



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**  
**REGION I**  
**5 POST OFFICE SQUARE, SUITE 100**  
**BOSTON, MASSACHUSETTS 02109-3912**

June 18, 2020

Martin Suuberg, Commissioner  
Department of Environmental Protection  
One Winter Street  
Boston, MA 02108

Re: Approval of the Waquoit Bay System TMDLs for Total Nitrogen

Dear Commissioner Suuberg:

Thank you for your Department's submittal of the TMDL analyses for the Waquoit Bay system on May 18, 2020. We appreciate your efforts and involvement with our office to finalize these TMDLS. The U.S. Environmental Protection Agency (EPA) has reviewed the documents entitled "Final Waquoit Bay System; including Eel Pond, Quashnet River, Hamblin Pond, and Jehu River Total Maximum Daily Loads for Total Nitrogen" (CN – 378.1), "Final Falmouth Inner Harbor Total Maximum Daily Load For Total Nitrogen" (CN – 452.1), and "Final Megansett-Squeteague Harbors Total Maximum Daily Load For Total Nitrogen" (CN – 396.1) and it is my pleasure to approve the Total Nitrogen TMDLs. EPA has determined, as set forth in the enclosed review document, that this TMDL meets the requirements of Section 303(d) of the Clean Water Act (CWA) and EPA's implementing regulations at 40 Code of Federal Regulations (CFR) Part 130.

MassDEP's efforts will help restore water quality and prevent further degradation of this, and adjacent, waterbody segments. My staff and I look forward to continued cooperation with the Massachusetts DEP in exercising our shared responsibility of implementing the requirements under Section 303(d) of the CWA. If you have any questions regarding this approval, please contact Ralph Abele at (617) 918-1629 or have your staff contact Ivy Mlsna of my staff at (617) 918-1311.

Sincerely,

/s/

Kenneth Moraff, Director  
Water Division

Enclosure

cc:

Laura Blake, MassDEP  
Barbara Kickham, MassDEP  
Ralph Abele, EPA  
Ivy Mlsna, EPA

## EPA NEW ENGLAND'S TMDL REVIEW

**DATE:** June 18, 2020

**TMDL:** Waquoit Bay System; including Eel Pond, Quashnet River, Hamblin Pond, and Jehu River Total Maximum Daily Loads for Total Nitrogen

**STATUS:** Final

**IMPAIRMENT/POLLUTANT:** 9 Total Nitrogen TMDLs and 3 Pollution Prevention TMDLs  
(See Attachment 1)

**BACKGROUND:** EPA Region 1 received the *Final Waquoit Bay System; including Eel Pond, Quashnet River, Hamblin Pond, and Jehu River Total Maximum Daily Loads for Total Nitrogen* (Control Number: CN 378.1) from the Massachusetts Department of Environmental Protection (MassDEP) with a transmittal letter dated May 18, 2020. In addition to the Final Nitrogen TMDL itself, the submittal included, either directly or in reference, the following documents:

- Public Meeting Information and Response to Comments, page 47 and Appendix E
- Applicable Massachusetts Surface Water Quality Standards (WQS), Appendix A
- Massachusetts Estuaries Project, Linked Watershed-Embayment Approach to Determine Critical Nitrogen Loading Threshold for the Waquoit Bay and Eel Pond Embayment System, Towns of Falmouth and Mashpee, Massachusetts, March 2013.  
<https://www.mass.gov/doc/waquoit-bay-eel-pond-embayment-system-falmouth-mashpee-ma-2013/download>
- Massachusetts Year 2016 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 (CN 450.1), January 2020.  
<https://www.mass.gov/files/documents/2020/01/07/16ilwplist.pdf>
- Massachusetts Estuaries Project Embayment Restoration and Guidance for Implementation Strategies, MassDEP 2003. <http://www.mass.gov/eea/docs/dep/water/resources/a-through/mepmain.pdf>

The following review explains how the TMDL submission meets the statutory and regulatory requirements of TMDLs in accordance with § 303(d) of the Clean Water Act and EPA's implementing regulations in 40 CFR Part 130.

**REVIEWERS:** Ivy Mlsna (617-918-1311) e-mail: [mlsna.ivy@epa.gov](mailto:mlsna.ivy@epa.gov)

## REVIEW ELEMENTS OF TMDLs

*Section 303(d) of the Clean Water Act (CWA) and EPA's implementing regulations at 40 C.F.R. § 130 describe the statutory and regulatory requirements for approvable TMDLs. The following information is generally necessary for EPA to determine if a submitted TMDL fulfills the legal requirements for approval under Section 303(d) and EPA regulations, and should be included in the submittal package. Use of the verb "must" below denotes information that is required to be submitted because it relates to elements of the TMDL required by the CWA and by regulation.*

### **1. Description of Waterbody, Pollutant of Concern, Pollutant Sources and Priority Ranking**

*The TMDL analytical document must identify the waterbody as it appears on the State/Tribe's 303(d) list, the pollutant of concern and the priority ranking of the waterbody. The TMDL submittal must include a description of the point and nonpoint sources of the pollutant of concern, including the magnitude and location of the sources. Where it is possible to separate natural background from nonpoint sources, a description of the natural background must be provided, including the magnitude and location of the source(s). Such information is necessary for EPA's review of the load and wasteload allocations which are required by regulation. The TMDL submittal should also contain a description of any important assumptions made in developing the TMDL, such as: (1) the assumed distribution of land use in the watershed; (2) population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources; (3) present and future growth trends, if taken into consideration in preparing the TMDL; and, (4) explanation and analytical basis for expressing the TMDL through surrogate measures, if applicable. Surrogate measures are parameters such as percent fines and turbidity for sediment impairments, or chlorophyll a and phosphorus loadings for excess algae.*

#### **A. Description of Waterbody, Priority Ranking, and Background Information**

The Waquoit Bay System in Falmouth, Mashpee, and Sandwich Massachusetts, at the southwestern edge of Cape Cod, faces Nantucket Sound to the south, and consists of several subembayments of varying size and hydraulic complexity, characterized by limited rates of flushing, shallow depths and heavily developed watersheds. Waquoit Bay has been designated an Area of Critical Environmental Concern (ACEC), including, the eastern shore of the Childs River and Seapit River, all of the saltwater reaches and portions of the freshwater reaches of the Quashnet River, Hamblin Pond, Jehu Pond, Great River, and Sage Lot Pond. Waquoit Bay including the areas just described and the saltwater portion of the Childs River and Seapit River has been designated as Priority Habitat of Rare Species and Estimated Habitat of Rare Wildlife by the Natural Heritage and Endangered Species Program (NHESP) of the Massachusetts Division of Fish and Game. Waquoit Bay is part of the National Oceanic and Atmospheric Association's (NOAA) National Estuarine Research Reserve program.

Waquoit Bay is an approximately 825-acre embayment located in Falmouth on Cape Cod. Waquoit Bay is generally shallow with an average depth less than 3 feet. Waquoit Bay has a number of tributary subembayments including Quashnet River, Hamblin Pond, Little River, Great River and Jehu Pond. The major sources of freshwater include Childs River, Quashnet River, Red Brook and groundwater flows. Salt water enters Waquoit Bay from Vineyard Sound through a maintained inlet and through the Eel Pond inlet. The main inlet to Waquoit Bay is fixed with jetties.

The watersheds of Waquoit Bay's embayments have all had rapid and extensive development of

single-family homes and the conversion of seasonal into full time residences. This is reflected in a substantial transformation of land from forest to suburban use between the years 1951 to 2000. Water quality problems associated with this development result primarily from on-site wastewater treatment systems, and to a lesser extent, from runoff, including fertilizers, from these developed areas. On-site subsurface wastewater disposal system effluents discharge to the ground, enter the groundwater system and eventually enter the surface water bodies. In the sandy soils of Cape Cod, effluent that has entered the groundwater travel towards the coastal waters at an average rate of one foot per day. The nutrient load to the groundwater system is directly related to the number of subsurface wastewater disposal systems, which in turn are related to the population. The population of Sandwich, Mashpee and Falmouth, as with all of Cape Cod, has increased steadily since the 1940's.

In order to restore and protect this estuarine system, nitrogen loadings, and subsequently the concentrations of nitrogen in the water, must be reduced to levels below the thresholds that cause the observed environmental impacts. This concentration will be referred to as the *target threshold N concentration*. It is the goal of the TMDL to reach this target threshold N concentration, as it has been determined for each impaired waterbody segment. Given the complex configuration and hydrodynamics of the Waquoit Bay system, multiple nitrogen threshold locations were selected as to ensure an accurate determination of estuarine response to reductions in watershed nitrogen loading and/or enhanced tidal flushing.

This TMDL supersedes the previously approved TMDL for the Quashnet River, Hamblin Pond and Jehu Pond, EPA TMDLs #33811-33815 and MassDEP Control Number 218.0. Additional modeling completed as part of this TMDL required changes to the boundary conditions in Waquoit Bay used to establish the TMDLs approved in 2007 for the Quashnet River, Hamblin Pond and Jehu Pond.

The TMDL document presents a sound overview of the estuary system and the companion Massachusetts Estuaries Project final report (March 2013) presents a thorough description of the Waquoit Bay system.

MassDEP has determined that all nutrient impaired segments in the Commonwealth are a high priority. See the Massachusetts 2016 Integrated List of Waters at: <https://www.mass.gov/files/documents/2020/01/07/16ilwplist.pdf>

## **B. Pollutant of Concern**

In the Waquoit Bay System, the pollutant of concern for this TMDL (based on observations of eutrophication), is the nutrient nitrogen (N). Nitrogen is the limiting nutrient in coastal and marine waters, which means that as its concentration is increased, so is the amount of plant matter. This leads to nuisance populations of macro-algae and increased concentrations of phytoplankton and epiphyton which impair eelgrass beds and imperil the healthy ecology of the affected water bodies. Additional SMAST-determined impaired parameters include elevated nutrients, low dissolved oxygen levels, elevated chlorophyll a levels, macroalgae, eelgrass loss and degraded benthic fauna habitat.

## **C. Pollutant Sources**

Most of the present watershed nitrogen load to the Waquoit Bay system is from on-site subsurface wastewater disposal systems (septic systems), with considerably less N originating from natural background sources, runoff, fertilizers, wastewater treatment facilities, and atmospheric deposition. The watershed nitrogen loading that is considered controllable affecting this system originates predominately from on-site subsurface wastewater disposal systems (septic systems, 75%), impervious surfaces (13%) and fertilizers (12%) and two wastewater treatment facilities (<0.5%).

**Assessment:** EPA Region 1 concludes that the TMDL document meets the requirements for describing the TMDL waterbody segments, pollutants of concern, identifying and characterizing sources of impairment, and priority ranking.

## **2. Description of the Applicable Water Quality Standards and Numeric Water Quality Target**

*The TMDL submittal must include a description of the applicable State/Tribe water quality standard, including the designated use(s) of the waterbody, the applicable numeric or narrative water quality criterion, and the antidegradation policy. Such information is necessary for EPA's review of the load and wasteload allocations which are required by regulation. A numeric water quality target for the TMDL (a quantitative value used to measure whether or not the applicable water quality standard is attained) must be identified. If the TMDL is based on a target other than a numeric water quality criterion, then a numeric expression, usually site specific, must be developed from a narrative criterion and a description of the process used to derive the target must be included in the submittal.*

The water quality classification of Waquoit Bay and all estuarine embayments in this TMDL are Class SA ORW and freshwater segments are 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) contain numeric criteria for dissolved oxygen but have only narrative standards that relate to the other variables. The narrative standards for nutrients (nitrogen and phosphorus) for waters of the Commonwealth are such that “all surface waters shall be free of nutrients in concentrations that would cause or contribute to impairment of existing or designated uses and shall not exceed site specific criteria developed in a TMDL or otherwise, established by the department” (MassDEP 2007). A more thorough explanation of applicable standards can be found in Appendix A As stated on page 23 of the TMDL document and in EPA guidance, individual estuarine and coastal marine waters tend to have unique characteristics and therefore, site-specific analyses of the individual water body are typically required. For example, the loading of nitrogen that a specific water body can handle without becoming impaired varies. Factors that influence the effect of nitrogen include: flow velocity, tidal hydraulics, dissolved oxygen, and sediment adsorption and desorption of nitrogen.

The Massachusetts Estuaries Project analytical method is the Linked Watershed-Embayment Management Model (Linked Model), discussed on pages 23-32 of the TMDL document. It links watershed inputs with embayment circulation and nitrogen characteristics, and:

- requires site-specific measurements within each watershed and embayment;
- uses realistic “best-estimates” of nitrogen loads from each specific type of land-use;
- spatially distributes the watershed nitrogen loading to the embayment;
- accounts for nitrogen 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 nitrogen regenerated within the embayment;

- is validated by both independent hydrodynamic, nitrogen concentration, and ecological data; and
- is calibrated and validated with field data prior to generation of “what if” scenarios.

The Linked Model has been previously applied to watershed N management in numerous embayments 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 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. Threshold N levels for each of the sub-embayment systems in this study were developed to restore or maintain SA waters of high habitat quality. In these systems, high habitat quality was defined as supportive of eelgrass and diverse benthic animal communities. Dissolved oxygen and chlorophyll a were also considered in the assessment.

Basins within the Waquoit Bay system with historic eelgrass coverage include: Waquoit Bay (main basin, Great River, Little River, Jehu Pond, Sage Lot Pond, Childs River, Eel Pond- East and Eel Pond – South). With the exception of Sage Lot Pond and Jehu Pond substantively all eelgrass has been lost from the Waquoit Bay Embayment System. Each of the basins with well documented historic eelgrass coverage within this system which no longer support eelgrass coverage are classified as significantly impaired relative to eelgrass habitat. Since eelgrass is more sensitive to nitrogen enrichment than benthic animal habitat, restoration of eelgrass habitat in these basins is anticipated to also restore impairments to benthic habitat as well.

Should the target concentration be met at the sentinel stations without restoration in Waquoit Bay, other management activities would have to be identified and considered to reach to goals outlined in this TMDL (page 46 of the TMDL document). MassDEP’s commitment to monitor the receiving water response is, in EPA’s view, a reasonable measure designed to manage the inherent uncertainty around selecting a target against a backdrop of considerable scientific and technical uncertainty. While there is sufficient basis in the administrative record at the time of approval to conclude that the selected target will be protective, EPA will coordinate with the MassDEP to review any additional monitoring data or other information that may become available concerning eelgrass populations in the receiving waters, consistent with MassDEP’s commitment to evaluate the adequacy of the target. EPA may determine at some point in the future whether a revision of this TMDL may be necessary in order to achieve water quality that fully supports the aquatic life designated use. These revisions may require additional monitoring, modeling and revised nitrogen targets at the sentinel stations.

**Assessment:** The use of the Linked Model, the description of the process in the TMDL document, and the companion Technical Report to this TMDL document adequately demonstrate the basis for deriving the target nitrogen loads and demonstrating that the targets will achieve water quality standards. EPA Region 1 concludes that MassDEP has properly presented its numeric water quality targets and has made a reasonable and appropriate interpretation of its narrative water quality criteria for the designated uses of the Waquoit Bay system. In addition, MassDEP’s adaptive management approach to the TMDL allows for revision if the target concentration is reached but habitat indicators are not met.

### **3. Loading Capacity - Linking Water Quality and Pollutant Sources**

*As described in EPA guidance, a TMDL identifies the loading capacity of a waterbody for a particular pollutant. EPA*

regulations define loading capacity as the greatest amount of loading that a water can receive without violating water quality standards (40 C.F.R. § 130.2(f) ). The loadings are required to be expressed as either mass-per-time, toxicity or other appropriate measure (40 C.F.R. § 130.2(i)). The TMDL submittal must identify the waterbody’s loading capacity for the applicable pollutant and describe the rationale for the method used to establish the cause-and-effect relationship between the numeric target and the identified pollutant sources. In most instances, this method will be a water quality model. Supporting documentation for the TMDL analysis must also be contained in the submittal, including the basis for assumptions, strengths and weaknesses in the analytical process, results from water quality modeling, etc. Such information is necessary for EPA’s review of the load and wasteload allocations which are required by regulation.

In many circumstances, a critical condition must be described and related to physical conditions in the waterbody as part of the analysis of loading capacity (40 C.F.R. § 130.7(c)(1) ). The critical condition can be thought of as the “worst case” scenario of environmental conditions in the waterbody in which the loading expressed in the TMDL for the pollutant of concern will continue to meet water quality standards. Critical conditions are the combination of environmental factors (e.g., flow, temperature, etc.) that results in attaining and maintaining the water quality criterion and has an acceptably low frequency of occurrence. Critical conditions are important because they describe the factors that combine to cause a violation of water quality standards and will help in identifying the actions that may have to be undertaken to meet water quality standards.

As stated in the TMDL document, the Linked Model is a robust and fairly complicated model that determines an embayment’s nitrogen sensitivity, nitrogen threshold watershed loading levels and response to changes in the loading rate. A key feature of the approach involves the selection of sentinel locations that have the poorest water quality in the embayment system. If these degraded areas come into compliance with the TMDL, other areas will also achieve water quality standards for nitrogen in the system. This approach captures the critical targets needed to address the impaired segments.

The percent reductions of existing nitrogen loads necessary to meet the target threshold watershed loads range from 0% to 80.7% with an overall required reduction of 53.4% for the Waquoit Bay system as a whole (TMDL Table 6 below, page 40 of the TMDL document). As described in the TMDL document, these loads represent one scenario using the Linked Model that could achieve the target threshold N concentration at the sentinel station. An alternative scenario to meet the target threshold N concentration can also be evaluated as part of the MEP process, at the town’s request.

**TMDL 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

<b>Subembayment</b>	<b>Present Controllable Watershed Load<sup>1</sup> (kg/day)</b>	<b>Target Threshold Watershed Load<sup>2</sup> (kg/day)</b>	<b>% Watershed Load Reductions Needed to Achieve Target Threshold Loads</b>
<i>Groundwater sources</i>			
Waquoit Bay	2.088	2.088	0.0%
Childs River – upper	12.019	4.076	-66.1%
Eel Pond – east branch	2.17	0.82	-62.2%

Eel Pond – south branch	0.523	0.523	0.0%
Eel Pond – west branch	16.337	8.808	-46.1%
Quashnet River	2.773	1.497	-46.0%
Hamblin Pond	4.381	0.953	-78.2%
Little River	1.096	0.211	-80.7%
Jehu Pond	3.912	1.025	-73.8%
Great River	3.671	0.997	-72.8%
Sage Lot Pond	2.753	1.622	-41.1%
<i>Freshwater sources</i>			
Childs River	10.622	4.115	-61.3%
Quashnet River	20.507	13.469	-34.3%
Red Brook	8.014	2.096	-73.8%
<b>System Total</b>	<b>90.866</b>	<b>42.3</b>	<b>-53.4%</b>

<sup>1</sup> Composed of combined fertilizer, runoff, WWTP effluent, and septic system loadings.

<sup>2</sup> Target threshold watershed load is the combined load from the sub-watersheds using one scenario that will meet the embayment threshold N concentrations identified above.

The TMDL for each embayment considers all sources of N and is therefore the sum of the calculated target threshold watershed load, atmospheric deposition load, and benthic flux load from sediment sources (TMDL Table 7 below, page 40 of the TMDL document). The TMDLs for the Waquoit Bay system range from 1.19 kg N/day to 21.31 kg N/day. The TMDL for the system as a whole is 120.02 kg N/day.

**Adapted from TMDL Table 7:** The Total Maximum Daily Loads (TMDLs) for the Waquoit Bay System subembayments

Subembayment	Target Watershed Load <sup>1</sup> (kg/day)	Atmospheric deposition (kg/day)	Benthic flux <sup>2</sup> (kg/ day)	TMDL <sup>3</sup> (kg/day)
<i>Groundwater</i>				
Waquoit Bay	2.088	11.96	0	14.04
Childs River – upper	4.076	0.46	0	4.53
Eel Pond – east branch	0.82	1.01	19.48	21.31
Eel Pond – south branch	0.523	0.66	0	1.19



Eel Pond – west branch	8.808	0.89	0	9.70
Quashnet River	1.497	0.25	9.50	11.25
Hamblin Pond	0.953	1.53	5.71	8.19
Little River	0.211	0.16	2.55	2.92
Jehu Pond	1.025	0.67	6.90	8.60
Great River	0.997	1.31	14.22	16.53
Sage Lot Pond	1.622	0.47	0	2.09
<i>Freshwater</i>				
Childs River <sup>4</sup>	4.115			4.115
Quashnet River <sup>4</sup>	13.469			13.469
Red Brook <sup>4</sup>	2.096			2.096
<b>Waquoit Bay System Total</b>	<b>42.30</b>	<b>19.36</b>	<b>58.36</b>	<b>120.02</b>

<sup>1</sup> Target threshold watershed load is the load from the watershed needed to meet the embayment target threshold nitrogen concentration identified in Table 4 of the TMDL Document.

<sup>2</sup> Projected sediment N loadings obtained by reducing the present loading rates (TMDL 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, sediment load, and atmospheric deposition load

<sup>4</sup> Protective TMDLs have been assigned due to hydraulic connection to impaired embayments

**Assessment:** The TMDL document explains and EPA concurs with the approach for applying the Linked Model to specific embayments for the purpose of developing target nitrogen loading rates and in identifying sources of needed nitrogen load reduction. EPA believes that this approach is reasonable because the factors influencing and controlling nutrient impairment were well justified, as demonstrated by the foregoing and the TMDL's administrative record.

#### 4. Load Allocations (LAs)

*EPA regulations require that a TMDL include LAs, which identify the portion of the loading capacity allocated to existing and future nonpoint sources and to natural background (40 C.F.R. § 130.2(g)). Load allocations may range from reasonably accurate estimates to gross allotments (40 C.F.R. § 130.2(g)). Where it is possible to separate natural background from nonpoint sources, load allocations should be described separately for background and for nonpoint sources.*

*If the TMDL concludes that there are no nonpoint sources and/or natural background, or the TMDL recommends a zero load allocation, the LA must be expressed as zero. If the TMDL recommends a zero LA after considering all pollutant sources, there must be a discussion of the reasoning behind this decision, since a zero LA implies an allocation only to point sources will result in attainment of the applicable water quality standard, and all nonpoint and background sources will be removed.*

Using the Linked Model, MassDEP has identified the portion of the loading capacity allocated to existing and future non-point sources necessary to meet water quality standards. In the case of the Waquoit Bay sub-embayments studied, the controllable nonpoint source loadings are primarily from on-site subsurface wastewater disposal systems. Additional N sources include stormwater runoff

(except from impervious cover within 200 feet of the waterbody which is defined as part of the waste load) and N from fertilizers. Additional nonpoint source N sources which are not feasibly controllable include sediments, natural background, and atmospheric deposition.

Stormwater that is subject to the EPA Phase II Program is considered a part of the wasteload allocation, rather than the load allocation. As presented in Chapter IV, V, and VI, of the MEP Technical Report, on Cape Cod the vast majority of stormwater percolates into the aquifer and enters the embayment system through groundwater, thus defining the stormwater in pervious areas to be a component of the non-point source load allocation. Even though there are measurable directly connected impervious areas in these systems, the wasteload allocation for stormwater was determined to be insignificant when compared to the overall controllable N load. Accordingly, this TMDL accounts for stormwater loadings and groundwater loadings in one aggregate allocation as a non-point source, thus combining the assessments of wastewater and stormwater for the purpose of developing control strategies. Continued Phase II Program implementation in Falmouth, new studies and possibly further modeling will identify what portion of the stormwater load may be controllable through Best Management Practices (BMPs).

MassDEP addresses load allocations for natural background sources (see page 34 of the TMDL document).

**Assessment:** EPA concludes that the TMDL document sufficiently addresses the calculation of the load allocations, as demonstrated by the foregoing and by the TMDL's administrative record.

## 5. Wasteload Allocations (WLAs)

*EPA regulations require that a TMDL include WLAs, which identify the portion of the loading capacity allocated to existing and future point sources (40 C.F.R. § 130.2(h)). If no point sources are present or if the TMDL recommends a zero WLA for point sources, the WLA must be expressed as zero. If the TMDL recommends a zero WLA after considering all pollutant sources, there must be a discussion of the reasoning behind this decision, since a zero WLA implies an allocation only to nonpoint sources and background will result in attainment of the applicable water quality standard, and all point sources will be removed.*

*In preparing the wasteload allocations, it is not necessary that each individual point source be assigned a portion of the allocation of pollutant loading capacity. When the source is a minor discharger of the pollutant of concern or if the source is contained within an aggregated general permit, an aggregated WLA can be assigned to the group of facilities. But it is necessary to allocate the loading capacity among individual point sources as necessary to meet the water quality standard.*

*The TMDL submittal should also discuss whether a point source is given a less stringent wasteload allocation based on an assumption that nonpoint source load reductions will occur. In such cases, the State/Tribe will need to demonstrate reasonable assurance that the nonpoint source reductions will occur within a reasonable time.*

The Commonwealth assigned to the WLA those point sources (1) that “discharge” pollutants to waters of the United States within the meaning of the Act and (2) that are subject to the NPDES permitting program (existing and future); it allocated sources that did not meet these two criteria to the LA. This approach is reasonable and is consistent with the Act and implementing regulations. EPA interprets 40 CFR § 130.2(h) to require that allocations for NPDES-regulated discharges of stormwater be included in the waste load component of the TMDL. There are two small wastewater treatment facilities that discharge to groundwater in the Waquoit Bay embayment system, but they are not considered point sources under EPA definition. These facilities (Mashpee Junior/Senior High School and Southport

Condominiums) are located in the Quashnet River sub-watershed and are required to denitrify as part of their groundwater discharge permit. Both permits require effluent discharge less than 10 mg/L N to the groundwater. MA DEP also states that they've considered the nitrogen load reductions from regulated MS4 sources necessary to meet the target nitrogen concentrations, however, this area is not subject to the MS4 regulations.

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.

As described above, 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 Cape Cod. The calculated stormwater WLA based on the 200-foot buffer for the whole embayment system is 0.51 kg/day or 1% of the total watershed load. This conservative load is negligible when compared to other sources.

In the absence of site-specific information on direct discharge sources, EPA believes the approach set out in the TMDL for the WLAs is reasonable. The specific WLAs are set forth in Appendix C and on pages 34-35 of the TMDL document.

**Assessment:** EPA concludes that the TMDL document sufficiently addresses the calculation of the

waste load allocations, as demonstrated by the foregoing and by the TMDL's administrative record.<sup>1</sup>

## 6. Margin of Safety (MOS)

*The statute and regulations require that a TMDL include a margin of safety to account for any lack of knowledge concerning the relationship between load and wasteload allocations and water quality (CWA § 303(d)(1)(C), 40 C.F.R. § 130.7(c)(1)). EPA 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. If the MOS is implicit, the conservative assumptions in the analysis that account for the MOS must be described. If the MOS is explicit, the loading set aside for the MOS must be identified.*

MassDEP employs an implicit MOS in this TMDL, described in the TMDL document on pages 36-39. There are several factors that contribute to the margin of safety inherent in the approach used to develop this TMDL including:

### 1) Use of conservative data in the Linked Model as follows:

- Nitrogen concentrations in the watershed that were used in the model are conservative because the model assumes 100% of the groundwater discharge load enters the embayment, and stream flow entering the embayment was directly measured to determine attenuation;
- Agreement between the modeled and observed values has been >95%;
- Water column nitrogen validation dataset is conservative. High or low measurements are marked as outliers;
- Reductions in benthic regeneration of nitrogen are most likely underestimates based on a reduced deposition of PON, due to lower primary production rates under the reduced N loading in these systems; and
- All ponds within the delineated subwatersheds were assigned a 50% nitrogen attenuation rate. Nitrogen attenuation in freshwater ponds has generally been determined by the MEP analysis to be at least 50%, so the watershed model assigns a conservative attenuation of 50% to all nitrogen from freshwater pond watersheds unless there is sufficient information to develop a pond-specific attenuation rate to incorporate into the loading analysis.

### 2) Conservative sentinel station/target threshold nitrogen concentrations. The target

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<sup>1</sup> The categorization of the pollutant sources on Cape Cod (*i.e.*, whether a particular source, or category of sources, is required as a matter of law to be placed within the WLA or LA) has been the subject of recent litigation. On August 24, 2010, CLF filed a complaint in the United States District Court for the District of Massachusetts, captioned *Conservation Law Foundation et al. v. United States Environmental Protection Agency, et al.*, Action No. 1:10-cv-11455, challenging EPA's approval of thirteen (13) Total Maximum Daily Load determinations submitted to EPA by the Commonwealth of Massachusetts under section 303(d), 33 U.S.C. § 1313(d), of the Clean Water Act, 33 U.S.C. §§ 1251-1387, as arbitrary and capricious, an abuse of discretion, and in violation of the Administrative Procedure Act, 5 U.S.C. § 706(2). EPA's positions on categorization, margin of safety, seasonal variation and other matters raised in the litigation, including climate change, have been described in the Agency's filings in that case; have been specifically considered and relied upon by EPA for the purpose of these TMDL approvals; and accordingly, have been incorporated into the TMDL's administrative record. Additionally, EPA has considered MassDEP's correspondence of April 3, 2015 regarding these issues, and EPA's analysis thereof has also been included in the administrative record.

nitrogen concentration was chosen based on sites 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; and

- 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.

**Assessment:** EPA concludes that the approach used in developing the TMDL provides for an adequate implicit MOS, as demonstrated by the foregoing and by the TMDL's administrative record.

## 7. Seasonal Variation

*The statute and regulations require that a TMDL be established with consideration of seasonal variations. The method chosen for including seasonal variations in the TMDL must be described (CWA § 303(d)(1)(C), 40 C.F.R. § 130.7(c)(1).*

The TMDLs for the water body segments identified in the document are based on achieving the nitrogen loads during the most critical time period, i.e., the summer growing season. Since the other seasons are less sensitive to nitrogen loading, the TMDLs are protective of all seasons throughout the year. Seasonal variation is addressed on page 39 of the TMDL document.

**Assessment:** Since the other seasons are less sensitive to nitrogen loading, EPA concludes that the TMDL is protective of all seasons throughout the year.

## 8. Monitoring Plan

*EPA's 1991 document, Guidance for Water Quality-Based Decisions: The TMDL Process (EPA 440/4-91-001), and EPA's 2006 guidance, Clarification Regarding "Phased" Total Maximum Daily Loads, recommend a monitoring plan when a TMDL is developed using the phased approach. The guidance indicates that a State may use the phased approach for situations where TMDLs need to be developed despite significant data uncertainty and where the State expects that the loading capacity and allocation scheme will be revised in the near future. EPA's guidance provides that a TMDL developed under the phased approach should include, in addition to the other TMDL elements, a monitoring plan that describes the additional data to be collected, and a scheduled timeframe for revision of the TMDL.*

The TMDL document presents two forms of monitoring that would be useful to determine progress towards achieving compliance with the TMDL (pages 45-46 of the TMDL document). MassDEP's position is that TMDL implementation will be conducted through an iterative process where adjustments may be needed in the future. The two forms of monitoring include 1) tracking implementation progress as approved in the CWMP 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. 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 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 infaunal communities would require periodic monitoring on a frequency of about every 3-5 years.

**Assessment:** EPA concludes that the anticipated ambient water quality monitoring program approved in the CWMP by MassDEP is sufficient to evaluate the adequacy of the TMDL and attainment of water quality standards, although is not a required element of EPA's TMDL approval process.

## 9. Implementation Plans

*On August 8, 1997, Bob Perciasepe (EPA Assistant Administrator for the Office of Water) issued a memorandum, "New Policies for Establishing and Implementing Total Maximum Daily Loads (TMDLs)," that directs Regions to work in partnership with States/Tribes to achieve nonpoint source load allocations established for 303(d)-listed waters impaired solely or primarily by nonpoint sources. To this end, the memorandum asks that Regions assist States/Tribes in developing implementation plans that include reasonable assurances that the nonpoint source load allocations established in TMDLs for waters impaired solely or primarily by nonpoint sources will in fact be achieved. The memorandum also includes a discussion of renewed focus on the public participation process and recognition of other relevant watershed management processes used in the TMDL process. Although implementation plans are not approved by EPA, they help establish the basis for EPA's approval of TMDLs.*

The implementation plan for the total nitrogen TMDL for the Waquoit Bay system is described on pages 41-45 of the TMDL document. MassDEP has provided the following implementation plan recommendations:

- **Septic system** loading from private residences is a significant contributor to the controllable N load, 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. An approximately 75.7% reduction in attenuated septic loads from present conditions is required in the septic load to the pond to achieve the threshold requirements. MassDEP realizes that an adaptive management approach may be used to observe implementation results over time and allow for adjustments based on those results.
- **Stormwater runoff** NPDES permits issued in Massachusetts do not establish numeric effluent limitations for stormwater discharges, rather, they establish narrative requirements, including best management practices, to meet the following six minimum control measures and to meet State Water Quality Standards.
  1. Public education and outreach particularly on the proper disposal of pet waste,
  2. Public participation/involvement,
  3. Illicit discharge detection and elimination,
  4. Construction site runoff control,
  5. Post construction runoff control, and
  6. Pollution prevention/good housekeeping.

As part of their applications for Phase II permit coverage, communities must identify the best management practices they will use to comply with each of these six minimum control measures and the measurable goals they have set for each measure. Therefore, compliance with the requirements of the Phase II stormwater permit in the Town of Falmouth will contribute to

the goal of reducing the nitrogen load as prescribed in this TMDL for the Waquoit Bay System watershed.

- **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.

EPA concludes that the approach taken by MassDEP is reasonable because of the resources available to the towns to address nitrogen such as the CWMP, additional Linked Model runs at nominal expense, assessment of cost-effective options for reducing loadings from individual on-site subsurface wastewater disposal systems, as well as reductions in stormwater runoff and/or fertilizer use within the watershed through the establishment of local by-laws and/or the implementation of stormwater Best Management Practices. 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 Falmouth that could be incorporated into the implementation plans.

**Assessment:** MassDEP has addressed the implementation plan. Although EPA is not approving the implementation plan, EPA has concluded that it outlines a reasonable approach to implementation, as demonstrated by the foregoing and by the TMDL's administrative record.

## 10. Reasonable Assurances

*EPA guidance calls for reasonable assurances when TMDLs are developed for waters impaired by both point and nonpoint sources. In a water impaired by both point and nonpoint sources, where a point source is given a less stringent wasteload allocation based on an assumption that nonpoint source load reductions will occur, reasonable assurance that the nonpoint source reductions will happen must be explained in order for the TMDL to be approvable. This information is necessary for EPA to determine that the load and wasteload allocations will achieve water quality standards.*

*In a water impaired solely by nonpoint sources, reasonable assurances that load reductions will be achieved are not required in order for a TMDL to be approvable. However, for such nonpoint source-only waters, States/Tribes are strongly encouraged to provide reasonable assurances regarding achievement of load allocations in the implementation plans described in section 9, above. As described in the August 8, 1997 Perciasepe memorandum, such reasonable assurances should be included in State/Tribe implementation plans and "may be non-regulatory, regulatory, or incentive-based, consistent with applicable laws and programs."*

The TMDL targets for point sources in this TMDL are not less stringent based on any assumed nonpoint source reductions, so documentation of reasonable assurance in the TMDL is not a requirement. However, MassDEP addresses the concept of reasonable assurance insofar as it relates to overall TMDL implementation on pages 46-47 of the TMDL document. 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 nitrogen loading on-site subsurface wastewater disposal systems, stormwater runoff (including fertilizers), and to prevent any future degradation of these valuable resources. Enforcement of local, state, and federal programs for pollution control contribute to the level of reasonable assurance. There are also financial incentives to encourage the town to follow through with its plans and prevent further degradation to water quality.

**Assessment:** Because MassDEP did not increase WLAs based on expected LA reductions, reasonable assurance is not required. However, EPA acknowledges MassDEP's reasonable assurance discussion for the record.

## 11. Public Participation

*EPA policy is that there must be full and meaningful public participation in the TMDL development process. Each State/Tribe must, therefore, provide for public participation consistent with its own continuing planning process and public participation requirements (40 C.F.R. § 130.7(c)(1)(ii)). In guidance, EPA has explained that final TMDLs submitted to EPA for review and approval must describe the State/Tribe's public participation process, including a summary of significant comments and the State/Tribe's responses to those comments. When EPA establishes a TMDL, EPA regulations require EPA to publish a notice seeking public comment (40 C.F.R. § 130.7(d)(2)).*

*Inadequate public participation could be a basis for disapproving a TMDL; however, where EPA determines that a State/Tribe has not provided adequate public participation, EPA may defer its approval action until adequate public participation has been provided for, either by the State/Tribe or by EPA.*

The public participation process for the Waquoit Bay System TMDL is described on page 47 of the TMDL document. MassDEP publicly announced the draft TMDL and copies were distributed to key stakeholders. A public meeting to present the results of and answer questions on this TMDL was held on December 19, 2019 in the Selectman's meeting room in Falmouth Town Hall. Comments received at the public meeting and received in writing within the 30-day comment period were considered by MassDEP. The attendance list, public comments from the meeting, written comments received by MassDEP, and the MassDEP responses are included in Appendix E of the TMDL document. MassDEP fully addressed all comments received in Appendix E of the TMDL document.

**Assessment:** EPA concludes that MassDEP has done a sufficient job of involving the public in the development of the TMDL, provided adequate opportunities for the public to comment and has addressed the comments received as set forth in the response to comment section of the TMDL document.

## 12. Submittal Letter

*A submittal letter should be included with the TMDL analytical document, and should specify whether the TMDL is being submitted for a technical review or is a final submittal. Each final TMDL submitted to EPA must be accompanied by a submittal letter that explicitly states that the submittal is a final TMDL submitted under Section 303(d) of the Clean Water Act for EPA review and approval. This clearly establishes the State/Tribe's intent to submit, and EPA's duty to review, the TMDL under the statute. The submittal letter, whether for technical review or final submittal, should contain such information as the name and location of the waterbody, the pollutant(s) of concern, and the priority ranking of the waterbody.*

**Assessment:** On May 18, 2020, MassDEP submitted the Final Waquoit Bay System; including Eel Pond, Quashnet River, Hamblin Pond, and Jehu River Total Maximum Daily Loads for Total Nitrogen (Control #378.1) and associated documents for EPA approval. The documents contained all of the elements necessary to approve the TMDL



**Attachment 1: Waquoit Bay System Total Nitrogen TMDLs (9 Restoration, 3 Pollution Prevention)** (Appendix D of TMDL document)

<b>Waterbody Name</b>	<b>Segment ID</b>	<b>Impairment [TMDL Type]</b>	<b>TMDL (kg N/day)</b>
Waquoit Bay <sup>1</sup>	MA96-21	Oxygen (Dissolved), Estuarine Bioassessments [Restoration]	<b>14.04</b>
Childs River – upper	MA96-120 <sup>2</sup>	Oxygen (Dissolved), Nutrient/Eutrophication Biological Indicators, Estuarine Bioassessments [Restoration]	<b>4.53</b>
Eel Pond System <sup>3</sup>	MA96-121 <sup>2</sup>	[Restoration]	<b>32.2</b>
Eel Pond - east		Estuarine Bioassessments, Nutrient/Eutrophication Biological Indicators	21.31
Eel Pond - south		Estuarine Bioassessments, Nutrient/Eutrophication Biological Indicators	1.19
Eel Pond - west		Oxygen (Dissolved), Nutrient/Eutrophication Biological Indicators	9.70
Quashnet River <sup>4</sup>	MA96-20	Oxygen (Dissolved), Nitrogen (Total) [Restoration]	<b>11.25</b>
Hamblin Pond <sup>3,4</sup>	MA96-58	Nitrogen (Total), Estuarine Bioassessments [Restoration]	<b>8.19</b>
Little River <sup>4</sup>	MA96-61	Nitrogen (Total), Estuarine Bioassessments [Restoration]	<b>2.92</b>
Jehu Pond <sup>4</sup>	MA96-59	Nitrogen (Total), Estuarine Bioassessments [Restoration]	<b>8.60</b>
Great River <sup>4</sup>	MA96-60	Nitrogen (Total), Estuarine Bioassessments [Restoration]	<b>16.53</b>
Sage Lot Pond	MA96-119 <sup>2</sup>	Estuarine Bioassessments, Nutrient/Eutrophication Biological Indicators [Restoration]	<b>2.09</b>
<i>Freshwater</i>			
Childs River	MA96-98	Not assessed for Nitrogen (Total) impairment, but TMDL needed since waterbodies are linked [Protective]	<b>4.12</b>
Quashnet River	MA96-90	Not assessed for Nitrogen (Total) impairment, but TMDL needed since waterbodies are linked [Protective]	<b>13.47</b>

Red Brook	MA96-25	Not assessed for Nitrogen (Total) impairment, but TMDL needed since waterbodies are linked [Protective]	<b>2.10</b>
<b>Waquoit Bay System Total</b>			<b>120.02</b>

<sup>1</sup>Includes the Seapit River (MA96-122<sup>2</sup>)

<sup>2</sup>To be considered in a future Integrated List of Waters (303(d))

<sup>3</sup>The Eel Pond System includes Eel Pond-east, Eel Pond-west, and Eel Pond-south

<sup>4</sup>These TMDLs replace previously EPA approved TMDLs #33811-33815

<b>Data for entry in EPA's National TMDL Tracking System</b>								
TMDL Name *		<b>Final Waquoit Bay System; including Eel Pond, Quashnet River, Hamblin Pond, and Jehu River Total Maximum Daily Loads for Total Nitrogen</b>						
Number of TMDLs*		9 restoration, 3 pollution prevention						
Type of TMDLs*		Nutrients (nitrogen)						
Number of listed causes/parameters (from 303(d) list)		20						
Lead State		Massachusetts (MA)						
TMDL Status		Final						
<b>Individual TMDLs listed below</b>								
Action ID#	TMDL Segment name	TMDL Segment ID #	TMDL Pollutant ID# & name	TMDL Impairment PARAMETERS/Cause(s), ID# and name	Pollutant endpoint	Unlisted?	MA DEP Point Source & ID#	Listed for anything else?
R1_MA_2020_8	Waquoit Bay	MA96-21	772 Nitrogen, Total	449 Oxygen (Dissolved) 472 Estuarine Bioassessments	14.04	N		
R1_MA_2020_8	Childs River – upper	MA96-120*  New segment	772 Nitrogen, Total	449 Oxygen (Dissolved) 791 Nutrient/Eutrophication Biological Indicators 472 Estuarine Bioassessments	4.53	N		
R1_MA_2020_8	Eel Pond System	MA96-121*  New segment	772 Nitrogen, Total	449 Oxygen (Dissolved) 791 Nutrient/Eutrophication Biological Indicators 472 Estuarine Bioassessments	32.2	N		
R1_MA_2020_8	Quashnet River	MA96-20	772 Nitrogen, Total	449 Oxygen (Dissolved) 772 Nitrogen (Total)	11.25	N		500 Fecal Coliform
R1_MA_2020_8	Hamblin Pond	MA96-58	772 Nitrogen, Total	772 Nitrogen (Total) 472 Estuarine Bioassessments	8.19	N		500 Fecal Coliform
R1_MA_2020_8	Little River	MA96-61	772 Nitrogen, Total	772 Nitrogen (Total) 472 Estuarine Bioassessments	2.92	N		
R1_MA_2020_8	Jehu Pond	MA96-59	772 Nitrogen, Total	772 Nitrogen (Total) 472 Estuarine Bioassessments	8.60	N		

R1_MA_2020_8	Great River	MA96-60	772 Nitrogen, Total	772 Nitrogen (Total) 472 Estuarine Bioassessments	16.53	N		
R1_MA_2020_8	Sage Lot Pond	MA96-119*  New segment	772 Nitrogen, Total	472 Estuarine Bioassessments 791 Nutrient/Eutrophication Biological Indicators	2.09	N		
R1_MA_2020_9p	Childs River	MA96-98	772 Nitrogen, Total	Not assessed for Nitrogen (Total) impairment, but TMDL needed since waterbodies are linked [Protective]	4.12	Y		
R1_MA_2020_9p	Quashnet River	MA96-90	772 Nitrogen, Total	Not assessed for Nitrogen (Total) impairment, but TMDL needed since waterbodies are linked [Protective]	13.47	Y		
R1_MA_2020_9p	Red Brook	MA96-25	772 Nitrogen, Total	Not assessed for Nitrogen (Total) impairment, but TMDL needed since waterbodies are linked [Protective]	2.10	Y		
TMDL Type			Nonpoint Sources					
Establishment Date (approval)*			June 18, 2020					
Completion (final submission) Date			May 18, 2020					
Public Notice Date			December 19, 2019					
EPA Developed			No					
Towns affected* (in alphabetical order)			Falmouth, Mashpee, Sandwich					