation strategies to reduce N loadings, and will assist in developing a monitoring plan for assessing the success of the nutrient reduction strategies.

In the Tisbury Great Pond/Black Point Pond estuarine system the pollutant of concern for this TMDL (based on observations of eutrophication) is the nutrient nitrogen. Nitrogen is the limiting nutrient in coastal and marine waters, which means that as its concentration increase so does the amount of plant matter. This leads to nuisance populations of macro-algae and increased concentrations of phytoplankton and epiphyton which impairs the healthy ecology of the affected water bodies.

The TMDL for total N for the Tisbury Great Pond/Black Point Pond estuarine system is based primarily on data collected, compiled and analyzed by University of Massachusetts Dartmouth's School of Marine Science and Technology (SMAST) Coastal Systems Program and the towns of West Tisbury, Chilmark and the Martha's Vineyard Commission, as part of the Massachusetts Estuaries Project (MEP). The data were collected over a study period from 1995 through 2007 and 2011, a period which will be referred to as the "present conditions" in the TMDL report, since it contains the most recent data available. The accompanying MEP Technical Report can be found at <https://www.mass.gov/doc/tisbury-great-pondblack-point-pond-system-dennis-ma-2013>. The MEP Technical Report presents the results of the analyses of the coastal embayment system using the MEP Linked Watershed-Embayment N Management Model (Linked Model).

The analyses were performed to assist the watershed communities with making decisions on current and future wastewater planning, wetland restoration, anadromous fish runs, shellfisheries, open space, and estuary maintenance programs. A critical element of this approach is the assessments of water quality monitoring data, historical changes in eelgrass distribution, time-series water column oxygen measurements and benthic community structure that was conducted on this embayment. These assessments served as the basis for generating a total N loading threshold for use as a goal for watershed N management. The TMDLs are based on the site specific total N threshold generated for this estuarine system. Thus, the MEP offers a science-based management approach to support the wastewater management planning and decision-making process for both West Tisbury and Chilmark.

## **Description of Water Bodies and Priority Ranking**

### **Watershed Characterization**

The MEP team has delineated a watershed area of approximately 18.5 square miles for the Tisbury Great Pond/Black Point Pond Estuarine system. The delineated contributory watershed includes eight subwatersheds which were delineated for estimation of groundwater flows and nutrient export (Figure 1, Howes *et. al*, 2013, pg. 34). The MEP team has estimated a total groundwater flow for the system of 89,728 m<sup>3</sup>/day.

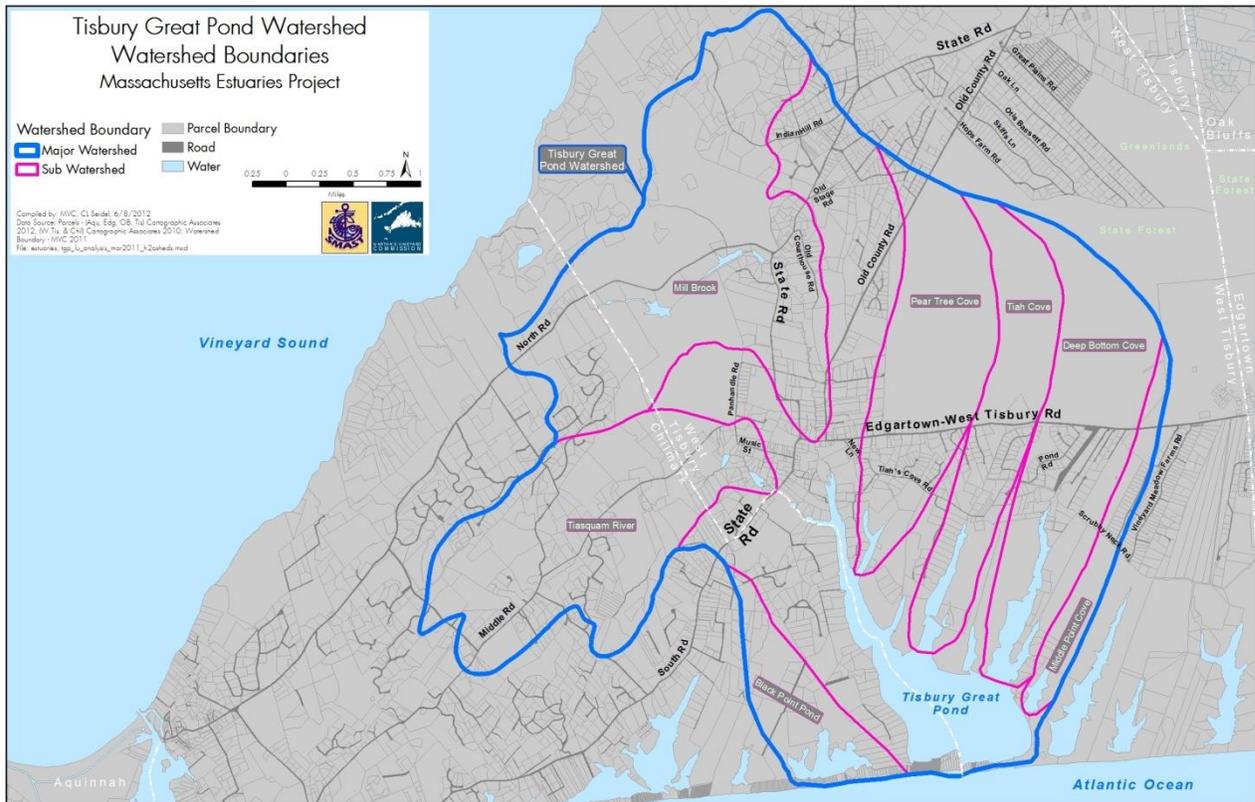
In the overall Tisbury Great Pond/Black Point Pond system, the predominant land use is residential, which accounts for 37% of the overall watershed area while public service lands represent the second highest percentage (33%) of watershed area (Howes *et. al* 2013, pg 40). Overall, undeveloped lands account for 24% of the entire watershed area. Undeveloped land is the dominant land use in the Black Point Pond subwatershed (39%).

### **Description of Waterbodies**

The Tisbury Great Pond/Black Point Pond estuarine system is one of the largest estuaries on Martha's Vineyard and its watershed is shared by the towns of Chilmark and West Tisbury (see Figures 1 and 2). The system is comprised of three major functional units; the main basin, a lagoon formed by the barrier beach, the shallow and narrow tributary coves, and Black Point Pond, a shallow pond surrounded by wetlands. The estuarine system is a complex coastal open-water embayment as evidenced by its size and structure. The estuary is maintained by the periodic breaching of the Tisbury Great Pond barrier beach, coordinated by the Riparian Owners of Tisbury Great Pond Association with a single temporary inlet. Its ponds and coves delineate a number of sub-basins (Town Cove, including the tributaries Mill Brook and Tiasquam River), Tiah Cove, Short Cove, Muddy Cove, Pear Tree Cove, Deep Bottom Cove, Thumb Cove, Tississa Pond, and Black Point Pond). The upper reaches of the great pond appear to be the most nitrogen sensitive, however, the N loads emanating from the upper portion eventually has an impact on the lower reaches, and therefore the system has to be managed as a whole.

This estuary constitutes an important component of the area's natural and cultural resources and the uses of the Tisbury Great Pond/Black Point Pond estuarine system must be balanced. The watershed is an attractive location due to its extensive shoreline, sheltered bays and accessibility for fishing, swimming and boating. These attributes also increase the pressure for development which tends to threaten the very qualities which make it so desirable. In particular, the estuary is at risk of further eutrophication from high nutrient loads in the groundwater and surface water, and runoff from the watershed. Tisbury Great Pond system is vulnerable to the effects of nutrient enrichment from the watershed considering that circulation is mainly through wind driven mixing in the small tributary sub-embayments, the long shoreline of the pond and only periodic flushing with the low nutrient waters of the Atlantic Ocean.

**Figure 1: Watershed Delineations for the Tisbury Great Pond/Black Point Pond Estuarine System**



Tisbury Great Pond main basin and the freshwater tributaries to Tisbury Great Pond (Tiasquam River and Mill Brook) were determined to be impaired for dissolved oxygen, chlorophyll a, and benthic fauna during the course of the MEP study. Tisbury Great Pond will be evaluated for listing in a future List of Waters for nutrient impairment. Tisbury Great Pond is listed as impaired for pathogens in the 2014 Integrated List of Waters (Table 1). Further discussion of pathogens is beyond the scope of this TMDL.

Black Point Pond is functionally a saltwater wetland basin (e.g. a pond surrounded by significant wetland area) and therefore has a higher capacity to assimilate nitrogen input. Nitrogen management for eelgrass restoration in Tisbury Great Pond will protect Black Point Pond from nitrogen over-enrichment, either through management of nitrogen sources in the Black Point watershed or through lower nitrogen concentrations in the main basin.

The primary ecological threat to the Tisbury Great Pond/Black Point Pond Estuarine System, as a coastal resource, is degradation resulting from nutrient enrichment. Loading of the critical eutrophying nutrient, nitrogen, to this estuarine system has impaired its animal and plant habitats and resulted in ecological changes and lost marine resources. Nitrogen related habitat impairment within the Tisbury Great Pond Estuary shows a gradient of high to low concentrations moving from the upper coves of Tisbury Great Pond to the tidal inlet.

The nitrogen loading to the Tisbury Great Pond/Black Point Pond Estuarine System is primarily from agricultural load and on-site disposal of residential (and some commercial) wastewater. The towns of West Tisbury and Chilmark, like most of Cape Cod and the Islands, has seen rapid growth over the past five decades and does not have a centralized wastewater treatment system or decentralized facilities that remove nitrogen. As such, none of the developed areas in the Tisbury Great Pond/Black Point Pond

Estuarine System watershed are connected to any municipal sewerage system and wastewater treatment and disposal is primarily through privately maintained on-site septic systems. As present and future increased levels of nutrients impact the coastal embayments in the towns of West Tisbury, water quality degradation will increase, with additional impairment and loss of environmental resources.

A complete description of this estuary system is presented in Chapters I and IV of the MEP Technical Report. A majority of the information presented here and used to develop this TMDL is drawn from the MEP Technical Report (Howes *et al* 2013). Chapters VI and VII of the MEP Technical Report provide assessment data that show that the Tisbury Great Pond/Black Point Pond estuarine system is impaired due to excess nutrients, low dissolved oxygen levels, elevated chlorophyll *a* levels and the lack of a permanent estuary outlet which has resulted in loss of eelgrass and stressed benthic infauna habitat. Table 1 identifies the segment previously listed in Category 5 of the Integrated List of Waters by MassDEP for fecal coliform. As a result of the MEP assessment, Tisbury Great Pond and its' tributary coves were determined to be impaired for nutrients as well. During the MEP evaluations Black Point Pond was not shown to be N impaired but the analysis of its' current condition indicates that it is at its limit of N uptake and the sub-watershed build-out indicates that impairment could become a future condition. Black Point Pond was determined to be supporting high quality benthic animal habitat (Howes *et al*, 2013). MassDEP has included Black Point Pond in this TMDL as a 'protective' measure.

**Figure 2: Map of the Tisbury Great Pond/Black Point Pond Estuarine System**



**Table 1: Comparison of MassDEP and SMAST Impaired Parameters for the Tisbury Great Pond/Black Point Pond Estuarine System**

System Component	MassDEP Segment Number (if applicable)	MassDEP Segment Description	Class	2014 Integrated List Category	SMAST Impaired Parameter <sup>1</sup>	Size
Tisbury Great Pond	MA97-18	Including Town Cove, Muddy Cove, Pear Tree Cove, Short Cove, Tiah Cove, Tississa Pond, Deep Bottom Cove, and Thumb Cove, Chilmark/West Tisbury, Martha's Vineyard	SA, Shell-fishing	5, Fecal Coliform	Nutrients, Dissolved Oxygen, Chlorophyll a, Benthic Fauna, Eelgrass	705.9 (acres)
Black Point Pond	MA97-33	Chilmark (includes channel connector to Tisbury Great Pond).	SA, Shell-fishing		None	58.4 (acres)
Mill Brook	MA97-24	Source in wetlands west of Roth Woodland Road, Chilmark to Old Millpond Dam, West Tisbury, Martha's Vineyard.	B	2		3.6 miles
Tiasquam River	MA97-25	Source in wetlands west of Tea Lane, Chilmark to Warren Pond Dam, Chilmark/West Tisbury, Martha's Vineyard.	B	2		3.2 miles

<sup>1</sup> As determined by the MEP Tisbury Great Pond/Black Point Pond System Study and reported in the Technical Report

### **Priority Ranking**

The embayment addressed by this document has been determined to be “high priority” based on three significant factors: (1) the initiative that the towns of Chilmark and West Tisbury have taken to assess the conditions of the entire embayment system; (2) the support of the towns to restore the Tisbury Great Pond/Black Point Pond estuarine system; and (3) the extent of impairment in the Tisbury Great Pond/Black Point Pond Estuarine System. In both marine and freshwater systems, an excess of nutrients results in degraded water quality, adverse impacts to ecosystems and limits on the use of water resources. Observations are summarized in the Problem Assessment section below and detailed in Chapter VII, Assessment of Embayment Nutrient Related Ecological Health, of the MEP Technical Report.

### **Description of Hydrodynamics of the Tisbury Great Pond/Black Point Pond System**

Tisbury Great Pond is generally fully enclosed but is managed by periodic breaching of a barrier beach. Due to energetic wave action on the southern coast of Martha's Vineyard breaches may be of short duration before the breach is filled in by sediment transport along the beach. There are generally three breaches per year with an average total number of days open of 144 days/year. (Howes *et. al* 2013, pg. 75). The average breach recorded during the period 1993 to 2011, remained open for 42 days.

In order to understand the hydrodynamics of this system during a breach, the MEP study team deployed temperature depth recorders at two locations within the system (Black Point Pond and Town Cove) between March 22 and April 15, 2012 immediately after a breach on March 21. The tidal data collected

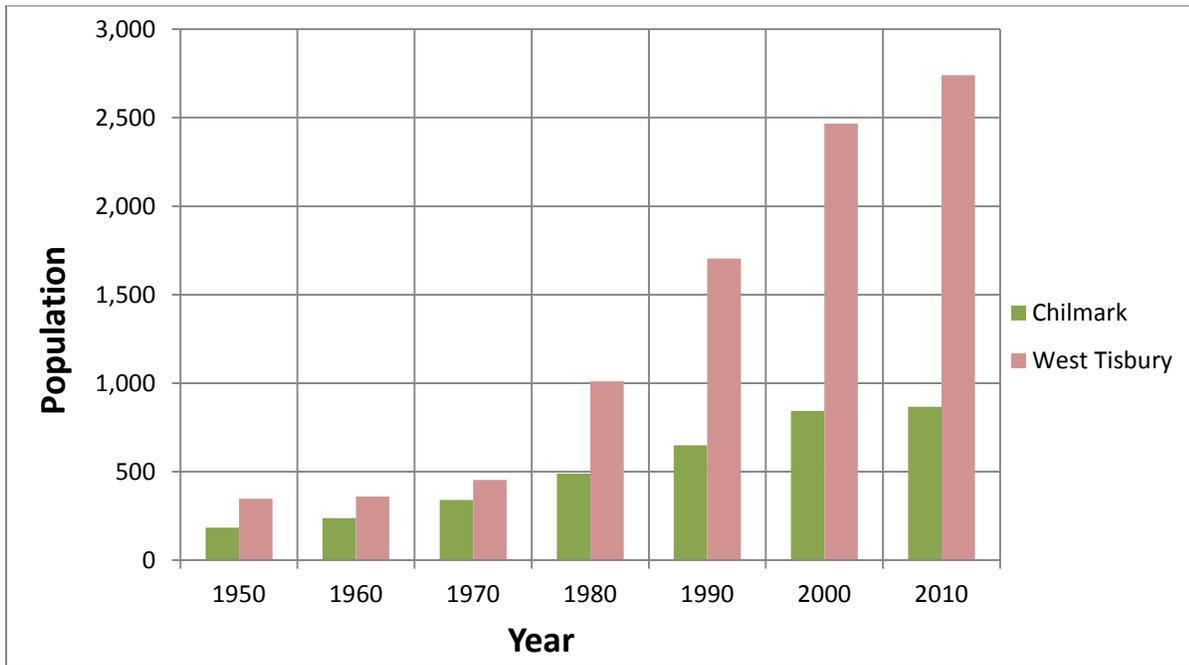
within the system was compared to data collected offshore of South Beach, at the Martha's Vineyard Coastal Observatory. For a 19 day period beginning March 25 the mean tidal range at the offshore station was 2.9 feet while it was 1.0 foot at the Town Cove gage station and only 0.1 feet at Black Point Pond. The MEP project found that Black Point Pond had a mean tidal level of 1.3 feet which is higher than the offshore mean tide of 0.5 feet, indicating that Black Point Pond "does not drain well into the remainder of the Tisbury Great Pond system" (Howes *et. al* 2013, pg. 79). The large tidal attenuation seen in Black Point Pond is likely due to its physical structure and the impact of sand flats in Crab Creek which connects Black Point Pond and Tisbury Great Pond.

Using an RMA-2 model the MEP project estimated local residence times that ranged between 1.8 and 7.1 days within the Tisbury Great Pond System. Black Point Pond had the longest local residence time. The system residence time was estimated to range between 2.3 days for entire Tisbury Great Pond system and 153.3 days for Black Point Pond. The relatively short flushing time of 2.3 days for the entire Tisbury Great Pond system, "provides some confidence that the temporary channel allows enough exchange to significantly improve water quality during a typical breach event" (Howes *et. al* 2013, pg. 98).

## **Problem Assessment**

Water quality problems associated with development within the watershed result primarily from agricultural activities, septic systems, stormwater runoff, and fertilizers. The water quality problems affecting nutrient-enriched embayments generally include periodic decreases of dissolved oxygen, decreased diversity and quantity of benthic animals and periodic algae blooms. In the most severe cases habitat degradation could lead to periodic fish kills, unpleasant odors and scums and near loss of the benthic community and/or presence of only the most stress-tolerant species of benthic animals.

Figure 3 illustrates population growth in West Tisbury and Chilmark since the 1950s. The population of West Tisbury has increased almost 8 fold from 347 people in 1950 to 2,740 people in 2010. In Chilmark, year round population increased from 183 people in 1950 to 866 people in 2010. Increases in N loading to estuaries are directly related to increasing development and population in the watershed. Communities throughout the Commonwealth have experienced rapid growth over the past three decades. This increase in population, both year round and summer visitors, contributes to a decrease in undeveloped land and an increase in septic systems, runoff from impervious surfaces and fertilizer use. All the residences in the Tisbury Great Pond/Black Point Pond estuarine system watersheds are serviced by septic systems. The greatest level of development and residential load is situated in the near shore regions of the system. These un-sewered areas contribute significantly to the estuary's watershed through transport in direct groundwater discharges to estuarine waters and through surface water flows to Tisbury Great Pond. Additionally, significant agricultural land utilizing nutrient application and pasturing of farm animals occurs adjacent to and within the watershed of the estuaries.



**Figure 3: Resident Population for West Tisbury and Chilmark**

<http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml>

Habitat and water quality assessments were conducted on this estuarine system based upon water quality monitoring data, changes in historical eelgrass distribution, time-series water column dissolved oxygen and chlorophyll *a* measurements and benthic community structure. The MEP evaluation of habitat quality supported by each area considers its natural structure and its ability to support eelgrass beds and the types of benthic communities that they support (Table 2). Currently, there is no eelgrass within Tisbury Great Pond. Eelgrass was present in the lower portion of the main basin in 1951 according to historic aerial photographs; however, subsequent eelgrass surveys in 1995, 2001, and 2006 by MassDEP did not include Tisbury Great Pond. At present, given moderate levels of watershed nitrogen loading and limited tidal exchange, occurring periodically during managed breaches of the barrier beach, the nitrogen, chlorophyll *a* and oxygen levels within the pond basins are not supportive of eelgrass. The infauna survey indicates that most sub-basins comprising the Tisbury Great Pond are presently near or beyond their ability to tolerate additional nitrogen inputs without impairment. There was a clear spatial pattern in habitat quality with moderately to significantly impaired benthic animal habitat found in the tributary coves and the healthy to moderately impaired areas within the large main basin. The level of oxygen depletion and the magnitude of daily oxygen excursions and chlorophyll-*a* levels are consistent with moderate to significant nutrient enrichment and impaired habitat quality within the main and tributary coves. Achieving the nitrogen threshold concentration at the sentinel stations, will result in the restoration of dissolved oxygen and chlorophyll *a* to levels supportive of eelgrass and benthic infaunal habitats. Black Point Pond is functioning as a wetland basin (e.g. a pond surrounded by significant wetland area) and, therefore, has a higher tolerance for nitrogen inputs. Coastal salt marsh ecosystems intercept watershed derived nitrogen and improve water quality through microbial denitrification.

Coastal communities, including West Tisbury and Chilmark, rely on clean, productive and aesthetically pleasing marine and estuarine waters for tourism, recreational swimming, fishing and boating, as well as, commercial fin fishing and shell fishing. The continued degradation of this coastal embayment, as described above, will significantly reduce the recreational and commercial value and use of these important environmental resources.

**Table 2: General Summary of Conditions Related to the Major Indicators of Habitat Impairment Observed in the Great Pond/Black Point Pond System (excerpted Howes et. al. 2013, pg. 145)**

Waterbody	Dissolved Oxygen	Chlorophyll <i>a</i>	Eelgrass	Infaunal Animals	Overall Health
<b>Upper Main Basin</b>	oxygen levels at mouth of Town Cove frequently >4 mg/L (23% record), with periodic depletions to <2 mg/L.; lower basin southeast periodically <4 mg/L and west >6 mg/L 90% of record [MI]	moderate chlorophyll-a levels, average 12 ug/L, with periodic blooms to 25 ug/L; WQMP average ~10 ug/L with blooms to ~30 ug/L [MI-SI]	--	High numbers of individuals (600-2000), moderate species numbers (14-18), low diversity (1.4-2.0) and Evenness (0.35 to 0.52). Dominated by organic and nitrogen enrichment indicators ( <i>Streblospio</i> , <i>Mediomastus</i> ) comprising >75% of community [MI-SI]	no historic eelgrass, assessment based on impairment of benthic communities showing MI-SI as evidenced by moderate number of species, low diversity & Evenness, with clear dominance by 2 organic enrichment tolerant species consistent with periodic oxygen depletion and high phytoplankton biomass. [MI-SI]
<b>Lower Main Basin</b>	southwest mooring, oxygen levels generally >6 mg/L (90% of record) and WQMP >6 mg/L; southeast mooring, >5 mg/L, 80% or record, periodic diurnal declines to <3 mg/L [H-MI]	moderate chlorophyll-a levels, average 11 ug/L, with blooms typically 15-20 ug/L; WQMP average ~9 ug/L., with periodic blooms typically 15-20 ug/L [MI]	Eelgrass beds (1951); now very sparse eelgrass periodically appearing in lowermost main basin (2009), not observed in MEP surveys. Major eelgrass loss, but density of beds unquantified [MI-SI]**	High numbers of individuals (>1000), moderate-high species numbers (20), low-moderate diversity (2.3) and Evenness (0.54). Dominants include organic and nitrogen enrichment indicators ( <i>Streblospio</i> , <i>Mediomastus</i> ) comprising ~50% of community, but amphipods & other crustaceans & molluscs, some head down deposit feeders. Sediments have oxidized surface layer and bioturbation [MI]	eelgrass has been lost since 1951, density unquantified; indicates MI-SI for this basin. Note that benthic animal habitat is MI as evidenced by the dominance of organic enrichment indicator species, low diversity and Evenness and periodic oxygen depletion. [MI-SI]
<b>Town Cove</b>	mid & lower mooring frequently <4 mg/L (14%-23% of record), <3 mg/L (7%-11%) periodically to 1 mg/L; WQMP periodically <4 mg/L and <3 mg/L (4% of samples). Frequent levels >10 mg/L indicate nitrogen enrichment and eutrophication. Deep basin.[SI]	moderate-high chlorophyll-a levels, average 12-15 ug/L, frequently >20 ug/L (11%-22% of record), with blooms >30 ug/L; WQMP average 10-16 ug/L., with periodic blooms >30 ug/L [MI-SI]	--	High numbers of individuals (600-2000), moderate species numbers (14-18), low diversity (1.4-2.0) and Evenness (0.35 to 0.52). Dominated by organic and nitrogen enrichment indicators ( <i>Streblospio</i> , <i>Mediomastus</i> ) comprising >75% of community [MI-SI]	no historic eelgrass, assessment based on impairment of benthic communities showing MI-SI as evidenced by moderate number of species, low diversity & Evenness, with clear dominance by 2 organic enrichment tolerant species consistent with periodic oxygen depletion and high phytoplankton biomass. [MI-SI]
<b>Pear Tree Cove</b>	WQMP frequently <5 mg/L and periodically <4 mg/L (5% of samples), shallow basin [MI]	moderate chlorophyll-a levels, WQMP average 12 ug/L, with periodic blooms typically 15- 20 ug/L [MI]	--	High numbers of individuals (600-2000), moderate species numbers (14-18), low diversity (1.4-2.0) and Evenness (0.35 to 0.52). Dominated by organic and nitrogen enrichment indicators ( <i>Streblospio</i> , <i>Mediomastus</i> ) comprising >75% of community [MI-SI]	no historic eelgrass, assessment based on impairment of benthic communities showing MI-SI as evidenced by moderate number of species, low diversity & Evenness, with clear dominance by 2 organic enrichment tolerant species consistent with periodic oxygen depletion and high phytoplankton biomass. [MI-SI]

Waterbody	Dissolved Oxygen	Chlorophyll <i>a</i>	Eelgrass	Infaunal Animals	Overall Health
<b>Tiah Cove</b>	oxygen depletions frequently to <5 mg/L (26% of record), <4 mg/L 11% of record, periodically to 2 mg/L [MI/SI]	high chlorophyll- <i>a</i> levels, average 27 ug/L, frequently >40 ug/L, with blooms >50 ug/L [SI]	--	High numbers of individuals (600-2000), moderate species numbers (14-18), low diversity (1.4-2.0) and Evenness (0.35 to 0.52). Dominated by organic and nitrogen enrichment indicators ( <i>Streblospio</i> , <i>Mediomastus</i> ) comprising >75% of community [MI-SI]	no historic eelgrass, assessment based on impairment of benthic communities showing MI-SI as evidenced by moderate number of species, low diversity & Evenness, with clear dominance by 2 organic enrichment tolerant species consistent with periodic oxygen depletion and high phytoplankton biomass. [MI-SI]
<b>Deep Bottom Cove</b>	oxygen >5 mg/L (88% of record), rarely to >4 mg/L (2% of record and 2% of WQMP samples [H-MI])	moderate-high chlorophyll- <i>a</i> levels, average 19 ug/L, frequently >20 ug/L (38% of record), blooms >30 ug/L; WQMP average ~10 ug/L., with periodic blooms >30 ug/L [MI-SI]	--	High numbers of individuals (600-2000), moderate species numbers (14-18), low diversity (1.4-2.0) and Evenness (0.35 to 0.52). Dominated by organic and nitrogen enrichment indicators ( <i>Streblospio</i> , <i>Mediomastus</i> ) comprising >75% of community [MI-SI]	no historic eelgrass, assessment based on impairment of benthic communities showing MI-SI as evidenced by moderate number of species, low diversity & Evenness, with clear dominance by 2 organic enrichment tolerant species consistent with periodic oxygen depletion and high phytoplankton biomass. Nitrogen management to restore this key resource should be undertaken [MI-SI]
<b>Black Point Pond</b>	insufficient data for assessment on this Health Indicator	low-moderate chlorophyll- <i>a</i> levels, WQMP average 5 ug/L, with maximum 13 ug/L [H]	--	High numbers of individuals (>600), moderate numbers of species (15), with high diversity (2.8) and Evenness (>0.7). Benthic community is consistent with high quality habitat in a wetland basin [H]	Habitat indicators consistent with an unimpaired wetland influenced basin [H]

H - Healthy habitat conditions, MI – Moderately Impaired, SI – Significantly Impaired, SD – Severely degraded, “—” no evidence this basin is supportive of eelgrass

These terms are more fully described in MEP report “Site-Specific Nitrogen Thresholds for Southeastern Massachusetts Embayments: Critical Indicators” December 22, 2003. <https://www.mass.gov/doc/massachusetts-estuaries-project-interim-report-on-site-specific-nitrogen-thresholds-for>

WQMP – Water Quality Monitoring Program (Martha’s Vineyard Commission, with field support from the Towns of Chilmark and West Tisbury)

\*\*Aerial photographs from 1951, and confirmed by a long time resident, indicate this basin supported eelgrass at one time.

## Pollutant of Concern, Sources, and Controllability

In the coastal embayments of the towns of Chilmark and West Tisbury, as in most marine and coastal waters, the limiting nutrient is N. Nitrogen concentrations beyond those expected naturally contribute to undesirable conditions including the severe impacts described above, through the promotion of excessive growth of plants and algae, including nuisance vegetation.

The embayments addressed in this TMDL report have had extensive data collected and analyzed through the Massachusetts Estuaries Program (MEP) and with the cooperation and assistance from the towns of

West Tisbury and Chilmark, the USGS, and the Martha’s Vineyard Commission. Data collection included both water quality and hydrodynamics as described in Chapters I, IV, V, and VII of the MEP Technical Report.

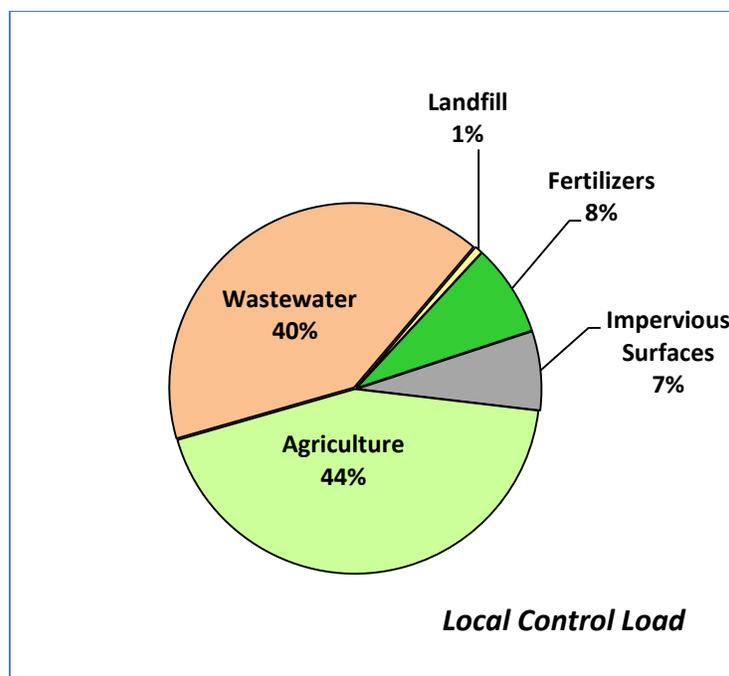
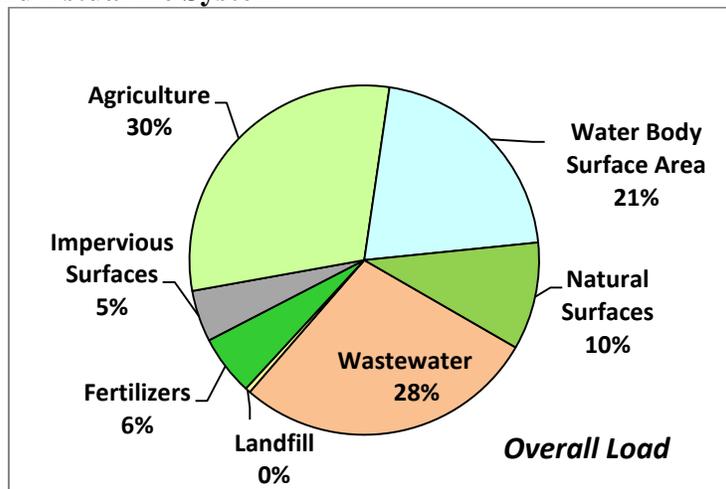
Table 3 illustrates the sources of N to the Tisbury Great Pond/Black Point Pond estuarine system. Most of the controllable N affecting these systems originates from on-site subsurface wastewater disposal systems (septic systems).

The level of “controllability” of each source, however, varies widely as shown in Table 3 below. Cost/benefit analyses will have to be conducted on all possible N loading reduction methodologies in order to select the optimal control strategies, priorities and schedules.

**Table 3: Sources of Nitrogen and their Controllability**

Nitrogen Source	Degree of Controllability at Local Level	Reasoning
Agricultural fertilizer and animal wastes	Moderate	These nitrogen loadings can be controlled through appropriate agricultural Best Management Practices (BMPs).
Atmospheric deposition to the estuary surface	Low	It is only through region- and nation-wide air pollution control initiatives that significant reductions are feasible. Local control although helpful is not adequate.
Atmospheric deposition to natural surfaces (forests, fields, freshwater bodies) in the watershed	Low	Atmospheric deposition (loadings) to these areas cannot adequately be controlled locally. However, the N from these sources might be subjected to enhanced natural attenuation as it moves toward the estuary.
Fertilizer	Moderate	Lawn and golf course fertilizer and related N loadings can be reduced through BMPs, bylaws and public education.
Landfill	Moderate	Related N loadings can be controlled through appropriate BMP and management techniques.
Natural Background	None	Background load if the entire watershed was still forested and contained no anthropogenic sources. It cannot be controlled.
Septic system	High	Sources of N can be controlled by a variety of case-specific methods including: sewerage and treatment at centralized or decentralized locations, transporting and treating septage at treatment facilities with N removal technology either in or out of the watershed, or installing N-reducing on-site wastewater treatment systems.
Sediment	Low	N loadings are not feasibly controlled on a large scale by such measures as dredging. However, the concentrations of N in sediments, and thus the loadings from the sediments, will decline over time if sources in the watershed are removed, or reduced to the target levels discussed later in this document. In addition, increased dissolved oxygen will help keep N from fluxing.
Stormwater runoff from impervious surfaces	Moderate	This nitrogen source can be controlled by BMPs, bylaws and stormwater infrastructure improvements and public education. Stormwater NPDES permit requirements help control stormwater related N loadings in designated communities.

**Figure 4: Percent Contribution of Nitrogen Sources to the Tisbury Great Pond/Black Point Pond Estuarine System**



### Description of Applicable Water Quality Standards

The Tisbury Great Pond/Black Point Pond estuarine system water quality classification is SA (all surface waters subject to the rise and fall of the tide). The two freshwater waterbodies covered as part of a protective TMDL are considered Class B. Water quality standards of particular interest to the issues of cultural eutrophication are dissolved oxygen, nutrients, aesthetics, and excess plant biomass and nuisance vegetation. The Massachusetts water quality standards (314 CMR 4.0) (MassDEP, 2007) contain descriptions of coastal and marine classes and numeric criteria for dissolved oxygen but have only narrative standards that relate to the other variables, as described in Appendix A.

Thus, the assessment of eutrophication is based on site-specific information within a general framework that emphasizes impairment of uses and preservation of a balanced indigenous flora and fauna. This approach is recommended by the EPA in their draft Nutrient Criteria Technical Guidance Manual for Estuarine and Coastal Marine Waters (Environmental Protection Agency, 2001). The Guidance Manual notes that lakes, reservoirs, streams and rivers may be subdivided by classes, allowing reference conditions for each class and facilitating cost-effective criteria development for nutrient management. However, individual estuarine and coastal marine waters tend to have unique characteristics and development of individual water body criteria is typically required.

## **Methodology – Linking Water Quality and Pollutant Sources**

Extensive data collection and analyses have been described in detail in the MEP Technical Report. Those data were used by SMAST to assess the loading capacity of each embayment. Physical (Chapter V), chemical and biological (Chapters IV, VII, and VIII) data were collected and evaluated. The primary water quality objective was represented by conditions that:

- 1) Restore the natural distribution of eelgrass because it provides valuable habitat for shellfish and finfish;
- 2) Prevent harmful or excessive algal blooms;
- 3) Restore and preserve benthic communities;
- 4) Maintain dissolved oxygen concentrations that are protective of the estuarine communities.

The details of the data collection, modeling and evaluation are presented and discussed in Chapters IV, V, VI, VII and VIII of the MEP Technical Report. The main aspects of the data evaluation and modeling approach are summarized below.

The core of the Massachusetts Estuaries Project analytical method is the Linked Watershed-Embayment Management Modeling Approach. It fully links watershed inputs with embayment circulation and N characteristics, and is characterized as follows:

- Requires site specific measurements within the watershed and each sub-embayment;
- Uses realistic “best-estimates” of N loads from each land-use (as opposed to loads with built-in “safety factors” like Title 5 design loads);
- Spatially distributes the watershed N loading to the embayment;
- Accounts for N attenuation during transport to the embayment;
- Includes a 2D or 3D embayment circulation model depending on embayment structure;
- Accounts for basin structure, tidal variations, and dispersion within the embayment;
- Includes N regenerated within the embayment;
- Is validated by both independent hydrodynamic, N concentration, and ecological data;
- Is calibrated and validated with field data prior to generation of “what if” scenarios.

The Linked Model has been applied previously to watershed N management in over 60 embayments thus far throughout Southeastern Massachusetts. In these applications it became clear that the model can be calibrated and validated and has use as a management tool for evaluating watershed N management options.

The Linked Model, when properly calibrated and validated for a given embayment becomes a N management-planning tool as described in the model overview below. The model can assess solutions for the protection or restoration of nutrient-related water quality and allows testing of management scenarios to support cost/benefit evaluations. In addition, once a model is fully functional it can be refined for changes in land-use or embayment characteristics at minimal cost. Also, since the Linked Model uses a holistic approach that incorporates the entire watershed, embayment and tidal source waters, it can be used to evaluate all projects as they relate directly or indirectly to water quality conditions within its geographic boundaries. It should be noted that this approach includes high-order, watershed and sub-watershed scale modeling necessary to develop critical nitrogen targets for each major sub-embayment. The models, data and assumptions used in this process are specifically intended for the purposes stated in the MEP Technical Report, upon which this TMDL is based. As such, the Linked Model process does not contain the type of data or level and scale of analysis necessary to predict the fate and transport of nitrogen through groundwater from specific sources. In addition, any determinations related to direct and immediate hydrologic connection to surface waters are beyond the scope of the MEP's Linked Model process.

The Linked Model provides a quantitative approach for determining an embayment's (1) N sensitivity, (2) N threshold loading levels (TMDL) and (3) response to changes in loading rate. The approach is fully field validated and unlike many approaches, accounts for nutrient sources, attenuation and recycling and variations in tidal hydrodynamics (Figure I-4 of the MEP Technical Report). This methodology integrates a variety of field data and models, specifically:

- Monitoring – multi-year embayment nutrient sampling
- Hydrodynamics
  - Embayment bathymetry (depth contours throughout the embayment)
  - Site-specific tidal record (timing and height of tides)
  - Water velocity records (in complex systems only)
  - Hydrodynamic model
- Watershed Nitrogen Loading
  - Watershed delineation
  - Stream flow (Q) and N load
  - Land-use analysis (GIS)
  - Watershed N model
- Embayment TMDL – Synthesis
  - Linked Watershed-Embayment Nitrogen Model
  - Salinity surveys (for linked model validation)
  - Rate of N recycling within embayment
  - Dissolved oxygen record
  - Macrophyte survey
  - Infaunal survey (in complex systems)

## **Application of the Linked Watershed-Embayment Model**

The approach developed by the MEP for applying the linked model to specific embayments, for the purpose of developing target N loading rates, includes:

- 1) Selecting one or two stations within the embayment system located close to the inland-most reach or reaches which typically have the poorest water quality within the system. These are called “sentinel” stations;
- 2) Using site-specific information and a minimum of three years of sub-embayment-specific data to select target threshold N concentrations for each sub-embayment. This is done by refining the draft target threshold N concentrations that were developed as the initial step of the MEP process. The target threshold N concentrations that were selected generally occur in higher quality waters near the mouth of the embayment system;
- 3) Running the calibrated water quality model using different watershed N loading rates to determine the loading rate that will achieve the target threshold N concentration at the sentinel station. Differences between the modeled N load required to achieve the target threshold N concentration and the present watershed N load represent N management goals for restoration and protection of the embayment system as a whole.

Previous sampling and data analyses and the modeling activities described above resulted in four major outputs that were critical to the development of the TMDL. Two outputs are related to **N concentration**:

- The present N concentrations in the sub-embayments
- Site-specific target threshold N concentrations

And, two outputs are related to **N loadings**:

- The present N loads to the sub-embayments
- Load reductions necessary to meet the site specific target N concentrations

In summary: if the water quality standards (for dissolved oxygen, chlorophyll a, nutrients) are met by reducing the N concentration (and thus the N load) at the sentinel station(s), then the water quality goals will be met throughout the entire system.

A brief overview of each of the outputs follows:

### **Nitrogen concentrations in the embayment**

- a) Observed “present” conditions:

Table 4 presents the average concentrations of N measured in this estuarine system from ten years of data collection by the Martha’s Vineyard Commission, towns of Chilmark and West Tisbury, and SMAST (1995- 2010 and 2011). The overall means and standard deviations of the

averages are presented in Appendix B (taken from Table VI-1 of the MEP Technical Report). Water quality sampling stations are shown in Figure 5 below.

b) Modeled site-specific target threshold N concentrations:

A major component of TMDL development is the determination of the maximum concentrations of N (based on field data) that can occur without causing unacceptable impacts to the aquatic environment. Prior to conducting the analytical and modeling activities described above, SMAST selected appropriate nutrient-related environmental indicators and tested the qualitative and quantitative relationship between those indicators and N concentrations. The Linked Model was then used to determine site-specific target threshold N concentrations by using the specific physical, chemical and biological characteristics of each harbor embayment system.

**Table 4: Present Nitrogen Concentrations (Select Stations) and Sentinel Station Target Threshold Nitrogen Concentrations for the Tisbury Great Pond/Black Point Pond Estuarine System**

Sub-embayment	Station	Mean Observed Nitrogen Concentration <sup>1</sup> (mg/L)	Target Threshold Nitrogen Concentration <sup>4</sup> (mg/L)
Deep Bottom Cove	TGP-6	0.54	0.48 <sup>2</sup>
Tiah Cove	TGP-5	0.42	0.48 <sup>2</sup>
Town Cove Upper	TGP-1	0.64	--
Pear Tree Cove	TGP-3	0.49	--
Town Cove Mid	TGP-4	0.53	0.48 <sup>2</sup>
Tisbury GP lower main basin	TGP-7	0.51	0.46 <sup>3</sup>
Black Point Pond	TGP-8 <sup>5</sup>	0.43	--
<b>Tisbury GP System Total</b>		<b>0.42 – 0.64</b>	<b>0.46 – 0.48</b>

1 Average total N concentrations from present loading based on an average of the annual N means from 1995-2010 and 2011

2 Secondary target threshold N concentrations at Tisbury Great Pond tributary coves stations TGP-4, TGP-5 and TGP-6

3 Primary target threshold N concentration for Tisbury Great Pond main basin, TGP-7.

4 Target concentrations through summer months, to be achieved by load reduction and successful breaching of the inlet in late spring and mid-summer.

5 TGP-8 is located at the outlet of Crab Creek to the main harbor.

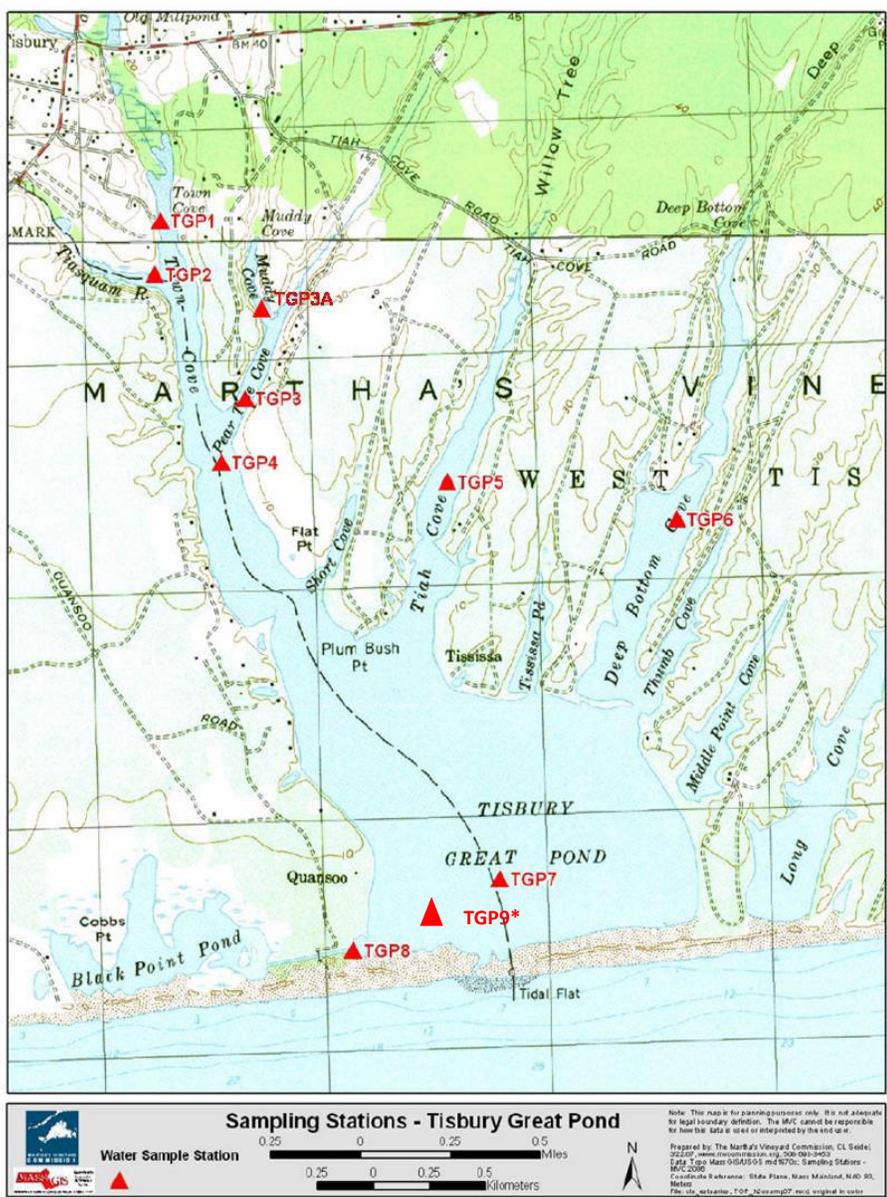
The target threshold nitrogen concentrations for the sub-embayments listed in Table 4 were determined as follows:

The approach for determining nitrogen loading rates, which will maintain acceptable habitat quality throughout an embayment system, is to first identify a sentinel location within the embayment and second to determine the nitrogen concentration within the water column which

will restore that location to the desired habitat quality. The sentinel location is selected such that the restoration of that one site will necessarily bring the other regions of the system to acceptable habitat quality levels. Once the sentinel site and its target threshold nitrogen concentration are determined, the MEP study modeled nitrogen loads until the targeted nitrogen concentration was achieved. In the case of Tisbury Great Pond, there are four sentinel stations distributed throughout the system.

The determination of the critical nitrogen threshold for maintaining high habitat within the Tisbury Great Pond/Black Point Pond estuarine system is based on the nutrient and oxygen levels, temporal trends in eelgrass distribution and benthic community indicators. The threshold analysis focused on the goal of restoring or maintaining SA waters of high habitat quality possibly supportive of eelgrass and diverse benthic animal communities. At the present moderate levels of watershed nitrogen loading with only periodic tidal exchange, the level of nitrogen enrichment has resulted in a condition no longer supportive of eelgrass (high chlorophyll *a*, oxygen depletion and high turbidity) and the infaunal survey indicated that most sub-basins are presently beyond their ability to tolerate additional nitrogen inputs without additional impairment.

**Figure 5: Water Quality Sampling Stations in the Tisbury Great Pond/Black Point Pond Estuarine System**



\* TGP 9 is an historic location and is approximated from Figure II-2 in the MEP.

The findings of the analytical and modeling investigations for these embayment systems are discussed and explained below.

The target threshold N concentration for an embayment represents the average water column concentration of N that will support the habitat quality and dissolved oxygen concentrations being sought. The water column N level is ultimately controlled by the integration of the watershed N load, the N concentration in the inflowing tidal waters (boundary condition), dilution, and flushing via tidal flows. The water column N concentration is modified by the extent of sediment uptake and/or regeneration and by direct atmospheric deposition.

Eelgrass has not generally existed in Tisbury Great Pond throughout the past several decades. There is evidence of historical distribution as shown in a 1951 photo interpretation and supported by reports from local residents. At present eelgrass cannot be supported given the measured levels of nitrogen enrichment and resulting high chlorophyll-*a* and low dissolved oxygen. Based on this, habitat restoration in this nutrient enriched system should focus on improving eelgrass habitat within the lower main basin, as well as restoration of infaunal habitat quality, pond-wide.

Target threshold N concentrations in this study were developed to restore or maintain SA waters or high habitat quality. To restore a modest level of eelgrass habitat (consistent with the uncertainties in the historic distribution record) the target time-averaged TN concentrations in the main basin of Tisbury Great Pond, at sentinel station TGP-7, is 0.46 mg/L TN. This nitrogen level is predicted to be supportive of sparse eelgrass in the shallow margins of the main basin. This concentration is consistent with other estuaries with eelgrass restricted to shallow water areas. To achieve the restoration of benthic habitat in the Tisbury Great Pond/Black Point Pond estuarine system the average TN level is set at 0.48 mg/L at stations TGP-4, TGP-5 and TGP-6. These distributed locations for the target threshold stations are due to the variability within each tributary cove and the non-tidal nature of this system. Achieving the nitrogen threshold concentration at the sentinel stations, will result in the restoration of dissolved oxygen and chlorophyll *a* to levels supportive of eelgrass and benthic infaunal habitats.

Black Point Pond differs from Tisbury Great Pond and its' tributary coves. It functions as a shallow pond surrounded by wetlands and is connected to the main pond through Crab Creek, a small restricted connection to the main basin. As a wetland influenced salt pond, it supports relatively high quality benthic animal habitat. There is no evidence Black Point Pond ever supported eelgrass habitat. Setting the TN level at 0.46 mg/L at TGP-7 will be protective of Black Point Pond and its high quality benthic habitat.

### **Nitrogen loadings to the embayment**

#### a) Present Loading rates:

The MEP Technical Report (Figure 4) calculated that agriculture and wastewater loads represent the largest controllable watershed contribution of N loading to Tisbury Great Pond/Black Point Pond estuarine system at 44% and 40%, respectively. Other sources calculated for controllable loads include fertilizers (8%), runoff from impervious surfaces (7%) and the landfill (1%). The MEP study determined that sediments contributed approximately 9.6 kg/day-N to the Tisbury Great Pond main basin. Atmospheric nitrogen deposition to the estuary and watershed surface area was found to be significant (21% of the overall load). Sediment flux and atmospheric deposition are not considered controllable sources of N.

A subwatershed breakdown of N loading, by source, is presented in Table 5. The data on which Table 5 is based can be found in Table ES-1 and Table IV-2 of the MEP Technical Report.

**Table 5: Present Attenuated Nitrogen Loadings to the Tisbury Great Pond/Black Point Pond Estuarine System**

Sub-embayment	Present Land Use Load <sup>1</sup> (kg N/day)	Present Septic System Load (kg N/day)	Present Watershed Load <sup>2</sup> (kg N/day)	Present Atmospheric Deposition <sup>3</sup> (kg N/day)	Present Sediment Flux <sup>4</sup> (kg N/day)	Total Nitrogen Load from All Sources <sup>5</sup> (kg N/day)
Deep Bottom Cove	1.57	1.23	2.80	1.51	0.55	4.86
Tiahs Cove	1.11	1.14	2.25	0.78	-1.34	3.03
Pear Tree Cove	2.14	1.70	3.84	0.26	0.01	4.10
Tisbury GP main basin	15.69	6.41	22.10	7.83	9.59	39.52
Black Point Pond	0.35	0.45	0.80	0.93	6.17	7.90
Mill Brook	6.34	2.30	8.64	-	-	8.64
Tiasquam River	2.64	2.92	5.56	-	-	5.56
System Total	29.84	16.15	45.98	11.30	14.98	72.26

1 Composed of fertilizer, agriculture, runoff, landfills, and atmospheric deposition to lakes and natural surfaces.

2 Composed of fertilizer, agriculture, runoff, landfills, atmospheric deposition to lakes and natural surfaces, and septic inputs.

3 Atmospheric deposition to the estuarine surface only.

4 Nitrogen loading from estuarine sediments.

5 Total of fertilizer, agriculture, runoff, landfills, atmospheric deposition, septic inputs, and sediment nitrogen input.

As previously indicated, the present N loadings to these embayment systems must be reduced in order to restore the impaired conditions and to avoid further nutrient-related adverse environmental impacts. The critical final step in the development of the TMDL is modeling and analysis to determine the loadings required that will achieve the target threshold N concentrations.

- b) Nitrogen loads necessary for meeting the site-specific target threshold N concentrations:

Table 6 lists the present watershed N loadings from the Tisbury Great Pond/Black Point Pond estuarine system and the percent watershed load reductions necessary to achieve the target threshold N concentration at the sentinel stations (see following section).

It is very important to note that load reductions can be produced through a variety of strategies: reduction of any or all sources of N; increasing the natural attenuation of N within the freshwater systems; and/or modifying the tidal flushing through inlet reconfiguration (where appropriate). This scenario establishes the general degree and spatial pattern of reduction that will be required for restoration of the N impaired portions of this system. The towns of West Tisbury and Chilmark should take any reasonable action to reduce the controllable N sources.

**Table 6: Present Watershed Nitrogen Loading Rates, Calculated Loading Rates that are Necessary to Achieve Target Threshold Nitrogen Concentrations, and the Percent Reductions of the Existing Loads Necessary to Achieve the Target Threshold Loadings\***

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
Deep Bottom Cove	2.80	2.80	0.0%
Tiah Cove	2.25	2.25	0.0%
Pear Tree Cove	3.84	3.84	0.0%
Tisbury GP main basin	22.10	16.97	23.2%
Black Point Pond	0.80	0.80	0.0%
Town Cove – Mill Brook	8.64	7.03	18.6%
Town Cove – Tiasquam River	5.56	3.51	36.8%
Total system	45.98	37.20	19.1%

1 Composed of natural background, septic, fertilizer, agriculture, landfill and runoff loadings.

2 Target threshold watershed load is the N load from the watershed (including natural background) needed to meet the target threshold N concentrations identified in Table 4, above.

\* From Tables ES-2 and VIII-3 in the MEP Technical Report with corrected % reductions.

## Total Maximum Daily Loads

As described in EPA guidance, a total maximum daily load (TMDL) identifies the loading capacity of a water body for a particular pollutant. EPA regulations define loading capacity as the greatest amount of loading that a water body can receive without violating water quality standards. The TN TMDLs are established to protect and/or restore the estuarine ecosystem, including eelgrass, the leading indicator of ecological health, thus meeting water quality goals for aquatic life support. Because there are no “numerical” water quality standards for N, the TMDLs for the Tisbury Great Pond/Black Point Pond estuarine system are aimed at establishing the loads that would correspond to specific N concentrations determined to be protective of the water quality and ecosystems. Bioavailable nutrients - such as nitrogen - in point and non-point discharges can stimulate algal growth, which then die and are eaten by bacteria, depleting oxygen in the water through the process of decomposition. Reducing the bioavailability of nitrogen in this estuarine system, through the implementation of this TMDL, will result in less algal growth, which will ensure chlorophyll-a levels are reduced and dissolved oxygen levels increase.

The development of a TMDL requires detailed analyses and mathematical modeling of land use, nutrient loads, water quality indicators, and hydrodynamic variables (including residence time) for each waterbody system. The results of the mathematical model are correlated with estimates of impacts on water quality, including negative impacts on eelgrass (the primary indicator), as well as dissolved oxygen, chlorophyll *a* and benthic infauna.

The TMDL can generally be defined by the equation:

$$TMDL = BG + WLAs + LAs + MOS$$

Where:

TMDL = loading capacity of receiving water

BG = natural background

WLAs = portion allotted to point sources

LAs = portion allotted to (cultural) non-point sources

MOS = margin of safety

## **Background Loading**

Natural background N loading is included in the loading estimates, but is not quantified or presented separately. It is a component of the target watershed threshold. Background loading was calculated on the assumption that the entire watershed is forested with no anthropogenic sources of N. It is accounted for in this TMDL but not defined as a separate component. Readers are referred to Table ES-1 of the MEP Technical Report for estimated loading due to natural conditions.

## **Waste Load Allocations**

Waste load allocations identify the portion of the loading capacity allocated to existing and future point sources of wastewater. In the Tisbury Great Pond/Black Point Pond estuarine system there are no NPDES regulated point source discharges in the watershed. EPA interprets 40 CFR 130.2(h) to require that allocations for NPDES regulated discharges of storm water also be included in the waste load component of the TMDL. It should be noted that no part of the towns of West Tisbury and Chilmark are designated as an urbanized area by EPA and thus are not required to obtain coverage under the NPDES Phase II General Permit for Storm-water Discharges from Small Municipal Separate Storm Sewer Systems (MS4s) that took effect March 31, 2017. Subsequently, in the Tisbury Great Pond/Black Point Pond estuarine system watershed there are no Phase II NPDES permitted stormwater discharges.

In estimating the nitrogen loadings from impervious sources, MassDEP considered that most stormwater runoff from impervious surfaces in the watershed is not discharged directly into surface waters, but, rather, percolates into the ground. The geology on Cape Cod and the Islands consists primarily of glacial outwash sands and gravels, and water moves rapidly through this type of soil profile. A systematic survey of stormwater conveyances on the Islands has never been undertaken. Nevertheless, most catch basins on the Islands are known to MassDEP to have been designed as leaching catch basins in light of the permeable overburden. MassDEP, therefore, recognized that most stormwater that enters a catch basin in these areas will percolate into the local groundwater table rather than directly discharge to a surface waterbody.

Since the majority of the nitrogen loading comes from septic systems and agriculture, and to a lesser extent fertilizer, the landfill and storm-water runoff that infiltrates into the groundwater, the allocation of nitrogen for any storm-water pipes that discharge directly to any of the embayments is expected to be insignificant as compared to the overall groundwater load. The Linked Model accounts for storm water loadings and groundwater loading in one aggregate allocation as a non-point source. However, MassDEP also considered that some stormwater may

be discharged directly to surface waters through outfalls. In the absence of specific data or other information to accurately quantify stormwater discharged directly to surface waters, MassDEP assumed that all impervious surfaces within 200 feet of the shoreline, as calculated from MassGIS data layers, would discharge directly to surface waters, whether or not it in fact did so. MassDEP selected this approach because it considered it unlikely that any stormwater collected farther than 200 feet from the shoreline would be directly discharged into surface waters. Although the 200 foot approach provided a gross estimate, MassDEP considered it a reasonable and conservative approach given the lack of pertinent data and information about stormwater collection systems on Martha's Vineyard.

Although the vast majority of storm water percolates into the ground and proceeds into the embayments through groundwater migration on the island, an estimated waste load was based on an assumption that runoff from all impervious surfaces within 200 feet of the shoreline discharges directly to the waterbodies. The calculated waste load allocation due to runoff from impervious surfaces within 200 feet of the estuary is 0.21 kg/day, or 0.36%, of the total unattenuated watershed load. (Refer to Appendix C for details.) This conservative load is obviously negligible when compared to other sources.

### **Load Allocations**

Load allocations identify the portion of loading capacity allocated to existing and future nonpoint sources. In the case of the Tisbury Great Pond/Black Point Pond estuarine system the locally controllable nonpoint source loadings are from agriculture and on-site subsurface wastewater disposal systems (septic systems) and, to a lesser extent, the landfill and fertilizers (which include storm-water runoff, except from impervious cover within 200 feet of the waterbody which is defined above as part of the waste load). Figure 4 (above) and Figure 6 (below) illustrate that septic systems and agriculture are the most significant portion of the controllable N load (16.58 kg N/day and 17.83, respectively). Fertilizers and runoff combined, contribute 6.1kg N/day and a relatively small contribution from the landfill (0.28 kg N/day). (N loadings, in kg/day, are from Table IV-2 in the MEP Technical Report). In addition, there are nonpoint sources of N from sediments, natural background and atmospheric deposition that cannot be feasibly controlled.

Chilmark and West Tisbury are not subject to the EPA Phase II Program. Storm-water that is subject to the EPA Phase II Program is considered a part of the waste load allocation, rather than the load allocation (see waste load allocation discussion). As discussed above and presented in Chapter IV, V, and VI, of the MEP Technical Report, on Cape Cod and the Islands, the vast majority of storm-water percolates into the aquifer and enters the embayment system through groundwater, thus defining the stormwater in pervious areas to be a component of the nonpoint source load allocation. Therefore, the TMDL accounts for storm-water and groundwater loadings in one aggregate allocation as a non-point source, thus combining the assessments of wastewater and storm-water for the purpose of developing control strategies. A portion of the storm-water load may be controllable through implementation of Best Management Practices (BMPs).

The sediment loading rates incorporated into the TMDL are lower than the existing benthic input listed in Table 5 above because projected reductions of N loadings from the watershed will result in reductions of nutrient concentrations in the sediments and therefore, over time,

reductions in loadings from the sediments will occur. Benthic flux of nitrogen from bottom sediments is a critical (but often overlooked) component of nitrogen loading to the shallow estuarine systems, therefore determination of the site specific magnitude of this component was also performed (see Section VI of the MEP Report). Benthic N flux is a function of N loading and particulate organic N (PON). Projected benthic fluxes are based upon projected PON concentrations and watershed N loads and are calculated by multiplying the present N flux by the ratio of projected PON to present PON using the following formulae:

$$\text{Projected N flux} = (\text{present N flux}) (\text{PON projected} / \text{PON present})$$

$$\text{When: } \text{PON projected} = (R_{load}) (D_{PON}) + \text{PON}_{\text{present offshore}}$$

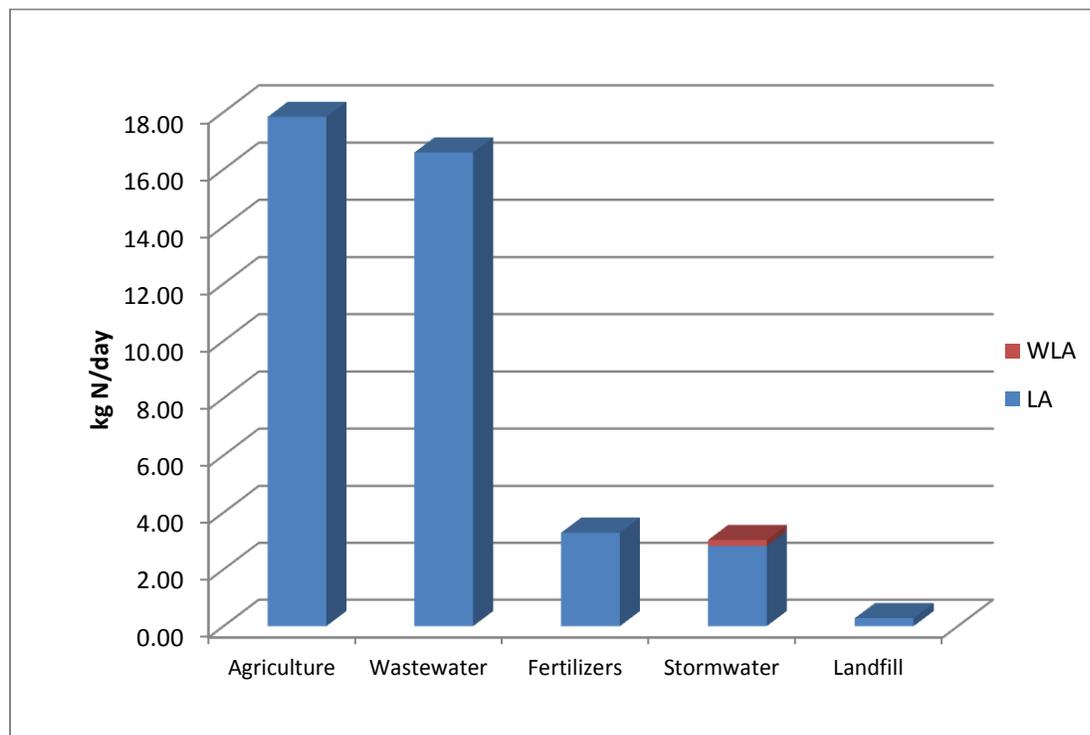
$$\text{When: } R_{load} = (\text{projected N load}) / (\text{Present N load})$$

And:  $D_{PON}$  is the PON concentration above background determined by:

$$D_{PON} = (\text{PON}_{\text{present embayment}} - \text{PON}_{\text{present offshore}})$$

The benthic flux modeled for the Tisbury Great Pond/Black Point Pond estuarine system is reduced from existing conditions based on the load reduction and the observed PON concentrations within each sub-embayment relative to the Atlantic Ocean (boundary condition). The benthic flux input to each sub-embayment was reduced (toward zero) based on the reduction of N in the watershed load. The loadings from atmospheric sources incorporated into the TMDL however, are the same rates presently occurring because, as discussed above, local control of atmospheric loadings is not considered feasible.

**Figure 6: Tisbury Great Pond/Black Point Pond Estuarine System Locally Controllable N Sources (Unattenuated N)**



## Margin of Safety

Statutes and regulations require that a TMDL include a margin of safety (MOS) to account for any lack of knowledge concerning the relationship between load and waste load allocations and water quality [CWA para 303 (d)(2)(c), 40C.G.R. para 130.7(c)(1)]. The MOS must be designed to ensure that any uncertainties in the data or calculations used to link pollutant sources to water quality impairment modeling will be accounted for in the TMDL and ensure protection of the beneficial uses. The EPA's 1991 TMDL Guidance explains that the MOS may be implicit, i.e., incorporated into the TMDL through conservative assumptions in the analysis, or explicit, i.e., expressed in the TMDL as loadings set aside for the MOS. The MOS for the Tisbury Great Pond/Black Point Pond estuarine system TMDL is implicit and the conservative assumptions in the analyses that account for the MOS are described below.

An explicit MOS quantifies an allocation amount separate from other Load and Wasteload Allocations. An explicit MOS can incorporate reserve capacity for future unknowns, such as population growth or effects of climate change on water quality. An implicit MOS is not specifically quantified but consists of statements of the conservative assumptions used in the analysis. The MOS for Tisbury Great Pond Embayment System TMDLs is implicit. MassDEP used conservative assumptions to develop numeric model applications that account for the MOS. These assumptions are described below, and they account for all sources of uncertainty, including the potential impacts of changes in climate.

While the general vulnerabilities of coastal areas to climate change can be identified, specific impacts and effects of changing estuarine conditions are not well known at this time (<https://www.mass.gov/service-details/2011-massachusetts-climate-change-adaptation-report>). Because the science is not yet available, MassDEP is unable to analyze climate change impacts on streamflow, precipitation, and nutrient loading with any degree of certainty for TMDL development. In light of these uncertainties and informational gaps, MassDEP has opted to address all sources of uncertainty through an implicit MOS. MassDEP does not believe that an explicit MOS approach is appropriate under the circumstances or will provide a more protective or accurate MOS than the implicit MOS approach, as the available data simply does not lend itself to characterizing and estimating loadings to derive numeric allocations within confidence limits. Although the implicit MOS approach does not expressly set aside a specific portion of the load to account for potential impacts of climate change, MassDEP has no basis to conclude that the conservative assumptions that were used to develop the numeric model applications are insufficient to account for the lack of knowledge regarding climate change.

Conservative assumptions that support an implicit MOS:

### 7. Use of conservative data in the linked model

The watershed N model provides conservative estimates of N loads to the embayment. Nitrogen transfer through direct groundwater discharge to estuarine waters is based upon studies indicating negligible aquifer attenuation and dilution, i.e. 100% of load enters embayment. This is a conservative estimate of loading because studies have also shown that in some areas less than 100% of the load enters the estuary. In this context, "direct groundwater discharge" refers to

the portion of fresh water that enters an estuary as groundwater seepage into the estuary itself, as opposed to the portion of fresh water that enters as surface water inflow from streams, which receive much of their water from groundwater flow. Nitrogen from the upper watershed regions, which travels through ponds or wetlands, almost always enters the embayment via stream flow, and is directly measured (over 12-16 months) to determine attenuation. In these cases the land-use model has shown a slightly higher predicted N load than the measured discharges in the streams/rivers that have been assessed to date. Therefore, the watershed model as applied to the surface water watershed areas again presents a conservative estimate of N loads because the actual measured N in streams was lower than the modeled concentrations.

The hydrodynamic and water quality models have been assessed directly. In the many instances where the hydrodynamic model predictions of volumetric exchange (flushing) have also been directly measured by field measurements of instantaneous discharge, the agreement between modeled and observed values was 95%. Since the water quality model incorporates all of the outputs from the other models, this excellent fit indicates a high degree of certainty in the final result. The high level of accuracy of the model provides a high degree of confidence in the output; therefore, less of a margin of safety is required.

In the case of N attenuation by freshwater ponds, attenuation was derived from measured N concentrations, pond watershed delineations and pond bathymetry. Mill Pond is the only major freshwater pond in the Tisbury Great Pond watershed with a delineated watershed. Due to its shallow bathymetry and short residence time (0.2-1.0 days) a conservative N attenuation rate of 5% was assigned to the Mill Brook, the outflow from the Mill Pond. Mill Pond is the terminal pond along Mill Brook and therefore integrates the attenuation of TN from each of the ponds and impoundments on Mill Brook. Similarly, the Tiasquam River is the stream outflow from Looks Pond. Measured N at the gage indicates only a 5% N attenuation.

Similarly, the water column N validation dataset was also conservative. The model is validated to measured water column N. However, the model predicts average summer N concentrations. The very high or low measurements are marked as outliers. The effect is to make the N threshold more accurate and scientifically defensible. If a single measurement two times higher than the next highest data point in the series raises the average 0.05 mg N/L, this would allow for a higher “acceptable” load to the embayment. Marking the very high outlier is a way of preventing a single and rare bloom event from changing the N threshold for a system. This effectively strengthens the data set so that a higher margin of safety is not required.

Finally, the predicted reductions in benthic regeneration of N are most likely underestimates, i.e. conservative. The reduction is based solely on a reduced deposition of PON, due to lower primary production rates under the reduced N loading in these systems. As the N loading decreases and organic inputs are reduced, it is likely that rates of coupled remineralization-nitrification, denitrification and sediment oxidation will increase. It was also conservatively assumed that the present negative benthic flux uptake measured in the Tisbury Great Pond System (Tiah Cove, -1.34 kg/day-N) does not exist under future loading conditions and such was designated as “0” for purposes of the TMDL.

Benthic regeneration of N is dependent upon the amount of PON deposited to the sediments and the percentage that is regenerated to the water column versus being denitrified or buried. The regeneration rate projected under reduced N loading conditions was based upon two assumptions

(1) PON in the embayment in excess of that of inflowing tidal water (boundary condition) results from production supported by watershed N inputs and (2) Presently enhanced production will decrease in proportion to the reduction in the sum of watershed N inputs and direct atmospheric N input. The latter condition would result in equal embayment versus boundary condition production and PON levels if watershed N loading and direct atmospheric deposition could be reduced to zero (an impossibility of course). This proportional reduction assumes that the proportion of remineralized N will be the same as under present conditions, which is almost certainly an underestimate. As a result, future N regeneration rates are overestimated which adds to the margin of safety.

## 2. Conservative sentinel station/target threshold nitrogen concentration

Conservatism was used in the selection of the sentinel stations and target threshold N concentrations. The sites were chosen that had stable eelgrass or benthic animal (infaunal) communities, and not those just starting to show impairment, which would have slightly higher N concentration. Meeting the target threshold N concentrations at the sentinel stations will result in reductions of N concentrations in the rest of the system.

## 3. Conservative approach

The target loads were based on tidally averaged N concentrations on the outgoing tide, which is the worst case condition because that is when the N concentrations are the highest. The N concentrations will be lower on the flood tides and therefore this approach is conservative.

Finally, the linked model accounted for all stormwater loadings and groundwater loadings in one aggregate allocation as a nonpoint source and this aggregate load is accounted for in the load allocation. The method of calculating the WLA in the TMDL for regulated stormwater was conservative as it did not disaggregate this negligible load from the modeled stormwater LA, hence this approach further enhances the margin of safety.

In addition to the margin of safety within the context of setting the N threshold levels as described above, a programmatic margin of safety also derives from continued monitoring of these embayments to support adaptive management. This continuous monitoring effort provides the ongoing data to evaluate the improvements that occur over the multi-year implementation of the N management plan. This will allow refinements to the plan to ensure that the desired level of restoration is achieved.

## **Seasonal Variation**

Since the TMDLs for the waterbody segments are based on the most critical time period, i.e. the summer growing season, the TMDLs are protective for all seasons. The daily loads can be converted to annual loads by multiplying by 365 (the number of days in a year). Nutrient loads to the embayment are based on annual loads for two reasons. The first is that primary production in coastal waters can peak in both the late winter-early spring and in the late summer-early fall periods. Second, as a practical matter, the types of controls necessary to control the N load, the nutrient of primary concern, by their very nature do not lend themselves to intra-annual manipulation since the majority of the N is from non-point sources. Thus, the annual loads make

sense since it is difficult to control non-point sources of N on a seasonal basis and N sources can take considerable time to migrate to impacted waters.

## **TMDL Values for the Tisbury Great Pond/Black Point Pond Estuarine System**

As outlined above, the total maximum daily loadings of N that would provide for the restoration and protection of the embayment were calculated by considering all sources of N grouped by natural background, point sources and non-point sources. A more meaningful way of presenting the loadings data from an implementation perspective is presented in Table 7 and Appendix D.

In this table the N loadings from the atmosphere are listed separately from the target watershed threshold loads which are composed of natural background N along with locally controllable N from the on-site subsurface wastewater disposal systems, agriculture, fertilizer sources, storm-water runoff and the landfill. In the case of the Tisbury Great Pond /Black Point Pond estuarine system the TMDLs were calculated by projecting reductions in locally controllable septic systems in the Mill Brook and Tiasquam River subwatersheds. Once again the goals of these TMDLs are to achieve the identified target threshold N concentration at the identified sentinel stations.

**Table 7: The Total Maximum Daily Loads (TMDL) for the Tisbury Great Pond/Black Point Pond Estuarine System. Represented as the Sum of the Calculated Target Threshold Loads, Atmospheric Deposition and Sediment Load**

System Component	Target Threshold Watershed Load <sup>1</sup> (kg N/day)	Atmospheric Deposition (kg N/day)	Load from Sediments <sup>2</sup> (kg N/day)	TMDL <sup>3</sup> (kg N/day)
Deep Bottom Cove	2.8	1.51	0.55	4.86
Tiah Cove	2.25	0.78	0	3.03
Pear Tree Cove	3.84	0.26	0.01	4.1
Tisbury Great Pond-main basin	16.97	7.83	8.9	33.7
Black Point Pond	0.8	0.94	6.17	7.9
Mill Brook	7.03	-	-	7.03
Tiasquam River	3.51	-	-	3.51
<b>System Total</b>	<b>37.2</b>	<b>11.3</b>	<b>15.63</b>	<b>64.12</b>

<sup>1</sup>Target threshold watershed load (including natural background) is the load from the watershed needed to meet the target threshold nitrogen concentrations for the embayment, identified in Table 4.

<sup>2</sup> Projected sediment N loadings obtained by reducing the present sediment flux loading rates (Table 5) proportional to proposed watershed load reductions and factoring in the existing and projected future concentrations of PON. (Negative fluxes set to zero.)

<sup>3</sup> Sum of target threshold watershed load, atmospheric deposition, and sediment load.

The target loads identified in this table represent one alternative-loading scenario to achieve that goal but other scenarios may be possible and approvable as well.

## **Implementation Plans**

The critical element of this TMDL process is achieving the sentinel station specific target threshold N concentrations presented in Table 4, above, that are necessary for the restoration and protection of water quality and eelgrass/infaunal habitat within the Tisbury Great Pond/Black Point Pond estuarine system. In order to achieve these target threshold N concentrations, N loading rates must be reduced throughout the embayment system. Additionally, the MEP recommends adding a seventeen day plus (17 day +) late summer breach for Tisbury Great Pond to further reduce the buildup in nitrogen levels at a critical habitat stressor time.

**Agricultural load** contributes the largest controllable N load (44%) to this system therefore it is recommended that the watershed communities also implement agricultural BMPs throughout the watershed with a goal of reducing N contribution from agricultural sources by 10% watershed-wide. By reducing the agricultural N load by just 10%, the need for sewerage could be reduced in some areas. The towns of West Tisbury and Chilmark should consider requesting an additional model run from SMAST that evaluates a scenario that includes recommendations for reductions in agriculture N loads, as well as, septic loads from the various subembayments. This will help focus agricultural BMP implementation activities to areas that will most effectively reduce N loads and perhaps reduce the need for sewerage. In particular, reductions in N use on agricultural land located immediately adjacent to Town Cove, Pear Tree Cove and Tiah Cove would provide improvements to water quality. Massachusetts Department of Agricultural Resources, Plant Nutrient Application Requirements, 330 CMR 31.00, became effective December 2015. These regulations require basic plant nutrient applications for 10 or more acres and adherence to application and seasonal restrictions.

**Septic system** loads from private residences is the second largest contributor to the controllable N load (40%), therefore as part of the Comprehensive Water Resources Management Plan (CWRMP) the town should assess the most cost-effective options for achieving the target N watershed loads, including but not limited to, sewerage and treatment for N control of sewage and septage at either centralized or de-centralized locations and denitrifying systems for all private residences.

**Breaching the barrier beach.** Current management of Tisbury Great Pond involves excavation of a trench through the barrier beach roughly every 3 months to allow tidal exchange with the Atlantic Ocean. Pond water levels must be at least one meter above mean sea level before a breach is attempted in order to have sufficient head to erode a channel to the sea. Breaching of the pond is undertaken mainly as a means of controlling salinity levels in the pond and as a flood control measure to maintain groundwater levels low enough to prevent flooding of basements of the homes bordering the pond. Records kept between 1993 and 2011 indicate the breach is typically opened three times each year with an average cumulative total of 144 days open per year. The average duration of all openings in the record was 42 days.

The riparian Owners of Tisbury Great Pond Association, coordinate and manage the breaching of pond. A number of considerations are taken into account; pond water level, fish spawning,

salinity, nitrogen, turbidity, tidal cycles, shoaling, weather and nesting shore birds. Typically an the trench is excavated through the barrier beach every 3 months to allow tidal exchange with the Atlantic Ocean

One recommended alternative to evaluate for management of low to moderate nutrient impairment of Black Point Pond, is to reduce the restriction in the channel connecting it to Tisbury Great Pond. Reducing the restriction will increase tidal exchange when Tisbury Great Pond is open to the low N waters of the Atlantic Ocean.

Table 8 presents a load reducing scenario to achieve the target threshold N concentration based on reducing the septic loads from three of the subwatersheds and includes a late spring and a mid-summer breach which remains open for 17 days (as part of the quarterly beaching schedule that now occurs). The modeling assumed that the breach openings allowed the pond-averaged TN concentrations to lower to 0.30 mg/L. The model also assumed that the breach closed for 60 days between breaches to allow the water level in the pond to rise sufficiently to allow flow through after the next breach.

**Table 8: Summary of the Present Septic System Loads and the Loading Reductions Necessary to Achieve the TMDL by Reducing Septic System Loads and Breaching the Inlet**

System Component	Present Septic N Load (kg N/day)	Threshold Septic load (kg N/day)	Threshold Septic Load % Change
Deep Bottom Cove	1.23	1.23	0.0%
Tiah Cove	1.14	1.14	0.0%
Pear Tree Cove	1.70	1.70	0.0%
Tisbury GP main basin	6.41	1.28	-80.0%
Black Point Pond	0.45	0.45	0.0%
Town Cove – Mill Brook	2.30	0.69	-70.0%
Town Cove – Tiasquam River	2.92	0.88	-70.0%
Total system	16.15	7.36	-54.4%

From Table VIII-2, Howes *et al*, 2013.

As previously noted, there is a variety of loading reduction scenarios that could achieve the target threshold N concentrations. Local officials can explore other loading reduction scenarios through additional modeling as part of their CWRMP. It must be demonstrated however, that any alternative implementation strategies will be protective of the entire embayment system. To this end, additional linked model runs can be performed by the MEP at a nominal cost to assist the planning efforts of the town in achieving target N loads that will result in the desired target threshold N concentration. The CWRMP should include a schedule of the selected strategies and estimated timelines for achieving those targets. However, the MassDEP realizes that an adaptive management approach may be used to observe implementation results over time and allow for adjustments based on those results. If a community chooses to implement TMDL measures without a CWRMP it must demonstrate that these measures will achieve the target threshold N

concentration. (Note: Communities that choose to proceed without a CWRMP will not be eligible for State Revolving Fund 0% loans.)

### **Climate Change:**

MassDEP recognizes that long-term (25+ years) climate change impacts to southeastern Massachusetts, including the area of this TMDL, are possible based on known science. Massachusetts Executive Office of Energy and Environmental Affairs 2011 Climate Change Adaptation Report: <https://www.mass.gov/service-details/2011-massachusetts-climate-change-adaptation-report> predicts that by 2100 the sea level could be from 1 to 6 feet higher than the current position and precipitation rates in the Northeast could increase by as much as 20 percent. However, the details of how climate change will affect sea level rise, precipitation, streamflow, sediment and nutrient loading in specific locations are generally unknown. The ongoing debate is not about whether climate change will occur, but the rate at and the extent to which it will occur and the adjustments needed to address its impacts. EPA's 2012 Climate Change Strategy [http://water.epa.gov/scitech/climatechange/upload/epa\\_2012\\_climate\\_water\\_strategy\\_full\\_report\\_final.pdf](http://water.epa.gov/scitech/climatechange/upload/epa_2012_climate_water_strategy_full_report_final.pdf) states: "Despite increasing understanding of climate change, there still remain questions about the scope and timing of climate change impacts, especially at the local scale where most water-related decisions are made." For estuarine TMDLs in southeastern Massachusetts, MassDEP recognizes that this is particularly true, where water quality management decisions and implementation actions are generally made and conducted at the municipal level on a sub-watershed scale.

EPA's Climate Change Strategy identifies the types of research needed to support the goals and strategic actions to respond to climate change. EPA acknowledges that data are missing or not available for making water resource management decisions under changing climate conditions. In addition, EPA recognizes the limitation of current modeling in predicting the pace and magnitude of localized climate change impacts and recommends further exploration of the use of tools, such as atmospheric, precipitation and climate change models, to help states evaluate pollutant load impacts under a range of projected climatic shifts.

In 2013, EPA released a study entitled, "Watershed modeling to assess the sensitivity of streamflow, nutrient, and sediment loads to potential climate change and urban development in 20 U.S. watersheds." (National Center for Environmental Assessment, Washington D.C.; EPA/600/R-12/058F). The closest watershed to southeastern Massachusetts that was examined in this study is a New England coastal basin located between Southern Maine and Central Coastal Massachusetts. These watersheds do not encompass any of the watersheds in the Massachusetts Estuary Project (MEP) region, and it has vastly different watershed characteristics, including soils, geography, hydrology, and land use – key components used in a modeling analysis. The initial "first order" conclusion of this study is that, in many locations, future conditions, including water quality, are likely to be different from past experience. However, most significantly, this study did not demonstrate that changes to TMDLs (the water quality restoration targets) would be necessary for the region. EPA's 2012 Climate Change Strategy also acknowledges that the Northeast, including New England, needs to develop standardized regional assumptions regarding future climate change impacts. EPA's 2013 modeling study does not provide the scientific methods and robust datasets needed to predict specific long-term climate change impacts in the MEP region to inform TMDL development.

MassDEP believes that impacts of climate change should be addressed through TMDL implementation with an adaptive management approach in mind. Adjustments can be made as environmental conditions, pollutant sources, or other factors change over time. Massachusetts Coastal Zone Management (CZM) has developed a StormSmart Coasts Program (2008) to help coastal communities address impacts and effects of erosion, storm surge and flooding which are increasing due to climate change. The program, [www.mass.gov/czm/stormsmart](http://www.mass.gov/czm/stormsmart) offers technical information, planning strategies, legal and regulatory tools to communities to adapt to climate change impacts.

As more information and tools become available, there may be opportunities to make adjustments in TMDLs in the future to address predictable climate change impacts. When the science can support assumptions about the effects of climate change on the nitrogen loadings to the Tisbury Great Pond/Black Point Pond Estuarine System the TMDL can be reopened, if warranted.

Chilmark and West Tisbury are urged to meet the target threshold N concentrations by reducing N loadings from any and all sources, through whatever means are available and practical, including agricultural BMPs, reductions in storm-water runoff and/or fertilizer use within the watershed through the establishment of local by-laws, and/or the implementation of storm-water BMPs, in addition to reductions in on-site subsurface wastewater disposal system loadings.

Based on land-use and the fact that the watershed of this system is located completely within the towns of Chilmark and West Tisbury it follows that nitrogen management necessary for the restoration of the Tisbury Great Pond System may be formulated and implemented entirely through the two towns.

MassDEP's MEP Implementation Guidance report:

<http://www.mass.gov/dep/water/resources/coastalr.htm#guidance> provides N loading reduction strategies that are available to Chilmark and West Tisbury and could be incorporated into the implementation plans. The following topics related to N reduction are discussed in the Guidance:

- Wastewater Treatment
  - On-Site Treatment and Disposal Systems
  - Cluster Systems with Enhanced Treatment
  - Community Treatment Plants
  - Municipal Treatment Plants and Sewers
- Tidal Flushing
  - Channel Dredging
  - Inlet Alteration
  - Culvert Design and Improvements
- Storm-water Control and Treatment \*
  - Source Control and Pollution Prevention
  - Storm-water Treatment
- Attenuation via Wetlands and Ponds
- Water Conservation and Water Reuse
- Management Districts

- Land Use Planning and Controls
  - Smart Growth
  - Open Space Acquisition
  - Zoning and Related Tools
  - Agricultural BMPs
- Nutrient Trading

## **Monitoring Plan**

MassDEP is of the opinion that there are two forms of monitoring that are useful to determine progress towards achieving compliance with the TMDL. MassDEP's position is that implementation will be conducted through an iterative process where adjustments maybe needed in the future. The two forms of monitoring include 1) tracking implementation progress as approved in the CWRMP plan and 2) monitoring water quality and habitat conditions in the estuaries, including but not limited to, the sentinel stations identified in the MEP Technical Report.

The CWRMP will evaluate various options to achieve the goals set out in the TMDL report and the MEP Technical Report. It will also make a final recommendation based on existing or additional modeling runs, set out required activities, and identify a schedule to achieve the most cost effective solution that will result in compliance with the TMDL. Through the adaptive management approach ongoing monitoring will be conducted and will indicate if water quality standards are being met. If this does not occur other management activities would have to be identified and considered to reach to goals outlined in this TMDL. Once approved by the Department tracking progress on the agreed upon plan will, in effect, also be tracking progress towards water quality improvements in conformance with the TMDL.

Relative to water quality, MassDEP believes that an ambient monitoring program much reduced from the data collection activities needed to properly assess conditions and to populate the model, will be important to determine actual compliance with water quality standards. Although the TMDL values are not fixed, the target threshold N concentrations at the sentinel stations are fixed. Through discussions amongst the MEP it is generally agreed that existing monitoring programs which were designed to thoroughly assess conditions and populate water quality models can be substantially reduced for compliance monitoring purposes. Although more specific details need to be developed on a case-by-case basis MassDEP believes that about half the current effort (using the same data collection procedures) would be sufficient to monitor compliance over time and to observe trends in water quality changes. In addition, the benthic habitat and communities would require periodic monitoring on a frequency of about every 3-5 years. Finally, in addition to the above, existing monitoring conducted by MassDEP for eelgrass should continue into the future to observe any changes that may occur to eelgrass populations as a result of restoration efforts.

The MEP will continue working with the watershed communities to develop and refine monitoring plans that remain consistent with the goals of the TMDL. It must be recognized however that development and implementation of a monitoring plan will take some time, but it is more important at this point to focus efforts on reducing existing watershed loads to achieve water quality goals.

## **Reasonable Assurances**

MassDEP possesses the statutory and regulatory authority, under the water quality standards and/or the State Clean Water Act (CWA), to implement and enforce the provisions of the TMDL through its many permitting programs including requirements for N loading reductions from on-site subsurface wastewater disposal systems. However, because most non-point source controls are voluntary, reasonable assurance is based on the commitment of the locality involved. The towns expect to use the information in this TMDL to generate support from their citizens to take the necessary steps to remedy existing problems related to N loading from on-site subsurface wastewater disposal systems, agriculture, the landfill, storm-water runoff (including fertilizers), and to prevent any future degradation of these valuable resources.

Moreover, reasonable assurances that the TMDL will be implemented include enforcement of regulations, availability of financial incentives and local, state and federal programs for pollution control. Storm-water NPDES permit coverage will address discharges from municipally owned storm-water drainage systems (where applicable). Enforcement of regulations controlling non-point discharges include local implementation of the Commonwealth's Wetlands Protection Act and Rivers Protection Act, Title 5 regulations for on-site subsurface wastewater disposal systems and other local regulations (such as the Town of Rehoboth's stable regulations). West Tisbury adopted a Wetlands Bylaw in 2006 which includes a 100 foot setback for septic system leach fields near salt ponds.

Financial incentives include federal funds available under Sections 319, 604 and 104(b) programs of the CWA, which are provided as part of the Performance Partnership Agreement between MassDEP and EPA. Other potential funds and assistance are available through the Massachusetts Department of Agriculture's Enhancement Program and the United States Department of Agriculture's Natural Resources Conservation Services. Additional financial incentives include income tax credits and low interest loans for Title 5, on-site subsurface wastewater disposal system upgrades, available through municipalities participating in this portion of the state revolving fund program. As the towns implement these TMDLs the loading values (kg/day of N) will be used by MassDEP for guidance for permitting activities and should be used by the communities as a management tool.

## **Public Participation**

The Public meeting to present the results of and answer questions on this TMDL was held on January 23, 2018 at the West Tisbury Public Library, West Tisbury, MA. Patti Kellogg, Brian Dudley and Barbara Kickham of MassDEP summarized the Massachusetts Estuaries Project and described the Draft Nitrogen TMDL Report findings. Public comments received at the public meeting and comments received in writing within a 30-day comment period following the public meeting, were considered by the Department. This final version of the TMDL report includes both a summary of the public comments together with the Department's response to the comments and scanned images of the attendance sheets from the meetings (Appendix E).

## References

Environmental Protection Agency (2001). Nutrient Criteria Technical Guidance Manual: Estuarine and Coastal Waters (EPA-822-B-01-003). The United States Environmental Protection Agency, Washington D.C. Available at: <http://www2.epa.gov/nutrient-policy-data/nutrient-criteria-technical-guidance-manual-estuarine-and-coastal-waters>

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MassDEP (2015). CN 400.1. *Massachusetts Year 2014 Integrated List of Waters: Final Listing of the Condition of Massachusetts' Waters Pursuant to Sections 305(b), 314 and 303(d) of the Clean Water Act*. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MassDEP (2007). *Massachusetts Surface Water Quality Standards (314 CMR 4.00)*. Massachusetts Department of Environmental Protection, 1 Winter Street, Boston, MA.

## **Appendix A: Overview of Applicable Water Quality Standards**

Water quality standards of particular interest to the issues of cultural eutrophication are dissolved oxygen, nutrients, bottom pollutants or alterations, aesthetics, excess plant biomass, and nuisance vegetation. The Massachusetts water quality standards (314 CMR 4.0) contain numeric criteria for dissolved oxygen, but have only narrative standards that relate to the other variables. This brief summary does not supersede or replace 314 CMR 4.0 Massachusetts Water Quality Standards, the official and legal standards. A complete version of 314 CMR 4.0 Massachusetts Water Quality Standards is available online at <https://www.mass.gov/regulations/314-CMR-4-the-massachusetts-surface-water-quality-standards> **Applicable Narrative Standards**

314 CMR 4.05(5)(a) states “Aesthetics – All surface waters shall be free from pollutants in concentrations that settle to form objectionable deposits; float as debris, scum, or other matter to form nuisances, produce objectionable odor, color, taste, or turbidity, or produce undesirable or nuisance species of aquatic life.”

314 CMR 4.05(5)(b) states “Bottom Pollutants or Alterations. All surface waters shall be free from pollutants in concentrations or combinations or from alterations that adversely affect the physical or chemical nature of the bottom, interfere with the propagation of fish or shellfish, or adversely affect populations of non-mobile or sessile benthic organisms.”

314 CMR 4.05(5)(c) states, “Nutrients – Unless naturally occurring, all surface waters shall be free from nutrients in concentrations that would cause or contribute to impairment of existing or designated uses and shall not exceed the site specific criteria developed in a TMDL or as otherwise established by the Department pursuant to 314 CMR 4.00. Any existing point source discharge containing nutrients in concentrations that would cause or contribute to cultural eutrophication, including the excessive growth of aquatic plants or algae, in any surface water shall be provided with the most appropriate treatment as determined by the Department, including, where necessary, highest and best practical treatment (HBPT) for POTWs and BAT for non POTWs, to remove such nutrients to ensure protection of existing and designated uses. Human activities that result in the nonpoint source discharge of nutrients to any surface water may be required to be provided with cost effective and reasonable best management practices for nonpoint source control.”

### **Description of Coastal and Marine Classes and Numeric Dissolved Oxygen Standards**

*Excerpt from 314 CMR 4.05(4) (a):*

- (4) Class SA. These waters are designated as an excellent habitat for fish, other aquatic life and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation. In certain waters, excellent habitat for fish, other aquatic life and wildlife may include, but is not limited to, seagrass. Where designated in the tables to 314 CMR 4.00 for shellfishing, these waters shall be suitable for shellfish harvesting without depuration (Approved and Conditionally Approved Shellfish Areas). These waters shall have excellent aesthetic value.

1. Dissolved Oxygen. Shall not be less than 6.0 mg/l. Where natural background conditions are lower, DO shall not be less than natural background. Natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained.

*Excerpt from 314 CMR 4.05(4) (b):*

(b) Class SB. These waters are designated as a habitat for fish, other aquatic life and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation. In certain waters, habitat for fish, other aquatic life and wildlife may include, but is not limited to, seagrass. Where designated in the tables to 314 CMR 4.00 for shellfishing, these waters shall be suitable for shellfish harvesting with depuration (Restricted and Conditionally Restricted Shellfish Areas). These waters shall have consistently good aesthetic value.

1. Dissolved Oxygen. Shall not be less than 5.0 mg/l. Seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained. Where natural background conditions are lower, DO shall not be less than natural background.

*Excerpt from 314 CMR 4.05(3) (b):*

(b) Class B. These waters are designated as a habitat for fish, other aquatic life, and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation. Where designated in 314 CMR 4.06, they shall be suitable as a source of public water supply with appropriate treatment (“Treated Water Supply”). Class B waters shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value.

1. Dissolved Oxygen. Shall not be less than 6.0 mg/l in cold water fisheries and not less than 5.0 mg/l in warm water fisheries. Where natural background conditions are lower, DO shall not be less than natural background conditions. Natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained.

### **Waterbodies Not Specifically Designated in 314 CMR 4.06 or the tables to 314 CMR 4.00**

Note many waterbodies do not have a specific water quality designation in 314 CMR 4.06 or the tables to 314 CMR 4.00. Coastal and Marine Classes of water are designated as Class SA and presumed High Quality Waters as described in 314 CMR 4.06 (4).

*314 CMR 4.06(4):*

(4) Other Waters. Unless otherwise designated in 314 CMR 4.06 or unless otherwise listed in the tables to 314 CMR 4.00, other waters are Class B, and presumed High Quality Waters for inland waters and Class SA, and presumed High Quality Waters for coastal and marine waters. Inland fisheries designations and coastal and marine shellfishing designations for unlisted waters shall be made on a case-by-case basis as necessary.

### **Applicable Antidegradation Provisions**

Applicable antidegradation provisions are detailed in 314 CMR 4.04 from which an excerpt is provided:

*Excerpt from 314 CMR 4.04:*

4.04:Antidegradation Provisions

(4) Protection of Existing Uses. In all cases existing uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.

(2) Protection of High Quality Waters. High Quality waters are waters whose quality exceeds minimum levels necessary to support the national goal uses, low flow waters, and other waters whose character cannot be adequately described or protected by traditional criteria. These waters shall be protected and maintained for their existing level of quality unless limited degradation by a new or increased discharge is authorized by the Department pursuant to 314 CMR 4.04(5). Limited degradation also may be allowed by the Department where it determines that a new or increased discharge is insignificant because it does not have the potential to impair any existing or designated water use and does not have the potential to cause any significant lowering of water quality.

(3) Protection of Outstanding Resource Waters. Certain waters are designated for protection under this provision in 314 CMR 4.06. These waters include Class A Public Water Supplies (314 CMR 4.06(1)(d)1.) and their tributaries, certain wetlands as specified in 314 CMR 4.06(2) and other waters as determined by the Department based on their outstanding socio-economic, recreational, ecological and/or aesthetic values. The quality of these waters shall be protected and maintained.

(a) Any person having an existing discharge to these waters shall cease said discharge and connect to a Publicly Owned Treatment Works (POTW) unless it is shown by said person that such a connection is not reasonably available or feasible. Existing discharges not connected to a POTW shall be provided with the highest and best practical method of waste treatment determined by the Department as necessary to protect and maintain the outstanding resource water.

(b) A new or increased discharge to an Outstanding Resource Water is prohibited unless: the discharge is determined by the Department to be for the express purpose and intent of maintaining or enhancing the resource for its designated use and an authorization is granted as provided in 314 CMR 4.04(5). The Department's determination to allow a new or increased discharge shall be made in agreement with the federal, state, local or private entity recognized by the Department as having direct control of the water resource or governing water use; or the discharge is dredged or fill material for qualifying activities in limited circumstances, after an alternatives analysis which considers the Outstanding Resource Water designation and further minimization of any adverse impacts.

Specifically, a discharge of dredged or fill material is allowed only to the limited extent specified in 314 CMR 9.00 and 314 CMR 4.06(1)(d). The Department retains the authority to deny discharges which meet the criteria of 314 CMR 9.00 but will result in substantial adverse impacts to the physical, chemical, or biological integrity of surface waters of the Commonwealth

(4) Protection of Special Resource Waters. Certain waters of exceptional significance, such as waters in national or state parks and wildlife refuges, may be designated by the

Department in 314 CMR 4.06 as Special Resource Waters (SRWs). The quality of these waters shall be maintained and protected so that no new or increased discharge and no new or increased discharge to a tributary to a SRW that would result in lower water quality in the SRW may be allowed, except where:

- (a) the discharge results in temporary and short term changes in the quality of the SRW, provided that the discharge does not permanently lower water quality or result in water quality lower than necessary to protect uses; and
- (b) an authorization is granted pursuant to 314 CMR 4.04(5).

(5) Authorizations.

(a) An authorization to discharge to waters designated for protection under 314 CMR 4.04(2) may be issued by the Department where the applicant demonstrates that:

- 1. The discharge is necessary to accommodate important economic or social development in the area in which the waters are located;
- 2. No less environmentally damaging alternative site for the activity, receptor for the disposal, or method of elimination of the discharge is reasonably available or feasible;
- 3. To the maximum extent feasible, the discharge and activity are designed and conducted to minimize adverse impacts on water quality, including implementation of source reduction practices; and
- 4. The discharge will not impair existing water uses and will not result in a level of water quality less than that specified for the Class.

(b) An authorization to discharge to the narrow extent allowed in 314 CMR 4.04(3) or 314 CMR 4.04(4) may be granted by the Department where the applicant demonstrates compliance with 314 CMR 4.04(5)(a)2. Through 314 CMR 4.04(5)(a)4.

(c) Where an authorization is at issue, the Department shall circulate a public notice in accordance with 314 CMR 2.06. Said notice shall state an authorization is under consideration by the Department, and indicate the Department's tentative determination. The applicant shall have the burden of justifying the authorization. Any authorization granted pursuant to 314 CMR 4.04 shall not extend beyond the expiration date of the permit.

(d) A discharge exempted from the permit requirement by 314 CMR 3.05(4) (discharge necessary to abate an imminent hazard) may be exempted from 314 CMR 4.04(5) by decision of the Department.

(e) A new or increased discharge specifically required as part of an enforcement order issued by the Department in order to improve existing water quality or prevent existing water quality from deteriorating may be exempted from 314 CMR 4.04(5) by decision of the Department.

(6) The Department applies its Antidegradation Implementation Procedures to point source discharges subject to 314 CMR 4.00.

(7) Discharge Criteria. In addition to the other provisions of 314 CMR 4.00, any authorized Discharge shall be provided with a level of treatment equal to or exceeding the requirements of the Massachusetts Surface Water Discharge Permit Program (314 CMR 3.00). Before authorizing a discharge, all appropriate public participation and intergovernmental coordination shall be conducted in accordance with Permit Procedures (314 CMR 2.00).

**Appendix B: Summary of the Nitrogen Concentrations for Tisbury Great Pond/Black Point Pond Estuarine System.**

(Excerpted from Howes *et. al* 2013, pg. 100)

Sampling Location	Station ID	Years of Data	Mean* (mg/L)	Standard deviation (mg/L)	N	Mean* (ppt)	Standard deviation (ppt)	N
Town Cove upper	TGP-1	12	0.643	0.254	48	9.9	7.1	50
Tiasquam River	TGP-2	11	0.563	0.219	42	10.5	6.9	44
Pear Tree Cove	TGP-3	6	0.485	0.132	23	12.6	6.8	24
Muddy Cove	TGP-3A	1	0.785	0.422	4	14.7	4.4	4
Town Cove mid	TGP-4	12	0.528	0.197	68	14.7	7.7	71
Tiah Cove	TGP-5	3	0.422	0.134	21	12.0	4.3	21
Deep Bottom Cove	TGP-6	12	0.536	0.213	49	14.3	5.8	53
Tisbury Great Pond low	TGP-7	11	0.509	0.263	49	17.0	6.3	53
Crab Creek	TGP-8	3	0.430	0.124	13	13.1	4.1	13
Tisbury Great Pond mid	TGP-9	1	0.413	0.156	4	13.2	5.7	4
Atlantic Ocean			0.232	0.044	17	32.3	0.6	5

\*The mean values represent the average of separate yearly means. Data represented were collected from 1995 through 2007 and 2011 in Great Pond. Offshore Atlantic Ocean data are from the summer of 2005.

**Appendix C: The Tisbury Great Pond and Black Point Pond Estuarine System estimated waste load allocation (WLA) from runoff of all impervious areas within 200 feet of its waterbodies.**

Estuary System Name	Watershed Impervious Area in 200ft Buffer of Embayment Waterbody (acres) <sup>1</sup>	Total Watershed Impervious Area (acres) <sup>2</sup>	Watershed Impervious Area in 200ft buffer as % of Total Watershed Impervious Area	MEP Total Unattenuated Watershed Impervious Load (kg/day) <sup>3</sup>	MEP Total Unattenuated Watershed Load (kg/day) <sup>4</sup>	Watershed Impervious buffer 200ft WLA (kg/day) <sup>5</sup>	Watershed buffer area WLA as percentage of MEP Total Unattenuated Watershed Load <sup>6</sup>
Tisbury Great Pond and Black Point Pond	13.81	182.44	7.6%	2.82	59.15	0.21	0.36%

1. The entire impervious area within a 200 foot buffer zone around all waterbodies as calculated by MassGIS. Due to the soils and geology of Cape Cod and the Islands it is unlikely that runoff would be channeled as a point source directly to a waterbody from areas more than 200 feet away. Some impervious areas within approximately 200 feet of the shoreline may discharge stormwater via pipes directly to the waterbody. For the purposes of the waste load allocation (WLA) it was assumed that all impervious surfaces within 200 feet of the shoreline discharge directly to the waterbody.
2. Total impervious surface for the watershed was obtained from SMAST N load data files.
3. From Table IV-2 of the MEP Technical Report.
4. This includes the unattenuated nitrogen loads from wastewater from septic systems, fertilizer, runoff from both natural and impervious surfaces, and atmospheric deposition to freshwater waterbodies.
5. The impervious watershed 200 ft. buffer area (acres) divided by total watershed impervious area (acres) then multiplied by total impervious watershed load (kg/day).
6. The impervious watershed buffer area WLA (kg/day) divided by the total watershed load (kg/day) then multiplied by 100.

**Appendix D: Tisbury Great Pond/Black Point Pond Estuarine System Total Nitrogen TMDLs (One TMDL for Restoration, Three Protective TMDLs)**

<b>Sub-embayment</b>	<b>Waterbody Segment ID</b>	<b>Impairment</b>	<b>Type of TMDL</b>	<b>TMDL (kg N/day)</b>
Deep Bottom Cove <sup>1</sup>				4.86
Tiah Cove				3.03
Pear Tree Cove				4.10
Tisbury Great Pond-main basin				33.70
<b>Tisbury Great Pond<sup>2,3</sup></b>	MA97-18	Nutrients, Dissolved Oxygen, Chlorophyll a, Benthic Fauna, Eelgrass.	<b>Restoration</b>	<b>45.69</b>
<b>Black Point Pond</b>	MA97-33	Not found to be impaired for nutrients during MEP but TMDL needed since waterbodies are hydraulically linked.	<b>Protective<sup>4</sup></b>	<b>7.90</b>
<b>Mill Brook<sup>5</sup></b>	MA97-24	Not found to be impaired for nutrients during MEP but TMDL needed since waterbodies are hydraulically linked.	<b>Protective<sup>4</sup></b>	<b>7.03</b>
<b>Tiasquam River<sup>5</sup></b>	MA97-25	Not found to be impaired for nutrients by MEP but TMDL needed since waterbodies are hydraulically linked.	<b>Protective<sup>4</sup></b>	<b>3.51</b>
Total for System:				64.13

<sup>1</sup> MEP study included Thumb Cove as part of Deep Bottom Cove.

<sup>2</sup> The total load for Tisbury Great Pond includes the load for Deep Bottom Cove, Tiah Cove, Pear Tree Cove, and Tisbury Great Pond main basin.

<sup>3</sup> This segment will be evaluated for nutrient impairment in a future Massachusetts Integrated List of Waters.

<sup>4</sup> Not impaired for nutrients, but TMDL needed since embayments are linked. (Pollution Prevention TMDL)

<sup>5</sup> Freshwater segments.

## Appendix E: Response to Comments

### Massachusetts Estuaries Project (MEP) Response to Comments For

DRAFT TOTAL MAXIMUM DAILY LOAD (TMDL) REPORT FOR  
TISBURY GREAT POND AND BLACK POINT POND (CONTROL #398.0)  
(REPORT DATED DECEMBER 2017)

THE FOLLOWING INCLUDES PUBLIC COMMENTS RECEIVED ON JANUARY 23, 2018 AT THE PUBLIC MEETING AND WRITTEN RESPONSES RECEIVED BY FEBRUARY 22, 2018. MASSDEP RESPONSES TO THOSE QUESTIONS/COMMENTS FOLLOWS.

#### **1. What is benthic fauna?**

MassDEP Response: Benthic fauna refers to the various organisms found on (epifauna) and in (infauna) the seabed. Sediment dwelling benthic fauna can be subdivided into the main groups of mussels/snails, crustaceans, bristle worms and enchinoderms. Benthic fauna are sensitive to over-enrichment of nutrients in the water column which subsequently settle and accumulate in the sediments. The sediments become overlain with thick layers of muck which results decreases in the number and diversity of benthic fauna.

#### **2. Do you have any more detailed information about agricultural runoff? Do you have agricultural loads broken out into separate categories for farming and farm animals?**

MassDEP Response: The MEP data disk has detailed information on the numbers and types of farm animals by parcel and the number of acres of land under agricultural use. However, for the purposes of the TMDL, the total nitrogen load attributed to both farm animals and farming crops was added together and referred to as “agricultural” load. With respect to the total nitrogen load attributed to agricultural land uses, it was not separated into load from animals and from crops.

#### **3. There is a lot of nitrogen in middle of pond. How often did you test the water in the middle of the pond?**

MassDEP Response: Sentinel station, TGP-7, is located in the middle of the main basin of Tisbury Great Pond. This station was sampled as frequently as the other sentinel stations. For purposed of the Technical Report, samples were collected there for 11 years, for a total of 49 samples, at the same or more frequently than the other stations. The average concentration at this station was 0.51 mg/L.

#### **4. Is DEP in the position to provide technical assistance to the towns and help decide what to do next?**

MassDEP Response: The next step for the towns of West Tisbury and Chilmark is to hire a consultant to begin Comprehensive Water Resources Management Planning (CWRMP). The MassDEP will work closely with you and your consultant to navigate this process. MassDEP is available as a technical resource and will work with the towns to prepare and implement the CWRMP to direct nitrogen removal strategies. Grant funding for stormwater Best Management Practices is available under the 319 Program. Low and even zero percent interest loans are available through the State Revolving Fund for infrastructure construction projects for nutrient reduction. MassDEP will support long term monitoring of eelgrass in coastal areas. MassDEP will monitor the Town's progress towards meeting restoration of benthic and eelgrass habitats in Tisbury Great Pond.

**5. The data was collected some time ago. Can you give us an estimate of how much worse it might be today?**

MassDEP Response: The Martha's Vineyard Commission (MVC) has continued to sample annually and has observed that the water quality data is above the threshold concentrations. There were one or two years in which the water quality concentration was lower than the threshold concentration. This data was analyzed by a different laboratory and therefore this data is not directly comparable to other data collected. MVC and the towns will continue to collect samples and submit the results to the same laboratory using the same analysis to document the changes in water quality over time. The goal of the TMDL is to restore eelgrass at historic locations and to restore benthic habitat. If the target concentration is achieved and the goal of habitat restored is not achieved, the target concentrations will be reassessed.

**6. We added to a bedroom to our house and expanded our septic system as required by Title 5. If other homes have done this, how much have we added to the overall load? Is a conventional Title 5 system adequate?**

MassDEP Response: The MEP does not estimate load based on Title 5 design but on water use records that can be used to estimate actual septic flows. Title 5 is designed to represent the worse-case scenario and because you added a bedroom does not mean you increased your nitrogen load up to the design load. However you are increasing your overall nitrogen load if you increase the average number of people in the house. The use of conventional Title 5 systems within the watershed will not reduce the nitrogen concentration in the effluent sufficiently to meet the target concentrations at the sentinel stations in the estuaries. Some combination of sewerage, nontraditional control measures, and innovated/alternative septic system technology will be needed.

**7. Would you agree that compliance with Title 5 does not mean that you will meet the target load concentration?**

MassDEP Response: Nitrogen concentrations discharged by Title 5 systems are well above the nitrogen concentration in effluent from Wastewater Treatment Plants. A combination of Innovative Alternative septic systems, Best Management Practices (BMPs) for agricultural load and stormwater runoff will likely be necessary to meet the target threshold concentration. Keep in mind that even if the target concentration at the sentinel station is reached, the goal is habitat restoration. Therefore, the target sentinel station concentration may need to be reevaluated if

restoration of the habitat is not observed. This is in part, what is meant by the process of adaptive management.

**8. What is a healthy benthic habitat?**

MassDEP Response: A healthy benthic habitat is one that will support a large number, a diverse range, and an even distribution of benthic fauna. Benthic habitats support a wide diversity of marine life by providing spawning, nursery, refuge, and foraging grounds for fisheries species. Benthic organisms function in nutrient cycling, help remove contaminants from the water column, and are essential to the marine food web.

**9. If you get below the threshold concentration will you see improved benthic animal habitat?**

MassDEP Response: We expect that through the implementation of the nitrogen removal strategy, the threshold concentration will be observed at the sentinel stations and benthic habitat will improve. However, recall that there will be a time lag from implementation of nitrogen removal strategies due to groundwater travel times. After increased nitrogen removal at the source, along with increased flushing of the estuary and aquaculture, improvements in the benthic habitat are expected. See response to question 7 above.

**10. If we see improvements in the estuary with non-traditional methods (aquaculture and openings), how long will DEP give us before requiring more nitrogen removal strategies?**

MassDEP Response: As long as a plan is developed and actions are being taken at a reasonable pace to achieve the goals of the TMDL, MassDEP will use discretion in requiring additional implementation strategies. The CWRMP will have a schedule and implementation plan to meet the target load reductions of the TMDL. However, in the event that reasonable progress is not being made, MassDEP has the broad authority granted by the Massachusetts Clean Waters Act and the Massachusetts Water Quality Standards to require additional actions.

**11. Are there reasonably cost effective and energy efficient Innovative Alternative (IA) septic systems?**

MassDEP Response: The Barnstable County Department of Health and Environment is continuing to evaluate the performance of various alternative onsite septic system technologies, known as Innovative Alternative (IA) systems. There is some progress being made to develop systems that are energy efficient and are also reliably reducing nitrogen levels in the effluent below 10 mg/L. More testing is required.

I/A systems must be piloted and receive approval from MassDEP before they are approved for residential use. Currently there are only three types of I/A systems that have “general use approval” by MassDEP. There are several additional I/A systems with “provisional use approval” that homeowners may install at their own risk. New I/A system proponents requesting “general use approval” must submit an application and demonstrate that the system will reduce the N load. It is up to I/A system proponents to take the initiative to get general or provisional

approval from MassDEP. It is important that new technologies are reviewed and approved because the cost to the home owners is significant. If an unapproved or provisional system does not work as intended, or even fails, it will require replacement. MassDEP will provide general use approval to I/A technologies for removal of N from wastewater if the applicants submit the appropriate documentation demonstrating they meet the required standards.

**12. Of all the communities you have worked with, which ones are implementing nitrogen control strategies that are working and are effective? What are they doing?**

MassDEP Response: In our experience, the nitrogen control strategies that are most successful are the conventional systems. The Pleasant Bay Alliance which consists of Orleans, Brewster, Harwich, and Chatham, is an example of a multi-town collaboration for conventional sewerage. The Towns of Falmouth and Orleans have installed Permeable Reactive Barriers and Wellfleet and Mashpee have installed oyster reefs; however the benefits are not yet confirmed. Upper Cape communities are working together on the Popponesset Bay watershed. The towns of Dennis, Yarmouth, and Harwich are also discussing a partnership to address wastewater issues.

**13. In the executive summary the range of observed concentrations includes the target threshold concentration. Is this correct?**

MassDEP Response: Yes, the observed range of mean concentrations overlaps the target concentrations, specifically at Tiah Cove (TGP-5) and in the main basin (TGP-7). The observed concentration at the sentinel stations ranges between 0.41 to 0.64 mg/L. Up to 12 years of data, with multiple samples per year, had been collected at the sentinel stations at the time the Technical Report was prepared. Target water quality concentrations at the sentinel stations have been established but restoration of habitat within the estuaries remains the goal. The primary target concentration is 0.46 mg/L for eelgrass restoration on the margins of the main basin (TGP-7) and the secondary target is 0.48 mg/L in the tributary coves (TGP-4, TGP-5, and TGP-6) for benthic habitat restoration.

**14. I don't think the measure of 17 days (or any specific number of days) for the opening of the barrier beach is a good measure to use. We should be measuring the change in height of the water in the embayment, or the salinity, or both.**

MassDEP Response: The number of days of that the barrier beach was assumed to remain open was determined from the historical record of beach openings and was considered a modeling starting point. Planning and monitoring of results will improve the eventual outcome.

**15. There has not been a measureable loss of oysters in a die-off.**

MassDEP Response: The MEP Tech Report stated that the estuarine system is supportive of habitat in varying states of impairment. The primary restoration target was established for the restoration of eelgrass on the margins of the main basin with the secondary target of restoring benthic habitat. The infauna habitat health throughout the Tisbury Great Pond System was identified as Moderately to Significantly Impaired in the MEP study. Black Point Pond was determined to be Healthy and consistent with a wetland basin.

**16. As we develop a comprehensive plan (Comprehensive Wastewater Management Plan), do you suggest that West Tisbury and Chilmark work together? What frequency should we monitor the sentinel stations?**

MassDEP Response: MassDEP encourages neighboring towns to work together to restore water quality in their watershed. There are many examples where this has worked effectively. As mentioned above, the Pleasant Bay Alliance which consists of Orleans, Brewster, Harwich, and Chatham. Harwich, Dennis and Yarmouth are in discussions regarding a shared wastewater treatment plant. Lagoon Pond Wastewater District is another example of towns working together, Oak Bluffs and Tisbury. Towns working together can consolidate their information and target data gaps.

We recommend that you continue to sample at the same frequency as you have previously been sampling.

**17. Flushing will skew the water quality sampling. Shouldn't we sample before we open?**

MassDEP Response: Agreed, the water quality sampling should be completed before the opening of the barrier beach and again after it naturally closes.

**18. Is sewerage the only "traditional" method?**

MassDEP Response: Innovative-Alternative (I/A) systems with a proven track record can be considered a "traditional" method.

**19. Can we use Total Kjeldahl Nitrogen (TKN) instead of Total Nitrogen analysis. There is no lab on the island that can provide Total Nitrogen analysis.**

MassDEP Response: Total Kjeldahl Nitrogen is not equivalent to total nitrogen and cannot be used to compare to the long term water quality data that has already been collected. TKN includes ammonia and total organic nitrogen. Total nitrogen also includes nitrate and nitrite. TKN plus nitrate and nitrite analyses is also not directly comparable to total nitrogen analysis.

**20. What do we do next? Do we need to send out an RFP to get a consultant?**

MassDEP Response: The next step would be to form a wastewater committee within each town to get the appropriate town officials involved. Your municipal council will work with you to determine the appropriate contract vehicle (ie Request for Quotes or Proposal). A consultant is needed to pursue preparation of the CWRMP. State Revolving Fund loans (at low or no interest) are available for communities for planning purposes (CWRMP) and for construction.

**21. Does DEP have a "stick" to get the towns to start working on the CWMP and implementation plans?**

MassDEP Response: MassDEP prefers to work cooperatively with communities to protect and restore impaired waters. This is especially true when pollution comes from nonpoint sources

such as stormwater runoff and on-site wastewater disposal, and where solutions are less straightforward than additional treatment of a point source discharge.

As long as a plan is developed and actions are being taken at a reasonable pace to achieve the goals of the TMDL, MassDEP will use discretion in taking enforcement steps. However, in the event that reasonable progress is not being made, MassDEP can take enforcement action through the broad authority granted by the Massachusetts Clean Waters Act and the Massachusetts Water Quality Standards.

As a means to allow municipalities to incorporate non-traditional nitrogen removal strategies, that are not otherwise required to get a surface water or groundwater discharge permit, MassDEP is piloting watershed permits. Watershed permits would include implementation timetables, standards to be achieved, and long-term monitoring to evaluate water quality improvements.

**22. How long until the TMDL is approved? Will EPA make any changes to the TMDL at this point?**

MassDEP Response: There is a 30-day comment period after the public meeting is held on the draft TMDL. MassDEP prepares written comments on the questions received both at the public meeting and in writing. After MassDEP internal reviews are complete, the TMDL is then submitted for final approval by EPA. This process can take six months to 1 year, particularly if significant comments are received on the TMDL.

**23. How long until Bill Wilcox is done with his agricultural load analysis?**

MassDEP Response: Bill Wilcox anticipated completion of his detailed loading analysis by the end of May 2018. His analysis provides a nitrogen budget for each farm. This analysis does not attempt to determine the percentage of the nitrogen load that leaches to the ground and ultimately migrates to the estuaries. The total farm budget will be compared to the total MEP nitrogen load. However, this data will not affect the TMDL determined by the MEP.

**24. Do you consider drip dispersal systems to be acceptable IA systems?**

MassDEP Response: No, a drip dispersal system is a delivery system for treated wastewater. There is no additional nitrogen removal through the drip system. Furthermore, the drip dispersal system has never been submitted to MassDEP for IA technology approval.

**25. Is there atmospheric deposition of nitrogen from motor vehicles and coal burning?**

MassDEP Response: Yes and it is considered to be “out of local control”.

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RECEIVED

FEB 13 2018

MADEP-CERO  
February 7, 2018

Ms. Barbara Kickham  
Division of Watershed Management  
Mass. DEP  
8 Bond St.  
Worcester, MA 01606

Dear Ms. Kickham:

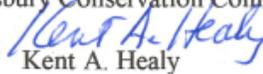
Thank you for your presentation, January 23, 2018, of the "Draft Total Maximum Daily Load for Total Nitrogen in the Tisbury Great Pond and Black Point Pond Estuarine System".

The Association of The Riparian Owners of Tisbury Great Pond, established by Mass. State Legislative Act 1904, Chap 302, is committed legally and financially to maintain the health of The Pond. As one of the three commissioners elected by the Riparian Owners, I propose the following program to meet the regulations of the Federal Clean Water Act Section 303d and the EPA's Water Quality Planning and Management Regulations.

The Riparian Commissioners will decide when to open the pond to the ocean, based on the pond level the weather and ocean tides, in order to scour a channel through the beach that is deep and long lasting. The beach is generally cut in mid April to allow the herring to enter the pond, in July or August to flush out excess nutrients and in November or December to maintain salinity for shellfish. The success of a "cut" is measured by the rise and fall of the pond due to ocean tides. A rise and fall of one foot for 10 tides or 1/2 foot for 20 tides will remove about 90% of the initial pond water. Measurement of the change of salinity of the mid pond water from about 10 parts per thousand to about 25 parts per thousand after a cut is also a measure of success.

Samples of the pond water will be taken by the commissioners at four MEP "sentinel" sites 4,5,6 and 7, just before the beach is cut and a few weeks after each cut, and the salinity, temperature and "Secchi" depth measured. These samples will be tested for Total Kjeldahl Nitrogen by The Wampanoag Environmental Lab. Samples taken just before the summer cut will be sent to a lab approved by The State DEP for additional testing for total nitrogen.

A record of the pond level, biweekly measurements of mid pond salinity and all water tests results will be kept by The West Tisbury Conservation Commission.

  
Kent A. Healy

c. Riparian Owners of Tisbury Great Pond, Martha's Vineyard Commission,  
West Tisbury Conservation Commission and Board of Selectmen,  
Chilmark Conservation Commission and Board of Selectmen

MassDEP Response: MassDEP acknowledges the plan you provide for assisting in the monitoring of the water quality of the estuary. We encourage and support the on-going cooperative work of the local commissions and boards in the watershed to meet water quality goals and to restore the estuarine habitat of Tisbury Great Pond.

## General Frequently Asked Questions:

**1. Can a Comprehensive Water Resources Management Plan (CWRMP) include the acquisition of open space, and if so, can State Revolving Funds (SRF) be used for this?**

MassDEP Response: State Revolving funds can be used for open space preservation if a specific watershed property has been identified as a critical implementation measure for meeting the TMDL. The SRF solicitation should identify the land acquisition as a high priority project for this purpose which would then make it eligible for the SRF funding list. However, it should be noted that preservation of open space will only address potential future nitrogen sources (as predicted in the build-out scenario in the MEP Technical report) and not the current situation. The town will still have to reduce existing nitrogen sources to meet the TMDL.

**2. Do we expect eelgrass to return if the nitrogen goal is higher than the concentration that can support eelgrass?**

MassDEP Response: There are a number of factors that can control the ability of eelgrass to re-establish in any area. Some are of a physical nature (such as boat traffic, water depth, or even sunlight penetration) and others are of a chemical nature like nitrogen. Eelgrass decline in general has been directly related to the impacts of eutrophication caused by elevated nitrogen concentrations. Therefore, if the nitrogen concentration is elevated enough to cause symptoms of eutrophication to occur, eelgrass growth will not be possible even if all other factors are controlled and the eelgrass will not return until the water quality conditions improve.

**3. Who is required to develop the CWRMP? Can it be written in-house if there is enough expertise?**

MassDEP Response: The CWRMP can be prepared by the town. There are no requirements that it must be written by an outside consultant; however, the community should be very confident that its in-house expertise is sufficient to address the myriad issues involved in the CWRMP process. MassDEP would strongly recommend that any community wishing to undertake this endeavor on its own should meet with MassDEP to develop an appropriate scope of work that will result in a robust and acceptable plan.

**4. Have others written regional CWRMPs (i.e. included several neighboring towns)?**

MassDEP Response: The Cape Cod Commission prepared a Regional Wastewater Management Plan or RWMP which formed a framework and set of tools for identifying several solutions for restoring water quality for each watershed on the Cape. The Section 208 Plan Update (or 208 Plan) is an area-wide water quality management plan and in general each town then prepared or is preparing its own CWRMP. An example of neighboring towns working on a regional plan is the Pleasant Bay Alliance which consists of Orleans, Brewster, Harwich, and Chatham. Harwich, Dennis and Yarmouth are in discussions regarding a shared wastewater treatment plant.

Joint Comprehensive Wastewater Management Plans (CWMPs) have been developed by multiple Towns particularly where Districts are formed for purposes of wastewater treatment. Some examples include the Upper Blackstone Water Pollution Abatement District that serve all

or portions of the towns Holden, Millbury, Rutland West Boylston and the City of Worcester and the Greater Lawrence Sanitary District that serves the greater Lawrence area including portions of Andover, N. Andover, Methuen and Salem NH.. There have also been recent cases where Towns have teamed up to develop a joint CWMP where districts have not been formed. The most recent example are the Towns discharging to the Assabet River. They include the Towns of Westboro and Shrewsbury, Marlboro and Northboro, Hudson, and Maynard. The reason these towns joined forces was because as a group, they received more priority points in the State Revolving Fund application process than they otherwise would have as individual towns.

**5. Does nitrogen entering the system close to shore impair water quality more? If we have to sewer, wouldn't it make sense to sewer homes closer to the shore?**

MassDEP Response: Homes closer to the waterbody allow nitrogen to get to that waterbody faster (shorter travel times). Those further away may take longer but still get there over time and are dependent upon the underlying geology. However, what is more important is the density of homes. Larger home density means more nitrogen being discharged thus the density typically determines where to sewer to maximize reductions. Also there are many factors that influence water quality such as flushing and morphology of the water body.

**6. Do you take into account how long it takes groundwater to travel?**

MassDEP Response: Yes, the MEP Technical report has identified long term (greater than 10 years) and short term time of travel boundaries in the ground-watershed.

**7. What if a town can't meet its TMDL?**

MassDEP Response: A TMDL is simply a nutrient budget that determines how much nitrogen reduction is necessary to meet water quality goals as defined by state Water Quality Standards. It is unlikely that the TMDL cannot be achieved however in rare occasions it can happen. In those rare cases the Federal Clean Water Act provides an alternative mechanism which is called a Use Attainability Analysis (UAA). The requirements of that analysis are specified in the Clean Water Act but to generalize the process, it requires a demonstration would have to be made that the designated use cannot be achieved. Another way of saying this is that a demonstration would have to be made that the body of water cannot support its designated uses such as fishing, swimming or protection of aquatic biota. This demonstration is very difficult and must be approved by the U.S. Environmental Protection Agency. As long as a plan is developed and actions are being taken at a reasonable pace to achieve the goals of the TMDL, MassDEP will use discretion in taking enforcement steps. However, in the event that reasonable progress is not being made, MassDEP can take additional regulatory action through the broad authority granted by the Massachusetts Clean Waters Act, the Massachusetts Water Quality Standards, and through point source discharge permits.

**8. What is the relationship between the linked model and the CWRMP?**

MassDEP Response: The model is a tool that was developed to assist the Town to evaluate potential nitrogen reduction options and determine if they meet the goals of the TMDL at the established sentinel station in each estuary. The CWRMP is the process used by the Town to evaluate your short and long-term needs, define options, and ultimately choose a recommended

option and schedule for implementation that meets the goals of the TMDL. The models can be used to assist the Towns during the CWRMP process.

**9. Is there a federal mandate to reduce fertilizer use?**

MassDEP Response: No, it is up to the states and/or towns to address this issue. However, the Massachusetts Department of Agricultural Resources (MassDAR) passed plant nutrient regulations (330 CMR 31.00) in June 2015, which requires specific restrictions for agricultural and residential fertilizer use, including seasonal restrictions, on nutrient applications and set-backs from sensitive areas (public water supplies and surface water) and Nutrient Management Plans. Compliance with the MassDAR regulations will result in reductions in future N loading from agricultural sources.

**10. Will monitoring continue at all stations or just the sentinel stations?**

MassDEP Response: At a minimum, MassDEP would like to see monitoring continued at the sentinel stations bi-monthly, May-September in order to determine compliance with the TMDL. However, ideally, it would be good to continue monitoring all of the stations, if possible. The benthic stations can be sampled every 3-5 years since changes are not rapid. The towns may want to sample additional locations if warranted. MassDEP intends to continue its program of eelgrass monitoring.

**11. What is the state's expectation with CWRMPs?**

MassDEP Response: The CWRMP is intended to provide the Towns with potential short and long-term options to achieve water quality goals and therefore provides a recommended plan and schedule for sewerage/infrastructure improvements and other nitrogen reduction options necessary to achieve the TMDL. The state also provides a low interest loan program called the state revolving fund or SRF to help develop these plans. Towns can combine forces to save money when they develop their CWRMPs.

**12. Can we submit parts of the plan as they are completed?**

MassDEP Response: Submitting part of a plan is not recommended because absent a comprehensive plan, a demonstration cannot be made that the actions will meet the requirements of the TMDL. With that said however the plan can contain phases using an adaptive approach if determined to be reasonable and consistent with the TMDL.

**13. How do we know the source of the bacteria (septic vs. cormorants, etc.)?**

MassDEP Response: This was not addressed because this is a nitrogen TMDL and not a bacteria TMDL.

**14. Is there a push to look at alternative new technologies?**

MassDEP Response: MassDEP recommends communities consider all feasible alternatives to develop the most effective and efficient plans to meet water quality goals. The 208 Plan Update includes an analysis of a wide range of traditional and alternative approaches to nutrient

reduction, remediation, and restoration. If a CWRMP relies on such alternative technologies and approaches, the plan must include demonstration protocols, including monitoring, that will confirm that the proposed reduction credits and, when appropriate, removal efficiencies are met. The implementation schedule is in the demonstration protocol for each alternative technology or approach, at which time a determination must be made as to whether the alternative technology/approach meets the intended efficacy goal. MassDEP is also developing a Watershed Permit Pilot program, which includes but is not limited to Under Ground Injection Control (UIC) and groundwater discharge permits and provides a permitting mechanism to approve nontraditional methods of wastewater management and/or impact mitigation that could not otherwise be approved by MassDEP under a typical wastewater management and discharge permit.

The Massachusetts Septic System Test Center, located on Cape Cod and operated by the Barnstable County Department of Health and Environment, tests and tracks advanced innovative and alternative septic system treatment technologies. In addition MassDEP evaluates pilot studies for other alternative technologies; however, absent a CWRMP and Watershed Permit, MassDEP will not approve a system for general use unless it has been thoroughly studied and documented to be successful.

**15. How about using shellfish to remediate and reduce nitrogen concentrations?**

MassDEP Response: The use of shellfish to remediate and reduce nitrogen concentrations is an alternative approach that has been utilized and is being evaluated in some areas of Long Island Sound (LIS), Wellfleet, and Chesapeake Bays. More recently, some Cape communities have been evaluating this method, including Falmouth, Mashpee and Orleans. While this approach has demonstrated promise for reducing nitrogen concentrations, there remain questions regarding the effectiveness and circumstances where it can be successfully utilized. MassDEP recommends communities considering this option discuss such plans with the Department, and evaluate the results from ongoing efforts on the Cape and on other states.

**16. The TMDL is a maximum number, but we can still go lower.**

MassDEP Response: The state's goal is to achieve designated uses and water quality criteria. There is nothing however that prevents a Town from implementing measures that go beyond that goal. It should also be noted that the TMDL is developed conservatively with a factor of safety included.

**17. Isn't it going to take several years to reach the TMDL?**

MassDEP Response: It is likely that several years will be necessary to achieve reductions and to see a corresponding response in the estuary. However, the longer it takes to implement solutions, the longer it is going to take to achieve the goals.

**18. The TMDL is based on current land use but what about future development?**

MassDEP Response: The MEP Study and the TMDL also take buildout into account for each community.

MassDEP Response: MassDEP acknowledges the plan you provide for assisting in the monitoring of the water quality of the estuary. We encourage and support the on-going cooperative work of the local commissions and boards in the watershed to meet water quality goals and to restore the estuarine habitat of Tisbury Great Pond.

MASS DEP PUBLIC HEARING  
TMDL DRAFT REPORT  
JANUARY 23, 2018  
SIGN IN SHEET

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