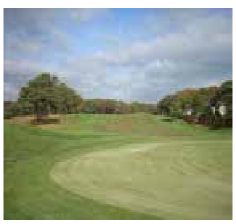
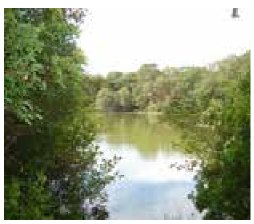
Final Recommended Plan / Final Environmental Impact Report

Town of Mashpee Sewer Commission





May 2015

GHD CLIENTS | PEOPLE | PERFORMANCE

June 10, 2015

Mr. Matthew A. Beaton, Secretary
Executive Office of Energy & Environmental Affairs
Attention: MEPA Office
EEA# 12615
100 Cambridge Street Suite 900
Boston, MA 02114

RE: Comprehensive Watershed Nitrogen Management Plan, Town of Mashpee
GHD File No.: 8612001

Dear Mr. Beaton:

On behalf of the Mashpee Sewer Commission, we are pleased to submit the enclosed Final Recommended Plan/Final Environmental Impact Report for the above referenced project. This is the fourth of four submittals prepared and submitted for MEPA review. This project culminates in the Final Recommended Plan and Environmental Impact Report for the project planning area as part of the Comprehensive Wastewater Management Planning (CWMP) process.

The Mashpee Sewer Commission has continued to work hard to develop this document, the approach to identify alternatives, and a Recommended Plan that is key to the environmental and economic sustainability of project planning area. We have consulted with the Massachusetts Department of Environmental Protection, Department of Energy Resources, Division of Marine Fisheries, the Cape Cod Commission and Joint Base Cape Cod/MassDevelopment among other agencies and entities in development of this plan. This document also addresses the various issues raised in the most recent Secretary's Certificate issued September 12, 2014 regarding the project.

Please find enclosed two (2) hard copies and one PDF file on CD of the above referenced document. We look forward to the MEPA review of this document so we can proceed with implementation.

If you have any questions, please contact Thomas Fudala, Mashpee Sewer Commission Chair at 508-539-1400 x 8521 or ftfudala@mashpeema.gov or J. Jefferson Gregg, P.E., BCEE, GHD Project Manager at 774-470-1640 or jeff.gregg@ghd.com.

Sincerely,

GHD Inc.

J. Jefferson Gregg, P.E., BCEE
Project Manager

Enclosure

cc: All individuals on Distribution List

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Applied Coastal Research and Engineering **(CD)** 766 Falmouth Road, Suite A-1 Mashpee, MA 02649	Brian Howes **(CD)** UMass Dartmouth School for Marine Science and Technology 706 Rodney French Boulevard New Bedford, MA 02744-1221
Cape Cod Water Protection Collaborative **(CD)** Andrew Gottlieb P.O. Box 427 3195 Main Street Barnstable, MA 02630	Dale Saad, P.E. **(HC & CD)** Special Project Manager, Embayment Nutrient Studies Town of Barnstable DPW, Engineering Div. 382 Falmouth Road Hyannis, MA 02601
David Mason, Health Agent **(CD)** Town of Sandwich 16 Jan Sebastian Drive Sandwich, MA 02563	Gerald Potamis, P.E. **(HC & CD)** Wastewater Superintendent 59 Town Hall Square Falmouth, MA 02540
Lindsey Counsell **(CD)** Three Bays Preservation P.O. Box 215 Osterville, Ma 02655	Lombardo Associates Inc. **(CD)** 188 Church Street Newton, MA 02458
Mashpee Wampanoag Indian Tribal Council **(CD)** P.O. Box 1048 Mashpee, MA 02649	Michael Ciaranca **(CD)** Environmental & Readiness Center Building 1204 West Inner Road Camp Edwards, MA 02542
Natural Resources Department **(CD)** Mashpee Wampanoag Tribe 483 Great Neck Road South Mashpee, MA 02649	Thomas O'Neill **(CD)** Mashpee Chamber of Commerce P.O. Box 625 Mashpee, MA 02649
Association to Preserve Cape Cod **(CD)** Edward J. DeWitt 3010 Main Street P.O. Box 398 Barnstable, MA 02630-0398	

HC = Hard Copy   CD = Compact Disc

FINAL RECOMMENDED PLAN / FINAL ENVIRONMENTAL IMPACT REPORT

Prepared for

TOWN OF MASHPEE SEWER COMMISSION

Prepared by

GHD INC.

1545 IYANNOUGH ROAD

HYANNIS, MASSACHUSETTS 02601-1840

MAY 2015

Executive Summary

Preamble

In June of 2014 the Draft Recommended Plan and Draft Environmental Impact Report (DRP/DEIR) was submitted as the third of four reports as part of the Town of Mashpee's Comprehensive Planning Process. It presented the recommendations of this planning process to address the nitrogen Total Maximum Daily Loads (TMDLs) established for Popponesset Bay and Waquoit Bay's eastern basin; it discussed the mitigation measures and implementation approach for Mashpee (and its neighboring communities within the project planning area) to address the needs as identified in previous documents.

The Comprehensive Wastewater Management Plan (CWMP) is the culmination of multiple documents, the last of which is the Final Recommended Plan and Final Environmental Impact Report (FRP/FEIR or The Plan). This report is the last of four documents required as part of the Massachusetts Environmental Policy Act (MEPA)/Cape Cod Commission (CCC) Development of Regional Impact (DRI) joint review process.

The Plan is the result of over 15 years of effort in examining Mashpee's needs and coordinating with the efforts of the Massachusetts Estuaries Project (MEP) and, most recently, the Cape Cod Commission's 208 Planning efforts. This has resulted in a 25-plus year implementation schedule allowing mid-course corrections to occur as part of the Adaptive Management part of the process. The Project Planning Area (PPA) includes all of Mashpee and portions of the neighboring communities of Barnstable, Falmouth and Sandwich that fall within the Popponesset Bay watersheds or eastern Waquiot Bay watersheds.

The plan is predicated on the use of shellfish in the following areas: Popponesset Bay/ Popponesset Creek, Ockway Bay, Mashpee River and Shoestring Bay on the Popponesset Bay watersheds side and inHamblin Pond, Little River, Jehu Pond and Great River .on the Waquiot Bay side. Removal of the remaining balance of nitrogen will rely on a combination of traditional infrastructure (sewers), stormwater improvements through current best management practices (BMPs) and fertilizer reduction through the new bylaws/regulations in Mashpee and Falmouth.

The traditional infrastructure is primarily focused in the Mashpee River watershed in Phase 1 with a shift to include the Quashnet/Moonakis River watershed in Phase 2. The efforts in the Quashnet/Moonakis watershed will depend on the findings of the proposed "soft solution" flushing analysis for the Moonakis River and, ultimately, the availability of Joint Base Cape Cod (JBCC) for a regional treatment solution.

Monitoring and additional modeling are proposed for tracking performance throughout the 20-30 year planning period. The Adaptive Management Plan is backed by a "Plan B" option to consider full traditional infrastructure in the needed areas at build-out if increased future loads or lesser performance of the adaptive approaches are seen over the planning period. TMDL compliance/MEP modeling points will be used to track performance and allow for mid-course corrections through adaptive management.

The estimated capital cost for Phase 1 is approximately $34 million, and, depending on shellfish performance and adaptive management, TMDL compliance is estimated between $220 and $360 million.

ES.1 Background

The purpose of the Final Recommended Plan and Final Environmental Impact Report (FRP/FEIR) is to present the recommendations of this planning process to address the nitrogen Total Maximum Daily Loads (TMDLs) established for Popponesset Bay and Waquoit Bay's eastern basin, and to discuss the mitigation measures and implementation approach for Mashpee (and its neighboring communities within the project planning area) to address these needs as identified in previous documents. These recommendations as they relate to Mashpee will then be managed through the Mashpee Water and Sewer District and the Town of Mashpee.

The Town of Mashpee initiated the process to develop a Watershed Nitrogen Management Plan (WNMP) in 1999 in order to address the nitrogen impacts to coastal embayments and to evaluate options for restoring those embayments through the development of a Comprehensive Wastewater Management Plan (CWMP). Because the contributing areas to the estuaries (watersheds) are shared by multiple towns, Mashpee's WNMP Project Planning Area (PPA) includes the Town of Mashpee and the portions of neighboring towns (Barnstable, Falmouth, and Sandwich) that fall within the Popponesset Bay and Waquoit Bay East Basin watersheds. The PPA is illustrated in Figure ES-1. The WNMP/CWMP is intended to provide an environmentally and economically sound plan for nitrogen reduction, wastewater treatment, and treated water recharge in the planning area.

As stated previously, the CWMP is the culmination of multiple documents generated during the planning process.

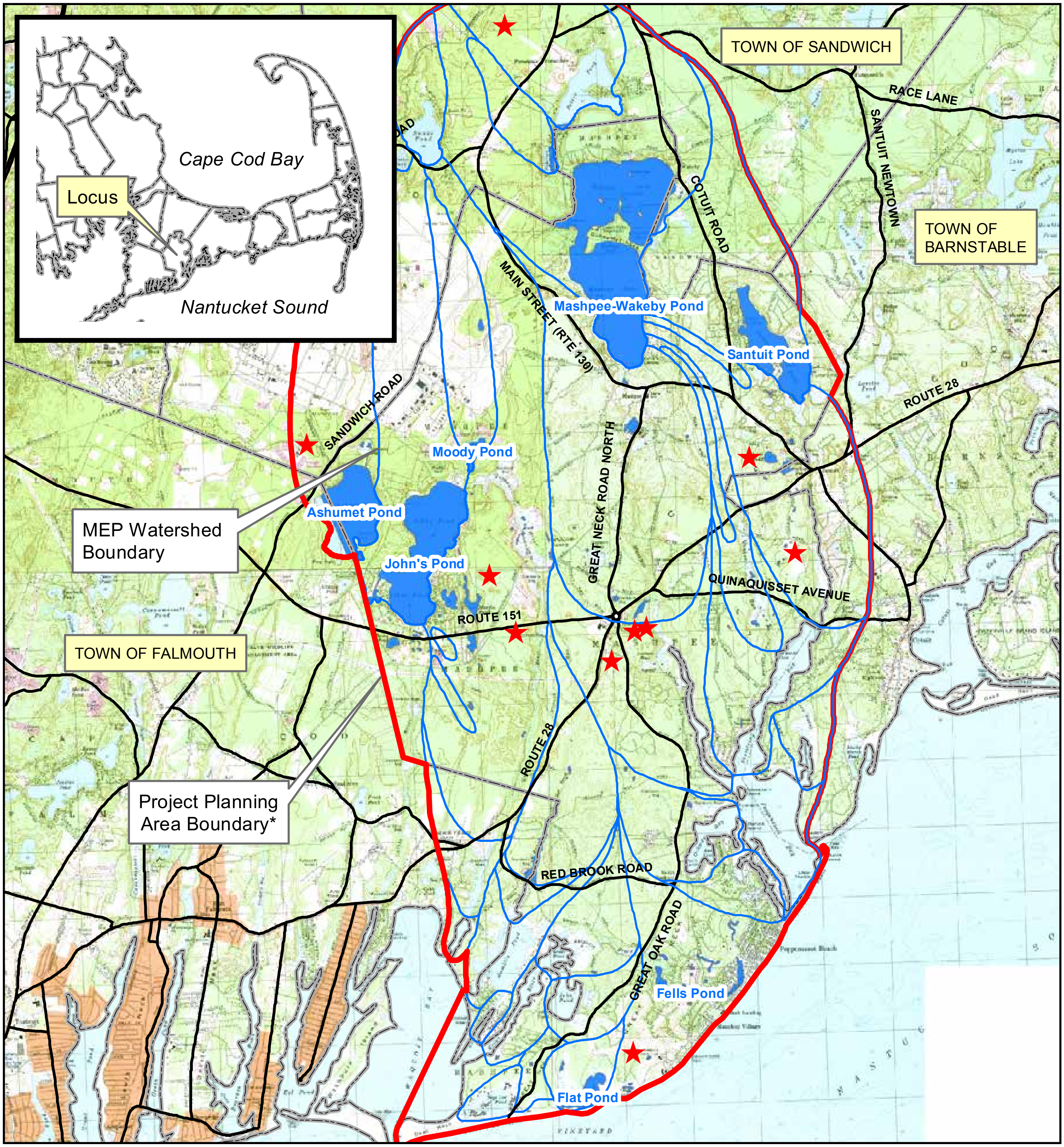
ES.2 MEPA Planning Documents

In September of 2001, the Town of Mashpee, through the Mashpee Sewer Commission, entered into the MEPA process by filing their Environmental Notification Form (ENF) and MEPA Unit/Cape Cod Commission Joint Review Process Application Form. That document identified several major deliverables to be submitted for review through this process in addition to the Notice of Project Change submittals required due to the extended nature of this project.

Those deliverables, which have been submitted, included:

1. **Needs Assessment Report** (NAR)—issued in April 2007
2. **Technology Screening Report**—issued in November 2007
3. **Draft Alternative Scenarios Analysis and Site Evaluation Report**—issued in March 2008
4. **Two (2) Notices of Project Change** (in 2007 and 2012)
5. **Alternatives Screening Analysis Report** (ASAR)—issued in August 2013
6. **Draft Recommended Plan/Draft Environmental Impact Report** (DRP/DEIR)—issued in June 2014

Following the submittal of the DRP/DEIR, MEPA issued their most recent certificate dated September 12, 2014, a copy of which is included in Appendix 1-1. That Appendix also includes the most recent response to comments.



LEGEND

- MEP Watershed
- ★ WWTF Location
- Major Roadway (For Location Reference)

***The Project Area is the combination of the entire Town of Mashpee and the watersheds of Popponesset Bay and Waquoit Bay-East as delineated by the Massachusetts Estuaries Project (MEP) extending into the Towns of Barnstable, Falmouth and Sandwich.**

Paper Size ANSI A

0 0.375 0.75 1.5 Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001

N

Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

PROJECT PLANNING AREA

Job Number	86-12001
Revision	A
Date	07 May 2015

Figure ES-1

1545 Iyannough Road, Hyannis Massachusetts 02601 USA T 1 508 362 5680 F 1 508 362 5684 E hyamail@ghd.com W www.ghd.com

G:\86\12001\GIS\00074 Mashpee\2014\Final Report Figures\Updated Figures 5_5_2015\00074F01-1_Project Planning Area.mxd

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ES.3 Public Participation

The Mashpee Sewer Commission has actively engaged in public participation throughout the planning process, with a focus on educating the public on the issues of wastewater and nutrients as they relate to the watersheds of Popponesset Bay and Waquoit Bay's east basin, as well as the remaining portions of Mashpee within the Project Planning Area. The Commission has actively encouraged residents, Town leaders, business leaders, regulators, and adjacent communities within and outside of the planning area to actively participate in the planning process. The public outreach program consists of several components, including:

- Monthly Sewer Commission meetings—televised and open to the public.
- A Community Advisory Committee (CAC)—as appointed by the Board of Selectmen.
- Public presentations on various phases and aspects of the project and related efforts through the Town and Region.
- Development of public education materials:
  - Project web page: www.mashpeewaters.com, including project description, meeting minutes, reports, contacts, and other project related information.
  - Project kiosk; focusing on the problem and where to get additional information.
  - Informational flier (first of two): the first focused on the nitrogen issues facing the PPA and general information on the project. The second will be coordinated with the submittal of the Final Recommended Plan.
- Participation in a formal MEPA/CCC environmental review process.
- Participation in several "Pilot" projects supported by Barnstable County and other regional agencies.
- Joint meetings with Barnstable, Falmouth, and Sandwich to review the project and the efforts being made by all parties to address nitrogen in these watersheds and throughout the region.
- Participation in the Cape Cod Commission 208 Planning process.

ES.4 Summary of Previous Evaluations

Throughout the planning process the CWMP has evaluated several alternatives/options and has performed additional related evaluations in the process of developing a Recommended Plan.

Following the release of the Needs Assessment Report, the Mashpee Sewer Commission identified five different management scenarios for evaluation and analysis. The 2008 Draft Alternative Scenarios Report discusses the general characteristics of each scenario and the basic methodology used to evaluate each scenario.

The five scenarios identified were:

- Scenario 1—No expansion of existing wastewater treatment facilities.
- Scenario 2—Upgrade and expansion of existing facilities to a practical extent.
- Scenario 3/3R—Cluster Scenario (prepared by Lombardo Associates Inc.).

- Scenario 4—Fair Share reduction.
- Scenario 5—Centralized treatment approach.

Each of these scenarios was modeled through the Massachusetts Estuaries Project (MEP) program for both Popponesset Bay and Waquoit Bay East. The findings were used in the development of Options 1A, 1B, and 1C as outlined in the 2012 Technical Memorandum presenting these options for addressing nitrogen in the watersheds. The ultimate goal of these new options was to advance the development of a Recommended Plan for nitrogen management within the PPA. Each option was modeled by the MEP to demonstrate feasibility to meet the TMDLs. The results of these model runs were formally presented in the Final ASAR.

The 2013 ASAR summarized the planning efforts performed to date, the model results and findings for the three proposed Options (1A, 1B, and 1C), and the technologies screened (as part of the 2007 Technology Screening Report). This document also summarized the framework for the Recommended Plan and identified the general categories of nitrogen removal that would be used to form the basis of the Recommended Plan.

The ASAR identified these main categories to address nitrogen removal:

- Source Removal.
- Direct Environmental Mitigation.
- Land Management Strategies.

Using these categories the ASAR outlined a framework for the development of the Recommended Plan.

The 2014 Draft Recommended Plan built upon this effort and evaluated alternatives to the Option 1A plan, including:

- Centralized vs. new cluster area treatment facilities
- Regional Solutions
- Existing Wastewater Treatment Facilities (WWTFs)
- Traditional vs. Hybrid Solutions
  - Primarily:
    - Shellfish Aquaculture
  - Secondarily:
    - Permeable Reactive Barrier (PRB)
    - Bog and Wetland Restoration
    - Onsite systems

The evaluations and draft recommended plan are included in Chapters 4 and 5 of this report.

ES.5 Summary of Recommended Plan

The efforts of the Draft Plan and comments from the various regulators and reviewers resulted in the Final Recommended Plan as outlined below. Chapter 6 provides additional detail of this Plan, and Chapter 9 outlines the proposed implementation schedule.

The following summarizes the major components of the Recommended Plan.

1. Shellfish Aquaculture:

Table ES-1 Shellfish Plan for Nitrogen Removal

Area	Nitrogen Removal[1] Required (MEP) Metric Tons (MT) N/year	Removal by Shellfish MT N/year	Shellfish Harvest MT Live/year	Number of Shellfish Million/Species
SC19 + SC20 (Shellfish Resource Areas)				
Popponesset Bay/Creek	1.46	1.46	292	4.87/quahogs[2]
Ockway Bay	0.87	0.87	174	2.45/quahogs[2]
Mashpee River	5.01	2.5	500	5.00/oysters[3]
Shoestring Bay	4.03	2.00	400	4.00/oysters[3]
Total	**11.37**	**6.83**	**1,366**	**16.32**
SC16 (Shellfish Resource Areas)				
Hamblin Pond	3.41	3.41	682	11.37/quahogs[2]
Little River	0.32	0.32	64	1.07/quahogs[2]
Jehu Pond	1.05	1.05	210	3.50/quahogs[2]
Great River	0.98	0.98	196	3.27/quahogs[2]
Total	**5.76**	**5.76**	**1,152**	**19.21**
Total SC16, 19 + 20	**17.13**	**12.59**	**2,518**	**35.53**

Notes:

1. Nitrogen removal required calculated from: MEP Report, Howes et al. 2004. Table ES-2 page ES 10
2. Littleneck quahogs @ 60 g. N
3. Oysters @ 100 g

2. Wastewater Treatment at Joint Base Cape Cod (JBCC):
   a. Potential expansion:
      i. Mashpee Subareas H (including High School), L, and M.
      ii. Sandwich Subareas Sand-1, -2, and -3.
      iii. No change to open sand beds.
      iv. Future consideration (potential WWTF additional expansion):
         a) Falmouth areas Fal-13 to Fal-17 (potentially to be recharged outside watershed).
         b) No change to open sand beds.
   b. Expansion of the existing Carrousel® WWTF to add another parallel train of equal size and an additional second clarifier.
3. Wastewater Treatment at Proposed New Facilities:
   a. Site 4 to serve Subareas: F, S1, S2, and T:
      i. Phased to pick up portions of S adjacent to Falmouth Road first.
      ii. Recharge at Site 4.
      iii. Fallback recharge area at Willowbend Golf Course.
      iv. Treatment performance dependent on recharge location
   b. Back Road Site as a backup to JBCC (see 2)
      i. Sand-1, Sand-2, and Sand-3 would need to be addressed in their watersheds and recharged outside the watershed, or possibly connect to a regional facility at Back Road.
   c. Site 6 to serve Subareas identified under shellfish propagation (except Subarea B):
      i. Later year project as shellfish performance is monitored.
4. Wastewater Treatment at Existing WWTFs with Improvements/Expansions/Modifications:
   a. New Seabury—expand recharge capacity, potential future expansion of Subarea B (as fallback to shellfish):
      i. Potential expanded recharge capacity from other treatment locations (Mashpee Commons, Windchime Point and Site 6) drip irrigation in addition to existing recharge capacity at Site 7 and golf course areas.
      ii. No initial expansion needed until new facilities are constructed at Site 6 or modeling shows shellfish program will not meet TMDLs with continued recharge from Mashpee Commons and Windchime Point.
   b. Willowbend—expand recharge capacity, as fallback for Site 4 WWTF, improved future performance to 3 mg/L TN:
      i. Potential expanded recharge capacity (drip irrigation).
      ii. Potential extension of service to pick up Subarea I.
      iii. Evaluate performance needs in conjunction with shellfish results.
   c. Mashpee Commons:
      i. Potential expansion to Subarea P (and N as required).
      ii. Recharge locally under shellfish program.

iii. Possible need to relocate recharge to Site 7/New Seabury depending on results of shellfish propagation.

d. Mashpee High School—expand (as alternative to Back Road WWTF) or pump to either JBCC or Back Road Site (which is the fallback to JBCC).

e. Cotuit Meadows:

   i. Potential extension of service area to pick up flow from adjacent areas.

f. Wampanoag Village:

   i. Potential extension of service area to pick up flow from adjacent areas.

5. Wastewater Treatment at Existing WWTFs: Operating under existing permit, consider upgrade to improve performance (3 to 6 mg/L TN) based on shellfish results and other adaptive management programs:

a. Forestdale School.

b. Mashpee Village, Subarea G (to be constructed); if JBCC is not an option for other Subareas within the Quashnet River watershed, flow from this facility must be treated to 3 mg/L TN and recharged at Back Road Site.

c. Southport—If JBCC is not an option, must be recharged at Back Road Site.

d. South Cape Village.

e. Stratford Ponds.

f. Windchime Point.

6. Coordination with Adjoining Towns within the planning area with recharge outside the watershed (collection, treatment, and recharge):

a. Barnstable: Barn-37, -38, -39, -42.

b. Falmouth: Fal-13 through -17—see JBCC option.

c. Sandwich: Sand-4, -5, -6, and -8.

7. No change of the following current practices:

a. Mashpee I/A facilities.

b. Mashpee septic systems.

c. Sandwich septic systems.

d. Barnstable septic systems.

e. Falmouth septic systems.

8. Coordination with the Following Future Demonstration Projects/Evaluations:

- PRB Options (following Falmouth demonstration efforts).
- Wetland restoration projects.
- Feasibility Study for Quashnet/Moonakis River.

9. Coordination with the Cape Cod 208 Planning Efforts.

ES.5.1 Cost Summary

Table ES-2 Estimated Total Capital Cost of Entire Recommended Plan With and Without Shellfish at Build-out (1, 2, 6)

Estimated Capital Costs	Recommended Plan with Shellfish Aquaculture	Recommended Plan without Shellfish Aquaculture
Town of Mashpee Estimate		
Shellfish Aquaculture (yr 1)(7)	$1,300,000	$0
Collection System	$120,000,000	$170,000,000
Treatment System (5)	$32,000,000	$66,000,000
Recharge Facility	$5,400,000	$13,000,000
Mashpee Total	**$160,000,000**	**$250,000,000**
Neighboring Towns Estimate (Barnstable, Falmouth, Sandwich)7		
Shellfish Aquaculture (yr 1)(7)	$200,000	$0
Collection System	$53,000,000	$ 80,000,000
Treatment System (3, 4, 5)	$8,700,000	$ 23,000,000
Recharge Facility (3, 4)	$300,000	$ 2,000,000
Neighboring Town Total	**$62,000,000**	**$110,000,000**
Total	**$220,000.000**	**$ 360,000,000**

Notes:

1. Values are rounded to two significant figures and include allowances for fiscal, legal and engineering services, and contingency.
2. Values are based on an ENR index year of 2017 and are based on future flow conditions and TMDL compliance.
3. Treatment costs include new facilities and improvements/upgrades to existing facilities, including allowances for facilities located in Sandwich (not including those proposed to connect to JBCC), and Barnstable (Falmouth assumed to go to JBCC).
4. For neighboring communities of Barnstable, Falmouth, and Sandwich, collection, treatment, and recharge costs were estimated for planning purposes only; actual location, technology type, and site considerations would need to be determined by each individual community.
5. Estimated costs with shellfish aquaculture presume that existing and future loads are managed through this adaptive management approach; that Joint Base Cape Cod is available, and no additional recharge capacity is required at JBCC.
6. Does not consider increasing shellfish aquaculture areas to reduce sewering if shellfish performance is as good as or better than projected.
7. Includes potential cost sharing of shellfish aquaculture projects.

Table ES-3 Estimated Total Present Worth Cost of Recommended Plan at Build-out [(1)]

Operation and Maintenance Costs	TMDL Compliance with Shellfish Aquaculture	TMDL Compliance without Shellfish Aquaculture
Town of Mashpee Estimate		
Shellfish Aquaculture[(7)]	$1,300,000	$0
Collection System	$540,000	$1,000,000
Treatment System[(2)]	$3,100,000	$4,600,000
Recharge Facility[(2)]	$530,000	$1,200,000
Mashpee Total	**$5,500,000**	**$6,800,000**
Neighboring Towns Estimate (Barnstable, Falmouth, Sandwich)[8]		
Shellfish Aquaculture[(7)]	$200,000	$0
Collection System	$350,000	$500,000
Treatment System[(3)]	$660,000	$1,600,000
Recharge Facilities[(3)]	$4,000	$21,000
Neighboring Town Total	**$1,200,000**	**$2,000,000**
O&M Annual Total [(5)]	**$6,700,000**	**$ 8,900,000**
Present Worth O&M	**$100,000,000**	**$140,000,000**
Total Capital Cost (Table 6-11) [(6)]	**$220,000,000**	**$360,000,000**
Total Present Worth	**$320,000,000**	**$500,000,000**

1. Values are rounded to two significant figures, and include allowances for fiscal, legal and engineering services, and contingency.
2. Treatment O&M costs include new facilities and improvements/upgrades to existing facilities.
3. Neighboring communities of Barnstable, Falmouth, and Sandwich collection, treatment, and recharge O&M costs were estimated for planning purposes only; actual location, technology type, and site considerations would need to be determined by each individual community.
4. Estimated annual costs with shellfish aquaculture presume that existing and future loads are managed through this adaptive management approach; that Joint Base Cape Cod is available, and no additional recharge capacity is required at JBCC.
5. Costs do not include existing O&M at Joint Base Cape Cod associated with those facilities' existing operations.
6. Total capital costs are based on an ENR index year of 2017.
7. Cost does not include Town staff which is currently funded by the Town through their existing program.
8. Includes potential cost sharing of shellfish aquaculture projects.

ES.6 Adaptive Management Plan

Following the submittal of the final CWMP, the Sewer Commission/Town and District will work to formalize the Adaptive Management Plan.

These efforts would include those non-traditional methods discussed in Chapter 4 and Chapter 6. The following were specifically identified in the Recommended Plan (Chapter 6):

- Shellfish Propagation (key aspect of Recommended Plan)
- Stormwater Mitigation
- Fertilizer Management

The following are other technologies and approaches discussed in the planning effort that may be considered through adaptive management. This list includes but is not limited to the following:

- Demonstration Projects:
  - Permeable Reactive Barriers
  - Wetland Restoration
  - Eco Toilets
- Land Management
- Floating Wetlands
- Ocean Outfall
- CCC 208 Plan technologies as appropriate

The plan will also cover both the short- and long-term monitoring and modeling required to set decision points on performance of the recommended plan and timing.

As the plan is currently crafted, existing infrastructure will be utilized to its fullest extent, while several small “Phase 1” projects requiring extension of sewers in areas within the Mashpee River watershed are proposed in addition to shellfish aquaculture.

As the monitoring and modeling demonstrates performance (especially as it relates to shellfish aquaculture), adjustments in additional shellfish, other nitrogen removal measures, or advancement/ delay in sewer extensions will be implemented as needed to address nitrogen removal performance. This will be done with consideration of future development within the watersheds, shellfish health, and advancement of other mitigation approaches allowing the Town to make mid-course adjustments to their implementation approach; changes will be documented through Notices of Project Change.

ES.6.1 Monitoring and Modeling

It is understood that ongoing and proposed environmental monitoring activities may indicate environmental changes, and mid-course corrections to the plan implementation may be necessary. This understanding of possible mid-course corrections is often referred to as “Adaptive Management”. The following components of the compliance monitoring of this plan are identified. It is understood that as time progresses the plan will need to be adjusted to account for changes in permitting requirements and to take into consideration the changes in the environment.

<u>Initial/Short-Term Monitoring and Modeling</u>

- Shellfish/estuary baseline monitoring.

- Estuary short-term (ongoing) intensive water quality and shellfish quality monitoring to check near-term performance following MEP established protocols for estuary water quality and health.
- MEP flushing and stream gauge monitoring necessary to update MEP TMDL compliance points.
- Groundwater/drinking water supply quality.
- Groundwater mounding analysis through localized modeling.

Long Term Monitoring and Modeling

- Each of the existing and proposed treatment facilities that have MassDEP groundwater discharge permits have various monitoring requirements (including but not limited to):
  - Daily monitoring of flow, pH, disinfection, and turbidity.
  - Weekly/monthly monitoring of flow, biochemical oxygen demand (BOD), total suspended solids (TSS), total nitrogen (TN), and possibly total phosphorus (TP).
  - Groundwater monitoring well data (typically quarterly); upgradient and down gradient of recharge facilities.
- MEP estuary monitoring and modeling (land and hydrodynamic):
  - TMDL Compliance.
  - Long-term trending of standard MEP water quality parameters.
  - Eel grass surveys typically provided by MassDEP.
  - Benthic habitat surveys (if required).
- Shellfish/Estuary Monitoring:
  - Long-term compliance monitoring performed following the same MEP protocols to measure estuary health.
  - Shellfish monitoring in compliance with Division of Marine Fisheries (DMF) requirements depending on end use of shellfish.
  - Sample analysis including shellfish physical characteristics (length, weight, etc.) and nitrogen content
- Groundwater quality monitoring through existing drinking water supply wells (as required by MassDEP and Environmental Protection Agency), and groundwater monitoring wells (as required by groundwater discharge permits issued by MassDEP for wastewater treatment facilities).

A more extensive list is provided in Chapter 10.

ES.6.2 Compliance Reporting

As part of the implementation of the plan, each implementation phase will be incorporated into a compliance document related to Mashpee's efforts in achieving the TMDLs. Depending on the requirements established by the regulators, this document may need to reference or be referenced by the neighboring communities as part of their compliance reporting. This document, which will need to be negotiated with the Town, District, and associated regulators, would then be available to MassDEP, DMF, Coastal Zone Management (CZM), MEP, CCC, neighboring communities, and other agencies as so identified in that effort.

This report is anticipated to be tied directly to the monitoring efforts and "modeling" plan necessary to demonstrate compliance with the TMDLs and performance of those efforts implemented to date. Due to the long-term nature of the implementation, it is anticipated that this document would be prepared and issued every five years, similar to the MassDEP groundwater discharge permit program.

ES.6.3 Regional Coordination

As discussed previously, planning efforts of the neighboring communities for TMDL compliance and other water quality (fresh, salt, ground) are expected to have positive impacts on the estuary water quality; as a result, Towns need to be able to make mid-course adjustments in their implementation related to these impacts.

ES.7 Implementation Schedule

A preliminary implementation schedule is presented in this report, focusing on five (5) year increments following the initial short-term period surrounding the completion of the Final CWMP.

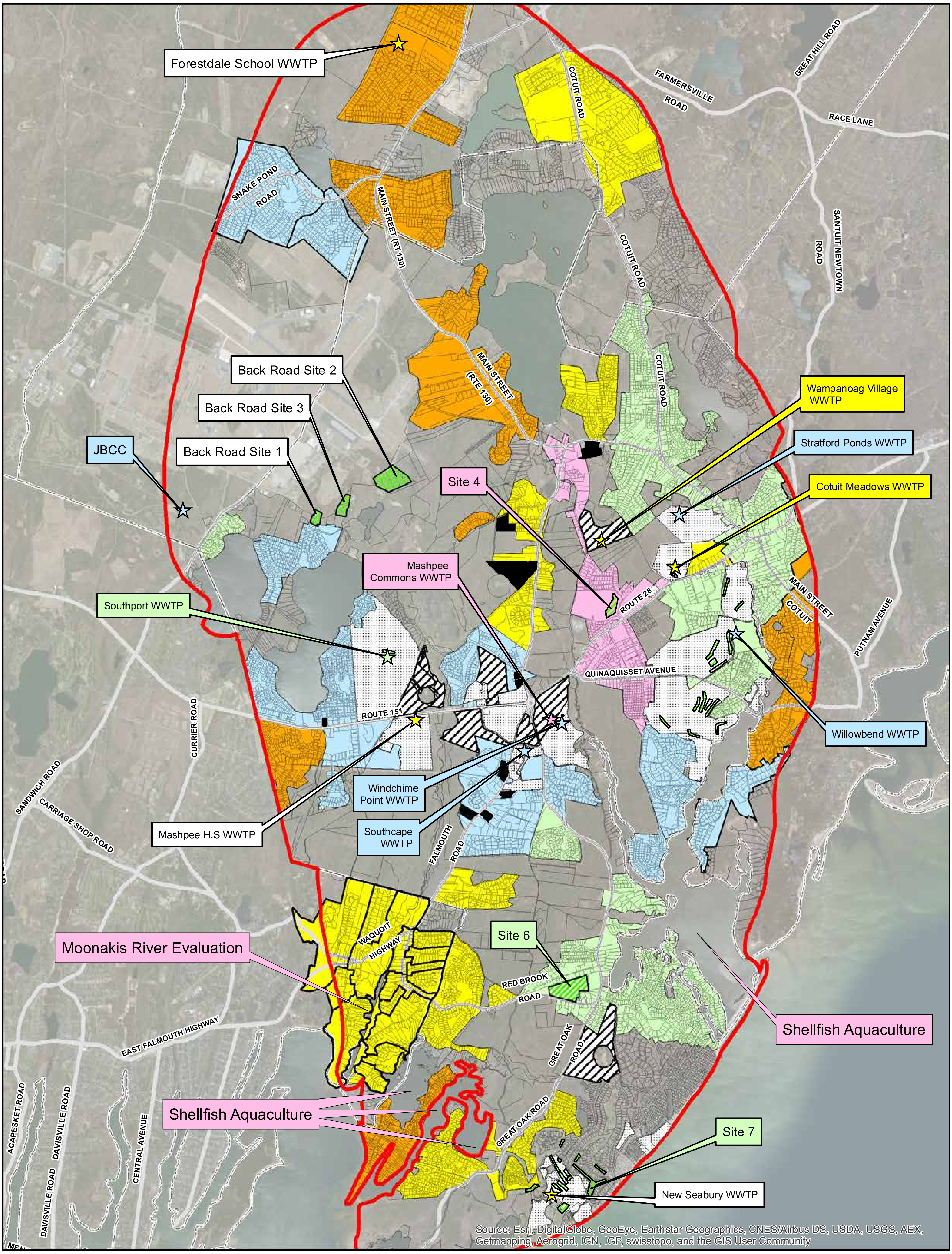
Shellfish aquaculture is targeted for early implementation because the Town is actively maintaining and pursuing expansion of shellfish aquaculture within Popponesset Bay (namely Mashpee River) in collaboration with the Wampanoag Tribe, MEP, and others. Additional initiatives and grant incentive programs are being pursued to expand this program; therefore this is the first part of the Recommended Plan's implementation. The shellfish program will work to fast-track the water quality improvement needed in the waterbodies as it relates to nitrogen impacts.

At the same time, efforts related to Ownership of several existing wastewater treatment facilities within the PPA and to the potential opportunity to work with MassDevelopment and Joint Base Cape Cod on a regional facility are critical ongoing tasks regarding implementation.

The following is a summary of the schedule (as shown in Figure ES-2).

2015-2016

- MEPA/DRI approval.
- Possible establishment of Mashpee Water and Sewer District. {Legislation passed April 14, 2014 – awaiting subsequent action – Spring 2015 Election}.
- MOU between the Mashpee Water and Sewer District and the Town of Mashpee (if needed), or creation/organization of Town departments for implementation and oversight.
- Shellfish Propagation (Current/Existing Program).
- WWTF Ownership Discussions
  - Joint Base Cape Cod/MassDevelopment
  - Private Facilities
    - New Seabury
    - Willowbend
    - Mashpee Commons
    - Southport
    - Stratford Ponds



LEGEND

- I/A
- Planning Area Boundary
- Parcel Boundary
- Wastewater WWTP (Color per Phase)
- Existing Private Sewer
- Proposed Private Sewer
- Proposed Treatment/Discharge Site

Implementation Phase

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5

Paper Size ANSI B

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

N

TOWN OF MASHPEE SEWER COMMISSION
Watershed Nitrogen Management Plan

Job Number 86-12001
Revision A
Date 07 May 2015

Implementation Phasing Plan

Figure ES-2

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- Continue development of Regional Memorandums of Understanding (this will also influence long-term implementation of areas within the neighboring communities).
- Fertilizer management bylaw implementation.
- Continued use of stormwater BMPs.

The following Phases 1 through 5 (divided into 5-year increments) are depicted in Figure ES-2 and were included in various phases based on considerations for areas targeted for shellfish and on each subarea's relative rankings established in Chapter 4 (Table 4-22).

2017-2021: Phase 1

- File Notices of Project Change and Development of Regional Impact (DRI) modifications (as needed/if required) to inform (and gain approval from) the environmental review process on the agreements and funding that will allow the next steps to proceed.
- Shellfish Propagation expansion in related sections of Popponesset Bay and addition in Jehu Pond and Hamblin Pond).
- Feasibility Study: Implementing Soft Solutions for Restoring the Quashnet/Moonakis River.
- Feasibility study on connection of Quashnet and Coombs Schools to Mashpee Commons WWTF.
- Implement findings of Quashnet/Moonakis River soft solutions (if favorable).
- Design and Construction of Site 4 facility (Phase 1) to serve sections of Subarea S (within Mashpee River Watershed) adjacent to Falmouth Road/Route 28.
- Design and Construction of related collection system to serve Site 4 WWTF.
- Design and Construction of collection system to extend to properties neighboring the Wampanoag WWTF.
- End of Phase compliance reporting—consider updating MEP Model runs (landuse and hydrodynamic models) and MEP calibrate with water quality and benthic flux sampling as needed.
- Determine additional evaluations of existing wastewater treatment facilities leading into next phase of proposed improvements.
- Coordinate with 208 Plan and potentially run CCC MVP tool in conjunction with MEP Model runs to check on updated water data and possible adaptive management approaches.

The estimated cost for Phase 1 infrastructure and long-term shellfish implementation is summarized in Table ES-4.

(continued)

Table ES-4 Estimated Total Present Worth Cost of Recommended Plan—Phase 1

Estimated Costs [1]	Phase 1 Implementation with Shellfish Aquaculture
Capital Costs	
Shellfish Aquaculture (yr1) [6]	$1,500,000
Collection System	$20,000,000
Treatment System [2, 3]	$11,000,000
Recharge facility [3, 4]	$1,500,000
Total	**$34,000,000**
O&M Costs	
Shellfish Aquaculture	$1,500,000
Collection System	$100,000
Treatment System	$1,300,000
Recharge Facilities	$30,000
Total	**$2,900,000**
Present Worth O&M [5]	$44,000,000
Total Present Worth	**$78,000,000**

Notes:

1. Values are rounded to two significant figures and include allowances for fiscal, legal and engineering services, and contingency. Based on an ENR year of 2017.
2. Treatment costs include new facilities and improvements/upgrades to existing facilities. For neighboring communities of Barnstable and Sandwich, collection, treatment, and recharge costs were estimated for planning purposes only; actual location, technology type, and site considerations would need to be determined by each individual community.
3. Allowances for facilities located in Sandwich (not including those proposed to connect to JBCC) and Barnstable (Falmouth assumed to go to JBCC).
4. Estimated costs with shellfish aquaculture presume that existing and future loads are managed through this adaptive management approach, Joint Base Cape Cod is available, and no additional recharge capacity is required.
5. Based on 20 years and 3% interest.
6. Cost does not include Town staff which is currently funded by the Town through their existing program(s).

2022-2026: Phase 2

- File Notices of Project Change and DRI modifications (as necessary) to inform (and gain approval from) the environmental review process on the agreements and funding that will allow the next steps to proceed.
- Shellfish Propagation (continuation and future expansion).

- Design and Construction of JBCC Improvements (or Back Road Site facility if agreement cannot be reached on a regional facility).
- Design and Construction of JBCC/Back Road Sewer Extensions (Mashpee) to serve Subarea H.
- If Quashnet/Moonakis soft solutions will not address 100% nitrogen TMDL and regional facility at JBCC is available, Sand-1, -2, and -3 should begin process of being connected to address the Quashnet River area, as should portions of Falmouth (in coordination/conjunction with any efforts regarding their plan and their demonstration projects being considered in that area).
- Connection of Quashnet and Coombs Schools to Mashpee Commons WWTF, upgrade as required.
- If shellfish propagation is not advancing as fast as or to the levels anticipated:
  - Site 4 facility expansion (Phase 2) development to serve additional Mashpee River and Popponesset Bay Watershed Mashpee (south of Route 28); with new recharge facilities at Willowbend.
  - Upgrade of Willowbend facility. Upgrade of Stratford Ponds, South Cape Village, and Windchime Point to improve nitrogen removal performance in conjunction with age of system improvements.
  - Mashpee River sewer extension (south of Route 28).
  - Popponesset Bay sewer extension (south of Route 28, south of Willowbend).
  - In conjunction with their planning efforts, Barnstable to address portions of Cotuit peninsula.
- End of Phase compliance reporting—consider updating MEP Model runs (landuse and hydrodynamic models) and MEP calibrate with water quality and benthic flux sampling as needed.
- Coordinate with 208 Plan and potentially run CCC MVP tool in conjunction with MEP Model runs to check on updated water data and possible adaptive management approaches.
- Determine additional evaluations of existing wastewater treatment facilities leading into next phase of proposed improvements.

2027-2031: Phase 3

- File Notices of Project Change and DRI modifications (as necessary) to inform (and gain approval from) the environmental review process on the agreements and funding that will allow the next steps to proceed.
- Shellfish Propagation (continuation and future expansion).
- If shellfish propagation continues to lag or is not advancing as fast or to the levels anticipated:
  - Upgrade of Southport to improve nitrogen removal performance.
  - Site 4 facility expansion with sewer extension to serve Mashpee River and Popponesset Bay Watershed Mashpee (north of Route 28) with associated sewer extensions.
  - Expansion of Willowbend WWTF service area.
  - Site 6 facility development initially to serve Ockway Bay area.

- New Seabury recharge facilities construction to support treated effluent from Mashpee Commons and Site 6.
- Barnstable and Sandwich to begin provisions to address their remaining portions of the Popponesset Bay Watersheds.

· End of Phase compliance reporting—consider updating MEP Model runs (landuse and hydrodynamic models) and MEP calibrate with water quality and benthic flux sampling as needed.

· Coordinate with 208 Plan and potentially run CCC MVP tool in conjunction with MEP Model runs to check on updated water data and possible adaptive management approaches.

· Determine additional evaluations of existing wastewater treatment facilities leading into next phase of proposed improvements.

<u>2032-2036: Phase 4</u>

· File Notices of Project Change and DRI modifications (as necessary) to inform (and gain approval from) the environmental review process on the agreements and funding that will allow the next steps to proceed.

· Upgrade of Cotuit Meadows and Wampanoag Village to improve nitrogen removal performance (dependent on MEP modeling results and permit requirements).

· If shellfish propagation continues to lag or is not advancing as fast or to the levels anticipated:

  - Site 6 facility expansion with associated sewer extensions to serve Hamblin/Jehu Pond areas of Mashpee.
  - Collection system expansion to Site 6.
  - Collection system expansion on Great Neck Road North to Mashpee Commons.
  - Collection system expansion for Hamblin and Jehu Pond Areas, upgrade/expansion of New Seabury WWTF.

· End of Phase compliance reporting—consider updating MEP Model runs (landuse and hydrodynamic models) and MEP calibrate with water quality and benthic flux sampling as needed.

· Coordinate with 208 Plan and potentially run CCC MVP tool in conjunction with MEP Model runs to check on updated water data and possible adaptive management approaches.

· Determine additional evaluations of existing wastewater treatment facilities leading into next phase of proposed improvements.

<u>2037-2041: Phase 5</u>

· File Notices of Project Change and DRI modifications (as necessary) to inform (and gain approval from) the environmental review process on the agreements and funding that will allow the next steps to proceed.

· If shellfish propagation continues to lag or is not advancing as fast or to the levels anticipated:

  - Remaining wastewater nitrogen from Barnstable (B-37 and parts of B-38) and Sandwich Subareas (Sand-4, -5, and -6) within the Popponsesset Bay watersheds will need to be removed outside of the watershed or treated to the levels required based on the MEP modeling results.

  - Collection system expansion (Main Street /Route 130) Subarea T to Site 4.
  - Collection system expansion to Subareas A and C (Seconsett and Monomoscoy Islands).
  - Collection system expansion to Childs River watershed portion of Subarea H.

- End of Phase compliance reporting—consider updating MEP Model runs (landuse and hydrodynamic models) and MEP calibrate with water quality and benthic flux sampling as needed.

This schedule represents one possible future where the PPA is forced to implement traditional infrastructure to serve those areas outside of the Quashnet River Watershed where shellfish aquaculture is being pursued to reduce nitrogen loadings within the affected bays. Development of MOUs with neighboring towns will be necessary to establish a potential phasing strategy based on each town's specific needs. Towns may address other "neighborhoods" within the watersheds based on each individual town's planning efforts and approach. Monitoring and modeling efforts at the five-year intervals will be necessary to establish the extent of nitrogen removal following shellfish aquaculture implementation.

ES.8 Next Steps

Due to the long duration and complexity of this project as well as the inclusion of a number of different stakeholders who are critical to the success of achieving the TMDLs, there are several items that will need to be addressed following the submittal of the plan. This is a function of several different initiatives that are proceeding concurrently with this project, most notably:

- The ongoing 208 Planning Process going on through Barnstable County and the Cape Cod Commission.
- Joint Base Cape Cod and Mass Development evaluations of the existing utilities (electrical, water, sewer, etc.) at the existing base and ownership discussions regarding these utilities.
- Town of Barnstable Nutrient Management Planning efforts Town-wide, as they are related to the portions of Cotuit within the PPA.
- Town of Falmouth Comprehensive Wastewater Management Planning efforts related to the "South Coast" embayments including Waquoit Bay.
- Town of Sandwich Comprehensive Planning efforts and future development projects being evaluated.
- Commonwealth of Massachusetts planning efforts related to the use of alternative approaches and technologies related to nutrient removal (primarily on Cape Cod, Southeastern Massachusetts, and Buzzards Bay).

With this in mind, there are several key steps/decisions/directions in wastewater and nitrogen management planning that will help in the completion of the Recommended Plan and its implementation over the next several decades.

These include:

- Cape Cod Commission and MassDEP direction on the enforcement and permitting issues associated with the TMDLs, such that each town within the Project Planning Area will have a clear understanding of their regulatory obligation and therefore will be able to create the necessary structure to monitor, manage, and enforce TMDL compliance, whether that be through a Board of Health, Sewer Commission, Department of Public Works, Sewer Department, Sewer District, or other structure. This is outside the control of the Town(s) and Districts related to this project.
- Development of a long-term monitoring program. Because the groundwater travel patterns, times, and estuary flushing conditions are influenced by a number of factors, an appropriate plan will need to be developed by the Towns and the regulatory agencies to monitor the effectiveness of the plan in meeting the TMDLs.
- Continue to discuss ownership of collection systems, management options, development versus build-out impact on costs. (This will be an ongoing function of implementation as the Town/District will not need to own all facilities initially, but should have documents in place to ease the transition when those facilities are required to be transferred, if necessary).
- Financial planning of phasing and bonding in increments. (This cannot be determined until the Water/Sewer District structure and rate schedule is established and ownership of existing facilities is resolved; this will be an ongoing part of implementation.)

The following items will need to be completed as part of the plan's implementation:

- Identification of the plan's funding mechanism (betterments, taxes, rates, and fees).
- Private facilities acquisition/ownership/operations/maintenance.
- Additional effluent disposal site evaluations and hydrogeological evaluations.
- Securing of facility, cluster, and PRB sites and pumping station locations.
- Development of Sewer Regulations.
- Development of Sewer Rate Structure.
- Phosphorus removal considerations (upgradient of fresh water systems).
- Development of a detailed Adaptive Management Plan and long-term TMDL monitoring (for fresh and salt water).
- Town/District rules and bylaws related to projected wastewater flows (growth/flow neutral).
- Introduction of new Mashpee Water and Sewer District to neighboring communities related departments.
- Cost sharing between neighboring communities and districts and MOU development for all aspects of the project.
- Scoping and development of subsequent implementation and planning steps including: adaptive management and additional studies.
- Completion of the Feasibility Study related to the Quashnet/Moonakis River.

TABLE OF CONTENTS

List of Tables

List of Figures

List of Appendices

(Appendices 1-2 through 7-3 provided on CD)

Glossary of Common Acronyms

ACEC	Area of Critical Environmental Concern
AM	Adaptive Management
ARC	Aquacultural Research Corporation
ASAR	Alternatives Screening Analysis Report
ASCE	American Society of Civil Engineers
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute
AS/EA	Activated Sludge/Extended Aeration
BFE	Base Flood Elevation
BMP	Best Management Practices
BOD	Biochemical Oxygen Demand
BOH	Board of Health
BWSC	Boston Water and Sewer Commission
CAC	Community Advisory Committee
CCC	Cape Cod Commission
CEC	Contaminants of Emerging Concern
CFR	Code of Federal Regulations
CLF	Conservation Law Foundation
CMR	Code of Massachusetts Regulations
COD	Chemical Oxygen Demand
CPR	Coastal Pollution Remediation
CWMP	Comprehensive Wastewater Management Plan
CWSRF	Clean Water State Revolving Fund
CZM	Coastal Zone Management
DCPC	District of Critical Planning Concern
DCR	Department of Conservation and Recreation
DEIR	Draft Environmental Impact Report
DEP	Department of Environmental Protection
DMF	Division of Marine Fisheries
DO	Dissolved Oxygen
DPW	Department of Public Works
DRI	Development of Regional Impact
DRP	Draft Recommended Plan

EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ENF	Environmental Notification Form
ENR	Engineering News Record
EOEEA	Executive Office of Energy and Environmental Affairs
EPA	Environmental Protection Agency
FEIR	Final Environmental Impact Report
FEMA	Federal Emergency Management Agency
GHG	Greenhouse Gas
gpd	Gallons per day
GWDP	Groundwater Discharge Permit
HAB	Harmful Algae Blooms
I/A	Innovative and Alternative
I/I	Infiltration and Inflow
IMA	Inter-municipal Agreement
IUP	Intended Use Plan
JBCC	Joint Base Cape Cod
kg/yr	Kilograms per year
kW	Kilowatts
LCP	Local Comprehensive Plan
LSP	Licensed Site Professional
MassCEC	Massachusetts Clean Energy Center
MassDEP	Massachusetts Department of Environmental Protection
MBR	Membrane Bio-Reactor
MEC	Mashpee Environmental Coalition
MEMA	Massachusetts Emergency Management Agency
MEP	Massachusetts Estuaries Project
MEPA	Massachusetts Environmental Policy Act
MET	Massachusetts Environmental Trust
mgd	Million gallons per day

M.G.L.	Massachusetts General Law
mg/L	Milligrams per liter
MHC	Massachusetts Historical Commission
MLE	Modified Ludzack Ettinger
MMR	Massachusetts Military Reservation
MOU	Memorandum of Understanding
MSL	Mean Sea Level
MT	Metric Ton
MW	Megawatt
NAR	Needs Assessment Report
NEPA	National Environmental Policy Act
NHESP	Natural Heritage and Endangered Species Program
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NS	New Seabury
NSSP	National Shellfish Sanitation Program
OSHA	Occupational Safety and Health Administration
O&M	Operations & Maintenance
PEF	Project Evaluation Form
PGP	Programmatic General Permit
PPA	Project Planning Area
ppb	Parts per billion
ppm	Parts per million
PRB	Permeable Reactive Barrier
PV	Photovoltaic
RBC	Rotating Biological Contactor
RIB	Rapid Infiltration Bed
RME	Responsible Management Entity
RP	Recommended Plan
RVA	Regina Villa Associates

SBR	Sequencing Batch Reactor
SCADA	Supervisory Control and Data Acquisition
sf	Square Foot
SMAST	School of Marine Science and Technology
SRF	State Revolving Fund
STEG	Septic Tank Effluent Gravity
STEP	Septic Tank Effluent Pump
SWPPP	Stormwater Pollution Prevention Plan
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TOC	Total Organic Compounds
TP	Total Phosphorus
TPW	Total Present Worth
TSS	Total Suspended Solids
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UV	Ultraviolet
VFD	Variable Frequency Drives
VOC	Volatile Organic Compounds
WBNERR	Waquoit Bay National Estuarine Research Reserve
WMA	Waste Management Agency
WNMP	Watershed Nitrogen Management Plan
WPA	Wetlands Protection Act
WPCF	Water Pollution Control Facility
WQMC	Water Quality Management Committee
WWTF	Wastewater Treatment Facility
WWTP	Wastewater Treatment Plant
W&S	Weston & Sampson

1 Introduction

1.1 Project Identification and Purpose

The Town of Mashpee initiated their Watershed Nitrogen Management Plan (WNMP) in 1999 in order to address the nitrogen impacts to coastal embayments and to evaluate options for restoring those embayments through the development of a Comprehensive Wastewater Management Plan (CWMP). Because the contributing areas to the estuaries (watersheds) are shared by multiple towns, Mashpee's WNMP Project Planning Area (PPA) includes the Town of Mashpee and the portions of neighboring towns (Barnstable, Falmouth, and Sandwich) that fall within the Popponesset Bay and Waquoit Bay East Basin watersheds. The Project Planning Area is illustrated in Figure 1-1. The WNMP/CWMP is intended to provide an environmentally and economically sound plan for nitrogen reduction, wastewater treatment, and treated water recharge in the Project Planning Area.

The CWMP is the culmination of multiple documents resulting in this report which is the Final Recommended Plan and Final Environmental Impact Report (EIR).

The purpose of the Final Recommended Plan and Final Environmental Impact Report is to present the recommendations of this planning process to address the nitrogen Total Maximum Daily Loads (TMDLs) established for Popponesset Bay and Waquoit Bay's eastern basin, and discuss the mitigation measures and implementation approach to address these needs as identified in previous documents.

Prior to presenting the components of the WNMP/CWMP, it is necessary to provide background on the other work that is related to this overall wastewater planning process. The purpose of this Chapter is to identify the previous Massachusetts Environmental Policy Act (MEPA) submittal/planning documents and identify the Massachusetts Estuaries Project (MEP) documents and their general findings which are an integral part of this planning project. This Chapter will also identify previous studies, whereas subsequent chapters will discuss the public outreach program, the Draft Recommended Plan, and present the Final Recommended Plan and environmental impacts and implementation schedule.

1.2 MEPA Planning Documents

In September of 2001, the Town of Mashpee through the Mashpee Sewer Commission, entered into the MEPA process by filing their Environmental Notification Form (ENF) and MEPA Unit/Cape Cod Commission Joint Review Process Application Form. As part of that document several major deliverables were identified to be submitted for review through this process.

In addition, since the start of this project, two (2) Notices of Project Change (in 2007 and 2012) have been issued and their certificates are included in the 2013 Alternatives Screening Analysis Report (ASAR). Responses to the comments that resulted from the Notice of Project Change were provided in that report.

The first major deliverable for the WNMP was the **Needs Assessment Report** (NAR)—issued in April 2007. The Needs Assessment Report was designed to develop the understanding of existing and future conditions in the Project Planning Area. The NAR summarized information on existing wastewater facilities (septic systems and small treatment plants), physical/environmental features, demographics, land use patterns, and regulatory issues affecting wastewater facilities. The NAR projected future conditions for the Project Planning Area relating to population, growth, and the potential effects of that growth on any proposed wastewater collection, treatment, and disposal facilities.

The second major deliverable was the **Technology Screening Report**—issued in November 2007—which outlined various centralized and decentralized wastewater collection, treatment, and disposal technologies, and the advantages and disadvantages of each. It provided recommendations of technologies to be considered for use in the development of the scenarios, and ultimately the Recommended Plan for addressing nitrogen. The Technology Screening Report and the following Draft Alternative Scenarios Analysis and Site Evaluation Report findings and updates were combined with additional items identified in the project's scope as called out in the NAR and ENF to create the Alternatives Screening Analysis Report for MEPA submittal and review.

The third major deliverable was the **Draft Alternative Scenarios Analysis and Site Evaluation Report**—issued in March 2008—this was the preliminary evaluation of potential recharge sites and development of alternative scenarios to meet the nitrogen removal needs of the Project Planning Area.

The fourth major deliverable and second formal MEPA submittal was the **Alternatives Screening Analysis Report**—issued in August 2013. This document expanded upon the Draft Alternative Screening Evaluation and Site Evaluation Report issued in 2008, and presented the findings of the MEP modeling work and provided a description of the eight scenarios/options that were developed to meet the nitrogen TMDLs. These findings were then used to present a framework for the development of the Draft Recommended Plan/Draft Environmental Impact Report (DRP/DEIR).

Following the submittal of the ASAR, MEPA issued their certificate dated November 1, 2013. This document was included in Appendix 1-2 of the DRP/DEIR, and the response to the comments resulting from that submittal can be found in the same Appendix of that report.

The fifth major deliverable and third formal MEPA submittal was the **Draft Recommended Plan/ Draft Environmental Impact Report (DRP/DEIR)**—issued in June 2014. This document presented the recommendations developed as part of this planning process to address the TMDLs established for Popponesset Bay and Waquoit Bay's eastern basin, and discussed the mitigation measures and implementation approach for Mashpee and the neighboring communities within the Project Planning Area. MEPA issued their most recent certificate dated September 12, 2014. This document is included in Appendix 1-1, and the response to the comments resulting from that submittal can be found in the same Appendix.

Copies of these previous reports by Stearns & Wheler/GHD are included in Appendix 1-2.

1.3 Massachusetts Estuaries Project (MEP) Findings

The MEP program was developed to evaluate the health of Massachusetts' estuaries and to establish nitrogen loading thresholds that can be used as management goals for a watershed. The MEP approach and results are discussed in detail in Chapter 4 of the Needs Assessment Report. In addition, the following reports and documents relevant to the Project Planning Area have been produced as part of MassDEP, University of Massachusetts Dartmouth School of Marine Science and Technology (SMAST), and MEP work:

- "Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for Popponesset Bay, Mashpee and Barnstable, Massachusetts" Final Report; September 2004.

- "Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for the Quashnet River, Hamblin Pond, and Jehu Pond, in the Waquoit Bay System of the Towns of Mashpee and Falmouth, MA" Final Report; January 2005.
- "FINAL DRAFT: Quashnet River, Hamblin Pond, Little River, Jehu Pond, and Great River in the Waquoit Bay System Total Maximum Daily Loads for Total Nitrogen"; October 14, 2005.
- "FINAL: Popponesset Bay Total Maximum Daily Loads for Total Nitrogen"; December 5, 2006.
- MEP Technical Memo "Popponesset Bay: Results Pilot Modeling Scenarios – Final"; June 15, 2006.
- MassDEP "Inter-municipal Watershed Planning and TMDL Implementation to Restore Embayment Water Quality on Cape Cod: Three Case Studies of Towns Sharing Coastal Watersheds"; November 2008.
- MEP Technical Memo "Report on Unified Database and Requested MEP Scenarios"; November 13, 2009.
- MEP Technical Memo "Report on Revised MEP Scenario 3 for Eastern Basins of Waquoit Bay System"; February 9, 2010.
- "Linked Watershed-Embayment Approach to Determine Critical Nitrogen Loading Thresholds for the Waquoit Bay and Eel Pond Embayment System – Towns of Falmouth and Mashpee, Massachusetts" Final Report; March 2013.
- MEP Technical Memo " Scenarios Results for Popponesset Bay and Waquoit Bay based on MEP Linked Models"; November 15, 2012 (revised).

Results obtained through the MEP monitoring and modeling are used to provide one possible scenario (as presented by MEP) to achieve the nitrogen limits for a given estuary. Table 1-1 summarizes the suggested nitrogen removal rates as identified in those reports from septic systems in the subwatersheds of Popponesset Bay and Waquoit Bay East under "existing" (2001) conditions as presented as part of the original reports and as updated based on the 2013 Final MEP Report for Waquoit Bay. The updates reflect the Massachusetts Estuaries Project re-modeling under conditions of the entire Waquoit Bay Estuary and watershed system versus the eastern portions of that system originally modeled in 2006.

(continued)

Table 1-1 Estimated Percent Nitrogen Removals from Septic Systems

Embayment System	Embayment	Percent Removal to Meet Threshold [3]	Updated Percent Removal to Meet Threshold [3]
Popponesset Bay System[1]	Popponesset Bay	0%	0%
	Popponesset Creek	100%	100%
	Pinquickset Cove	0%	0%
	Ockway Bay	100%	100%
	Mashpee River	100%	100%
	Shoestring Bay	100%	100%
	Mashpee River [4]	49%	49%
	Santuit River [4]	35%	35%
	Quaker Run River [4]	0%	0%
Waquoit Bay System[2] [6][7]	Hamblin Pond	75%	100%
	Upper Hamblin Pond	75%	100%
	Little River	75%	100%
	Lower Great River	100%	100%
	Upper Great River	100%	100%
	Jehu Pond	100%	100%
	Upper Quashnet River	67%	67%
	Lower Quashnet River	67%	67%
	Red Brook [4]	75%	90%
	Quashnet River [4, 5]	67%	67%

Notes:

1. Source: Table B-1 of *Final Popponesset Bay Total Maximum Daily Loads for Total Nitrogen*, April 10, 2006, no change in the “updated column”.
2. Source: Table B-1 of *Final Draft Quashnet River, Hamblin Pond, Little River, Jehu Pond, and Great River in the Waquoit Bay System Total Maximum Daily Loads for Total Nitrogen*, October 14, 2005.
3. Based on one MEP developed scenario that is considered one of many potential scenarios to achieve the target concentration.
4. Indicates a surface water source.
5. MEP report lists this as Moonakis River. However, based on information provided by the Mashpee Town Planner, Moonakis River is only the lower, brackish portion of this river (Moonakis referring to the name given to the river in the Town of Falmouth).
6. Source: Updated Column Table VIII-2 of *Revised Draft Linked Watershed-Embayment Approach to Determine Critical Nitrogen Loading Thresholds for the Waquoit Bay and Eel Pond Embayment System Towns of Falmouth and Mashpee, Massachusetts,* May 2012.
7. Although portions of Mashpee fall within the Childs River Watershed, the entire Childs River Watershed is not part of the Project Planning Area, and therefore its removal requirements aren’t provided.

Figure 1-2 shows the various subwatersheds and the updated removal percentages identified in Table 1-1. These percent removals form the initial basis used for the development of the alternative scenarios/options presented in the ASAR. This information and the results of the work of the ASAR have been used in the formation of the Recommended Plan.

1.4 Previous Planning Documents

In addition to the reports and planning documents discussed in Sections 1.2 and 1.3, the following additional documents were prepared. A summary of these documents is also included in Chapter 2 of the Draft Recommended Plan/Draft Environmental Impact Report (DRP/DEIR):

- Technical Memorandum on Development of Options 1A, 1B, and 1C (2012).
- MEP Model Results—Options 1A, 1B, and 1C (2012).
- Overview of the 2009 Water Quality Monitoring Program for the Popponesset Bay and Waquoit Bay Estuaries; June 2010.
- Popponesset Bay: Results Pilot Project Modeling Scenarios – Final – June 2006.
- Final Popponesset Total Maximum Daily Loads for Total Nitrogen (Report #96-TMDL-4); December 2006.
- Final Quashnet River, Hamblin Pond, Little River, Jehu Pond, and Great River in the Waquoit Bay System for Total Maximum Daily Loads for Total Nitrogen (Report #96-TMDL-5); January 2006.
- Community Preservation Funding Application – Shellfish Propagation/Estuary Restoration; Rick York; February 2013.
- Shellfish Plan for Nitrogen Removal; Rick York; June 20, 2013.
- Technical Report – Intensive (Locational) Archaeological Survey Site 4 at Mashpee Transfer Station and Landfill Property; PAL; September 2010.
- Hydraulic Load Test – Site 4 (Transfer Station) Technical Memorandum; GHD; 2012, updated 2014 (Appendix 1-3).
- USGS – The Simulated Effects of Wastewater Management Actions on the Hydrologic System and Nitrogen Loading Rates to Wells and Ecological Receptors, Popponesset Bay Watershed, Cape Cod, Massachusetts – Report 2013-5060.
- Sewer Modeling and Preliminary Design Evaluations Guidance Document and Case Study Report; Stearns & Wheler, LLC; November 2005.
- Inter-municipal Watershed Planning and TMDL Implementation to Restore Embayment Water Quality on Cape Cod: Three Case Studies of Town's Sharing Coastal Watersheds; MassDEP/SMAST; Nov 2008.
- Appraisal Consulting Services for the Wastewater Treatment System at the Massachusetts Military Reservation; CH2MHill; December 2012.
- Town of Mashpee, Popponesset Bay, & Waquoit Bay East Watersheds – Nitrex TM Technology Scenario Plan; Lombardo Associates, Inc.; April 2010.
- Enhancing Wastewater Management on Cape Cod: Planning, Administrative and Legal Tools; Wright-Pierce; July 2004.

2 Summary of Cape Cod Commission Draft 208 Planning Document

2.1 Introduction

This Chapter summarizes the Draft 208 Water Quality Plan developed by the Cape Cod Commission (CCC). The final document is anticipated to be completed and accepted by United States Environmental Protection Agency (USEPA) by September 15, 2015. This document will focus on the draft document dated August 2014. The Cape Cod Commission's documents can be found on their Web page at www.capecodcommission.org. This Chapter is not intended to summarize the entire document, but focus on those aspects as they relate to the Town of Mashpee's plan.

The following sections, using the names from the Draft 208 Plan chapters, will summarize Mashpee's efforts in relation to the efforts of the 208 document.

2.2 Community Engagement

As identified in Chapter 3 of this document, the Town of Mashpee has spent a significant effort in public participation and outreach regarding this project. The public outreach and stakeholder involvement as part of the 208 Plan and as described in the first chapter of that document focuses on the update to the 1978 208 Plan and the extensive public engagement process that the Cape Cod Commission employed to complete their update.

The recommendation presented at the end of that chapter focused on "managing disagreement". Through the 208 Plan, the Cape Cod Commission has identified some methods that may be employed to manage disagreements in the implementation of the Mashpee plan and offers county resources to help achieve resolutions as Mashpee moves forward collaboratively with its neighboring communities and their residents to complete this important task of cleaning up and protecting their natural resources, and primarily their coastal embayments.

2.3 The People and the Place

As discussed in the Needs Assessment Report the Town of Mashpee has documented the Project Planning Area's existing environmental resources and demographics. The 208 Plan discusses these with a regional perspective and the efforts to develop the TMDLs for nitrogen among other impacts to fresh water systems and drinking water/groundwater supplies. These same topics are reviewed throughout Mashpee's documents including all the MEP related efforts and technical memorandums developed specifically regarding Mashpee's watersheds and pilot projects reviewing these same resources and summaries of the planning areas natural environments.

As a brief update to the Town's demographics based on information provided by the Town Planner: in 2014 the year-round population was 14,842, with a summer peak day population of 33,847, with 6,384 homes occupied year-round and 3,558 summer-only. Projected build-out population is 22,704 in 9,790 year-round occupied homes, with summer build-out population of 35,928 and 3,046 summer-only homes. Total private housing units are projected to increase from 10,313 in July 2014 to 12,836 at build-out, or 24.5%.

Mashpee is essentially built-out as regards its development pattern, with the only significant property remaining to be developed being the Mashpee Commons project, which is/will be a compact New Urbanist development supported by a private sewer system which may become part of the municipal system. All other remaining development is either infill lots in existing subdivisions or remaining portions of compact developments (New Seabury, Southport, Quashnet Valley) which were permitted in the 1960s and 70s and are “grandfathered” from current or future zoning requirements. Remaining New Seabury and Southport development is being connected to their private wastewater systems, which may become part of the municipal system. Otherwise, the proposed early-phase wastewater facilities are targeting high-density existing developed areas.

2.4 Nutrient Mitigation Technologies and Policies

As part of Mashpee’s planning process, the project has spent a significant amount of effort discussing a wide selection of technologies—some more traditional than others. This discussion can be found in several of the reports including the Technology Screening Report, Alternatives Screening Analysis, and the Draft Recommended Plan, and have included a wide range of technologies from onsite systems to traditional wastewater treatment facilities to shellfish aquaculture. Copies of each of these reports, evaluations, and analysis have been included on CD as part of Appendix 1-2.

The CCC 208 Plan established a technology matrix considering the relation between technologies and the area of application. Technologies/strategies were grouped as “Remediation”, “Reduction”, and “Prevention”, and assigned by scale to “Site Scale”, “Neighborhood”, “Watershed”, and “Cape Wide”. Technologies were also grouped into several categories (see Table 3-1 of the CCC Draft 208 Plan).

Since the development of these reports and as part of the 208 Planning process, several additional technologies have been identified or are receiving further review and piloting including:

- Phytoirrigation
- Phytoremediation
- Fertigation Wells – Turf
- Fertigation Wells – Cranberry Bogs
- Urine Diverting Toilets
- Floating Constructed Wetlands
- Surface Water Remediation Wetlands
- Ocean Outfall (previously identified but regulations changed regarding allowable use)

Similar to Mashpee’s Technology Screening Report and subsequent documents, the 208 Plan reviews how each technology works, performs, estimated costs, and considerations in use.

Some of the above referenced technologies/approaches like urine diverting toilets and fertigation wells are simply expansions of the Town’s existing eco-toilet allowances and fertilizer bylaws where these could be applied. However, the Town is not actively seeking their use as part of the plan, but are not restricting their use. Phytobuffers/phytotechnology are similar to the “SolarAquatics” type of treatment technologies and also stormwater BMPs discussed within the previous planning documents.

Floating constructed wetlands are another interesting approach that will require—like many other new technologies—piloting and permitting. These systems, depending on their location, may impact navigation and the protection of the near-shore from storm surge. These may also have aesthetic impacts associated with them which would need to be taken into consideration if the Town considers their use as part of their adaptive management program in the future. These systems do not manage source impacts and would be considered a Direct Environmental Mitigation approach.

Ocean outfalls were also identified by Department of Environmental Protection (DEP) for consideration. Although not being considered now, an ocean outfall could be considered as part of the future phasing if the shellfish program does not perform to the levels needed, New Seabury's golf course falls through, and impacts of sea-level rise become of greater concern to the implementation of the plan. The Town may also consider use of an ocean outfall through an adaptive management approach.

2.5 The Cape Cod Model—Technical Review

The CCC developed "bookend" approaches to look at each watershed on Cape Cod and take a strictly traditional infrastructure approach and compare it to one where sewers were avoided to the greatest extent possible.

The Town of Mashpee started with a watershed approach when considering its Project Planning Area and looked beyond its boundaries to consider impacts and recommendations for the neighboring communities of Barnstable, Falmouth, and Sandwich.

As part of the Mashpee planning process, a similar technology review approach was taken. At the time the TMDLs for the Waquoit Bay East watersheds and Popponesset Bay watersheds were issued, as part of the MEP evaluations the Town ran a scenario of seeing if the TMDLs could be addressed through I/A technologies at individual lots (in conjunction with the existing wastewater treatment facility's). It was determined that this approach would not achieve the TMDLs. In addition, the Mashpee Shellfish Constable evaluated the removal of nitrogen at the embayments with shellfish and established the percent removals he believed could conservatively be met. Based on that approach he found that not all watersheds could be addressed, for example Quashnet River/Moonakis River could not support shellfish, and Mashpee River and Shoestring Bay could only support removal of about 50% of the load. GHD also performed a full traditional approach using collection, treatment and recharge facilities to address the TMDLs for the Project Planning Area. This could be done, but at a very high cost.

As a result of this, Mashpee developed its hybrid approach to maximize the use of shellfish aquaculture and minimize traditional infrastructure, and reuse existing infrastructure to the fullest extent possible including the recommendation to use Joint Base Cape Cod (JBCC). In addition, although not formally seeking to take nitrogen credit for its use as part of the plan, the Town developed a fertilizer/nitrogen bylaw (included in Appendix 4-3) to further support the reduction of nitrogen in its waterbodies. Also, the Town DPW actively employs BMPs where practical to reduce bacteria and other contaminants from entering Mashpee's waterbodies.

As part of the 208 Plan, new tools are being made available; however, a number of these screening and evaluation tools are geared towards communities in the beginning stages of these processes. Mashpee will consider the use of these tools at their permitting cycles if shellfish performance is not approaching the necessary goals and other alternative means of achieving TMDLs are being sought. This is identified in Chapter 9 regarding implementation and Chapter 10 regarding adaptive management.

These tools with current data will allow the Town to check on nitrogen loading considerations and be used in the update of the MEP modeling necessary to show conformance to the TMDLs.

According to the CCC Watershed Prioritzation – Upper Cape (Table 4-2, CCC 208 Plan, 2014), Waquoit Bay was ranked first and Popponesset Bay seventh out of 22 watersheds in the Upper Cape.

2.6 Regulations

Throughout the planning process, Mashpee has identified the various regulatory requirements and is actively going through the MEPA/DRI process with the Massachusetts Secretary of Energy and Environmental Affairs and the Cape Cod Commission.

These regulations are discussed in the following sections of the planning process:

- Needs Assessment Report: Chapter 3 Regulatory Issues.
- DRP/DEIR: Chapter 8 Draft Section 61 Findings and Mitigation Measures.
- Chapter 8 of this Report.

As part of this planning process and implementation, Mashpee and its neighboring communities are waiting on Massachusetts Department of Environmental Protection (MassDEP) to see what the watershed permitting will look like; and Mashpee will continue to work with all the regulatory agencies in relation to the implementation of the plan as outlined in Chapter 8 – Draft Section 61 Findings and Mitigation Measures.

As discussed in Chapter 9 under implementation, the Town of Mashpee is currently considering two approaches for the management and implementation of the Recommended Plan.

1. Development of a Water and Sewer District.
2. Town of Mashpee management.

Since the issuance of the Draft Recommended Plan report, the Town is reconsidering creation of the Mashpee Water & Sewer District; and discussions between the Town and Mashpee Water District regarding a Memorandum of Understanding (MOU)—except metering and billing—have been halted by the Board of Selectmen. This was a change in the Selectmen's previous position regarding the District formation. The Board of Selectmen voted to recommend against creation of the District at the end of 2014. At this time, the District will only come into existence upon a favorable ballot vote at the May 16, 2015 Town election; however, the Mashpee Selectmen are now recommending a "no" vote. Either way, the structure and management authority will be known before implementation of this plan.

In addition, the CCC 208 Planning process is required to identify the responsible party for each watershed. However, the final determination and acceptance of these recommendations by USEPA is not expected until September 15, 2015.

2.7 Planning and Growth Management

As discussed in the CCC 208 Plan Chapter 6 on Planning and Growth, Mashpee efforts are cataloged through April 2014, prior to the submittal of the DRP/DEIR in September 2014. Use of JBCC is also discussed as it was in the Mashpee DRP/DEIR and in this report.

Mashpee has had the advantage of the Town's Planner also being the Chair of the Sewer Commission—the Commission being the shepherds of the current plan—and therefore growth and development has always been on the forefront of the work performed. As the Town approaches the completion of the plan and looks to position itself for State Revolving Funds (SRF), the Town intends to propose a Growth Neutral bylaw similar to that adopted by the Town of Falmouth.

When considering open space and land use, the Town's Transferrable Development Rights zoning by-law (Open Space Incentive Development) was adopted in 1987, requiring 50% open space in specific mapped areas and targeting the resulting development to other specific areas, as well as providing density bonuses as an incentive for transfers, including a bonus for sewering. Mandatory cluster subdivision, with a minimum of 50% open space and incentives for a larger percentage, was adopted in 2006 (replacing cluster zoning provisions that dated back to 1963 and 1971 which were used in the large majority of non-condo developments since then).

Regarding past land acquisitions protective of the Mashpee River, it should be noted that, building on the extensive ownership of lands along the River by The Trustees of Reservation since 1949, the Town and Massachusetts Division of Fish and Wildlife have, beginning in the mid-1980s, acquired every undeveloped parcel of land along the River at a cost of over $8 million. Mashpee has protected over 1,826 acres of land under the control of the Conservation Commission and an additional 405 acres under the Land Bank Act which are controlled by the Board of Selectmen, along with more than 159 acres of other Town-owned land with open space restrictions. In addition, 266 acres are owned by the US Fish & Wildlife Service, 265 acres are owned or restricted from development by the US Military in clear zones related to the aviation activities at Joint Base Cape Cod, 1,170 acres are owned by Mass DFW or Department of Conservation and Recreation (DCR), 1,331 acres are private condo or cluster subdivision protected open space, 177 acres are protected well sites owned by the Mashpee Water District, 474 acres is owned by land conservation trusts, 64 acres of Falmouth Rod & Gun Club land are subject to a conservation restriction, and 482 acres are subject to Chapter 61 current use taxation restrictions, for a total of 6,619 acres protected of the total town land area of 14,894 acres (44.4%). Another 1160 acres owned by the US government lies within Joint Base Cape Cod, and approximately 1,000 acres lies within the layouts of public and private roadways.

2.8 Cost and Financial Affordability

The CCC 208 Plan summarizes the funding opportunities available to communities and these too have been discussed and reviewed as part of Mashpee's planning process in Chapter 9 - Phasing and Implementation of both the DRP/DEIR and this report.

The Town of Mashpee has yet to determine all of the funding opportunities they will seek or employ as part of implementation of their plan. The team is working with a consultant through the Cape Cod Water Protection Collaborative on this effort.

2.9 Recommendations and Implementation

The Draft 208 Plan calls for several steps as part of its recommendation including:

- Information (in the form of monitoring and water quality data)
- Regulatory Reform (including the creation of Targeted Plans and Watershed Permitting)
- Support (efforts to support ongoing planning efforts)
- Costs (creating new financial /funding sources)

Mashpee supports these efforts and has integrated these into its planning process.

3 Public Participation, Outreach, and Regional Coordination

3.1 Introduction

The Mashpee Sewer Commission has actively engaged in public participation and regional coordination throughout the planning process, with a focus on educating the public on the issues of wastewater and nutrients as they relate to the watersheds of Popponesset Bay and Waquoit Bay's east basin, in addition to the remaining portions of Mashpee within the Project Planning Area. The Commission has actively encouraged residents, Town leaders, business leaders, regulators, and adjacent communities within and outside of the planning area to actively participate in the planning process. The public outreach program consists of several components, including:

- Monthly Sewer Commission meetings—televised and open to the public.
- Community Advisory Committee (CAC).
- Public Presentations.
- Development of public education materials:
  - Project Web page: www.mashpeewaters.com
  - Project kiosk
  - Informational flier (first of two)—the second will be coordinated with the submittal of the Final Recommended Plan
- Participation in a formal MEPA/Cape Cod Commission environmental review process.
- Participation in several "Pilot" projects supported by Barnstable County and other regional agencies.
- Joint meetings with Barnstable, Falmouth, and Sandwich.

The project's regional coordination efforts, in addition to the meetings and CAC listed above, include the initial drafting of an MOU between the communities (specifically regarding Popponesset Bay) with the intent of that being a model for Waqouit Bay and a model for other communities to consider as well.

3.2 Mashpee Sewer Commission

The Town of Mashpee formed the Mashpee Sewer Commission in 1987 which is the lead in the planning efforts for this project. Formed under provision of Massachusetts General Law (M.G.L.), the Commission was empowered to build, maintain, and operate sewers and wastewater treatment facilities, and to assess betterments and sewer-use charges to fund sewer construction and operation. The Commission has transformed over the 14 years of this project, starting as a group of three (3) elected members, and then becoming a seven (7) member body appointed by the Mashpee Selectmen on which the following five (5) members serve (two vacancies):

- F. Thomas Fudala—Chairman
- Joseph N. Lyons—Vice-Chairman
- Mark N. Gurnee—Clerk
- Thomas F. Burns

- L. Glenn Santos

The Commission has also had an administrator since 2012, Paul Gobell, P.E. who works with the Commission and GHD.

The Sewer Commission has been meeting on a monthly basis regarding the WNMP since 2001, reviewing project information, presenting project related information and findings from MEP, Massachusetts Department of Environmental Protection, United States Geological Survey (USGS), CCC, and other regional efforts related to wastewater and nutrient management issues. As part of their regular meetings, the Commission also solicits input from the CAC, residents, and neighboring communities.

3.3 Community Advisory Committee

The Community Advisory Committee (CAC) is made up of a diverse group of representatives. It includes representatives from:

- The Mashpee Board of Health
- Mashpee Wampanoag Indian Tribal Council (currently vacant)
- Mashpee Conservation Commission
- Mashpee Chamber of Commerce
- Mashpee Historical Commission
- Mashpee Environmental Coalition
- Mashpee Shellfish Commission
- Mashpee Waterways Commission
- Mashpee Precinct Representatives (five appointed by the Board of Selectmen)
- Town of Barnstable Representatives
- Town of Falmouth Representatives
- Town of Sandwich Representatives

All members are invited to each meeting and copied on major correspondence including reports; however, attendance and representation has been limited likely due to the extended nature of this project. This project predated the MEP work and therefore a lengthy delay was incurred as the project awaited the results of this work and the finalized TMDLs. In addition, several of the adjacent communities are involved in their own concurrent planning projects.

3.4 Public Outreach and Materials

The Sewer Commission as part of this project has worked with GHD and Regina Villa Associates (RVA) of Boston to develop several public outreach items including:

- 2011: A tabletop display/kiosk that presented “What’s the Problem”, discussing what the project was about and a map of the planning area. A copy of this is located in Appendix 3-1.

- 2011: An informational Web page where people can find out about the project, the problem, meetings and news, documents and resources, and contact information. The Web page can be found at: http://www.mashpeewaters.com/index.html and screen shots of several of the pages are included in Appendix 3-1.

- 2013: Sewer Commission booth at “Octoberfest” held October 12th in Mashpee.

- 2013: Sewer Commission booth at October Town Meeting.
- 2013: An informational flier reminding the public of the issues related to wastewater and nutrients, their impacts on the Town, and what the Town is working on to address these issues. A copy of this flier is located in Appendix 3-1.

The Commission will also create a second flier outlining the recommendations of the Final WNMP/CWMP/Draft Environmental Impact Report.

3.5 Public Presentations

Throughout the course of the project there have been several presentations made and the following is a sample of those:

- Sewer Commission meeting presentations:
  - 2005 presentation on "Sewer System and Groundwater Modeling Evaluations"
  - 2007 presentation on the "Final Needs Assessment Report"
  - 2008 presentation on the "Final Technology Screening Report"
  - 2011 presentations on modeling scenarios
  - 2012 presentation on the Project progress and next steps
  - 2013 presentation on "Alternative Screening Analysis"
  - 2014 presentation on "Draft Recommended Plan/Draft Environmental Impact Report"
- Presentations to other groups:
  - 2006 "Popponesset Bay Pilot Project", presented by Tom Fudala
  - 2007 "WNMP Introduction and Status to Sandwich Water Quality Advisory Committee"
  - 2013 "Mashpee Next Steps presented to Falmouth Water Quality Management Committee"
  - 2013 "Mashpee Next Steps presented to Barnstable CAC"
  - 2013 "Presentation to Cape Wastewater Planning Workshop"
  - 2014 MEPA/CCC Joint Public Hearing on Draft Recommended Plan/Draft Environmental Impact Report

In addition there were several presentations by the Popponesset Bay Pilot Project group, MEP, CCC and Cape Cod Water Quality Collaborative, USGS on particle tracking and groundwater modeling, and equipment suppliers related to various collection system technologies.

3.6 Coordination and Outreach to Neighboring Towns and Joint Base Cape Cod

Throughout the course of the project there have been several regional meetings both directly related to this project and those meetings generated by regional efforts. Several of these meetings with adjacent communities have been identified above. In addition, the Sewer Commission and the Town have actively participated in the following:

- Participation in the Town of Barnstable CAC.

- Joint meetings of Falmouth Water Quality Management Committee (WQMC) with Mashpee Sewer Commission (in Mashpee).
- Attendance at Falmouth WQMC Meetings.
- Participation at Cape Cod 208 Planning Meetings.

Mashpee has been actively coordinating with MassDevelopment, who is working with Joint Base Cape Cod and their consultant to determine how the future use of the wastewater treatment facility at the base will be managed and operated. As of January 2015, correspondence with MassDevelopment indicated that they will convey Mashpee's continued interest to the leadership group who are evaluating the decision on the Base and they will keep the Town informed of their decision on the future of the facility once they have completed their evaluation.

As part of the MassDEP Pilot Project and a program through the Cape Cod Commission and the County's Water Protection Collaborative, Mashpee and its neighbors have also developed a draft Memorandum of Understanding for Popponesset Bay. This has been reviewed by the Town of Barnstable with a favorable response from the Citizens Advisory Committee and is discussed in the following section.

3.7 Popponesset Bay Memorandum of Understanding (MOU)

A draft "Inter-municipal Agreement (IMA) for Development and Implementation of a Regional, Watershed Based Wastewater Management Plan for the Popponesset Bay Watershed" has been developed and circulated between Barnstable, Mashpee, and Sandwich.

The proposed IMA has its origins in the DEP Pilot Project, funded by the Environmental Protection Agency (EPA), formally titled "Inter-municipal Watershed Planning and TMDL Implementation to Restore Embayment Water Quality on Cape Cod". The final report's Executive Summary states that the goal of this project "was to report the decision making process that engaged the attention community leaders for the load reductions the towns would collectively share for restoring estuarine water and habitat quality for compliance with the federal Clean Water Act Total Maximum Daily Load (TMDL). This project engaged the stakeholders (municipal, county, state, and environmental organizations) within the Popponesset Bay (Mashpee, Barnstable, and Sandwich, MA), Three Bays (Barnstable, Sandwich, and Mashpee, MA), and Pleasant Bay watersheds (Chatham, Orleans, Brewster, and Harwich, MA)." The working group for the Popponesset estuary, involving representatives of Barnstable, Mashpee, and Sandwich, worked on the project from 2003 to 2008, facilitated by DEP and supported by UMass-Dartmouth SMAST under the Massachusetts Estuaries Program. Results of the MEP and resulting DEP TMDL reports for the Popponesset Bay watershed were utilized to develop a methodology for allocating each town's attenuated and unattenuated nitrogen loads to the estuary, along with a "fair share" allocation of responsibility for reducing each town's nitrogen load to meet the TMDL. The methodology was based on an equal reduction of each town's 2001 loads (per the MEP report) to a level that met the TMDL. Per SMAST, the required reduction was 49.2% of the attenuated load reaching the Bay. The remaining load, after reduction, or 50.8% of 2001 loads, was each town's permanent "fair share" of allowed nitrogen loading to the estuary. Aside from discussions within the working group, the methodology and town shares were presented to the Sandwich Water Quality Advisory Committee and the Barnstable Citizens Advisory Committee for Wastewater Planning in 2007 by representatives from Mashpee and GHD. Additional meetings, particularly with Barnstable, have been held since then.

In 2010, the Town of Mashpee sought and received a $27,500 grant from the County to fund facilitation of a formal inter-municipal agreement between the three towns regarding shared responsibility for meeting the TMDL target based on the “fair share” methodology developed under the Pilot Project, as well as a similar agreement with Sandwich and Falmouth regarding Waquoit Bay. Michael Domenica, P.E., of CH2M Hill (at that time) was hired as the facilitator by the County Water Quality Collaborative. He prepared a draft IMA for Popponesset Bay in 2011, circulated it to the towns, and attended a number of meetings with their relevant committees including the Sandwich Wastewater Advisory Committee, the Barnstable Citizens Advisory Committee for Wastewater Planning, and the Mashpee Sewer Commission. Mashpee and Barnstable indicated support for the IMA. Sandwich took no action, as they had not begun work on a wastewater plan. The last draft of the Popponesset Bay IMA is dated October 2012, after which no further work was done under the grant. No work was ever done on a Waquoit Bay IMA.

3.8 Local Newspaper Coverage

Throughout the course of the project, the Mashpee Enterprise has typically had a reporter at each of the Mashpee Sewer Commission meetings documenting and presenting the findings of each of these meetings. Due to the large number of related articles, they have not been included in this document; however they can be requested from the paper.

3.9 Participation in the MEPA/Development of Regional Impact (DRI) Process

In 2001, the Mashpee Sewer Commission filed the initial Environmental Notification Form (ENF) noticing the project and entering into the MEPA review process. Throughout the process, the Town has submitted several documents for public and regulatory review including two (2) Notice of Project Change documents, the Needs Assessment Report, Alternatives Screening Analysis Report, Draft Recommended Plan and Draft Environmental Impact Report, and this Final Recommended Plan and Final Environmental Impact Report.

The Town held a public hearing as part of the DEIR (listed in Section 3.5), and will hold additional public hearings as part of the Final Environmental Impact Report (FEIR) and DRI processes following the submittal of this document and the subsequent final document.

4 Planning Framework and Summary of Evaluations

4.1 Introduction

The purpose of this chapter is to summarize the Recommended Plan framework as presented in the 2013 Alternatives Screening Analysis Report (ASAR) and the Draft Recommended Plan/Draft Environmental Impact Report (DRP/DEIR) and present the evaluations performed in Chapter 5 of the DRP/DEIR.

Following the Mashpee Sewer Commission meeting held on January 17, 2013, the framework of the Recommended Plan development began to take shape based on the findings of the three Options run through the MEP model and summarized in the ASAR.

Based on the various components being considered in the Recommended Plan, each was grouped into one of the following three categories (each as defined below):

- Source Removal
- Direct Environmental Mitigation
- Land Management Strategies

Source Removal is generally defined for this project as the removal of nitrogen (or some portion of it) and other contaminants before they reach the local groundwater. Source Removal has been further subdivided into the following categories for this plan based on the major controllable sources:

- Wastewater Management
- Stormwater Management
- Fertilizer Management

Each of these management approaches allows the towns within the planning area to mitigate nitrogen before it enters the groundwater and eventually reaches the ponds and estuary systems.

Direct Environmental Mitigation is generally defined for this project as the reduction and/or removal of nitrogen (or some portion of it) at or in close proximity to the area of impact. It has been further subdivided into the following categories:

- Dredging/Inlet Widening
- Shellfish Aquaculture
- Permeable Reactive Barriers (PRBs)
- Enhanced Natural Systems

Each of these management approaches has been identified as an alternative or additional management approach allowing the towns within the planning area to mitigate nitrogen after it has entered the groundwater but prior to or at the point it reaches the ponds and estuary systems.

Land Management Strategies are generally defined for this project as the growth and development management strategies to reduce the potential of the Project Planning Area reaching a build-out condition which increases the cost and difficulty of achieving TMDL compliance.

Much of the discussion as part of this project to date has focused on the Source Removal approach, and recently there has been a greater push for Direct Environmental Mitigation to be used in one of two ways—reduce or eliminate the need for Source Removal in certain areas, or be implemented prior to Source Removal—to either allow longer phasing of any Source Removal strategy or ultimately the reduction of the need for full-scale traditional wastewater management.

As was clearly shown in all eight previous scenarios identified in the ASAR and DRP/DEIR, a massive amount of Source Removal is required to achieve the TMDLs under the build-out condition if Direct Environmental Mitigation is not considered or proven feasible through current efforts and/or demonstration/pilot projects.

Land Management Strategies are intended to reduce the potential for new sources entering the planning area, typically through development and growth. This will be an important component with regards to minimizing future nitrogen levels and funding incentives for controlling growth.

4.2 Source Removal

As discussed in the DRP/DEIR several Source Removal approaches were identified and screened as part of the planning process.

As part of the Draft Recommended Plan the following Source Removal approaches were included:

- Use of existing Wastewater Treatment Plants (WWTP) with needed improvements/expansions/modifications (in the planning area):
  - Joint Base Cape Cod
  - New Seabury
  - Willowbend
  - Mashpee Commons
  - Mashpee High School (depending on JBCC)
  - Cotuit Meadows
  - Wampanoag Village
- Wastewater treatment at existing Wastewater Treatment Facility (WWTF): Operating under existing permit, consider upgrade to improve performance (3 to 6 mg/L TN) based on shellfish results and other adaptive management programs:
  - Forestdale School
  - Mashpee Village
  - Southport
  - South Cape Village
  - Stratford Ponds
  - Windchime Point

- Potential new WWTPs:
  - Transfer Station (Site 4)
  - Possibly at Site 6 (depending on shellfish performance)
  - Possibly at Back Road Sites (as an alternative to Joint Base Cape Cod)
- Continued use of existing septic systems and Innovative and Alternative (I/A) Onsite Systems:
  - Existing I/A systems at various performance levels.
  - Systems used in accordance with Board of Health (BOH) requirements in areas not identified for nitrogen removal.
  - Mashpee will establish how its plan will address these types of systems as part of a management approach if used as part of any TMDL compliance.
- Stormwater improvements:
  - Continued Best Management Practices (BMP) implemented through Department of Public Works (DPW) on a case-by-case basis, with nutrient removal capabilities considered in most sensitive watersheds.
  - Zoning bylaws and subdivision regulations in place regarding stormwater controls.
- Fertilizer Management:
  - Nitrogen bylaw
  - Local regulations and Cape Cod Commission efforts creating a Cape-wide District of Critical Planning Concern (DCPC)

Regarding the last two items, the Town of Mashpee has adopted its fertilizer management bylaw (nitrogen reduction bylaw – as has the Town of Falmouth) and Mashpee has been implementing best management practices regarding stormwater improvements for nitrogen removal since the 1990s both through its zoning requirements for new development and through Town-constructed stormwater projects.

4.3 Direct Environmental Mitigation

Direct environmental mitigation is essentially removal of nitrogen (or some portion of it) at or in close proximity to the area of impact. This can be further divided into the following subcategories, with a brief description of potential considerations for use:

- Shellfish Aquaculture:
  - Build upon the Town's existing program and consider expansion for anticipated positive impact on embayments.
  - Oysters—Mashpee River, Popponesset Bay, Shoestring Bay.
  - Quahogs—Jehu, Hamblin, Great River, Little River, Ockway Bay, and Popponesset Bay.
- CCC 208 Plan Options

- Several alternative technologies were reviewed and identified as part of the 208 planning process. These technologies as proven feasible and either piloted or permitted could be implemented as part of the Adaptive Management Program discussed in Chapter 10.

- Feasibility Study for Implementing Soft Solutions for Restoring the Quashnet/Moonakis River.
  - This was identified as a potential approach to address an area that could not be served by shellfish aquaculture and could potentially reduce the amount of traditional infrastructure that may be necessary to serve this watershed.

4.4 Land Management Strategies

Land management strategies are essentially growth and development management strategies intended to reduce the potential of the PPA reaching a build-out condition. As communities approach a “build-out” condition there is an increase in the cost and difficulty of achieving TMDL compliance.

Typically comprehensive planning regarding wastewater and nutrient management has focused on the Source Removal approach, and with the preparation of the 208 Plan and Piloting projects on Cape Cod there has been a greater regional focus on Direct Environmental Mitigation. This will allow communities like Mashpee and its neighbors to use Direct Environmental Mitigation approaches to reduce or eliminate the need for Source Removal in certain areas, or be implemented prior to Source Removal—to either allow longer phasing of any Source Removal strategy or ultimately the reduction of the need for full-scale traditional wastewater management.

As was clearly shown in all eight previous Scenarios/Options modeled through MEP, a massive amount of nitrogen removal (addressed via “Source Removal” in those Scenarios/Options) is required to achieve the TMDLs under the build-out condition if “Direct Environmental Mitigation” is not considered or not feasible. However, with the use of Land Management Strategies to complement Source Removal and Direct Environmental Mitigation approaches, it is possible to reduce these costs and impacts before new/redevelopment becomes a new nitrogen source.

- Growth Neutral/Flow Neutral:
  - Town will need to develop a policy that meets the criteria of the State Revolving Fund (SRF) program to make themselves eligible for zero-percent SRF loans.
- Purchase of Open Space/Build-out Development Properties:
  - Mashpee has been very proactive in the purchase and protection of land throughout Town. Town’s in the planning area can continue to identify properties which could be purchased to reduce build-out potential, therefore reducing potential future flow, and reducing the projected nitrogen loading to the embayments. Mashpee, working with other state and federal agencies, has preserved approximately 4,000 acres over the last 30+ years to: protect natural resources, limit development, and preserve open space for perpetuity.
- Potential Well and/or Treatment and Disposal Sites:
  - Towns can work towards securing additional public drinking water supply well locations and potential treated water recharge sites to foster flexibility in addressing their wastewater needs and protecting their drinking water supplies.

- Seasonal and year-round property phasing impacts:
  - The recommendations identified in the draft plan took into consideration phasing and implementation that targeted year-round developments as part of the Matrix evaluation.

4.5 Summary of DRP/DEIR Evaluations

4.5.1 General

As developed as part of the initial Scenarios/Options, the following sections identify those decisions/recommendations made to date as they relate to Source Removal, Direct Environmental Mitigation, and Land Management Strategies. These were then evaluated as part of the DRP/DEIR and the evaluations and findings are included here.

4.5.2 Source Removal

The following sites and technologies were selected for further consideration for wastewater treatment and removal. This section will also briefly mention stormwater removal technologies identified previously as part of this project.

4.5.2.1 Sites

As identified in the ASAR, the following new treatment and recharge sites were identified and were carried forward. These sites are illustrated in Figure 4-1.

4.5.2.1.1 Potential New Treatment Sites

1. Site 2—Ashumet Road
2. Site 4—Transfer Station
3. Site 6—Formerly referred to as the Keeter Property
4. Back Road Sites

Although being kept as a viable location, Site 2 will likely be combined with a wastewater treatment and recharge facility at Site 4. Similarly, the Back Road Site may be considered for a cluster facility, it is also considered as a backup location to JBCC.

4.5.2.1.2 New Recharge Sites

The following sites are shown in Figure 4-1:

1. New Seabury/Site 7
2. Back Road Sites
3. Site 4—Transfer Station
4. Site 6
5. Willowbend Golf Course

4.5.2.1.3 Potential Cluster System Sites

The following potential cluster developments were identified in the ASAR for consideration in the Recommended Plan development (Figure 4-2):

- Briarwood/Otis Trailer Village
- Pickerel Cove
- Pirates Cove
- Tri-Town Circle
- Santuit Pond

4.5.2.1.4 Existing WWTF Sites (in the Planning Area)

The Recommended Plan evaluation considers the use of all existing facilities. However the ownership, upgrade, and expansion issues associated with each specific facility will be site-dependent and will need to be taken into consideration as part of the Recommended Plan regarding their integration into that plan.

Upgrade and expansion of the following facilities/locations was identified in the ASAR:

- New Seabury
- Willowbend
- Mashpee High School
- Mashpee Commons

Each of these facilities was discussed in detail as part of the 2007 Needs Assessment Report (NAR) including the identification and history of the facility, a description of each facilities process, flow capacity, and performance.

Upgrade and expansion may include physical plant improvements, upgrades to systems handling the currently permitted design flows, upgrades required to handle additional wastewater flows, or complete replacement of the existing facility with a new facility (due to age of system, year of implementation, and level of treatment).

4.5.2.1.5 Joint Base Cape Cod Site

The potential use of the WWTF at Joint Base Cape Cod was as part of the Draft Recommended Plan development (as recounted later in this chapter); however, because a local or regional plan has yet to be developed or agreed upon with this facility, the details of its use may need to be addressed as part of the adaptive management approach. The Town has taken into consideration the use of this facility with its neighbors Falmouth and Sandwich, but until the JBCC study and findings by MassDevelopment is complete and released to the public, remaining use of this facility in the future remains unknown. The Towns' Board of Selectmen has written a letter dated March 27, 2013 stating the Towns' interest in the use of facilities at this site. A copy of the letter is included in Appendix 4-1. The Sewer Commission has also continued to correspond with those evaluating the facility to maintain its potential as an option for Mashpee.

4.5.2.2 Wastewater Treatment Technologies Being Considered

Wastewater treatment facilities (for the new facilities at Sites 2, 4, 6, or Back Road) with performance to reach 6 to 10 mg/L total nitrogen being carried forward include:

- Activated Sludge/Extended Aeration (AS/EA)
- Sequencing Batch Reactor (SBR)
- Membrane Biological Reactor (MBR)

The use of each of these technologies with denitrification filters to achieve levels less than 3 mg/L will be considered for those facilities that would recharge within one of the watersheds (Popponesset or Waquoit Bay); however, since this can be added to the end of the treatment process, these types of advanced treatment facilities may be phased in over time. There are several different types, and they will be specific based on the treatment system that precedes them and client preference regarding operations. These can include traditional upflow and downflow filters in addition to Nitrex™ or other media-based systems.

Use of Rotating Biological Contactors (RBC) will only be considered as they currently exist within the Town at existing wastewater treatment facilities. Any facility that has to achieve 3 mg/L in the future will be based on one of the three previously identified technologies (AS/EA, SBR, MBR) due to the difficulty of RBC systems to consistently achieve full nitrification of their effluent.

Ultraviolet (UV) disinfection will be the only disinfection technology considered as stated in the ASAR and the Technology Screening Report.

Odor control and sludge management systems/technologies will be considered on a site-by-site and process-by-process basis as part of the Recommended Plan development.

Collection systems (vacuum, gravity, septic tank effluent pump (STEP), septic tank effluent gravity (STEG), and low pressure sewers) all remain in consideration and should be evaluated at the time of design when site conditions, survey, utility constraints, and design requirements are known. At this time the Town/Sewer Commission does not have any formal sewer guidelines or regulations that may dictate the components of the system and therefore impact the cost of installation.

4.5.2.3 Treated Water Recharge Technologies

As stated previously, use of open sand beds, traditional subsurface leaching facilities, and drip irrigation are being carried forward as treated water recharge technologies. Spray irrigation is limited by its use, its infrastructure requirements, and the DEP regulations that regulate it and its effluent quality. In addition, there are also time-of-year use restrictions and other considerations when dealing with spray irrigation that have screened it from consideration.

4.5.2.4 Eco-Toilets

Although not currently being considered as part of Mashpee's Draft Recommended Plan for TMDL compliance, if considered later through their Adaptive Management Program the Town will need to establish how Eco-Toilets could be used, monitored, and reported as part of TMDL compliance through Adaptive Management. The Town of Falmouth is actively leading this work in demonstration projects, and the Town of Mashpee currently has regulations allowing the use of certain types of Eco-Toilets (See Appendix 4-2); but a robust plan of how these can be used as part of achieving TMDL compliance must be established in order to be considered part of the adaptive management approach of the Recommended Plan.

4.5.2.5 Innovative and Alternative Septic System Technologies

Although not being considered for a PPA-wide implementation, based on previous MEP modeling of the use of these technologies under the current systems approved for “General Use”, the use of these systems could be considered through adaptive management. Their use would depend on water quality improvements seen within watersheds that could be addressed through shellfish propagation. There are other systems currently approved for “Pilot” or “Provisional Use” with different levels of nitrogen removal performance that could be considered for use through the Adaptive Management Process.

It is understood that there are a large variety of these types of systems for individual home owners (as documented through the Barnstable County Department of Health and Environment Reports developed in 2007). These systems could be used to address isolated areas depending on the level of performance required and allowable nitrogen load to that watershed.

In order to consider these systems further as part of a TMDL compliance plan, the Town/District would need to develop a management plan in order to monitor and report performance. It is expected that because this would be considered for TMDL compliance, a more rigorous monitoring program and operational and maintenance requirements would be necessary to ensure that these systems were performing at the levels required based on the loading limits within any particular watershed. This could lead to additional costs for both the property owner and the Town.

4.5.2.6 Stormwater

Best Management Practices need to be implemented on a case-by-case basis, with nutrient removal capabilities considered in most sensitive watersheds. The Town should continue the implementation of these features and focus on the use of the following technologies within the more sensitive watersheds:

- Dry extended detention basins.
- Wet retention ponds.
- Infiltration basins.
- Stormwater wetlands.
- Submerged gravel wetlands.
- Bioretention (rain gardens).
- Water quality swales.
- Infiltration trenches.

Appendix 4-3 includes the Town’s current bylaw regarding BMP use for residential and non-residential development and a copy of the Town’s (2013) MS4 Annual report.

4.5.2.7 Fertilizer Management

Fertilizer management is identified as another nitrogen (and phosphorus) source that is currently impacting water resources within the PPA. The Cape Cod Commission (CCC) has developed model regulations that Town BOHs can adopt regarding Fertilizer Management Regulations. The CCC has designated the entire Cape a Fertilizer Management District of Critical Planning Concern (DCPC), allowing the development of these regulations that can be adopted by local BOHs.

The Town of Mashpee has also developed a Nitrogen Control Bylaw designed to reduce the amount of excess nitrogen entering the Town's Resource Areas and to improve the water quality in Waquoit Bay and Popponesset Bay. A copy of this Bylaw is included in Appendix 4-3.

4.5.3 Direct Environmental Mitigation

As discussed previously in this chapter, these measures will be considered as applicable. Their implementation will depend on several factors, which will be a function of existing pilot projects, new pilot/demonstration projects, and adaptive management strategies developed with the Recommended Plan. Therefore the following options have been identified and will be discussed further in this document:

- Shellfish Aquaculture (intended to be a significant component of any proposed recommended plan).
- Dredging/Inlet Opening.
- PRBs.
- Enhanced Natural Systems (wetlands/old cranberry bog restoration).

4.5.4 Land Management Strategies

In addition to the traditional Source Removal and Direct Environmental Mitigation measures, the Town/District has considered how to include other nitrogen mitigation measures through the following approaches identified previously:

- Growth Neutral/Flow Neutral.
- Purchase of Open Space/Build-out Development Properties.
- Potential Well and/or Treatment and Disposal Sites.
- Seasonal and year-round property phasing impacts.

4.6 DRP/DEIR Evaluations

4.6.1 Introduction

As discussed in the DRP/DEIR, Option 1A was the basis for the development of the Draft Recommended Plan and formed the contingency plan if shellfish aquaculture were not successful. However, because this was based on a fully traditional approach to managing wastewater nitrogen, additional evaluations and considerations were made for the Draft and Final Recommended Plans which are predicated on using non-traditional methods to potentially reduce the amount of traditional infrastructure. The following sections include the evaluations performed as part of the DRP/DEIR where alternative approaches to achieving the TMDL were considered; and based on the findings of the evaluations, recommendations of modifications to Option 1A were considered while achieving the same TMDL compliance goal. The subareas created for the evaluations are shown on Figure 4-3.

4.6.2 Option 1A Summary

Option 1A, as shown in Figure 4-4, consisted of the following primary components (all flows presented as average annual):

- Three new wastewater treatment facilities (WWTF) located at Sites 2, 4, 6, and the "Back Road" site; treating approximately 1.2 million gallons per day (mgd).
- Reuse of existing WWTF:
  - South Cape Village
  - New Seabury
  - Willowbend
  - Windchime Point
  - Stratford Ponds
  - Mashpee High School
  - Southport
- Reuse and expansion of the service area for the following WWTFs:
  - Cotuit Meadows
  - Wampanoag Village
- New effluent disposal facilities:
  - Site 7/New Seabury (approximately 1 mgd)
  - Back Road (approximately 370,000 gpd)
  - Site 4 (approximately 110,000 gpd)
- Adjacent communities (portions within the PPA):
  - Falmouth
    - § Approximately 50,000 gpd recharged outside watershed
    - § Limited septic system use
    - § Balance addressed at Site 6
  - Barnstable
    - § Approximately 80,000 gpd recharged outside watershed
    - § Balance remained on septic systems
  - Sandwich
    - § Approximately 300,000 gpd recharged outside watershed
    - § Balance remained on septic systems or at Forestdale School WWTF
- Innovative and Alternative (I/A) Systems:
  - Large "cluster"/neighborhood systems to remain

4.6.3 Targeted Evaluations

Option 1A allows the Town to achieve its TMDLs based on the recharge locations identified above and the MEP modeling results[1]. However, several alternative approaches to Option 1A to managing the nitrogen have been proposed, and the following sections will examine those approaches and discuss their advantages, disadvantages, and cost impacts. Environmental impacts associated are discussed in Chapter 7 of this report.

These alternatives will look at components of Option 1A including:

- Centralized versus cluster development at specific locations.
- Regional solutions (i.e. use of Joint Base Cape Cod and portions of Falmouth being addressed within Mashpee).
- Existing WWTF upgrade versus replacement and management options.
- Traditional versus hybrid solutions:
  - Shellfish
  - PRBs
  - Bog/Wetland restoration

Alternative evaluation areas are depicted in Figure 4-5.

4.6.4 Centralized Versus New Cluster Area Treatment Facilities

The Town of Mashpee has several existing “cluster” or neighborhood developments, most of which are currently served by small wastewater treatment facilities as have been discussed in previous reports submitted as part of this project. Although the term cluster has been used in several ways, it is often associated with areas serving less than 30 properties (as stated in the 2010 Barnstable County Wastewater Task Force Report); however for the purpose of this report, the term simply refers to a subset of the community or neighborhood that could be served by its own treatment facility. This is similar to the existing package treatment facilities serving neighborhoods and developments throughout Mashpee (examples of such facilities include Southport, Windchime Point, or Willowbend).

This evaluation will focus on potential new “cluster” development service areas. These areas typically fall within “subareas” previously identified for nitrogen mitigation in order to meet the established TMDLs; however Briarwood actually includes sections of two “subareas”. The cluster areas being considered were identified in the ASAR, and include:

- Briarwood/Otis Trailer Village;
- Pickerel Cove;
- Pirates Cove;
- Tri-Town Circle; and
- Santuit Pond.

[1] Based on original MEP model runs for Waquoit Bay East. This also is considering that although the new MEP model was for all of Waquoit Bay and the limits were close but not below the TMDLs, MEP explicitly stated that the new model had assumed no improvements made by Falmouth in the rest of that watershed, which is unlikely and also outside the limits of this Project Planning Area; and with improvements in those areas, the TMDLs would be achieved.

These five (5) potential “cluster” development areas were identified for further evaluation in order to compare the option of having their wastewater treated locally (to the development) versus being connected to an existing or new WWTF potentially serving a larger part of the community. Each cluster area which falls within an area identified for advanced treatment in Option 1A would be treated and recharged locally and compared to the proposed treatment and recharge options as presented in Option 1A as identified in Chapter 4 of the ASAR.

Table 4-1 identifies various characteristics of these cluster areas that could impact wastewater treatment and recharge facilities located within these developments. These include proximity to Zone II’s, flood plains, and protected habitats. Although each of these areas includes some of these features, it is probable that sufficient area to support a cluster system is present. If not, potential cluster areas will be served by the appropriate WWTF.

Table 4-1 Potential Cluster System Site Review

Cluster Sites	In Zone II	In 100 Year Flood	In V Zone	In 500 Year Flood	In Natural Habitat
Briarwood/Otis Trailer Village					Yes-Part
Pickerel Cove					Yes–Part
Pirates Cove		Yes-Part	Yes-Part	Yes-Part	
Santuit Pond	Yes–Part				Yes-Part
Tri-Town Circle	Yes-Part				

Notes:

1. Blank boxes indicate that these features are not within the mapped areas shown in Figure 4-2. “Part” indicates that a portion of that area includes the related feature; however it may not impact the development of a cluster system at that location.

The following table summarizes several characteristics of these subareas, including the primary watershed within which they are located and would recharge (under a cluster approach); which larger subarea they have been assigned as part of Option 1A; their estimated flows; and estimated number of properties served. It should be noted that as part of Option 1A, Santuit Pond Cluster area was not an area targeted for new treatment and recharge.

(continued)

Table 4-2 Possible Cluster Subareas and Estimated Flows

Subarea ID – "Cluster"	Subarea Description	Primary MEP Watershed	Approx. Subarea Size (acres)	Estimated Existing Flow (in gpd)	Estimated Future Flow (in gpd)	Total Number of Parcels
Briarwood/Otis Trailer Village	Potential Cluster site {Part of Subarea L}	Waquoit	240	34,000	52,000	320
Pickerel Cove	Potential Cluster site {Part of Subarea T}	Popponesset	75	6,200	8,000	60
Pirates Cove	Potential Cluster site {Subarea F}	Popponesset	70	13,000	14,000	150
Tri-Town Circle	Potential Cluster site {Subarea M}	Waquoit	50	6,300	11,000	90
Santuit Pond	Potential Cluster site {Subarea R}	Popponesset	110	29,000	30,000	180

Note: Values in table are rounded.

Each of these areas was included in the subareas modeled through MEP as part of Options 1A, 1B, and 1C evaluated in the ASAR; and their proposed treatment level, treatment location, and recharge locations were identified for each and are summarized in Table 4-3 for reference.

(continued)

Table 4-3 Originally Proposed Treatment and Recharge Areas to Meet TMDLs Per MEP Modeling

Subarea ID – "Cluster"	Subarea Description	Estimated Existing Flow (in gpd)	Estimated Future Flow (in gpd)	Option 1A	Option 1B	Option 1C
				Proposed Treatment (T) and Recharge (R)		
Briarwood/Otis Trailer Village	Potential Cluster site {Parts of Subarea L and H}	34,000	52,000	Back Road	Back Road	Back Road
Pickerel Cove	Potential Cluster site {Part of Subarea T}	6,200	8,000	Site 2 (T) Site 7 (R)	Site 2 (T) Willowbend (R)	Site 2 (T) Willowbend (R)
Pirates Cove	Potential Cluster site {Subarea F}	13,000	14,000	Site 6 (T) Site 7 (R)	Local Cluster	Local Cluster
Tri-Town Circle	Potential Cluster site {Subarea M}	6,300	11,000	Back Road	Back Road	Back Road
Santuit Pond	Potential Cluster site {Subarea R}	29,000	30,000	Title 5	Local Cluster	Title 5

Although being presented as an alternative approach to wastewater management, several of these areas were already considered for a "cluster" approach. As can be seen from Table 4-3, two areas—Pirates Cove and Santuit Pond—were identified as Subareas R and F and as a cluster system under either Option 1B or 1C based on their relatively isolated locations. Of these two locations, Santuit Pond (Subarea R) was not included in Option 1A for any change in its wastewater management (properties were identified to remain on Title 5 septic systems). Therefore as part of the Recommended Plan development, this area would continue to remain as is and therefore will not be evaluated compared to the potential connection to a centralized facility. However, in the future this area may be addressed (through adaptive management) in order to further assist in improving the water quality of Santuit Pond (as it relates to phosphorus impacts) or other needs in that area.

As for the remaining four proposed cluster sites identified in Table 4-3, each of these "clusters" will be evaluated and compared to Option 1A as presented previously in this Chapter.

The following is a brief summary of these four cluster areas:

- Briarwood/Otis Trailer Village (Parts of Subarea L and H) and Tri-Town Circle (Subarea M) are areas that were proposed to go to the Back Road Sites for treatment and recharge. As part of a cluster analysis this would be unlikely to change, the difference being how much additional flow from other areas around the John's Pond/Ashumet Pond areas would go there as well, changing from a cluster facility to a larger system. This area will also be evaluated later in this Chapter as part of the regional option and potential use of Joint Base Cape Cod (formerly the Massachusetts Military Reservation (MMR)). Although portions of these areas are outside of the Waquoit East Watersheds, they are still part of the greater Waquoit watersheds and within the planning area and therefore contribute nitrogen load to one of the embayments of interest. Although the MEP report identified "one" scenario for nitrogen removal, removal in other portions of the watershed is not a negative and shouldn't be flagged as "not-requiring" nitrogen removal—it is a function of cost-effectiveness and coordination and addressing other needs as well. It should also be noted that reduction of phosphorus impacts on freshwater bodies, such as Ashumet and Johns Ponds, is of importance to the Town.

- Pickerel Cove (part of Subarea T) is also fairly isolated and could be potentially served by a cluster system if land is available.
- Pirates Cove (Subarea F) is another isolated area (south of Willowbend) and in other options was identified as a potential cluster area. This area will be evaluated under both situations as part of this section.

Each of the cluster areas is evaluated on its own and then compared to how the same area would be addressed as part of the Option 1A proposal. In addition, each will then be compared to a limited number of possible variations of the Option 1A approach to TMDL compliance (i.e. alternate treatment and/or recharge sites).

4.6.4.1 Costs

The cost evaluation component for examining each of the cluster areas versus facilities serving a larger constituency were based on the Barnstable County Wastewater Cost Task Force Report dated April 2010, and the associated cost graphs (Figures 3 and 4 of that document). That report was based on facilities that would typically achieve an average TN of 6 to 8 mg/L for cluster/satellite type systems, and 5 mg/L TN in the effluent of larger facilities (assumed to be larger than 1 mgd); therefore additional costs were considered for facilities proposed as part of the Draft Recommended Plan to achieve less than 3 mg/L TN. These higher levels of performance were dictated by the MEP modeling which demonstrated that the effluent concentration within the majority of watersheds within the planning area would need to be at the limit of technology (i.e. 3 mg/L). To develop these costs, these dollars per gallon treatment values (as presented in the Barnstable County report) were supplemented by increased performance cost escalators as presented in the referenced Chesapeake Bay Study[2] prepared in 2002 examining the incremental treatment and operations and maintenance (O&M) costs between biological nitrogen removal (6 to 10 mg/L) to enhanced nitrogen removal (3 to 5 mg/L). This was also compared to the costs from similar local facilities on Cape Cod (namely the improvements at the Barnstable Water Pollution Control Facility (WPCF) and the Chatham WPCF), each of which have had related improvements approaching this higher level of performance.

For use in this analysis, costs from the Barnstable County and Chesapeake Bay reports were adjusted for the following factors:

- Costs were escalated using an estimated Engineering News Record (ENR) index of 9922 (Year 2017 estimate); and
- Contingency and fiscal, legal, and engineering services were added where applicable.

In the 2010 Barnstable County Report, graphs outlining their cost estimates for treatment were presented as "pure construction costs" and an ENR index of 8600. The engineering, fiscal, legal, and contingency

[2] Nutrient Reduction Technology Cost Estimations for Point Sources in Chesapeake Bay Watershed, 2002.

was then added in later in their analysis. In that report, a factor of 40-percent was carried to cover those costs in addition to land purchase to arrive at a total capital cost, and this same factor was added as part of this evaluation. In addition, as a planning document, the cost estimates have been rounded to two significant figures and carry a contingency appropriate for planning level documents.

In the Chesapeake Bay Report, costs were based on year 2000 dollars (and we assumed a mid-year ENR index of 6343 for that year), and included engineering and contingency similar to those carried by the Barnstable County Report.

The following tables (Table 4-4 and Table 4-5) summarize Total Capital Costs and O&M Costs, respectively, for a range of $/gpd treated based on the approach developed for this report.

Table 4-4 Estimated Capital Wastewater Treatment Cost per Gallon Treated

Facility Size	Cost to 6 to 8 mg/L TN	Cost to <3 mg/L
10,000 to 100,000 gpd	$120/gal to $60/gal	$150/gal to $70/gal
100,000 gpd to 1 mgd	$60/gal to $25/gal	$70/gal to $30/gal
Greater than 1 mgd	$25/gal	$30/gal
Values rounded and presented as "best fit" trend line.		

Table 4-5 Estimated O&M Wastewater Treatment Cost per Gallon Treated

Facility Size	Cost to 6 to 8 mg/L TN	Cost to <3 mg/L
10,000 to 100,000 gpd	$13/gal to $5/gal	$14/gal to $5.5/gal
100,000 gpd to 1 mgd	$5/gal to $2/gal	$5.5/gal to $2.2/gal
Greater than 1 mgd	$2/gal	$2.2/gal
Values rounded.		

The focus of these evaluations is on the treatment facility, and it assumes that the recharge facility and collection system costs would be proportional to the area served and similar across each approach, and therefore would not influence the cost evaluation. In some areas it will be explained that "transportation" costs (i.e. force main to remote locations) may be considered if that was identified in Option 1A. However, in areas like Briarwood and Tri-Town, their location relative to either Back Road or Joint Base Cape Cod makes this analysis unnecessary. For areas like Pirates Cove and Pickerel Cove, transportation costs are significant and are included in the analysis.

In addition, improvements proposed as part of a facility at Joint Base Cape Cod to serve portions of the planning area (as an alternative to the approach presented in the original Option 1A) were also developed based on similar types of facilities on Cape Cod (namely the Barnstable WPCF and the Chatham WPCF again).

Table 4-6 Estimated JBCC Improvement Costs [1, 2] per Gallon

Component	Capital Cost	O&M [3]
Expansion of Secondary Process	$6.0/gal	-
Clarification	$2.0/gal	-
Misc. Improvements	$1.0/gal	-
Construction Contingency	$4.0/gal	-
Total	$13/gal	$1.0/gal

Notes:

1. Based on recent improvement projects at Hyannis WPCF and Chatham WPCF.
2. Costs only related to improvements at the facility and do not include O&M costs related to existing facilities or improvements that may be necessary at the existing facility due to age or other compliance related issues.
3. O&M values not broken out by category.

4.6.4.2 Briarwood/Otis Trailer Village and Tri-Town Circle

This evaluation considers the advantages and disadvantages of Briarwood/Otis Trailer Village and Tri-Town Circle (within subareas (L and M) respectively) cluster areas being part of one larger facility or two smaller facilities. It is important to note that the Briarwood/Otis Trailer Village would use the same location as the proposed Back Road site for treatment and recharge as identified in Option 1A serving several subareas of Mashpee. The Briarwood and Tri-Town cluster areas—as shown on Figure 4-5—are located adjacent to Johns/Ashumet Ponds and are relatively isolated in respect to other facilities within the Town of Mashpee.

As identified previously, this area is also targeted for potential treatment and recharge at the Joint Base Cape Cod existing WWTF as an alternative to the approach presented in Option 1A. However, that is evaluated in the next section of this Chapter; this section focuses on the Option 1A approach for this area versus breaking these areas off into “cluster” facilities.

Cost evaluations were based on the approach outlined in Section 4.6.4.1, and consider the treatment facility only. O&M values ranging from five to 13 dollars per gallon (as presented in Table 4-5) were used to estimate O&M costs, and these values were then converted to a present-worth value based on an interest rate of 3-percent and applied over 20 years (reference NISTIR 85-3273-28).

These values were then compared to a new facility constructed at the Back Road site that would serve these areas and the other areas identified in Option 1A. In both cases, treated effluent recharge/disposal was not included because the incremental cost increase would be proportional to the size of the facility and therefore is considered inconsequential to the evaluation; however, costs of the selected approach developed for the Recommended Plan would include these costs. For comparison purposes a treatment cost for upgrade of the Joint Base Cape Cod facility was also included (that facility is assumed to have sufficient recharge capacity under that approach, as will be discussed later in this Chapter). According to the Barnstable County Report, small/cluster/satellite systems treating less than 50,000 gpd are typically less cost-effective on a cost per nitrogen removed than a centralized facility; however, they have the advantage of best use for isolated areas.

The following cost table represents a stepped approach and focuses on the cost of treating each "cluster" area individually compared to treating it as part of a larger group. This was done to show the economy of scale of going from a small isolated facility to larger and larger facilities serving larger populations with an economic advantage.

Therefore, in Table 4-7 the Tri-Town Area treatment costs are developed for just that area; then a cost was estimated for treating only Tri-Town and the Briarwood cluster areas together; then how the Tri-Town Area cost might be distributed if it were part of the Option 1A Back Road Site; and lastly, if this area was collected and treated as part of a regional facility at Joint Base Cape Cod.

Table 4-7 Summary of Treatment Costs (5)—Tri-Town Area

Facility	Estimated Future Average Flow (in gpd)	Estimated Capital Cost	Estimated O&M Cost	Estimated Total Present Worth (TPW)	Estimated Present Worth Cost/Gallon Treated(3)	Estimated Present Worth Cost/lb TN Removed(4)
Tri-Town Only	11,000	$1.9 Million	$140,000	$4.1 Million	$370	$350
Tri-Town and Briarwood	63,000	$7.0 Million	$480,000	$14 Million	$220	$210
Back Road Facility(1)	270,000	$17 Million	$1 Million	$33 Million	$120	$120
Joint Base Cape Cod (2)	320,000	$8.8 Million	$480,000	$16.1 Million	$50	$70

Notes:

1. Back Road Facility assumes that Southport does not connect. Based on the MBR approach.
2. Joint Base Cape Cod assumes same flow that would go to Back Road Site (no Southport) plus three Sandwich subareas (cost is only the added cost for improvements and the incremental O&M cost to treat total new flow sent to JBCC). No improved performance levels required assuming current permit remains in place of less than 10 mg/L TN.
3. TPW cost/gallon treated based on Future Average Annual gpd.
4. Nitrogen "removed" based on difference between septic load (based on nitrogen concentration of 26.25 mg/L) of area and recharge load from the WWTF/cluster system (based on an effluent concentration of 3 mg/L if recharged within watershed, and 10 mg/L if recharged out of watershed).
5. Values rounded to two significant figures.

Similar to Table 4-7, Table 4-8 presents the same "stepped" approach, but this time it reviews the Briarwood cluster area on its own and as part of a larger service area.

Table 4-8 Summary of Treatment Costs [5]—Briarwood/Otis Trailer Park Area

Facility	Estimated Future Average Flow (in gpd)	Estimated Capital Cost	Estimated O&M Cost	Estimated Total Present Worth	Estimated Present Worth Cost/gallon Treated[3]	Estimated Present Worth Cost/lb TN Removed[4]
Briarwood Only	52,000	$6.1 Million	$450,000	$13 Million	$250	$230
Tri-Town and Briarwood	63,000	$7.0 Million	$480,000	$14 Million	$220	$210
Back Road Facility[1]	270,000	$17 Million	$1 Million	$33 Million	$120	$120
Joint Base Cape Cod[2]	320,000	$8.8 Million	$480,000	$16.1 Million	$50	$70

Notes:

1. Back Road Facility assumes that Southport does not connect. Based on the MBR approach.
2. Joint Base Cape Cod assumes same flow that would go to Back Road Site (no Southport) plus three Sandwich subareas (cost is only the added cost for improvements and the incremental O&M cost to treat total new flow sent to JBCC). No improved performance levels required assuming current permit remains in place of 10 mg/L TN.
3. TPW cost/gallon treated based on Future Average Annual gpd.
4. Nitrogen "removed" based on difference between septic load (based on nitrogen concentration of 26.25 mg/L) of area and recharge load from the WWTF/cluster system (based on an effluent concentration of 3 mg/L if recharged within watershed, and 10 mg/L if recharged out of watershed).
5. Values rounded to two significant figures.

Costs developed do not consider costs associated with existing infrastructure or O&M costs currently expended on existing facilities. Costs are only intended to reflect the "added" cost of providing a new facility or upgrading/expanding existing systems to address the flows from these areas.

Because of the proximity of these cluster areas/subareas to either the Back Road Site or JBCC, transportation costs were not included in the evaluation; and because the Back Road Site would be recharging locally (similar to a cluster/satellite facility—the JBCC already has recharge facilities in operation) those costs were not included in the evaluation either. Recharge facilities costs are carried as part of the Draft Recommended Plan.

As shown in both tables, the alternative of being able to send flow to an expanded facility at Joint Base Cape Cod is significantly more cost-effective on both a dollar per flow and dollar per pound of nitrogen removed basis. In consideration of the need for construction of effluent recharge facilities at the other sites, JBCC becomes even more cost-effective and therefore is recommended for consideration as part of the Final Recommended Plan.

Table 4-9 summarizes the advantages and disadvantages of each approach (outside of the costs discussed above) regarding the use of these facilities.

Table 4-9 Advantages and Disadvantages Summary—Briarwood/Otis Trailer Park Area

Type	Advantages	Disadvantages
Small "Cluster" Facility (Briarwood/Tri-Town)	· If Joint Base Cape Cod is not available, these areas are isolated and ideal for satellite systems. · Briarwood has potential land area adjacent to the development including Back Road site and is not within a Zone II area. · Combined, Briarwood and Tri-Town circle would have design flows potentially greater than 50,000 gpd, improving its cost-effectiveness. · Any wastewater treatment in the Tri-Town area would provide additional protection for the existing Zone II area. · Reduces transportation cost by keeping facility local (relative to Site 4).	· Tri-Town subarea is primarily located within a Zone II area, therefore treatment costs to recharge within that area would be very high. · Both areas are within Natural Heritage and Endangered Species Program (NHESP) Estimated Habitats. · Briarwood and Tri-Town subareas have less than 50,000 gpd. (less cost effective) · Both would require land-takings unless Back Road site is used for Briarwood. · Would result in the area around Johns Pond and Ashumet Pond to have over six WWTFs located within this one area—these two new facilities and the facilities at JBCC, Southport, Mashpee High School, and Mashpee Village (in design). · Potential impacts of recharge facilities located upgradient of the two ponds may require additional phosphorus removal, adding to the facility costs.
Centralized Facilities (Back Road or Site 4)	· Economy of scale as identified in Barnstable County Report. · Reduction in the number of WWTFs required to operate in the area. · Reduction in the number of existing WWTF upgrades potentially required. · Centralized sites are located outside Zone II areas.	· Back Road site is within NHESP Estimated Habitats. · Access easement required for Back Road site (location would need to be negotiated). · Potential impacts from recharge at Back Road site upgradient of the two ponds may require additional phosphorus removal, adding to the facility costs.

Advantages and disadvantages of a cluster area approach for wastewater management versus treatment at a regional facility at JBCC are discussed later in this section.

4.6.4.3 Pickerel Cove Versus Site 2 or Site 4

The Pickerel Cove Cluster Area is a subset of approximately 60 properties that was included in the original Subarea "T". As part of Option 1A, this subarea (T) was designated to be treated at Site 2; however it could also have been collected, transported, and treated at Site 4. This evaluation will look at the costs of dealing with Pickerel Cove alone, treating it as part of Subarea T at Site 2, or treating it as part of Subarea T at Site 4 with other areas of Town designated to go to Site 4 as part of Option 1A. In the case of the latter, Site 4 would include flows from Subareas S, P, N, O, and I.

Under this evaluation, transportation (force main transmission of flow) costs from Pickerel Cove to either Site 2 or Site 4 need to be taken into consideration as do transportation costs to recharge at Site 7 from either of these two locations.

Table 4-10 summarizes these estimated costs.

Table 4-10 Summary of Transmission Costs [1]—Pickerel Cove Area

Facility	Estimated Distance (miles)	Estimated Capital Cost	Estimated O&M Cost	Estimated Total Present Worth
Pickerel Cove to Site 2	2.5	$3.5 Million	$60,000	$4.4 Million
Pickerel Cove to Site 4	4	$5.6 Million	$95,000	$7.0 Million
Site 2 to Site 7/New Seabury	8	$11 Million	$190,000	$14 Million
Site 4 to Site 7/New Seabury	6	$8.5 Million	$140,000	$10 Million

Notes:

1. Values rounded to two significant figures

The following Table 4-11 summarizes the estimated cost evaluation for serving the Pickerel Cove Area.

(continued)

Table 4-11 Summary of Costs (4, 8, 10)—Pickerel Cove Area

Facility	Estimated Future Average Flow (in gpd)	Estimated Capital Cost	Estimated O&M Cost	Estimated Total Present Worth	Estimated Present Worth Cost/gallon Treated	Estimated Present Worth Cost/lb TN Removed(9)
Pickerel Cove	8,000	$1.5 Million	$120,000	$3.5 Million	$410	$390
Site 2 Facility(1,3,5)	110,000	$23 Million	$800,000	$35 Million	$330	$440
Site 4 Facility (recharge outside watershed) (2,3,5,7)	530,000	$35 Million	$1.6 Million	$59 Million	$110	$150
Site 4 Facility (recharge within the watershed)(2,6,7)	530,000	$27 Million	$1.4 Million	$48 Million	$90	$90

Notes:

1. Site 2 Facility assumes that all of Subarea T is connected and treated at that location. Based on the more expensive MBR versus SBR approach. See Figures 4-1 and 4-3.
2. Site 4 Facility assumes treatment of Subareas S, P, N, O, and I.
3. Recharge from Site 2 or Site 4 would be out of the watershed at Site 7 per Option 1A. Therefore treatment levels are only to 10 mg/L TN, whereas Pickerel Cove will need to achieve 3 mg/L.
4. No collection or recharge costs are considered.
5. Costs for Sites 2 and 4 include transmission costs (see Table 4-10) to those sites (since the pumping flow to those locations is significantly greater than the cluster area). Discharge to outside watershed also included an additional transmission cost to Site 7.
6. Recharge at Site 4 within the watershed would be split between local recharge and the Willowbend Golf Course.
7. Each Site 4 facility under this evaluation assumes that Mashpee Commons is treated and recharged through its existing facility.
8. Costs developed do not consider costs associated with existing infrastructure or O&M costs currently expended by existing facilities. Costs are only intended to reflect the “added” cost of providing a new facility or upgrading/expanding existing systems to address the flows from these areas.
9. Nitrogen “removed” based on difference between septic load (based on nitrogen concentration of 26.25 mg/L) of area and recharge load from the WWTF/cluster system (based on an effluent concentration of 3 mg/L if recharged within watershed, and 10 mg/L if recharged out of watershed).
10. Values rounded to two significant figures.

In evaluating the costs of treating the wastewater from the area, the costs show that on cost per gallon of wastewater treated, and cost per pound of nitrogen removed that it is most cost-effective to consider treatment at a larger facility located at Site 4 than it is to treat it locally at Pickerel Cove. Although Site 4 could be used as a recharge location—under Option 1A this flow would be treated and recharged at Site 7 (outside of the watershed)—there would be an added cost to transport it outside of the watershed. However, at this size facility, it is more cost-effective to treat to a higher level and locally recharging than sending to Site 7. This is a result of the transportation cost offsetting the higher level of treatment cost to stay within the watershed. However, the sensitivity of the watershed to nitrogen makes sending it out of the watershed more of a necessity.

The following table summarizes other advantages and disadvantages (outside of the costs previously discussed) regarding the use of these facilities. Table 4-12 presents advantages and disadvantages of each approach:

Table 4-12 Advantages and Disadvantages Summary—Pickerel Cove Area

Type	Advantages	Disadvantages
Small “Cluster” Facility (Pickerel Cove)	· These areas are isolated and ideal for satellite systems. · Pickerel Cove has potential land area adjacent to the development · Recharge could be located outside a Zone II area. · Any wastewater treatment in the Pickerel Cove area would provide additional protection for Mashpee-Wakeby Pond.	· Pickerel Cove subarea is primarily located within the recharge area to Mashpee-Wakeby Pond and there may be additional costs for Total Phosphorus (TP) removal. · Pickerel Cove subarea has less than 50,000 gpd. · Would require land-takings.
Centralized Facilities (Site 2 or Site 4)	· Economy of scale as identified in Barnstable County Report. · Reduction in the number of WWTFs required to operate in the area and related upgrades required. · Centralized sites (Site 2 and Site 4) are located outside Zone II areas; recharge at Site 7 is outside watershed and Zone II areas.	· Site 2 is not cost-effective (less cost-effective than Pickerel Cove on a cost per parcel basis, but more effective on $/lb N removal and gallon treated). · Site 4 is limited in recharge (due to TMDL compliance) and therefore there is added cost to transport effluent to Site 7.

Based on this evaluation, this area is recommended to be served through Site 4 and is carried forward as part of the Recommended Plan.

4.6.4.4 Pirates Cove Versus Site 6/Site 4 or Willowbend

Pirates Cove is located at the mouth of the Mashpee River and consists of approximately 150 properties. As part of Option 1A this area was designated as Subarea “F”. Also as part of Option 1A, this Subarea was designated to be treated at Site 6; however it could also have been collected, transported, and treated at Site 4 or Willowbend. This evaluation included the costs of addressing Pirates Cove alone, treating it as part of areas designated to go to Site 6, or Site 4 with other areas of Town designated to go to Site 4 as part of Option 1A. In the case of the latter, Site 4 would include flows from Subareas S, P, N, O, and I.

Under this evaluation, transportation (force main transmission of flow) costs from Pirates Cove to either Site 4 or Site 6 need to be taken into consideration as do transportation costs to recharge at Site 7 from either of these two locations.

Table 4-13 summarizes these estimated costs.

Table 4-13 Summary of Transmission Costs [1]—Pirates Cove Area

Facility	Estimated Distance (miles)	Estimated Capital Cost	Estimated O&M Cost	Estimated Total Present Worth
Pirates Cove to Site 4	2.5	$3.5 Million	$60,000	$4.4 Million
Pirates Cove to Site 6	6.5	$9.1 Million	$150,000	$11 Million
Site 4 to Site 7/New Seabury	6	$8.5 Million	$140,000	$11 Million
Site 6 to Site 7/New Seabury	2.5	$3.5 Million	$60,000	$4.4 Million

Notes:

1. Values rounded to two significant figures.

The following Table 4-14 summarizes the estimated cost evaluation for serving the Pirates Cove Area.

(continued)

Table 4-14 Summary of Costs (1, 4)—Pirates Cove Area

Facility	Estimated Future Average Flow (in gpd)	Estimated Capital Cost	Estimated O&M Cost	Estimated Total Present Worth	Estimated Present Worth Cost/gallon Treated	Estimated Present Worth Cost/lb TN Removed
Pirates Cove	14,000	$2.4 Million	$170,000	$4.5 Million	$320	$350
Site 6 Facility (3,5)	240,000	$25 Million	$1.1 Million	$42 Million	$180	$240
Site 4 Facility (recharge outside watershed) (2,3.5.6,7)	530,000	$33 Million	$1.5 Million	$56 Million	$110	$140
Site 4 Facility (recharge within the watershed) (2,3.5.6,7)	530,000	$25 Million	$1.4 Million	$46 Million	$85	$80

Notes:

1. Values rounded to two significant figures.
2. Site 4 Facility assumes treatment of Subareas S, P, N, O, and I. See Figures 4-1 and 4-3.
3. Recharge from Site 6 or Site 4 would be out of the watershed at Site 7 per Option 1A. Therefore treatment levels are only to 10 mg/L TN, whereas Pirates Cove will need to achieve 3 mg/L.
4. No collection or recharge costs are considered.
5. Costs for Sites 4 and 6 include transportation to those sites (since the transportation to those locations is significantly greater than the cluster area). Discharge to outside watershed also included an additional transportation cost to Site 7.
6. Each Site 4 facility under this evaluation assumes that Mashpee Commons is treated and recharged through its existing facility.
7. Costs developed do not consider costs associated with existing infrastructure or O&M costs currently expended by existing facilities. Costs are only intended to reflect the “added” cost of providing a new facility or upgrading/expanding existing systems to address the flows from these areas.

In evaluating the costs of treating the wastewater from the area, the costs show that on cost per gallon of wastewater treated, and cost per pound of nitrogen removed that it is most cost-effective to consider recharge at a larger facility located at Site 4 than it is to treat it locally at Pirates Cove. Although Site 4 could be used as a recharge location—under Option 1A this flow would be treated and recharged at Site 7 (outside of the watershed)—there would be an added cost to transport it outside of the watershed; however at this size facility, there is only a nominal cost savings when going from treating to 3 mg/L to less than 10 mg/L which is lost in the transport to Site 7. The sensitivity of the watershed makes sending it out of the watershed more of a necessity.

The following information summarizes other advantages and disadvantages (outside of the costs previously discussed) regarding the use of these facilities. Table 4-15 presents advantages and disadvantages of each approach.

Table 4-15 Advantages and Disadvantages Summary—Pirates Cove Area

Type	Advantages	Disadvantages
Small "Cluster" Facility (Pirates Cove)	· These areas are isolated and ideal for satellite systems. · Pirates Cove has potential land area adjacent to the development and is not within a Zone II area.	· Pirates Cove subarea has less than 50,000 gpd and therefore is less cost-effective. · Would require land-takings.
Centralized Facilities (Site 4 or Site 6)	· Economy of scale as identified in Barnstable County Report. · Reduction in the number of WWTFs required to operate in the area. · Centralized site (Site 4) is located outside Zone II areas; recharge at Site 7 is outside watershed and Zone II areas.	· Site 6 is located within a Zone II therefore discharge must be at Site 7, or a significantly higher level of treatment is required. · Site 4 is limited in recharge (due to TMDL compliance) and therefore there is added cost to transport effluent to Site 7. · Both Sites 4 and 6 have significant costs associated with transportation to the site(s) from Pirates Cove and from those treatment locations to Site 7 if discharging outside of the watershed.

Based on these evaluations, the Recommended Plan was developed based on the use of Site 4 and recharge within the watersheds, however recharge location may require shifting to Site 7 if shellfish performance is not at the levels expected in the subwatersheds that surround the Pirates Cove area.

4.6.5 Regional Solutions

Several regional approaches have been considered as part of this planning effort. Each of the most recent options considered the treatment and recharge within Mashpee of flow from the area east of the Quashnet/Moonakis River in Falmouth. Option 1B was based on a large portion of Cotuit located in the Popponesset Bay watershed being treated and recharged within Mashpee. However the most recent consideration (and most cost-effective) is for the use of the existing WWTF located at JBCC which is located within the Project Planning Area in Sandwich near the Ashumet Pond and Johns Pond parts of Mashpee, as shown on Figure 4-5.

As part of this evaluation, the focus is on the impact of sending flow to JBCC to get additional flow outside of the Waquoit Bay watershed, potentially reducing the needed infrastructure to address nitrogen in this watershed, eliminates advance nitrogen treatment needs within the watershed, and it removes groundwater contaminants in well recharge areas (Zone IIs and private wells) from existing septic systems.

Advantages:

- Use of JBCC (with associated upgrade and improvements) appears to be less than half the cost of a new facility at Back Road Site. JBCC has effluent disposal capacity that would just need to add a third carrousel train and clarifier. Would pick up Sandwich 1, 2, 3, and Subareas G, H, J (less Southport), L, and M. Southport would need to achieve between 5 and 7 mg/L and could remain in its same location.
- New facilities for those areas at Back Road would be approximately $20M (when considering recharge facilities). These facilities would need to be designed for the limit of technology, and costs do not consider any advanced treatment for potential phosphorus removal due to its location (of the recharge) upgradient of two fresh water ponds (Johns and Ashumet).
- Upgrade at JBCC likely around $4M, compared to $20M.
- Favors a regional solution with Sandwich and serves all high priority areas in both towns.
- Assumes collection system costs are the same with both options (savings on treatment and recharge).
- The Joint Base Cape Cod site also offers the advantage of potentially being expanded for use for Falmouth within Waquoit Bay Watershed, presuming the recharge capacity is available at the existing four open sand beds.
- Recharge is outside of the PPA watersheds.
- Regional solutions may carry more weight in funding opportunities, and are supported at the County and State level.

Disadvantages:

- Future of the JBCC facilities ownership is unclear and may not be available for Mashpee.
- The timing of a JBCC ownership decision may push this area out further in the timeline.
- Will require development of Memorandums of Understanding (MOUs) with several adjoining towns, regional entities, and/or the Mashpee Water District.

It is recommended that a regional solution approach be carried forward in the Recommended Plan.

4.6.6 Existing WWTFs

As part of considering alternatives to Option 1A, this section briefly identifies each of the existing small wastewater treatment facilities and their proposed use as part of Option 1A. Alternatives to those recommendations are considered in this section. Two of the largest impacts to any change in the use of existing WWTFs as outlined in Option 1A would be the use of shellfish as a means to mitigate the nitrogen issue within the estuary as discussed in a subsequent section of this report, and the use of Joint Base Cape Cod, both of which change the extent of traditional infrastructure needs within the PPA.

Table 4-16 summarizes the existing WWTFs within the PPA and identifies how they were incorporated into Option 1A, and also how Option 1A might be altered to consider an alternative approach to handing those facilities (either in treatment performance, treatment location, or recharge location for example).

Table 4-16 Summary of Existing WWTF and Proposed Future Operation

Facility	Permitted Flow (gpd) (3)	Proposed Use in Option 1A (1)	Alternative to Option 1A
Forestdale School	20,000	No change.	No change.
New Seabury	300,000	Use existing capacity for adjacent Subareas.	No change.
Mashpee Commons	180,000	Improved treatment to 3 mg/L and recharge proposed to be relocated to Site 4.	Flow remains treated and recharged at existing site.
South Cape Village	24,000	Improved to 3 mg/L.	Monitor per AM (2).
Mashpee High School	18,000	Flow proposed to be treated to 3 mg/L and recharged at Back Road Site.	Treated and recharged at JBCC.
Southport	172,000		Flow remains treated and recharged at existing site.
Willowbend	132,000	Improved to 3 mg/L.	Expand recharge area as alternate recharge area for Site 4, moderate improvements to less than 6 mg/L and monitor per AM.
Stratford Ponds	35,500	Improved to 3 mg/L.	Monitor per AM.
Cotuit Meadows	59,000	Connect small adjacent area.	Monitor per AM.
Wampanoag Village	10,000	Connect small adjacent area.	Monitor per AM.
Joint Base Cape Cod		Not included	Treatment and Recharge
Windchime Point	40,000	Improved to 3 mg/L.	Monitor per AM.

Notes:

1. As modeled through MEP.
2. AM = Adaptive Management program.
3. Values from each facility's MassDEP Groundwater Discharge Permit.

For each of the existing WWTFs within the PPA, several approaches for their use as part of a Recommended Plan were identified including upgrade, reconstruction, replacement, and the considerations of public or private operations. These approaches are summarized below:

- Upgrade or reconstruction/replacement of existing WWTF:
  - Use of Joint Base Cape Cod will not require major improvements to Southport or High School.
  - The cost-effectiveness of this was shown in the cluster evaluation for both the High School and Southport; where Southport would need no major improvements over what is currently required, and the High School facility could remain until it was determined its flow needed to be transported to JBCC for treatment and recharge.
  - Under the proposed alternative, the Mashpee Commons facility would be allowed to continue under its current proposed improved treatment, thereby reducing the cost of a larger facility at Site 4 and potential transport to either Willowbend or Site 7 for recharge.
  - Increased propagation of shellfish should allow smaller facilities to operate within their existing permits and be monitored as part of adaptive management to determine if future improvements could be implemented without having to treat to the limit of technology which would be difficult for several of the smaller facilities.
  - Wampanoag Village facility: The expansion is required to offset 237 lbs N/yr produced by the housing development. In addition, the constructed treatment plant has significant capacity in excess of that needed for Wampanoag Village and the 237 lbs N/yr Groundwater Discharge Permit (GWDP) requirement, regarding which the Town and Tribe have begun discussions about extending the collection system served by the facility to include Town Hall and the surrounding area.
- Public versus private ownership and operations:
  - By allowing Southport and Mashpee Commons to remain independent (private), the future number of facilities owned, operated, and maintained by the Town/Mashpee Water District is reduced.
  - Further analysis by the Town/Water District should be performed to establish the cost benefits of public versus private ownership and operation.

4.6.7 Traditional Versus Hybrid Solutions

4.6.7.1 Shellfish Aquaculture

The Town of Mashpee Shellfish Constable/Resource Officer identified several embayments where the Town is either actively pursuing and implementing shellfish propagation or areas where they plan to expand the shellfish resources in the future (i.e. new or larger shellfish beds). This program has been developed with the goal of restoring the historic shellfish resources in the area with the added benefit of addressing the nitrogen load within some of the Town’s sensitive water bodies.

Table 4-17 presents a summary of this information identifying the watersheds, estimated nitrogen removal, and proposed shellfish type to be used. This information also provides a comparison to the estimated attenuated load to these embayments from various watersheds and an estimated percent removal of septic/wastewater nitrogen was estimated.

Table 4-17 Existing Shellfish Estimated Positive Impact [4, 5]

Watershed [3]	Estimated Existing Attenuated Wastewater Nitrogen (m ton/yr)	Estimated Nitrogen Removal by Shellfish (m ton/yr)	Shellfish Type	Potential Percent of Existing WW Nitrogen Removal with Shellfish
Mashpee River	5.0	2.5	Oysters	50%
Popponesset Bay [1]	1.5	1.5	Quahogs	100%
Ockway Bay	0.9	0.9	Quahogs	100%
Shoestring Bay	4.0	2.0	Oysters	50%
Great River	1.0	1.0	Quahogs	100%
Jehu Pond	1.0	1.0	Quahogs	100%
Hamblin Pond [2]	3.7	3.7	Quahogs	100%
Quashnet River	3.0	0	0	0%

Notes:

1. Includes Popponesset Creek.
2. Includes both Red Brook and Little River watersheds.
3. Watersheds are made up of multiple subwatersheds, but do not extend above Mashpee-Wakeby Pond.
4. Values based on MEP 2001 wastewater flow estimates.
5. All values based on "existing" conditions from MEP reports.

As shown above, per the existing conditions, several of the watersheds are estimated to have 100% of the load that exceeds the threshold (from any sources) would be removed. Shoestring Bay and Mashpee River are estimated to have a 50% removal, but the actual performance would be determined through monitoring and future watershed modeling.

Table 4-18 provides an estimate of the number of parcels based on subareas projected to be served within each watershed area that could potentially be addressed once the shellfish propagation reaches the proposed growth levels as identified in Chapter 5 which summarized the Draft Plan and Chapter 6 where the Final Recommended Plan is discussed. The estimated number of parcels addressed is based on the estimated removal percentage of nitrogen being targeted using this management approach.

Table 4-18 presents the percent removal information but under a future nitrogen load in terms of equivalent parcels as estimated and modeled as part of the ASAR evaluation of Options 1A, 1B, and 1C.

Table 4-18 Future Shellfish Estimated Positive Impact (equivalent number of dwellings addressed) (5)

Watershed (3)	Estimated Existing Developed Parcels in Subarea (4)	Estimated Percent Nitrogen Removal via Shellfish Aquaculture	Estimated Number of Parcels Addressed(4)
Mashpee River	1,100	50%	550
Popponesset Bay (1)	420	100%	420
Ockway Bay	210	100%	210
Shoestring Bay	2,000	50%	1,000
Great River	260	100%	260
Jehu Pond	190	100%	190
Hamblin Pond (2)	460	100%	460
Little River	70	100%	70

Notes:

1. Includes Popponesset Creek.
2. Includes both Red Brook watersheds.
3. Watersheds are made up of multiple subwatersheds, but do not extend above Mashpee-Wakeby Pond.
4. Rounded to two significant figures.
5. Based on final Popponesset Bay and Waquoit Bay MEP and TMDL reports.

One approach to consider the potential cost savings of using shellfish aquaculture over traditional infrastructure is to consider how many potential parcels would be connected to a collection system for treatment if no shellfish were considered. Using the cost estimating approach for collection systems as presented in Chapter 5 of the ASAR, assuming an average of $23,000 per property connected including the sewer mains, pumping stations, and road construction (excluding property owner connection costs, treatment, recharge, force mains, or design engineering or contingencies), a significant savings is estimated in the implementation of this program. This can then be compared to the estimated costs associated with the long-term management of the proposed shellfish program within these watersheds. Operation and Maintenance was conservatively estimated at an average of $130.00 per property per year to cover pumping stations operations, piping, and possible Town ownership/maintenance of individual grinder, vacuum valve pits, or septic tank effluent systems. Table 4-19 presents the estimated costs for implementation of the shellfish program in present worth dollars compared to the estimated present worth value of equivalent collection system costs by watershed area (based on the estimated number of properties potentially addressed through shellfish propagation under existing conditions). Treatment and recharge costs are not shown in the comparison as they are dependent on the size of the area being served (as shown in previous evaluations in this chapter); however additional cost savings are anticipated if those facilities are reduced in size or not required as a result of improved water quality from the propagation of shellfish.

The estimated annual cost for supporting shellfish aquaculture in each watershed is estimated as:

- Mashpee River $140,000
- Popponesset Bay/Creek $233,000
- Ockway Bay $140,000
- Shoestring Bay $112,000
- Great River $160,000
- Jehu Pond $160,000
- Hamblin Pond/Little River $547,000

The shellfish aquaculture annual costs were then converted into a Total Present Worth (TPW) cost as summarized in Table 4-19 to be compared to a TPW estimated value for simply the construction of a collection system within the road right-of-way to serve these same areas.

Table 4-19 Shellfish Program Versus Equivalent Parcels Collection System Total Present Worth Costs (1, 2)

Watershed	Estimated Shellfish $ (3,4)	Equivalent Parcels Collection System $ (5)
Mashpee River	$2,000,000	$16,000,000
Popponesset Bay (including Popponesset Creek)	$3,500,000	$10,000,000
Ockway Bay	$2,000,000	$5,100,000
Shoestring Bay	$1,600,000	$24,000,000
Great River	$2,400,000	$6,400,000
Jehu Pond	$2,400,000	$4,600,000
Hamblin Pond (Including Red Brook, Little River)	$8,100,000	$18,000,000
Total	$22,000,000	$80,000,000

Notes:

1. Values rounded to two significant figures.
2. Total Present worth based on 3% interest over 20 years.
3. Shellfish costs are conservative and assume that there is no natural reseeding and therefore there is a continuous annual cost, whereas, it is likely to be significantly less with natural reseeding.
4. Shellfish costs also do not consider the overall economic benefit through harvest into the local economy.
5. Collection system cost estimated based on future nitrogen loading from watershed.
6. Estimated costs are based on average cost per property connected for collection system mains only. Individual property service connections, and annual sewer user fees are not included. Treatment and recharge cost are dependent on the size of area being served, therefore are not shown as part of this analysis.

The cost savings in the total present worth of collection system costs is roughly 70% which does not include the cost savings in wastewater treatment and recharge costs; and this does not take into consideration any natural reseeding of shellfish that will reduce the annual cost related to shellfish aquaculture.

The results indicate that shellfish propagation within Popponesset Bay and Ockway Bay has the potential for a major reduction in Subarea D.

In addition, expanded shellfish resources as proposed in Hamblin/Jehu/Little River/Great River/Red Brook could potentially reduce the nitrogen loading impacts from Subareas A, and most of Subareas B, C, D, E, and F-1 through F-12.

Advantages of this approach over conventional treatment approaches are:

- Starts addressing the nitrogen currently within the embayments.
- Has a much lower capital and O&M cost associated with it.
- Public perception and reception of this approach is typically higher than traditional methods on Cape Cod.
- Helps restore existing and historic shellfish resources.
- Has the potential to generate additional capital through additional licenses, permits, and sales of shellfish.
- Has the potential to generate other positive impacts related to habitat generation and shore stabilization.
- Has potential to reduce storm impacts through reef creation.
- Has the potential to address some of the existing benthic flux nitrogen loading, which traditional infrastructure would not address.
- The proposed shellfish implementation in Mashpee would be sub-tidal (out of sight) and therefore would not create aesthetic impacts associated with support/growth systems (i.e. bags, and other artificial substrate visible at the surface).

Disadvantages of this approach versus conventional treatment approaches are:

- Only watersheds with appropriate habitat characteristics can be targeted.
- Natural predators of shellfish and diseases can impact performance.
- Long-term performance by watershed is unknown.
- Regulatory requirements and permitting when considering as part of a CWMP are not established. Work is currently underway with the State to provide greater guidance on the use of these systems. If successful, the shellfish will contribute to achieving the nitrogen TMDL/water quality restoration whether they are part of an approved plan or not and would be considered under adaptive management.
- Does not address other constituents in septic system effluent that can be addressed through advanced wastewater treatment.
- Does not address the source, and is considered a Direct Environmental Management Approach.
- Long-term “maintenance” is unknown relative to maintaining TMDL compliance. Annual seeding may be required in certain areas (like Popponesset Bay/Creek) due to higher water flow rates.

Based on this evaluation, shellfish aquaculture is recommended to be considered as part of the Recommended Plan.

4.6.7.2 Permeable Reactive Barrier (PRB) Use

At this time, no additional specific areas (beyond the Pirates Cove proposal) within the Project Planning Area have been identified as a definite candidate site for PRB installation. As the Town of Falmouth moves forward with its demonstration project program as part of their ongoing planning efforts, the Town of Mashpee shall look to learn from Falmouth's experiences.

The potential for use of these facilities has been identified for discussion purposes including:

- Around existing recharge facilities.
- The Pirates Cove area.

Advantages of this approach over conventional treatment approaches are:

- Starts addressing the nitrogen currently within the embayments.
- Reduction in traditional infrastructure.
- Reduced O&M costs associated with long-term operation.

Disadvantages of this approach versus conventional treatment approaches are:

- Only areas with shallow depths to groundwater are typically considered, and may have limited application within the PPA.
- Long-term performance within any particular watershed is unknown.
- Regulatory requirements and permitting when considering as part of a Comprehensive Wastewater Management Plan (CWMP) are not established. Work is currently underway with the State to provide greater guidance on the use of these systems.
- Siting will depend on wetland and conservation commission regulations. Potentially significant permitting and regulation requirements.
- Does not necessarily address other constituents in septic system effluent that can be addressed through advanced wastewater treatment. Additional study and piloting would be required to demonstrate performance.
- Does not address the source and is considered a Direct Environmental Management Approach.
- Long-term maintenance of this system is unknown relative to maintaining long-term TMDL compliance.
- Level of disturbance dictated by type of barrier selected (open trench versus injection type).
- No operational control.

At this time, until PRB piloting is complete in neighboring communities or more technical information is available on their performance for nitrogen removal in coastal communities such as Mashpee, they will remain in the "toolbox" for consideration as part of Adaptive Management, but are not being recommended as a formal part of the plan.

4.6.7.3 Bog and Wetland Restoration

Advantages of this approach over conventional treatment approaches are:

- Restoration and reuse of an existing or historic natural resource.
- Potential reduction in conventional treatment and infrastructure required.
- Reduced O&M costs.

Disadvantages of this approach versus conventional treatment approaches are:

- Long-term performance is unknown.
- Regulatory requirements and permitting when considering as part of a CWMP are not established. Work is currently underway with the State to provide greater guidance on the use of these systems.
- Does not necessarily address other constituents in septic system effluent that can be addressed through advanced wastewater treatment.
- Does not address the source and is considered a Direct Environmental Management Approach.
- Long-term maintenance of this system is unknown relative to maintaining TMDL compliance.

At this time, bog and wetland restoration will remain in the "toolbox" for consideration as part of Adaptive Management, but are not being recommended as a formal part of the plan.

4.6.7.4 Onsite Systems

As part of a Recommended Plan, those properties proposed to either remain on septic systems or upgrade to I/A per Town requirements will also require a management strategy related to TMDL compliance. As part of the Recommended Plan, the Town/District will need to discuss opportunities and obstacles for using technologies assigned with MassDEP provisional approval (seasonal issues, permitting, proprietary nature, ownership, permitting, and oversight), in addition to long-term maintenance and performance testing/permitting to show compliance with TMDLs.

Advantages of this approach over conventional treatment approaches are:

- Is a source removal technology.
- Existing facilities can remain.
- I/A type systems (with nitrogen removal) provide a greater level of treatment over existing septic systems and cesspools.

Disadvantages of this approach versus conventional treatment approaches are:

- Highly variable systems, performance levels vary both on technology type and application.
- Average performance of existing systems on Cape Cod demonstrate performance levels short of needed levels for TMDL compliance.
- Does not necessarily address other constituents in septic system effluent that can be addressed through advanced wastewater treatment at a larger facility.
- Requires appropriate space on individual properties, puts operational responsibilities on the homeowner/property owner for compliance.

- Long-term maintenance of these types of systems is unknown relative to maintaining TMDL compliance when applied on a Town-wide basis.

At this time, I/A systems use will remain in the “toolbox” for consideration as part of Adaptive Management and within those areas or watersheds where sewering or shellfish aquaculture are not being considered.

4.7 Matrix Evaluation

As presented previously and as part of the ASAR, the Project Planning Area was broken into several “subareas” in order to assign flows to various treatment and recharge locations, and to allow a prioritization of the PPA to be used as part of implementation. Tables 4-20, 4-21, and 4-22 provide a summary of the general information on each planning area, information on wastewater generation, drinking water supply, watersheds, proximity to infrastructure, and other considerations. This general “demographic” information was then evaluated based on various weighted criteria so that each Subarea could be ranked.

General information included the following:

- Subarea identification;
- Subarea description;
- Primary MEP Watershed (Popponesset Bay, Waquoit Bay, or both);
- Subarea size (acres);
- Estimated existing wastewater (gpd);
- Estimated future wastewater (gpd);
- Number of parcels;
- Estimated number of “existing” developed parcels; and
- Estimated number of total potential developed parcels.

Wastewater generation information included:

- Percent of flow “existing” versus “future” (to show development potential);
- Estimated census occupancy by planning area (percent of year-round occupied—as provided by planning department);
- Estimated gallons per acre (“existing”) to show density;
- Estimated gallons per acre (“future”) to show future density;
- Estimated existing attenuated nitrogen load (kg/y per acre); and
- Estimated future attenuated nitrogen load (kg/y per acre).

Drinking water supply information included:

- Percent of planning area in Zone II;
- Percent of Subarea in USGS well recharge area; and
- Estimated percent of parcels in Subarea on private wells.

Watershed information included:

- Watershed attenuation;

TABLE 4-20 : MATRIX EVALUATION POINTS

		Points per Category	Maximum Points by Group
GENERAL INFORMATION	Subarea ID		
	Subarea Description		
	Primary MEP Watershed		
	Subarea Size (acres)		
	Existing gpd		
	Future gpd		
	Total number of parcels		
	Number "existing" developed		
	Number of developed / developable parcels		
WASTEWATER GENERATION	Percent of flow existing vs. at future (weight)	5	30
	Est. Census Occupancy by planning area (% year round) (weight)	5	
	Existing Gal/Ac (Weight)	5	
	Future Gal/Ac (weight)	5	
	Est. Existing Attenuated load (kg/y per acre) (weight)	5	
	Est. Future attenuated load (kg/y per acre) (weight)	5	
DRINKING WATER	Percent of Subarea in Zone II (weight)	5	20
	Percent of Subarea in USGS Well Recharge Area (weight)	10	
	Estimated Percent on Private Wells (weight)	5	
WATERSHED	Watershed Attenuation (weight)	10	30
	In Subwatershed to Shellfish Propogation (weight)	5	
	Embayment Habitat Quality (weight)	10	
	Number of upgradient properties within 300ft Fresh Water (P) (weight)	5	
PROXIMITY TO INFRASTRUCTURE	Proximity to JBCC (weight)	3	20
	Proximity to "Closest" Existing WWTF (weight)	4	
	Proximity to "Closest" Potential New WWTF (weight)	3	
	Proximity to Potential Recharge - New Seabury (weight)	3	
	Proximity to Potential New Recharge - Back Road (weight)	2	
	Proximity to Potential New Recharge - Site 4 (weight)	2	
	Proximity to Potential New Recharge - Site 6 WWTF (weight)	1	
	Proximity to Potential New Recharge Willowbend (weight)	2	
BONUS	Subarea includes: Summerwood Condos, Sea Oaks Condos, Lake Side Estates, or South Cape Resort	+5	+10
	Subarea within Mashpee River Watershed	+5	
RANK	VALUE TOTAL (with Maximum Bonus)	110	110
	RANK	#	

TABLE 4-21: SUBAREA DATA (FOR MATRIX EVALUATION - ROUNDED)

GENERAL INFORMATION									WASTEWATER GENERATION											
Subarea ID	Subarea Description	Primary MEP Watershed	Subarea Size (acres)	Existing gpd	Future gpd	Total number of parcels	Number "existing" developed	Number of developed / developable parcels	Percent of flow "Existing" vs. "Future"	Est. Census Occupancy by planning area (% year round)	Gallons Per Acre ("Existing")	Gallons Per Acre ("Future")	Est. "Existing" N. Load (septic) kg/yr	Est. "Future" N. Load (septic) kg/yr	Est. "Existing" Unattenuated Load per acre (kg/y/ac)	Est. "Future" Unattenuated Load per acre (kg/y/ac)	"Existing" Nitrogen Loading Att. (kg/y)	"Future" Nitrogen Loading Att. (kg/y)	Est. "Existing" Attenuated load (kg/y) per acre	Est. "Future" Attenuated load (kg/y) per acre
{alpha#}	{Desc.}	{Poppy / Waquiot / Both}	{#}	{#}	{#}	{#}	{#}	{#}	{%}	{%}	{#}	{#}	{#}	{#}	{#}	{#}	{#}	{#}	{#}	{#}
A	A. Seconsett Island	Waquoit	40	10,000	13,000	90	80	80	82%	41%	267	326	380	460	10	12	380	460	10	12
B	B. Areas to the east and west of the existing New Seabury facility	Waquoit	220	53,000	75,000	530	440	490	71%	29%	234	332	1,900	2,700	8	12	1,910	2,710	8	12
C	C. Monomoscoy Island	Waquoit	70	12,000	18,000	220	130	160	71%	50%	166	235	450	640	6	9	450	640	6	9
D	D. Areas surrounding and including the Keeter Property (not including outside watershed area)	Both	690	110,000	140,000	1030	810	920	80%	48%	159	198	4,000	4,900	6	7	3,900	4,900	6	7
E	E. Area around Holland Mills Estates, Great Hay Acres, and Southcape Resorts	Waquoit	90	16,000	22,000	100	60	90	71%	69%	176	249	570	800	6	9	570	800	6	9
F	F. Pirates Cove	Popponessett	50	13,000	14,000	160	140	150	91%	43%	233	256	500	500	8	9	460	500	8	9
G	G. Mashpee Village	Waquoit	30	13,000	20,000	0	0	0	65%	95%	386	598	500	700	14	22	480	740	14	22
H	H. Areas south of Johns Pond including the High School	Waquoit	540	73,000	140,000	580	450	540	54%	91%	135	248	0	0	0	0	0	0	0	0
H -Only	H. Without HS or MC or I/A	Waquoit	350	71,000	120,000	570	450	530	59%	85%	200	337	2,600	4,300	7	12	2,400	3,200	7	9
I	I. Area around Willowbend	Popponessett	630	83,000	120,000	610	290	390	68%	45%	132	193	0	0	0	0	0	0	0	0
I -Only	I without Willowbend	Popponessett	400	39,000	56,000	380	110	160	69%	55%	98	141	1,400	2,000	4	5	1,100	1,600	3	4
J	J. Southport	Waquoit	320	2,000	150,000	10	0	10	1%	61%	7	488	0	0	0	0	0	0	0	0
J-only	J. Without Southport	Waquoit	80	0	50,000	10	0	10	0%	42%	2	665	10	1,800	0	24	10	1,800	0	24
K	K. Cotuit Meadows and portion of Barnstable to the east	Popponessett	100	13,000	32,000	20	10	20	40%	2%	128	324	500	1,200	5	12	440	940	4	9
L	L. North of Johns Pond, Briarwood area	Waquoit	130	31,000	49,000	270	230	260	63%	58%	247	391	1,100	1,800	9	14	460	720	4	6
M	M. North of Ashumet Pond	Waquoit	40	6,000	11,000	90	50	80	57%	62%	168	295	200	400	6	11	40	60	1	2
N	N. Steeplechase	Popponessett	20	4,000	4,000	30	30	30	100%	95%	215	208	200	100	8	8	110	100	5	5
O	O. Stratford Ponds	Popponessett	120	3,000	22,000	10	10	10	12%	43%	23	187	0	0	0	0	0	0	0	0
O Only	O without Stratford Ponds	Popponessett	50	0	0	10	0	0	100%	87%	10	10	20	20	0	0	10	10	0	0
P	P. Area around Mashpee Rotary north along Great Neck Road	Both	1,130	190,000	370,000	730	490	670	51%	42%	168	327	0	0	0	0	0	0	0	0
P-only	P Without Mashpee Commons/South Cape/Windchime Point/I/A	Both	840	130,000	220,000	700	480	650	58%	70%	151	259	4,600	7,900	5	9	4,400	7,600	5	9
Q	Q. Future Wampanoag Village site north towards Town Hall	Popponessett	160	4,200	14,000	60	20	30	29%	83%	27	92	0	0	0	0	0	0	0	0
Q-Only	Q Without Wampanoag Village	Popponessett	140	4,200	7,400	60	20	30	57%	88%	31	54	150	270	1	2	110	190	1	1
R	R. Northeast of Santuit Pond	Popponessett	90	28,000	29,000	160	150	160	97%	85%	324	335	1,000	1,100	12	12	270	280	3	3
S	S. West of Santuit Pond (south picking up neighborhoods west and south of Willowbend)	Popponessett	1,260	200,000	260,000	1900	1400	1700	76%	84%	159	210	7,200	9,600	6	8	5,300	7,400	4	6
T	T. Area along Rte. 130 between Town Hall and Sandwich	Both	550	34,000	110,000	240	180	220	32%	84%	63	198	1,300	4,000	2	7	860	2,270	2	4
Sand-1	-	Waquoit	80	27,000	30,000	160	150	150	90%	0%	321	357	1,000	1,100	12	13	80	90	1	1
Sand-2	-	Waquoit	120	34,000	41,000	200	160	190	82%	0%	270	330	1,200	1,500	10	12	120	180	1	1
Sand-3	-	Waquoit	110	27,000	35,000	180	140	180	77%	0%	245	319	1,000	1,300	9	12	790	930	7	8
Sand-4	-	both	240	47,000	61,000	340	280	330	77%	0%	200	259	1,700	2,200	7	9	570	730	2	3
Sand-5	-	Popponessett	300	48,000	55,000	330	250	280	86%	0%	157	181	1,700	2,000	6	7	320	380	1	1
Sand-6	-	Popponessett	110	29,000	31,000	140	140	140	93%	0%	260	281	1,000	1,100	9	10	180	200	2	2
Sand-7	-	Popponessett	290	26,000	36,000	270	200	240	73%	50%	91	124	900	1,300	3	5	320	440	1	2
Sand-8	-	Popponessett	440	38,000	45,000	270	230	260	85%	7%	86	100	1,400	1,600	3	4	450	530	1	1
Sand-9	-	Popponessett	200	32,000	33,000	240	230	240	95%	0%	156	164	1,200	1,200	6	6	300	320	1	2
Fal-1	-	Waquoit	40	650	2,500	20	0	10	26%	0%	18	68	20	90	1	2	20	90	1	2
Fal-2	-	Waquoit	20	1,500	7,100	50	10	50	21%	0%	62	291	100	300	2	11	60	260	2	11
Fal-3	-	Waquoit	30	2,400	3,600	30	20	20	65%	0%	93	142	90	130	3	5	90	130	3	5
Fal-4	-	Waquoit	30	600	3,800	30	0	30	15%	0%	22	151	20	140	1	5	20	140	1	5
Fal-5	-	Waquoit	10	0	2,500	20	0	20	0%	0%	0	239	0	90	0	9	0	90	0	9
Fal-6	-	Waquoit	30	0	4,300	30	0	30	0%	0%	0	162	0	160	0	6	0	160	0	6
Fal-7	-	Waquoit	30	140	3,100	20	0	20	5%	0%	5	116	10	110	0	4	10	110	0	4
Fal-8	-	Waquoit	10	420	2,900	20	0	20	15%	0%	36	250	20	100	1	9	20	100	1	9
Fal-9	-	Waquoit	90	3,000	11,000	50	10	50	27%	0%	34	128	110	410	1	5	110	410	1	5
Fal-10	-	Waquoit	30	7,600	10,000	30	10	20	77%	0%	250	327	270	360	9	12	270	360	9	12
Fal-11	-	Waquoit	20	12,000	13,000	20	20	20	90%	0%	536	599	420	470	19	22	420	470	19	22
Fal-12	-	Waquoit	30	810	2,000	20	10	10	42%	5%	31	74	30	70	1	3	30	70	1	3
Fal-13	-	Waquoit	60	6,000	8,700	50	40	50	69%	0%	107	156	220	320	4	6	220	320	4	6
Fal-14	-	Waquoit	20	2,400	4,400	20	10	20	55%	0%	131	238	90	160	5	9	90	160	5	9
Fal-15	-	Waquoit	130	10,000	13,000	70	50	60	75%	0%	76	102	350	470	3	4	350	470	3	4
Fal-16	-	Waquoit	50	7,000	10,000	40	30	40	73%	0%	149	204	250	350	5	7	250	350	5	7
Fal-17	-	Waquoit	120	7,000	13,000	50	30	50	53%	0%	58	110	240	470	2	4	240	470	2	4
Barn 37	-	Popponessett	40	10,000	14,000	70	60	70	71%	0%	221	310	360	500	8	11	250	350	6	8
Barn 38	-	Popponessett	280	46,000	59,000	320	280	310	77%	0%	160	209	1,700	2,200	6	8	1,300	1,700	5	6
Barn 39	-	Popponessett	130	21,000	26,000	130	120	130	79%	0%	160	201	800	900	6	7	750	950	6	7
Barn 42	-	Popponessett	290	37,000	49,000	260	200	250	75%	26%	127	170	1,300	1,800	5	6	680	940	2	3
Briarwood/Otis Trailer Village	Potential Cluster site {Part of Subarea L}	Waquoit	240	34,000	52,000	320	300	320	64%	55%	139	218	1,200	1,900	5	8	490	770	2	3
Pickerel Cove	Potential Cluster site {Part of Subarea T}	Popponessett	70	6,200	8,000	60	50	60	77%	89%	84	109	220	290	3	4	80	110	1	1
Pirates Cove	Potential Cluster site {Subarea F}	Popponessett	70	13,000	14,000	150	150	150	91%	43%	191	210	450	500	7	8	450	500	7	8
Tri-Town Circle	Potential Cluster site {Subarea M}	Waquoit	50	6,000	11,000	90	70	90	57%	62%	128	225	230	400	5	8	40	60	1	1
Santuit Pond	Potential Cluster site {Subarea R}	Popponessett	110	29,000	30,000	180	180	180	96%	77%	253	264	1,000	1,100	9	10	270	280	2	2
D1	Subset of D (Poppy Side) including D-Future	Popponessett	490	79,000	93,000	810	640	710	85%	35%	161	189	2,900	3,400	6	7	2,810	3,300	6	7
D2	Subset of D (Waquoit Side)	Waquoit	190	35,000	43,000	310	240	300	82%	62%	184	225	1,300	1,600	7	8	1,280	1,560	7	8
S1	Subset of S (south of Falmouth Rd)	Popponessett	400	67,000	89,000	630	430	540	75%	75%	169	224	2,400	3,200	6	8	2,430	3,230	6	8
S2	Subset of S (north of Falmouth Rd)	Popponessett	860	130,000	180,000	1,200	1,000	1,100	76%	88%	155	204	4,800	6,400	6	7	2,940	4,180	3	5
P1	Subset of P (north of Nathan Ellis)	Popponessett	420	72,000	110,000	330	220	320	63%	74%	172	274	2,600	4,200	6	10	2,230	3,520	5	8
P2	Subset of P (south of Nathan Ellis)	Both	710	120,000	260,000	400	280	360	46%	66%	166	358	4,300	9,300	6	13	3,140	6,350	4	9

	DRINKING WATER SUPPLY				WATERSHED					PROXIMITY TO INFRASTRUCTURE								OTHER			
Subarea ID	% Area within Zone II	Percent of Planning Area in USGS Well Recharge Area (weight)	Estimated Number of Private Wells	Est. Percent on Private Wells	Watershed Attenuation % (future)	In Subwatershed to Shellfish Propogation	Embayment Habitat Quality	Number of upgradient properties within 300ft Fresh Water (P)	Percent of upgradient properties within 300ft Fresh Water (P)	Proximity to JBCC (miles)	Proximity to "Closest" Existing WWTF (miles)	Proximity to "Closest" Potential New WWTF (miles)	Proximity to Potential Recharge - New Seabury	Proximity to Potential New Recharge - Back Road	Proximity to Potential New Recharge - Site 4	Proximity to Potential New Recharge - Site 6 WWTF	Proximity to Potential New Recharge Willowbend	Needs Assessment Priority Areas	Bonus Criteria For Matrix	Summerwood/Lakeside Estates Trailer Park/Sea Oaks/ South Cape Resort	Percent in Mashpee River Watershed
{alpha#}	{%}	{%}	{#}	{%}	{%}	{yes/no}	{Level of Impairment}	{#}	{%}	{#}	{#}	{#}	{#}	{#}	{#}	{#}	{#}	{Pri. /Sec. /Ter.}	{Yes/No}	{Yes/No}	{%}
A	0%	0%	0	0%	0%	yes	MI	0	0%	5.2	1.3	1.6	1.7	5.3	4.8	1.8	4.8	Secondary	No	No	0%
B	11%	0%	0	0%	0%	yes	MI	0	0%	5.4	0.1	0.8	0.9	5.4	4.7	1.6	4.5	Secondary	No	No	0%
C	0%	0%	0	0%	0%	yes	H/MI	0	0%	5.1	1.1	1.0	1.3	5.0	4.5	1.6	4.5	Secondary	No	No	0%
D	74%	7%	65	6%	0%	yes	SI	0	0%	4.1	1.2	0.0	1.7	4.4	3.1	0.1	2.8	Secondary	Yes	No	3%
E	100%	0%	0	0%	0%	yes	MI	0	0%	3.7	1.3	0.7	2.4	3.3	2.6	1.1	2.7	Tertiary	Yes	Yes	0%
F	0%	0%	0	0%	0%	yes	SI	0	0%	4.5	1.2	1.1	2.7	3.8	2.1	1.3	1.7	Primary	Yes	No	43%
G	24%	0%	0	0%	0%	no	SD	0	0%	2.3	0.1	1.3	4.3	1.7	1.6	2.8	2.3	Primary	No	No	0%
H	98%	14%	10	2%	5%	no	SD	37	6%	1.3	0.1	0.6	4.3	1.7	2.4	2.8	3.1	Primary	Yes	Yes	0%
H -Only	98%	14%	10	2%	5%	no	SD	37	6%	1.3	0.1	0.6	4.3	1.7	2.4	2.8	3.1	Primary	Yes	yes	0%
I	5%	0%	10	2%	23%	yes	MI/SI	0	0%	4.0	0.0	0.3	4.5	3.4	1.0	3.1	0.1	Primary	No	No	0%
I -Only	5%	0%	10	3%	23%	yes	MI/SI	0	0%	4.0	0.0	0.3	4.5	3.4	1.0	3.1	0.1	Primary	No	No	0%
J	0%	0%	0	0%	0%	no	SD	0	0%	1.7	0.0	0.5	4.5	1.3	1.8	3.1	2.7	Primary	No	No	0%
J-only	0%	0%	0	0%	0%	no	SD	0	0%	1.7	0.2	0.6	4.8	1.0	1.7	3.6	2.6	Primary	No	No	0%
K	84%	5%	0	0%	19%	yes	MI/SI	0	0%	3.9	0.5	0.2	5.1	3.0	0.7	3.6	0.9	Tertiary	No	No	0%
L	0%	0%	0	0%	59%	no	SD	49	18%	0.6	0.9	0.0	5.6	0.4	2.6	4.1	3.6	Primary	No	No	0%
M	57%	0%	0	0%	84%	no	SD	49	54%	0.3	1.6	0.5	6.1	0.8	3.3	4.7	4.1	Primary	No	No	0%
N	60%	0%	0	0%	31%	yes	SI/SD	0	0%	2.2	1.1	1.1	5.5	1.3	1.3	3.8	2.3	Secondary	Yes	No	100%
O	90%	0%	0	0%	29%	yes	MI/SI	0	0%	3.7	0.8	0.7	5.7	2.9	1.0	4.1	1.3	Tertiary	No	No	0%
O Only	90%	0%	0	0%	29%	yes	MI/SI	0	0%	3.7	0.9	0.7	5.7	2.9	1.0	4.1	1.3	Tertiary	No	No	0%
P	21%	0%	56	8%	4%	yes	SI	0	0%	2.5	0.0	0.7	3.8	2.3	1.3	2.3	1.7	Primary	Yes	No	82%
P-only	21%	0%	56	8%	4%	yes	SI	0	0%	2.5	0.2	0.5	3.8	2.3	1.3	2.3	1.7	Primary	Yes	No	82%
Q	0%	0%	10	18%	30%	yes	SI/SD	0	0%	3.0	0.0	0.4	5.7	2.1	1.0	4.1	1.8	Secondary	Yes	No	100%
Q-Only	0%	0%	10	18%	30%	yes	SI/SD	0	0%	3.0	1.1	0.4	5.7	2.1	1.0	4.1	1.8	Secondary	Yes	No	100%
R	83%	0%	0	0%	74%	yes	MI/SI	27	17%	4.3	2.0	1.9	6.8	3.6	2.2	5.3	2.6	Secondary	No	No	0%
S	54%	12%	109	6%	23%	yes	SI	99	5%	3.2	0.4	0.0	5.3	2.6	0.6	3.7	1.1	Primary	Yes	Yes	26%
T	53%	0%	60	25%	23%	yes	SI/SD	24	10%	2.0	1.7	1.0	6.7	1.4	2.3	5.1	3.1	Secondary	Yes	No	71%
Sand-1	99%	38%	6	4%	92%	no	SD	9	6%	2.4	3.9	2.5	8.7	2.8	4.5	7.1	5.4	Tertiary	No	No	0%
Sand-2	99%	26%	5	3%	88%	no	SD	9	5%	2.3	3.5	2.2	8.4	2.6	4.3	6.8	5.1	Tertiary	No	No	0%
Sand-3	34%	0%	8	4%	27%	no	SD	0	0%	2.3	3.1	1.9	8.1	2.3	3.8	6.5	4.5	Secondary	No	No	0%
Sand-4	39%	0%	20	6%	67%	yes	SI	31	9%	2.8	3.4	2.3	8.2	2.7	3.7	6.7	4.5	Tertiary	No	No	0%
Sand-5	26%	0%	6	2%	81%	yes	MI/SI	1	0%	3.5	4.2	3.2	9.2	3.7	4.5	7.5	5.4	Tertiary	No	No	0%
Sand-6	100%	0%	119	86%	83%	yes	MI	0	0%	4.4	5.0	4.0	9.7	4.3	5.0	8.0	5.7	Tertiary	No	No	0%
Sand-7	0%	0%	171	65%	66%	yes	SI	0	0%	0.0	3.5	2.8	8.4	3.3	3.7	6.7	4.4	Tertiary	No	No	0%
Sand-8	100%	0%	228	83%	67%	yes	SI	6	2%	4.1	3.5	3.1	8.8	4.0	4.0	7.1	4.5	Tertiary	No	No	0%
Sand-9	91%	0%	125	52%	74%	yes	MI/SI	0	0%	4.1	2.6	2.4	7.7	3.7	2.8	6.0	3.3	Tertiary	No	No	0%
Fal-1	92%	0%	12	75%	1%	yes	MI	0	0%	3.8	1.5	0.9	2.4	3.4	3.0	1.1	3.1	Secondary	No	No	0%
Fal-2	48%	0%	0	0%	0%	yes	SI	0	0%	3.9	1.7	0.8	2.3	3.6	3.1	1.1	3.3	Secondary	No	No	0%
Fal-3	0%	0%	0	0%	0%	no	SD	0	0%	3.9	1.7	1.1	2.3	3.7	3.3	1.3	3.6	Secondary	No	No	0%
Fal-4	14%	0%	0	0%	0%	no	SD	0	0%	4.0	1.9	0.8	2.2	3.7	3.3	1.1	3.3	Secondary	No	No	0%
Fal-5	0%	0%	0	0%	0%	yes	H	0	0%	4.2	2.0	0.9	2.1	3.8	3.4	1.0	3.4	Secondary	No	No	0%
Fal-6	0%	0%	0	0%	0%	yes	H	0	0%	4.2	1.9	0.9	2.1	4.0	3.4	1.0	3.6	Secondary	No	No	0%
Fal-7	0%	0%	0	0%	0%	no	SD	0	0%	4.2	1.9	1.0	2.1	3.8	3.6	1.3	3.7	Tertiary	No	No	0%
Fal-8	0%	0%	0	0%	0%	no	SD	0	0%	4.3	2.0	1.1	2.1	4.0	3.7	1.3	3.8	Secondary	No	No	0%
Fal-9	0%	0%	3	6%	0%	yes	SI/SD	0	0%	4.4	1.6	0.9	2.0	4.1	3.8	1.3	4.0	Secondary	No	No	0%
Fal-10	0%	0%	0	0%	0%	yes	MI/SI	0	0%	4.7	1.6	1.2	1.8	4.4	4.1	1.4	4.1	Secondary	No	No	0%
Fal-11	0%	0%	0	0%	0%	yes	MI/SI	0	0%	4.8	1.6	1.5	1.8	4.5	4.4	1.6	4.4	Secondary	No	No	0%
Fal-12	0%	0%	0	0%	0%	yes	MI/SI	0	0%	4.8	1.5	1.6	1.8	4.8	4.5	1.8	4.5	Secondary	No	No	0%
Fal-13	0%	0%	23	47%	0%	no	SD	0	0%	4.2	1.9	1.4	2.2	4.1	4.1	1.7	4.3	Tertiary	No	No	0%
Fal-14	0%	0%	0	0%	0%	no	SD	0	0%	4.0	2.1	1.6	2.5	3.8	3.8	1.7	4.0	Tertiary	No	No	0%
Fal-15	3%	0%	0	0%	0%	no	SD	0	0%	3.6	1.4	1.2	2.6	3.6	3.3	1.4	3.6	Tertiary	No	No	0%
Fal-16	0%	0%	0	0%	0%	no	SD	0	0%	3.5	1.4	1.4	2.7	3.3	3.1	1.6	3.4	Tertiary	No	No	0%
Fal-17	0%	0%	1	2%	0%	no	SD	0	0%	3.3	1.4	1.6	2.8	3.3	3.4	1.8	3.7	Tertiary	No	No	0%
Barn 37	0%	0%	0	0%	30%	yes	MI/SI	0	0%	4.8	0.2	1.2	4.8	4.0	1.4	3.4	0.9	Tertiary	No	No	0%
Barn 38	42%	0%	0	0%	21%	yes	MI/SI	0	0%	4.8	0.4	1.3	4.7	4.0	1.5	3.4	0.7	Tertiary	No	No	0%
Barn 39	0%	0%	0	0%	0%	yes	SI	0	0%	4.9	1.1	1.5	3.4	4.1	1.8	2.1	1.3	Tertiary	No	No	0%
Barn 42	65%	0%	0	0%	30%	yes	MI/SI	0	0%	4.1	0.2	1.1	5.7	3.6	1.4	4.3	1.3	Tertiary	No	No	0%
Briarwood/Otis Trailer Village	6%	0%	0	0%	59%	no	SD	72	22%	0.6	0.8	0.0	5.7	0.3	2.6	4.1	3.6	Primary	No	No	0%
Pickerel Cove	0%	0%	12	21%	63%	yes	SI	24	43%	2.6	2.8	1.6	7.5	2.4	3.0	6.0	3.8	Tertiary	Yes	No	7%
Pirates Cove	0%	0%	0	0%	0%	yes	SI	0	0%	4.5	1.2	1.1	2.8	3.8	2.1	1.3	1.7	Primary	Yes	No	44%
Tri-Town Circle	50%	0%	0	0%	84%	no	SD	49	53%	0.3	1.6	0.5	6.1	0.8	3.3	4.7	4.1	Primary	No	No	0%
Santuit Pond	69%	0%	0	0%	74%	yes	MI/SI	27	15%	4.3	2.0	1.9	7.0	3.6	2.2	5.3	2.6	Secondary	No	No	0%
D1	71%	18%	65	8%	0%	yes	MI/SI	0	0%	5.7	1.8	0.9	1.7	4.4	3.1	0.1	2.8	Secondary	No	No	0%
D2	34%	0%	0	0%	0%	yes	MI	0	0%	4.7	1.8	0.9	1.7	4.4	3.1	0.1	2.8	Secondary	No	No	0%
S1	16%	0%	10	2%	0%	yes	SI	0	0%	4.5	0.7	0.9	4.0	3.3	1.0	2.6	0.9	Primary	Yes	yes	17%
S2	65%	10%	99	8%	34%	yes	SI	99	8%	4.3	2.0	1.4	6.5	2.8	1.4	4.7	1.8	Primary	Yes	Yes	22%
P1	3%	0%	10	3%	8%	yes	SI/SD	0	0%	3.3	0.0	0.9	4.7	1.8	0.9	3.3	1.7	Primary	Yes	No	92%
P2	19%	0%	45	11%	0%	yes	SI/SD	0	0%	3.8	0.0	1.7	3.3	2.8	1.6	1.8	1.8	Primary	Yes	No	39%

TABLE 4-22: MATRIX RANKING (ROUNDED)

GENERAL INFORMATION									WASTEWATER GENERATION						DRINKING WATER SUPPLY			WATERSHED				PROXIMITY TO INFRASTRUCTURE								OTHER		
Subarea ID	Subarea Description	Primary MEP Watershed	Subarea Size (acres)	Existing gpd	Future gpd	Total number of parcels	Number "existing" developed	Number of developed / developable parcels	Percent of flow existing vs. at future (weight)	Est. Census Occupancy by planning area (% year round) (weight)	Existing Gal/Ac (Weight)	Future Gal/Ac (weight)	Est. Existing Attenuated load (kg/y per acre) (weight)	Est. Future attenuated load (kg/y per acre) (weight)	Percent of Subarea in Zone II (weight)	Percent of Subarea in USGS Well Recharge Area (weight)	Estimated Percent on Private Wells (weight)	Watershed Attenuation (weight)	In Subwatershed to Shellfish Propogation (weight)	Embayment Habitat Quality (weight)	Number of upgradient properties within 300ft Fresh Water (P) (weight)	Proximity to JBCC (weight)	Proximity to "Closest" Existing WWTF (weight)	Proximity to "Closest" Potential New WWTF (weight)	Proximity to Potential Recharge - New Seabury (weight)	Proximity to Potential New Recharge - Back Road (weight)	Proximity to Potential New Recharge - Site 4 (weight)	Proximity to Potential New Recharge - Site 6 WWTF (weight)	Proximity to Potential New Recharge Willowbend (weight)	BONUS (Within Mashpee River Watershed up to +5, Summerwood Condos, etc +5)	VALUE TOTAL	RANK
								Points per Category	5	5	5	5	5	5	5	10	5	10	5	10	5	3	4	3	3	2	2	1	2	up to 10+	100	
GENERAL INFORMATION									WASTEWATER GENERATION						WATER SUPPLY			WATERSHED				INFRASTRUCTURE								OTHER		
{alpha#}	{Desc.}	{Poppy / Waquiot / Both}	{#}	{#}	{#}	{#}	{#}	{#}	WEIGHT						WEIGHT			WEIGHT				WEIGHT								WEIGHT	RANK	
H -Only	H. Without HS or MC or I/A	Waquoit	350	71,000	120,000	570	450	530	3	5	2	3	2	2	5	1	1	10	5	10	1	2	4	3	0	1	1	0	0	5	66	1
G	G. Mashpee Village	Waquoit	30	13,000	20,000	0	0	0	4	5	3	4	3	5	2	0	0	10	5	10	0	2	4	2	0	1	1	0	1	0	62	2
H	H. Areas south of Johns Pond including the High School	Waquoit	540	73,000	140,000	580	450	540	3	5	1	2	0	0	5	1	1	10	5	10	1	2	4	3	0	1	1	0	0	5	60	3
S	S. West of Santuit Pond (south picking up neighborhoods west and south of Willowbend)	Popponessett	1,260	200,000	260,000	1,900	1,400	1,700	4	5	2	2	1	2	3	1	1	8	0	7	1	1	4	3	0	0	2	0	1	6	54	4
P-only	P Without Mashpee Commons/South Cape/Windchime Point/I/A	Both	840	130,000	220,000	700	480	650	3	4	2	2	2	2	2	0	1	10	0	8	0	2	4	3	1	1	1	1	1	4	54	4
P1	Subset of P (north of Nathan Ellis)	Popponessett	420	72,100	110,000	330	220	320	4	4	2	2	2	2	1	0	1	9	0	9	0	1	4	3	0	1	2	0	1	5	53	6
J-only	J. Without Southport	Waquoit	80	140	50,000	10	0	10	1	3	1	5	1	5	0	0	0	10	5	10	0	2	4	3	0	2	1	0	0	0	53	6
S1	Subset of S (south of Falmouth Rd)	Popponessett	400	67,000	89,000	630	430	540	4	4	2	2	2	2	1	0	1	10	0	7	0	0	3	3	1	0	2	0	2	6	52	8
N	N. Steeplechase	Popponessett	20	4,200	4,100	30	30	30	5	5	2	2	2	2	4	0	0	7	0	9	0	2	2	2	0	1	1	0	1	5	52	8
P	P. Area around Mashpee Rotary north along Great Neck Road	Both	1,130	190,000	370,000	730	490	670	3	3	2	3	0	0	2	0	1	10	0	8	0	2	4	3	1	1	1	1	1	4	50	10
E	E. Area around Holland Mills Estates, Great Hay Acres, and Southcape Resorts	Waquoit	90	16,000	22,000	100	60	90	4	4	2	2	2	2	5	0	0	10	0	4	0	1	2	3	2	0	0	1	0	5	49	11
P2	Subset of P (south of Nathan Ellis)	Both	710	120,000	260,000	400	280	360	3	4	2	3	1	2	1	0	1	10	0	8	0	1	4	2	1	0	1	1	1	2	48	12
S2	Subset of S (north of Falmouth Rd)	Popponessett	860	130,000	180,000	1,230	1,010	1,130	4	5	2	2	1	1	4	1	1	7	0	7	1	0	2	2	0	0	1	0	1	6	48	12
D	D. Areas surrounding and including the Keeter Property (not including outside watershed area)	Both	690	110,000	140,000	1,030	810	920	5	3	2	2	2	2	4	1	1	10	0	7	0	0	2	3	2	0	0	1	0	0	47	14
T	T. Area along Rte. 130 between Town Hall and Sandwich	Both	550	34,500	110,000	240	180	220	2	5	1	2	1	1	3	0	2	8	0	9	1	2	2	2	0	1	1	0	0	4	47	14
M	M. North of Ashumet Pond	Waquoit	40	6,300	11,100	90	50	80	3	4	2	2	1	1	3	0	0	2	5	10	3	3	2	3	0	2	0	0	0	0	46	16
L	L. North of Johns Pond, Briarwood area	Waquoit	130	31,000	49,000	270	230	260	4	3	2	3	1	2	0	0	0	4	5	10	1	3	3	3	0	2	0	0	0	0	46	16
J	J. Southport	Waquoit	320	2,200	150,000	10	0	10	1	4	1	4	0	0	0	0	0	10	5	10	0	2	4	3	0	1	1	0	0	0	46	16
D1	Subset of D (Poppy Side) including D-Future	Popponessett	490	79,000	93,000	810	640	710	5	2	2	2	2	2	4	2	1	10	0	6	0	0	2	3	2	0	0	1	0	0	46	16
Q-Only	Q Without Wampanoag Village	Popponessett	140	4,200	7,400	60	20	30	3	5	1	1	1	1	1	0	1	7	0	9	0	1	2	3	0	1	2	0	1	5	45	20
Fal-13	-	Waquoit	60	6,000	8,700	50	40	50	4	0	1	2	1	2	0	0	3	10	5	10	0	0	2	2	2	0	0	1	0	0	45	20
Tri-Town Circle	Potential Cluster site {Subarea M}	Waquoit	50	6,300	11,100	90	70	90	3	4	1	2	1	1	3	0	0	2	5	10	3	3	2	3	0	2	0	0	0	0	45	20
Briarwood/Otis Trailer Village	Potential Cluster site {Part of Subarea L}	Waquoit	240	34,000	52,000	320	300	320	4	3	1	2	1	1	1	0	0	4	5	10	2	3	3	3	0	2	0	0	0	0	45	20
Fal-11	-	Waquoit	20	12,000	13,000	20	20	20	5	0	4	4	4	5	0	0	0	10	0	5	0	0	2	2	2	0	0	1	0	0	44	24
Q	Q. Future Wampanoag Village site north towards Town Hall	Popponessett	160	4,200	14,400	60	20	30	2	5	1	1	0	0	1	0	1	7	0	9	0	1	4	3	0	1	2	0	1	5	44	24
Sand-1	-	Waquoit	80	27,000	30,000	160	150	150	5	0	3	3	1	1	5	4	1	1	5	10	1	2	1	1	0	0	0	0	0	0	44	24
Sand-3	-	Waquoit	110	27,000	35,000	180	140	180	4	0	2	3	2	2	2	0	1	7	5	10	0	2	1	2	0	1	0	0	0	0	44	24
F	F. Pirates Cove	Popponessett	50	13,000	14,000	160	140	150	5	3	2	2	2	2	0	0	0	10	0	7	0	0	2	2	1	0	1	1	1	2	43	28
Pirates Cove	Potential Cluster site {Subarea F}	Popponessett	70	13,000	14,000	150	150	150	5	3	2	2	2	2	0	0	0	10	0	7	0	0	2	2	1	0	1	1	1	2	43	28
Sand-2	-	Waquoit	120	34,000	41,000	200	160	190	5	0	2	3	1	1	5	3	1	1	5	10	1	2	1	2	0	0	0	0	0	0	43	28
Fal-16	-	Waquoit	50	6,900	9,500	40	30	40	4	0	1	2	2	2	0	0	0	10	5	10	0	1	2	2	1	0	0	1	0	0	43	28
O Only	O without Stratford Ponds	Popponessett	50	470	470	10	0	0	5	5	1	1	1	1	5	0	0	7	0	6	0	1	3	3	0	0	2	0	1	0	42	32
B	B. Areas to the east and west of the existing New Seabury facility	Waquoit	220	53,000	75,000	530	440	490	4	2	2	3	2	3	1	0	0	10	0	4	0	0	4	3	3	0	0	1	0	0	42	32
Fal-3	-	Waquoit	30	2,400	3,600	30	20	20	4	0	1	1	1	2	0	0	0	10	5	10	0	1	2	2	2	0	0	1	0	0	42	34
Fal-14	-	Waquoit	20	2,400	4,400	20	10	20	3	0	1	2	1	2	0	0	0	10	5	10	0	1	2	2	2	0	0	1	0	0	42	34
Fal-15	-	Waquoit	130	9,700	12,900	70	50	60	4	0	1	1	1	1	1	0	0	10	5	10	0	1	2	2	1	0	0	1	0	0	41	36
Fal-4	-	Waquoit	30	560	3,800	30	0	30	1	0	1	2	1	2	1	0	0	10	5	10	0	0	2	3	2	0	0	1	0	0	41	36
D2	Subset of D (Waquoit Side)	Waquoit	190	35,000	43,000	310	240	300	5	4	2	2	2	2	2	0	0	10	0	4	0	0	2	3	2	0	0	1	0	0	41	36
K	K. Cotuit Meadows and portion of Barnstable to the east	Popponessett	100	13,000	32,000	20	10	20	2	1	1	3	1	2	5	0	0	8	0	6	0	1	3	3	0	0	2	0	2	0	40	39
Fal-17	-	Waquoit	120	6,700	12,800	50	30	50	3	0	1	1	1	1	0	0	1	10	5	10	0	1	2	2	1	0	0	1	0	0	40	39
Fal-2	-	Waquoit	20	1,500	7,100	50	10	50	2	0	1	2	1	3	3	0	0	10	0	8	0	1	2	3	2	0	0	1	0	0	39	41
I -Only	I without Willowbend	Popponessett	400	39,000	56,000	380	110	160	4	3	1	1	1	1	1	0	1	8	0	6	0	1	4	3	0	0	2	0	2	0	39	41
Fal-8	-	Waquoit	10	420	2,900	20	0	20	1	0	1	2	1	2	0	0	0	10	5	10	0	0	2	2	2	0	0	1	0	0	39	41
R	R. Northeast of Santuit Pond	Popponessett	90	28,000	29,000	160	150	160	5	5	3	3	1	1	5	0	0	3	0	6	1	0	2	2	0	0	1	0	0	0	38	44
A	A. Seconsett Island	Waquoit	40	10,000	13,000	90	80	80	5	3	2	3	2	3	0	0	0	10	0	3	0	0	2	2	2	0	0	1	0	0	38	44
Barn 39	-	Popponessett	130	21,000	26,000	130	120	130	4	0	2	2	2	2	0	0	0	10	0	8	0	0	2	2	1	0	1	1	1	0	38	44
Fal-1	-	Waquoit	40	650	2,500	20	0	10	2	0	1	1	1	1	5	0	4	10	0	4	0	1	2	3	2	0	0	1	0	0	38	44
I	I. Area around Willowbend	Popponessett	630	83,000	120,000	610	290	390	4	3	1	2	0	0	1	0	1	8	0	6	0	1	4	3	0	0	2	0	2	0	38	44
Fal-7	-	Waquoit	30	140	3,100	20	0	20	1	0	1	1	1	1	0	0	0	10	5	10	0	0	2	3	2	0	0	1	0	0	38	44
Barn 38	-	Popponessett	280	46,000	59,000	320	280	310	4	0	2	2	1	2	3	0	0	8	0	6	0	0	4	2	0	0	1	0	2	0	37	50
Fal-10	-	Waquoit	30	7,600	9,900	30	10	20	4	0	2	3	2	3	0	0	0	10	0	5	0	0	2	2	2	0	0	1	0	0	36	51
Barn 42	-	Popponessett	290	37,000	49,000	260	200	250	4	2	1	2	1	1	4	0	0	7	0	6	0	0	4	2	0	0	1	0	1	0	36	51
C	C. Monomoscoy Island	Waquoit	70	12,000	18,000	220	130	160	4	3	2	2	2	2	0	0	0	10	0	2	0	0	2	3	2	0	0	1	0	0	35	53
Barn 37	-	Popponessett	40	9,800	14,000	70	60	70	4	0	2	3	2	2	0	0	0	7	0	6	0	0	4	2	0	0	1	0	2	0	35	53
O	O. Stratford Ponds	Popponessett	120	2,700	22,000	10	10	10	1	3	1	2	0	0	5	0	0	7	0	6	0	1	3	3	0	0	2	0	1	0	35	53
Santuit Pond	Potential Cluster site {Subarea R}	Popponessett	110	29,000	30,000	180	180	180	5	4	2	2	1	1	4	0	0	3	0	6	1	0	2	2	0	0	1	0	0	0	34	56
Pickerel Cove	Potential Cluster site {Part of Subarea T}	Popponessett	70	6,200	8,000	60	50	60	4	5	1	1	1	1	0	0	2	4	0	7	3	1	1	2	0	1	0	0	0	0	34	56
Fal-9	-	Waquoit	90	3,000	11,300	50	10	50	2	0	1	1	1	1	0	0	1	10	0	9	0	0	2	3	2	0	0	1	0	0	34	56
Sand-8	-	Popponessett	440	38,000	45,000	270	230	260	5	1	1	1	1	1	5	0	5	3	0	7	1	0	1	1	0	0	0	0	0	0	33	59
Sand-9	-	Popponessett	200	32,000	33,000	240	230	240	5	0	2	2	1	1	5	0	3	3	0	6	0	0	1	2	0	0	0	0	0	0	31	60
Fal-12	-	Waquoit	30	810	2,000	20	10	10	3	1	1	1	1	1	0	0	0	10	0	6	0	0	2	2	2	0	0	1	0	0	31	60
Sand-7	-	Popponessett	290	26,000	36,000	270	200	240	4	3	1	1	1	1	0	0	4	3	0	7	0	3	1	1	0	0	0	0	0	0	30	62
Sand-6	-	Popponessett	110	29,000	31,000	140	140	140	5	0	2	2	1	1	5	0	5	2	0	4	0	0	0	1	0	0	0	0	0	0	28	63
Sand-4	-	both	240	47,000	61,000	340	280	330	4	0	2	2	1	1	2	0	1	3	0	7	1	1	1	2	0	0	0	0	0	0	28	63
Sand-5	-	Popponessett	300	48,000	55,000	330	250	280	5	0	2	2	1	1	2	0	1	2	0	6	1	1	0	1	0	0	0	0	0	0	25	64
Fal-5	-	Waquoit	10	0	2,500	20	0	20	0	0	0	2	0	2	0	0	0	10	0	0	0	0	2	3	2	0	0	1	0	0	22	66
Fal-6	-	Waquoit	30	0	4,300	30	0	30	0	0	0	2	0	2	0	0	0	10	0	0	0	0	2	3	2	0	0	1	0	0	22	66

- Whether the Subarea was within a subwatershed to shellfish propagation;
- Embayment Habitat Quality (based on MEP habitat impairment levels); and
- Estimated number of upgradient properties within 300 feet of a fresh water body.

Infrastructure proximity information included proximity to:

- Joint Base Cape Cod;
- "Closest" existing WWTF (straight-line distance);
- "Closest" potential new WWTF (straight-line distance); and
- Potential new recharge facility (straight-line distance):
  - New Seabury
  - Back Road
  - Site 4
  - Site 6
  - Willowbend

Other considerations:

- Additional points were provided to Subareas that included properties of special interest:
  - Summerwood Condominiums
  - Lakeside Estates
  - South Cape Resort
  - Sea Oaks Condominiums
- Additional points were also provided to Subareas within the Mashpee River Watershed south of Mashpee-Wakeby Pond.

Table 4-20 identifies the point per category assigned to each "Subarea" and "Cluster" area evaluated as part of the matrix.

Table 4-21 then presents the demographics of each "Subarea" and "Cluster" area related to the characteristics summarized above.

Table 4-22 then presents the matrix results when the point system identified in Table 4-20 is applied to the data presented in Table 4-21. This data is then sorted from highest point total to lowest. In addition, several sensitivity analyses were performed to evaluate the change in matrix results if any one of the following criteria wasn't considered (not shown in table):

- Infrastructure
- Shellfish propagation
- Seasonality

However, the results typically did not change the highest or lowest ranked Subareas and typically only impacted those in the middle. Two of these results are depicted in Figures 4-6 and 4-7 with the first showing the matrix results and potential prioritization of areas when considering all factors, and the second when not considering the impact of shellfish propagation.

Figure 4-6 and Figure 4-7 display the matrix results and the sensitivity analysis when removing shellfish from consideration. The Sewer Commission expressed interest in seeing the impact on the Subarea rankings if shellfish watersheds were not considered. Since shellfish—as a nitrogen removal approach relative to TMDL compliance—does not have a long-term performance record, its influence on the matrix results was of interest. The changes in these figures show the shifting of possible priorities as a result of not using shellfish and do not represent a shift or reduction in nitrogen loads.

Both results show no change in the areas south of Johns Pond (Subareas G and H) which remain the highest priority, primarily due to their location within the Quashnet River Watershed. The western side of the Popponesset Bay Watershed also remained a highly ranked area, primarily due to its proximity to the Mashpee River Watershed, amongst other factors including proximity to existing “private” infrastructure or proposed municipal facilities. Most of Sandwich and the areas (in Falmouth and Mashpee) around the proposed shellfish propagation (areas around Hamblin and Jehu Ponds) also remained lower ranked. However, the area north of Joint Base Cape Cod in Sandwich maintained a higher rank than the rest of Sandwich because of its location within the sensitive Quashnet River watershed.

4.8 Conclusion

As was discussed in the DRP/DEIR, after the evaluations were completed the following recommendations/changes were made in modifying Option 1A in the Draft Recommended Plan.

- Use of shellfish aquaculture as a direct environmental mitigation approach, with the fallback being traditional sewering as outlined in Option 1A.
- Use of JBCC as a treatment and recharge facility and regional solution to address portions of the Waquoit Bay watershed, with Back Roads site as a fallback location.
- PRB and bog restoration should be considered in the Adaptive Management “toolbox” but are not formally proposed in the plan.
- More centralized facilities were recommended over smaller cluster facilities in addressing TMDLs.
- Existing WWTFs:
    - Continued use of Mashpee Commons with shellfish versus relocating that recharge to Site 4
    - High School treated and recharged at JBCC
    - Southport would remain treated and recharged onsite
    - Willowbend expanded recharge areas
    - All other facilities would be monitored and require improvements only if necessary based on Adaptive Management and monitoring results.

Chapter 5 presents the summary of the Draft Recommended Plan as presented in the June 2014 report.

5 Summary of Draft Recommended Plan

5.1 Introduction

This Chapter provides the summary of the Draft Recommended Plan as presented in the last report and also a summary of the impacts if “No Action” is taken within the Project Planning Area (PPA).

As part of the development of the Recommended Plan, a summary of a “No Action” Alternative is used to present the impacts if a community proceeds without addressing the needs identified during the planning process, and provides a simple point of comparison to the Recommended Plan.

This Chapter simply presents the Draft Recommended Plan whereas Chapter 6 builds from this plan and the comments received through the project review process to establish the Final Recommended Plan for this project.

5.2 No Action Alternative

As part of the development of the Recommended Plan (RP) as part of the EIR process, a “No Action” Alternative is considered; this alternative establishes an initial baseline of the project and summarizes the potential impacts if the Town were to proceed without implementing any recommended improvements to address its nitrogen reduction needs through an approved CWMP/RP/EIR. This “Alternative” presents a possible scenario if the Town were to continue to address its wastewater needs through its existing (and currently proposed/approved) private cluster treatment systems, its High School facility, individual I/A systems, and traditional septic systems/cesspools. It also assumes under this “Alternative” that the portions of the adjacent towns within the PPA would continue with individual onsite units and the package wastewater treatment facilities located within Barnstable (Cotuit Meadows) and the Forestdale School in Sandwich. The Town of Mashpee would also continue with its existing pursuit of modest expansion of shellfish aquaculture through its local Shellfish Constable, implementation of Best Management Practices with stormwater infrastructure projects, and Mashpee’s new fertilizer bylaw. Adjacent communities would also proceed with their stormwater BMPs and fertilizer management approaches (if developed, like Falmouth).

The Town would also continue with expansion/growth in those areas where approved subdivisions and developments exist on the planning department “books” and would likely see an increase in new package/cluster type treatment systems. The majority of which, under existing MassDEP regulations, would simply be required to achieve less than 10 mg/L total nitrogen in their effluent within the Town’s sensitive watersheds. Town Zoning “Special Permits” for some facilities do require achieving 5 mg/L total nitrogen. While that is a vast improvement over traditional septic systems/cesspools and most I/A systems, this would not achieve the TMDLs currently established for Waquoit Bay East and Popponesset Bay.

The impacts of nutrients and pathogens on coastal waters, fresh surface waters, drinking water supplies, and other natural resources are well documented. Without addressing these needs, Mashpee (and their neighboring communities of Barnstable, Falmouth, and Sandwich) will continue to lose natural and economic resources, including declines in the fin-fishing and shellfishing habitats, loss of property values, continued algal blooms in coastal embayments and freshwater ponds, beach and shellfish closures, and potential declines in tourism as the aesthetic impacts continue to impair the Town's (and region's) water resources (coastal, fresh, and drinking).

At this time, the financial implications of the No Action Alternative are unknown; however, the financial impacts may include:

- Reduced property values and revenues from bay-front properties.
- MassDEP Consent Order to achieve the TMDLs and associated fines for not doing so in a timely manner.
- Reduced commercial shellfish income.
- Potential litigation either with groups like Conservation Law Foundation (CLF) as has been threatened in the region or others calling for the cleaning up of the bays.
- Reduced income to local businesses due to reduced attractiveness of Town to tourists and seasonal residents and retirees with accompanying loss of jobs.
- Costs associated with the Regional 208 Planning process, whether they result in implementation approaches, regulatory mandates, or possible fines for not addressing the TMDLs in accordance with the regional plan. Although the implementation of the 208 Plan would be a positive step, it has been identified that this process will not be preparing plans for each town; therefore the towns will still have to proceed with their own actions.
- Loss of future funding for projects through SRF or other means.

5.3 Summary of Draft Recommended Plan

The evaluations summarized in the DRP/DEIR and in Chapter 4 of this Report formed the Draft Recommended Plan as outlined below.

Figure 5-1 highlights those Subareas to be addressed for nitrogen removal through the following methods:

1. Shellfish Aquaculture:
   a. Begin propagation and monitoring Contributing Subareas influenced:
      i. A through F
      ii. Fal-2 through Fal-11
   b. Begin the adaptive management approach as the Town/District prepares for traditional infrastructure approaches.
   c. Begin near-term nitrogen removal implementation in Jehu Pond, Hamblin Pond, Popponesset Bay, Shoestring Bay, Ockway Bay, and Mashpee River.
   d. Serves the following watersheds:
      i. Mashpee River, Ockway Bay, Shoestring Bay, and Popponesset Bay.
      ii. Jehu Pond, Great River, Hamblin Pond (possibly also Red Brook and Lower Red Brook), and Little River.
   e. Significant collection system cost savings possible if monitored and can be maintained as a long-term solution.
   f. Hamblin/Jehu, Great/Little River, and Red Brook Subareas include:
      i. A, B, C, D, E, F-2 through F-11, and part of P.

g. If proven effective, this option could address or allow later phasing of all these areas:
    i. Ockway/Mashpee River/Popponesset Bay/Shoestring Bay Subareas including:
        a) D (D1, D2), I, N, O, P, Q, S, and T.
        b) Barn -37, Barn -39, Barn -42
        c) Could address most of Subarea D, potential reduction of initial infrastructure implementation of harder to address areas.
h. Findings indicate that the areas within these watersheds could be phased later or eliminated, reducing collection and treatment—fallback would be the traditional infrastructure outlined below.

2. Wastewater Treatment at Joint Base Cape Cod:
    a. Begin negotiations for use of Joint Base Cape Cod WWTF.
    b. Potential expansion:
        i. Mashpee Subareas H (including High School), L, and M; 0.20 mgd.
        ii. Sandwich Subareas Sand-1, -2, and -3; 0.1 mgd.
        iii. No change to open sand beds.
        iv. Future consideration (potential WWTF additional expansion):
            a) Falmouth areas Fal-13 to Fal-17 (potentially to be recharged outside watershed; 0.05 mgd; needed recharge capacity of 0.07 mgd).
            b) No change to open sand beds (within capacity with one bed out of service).
    c. Expansion of the existing 0.36 mgd capacity (average annual) Carrousel® WWTF, expanded to add another parallel train of equal size and an additional second clarifier.
    d. Provides potential regional solution.
    e. Can be achieved with adding a third train to the existing WWTF, appears to have recharge capacity per CH2MHill Report.
    f. Significant cost savings over new treatment and recharge facilities at Back Road site for Subareas G (including new facility), H (including High School), L, J (including Southport), and M (which would be required for all these areas if the nitrogen load remains within the watershed).
    g. Allows Southport facility to remain under current operation and recharge at its current location.
    h. Allows Mashpee Village at 5 mg/L to remain and potentially the I/A systems (Bridges at Mashpee) adjacent to High School.

3. Wastewater Treatment at Proposed New Facilities:
    a. Site 4 to serve Subareas: F, S1, S2, and T:
        i. Estimated total 0.39 mgd (average annual).
        ii. Phased to pick up portions of S adjacent to Falmouth Road first.
        iii. Recharge at Site 4.
        iv. Fallback recharge area at Willowbend Golf Course.
        v. Treatment performance dependent on recharge location:
            a) Initially 5 mg/L TN at Site 4
            b) Within watershed (Site 4 or Willowbend golf course), as low as 3 mg/L TN

b. Back Road Site as a backup to Joint Base Cape Cod (see item 2)
   i. Sand-1, Sand-2, and Sand-3 would need to be addressed in their watersheds with nitrogen treated to 3 mg/L, be recharged outside the watershed, or possibly connect to a regional facility at Back Road.
c. Site 6 to serve Subareas identified under shellfish propagation (except Subarea B):
   i. Estimated 0.27 mgd (average annual).
   ii. Later year project as shellfish performance is monitored.

4. Wastewater Treatment at Existing WWTF with Needed Improvements/Expansions/Modifications:
   a. New Seabury—expand recharge capacity, potential future expansion of Subarea B (as fallback to shellfish):
      i. Existing capacity = 0.3 mgd.
      ii. Potential expanded recharge capacity from other treatment locations (Mashpee Commons, Windchime Point, and Site 6) = 0.71 mgd maximum month (drip irrigation in addition to existing recharge capacity) at Site 7 and golf course areas.
      iii. No initial expansion needed until new facilities are constructed at Site 6 or modeling shows shellfish program will not meet TMDLs with continued recharge from Mashpee Commons and Windchime Point.
   b. Willowbend—expand recharge capacity, as fallback for Site 4 WWTF, improved future performance to 3 mg/L TN:
      i. Existing recharge capacity = 0.13 mgd.
      ii. Potential expanded recharge capacity = 0.8 mgd maximum month (drip irrigation) hydraulic capacity.
      iii. Potential extension of service to pick up Subarea I (0.05 mgd).
      iv. Evaluate performance needs in conjunction with shellfish results.
   c. Mashpee Commons:
      i. Existing capacity = 0.18 mgd.
      ii. Potential expansion = 0.33 mgd (average annual).
      iii. Subareas P (and N as required).
      iv. Performance = less than 5 mg/L TN.
      v. Recharge locally under shellfish program.
      vi. If shellfish are not successful, may need to relocate recharge to Site 7/New Seabury.
   d. Mashpee High School—either abandon facility/convert to pumping station or pump treated effluent in both cases to Joint Base Cape Cod or Back Road Site (fallback).
   e. Cotuit Meadows:
      i. Potential extension of service area to pick up less than 5,000 gpd from adjacent areas.
   f. Wampanoag Village:
      i. Potential extension of service area to pick up approximately 7,000 gpd from adjacent areas. The expansion is required to offset 237 lbs N/yr produced by the housing

development. In addition, the constructed treatment plant has significant capacity in excess of that needed for Wampanoag Village and the 237 lbs N/yr GWDP requirement, regarding which the Town and Tribe have begun discussions about extending the collection system served by the facility to include Town Hall and the surrounding area.

5. Wastewater Treatment at Existing WWTF: Operating under existing permit, consider upgrade to improve performance (3 to 6 mg/L TN) based on shellfish results and other adaptive management programs:
   a. Forestdale School
   b. Mashpee Village, Subarea G (to be constructed); if JBCC is not an option for other Subareas within the Quashnet River watershed, flow from this facility must be treated to 3 mg/L TN and recharged at Back Road Site.
   c. Southport—if JBCC is not an option must be recharged at Back Road Site.
   d. South Cape Village.
   e. Stratford Ponds.
   f. Windchime Point.
6. Coordination with Adjoining Towns within the planning area with recharge outside the watershed (collection, treatment, and recharge):
   a. Barnstable: Barn-37, -39, -42 outside watershed (0.08 mgd average annual).
   b. Falmouth: Fal-13 through -17 (0.05 mgd average annual)—see JBCC option.
   c. Sandwich: Sand-4, -5, -6, and -8 (0.19 mgd average annual).
7. No change of the following current practices (average flows):
   a. Mashpee I/A facilities (0.02 mgd).
   b. Mashpee septic systems (0.27 mgd).
   c. Sandwich septic systems (0.13 mgd).
   d. Barnstable septic systems (0.07 mgd).
   e. Falmouth septic systems (0.01 mgd).
8. Coordination with the Following Future Demonstration Projects/Evaluations:
   - PRB Options (following Falmouth demonstration efforts).
   - Wetland restoration projects.
9. Coordination with the Cape Cod 208 Planning Efforts.

5.4 Draft Recommended Plan Cost Summary

The following section presents the summary tables outlining the estimated flows and costs as presented as part of the June 2014 Draft Recommended Plan/Draft Environmental Impact Report. Table 5-1 presents a summary of the Draft Recommended Plan with and without shellfish aquaculture.

Table 5-1 Summary Table—Draft Recommended Plan To Achieve TMDLs (Average Annual Flows, gpd)[1]

Treatment and Recharge Location (treated/recharged flows- not capacity)	Recommended Plan (without Shellfish Aquaculture)		Recommended Plan (with Shellfish Aquaculture)	
	Treatment	Recharge	Treatment	Recharge
Existing Facilities				
Joint Base Cape Cod[2]	300,000	300,000	300,000	300,000
Southport WWTF	160,000	160,000 [7]	160,000	160,000 [7]
Mashpee Commons [3]	330,000	NS/Site 7	180,000	180,000
South Cape Village	12,000	12,000	12,000	12,000
New Seabury (and expanded recharge)	180,000	780,000	180,000	180,000
Willowbend (and expanded recharge)	120,000	500,000	120,000	120,000
Windchime Point	22,000	22,000	22,000	22,000
Stratford Ponds	30,000	30,000	30,000	30,000
Cotuit Meadows	37,000	37,000	37,000	37,000
Wampanoag Village	15,000	15,000	15,000	15,000
Proposed Facilities				
Site 4[3]	390,000	Willowbend	100,000	100,000
Back Road Site (Alternate to JBCC) [8]	*200,000*	*200,000*	*200,000*	*200,000*
Site 6	260,000	NS[9]/Site 7	Not Used	Not Used
Mashpee Village	20,000	20,000 [7]	20,000	20,000
Sand-1, -2, -3 (Alternate to JBCC)	*100,000*	*100,000*	*100,000*	*100,000*
Outside Watershed				
Sandwich Outside Watershed (Sand-4, 5, 6, 8)	190,000	190,000	[4,5]	[4,5]
Falmouth Outside Watershed	50,000	50,000[6]	50,000	50,000[6]
Barnstable Outside Watershed	80,000	190,000	[4,5]	[4,5]
Onsite and I/A Systems				
Existing I/A and Septic Systems (all Towns)	500,000	500,000	500,000	500,000
Total (JBCC option)	2,700,000	2,700,000	1,700,000	1,700,000

Notes:

1. Flows are future average annual flows. Values rounded to two significant figures.
2. JBCC flows only reflect added flows from the PPA not total facility capacity.
3. Secondary recharge from Site 4 may shift to Willowbend in future and Mashpee Commons would need to be recharged at Site 7 with no shellfish.

4. Under shellfish aquaculture, shellfish potentially address flows that would have gone to Sites 4, 6, and out of the watershed from Barnstable, Mashpee, and Sandwich.
5. Town of Mashpee may look to create MOUs with Barnstable and Sandwich to help support the shellfish aquaculture program, which would help cover “fair share” considerations of nitrogen loadings from those neighboring communities on Popponesset Bay.
6. Joint Base Cape Cod is one potential location.
7. If JBCC is not available, needs to be recharged at Back Road Site.
8. Does not include Southport or Mashpee Village, which would have to be recharged (at 3 mg/L TN) at this location if JBCC is not available.
9. New Seabury.

Costs for the Draft Recommended Plan with and without shellfish aquaculture are presented below. These costs are presented as total capital costs and a total present worth value of the project when considering long-term operations and maintenance costs. The costs do not reflect phasing; however it is presumed that the first phase (discussed in Chapter 9) is the Recommended Plan with shellfish. This phase would include those improvements to JBCC, Site 4, and associated collection system in conjunction with the shellfish program outlined in the 2014 DRP/DEIR.

The project costs related to neighboring communities are also included to provide a rough estimate of the total impact of the project. These costs are presented with the understanding that they are dependent on how each of these communities will address the nitrogen removal needs of these estuaries. The costs assume a traditional approach for simplicity and will be dependent on site availability (for those areas where flow needs to be removed from the watershed); memorandums of understanding (to be developed/completed) between the various communities regarding use of joint facilities; system and watershed nitrogen loading responsibility; and will ultimately depend on the actual build-out conditions experienced in each community. Therefore, adaptive management and long-term monitoring and modeling results will be critical in the determination of each community’s contribution.

Table 5-2 presents the total capital cost for both the first phase of the Draft Recommended Plan based on shellfish aquaculture managing the bulk of the nitrogen removal in the embayments, and a total capital cost if shellfish and other adaptive management approaches are not considered. If shellfish aquaculture and other adaptive management approaches are not considered, a strictly traditional infrastructure approach is applied. These cost values in Table 5-2 represent an estimated 2017 dollar value. Additional capital expenditure including efforts in neighboring communities will be required to meet the TMDLs within Quashnet River, Mashpee River and possibly Shoestring Bay.

Table 5-3 presents an estimate of costs related to TMDL compliance with shellfish aquaculture based on the following:

- Shellfish aquaculture performance based on existing conditions and MEP results.
- Aquaculture supported by traditional infrastructure to manage existing conditions.
- Projected future conditions that could occur with increased development and growth in approved areas as presented throughout the CWMP/WNMP process.

In addition, if a traditional infrastructure approach is used to address the entire issue, the project will need to be phased with the costs spread over 20 to 40 years. The resulting costs would be subject to associated inflation and the total project costs would also have to consider any funding opportunities that could be applied for financing purposes (for example SRF loans of 0- or 2-percent). Those costs are also presented in Table 5-3.

Table 5-2 Estimated Total Capital Cost of Draft Recommended Plan Phase 1 (1, 2)

Estimated Capital Costs	Recommended Plan Phase 1 with Shellfish Aquaculture
Shellfish Aquaculture (year one startup)	$1,500,000
Collection System	$25,000,000
Treatment System (3, 4, 5)	$21,000,000
Recharge Facility (3, 4)	$1,500,000
Total	$49,000,000

Notes:

1. Values rounded to two significant figures, and include allowances for fiscal, legal and engineering services, and contingency.
2. Values based on an ENR index year of 2017.
3. Treatment costs include new facilities and improvements/upgrades to existing facilities.
4. Estimated costs with shellfish aquaculture presume that existing and future loads are managed through this adaptive management approach, and Joint Base Cape Cod is available and no additional recharge capacity is required at JBCC.

Table 5-3 Estimated Total Capital Cost of Entire Draft Recommended Plan With and Without Shellfish (1, 2, 6)

Estimated Capital Costs	Recommended Plan with Shellfish Aquaculture	Recommended Plan without Shellfish Aquaculture
Shellfish Aquaculture (year 1)(7)	***$1,500,000***	***$0***
Town of Mashpee Estimate		
Collection System	$110,000,000	$180,000,000
Treatment System (5)	$28,000,000	$66,000,000
Recharge Facility	$5,100,000	$13,000,000
Mashpee Total	***$140,000,000***	***$260,000,000***
Neighboring Towns Estimate (Barnstable, Falmouth, Sandwich)		
Collection System	$26,000,000	$72,000,000
Treatment System (3, 4, 5)	$8,700,000	$23,000,000
Recharge Facility (3, 4)	$300,000	$ 2,000,000
Neighboring Town Total	$35,000,000	$97,000,000
Total	***$180,000.000***	***$360,000,000***

Notes:

1. Values rounded to two significant figures, and include allowances for fiscal, legal and engineering services, and contingency.
2. Values based on an ENR index year of 2017, and are based on future flow conditions and TMDL compliance.
3. Treatment costs include new facilities and improvements/upgrades to existing facilities, including allowances for facilities located in Sandwich (not including those proposed to connect to JBCC), and Barnstable (Falmouth assumed to go to JBCC).
4. For neighboring communities of Barnstable, Falmouth, and Sandwich, collection, treatment, and recharge costs were estimated for planning purposes only; actual location, technology type, and site considerations would need to be determined by each individual community.
5. Estimated costs with shellfish aquaculture presume that existing and future loads are managed through this adaptive management approach, and Joint Base Cape Cod is available and no additional recharge capacity is required at JBCC.
6. Does not consider increasing shellfish aquaculture areas to reduce sewering if shellfish performance is as good or better than projected.
7. Cost does not include Town staff which are currently funded by the Town through their existing program.

Another element in selecting the most cost-effective approach is the consideration of the annual costs to operate and maintain the selected alternatives. It is possible for example to have a very low initial capital cost but the alternative may have very expensive annual costs. Thus the rate payers would be burdened with high annual costs although the capital or construction costs were low in comparison.

In order to account for the annual costs as well as the construction costs, a method of developing the total present worth of an alternative is used. The purpose of adding the present worth of the annual operating and maintenance costs to the capital costs (which is the Total Present Worth) is to identify which alternative is the most cost-effective. The state agencies require that an interest rate that is established by the Federal government is used when developing the present worth of the annual costs. Currently, the federal interest rate to be used in a present worth analysis is 3%. First, an estimate is made for the annual costs such as power, labor, chemical, and other related costs that would be spent on an annual basis. Then, a factor tied to the specific Federal interest rate is multiplied by the annual costs to calculate the present worth of those 20 years of payments in the future. The capital or initial construction costs of the project would be added to the present worth of the annual costs to develop the Total Present Worth of a project. Table 5-4 presents the estimated annual operation and maintenance (O&M) costs related to the proposed first phase of implementation including shellfish aquaculture.

The annual cost for shellfish aquaculture as presented below also represents the worst case scenario, in this case if there is no natural reseeding and the areas are reseeded each year. The traditional infrastructure O&M also represents the O&M over 20 years if all facilities were built and in operation in the first year; however, in reality, these facilities would be constructed in phases as outlined in Chapter 9 of the 2014 DRP/DEIR and would be staggered so that only once all facilities were constructed (approximately 30+ years out) and operated for another 20 years is what these values would represent.

Table 5-4 Estimated Total Present Worth Cost of the First Phase of Draft Recommended Plan Implementation [1, 2, 3, 4, 5]

Operation and Maintenance Costs	Phase 1 with Shellfish Aquaculture
Shellfish Aquaculture (reseeding) [6]	$1,500,000
Collection System	$100,000
Treatment System	$1,300,000
Recharge Facilities	$30,000
O&M Annual Total	**$2,900,000**
Present Worth O&M	**$43,000,000**
Total Capital Cost (Table 6-9) [5]	*$49,000,000*
Total Present Worth	**$92,000,000**

Notes:

1. Values rounded to two significant figures, and include allowances for fiscal, legal and engineering services, and contingency.
2. Treatment O&M costs include new facilities and improvements/upgrades to existing facilities.
3. Estimated annual costs with shellfish aquaculture presume that existing and future loads are managed through this adaptive management approach, and Joint Base Cape Cod is available and no additional recharge capacity is required at JBCC.
4. Costs do not include existing O&M at Joint Base Cape Cod associated with those facilities existing operations.
5. Total Capital costs based on an ENR index year of 2017.
6. Cost does not include Town staff which are currently funded by the Town through their existing program.

As stated previously, Phase 1 is based on using shellfish aquaculture and Mashpee initiating traditional infrastructure in parts of the Quashnet River and Mashpee River watersheds where shellfish aren't proposed or anticipated to achieve TMDL compliance.

Table 5-5 that follows presents the O&M costs and estimated Total Present Worth of the Draft Recommended Plan for TMDL compliance with and without considering shellfish aquaculture. These costs are also presented based on a 2017 year and a 20-year timeframe, however implementation (design, construction, startup, and operation) of these types of facilities would be staggered and therefore the costs would be staggered as well, and this must be taken into consideration when considering the estimated costs.

Table 5-5 Estimated Total Present Worth Cost of Draft Recommended Plan [1]

Operation and Maintenance Costs	TMDL Compliance with Shellfish Aquaculture	TMDL Compliance without Shellfish Aquaculture
Shellfish Aquaculture [7]	***$1,500,000***	***$0***
Town of Mashpee Estimate		
Collection System	$420,000	$800,000
Treatment System	$2,600,000	$4,900,000
Recharge Facility	$490,000	$1,200,000
Mashpee Total	***$3,500,000***	***$6,900,000***
Neighboring Towns Estimate (Barnstable, Falmouth, Sandwich)		
Collection System	$160,000	$390,000
Treatment System[3, 4]	$660,000	$1,600,000
Recharge Facilities[3, 4]	$4,000	$21,000
Neighboring Town Total	***$820,000***	***$2,000,000***
Project Totals		
O&M Annual Total [5]	**$5,800,000**	**$ 8,900,000**
Present Worth O&M	**$86,000,000**	**$130,000,000**
Total Capital Cost (Table 6-9) [6]	*$180,000,000*	*$360,000,000*
Total Present Worth	**$270,000,000**	**$490,000,000**

Notes:

1. Values rounded to two significant figures, and include allowances for fiscal, legal and engineering services, and contingency.
2. Treatment O&M costs include new facilities and improvements/upgrades to existing facilities, including allowances for facilities located in Sandwich (not including those proposed to connect to JBCC), and Barnstable (Falmouth assumed to go to JBCC).
3. Neighboring communities of Barnstable, Falmouth, and Sandwich, collection, treatment, and recharge O&M costs were estimated for planning purposes only; actual location, technology type, and site considerations would need to be determined by each individual community.
4. Estimated annual costs with shellfish aquaculture presume that existing and future loads are managed through this adaptive management approach, and Joint Base Cape Cod is available and no additional recharge capacity is required at JBCC.
5. Costs do not include existing O&M at Joint Base Cape Cod associated with those facilities existing operations.
6. Total Capital costs based on an ENR index year of 2017.
7. Cost does not include Town staff which are currently funded by the Town through their existing program.

This Draft Plan has since been modified for this report based on the comments received as part of the MEPA review process and the Draft 208 Plan being developed by the Cape Cod Commission. The Final Recommended Plan is summarized in the next Chapter. Following that Chapter, Chapter 7 will discuss the Environmental Evaluations; Chapter 8 the Draft Section 61 Findings; and Chapter 9 presents the initial implementation schedule for the plan.

6 Recommended Plan

6.1 Introduction

The focus of this Chapter is to present the details of the Final Recommended Plan as modified and updated from the Draft Recommended Plan Summarized in Chapter 5. The Final Plan includes components of shellfish aquaculture, traditional infrastructure, regional approaches, and use of existing facilities and is built as an adaptive approach building on direct environmental mitigation through shellfish aquaculture supported by a minimum amount of traditional infrastructure to start. The plan is predicated on having a fallback/contingency plan based on traditional infrastructure if there are problems with the shellfish achieving their removal goals. However, the plan also includes the adaptive management program that allows the consideration and inclusion of 208 Plan findings and other recommendations or approaches to be considered to supplement the Plan in an effort to potentially minimize the traditional infrastructure and further support shellfish aquaculture in order to achieve the TMDLs.

Following the submittal of the Draft Plan in June 2014 this Chapter discusses some of the additional evaluations, descriptions, and details requested as part of the comments from the Secretary and presents the Final Recommended Plan.

Subsequently, Chapter 7 reviews the environmental impacts associated with this Plan, and Chapter 8 identifies the permitting and Draft Section 61 findings[1] associated with the Plan. Chapters 9 and 10 focus on the proposed phasing and implementation, and adaptive management program that will be necessary to implement and monitor the progress of the Plan. The report ends with Chapter 11 which identifies additional steps and efforts needed by the Town and the Water/Sewer District to continue the implementation of this proposed Plan.

6.1.1 Background

Following the submittal of the DRP/DEIR, the plan has gone through minor refinements based on the comments received through the MEPA review, CCC public hearing process, and changes within the Town regarding the potential management of the plan.

The Final Plan, which is based on the Draft Plan, is built under the general approach that shellfish aquaculture will be used in conjunction with traditional infrastructure in order to meet the TMDL. It is also based on the approach that, under a worst case scenario of shellfish aquaculture and other adaptive management approaches being unsuccessful in reducing their portion of the load (the portion not being addressed by traditional infrastructure) as described in the phasing plan from the DRP/DEIR, a complete traditional infrastructure approach is planned to achieve the nitrogen TMDLs under the future build-out condition. That is the contingency plan and remains so from Draft to Final. The plan also makes provisions that allow adaptive management to be used to additionally mitigate nitrogen, or pilot approaches to

[1] References the MEPA regulations 301 CMR 11.12 (5): "In accordance with M.G.L. c. 30, section 61, any Agency that takes Agency Action on a Project for which the Secretary required an EIR shall determine whether the Project is likely, directly or indirectly, to cause any Damage to the Environment and make a finding describing the Damage to the Environment and confirming that all feasible measures have been taken to avoid or minimize the Damage to the Environment."

mitigate nitrogen that could also reduce the amount of traditional infrastructure necessary to achieve the nitrogen TMDLs.

Detailed evaluations were also prepared in advance of the development and completion of the DRP/DEIR and are discussed in that document as well as the previous planning documents including the Needs Assessment Report, Draft Alternatives Evaluation Report and Site Evaluation Report, ASAR, and DRP/DEIR. These reports discussed the capacity, performance, and process of the existing WWTFs within the Project Planning Area, the hydraulic load testing at Site 4 (the proposed site being considered as part of the Phase 1 implementation), and the proposed WWTF to be used at each proposed site. With shellfish aquaculture and adaptive management approaches so prominent in the project, and the timing of later phases of traditional infrastructure predicated on performance of the shellfish initially, the further detailed evaluation of recharge facilities and treatment technologies would be addressed in the phasing and permitting aspects of implementation.

Due to the complexity of using shellfish to achieve TMDL compliance, the plan is not able to project beyond the initial phase of nitrogen removal, as shellfish are anticipated to be able at a minimum to remove some portion of the load, therefore nitrogen loading is evaluated on 5-year intervals in order to see what amount of traditional or other approaches would be needed in the subsequent phases. Lacking the aquaculture mitigation aspect of the plan, all phases of the contingency plan (facilities construction) will be necessary to meet the Town's share of nitrogen load to the impacted bays. The Town is committed to reaching the TMDL limits as prescribed by law. It is difficult to forecast from this point what particular levels of removal, methods, or areas will be necessary to implement to attain the required levels. There are many variables and sequences open to reach that goal. There is a lot of discussion as to the efficacy of the proposed aquaculture plan as discussed later. It is intended that the phasing of the project in 5-year segments will provide the opportunity to assess progress and redirect effort, if necessary, to a needed area.

Rick York, the Mashpee Shellfish Constable and lead on the development of the shellfish program proposed for this project, set up meetings with regulatory agencies to follow up on their comments on the Draft Report.

- On December 10, 2014 he met with CZM Cape and Islands Regional Coordinator Stephen McKenna. At that time CZM expressed their support for the draft plan.
- On December 18, 2014 he met with DMF Shellfish Program Chief Michael Hickey and South Shore Section Leader Thomas Shields and discussed the Comprehensive Planning project and DRP/DEIR.

During the second meeting the DMF expressed their support for the draft and the shellfish part of the plan. Comments about nitrogen removal, habitat, planting densities, and seed supply were reviewed and DMF was satisfied with Mr. York's responses to their comments.

A key to those comments was related to the shellfish habitat areas. As part of the process of addressing the comments, the Town of Mashpee's GIS Department mapped the shellfish habitat based on GPS data collected from the estuaries, and these maps are included as Figures 6-1 and 6-3. Based on this information, there is sufficient habitat to support the proposed densities of shellfish and the habitat proposed to be used is well within historical natural densities as discussed in Section 6.2.1.

During these meetings with the various regulatory agencies, the availability of the necessary seed was discussed. Mashpee, through Mr. York, has been in contact with the President of Aquacultural Research Corporation, Richard Kraus, regarding supply of shellfish and shellfish seed. During these initial discussions, Mr. Kraus stated that they could supply the shellfish seed needed to implement the plan with a year or two lead-time for the first order if all of the seed was ordered for one year. Subsequently, a phased approach with smaller orders per year would not require that much lead-time.

Mashpee has also initiated discussions with the Town of Barnstable's Natural Resources Division on ways that the two communities can partner in expanding the shellfish aquaculture in Popponesset Bay and take advantage of restoring the habitats in both of the communities shared waters.

6.2 Recommended Plan

As identified in Chapter 5, the Draft Recommended Plan was summarized as it included:

- Shellfish aquaculture within several embayments (with contingency for use of traditional infrastructure).
- Expansion of Joint Base Cape Cod WWTF (with a contingency of the use of Back Road Site if JBCC was not available or available but at a reduced capacity).
- Construction of new wastewater treatment and recharge facilities.
- Upgrade/expansion of existing wastewater treatment facilities.
- Continued use of existing smaller wastewater treatment facilities.
- Regional assistance from Barnstable, Falmouth, and Sandwich in addressing nitrogen sources within their town boundaries.
- Developing a management structure for those areas where septic systems and innovative and alternative (I/A) systems will remain in use in Mashpee.
- Future demonstration projects and advancement of the Cape Cod Commission 208 Planning efforts.
- Adaptive management.

Each of these is discussed in more detail in following sections.

6.2.1 Shellfish Aquaculture

The Town of Mashpee, in conjunction with the Wampanoag Tribe, Barnstable County Cooperative Extension, AmeriCorps Cape Cod and MEP, have ongoing oyster aquaculture projects in the Mashpee River for water quality improvements and shellfish harvesting. The approach is to expand shellfish aquaculture and harvesting for water quality improvement in Shoestring Bay, and complete restoration of water quality in Ockway Bay, Popponesset Creek, Great River, Jehu Pond, Hamblin Pond, and Little River. The following section describes the approach proposed through the Mashpee Shellfish Constable.

As stated previously, both Coastal Zone Management (CZM) and DMF were consulted following the MEPA comments to address their concerns and additional information has been provided in support of the program.

6.2.1.1 Mashpee Shellfish Constable—Program Discussion and Summary

Excess nitrogen—primarily from septic systems—is causing algae blooms in the estuaries. Nitrogen is the nutrient limiting algae growth in estuaries. In Mashpee and similar areas, sand acts as a natural filter for removing bacteria from the wastewater and allowing clean nitrogen to flow through groundwater to the surface waters. Algae blooms block sunlight causing the death of eelgrass. By the early 1990s, all of the eelgrass died off in the Popponesset Bay system and Waquoit Bay with only small eelgrass beds remaining in Jehu and Sedge Lot ponds. As nitrogen levels and algae blooms increase, the algae can deplete dissolved oxygen (DO) at night when there is no light for oxygen production by photosynthesis. One night in August 2005, an algae bloom consumed all of the dissolved oxygen in the Mashpee River causing mass mortality of fish and invertebrates such as crabs. DO and chlorophyll data from a deployed water quality monitoring instrument (sonde) documented the cause. Loss of habitat and species occurs when the algae die, settle to the bottom, and are decomposed causing the accumulation of muck (soft organic sediment with the consistency of mayonnaise). Most benthic species do not survive the anaerobic conditions in muck.

Reduction of nitrogen sources by construction of nitrogen-reducing wastewater treatment facilities takes time and money. Shellfish can remove algae and nitrogen by filtering algae for food. Some of the algae (containing nitrogen) is digested and assimilated into the shellfish meat and shell, and the rest is excreted. Most of the excreted material settles to the bottom (biodeposition) and can be buried in the sediments or recycled to the water by microbial processes. Through a process called denitrification, certain microbes convert the nitrogen from shellfish waste (and other sources) into nitrogen gas that evaporates to the atmosphere. Estimates of 20- to 50-percent of the nitrogen input to estuaries being removed by denitrification have been reported (Seitzinger 1988). Newell (2004) estimated that a 3-inch (7.6 cm) eastern oyster (Crassostrea virginica) caused 0.75 g of nitrogen to be buried and denitrified annually. Oyster beds and reefs can create an environment favorable for denitrification because there is a nutrient rich aerobic/anaerobic interface in the deposition zone. Denitrification is variable and data is limited due to analytical constraints. Oyster reefs have a number of benefits that were summarized by Grabowski et al. (2012) as (1) water quality improvement, (2) seashore stabilization, (3) carbon burial, (4) habitat provision for mobile fish and invertebrates, (5) habitat for epibenthic fauna, (6) diversification of the landscape, and (7) oyster production.

The existing shellfish populations are filtering algae (nitrogen) and water quality would be worse without them. Shellfish are a good fit for water quality improvement even though most shellfish hibernate and do not filter water for most of the winter. Water quality is good in winter because algae normally do not bloom in winter. Resulting conditions are clear water and good dissolved oxygen levels even in areas of high nitrogen concentrations. Cold water holds more dissolved oxygen, and removal of oxygen by organisms for metabolism is relatively low because of the cold temperatures.

Shellfish aquaculture in private shellfish farms and municipal shellfish propagation programs for fisheries restoration have the potential to restore water quality while source reduction is being planned and implemented, or as an alternative if proven successful in the long run. Complete restoration of water quality in a eutrophic estuary by shellfish has not been accomplished yet, but work is progressing toward that goal in Mashpee and some other towns/estuaries. Conflicts and visual impacts limiting new commercial shellfish aquaculture farms are not a problem because the Town of Mashpee shellfish propagation for fisheries and the Mashpee Wampanoag Tribe's existing shellfish farm are sub-tidal, already permitted, and out of sight.

Limitations

Shellfish aquaculture cannot be applied in all areas of estuaries. In some cases, the area is too small to grow enough shellfish for the nitrogen load reduction needed, or the salinity is too low. Areas that are classified as prohibited for the harvest of shellfish because of contamination (fecal coliform bacteria) are not suitable because of public health concerns. Areas that are conditionally approved (closed to shellfishing seasonally and opened for the harvest of shellfish for part of the year) are suitable. Massachusetts Division of Marine Fisheries (DMF) maps of shellfish areas with sections classified as approved, conditionally approved, or prohibited for shellfish harvest in Mashpee are included in Appendix 6-1.

Risks

Risks include mortality due to disease and predation, but nitrogen-reducing sewage treatment systems also have risks of death or lack of growth of nitrogen-consuming microbes (e.g. from toxic chemicals in the wastewater). In protected waters such as the upper estuarine areas in Mashpee, storms do not damage shellfish because land blocks the wind and waves, and the low pressure in storms makes the water level higher (shellfish are deeper underwater). Harmful algae blooms (HABs) have not been a problem in Mashpee. The Mashpee Water Quality Monitoring Program includes microscopic identification and quantification of algae. If detected, control methods could be applied to control harmful algae. Options include natural controls such as algae eating ciliates that are found in Mashpee waters. Ocean acidification would not be a problem because algae in the estuaries raise the pH during photosynthesis (Duarte et al., 2013). Oysters grow well in the Mashpee River where pH levels drop to 7 or less at night due to respiration, but can go as high as 9 during the day due to photosynthesis.

Species

Shellfish species selection for maximum benefit and minimum risk results in the selection of oysters (Crassostrea virginica) in lower salinity area such as the Mashpee River and Shoestring Bay, and quahogs (Mercenaria mercenaria) in other higher salinity areas. In low salinity areas, oyster diseases are blocked, most predators are excluded, and fouling is not a problem. Aquaculture practices can protect seed oysters from remaining predators—such as crabs—that are not a problem when the oysters are larger. Higher nitrogen loads and algae blooms are often found in the low salinity areas because the nitrogen is carried in fresh ground and surface waters. The benefits of algae and nitrogen removal by oysters are maximized there.

Quahogs are better in higher salinity areas than oysters, where oyster mortality is higher due to diseases and predators. Quahogs cannot grow in low salinity areas. Disease is not a problem for quahogs in Mashpee. The quahog disease Quahog Parasite Unknown (QPX) has not been found in Mashpee. Our summer water temperatures in the estuaries (up to mid 80s F) are lethal to the causal microbe. Fouling is not a problem because quahogs dig into the sediment. Aquaculture of quahog seed to over an inch in size before planting minimizes predation.

Nitrogen Content

Nitrogen is removed from the estuary when the shellfish are harvested. Oysters and quahogs collected from Mashpee and other towns by the Barnstable County Cooperative Extension in the spring and fall of 2012 were analyzed at Boston University for nitrogen content. Relevant Mashpee data is listed in Appendix 6-1 as Shellfish Sample Data 2012. Shellfish from Mashpee had higher percent N than the average of all towns sampled. This is probably the result of higher nitrogen concentrations and algae blooms (eutrophication) in the Mashpee areas. The percent nitrogen per whole oyster or clam (percent live weight) was lowest in the spring because they metabolize reserves when water temperatures warm, but the algae have not bloomed yet. Oysters are harvested during the fall and winter, so fall nitrogen content data is used to calculate nitrogen removal by oysters. In samples from Mashpee harvest areas, the average in whole animal (wet weight) was 0.5-percent nitrogen. A 3.5-inch 100 g oyster would have 0.5 g N and 2 million of them (200 metric tons (MT) of oysters) would have a metric ton of nitrogen. Because the majority of quahogs are harvested in the summer, an average of the spring and fall data is used (no summer data was available). That also was 0.5-percent N per whole animal. So a 60 g littleneck would have 0.3 g N and 3.3 million of them (200 MT) would contain a metric ton of nitrogen. (The numbers are different in the Community Preservation Funding Applications in 2013 because they were based on incomplete spring data available at the time.)

The weight of oyster seed from the hatchery at about a millimeter in size is insignificant regarding its initial nitrogen content. However, the weight of 1-inch quahog seed from the hatchery is about 6 grams each which is 10% of the 60 g average harvest size of littleneck quahogs. In areas seeded with 1-inch quahogs, the weight of littleneck quahogs harvested the following year needed to remove the required amount of nitrogen would be increased by 10% of those presented in Table 6-2. Quahog seed planted would have to be increased by 10% for the estimated survival rate in the plan. Alternatively, if the quahog seed is grown in an aquaculture system from small (~1 mm) seed in the water body that is to be planted in, then the initial weight is insignificant in relation to its nitrogen content. Lastly, if the population becomes self-sustaining through spawning, then the initial weight will no longer be relevant when considering nitrogen removal.

Nitrogen Removal

The attenuated nitrogen load reductions needed to restore water quality in the estuaries are found in The Massachusetts Estuaries Project (MEP) reports (Howes et al., 2004 and 2011) for Popponesset Bay and Waquoit Bay, and the TMDL report for Popponesset Bay (Commonwealth of Massachusetts, 2006). These are converted from kg nitrogen/day to kg nitrogen/year in Table 6-1. The nitrogen load reduction needed in the Popponesset Bay system (DMF shellfish areas SC19 and SC20) is 11,343 kg/yr. The nitrogen load reduction needed in the Great River, Little River, Hamblin Pond, and Jehu Pond sub-estuary (DMF shellfish area SC16) is 5,764 kg/yr.

Table 6-1 Reduction of Nitrogen Load in Estuary for TMDL

Sub-embayment	Present(1,5) Septic Load kg N/day	Threshold(1) Septic Load kg N/day	Reduction Required	
			kg N/day	kg N/year
Popponesset Bay (SC19 + SC20)				
Popponesset Bay	1.58	1.58	0.00	0
Popponesset Creek	4.00	0.00	4.00	1,460
Pinquickset Cove	0.58	0.58	0.00	0
Ockway Bay	2.39	0.00	2.39	872
Mashpee River	19.57(2)	5.85	13.72	5,008
Shoestring Bay	23.32(3)	12.27(4)	11.05	4,033
		Total	**31.16**	**11,343**
Great River, Little River, Hamblin Pond, and Jehu Pond (SC16)				
Hamblin Pond	12.395(6)	3.049(7)	9.346	3,411
Little River	1.096	0.211	0.885	323
Jehu Pond	3.912	1.025	2.887	1,054
Great River	3.671	0.997	2.674	976
		Total	**15.792**	**5,764**

1. Commonwealth of Massachusetts 2006. Table B-1, page 25 (Howes et al. 2004. Table VIII-1, page 125)
2. Mashpee River: 9.61 watershed + 9.96 surface water = 19.57
3. Shoestring Bay: 6.94 watershed + 11.69 Santuit R. + 4.69 Quaker Run R. = 12.32
4. Shoestring Bay: 7.58 Santuit R. + 4.69 Quaker Run R. = 12.27
5. Howes et al. 2011. Table ES-2, page ES 13 (for SC16)
6. Hamblin Pond: 4.381 watershed + 8.014 Red Brook = 12.395
7. Hamblin Pond: 0.953 watershed + 2.096 Red Brook = 3.049

In the SC16 area, the Waquoit Bay MEP report Table ES-1 (Howes et al., 2011, page Executive Summary (ES) 12) estimates the total nitrogen load to be 65.60 kg/day (Hamblin Pond/Red Brook, Little River, Jehu Pond and Great River). The septic system load contribution to the total load is 16.45 kg/day (25%). The benthic flux (net nitrogen released from sediments in the bottom of the estuary) contribution to the total load is 40.86 kg/day (62%). The nitrogen load reduction needed for the TMDL/water quality restoration (Table ES-2 of the MEP Report, page ES 13) is 15.79 kg/day (24%). The in-estuary reduction of nitrogen through shellfish filtering out algae makes sense given the high percentage of total load coming from the sediments. This is not the case in other areas of the estuary. In Waquoit Bay proper, massive seaweed beds are removing (for growth) a large percentage of the total nitrogen load from that part of the estuary based on benthic flux measurements there. On average, little or no nitrogen from the dead, decomposed seaweed at the bottom of the bed makes it back to the water through the bed because the live seaweed takes it up for growth. Quantification of this favorable benthic flux demonstrates the value of the MEP efforts in which these measurements were taken. The seaweed beds, mostly Cladophora vagabunda have been stable for decades. Water quality would be much worse if the seaweed was not there.

The weight of shellfish to be harvested for removal of nitrogen based on 0.5-percent N is listed in Table 6-2. This would be annual harvest for restoration. Oyster harvests in the Mashpee River and Shoestring Bay would remove half of the nitrogen needed to restore water quality. Quahog harvests in the other areas would remove all the nitrogen needed for complete restoration of water quality.

Table 6-2 Shellfish Plan for Nitrogen Removal

Area	Nitrogen Removal(1) Required (MEP) Metric Tons (MT) N/year	Removal by Shellfish MT N/year	Shellfish Harvest MT Live/year	Number of Shellfish Million/Species
SC19 + SC20				
Popponesset Bay/Creek	1.46	1.46	292	4.87/quahogs(2)
Ockway Bay	0.87	0.87	174	2.45/quahogs(2)
Mashpee River	5.01	2.5	500	5.00/oysters(3)
Shoestring Bay	4.03	2.00	400	4.00/oysters(3)
Total	**11.37**	**6.83**	**1,366**	**16.32**
SC16				
Hamblin Pond	3.41	3.41	682	11.37/quahogs(2)
Little River	0.32	0.32	64	1.07/quahogs(2)
Jehu Pond	1.05	1.05	210	3.50/quahogs(2)
Great River	0.98	0.98	196	3.27/quahogs(2)
Total	**5.76**	**5.76**	**1,152**	**19.21**
Total SC16, 19 + 20	**17.13**	**12.59**	**2,518**	**35.53**

1. Nitrogen removal required calculated from: Howes et al. 2004.Table ES-2 page ES 10.
2. Littleneck quahogs @ 60 g. N.
3. Oysters @ 100 g.

The estimated nitrogen removal amounts identified in Table 6-2 are considered conservative. Removal of nitrogen by denitrification and other processes in the oyster bed or reef is not included, and could be as much as the amount contained in the oysters (Peterson, 2004). In that case, the total nitrogen removed would equal the required amount identified by MEP and the result should be that the total nitrogen measured at the sentinel station (and other stations) would be the target number(s) under the MEP existing conditions. Other parameters such as chlorophyll and DO should also show acceptable water quality. The estimated number of shellfish to be harvested based on an average weight assumption is needed to calculate the amount of seed needed.

Table 6-3 Shellfish Plan—Quantities and Areas

Area	Species	Number of Shellfish Required (calculated/ planned)	Average Density of Existing Shellfish Sampled (#/ft^2)	Planned Harvest Area (ac)	Planned Shellfish Density (/ft^2)	Extra Capacity
		SC19				
Popponesset Creek	quahogs	4.87 / 4.87	< 0.1	24.9	4.49	> density (2)
Ockway Bay	quahogs	2.45 / 2.45	< 0.3	11.1	5.07	> density
Total (SC19)		**7.32 / 7.32**		**36**		
		SC20				
Mashpee River	oysters	5.00 / 5.00	30(1)	12.3		
Mashpee /Wampanoag Farm	*oysters*	*4.00 / 4.00*	*30(1)*	*9.1*	*30.6 (3)*	*none*
Town	*oysters*	*1.00 / 1.00*	*30(1)*	*3.2*	*23 (4)*	*> acres*
Shoestring Bay	oysters	4.00 / 4.00	0	9.4	30.6 (5)	18 acres (6)
Total(SC20)		**9.00 / 9.00**		**21.7**		
		SC16				
Hamblin Pond	quahogs	11.37 / 4.82	< 0.3	38.4	2.88 (7)	> density
Little River	quahogs	1.07 / 7.62	< 0.3	25	7.00 (7)	> density
Jehu Pond	quahogs	3.50 / 3.50	< 0.1	11.3	7.11	> density
Great River	quahogs	3.27 / 3.27	< 0.3	27.7	2.71	> density
Total(SC16)		**19.21 / 19.21**		**102.4**		
Total SC16, 19 + 20		**35.53 / 35.53**		**160**		

Notes:

1. Aquaculture only.
2. "> density" (typical) indicates carrying capacity is greater than the planned density
3. Aquaculture (trays), calculated based on 3 acres per year (three year cycle).
4. Calculated based on 1 acre per year (3 year cycle)
5. Oyster reefs, calculated based on 3 acres per year (three year cycle)
6. Acres in Barnstable waters
7. Little River supports higher density because of rapid water flow rate. Most of Hamblin Pond water flows daily through Little River.

As shown in Table 6-3, the areas being considered for quahog production are using most or the entire available habitat, and for oysters the habitat is being created through the use of trays or oyster reefs. The existing shellfish densities are very low (0.3/ft^2 or less). Although quahogs can grow at densities greater than 25 per ft^2, the plan is based on 4 to 8 per ft^2. Oysters can grow at much higher densities (over 80 per ft^2) but the plan calls for 30 per ft^2.

The estuaries have the carrying capacity for numbers of oysters and quahogs needed based on past populations that were much higher. This plan is to restore shellfish populations by planting hatchery-produced seed. Once established, there is a potential for the populations to become self-sustaining by recruitment from spawning so that annual seeding would not be needed (as was the case years ago before the populations declined), but the cost estimates are based on seeding every year. After water quality is restored (lower algae/TN concentration), the numbers of shellfish needed to maintain restoration would be supported with less algae, but the shellfish would grow more slowly due to lower food (algae) concentrations.

If necessary for future higher nitrogen loads, the shellfish populations and harvests could be increased by planting more seed, and/or by management of the established populations for recruitment from spawning. This would be part of the adaptive management strategy.

Based on the draft MEP Report for the Waquoit Bay system, the amount of nitrogen to be removed by shellfish to achieve the TMDL-N and restore water quality in the Great River, Little River/Hamblin Pond, and Jehu Pond area (DMF area SC16) is about 15% of the total land-derived nitrogen load (calculated from Table ES-1, Howes et. al. 2011). For the Popponesset Bay system, this estimate is approximately 25% (calculated from Table ES-1, Howes et. al. 2004). Shellfish densities and proposed planting area location maps are shown on Figure 6-1 (SC16, Figure 6-2 (SC19) and Figure 6-3 (SC20).

Implementation

The Town Oyster Propagation Project started in the Mashpee River in 2004 with the goal of restoration of oyster populations and fishery that were lost in the 1980s. The specific goal is removal of 500 kg of nitrogen from the river (10% of the 5,000 kg annual N reduction needed). Aquaculture of oysters is from seed (spat) set on clean shell at the Aquacultural Research Corporation (ARC) hatchery in Dennis, MA. In 2008—the best year so far—520,000 oysters were harvested, removing 260 kg of nitrogen (5% of the N reduction needed). The recreational fishery has been restored, and no fish kills have occurred since large numbers of oysters have been growing in the river. (The small number of seed oysters that were in the river during the mass mortality in August 2005 did not have enough biomass to affect water quality and survived the one night anoxic event.). Barnstable County Cooperative Extension and AmeriCorps Cape Cod participate in the project. The project is primarily funded from Town Shellfish Permit fees and more recently local Community Preservation Act funds with some funding from Barnstable County and DMF. Oyster production has increased in recent years at the Mashpee Wampanoag Tribe's oyster farm (commercial shellfish aquaculture area) at the mouth of the Mashpee River. The plan is to increase oyster production in the Mashpee River at the Town Propagation sites and the Tribe's oyster farm for combined harvest of 500 MT of oysters removing 2.5 MT of nitrogen, and expand the Town Oyster Propagation Program into Shoestring Bay for harvest of 400 MT of oysters removing 2.0 MT of nitrogen. Annual harvests would remove about half of the nitrogen needed to restore water quality in the Mashpee River and Shoestring Bay based on the TMDL-N report from DEP (Commonwealth of Massachusetts, 1996).

A new Town propagation project funded by the Community Preservation Act started in 2013 with the goal of harvesting enough quahogs from Great River to remove a metric ton of nitrogen, which is the N removal target there (York, 2013 a and b). Aquaculture of small seed from the hatchery involves growth in upwellers and trays and then planting in sandy bottom under nets to grow larger than one inch before planting in the river. Larger seed has better survival rates than smaller seed because there is more predation of small seed. The plan is to expand this project with the purchase of larger (>1-inch) seed that is ready to plant. After growth, the harvest of about 1,152 metric tons of quahogs (19 million littlenecks) in the Great River, Little River, Hamblin Pond, and Jehu Pond area (SC16, Figure 6-1) would remove about 5.76 MT of nitrogen which is the nitrogen reduction needed to restore water quality based on the MEP report for that area (Howes et al. 2011). There is enough good sandy bottom in the area to support 19 million quahogs at densities that occurred naturally years ago. This would also restore the quahog fishery. There is a good chance that spawns of the restored quahogs would recruit and make the population self-sustaining. If not, annual seeding would be needed. The majority of the nitrogen load in this area (SC16) is from benthic flux, which would not be removed by sewage treatment infrastructure. Restoration of the fishery is a good solution to that problem.

Oyster aquaculture uses gear and/or habitat enhancement (culch) to make up for historic habitat loss. For quahogs, there is enough good habitat remaining in the areas proposed. Habitat maps have been updated by the Mashpee GIS Department with GPS data collected by the Shellfish Constable as shown on Figures 6-1 through 6-3. For example, more than 102 acres of good quahog habitat have been mapped in the SC16 area. The approximately 20 million littleneck quahogs needed to remove the required amount of nitrogen. There would only be at an average density up to 7 per square foot which is within common historical densities and high densities at which quahogs can grow greater than 25 per square foot (up to 50 per square foot in aquaculture and infrequent situations in nature).

Quahog aquaculture would also be applied to Popponesset Creek and Ockway Bay for harvest of 1.46 and 0.87 metric tons of nitrogen respectively (Figure 6-2, SC19). The Ockway Bay population might become self-sustaining from spawning, but the Popponesset Creek area has a higher water flow rate and would probably require annual seeding.

The infrastructure for implementation, management, and maintenance is currently in place and will be expanded as needed. The Board of Selectmen, Town Manager, Shellfish Constable, Waterways Assistants, Shellfish Commission, and Masphee Wampanoag Tribe work together to manage the existing propagation programs and are committed to full implementation of the plan. Existing infrastructure including Carolina Skiffs, barges, and propagation gear will be upgraded as needed. Discussions with ARC hatchery (the proposed seed supplier) have indicated that with sufficient lead-time they could supply the quantities of oyster and quahog seed needed to implement the plan.

The goal of the shellfish program would be to develop one which is self-sustaining; however, costs (as discussed later in this section) are based on annual seeding and an estimated 80% survival rate of quahogs from 1-inch seed and less than 50% of oysters from small spat.

Quantification and Monitoring

When implemented, most of the harvest will be commercial. Commercial harvest data are reported electronically by wholesale dealers to DMF by shellfish area and available on request. Harvesters can only sell to dealers (in some cases, harvesters also have dealer licenses). The non-commercial (family) harvest is monitored by the Town. The nitrogen removed will be calculated from both harvest data sets and the nitrogen content of the shellfish. Samples of shellfish harvested will be analyzed for nitrogen content annually.

Data from ongoing Mashpee Water Quality Monitoring Program (WQMP) will document improvements in total nitrogen concentration, chlorophyll, dissolved oxygen, and other parameters at the sentinel and other stations. The WQMP is a collaboration of the Town of Mashpee (Shellfish Constable, Waterways Commission, and volunteers), Mashpee Wampanoag Tribe (Natural Resources Dept.), and the University of Massachusetts Dartmouth (SMAST). The program continues monitoring with the protocols, sampling stations, and analyses used to prepare MEP and TMDL reports. Water quality parameters measured include conductivity (salinity), chlorophyll, dissolved oxygen, nitrogen (TN, NH_4, NO_2/NO_3, TDN, POC/N), phytoplankton (microscopic identification and counts), Secchi disk visibility, suspended solids, and temperature. In addition, deployed water quality monitoring instruments (YSI sondes) are maintained at several locations in the estuaries collecting data every 15 minutes year-round measuring conductivity (salinity), chlorophyll, dissolved oxygen, pH, turbidity, and temperature. Nitrogen removed by the harvest of shellfish, and water quality monitoring data will be included in 5-year TMDL-N compliance reports.

The Mashpee Water Quality Monitoring program is continuing the same sampling protocols, stations, and analytical methods that were used to provide data for the MEP and TMDL reports for the Popponesset Bay and Waquoit Bay systems. The stations are listed and mapped in the reports (Howes et al. 2004, pp. 88 and 89/Howes et al. 2011, p. 117). Water samples are analyzed at the UMass Dartmouth SMAST certified lab. The protocols, analytical methods documents, and reports from ongoing monitoring (after the MEP reports) are available from Dr. Brian Howes, UMass Dartmouth SMAST.

Cost/Benefit

Annual seeding of oysters would cost $168,000 for oyster seed (spat) set on shell from the hatchery. Annual seeding would not be necessary if spawns from the oysters on the reef made the population self-sustaining.

The cost for 32 million quahog seed (1-inch size) would be $1,280,000. At 80% survival, the projected harvest would be 26,500,000 littlenecks. This would be an annual cost if the population does not become self-sustaining.

The total initial cost for all shellfish seeding would be about $1,500,000. Annual seeding costs would be up to about $1,500,000 depending on the amount of seeding needed. Annual harvest of 12 million oysters would have a landed value ($ paid to the harvester) of $6,000,000, and for 26.5 million littlenecks about $4,000,000 for a total value of about $10,000,000. This could create over 100 shellfish harvesting jobs (commercial shellfishing). There are more than enough skilled harvesters that are unemployed or working in other trades that would shellfish if shellfish populations were restored. The demand for shellfish exceeds the supply. Nationally, a large part of the foreign trade deficit is for seafood including shellfish. An economic multiplier would increase the value in the local economy. Grabowski et al. (2012) conservatively estimate the economic value of oyster reef ecological services at $5,500 to $99,000 per hectare per year. That estimate translates an added benefit of $25,000 to $450,000 of benefit per year for the 10 acres of oyster reef created in Mashpee. If proven as an effective alternative in the long run, potential savings in the avoidance of new sewage treatment infrastructure costs could be in the hundreds of millions of dollars in Mashpee.

6.2.1.2 Shellfish Aquaculture Subarea Impacts

This program would initially start addressing Subareas recharging to all of the Popponesset Bay watershed, and portions of Waquoit Bay watershed feeding to Jehu and Hamblin Ponds which include portions of Barnstable and Falmouth, and influence on portions of Sandwich as well. In general, these shellfish-influenced areas (primarily south of the three major fresh water ponds in Mashpee) are shown on Figure 5-1. This is the start of the adaptive management program allowing the Town to focus hard infrastructure approaches in the Quashnet River/Moonakis River watershed where shellfish aquaculture is not appropriate (as discussed in the next section), and on the Mashpee River watershed where shellfish are not projected to address the entire existing nitrogen load. The development of shellfish aquaculture in these areas will initiate the near-term nitrogen removal in Great River, Jehu Pond, Hamblin Pond (including Little River, Red Brook), Popponesset Bay (including Popponesset Creek, Shoestring and Ockway), and Mashpee River, and the associated monitoring programs that will be used as described in later chapters.

Shellfish Aquaculture will potentially reduce the nitrogen load at the estuaries that is generated from the following watersheds:

- Mashpee River
- Ockway Bay
- Popponesset Creek
- Shoestring Bay
- Jehu Pond
- Great River
- Hamblin Pond (possibly also Red Brook and Lower Red Brook)
- Little River

As a result, a significant collection system cost savings is possible. This will be determined as outlined in the implementation discussion in Chapter 9. These water bodies will be monitored, and then that water quality information will be used in periodic MEP modeling efforts to demonstrate performance of the plan under a long-term program.

Subareas for Waquoit Bay East that without shellfish would require more traditional approaches to deal with existing and future nitrogen loadings for the Hamblin/Jehu, Great/Little River, and Red Brook watersheds include:

- A
- B
- C
- D
- E
- P
- Fal-2 through Fal-11

Subareas for Popponesset Bay that without shellfish would require more traditional approaches to deal with existing and future nitrogen loadings for the associated subwatersheds watersheds include:

- D
- I
- F
- N
- O
- P
- Q
- S
- T
- Barn-37, Barn-39 and Barn-42
- Portions of Sandwich

As shown in Chapter 4, Section 4.6.7, these areas within these watersheds could be phased later or eliminated, reducing collection and treatment costs. However, as will be discussed here and considered in the Environmental Impact Section of Chapter 7, the fallback approach would be the traditional infrastructure discussed in Sections 6.2.3 through 6.2.6.

6.2.2 Wastewater Treatment at Joint Base Cape Cod

The existing Joint Base Cape Cod (JBCC) wastewater treatment facility was constructed in 1996 with various upgrades made through the years including most recently a 2006 upgrade to their SCADA system (CH2MHill, 2012). The facility consists of an extended aeration type oxidation ditch system using the Carrousel® configuration and operating as a modified Ludzak-Ettinger (MLE) process. The headworks to the facility provides grit and screening removal, and is followed by the secondary biological process of anoxic tanks preceding the Carrousel® oxidation ditches. The secondary process is followed by secondary clarifiers, and disinfection and effluent disposal at open sand beds or “rapid infiltration basins” (RIBs) located approximately 10 miles away along the Cape Cod Canal (CH2MHill, 2012). Solids handling consists of storage in aerated sludge holding tanks prior to hauling of the liquid sludge to an offsite facility (CH2MHill, 2012).

As part of the most recent study performed at the site, the remaining hydraulic capacity of the treatment facility was approximately 160,000 gpd of their 360,000 gpd per their current groundwater discharge permit (GWDP). The facility was also estimated to have a total design recharge capacity of 675,000 gpd at their existing sand infiltration beds (based on the largest of the four beds out of service).

The Recommended Plan identifies sending additional flow from the towns of Mashpee and Sandwich (and potentially Falmouth in the future) to the JBCC facility for treatment and recharge through its existing facility. Flows from these areas include: Mashpee at approximately 0.20 mgd, Sandwich at approximately 0.1 mgd, and Falmouth (under a long-term plan) might send 50,000 gpd from the western side of the Quashnet River watershed within the Project Planning Area (PPA).

Based on these values, Table 6-4 summarizes the existing facility flows and proposed upgrade, and Table 6-5 presents the impacts of adding additional community flow. Table 6-6 considers the addition of the

Town of Falmouth west portion of the Moonakis River/Quashnet River watershed, proposed to be treated outside of the PPA. There are other regional discussions regarding the use of these facilities, and those would need to be taken into consideration during negotiation of any agreement with this facility.

Table 6-4 Joint Base Cape Cod WWTF Estimated Design Flows

Joint Base Cape Cod WWTF	Average Annual Design Flow (gpd)	Maximum Month Design Flow (gpd)	Peak Day (gpd)	Recharge Capacity[4]
Existing Design	360,000	430,000	800,000	670,000
Proposed Upgrade Needed to Accommodate PPA	600,000	860,000	1,600,000	670,000

1. Data from 2012 CH2MHill Report, facility permitted for 360,000 gpd average annual (rolling average).
2. Data rounded to two significant figures.
3. Proposed upgrade to add parallel train to accommodate additional flow.
4. With largest bed out of service; 960,000 gpd with all beds in service.
5. PPA (Mashpee, Sandwich, and Falmouth)

Table 6-5 JBCC WWTF with Subarea Flows

Proposed Service Area	Average Annual Flow (gpd)	Maximum Month Flow (gpd)
Mashpee Subareas	200,000	300,000
Sandwich Subareas	110,000	160,000
Total Subareas	**310,000**	**460,000**
JBCC Existing	200,000	240,000
Total (Proposed Facility)	**510,000**	**700,000**
Remaining Capacity	**(150,000)**	**(270,000)**

1. Remaining capacity of existing facility with no upgrade. (360,000 gpd permit minus 510,000 gpd proposed).

Table 6-6 JBCC Proposed Upgrade Requirements

Proposed Upgrade Needed to Accommodate PPA	Average Annual Flow (gpd)	Maximum Month Flow (gpd)
Proposed Upgrade Capacity from Table 6-4	600,000	860,000
Proposed Total Flows from Table 6-5	510,000	700,000
Remaining Capacity	**90,000**	**160,000**
Possible Additional Future Flow from Falmouth	50,000	75,000
Remaining Capacity	**40,000**	**85,000**

The balance of needed capacity as shown in Table 6-6 can be augmented or increased in a couple of ways. The first would be to reduce existing infiltration and inflow (I/I) following the evaluation of the existing collection system, thereby increasing the available capacity for treatment; another option would be to increase the capacity of the new proposed treatment train to accommodate this flow. Both of these would be determined during a more detailed preliminary design and final design. This would allow for additional capacity needs for treatment from other potential sources (in Mashpee or neighboring communities).

6.2.2.1 Proposed Expanded Service Area for JBCC WWTF

The Subareas proposed to be served by expanding the existing facilities at JBCC would include the northwestern sections of the PPA primarily around the Johns Pond/Ashumet Pond areas and portions of Sandwich adjacent to the JBCC boundary. The primary goal of addressing these areas is to reduce the nitrogen load in the Quashnet River watershed which based on the MEP modeling that requires a high level of nitrogen removal in order to achieve the TMDLs, and has also been identified as an area that is not conducive to the use of shellfish to help mitigate the nitrogen impacts to this estuarine system. In addition, addressing these areas will also potentially target development that is located upgradient of Johns Pond and Ashumet Pond, both large fresh water ponds. These areas are identified as:

- Mashpee Subareas H, L, M, and; 0.20 mgd.
- Sandwich Subareas Sand-1, -2, and -3; 0.1 mgd.

In addition, a potential future service area could include the portions of Falmouth within the PPA that are west of the Quashnet/Moonakis River. These areas are identified as:

- Falmouth areas Fal-13 to Fal-17 (potentially to be recharged outside watershed; 0.05 mgd, needed recharge capacity of 0.07 mgd).

It is noted that portions of Subarea H are actually outside of the Waquoit Bay East watershed to the Quashnet River; however, they are part of the Waquoit Bay proper watershed and Childs River subwatersheds. Although nitrogen TMDLs for this watershed have not yet been completed, it is anticipated there will be some level of removal required; and based on the neighborhood aspects of addressing this area in addition to the need for reductions in the entire watershed to improve nitrogen levels in the subembayments, it is still recommended to address areas like this.

6.2.2.2 JBCC WWT Facility Improvements

Collection System:

For the purposes of this planning document, the intention is for these Subareas (identified above) to be pumped directly into the headworks of the JBCC facility; however, following the ongoing studies at JBCC as part of a separate planning and facility evaluation effort, there may be the possibility of connecting Falmouth and Sandwich into the existing collection system. However, anecdotal information has indicated that several portions of the existing collection infrastructure are in need of repair to address operational and I/I issues.

Sewer lengths and number of potential lift stations are considered approximate only, and are presented here as part of the planning process in order to develop comparative costs. Preliminary and detailed design involving land survey, siting considerations, and availability of land will need to be completed to determine the actual lengths and number of stations and/or their location.

The Mashpee service area (Subareas H, L, and M) would be served by the following infrastructure:

- Approximately 15 miles of collection system.
- Approximately two miles of force main.
- Potentially seven lift stations (including the potential of one at the High School Facility). This also includes the existing pumping station that serves the Great Coves and Breezy Acres affordable housing development, pumping to the High School.

This area is shown on Figure 6-4.

The Sandwich service area (Subareas Sand-1, Sand-2, and Sand-3) would be served by the following infrastructure:

- Approximately eight miles of collection system and force main.
- Potentially three lift stations.

This area is shown on Figure 6-5.

The type of collection system technology would be selected during design based on site conditions, survey, Town/District preference, and other considerations. In addition, if the Town of Falmouth were to send flow from the western side of the Moonakis/Quashnet River to JBCC, the Falmouth service area (Subareas Fal-13 through Fal-17) would be served by the following infrastructure:

- Approximately four miles of collection system and force main.
- Approximately five pumping stations.

This area is shown on Figure 6-6.

Open Sand Beds:

It is also presumed that there are no improvements required to the existing open sand beds and transmission system to the existing facilities. These facilities were sized based on 3.5 gpd/sf (CH2MHill, 2012), and it would be recommended that hydraulic load testing be performed at those facilities with the existing treated effluent to determine if a higher loading rate is possible. However, based on the proposed flows under average annual flow conditions, no expansion or higher rate of recharge would be needed even with one bed out of service; and the facility under maximum month conditions appears to be still sufficiently sized with all beds in service while still having additional capacity available.

Wastewater Treatment Facility (WWTF):

The following improvements would be recommended:

- Expansion of the existing two-train 0.36 mgd capacity (average annual) Carrousel® WWTF, expanded to add a parallel train of equal size and an additional secondary clarifier. This third train would be located adjacent to the existing two trains.
- The additional secondary treatment would also require additional pre-anoxic zone.
- Expansion would likely require upgrades to the headworks (grit and screenings removal) and sludge handling facility to accommodate the additional flows.
- Expansion of Supervisory Control and Data Acquisition (SCADA) and controls to accommodate the additional facilities, and miscellaneous electrical improvements will also likely be required.
- Evaluation and reduction of the existing systems I/I that has been documented to improve performance and free up additional capacity. The facility is currently under evaluation by MassDevelopment and the FRP/FEIR would build off recommendations made as part of that evaluation versus conducting a duplicate evaluation. Further recommendations regarding improvements relative to JBCC would come after that report and findings are made public.

The potential layout of this facility is depicted in Figure 6-7.

6.2.3 Wastewater Treatment at Proposed New Facilities

One of these two new facilities is proposed to be located at Site 4, an area of land adjacent to the Mashpee Transfer Station. The Site 4 facility would serve as a central treatment location through the heart of Mashpee and the PPA. The characteristics of this area include:

- Estimated 0.39 mgd (average annual). Initial Phase with Shellfish of 0.1 mgd.
- Initial Subarea (part of S around Falmouth Road).
- Future Subareas (if needed): F, N, balance of S, and T.
- Recharge at Site 4.
- Fallback recharge area at Willowbend Golf Course.
- Treatment performance dependent on recharge location.
- Within watershed (Site 4 or Willowbend golf course), as low as 3 mg/L (depends on average year discharge if only used for certain times of year and shellfish performance). This would need to be a load-based discharge; therefore, performance of less than 10 mg/L could be possible initially.

If the shellfish program is not successful in addressing all of the nitrogen issues as identified in the proposal as summarized in Section 6.2.1, then in order to achieve the TMDLs the Town/District will need to address the balance of the remaining nitrogen through methods that are more conventional. The conventional fallback approach would be the construction of new WWTFs to supplement existing facilities discussed in this Section and 6.2.4, and Joint Base Cape Cod (with fallback to Back Road Site) discussed previously.

The other new facility is proposed to be located at Site 6, an area of land in the southern third of Mashpee that would serve Subareas A, C, D1, D2, E, and Fal-2 through Fal-11.

- Estimated 0.27 mgd (average annual).

Sewer lengths and number of potential lift stations (summarized below) to serve these facilities are considered approximate only, and are presented here as part of the planning process in order to develop comparative costs. Preliminary and detailed design involving land survey, siting considerations, and availability of land will need to be completed to determine the actual lengths and number of stations and/or their location.

Collection System (Site 4):

The targeted areas that would be collected and treated at Site 4 under this plan would include serving Subareas N, F S1, S2, and T.

These subareas would be served by the following infrastructure, as shown in Figures 6-4 through 6-6:

- Approximately 30 miles of collection system.
- Approximately five miles of force main.
- Potentially nine pumping stations.

Collection System (Site 6):

These subareas (A, C, D1 including Popponesset Island, D2, and E) would be served by the following infrastructure, as shown in Figure 6-6:

- Approximately 18 miles of collection system.
- Approximately three miles of force main.
- Potentially 11 pumping stations not including facilities to serve Falmouth.

In addition, if the Town of Falmouth were to send flow from the eastern side of the Moonakis/Quashnet River to Site 6, the Falmouth service area (Subareas Fal-2 through Fal-11) would be served by the following infrastructure:

- Approximately 5 miles of collection system and force main.
- Potentially 10 pumping stations.

Effluent Recharge:

Site 4: These facilities would consist of new open sand beds sized based on 5 gpd/sf. This value is recommended to be negotiated higher based on the findings of the hydraulic load testing performed in 2011 (see Appendix 6-2) and this would be determined (including final shape of the beds) during final design and permitting.

Sand Beds:

- Total of three beds (two needed for maximum month, with one additional out of service)
- Bottom area of each bed is approximately (240 ft x 240 ft))
- Total acres = 4

Site 7/New Seabury Golf Course: These facilities would be the primary recharge location for Site 6. The existing recharge facilities, consisting of subsurface leaching facilities designed to handle 300,000 gpd, would remain to service the New Seabury WWTF and therefore is discussed in a subsequent section. The new facilities would include the installation of drip irrigation facilities at eight potential existing fairways as depicted in Figure 6-8 (including the fairway referred to as Site 7), and their associated supporting infrastructure including distribution pumping, filtration, backwash facilities, and receiving/storage tanks. Because these facilities are not intended for use as irrigation or for additional nitrogen uptake in the vegetation, they are simply intended to be used as recharge facilities located below the root zone of these areas.

The following Table 6-7 summarizes the total estimated recharge capacity for Site 7/New Seabury Golf Course area.

Table 6-7 New Seabury Recharge Facilities Estimated Capacity

Location	Subsurface (gpd – Max. Month)	Drip Irrigation (gpd – Max. Month)
Existing Facility	300,000	NA
Site 7 (2)	500,000	440,000
Additional Golf Course Area	800,000	630,000

Notes:

1. NA – Not applicable
2. Drip is proposed, but the alternative of subsurface is presented as well for comparison.

These capacities are provided as an estimated hydraulic capacity based on potential available area and an estimated loading rate of 2.5 gpd/sf for subsurface and 0.74 gpd/sf for drip irrigation based on DEP guidelines. Detailed site investigation and preliminary design is required to establish the actual available loading rates and available recharge capacity.

*Willowbend Golf Course (expansion/fallback area):*Similar to the facilities proposed at New Seabury, those at Willowbend Golf Course would include drip irrigation installed below the root zone and associated supporting infrastructure to allow distribution beneath the various fairways. During the MEP modeling of the Options that targeted the use of Willowbend, five of the 12 fairways (shown in Figure 6-9) were considered due to their location within the Santuit River Watershed. Because this area is being proposed as a fallback location for recharge, its actual recharge capacity (for TN to the watersheds) would be load-based and therefore could be potentially distributed over a larger area, in addition to the considerations of shellfish propagation that is proposed throughout Shoestring Bay and Popponesset Bay.

The following Table 6-8 summarizes the total estimated recharge capacity for recharge facilities at the Willowbend Golf Course area.

Table 6-8 Willowbend Recharge Facilities Estimated Capacity

Location	Subsurface (gpd – Max. Month)	Drip Irrigation (gpd – Max. Month)
Existing WWTF	132,000	NA
Willowbend Golf North (2)	1,200,000	960,000
Willowbend Golf South (2)	620,000	500,000

Notes:

1. NA – Not applicable
2. Drip is proposed, but the alternative of subsurface is presented as well for comparison.

These capacities are provided as an estimated hydraulic capacity based on potential available area and an estimated loading rate of 2.5 gpd/sf for subsurface and 0.74 gpd/sf for drip irrigation based on DEP guidelines. Detailed site investigation and preliminary design is required to establish the actual available loading rates and available recharge capacity.

Recharge areas are based on those areas considered as part of the original "Option 1A" scenario, however Rock Landing is replaced by Site 7/New Seabury and some flow is now relocated out of the watershed using JBCC instead of Back Roads. The phasing of recharge areas as part of the recommended plan do depend on shellfish use that was not considered during original options. However, if shellfish do not perform and JBCC is not available the recharge patterns follow those established in developing Option 1A. Each option was input into the "rainbow" landuse spreadsheets to estimate loads to the embayments in order to try to mimic those used in the Option 1A scenario.

<u>WWTF (suitable for either Site 4 or 6):</u>

Due to the limited area associated with both of these sites and their location relative to surrounding neighborhoods, it is recommended that either a sequencing batch reactor (SBR) or membrane bio-reactor (MBR) be selected for the treatment process. Both of these could be of modular design allowing a gradual expansion as needed to address the multiple service areas that each could be serving, and can be designed with the flexibility of improving performance from the effluent total nitrogen of less than 6 to 8 mg/L to less than 3 mg/L TN with the addition of denitrification processes. This improvement in performance primarily for Site 4 (as Site 6 would recharge outside the watershed at Site 7) will be predicated on the existing performance of the facility in question, the performance of shellfish aquaculture and monitoring and modeling results regarding TMDL compliance.

SBR facilities would include:

- Headworks (6mm screening and grit removal).
- SBRs for secondary treatment and nitrification/denitrification per design.
- Polishing filter that would be designed for further nitrogen polishing as needed with supplemental carbon addition.

- UV disinfection.
- Sludge handling.

A typical process flow schematic for this process is shown in Figure 6-10.

MBR facilities would include:

- Headworks (1 to 3 mm fine-screens to protect the membranes and grit removal).
- MBRs for secondary treatment and nitrification/denitrification per design with nitrate recycle and supplemental carbon addition.
- Post aeration systems.
- UV disinfection.
- Sludge handling.

A typical process flow schematic for this process is shown in Figure 6-11.

Potential layouts of Sites 4, 6, and Back Road are shown in Figures 6-12, 6-13, and 6-14 respectively.

The need for upgrades to wastewater treatment facilities for additional nitrogen removal will depend on the performance of shellfish program and its effectiveness in removing nitrogen. If improvements are required to meet the TMDLs (based on shellfish results), the first step will be to construct or improve facilities to a higher level of treatment. Ultimately, if the shellfish aquaculture program is not as successful as estimated in the CWMP, these facilities will need to achieve 3mg/L total nitrogen removal and therefore improvements made to these facilities will need to be done so with this taken into consideration.

Sludge Disposal:

Sludge disposal is anticipated to be initially handled by simple sludge storage and hauling during the initial implementation of either of these sites. As the Town/District expands their facilities, it will be necessary to perform a cost-effectiveness analysis to determine the best means to handle sludge. Because of the changing landscape of sludge handling facilities and the recent change in organic waste management by MassDEP, it would be best to make the decision on sludge management at the time of design so that the most cost-effective alternatives can be addressed with greater knowledge of the regional facilities capable of handling solids.

As a summary of other regional facilities and their management approaches, the following identifies how those solids are currently handled. For the purposes of this planning document, liquid sludge is assumed to be less than 2% solids, thickened is assumed to be less than 6% solids, and dewatered is assumed to be greater than 10% solids (and can be more like 15% to 30%).

- Mashpee's existing public/private WWTF—sludge is pumped and hauled off (as liquid sludge).
- Falmouth WWTF—hauls thickened sludge.
- Hyannis WPCF (Barnstable)—hauls thickened sludge.
- Chatham WPCF—hauls dewatered sludge.
- Oak Bluffs WWTF—sends liquid sludge to Edgartown for dewatering.

- Edgartown WWTF—hauls dewatered sludge.
- Provincetown WWTF—hauls thickened sludge.
- Nantucket WWTF—hauls dewatered sludge.

Dewatered sludge typically goes to a regional facility in New Hampshire, and thickened sludge to facilities in Woonsocket or Cranston Rhode Island. Liquid sludge may go to one of many regional facilities for further processing.

6.2.4 Wastewater Treatment at Existing WWTF with Needed Improvements/Expansions/Modifications

Mashpee Commons (currently completing their MBR upgrade)—potentially expand treatment and recharge capacity (site dependent, and dependent on shellfish performance)

- Subareas potentially added: P and possibly N if needed.
- Existing capacity = 0.18 mgd.
- Potential expanded capacity = 0.33 mgd.
- No initial expansion needed, expansion will be based on need to address TMDLs following shellfish aquaculture implementation.

New Seabury—expand recharge capacity, potential future expansion of Subarea B (as fall back to shellfish): (2000 - 2020)[2]

- Existing capacity = 0.3 mgd.
- Potential expanded capacity = 1.0 mgd (drip irrigation) to serve other WWTF sites (Mashpee Commons, Windchime Point, SouthCape Village and Site 6).
- No initial expansion needed until new facilities are constructed at Site 6 or it is determined that additional nitrogen load must be removed from the Mashpee River watershed.
- Possible expansion of recharge for Site 4 if shellfish performance or Willowbend facility not available or if unable to meet TMDLs with added load.

Willowbend—expand recharge capacity, as an alternative for Site 7 recharge from Site 4 WWTF, improved future performance to 3 mg/L TN: (1993 -2013) [2]

- Existing recharge capacity = 0.13 mgd.
- Potential expanded recharge capacity = up to 1.0 mgd (drip irrigation) (hydraulic capacity may be less relative to nitrogen load).
- Potential extension of service to pick up Subarea I (0.05 mgd).
- Evaluate performance needs in conjunction with shellfish results.

Mashpee High School—either abandon facility/convert to pumping station or pump treated effluent in both cases to Joint Base Cape Cod: (1995 – 2015) [2]. Site could also be considered as an alternative to Back Road for WWTF with recharge still remaining at Back Road Site.

Cotuit Meadows: (2010 – 2030) [2]

- Potential extension of service area to pick up less than 5,000 gpd from adjacent areas.

Wampanoag Village: (2010 – 2030) [2]

- Potential extension of service area to pick up an amount of up to 25,000 gpd of flow from adjacent areas. The facility is permitted for up to 40,000 gpd and is anticipated to serve other neighboring areas depending on the build-out potential of the Wampanoag Village.

The performance of the facilities identified above will depend on the shellfish program and its effectiveness. The first step is to improve facilities to a higher level of treatment. Ultimately, if the shellfish aquaculture program is not as successful as estimated in the CWMP, these facilities will need to achieve 3 mg/L total nitrogen removal; therefore improvements made to these facilities will need to be done so with this taken into consideration.

6.2.5 Wastewater Treatment at Existing WWTF

Operating under existing permit, consider upgrade to improve performance (3 to 6 mg/L TN) based on shellfish results and other adaptive management programs. The performance of the facilities discussed in this section will depend on the shellfish program and its effectiveness. The first step is to improve facilities to a higher level of treatment. Ultimately, if the shellfish aquaculture program is not as successful as estimated in the CWMP, these facilities will need to achieve 3 mg/L total nitrogen removal; therefore improvements made to these facilities will need to be done so with this taken into consideration.

Assuming an estimated design life of 20 years[2] the following summarizes construction year and estimated end of design life:

- Forestdale School (1990 – 2010)
- Southport (1997 – 2017)
- South Cape Village (2003 – 2023)
- Stratford Ponds (1996 – 2016)
- Windchime Point (2000 – 2020)
- Mashpee Village (proposed to serve Subarea G – currently under construction)

Special permits issued by the Town are included in Appendix 6-3 as they relate to Stratford Ponds, Willowbend, Windchime Point, and South Cape Village.

The special permit for Willowbend states:

> "If a Town sewer district is established, or the Town establishes a sewer department to oversee operations of sewerage treatment plants within the Town, the sewage treatment facility, collection system and any other appurtenant items and necessary easements shall be transferred upon request of the Town, to it or to the sewer district under terms similar to the water distribution system."

[2] Design life does not mean the facility needs complete replacement, as design life of concrete structures is typically much longer than 20 years, but major mechanical equipment life is typically 20 years.

Similarly, the Windchime Point WWTF includes similar language stating:

> "That the applicant will, upon written request of the Town of Mashpee and after the establishment of a municipal waste water treatment commission (or equivalent governmental entity within the Town of Mashpee) transfer ownership of the waste water sewage treatment plant to the Town of Mashpee, pursuant to M.G.L., Chapter 79, or by agreement with the Town."

In addition the Town has received letters from New Seabury, Willowbend and Mashpee Commons stating their continued willingness to work with the Town regarding the use of their facilities as part of the CWMP/FRP/FEIR. Copies of these letters are included in Appendix 6-3.

6.2.6 Coordination with Adjoining Towns Within Planning Area Recharged Outside Watershed (collection, treatment, and recharge)

- Barnstable: Barn-37, -39, -42 outside watershed (0.08 mgd average annual).
- Falmouth: Fal-13 through Fal-17 (0.05 mgd average annual) – see JBCC option.
- Sandwich: Sand-4, -5, -6, and -8 (0.2 mgd average annual).

Each of these Town's relative prioritization based on the Matrix results is displayed on Figures 4-6, 4-7 and 5-1, where nitrogen load attenuation is taken into consideration.

The Mashpee Shellfish Constable has been in contact with the Barnstable Natural Resources Department regarding coordination of shellfish efforts (as discussed previously in this report).

Mashpee has also been in discussion with the Falmouth WQMC regarding the potential additional studies around the Quashnet/Moonakis River watershed and potential improvements to flushing that could address some of the nitrogen loading to this waterbody.

6.2.7 No Change to Current Practices—Average Flows

As part of the Recommended Plan, several areas were identified within the PPA that could remain on onsite septic systems or I/A systems. The following list summarizes the approximate magnitude of the flows associated with these areas. The flows associated with "Mashpee I/A facilities" is intended to include larger neighborhood areas currently served by individual I/A systems and commercial areas, and does not necessarily include all residential or commercial properties that are on I/A facilities.

- Mashpee I/A facilities (0.02 mgd).
- Mashpee septic systems (0.27 mgd).
- Sandwich septic systems (0.13 mgd).
- Barnstable septic systems (0.07 mgd).
- Falmouth septic systems (0.01 mgd).

The Town/District will need to consider possible wastewater management considerations for operation and maintenance and monitoring of denitrifying on-site systems if considered as a means to achieve TMDL compliance. At a minimum, those facilities allowed to remain on their on-site system should be captured within an operation/maintenance and monitoring database.

Large-scale implementation of denitrifying on-site systems to address TMDL compliance does not lend itself to individual operation, maintenance, and monitoring of these systems. Denitrifying systems are a larger investment that must be properly operated and monitored if they are expected to achieve the required nitrogen removal. They will require operation, maintenance, and monitoring knowledge and skill that is not required for Title 5 systems. Many individual homeowners will not have the skill or desire to properly operate and maintain these systems. Health departments in most towns do not have the resources to regulate large-scale implementation of these systems.

The possible formation of decentralized management districts could address the concerns about maintenance, operations, and monitoring of these systems. A decentralized management district could be set up similar to a sewer or water district through special legislation in the Massachusetts Legislature. That legislation would define the limits, function, and responsibility of the district. The Town or district needs to identify where the responsibility will remain for TMDL/Plan compliance and this should be staffed to provide the following possible functions:

- On-site system records storage:
  - system pumping records
  - system design
  - monitoring and performance data
- System maintenance and repairs.
- Regulatory enforcement.
- Summary reporting on district (watershed) performance.
- Monitoring on other district or watershed issues such as fertilizer usage or stormwater system operations.

This type of entity could report to the Water and Sewer Commissioners, Board of Selectman, Board of Health or other similar entity, depending on the structure selected.

6.2.7.1 Options for Ownership and Management of Decentralized Facilities

Several documents have been developed on the Regional, State, and Federal level discussing management options that can assist the Town of Mashpee or the Water/Sewer District with regards to these management options.

6.2.7.1.1 Federal Guidance

USEPA published the “Voluntary National Guidelines for Management of Onsite and Clustered (Decentralized) Wastewater Treatment Systems” in March 2003. This document presents five different management models that could be employed by a Town or Regional Management Entity. The five models identified are as follows:

Model 1—Homeowner Awareness Model. The homeowner is educated on their system, including operations and maintenance requirements.

Model 2—Maintenance Contract Model. The homeowner is required to contract with a maintenance company to maintain their system, usually for those onsite systems that would go beyond a standard Title 5 system in Massachusetts.

Model 3—Operating Permit Model. This would be applicable to those properties in Mashpee that would be required to have an I/A system based on their location in order to achieve TMDL compliance. This would be similar to a groundwater discharge permit for each individual property falling into this category.

Model 4—Responsible Management Entity (RME) Operation and Maintenance Model. This would be similar to Model 3, except a management district would be responsible for permit compliance; however, the system would still be owned by the homeowner.

Model 5—RME Ownership Model. This is taking Model 4 to the next level where the system ownership and maintenance requirements fall on the management district and the homeowner is no longer responsible for the system.

Currently, most towns essentially operate under Model 1; Model 2 is likely an approach that could be taken in areas where use of on-site systems aren't critical to TMDL compliance, however it allows a Town or District to have a better understanding of their existing on-site systems and provides for greater performance. If TMDL compliance is to be considered (as part of a wider program, if shellfish propagation proves greater performance), Models 3, 4, or 5 would likely need to be implemented in order to confirm performance is being achieved locally (on-site).

6.2.7.1.2 State Guidance

MassDEP prepared a guidance document as part of the Massachusetts Estuaries Project. This document entitled "Embayment Restoration and Guidance for Implementation Strategies" was published in 2003 and discusses several approaches to nitrogen reduction including the formation of management districts.

This document summarizes the advantages of a "District Approach" in dealing with nitrogen reduction, including the flexibility and funding advantages this type of approach to management could provide. The document also identifies the three legal options for creation of such districts:

Massachusetts General Law.

- Formation of "Water Pollution Abatement Districts", as defined under the Massachusetts Clean Water Act.
- Creation of "Independent Water and Sewer Commissions and Inter-municipal Agreements".
- Creation of "Regional Health Districts" for two or more municipalities.

Mashpee is currently in the process of considering the formation of a Water and Sewer District to deal with management of wastewater facilities in the future. A vote during the Spring 2015 Election will determine if the Town moves towards this approach or handles these operational considerations within their existing structure or creates a new Town department.

Special Act of the Legislature.

Allows municipalities to file home-rule petitions requesting enactment of a special law. One example of this on Cape Cod is Provincetown's legislation on the "checkerboard" approach to sewering.

Municipal Home Rule Authority, Bylaws, and Regulations.

Essentially, this provides the municipality the ability to use Zoning Bylaws, General Bylaws, and Local Boards of Health to regulate wastewater. This is likely to come into play with the development of a "Growth/Flow Neutral Bylaw" that would allow the Town or District to be eligible for zero-percent SRF loans under the "O'Leary Bill".

6.2.7.1.3 Regional Guidance

The Cape Cod Commission also developed a "Cape Cod Comprehensive Regional Wastewater Management Strategy Development Project" Report published in June 2003. This document also discussed Wastewater Management Districts.

The formation of a District or Town department to manage these types of systems will be considered as part of any alternative plan.

The Cape Cod Commission has also completed their Draft 208 Plan for the region and are creating tools and generating resources to assist communities on the Cape. Towns are awaiting the final approved 208 Plan expected sometime in early Fall 2015.

6.3 Non-Wastewater Management Components

6.3.1 Stormwater Management

Stormwater impacts from runoff to fresh and salt-water bodies are another major source of contamination, including nitrogen and bacteria. Although best management practices (BMPs) to deal with the various contaminants may differ, their ultimate management practice of reducing or eliminating direct discharges are common. The primary way to manage bacterial contamination is to recharge to the ground allowing the sand to act as a filter; whereas for nitrogen removal, the goal is to direct the stormwater to vegetative areas, wetlands, and treatment type systems designed to biologically remove nitrogen.

There is much public information on the general approaches for applying BMPs for stormwater and the Town of Mashpee is actively requiring their use through their current regulations. Local Bylaws including Zoning Bylaw Section 174-27.2 Stormwater Management identifies the Town's requirements for residential and non-residential development and refers to the MassDEP Stormwater Management Handbook. The regulations also require submission of "…sufficient plans and specifications to demonstrate the location and nature of proposed stormwater facilities for development…". This is also covered in the Town of Mashpee's Annual Report for the NPDES Phase II Small MS4 General Permit. Design of new stormwater facilities shall be in compliance with this document and the MassDEP Stormwater Management Handbook referenced above. A copy of the 2013 Annual report is included in Appendix 4-3.

Towns can also support and promote other landscape methods and practices that can further improve water quality through the management of stormwater at the individual property. Programs like those through the North and South Rivers Watershed Association (serving the coastal areas south of Boston and north of Plymouth) have created programs and information regarding stormwater pollution prevention http://www.nsrwa.org/Page.59.html. At this time, the Town of Mashpee is not requiring retrofitting/upgrading of existing private property.

6.3.2 Fertilizer Management

Fertilizer management is identified as another nitrogen (and phosphorus) source that is currently impacting water resources within the PPA. The CCC has developed model regulations that Town BOHs can adopt regarding Fertilizer Management Regulations. The CCC has designated the entire Cape a Fertilizer Management District of Critical Planning Concern (DCPC), allowing the development of these regulations that can be adopted by local BOHs.

The Town of Mashpee has enacted a Nitrogen Control Bylaw designed to reduce the amount of excess nitrogen entering the Town's Resource Areas and to improve the water quality in Waquoit Bay and Popponesset Bay. A copy of this regulation is located in Appendix 4-3. The Town of Falmouth has also adopted a fertilizer regulation and a copy of this document is also included in Appendix 4-3.

6.3.3 Future Demonstration Projects/Evaluations

Several other additional nitrogen mitigation approaches have also been discussed during the planning process. Although not formally being considered at this time as part of the plan, the Town will be awaiting the findings of the final approved Cape Cod Commission 208 Planning document and the ongoing demonstration projects in Falmouth to consider additional approaches that could be used through adaptive management including:

- Permeable Reactive Barriers
- Wetland restoration projects
- Eco-Toilets

Each of these appear to offer some advantages and disadvantages when considering TMDL compliance, the largest of which involve permitting and long-term monitoring. This is not unlike the shellfish aquaculture; however, shellfish, unlike these technologies, are actively being pursued within Mashpee. Long-term historic monitoring data exists and future monitoring approaches have been established to monitor estuary water quality.

At this time, concerning Eco-Toilets and PRBs, the Town or District would need to create a program to pilot these within the PPA (outside of Falmouth, which could see these types of systems be implemented in that area).

In 2006, a scenario was run through the MEP program related to three bogs/ponds within an area south of Santuit Pond being converted to fresh water ponds to enhance natural attenuation (MEP, 2006). The findings of that study indicated that a larger "capture" area would be required to make this a cost-effective approach, as it was only addressing 10 to 15 upgradient parcels due to the limited depth of the proposed ponds, intersecting only a small portion of groundwater flow from upgradient development. It was then presented that the addition of several more bogs and connection to the Santuit River with greater "management" of flows could lead to a more effective nitrogen removal by passing Santuit Pond outflow through the bog/pond system. It was left that additional study would be required. At that time, the following recommendations were made:

1. Survey the bogs to determine how they could be hydraulically connected.
2. Determine how flood controls would be handled to maximize nitrogen attenuation.

3. Determine the ratio of open water to wetland necessary per bog to improve efficiency.

6.4 Summary

With the components of the Recommended Plan as described in this chapter, Chapter 7 will review the environmental impacts associated with this plan and Chapter 9 will discuss the phasing and implementation of the plan. Table 6-9 presents a summary of the Recommended Plan with and without shellfish aquaculture.

Table 6-9 Summary Table – To Achieve TMDLs (Average Annual Flows, gpd)[(1)]

Treatment and Recharge Location (treated/recharged flows- not capacity)	Recommended Plan (without Shellfish Aquaculture)		Recommended Plan (with Shellfish Aquaculture)	
	Treatment	Recharge	Treatment	Recharge
Existing Facilities				
Joint Base Cape Cod[(2)]	300,000	300,000	300,000	300,000
Southport WWTF	160,000	160,000 [(7)]	160,000	160,000 [(7)]
Mashpee Commons [(3)]	330,000	NS/Site 7	180,000	180,000
South Cape Village	12,000	12,000	12,000	12,000
New Seabury (and expanded recharge)	180,000	780,000	180,000	180,000
Willowbend (and expanded recharge)	120,000	500,000	120,000	120,000
Windchime Point	22,000	22,000	22,000	22,000
Stratford Ponds	30,000	30,000	30,000	30,000
Cotuit Meadows	37,000	37,000	37,000	37,000
Wampanoag Village	15,000	15,000	15,000	15,000
Proposed Facilities				
Site 4[(3)]	390,000	Willowbend	100,000	100,000
Back Road Site/High School (Alternate to JBCC) [(8)]	*200,000*	*200,000*	*200,000*	*200,000*
Site 6	260,000	NS/Site 7	Not Used	Not Used
Mashpee Village	20,000	20,000 [(7)]	20,000	20,000
Sand-1, -2, -3 (Alternate to JBCC)	*100,000*	*100,000*	*100,000*	*100,000*
Outside Watershed				
Sandwich Outside Watershed (Sand-4, -5, -6, -8)	190,000	190,000	[(4,5)]	[(4,5)]
Falmouth Outside Watershed	50,000	50,000[(6)]	50,000	50,000[(6)]
Barnstable Outside Watershed	80,000	190,000	[(4,5)]	[(4,5)]

Table 6-9 Continued

Treatment and Recharge Location (treated/recharged flows- not capacity)	Recommended Plan (without Shellfish Aquaculture)		Recommended Plan (with Shellfish Aquaculture)	
	Treatment	Recharge	Treatment	Recharge
Onsite and I/A Systems				
Existing I/A and Septic Systems (all Towns)	500,000	500,000	500,000	500,000
Total (JBCC option)	2,700,000	2,700,000	1,700,000	1,700,000

Notes:

1. Flows are future average annual flows. Values rounded to two significant figures.
2. JBCC flows only reflect added flows from the PPA not total facility capacity.
3. Secondary recharge from Site 4 may shift to Willowbend in future and Mashpee Commons would need to be recharged at Site 7 with no shellfish.
4. Under shellfish aquaculture, shellfish potentially address flows that would have gone to Sites 4, 6, and out of the watershed from Barnstable, Mashpee, and Sandwich.
5. Town of Mashpee would look to create MOUs with Barnstable and Sandwich to help support the shellfish aquaculture program, which would help cover “fair share” considerations of nitrogen loadings from those neighboring communities on Popponesset Bay.
6. Joint Base Cape Cod is one potential location.
7. If JBCC is not available, needs to be recharged at Back Road Site.
8. Does not include Southport or Mashpee Village, which would have to be recharged (at 3 mg/L TN) at this location if JBCC is not available.

Minimum performance at existing wastewater treatment facilities (based on implementation schedule in Chapter 9) to achieve the nitrogen TMDLs in the embayments, under build-out condition with shellfish successful:

- Existing I/A systems within Mashpee perform at 19 mg/L TN in effluent
- Wampanoag Village WWTF: 8 mg/L TN in effluent
- Site 4 WWTF: 5 mg/L TN in effluent (with recharge shifting to Willowbend Golf Course)
- South Cape Village: 10 mg/L TN in effluent
- Windchime Point: 10 mg/L TN in effluent
- Mashpee Commons: 5 mg/L TN in effluent
- Willowbend WWTF: 5 mg/L TN in effluent
- Stratford Ponds: 10 mg/L TN in effluent
- Cotuit Meadows: 5 mg/L TN in effluent
- Southport: 10 mg/L TN in effluent
- JBCC and New Seabury both discharge outside of the watershed

It is also considered that if JBCC is not available and shellfish are used that the following shifts would be made to the Back Road Site:

- Back Road Site WWTF and recharge: 3 mg/L TN in effluent
- Southport would either need:
  - to treat to 3 mg/L TN and then pump to and recharge at Back Road;
  - pump to Back Road for additional treatment and recharge to achieve 3 mg/L TN; or
  - pump to Back Road WWTF untreated (i.e. convert to a pumping station) and then treat to 3 mg/L TN at the Back Road WWTF

If shellfish performance levels are less than anticipated for TMDL compliance, depending on watershed, any of the WWTF performance levels of TN would need to be improved to levels at or approaching 3 mg/L. This will be dependent on:

- Watershed(s) or subwatershed of interest
- Shellfish performance
- WWTF performance

Costs for the recommended plan with and without shellfish aquaculture are presented below. These costs are presented as total capital costs and a total present worth value of the project when considering long-term operations and maintenance costs at the build-out condition. The costs do not reflect phasing; however, it is presumed that the first phase (discussed in Chapter 9) is the Recommended Plan with shellfish. This phase would include those improvements Site 4, Wampanoag WWTF and associated collection system in conjunction with the shellfish program outlined in this Chapter.

The project costs related to neighboring communities are also included to provide a rough estimate of the total impact of the project. These costs are presented with the understanding that they are dependent on how each of these communities will address the nitrogen removal needs of these estuaries. The costs assume a traditional approach for simplicity and will be dependent on site availability (for those areas where flow needs to be removed from the watershed); memorandums of understanding (to be developed/completed) between the various communities regarding use of joint facilities, system and watershed nitrogen loading responsibility; and will ultimately depend on the actual build-out conditions experienced in each community. Therefore, adaptive management and long-term monitoring and modeling results will be critical in the determination of each community's contribution.

Table 6-10 presents the total capital cost for both the first phase of the Recommended Plan based on shellfish aquaculture managing the bulk of the nitrogen removal in the embayments, and a total capital cost if shellfish and other adaptive management approaches are not considered. If shellfish aquaculture and other adaptive management approaches are not considered, a strictly traditional infrastructure approach is applied. These cost values in Table 6-10 represent an estimated 2017-dollar value. Additional capital expenditure including efforts in neighboring communities will be required to meet the TMDLs within Quashnet River, Mashpee River and possibly Shoestring Bay.

Table 6-10 Estimated Total Capital Cost of Recommended Plan Phase 1 (1, 2,5)

Estimated Capital Costs	Recommended Plan Phase 1 with Shellfish Aquaculture
Shellfish Aquaculture (year one startup)	$1,500,000
Collection System	$20,000,000
Treatment System (3, 4)	$11,000,000
Recharge facility (3, 4)	$1,500,000
Total	**$34,000,000**

1. Values rounded to two significant figures, and include allowances for fiscal, legal and engineering services, and contingency.
2. Values based on an ENR index year of 2017.
3. Treatment costs include new facilities and improvements/upgrades to existing facilities.
4. Estimated costs with shellfish aquaculture presume that existing and future loads are managed through this adaptive management approach.
5. Costs do not include additional studies and evaluations (for example the Moonakis River Evaluation)

Table 6-11 presents an estimate of costs related to TMDL compliance with shellfish aquaculture based on the following conditions:

- Shellfish aquaculture performance based on existing conditions and MEP results.
- Traditional infrastructure used to manage existing conditions and projected future conditions that could occur with increased development and growth in approved areas as presented throughout the CWMP/WNMP process.

In addition, if a traditional infrastructure approach is used to address the entire issue, the project will need to be phased with the costs spread over 20 to 40 years. The resulting costs would be subject to associated inflation and the total project costs would also have to consider any funding opportunities that could be applied for financing purposes (for example SRF loans of 0% or 2%). Those costs are also presented in Table 6-11.

Table 6-11 Estimated Total Capital Cost of Entire Recommended Plan With and Without Shellfish at Build-out (1, 2, 6)

Estimated Capital Costs	Recommended Plan with Shellfish Aquaculture	Recommended Plan without Shellfish Aquaculture
Town of Mashpee Estimate		
Shellfish Aquaculture (yr 1)(7)	$1,300,000	$0
Collection System	$120,000,000	$170,000,000
Treatment System (5)	$32,000,000	$66,000,000
Recharge Facility	$5,400,000	$13,000,000
Mashpee Total	**$160,000,000**	**$250,000,000**
Neighboring Towns Estimate (Barnstable, Falmouth, Sandwich)7		
Shellfish Aquaculture (yr 1)(7)	$200,000	$0
Collection System	$53,000,000	$ 80,000,000
Treatment System (3, 4, 5)	$8,700,000	$ 23,000,000
Recharge Facility (3, 4)	$300,000	$ 2,000,000
Neighboring Town Total	**$62,000,000**	**$110,000,000**
Total	**$220,000.000**	**$ 360,000,000**

Notes:

1. Values rounded to two significant figures, and include allowances for fiscal, legal and engineering services, and contingency.
2. Values based on an ENR index year of 2017, and are based on future flow conditions and TMDL compliance.
3. Treatment costs include new facilities and improvements/upgrades to existing facilities, including allowances for facilities located in Sandwich (not including those proposed to connect to JBCC), and Barnstable (Falmouth assumed to go to JBCC).
4. For neighboring communities of Barnstable, Falmouth, and Sandwich, collection, treatment, and recharge costs were estimated for planning purposes only; actual location, technology type, and site considerations would need to be determined by each individual community.
5. Estimated costs with shellfish aquaculture presume that existing and future loads are managed through this adaptive management approach; that Joint Base Cape Cod is available, and no additional recharge capacity is required at JBCC.
6. Does not consider increasing shellfish aquaculture areas to reduce sewering if shellfish performance is as good or better than projected.
7. Includes potential cost sharing of shellfish aquaculture projects.

Another element in selecting the most cost-effective approach is the consideration of the annual costs to operate and maintain the selected alternatives. It is possible for example to have a very low initial capital cost but the alternative may have very expensive annual costs. Thus, the ratepayers would be burdened with high annual costs although the capital or construction costs were low in comparison.

In order to account for the annual costs as well as the construction costs, a method of developing the total present worth of an alternative is used. The purpose of adding the present worth of the annual operating and maintenance costs to the capital costs (which is the Total Present Worth) is to identify which alternative is the most cost-effective. The state agencies require that an interest rate that is established by the Federal government be used when developing the present worth of the annual costs. Currently, the federal interest rate to be used in a present worth analysis is 3%. First, an estimate is made for the annual costs such as power, labor, chemical costs, and other related costs that would be spent on an annual basis. Then, a factor tied to the specific Federal interest rate is multiplied by the annual costs to calculate the present worth of those 20 years of payments in the future. The capital or initial construction costs of the project would be added to the present worth of the annual costs to develop the Total Present Worth of a project. Table 6-12 presents the estimated annual operation and maintenance (O&M) costs related to the proposed first phase of implementation including shellfish aquaculture.

The annual cost for shellfish aquaculture as presented below also represents the worst-case scenario, in this case if there is no natural reseeding but the areas are reseeded by the Towns each year. The traditional infrastructure O&M also represents the O&M over 20 years if all facilities were built and in operation in the first year, however in reality, these facilities would be constructed in phases as outlined in Chapter 9 and would be staggered so that only once all facilities were constructed (approximately 30+ years out) and operated for another 20 years is what these values would represent.

Table 6-12 Estimated Total Present Worth Cost of the First Phase of Recommended Plan Implementation [1, 2, 3, 4]

Operation and Maintenance Costs	Phase 1 with Shellfish Aquaculture
Shellfish Aquaculture (yr 1) [5]	$1,500,000
Collection System	$100,000
Treatment System	$1,300,000
Recharge Facilities	$30,000
O&M Annual Total	**$2,900,000**
Present Worth O&M	**$44,000,000**
Total Capital Cost (Table 6-10)	**$34,000,000**
Total Present Worth	**$78,000,000**

1. Values rounded to two significant figures, and include allowances for fiscal, legal and engineering services, and contingency.
2. Treatment O&M costs include new facilities and improvements/upgrades to existing facilities.
3. Estimated annual costs with shellfish aquaculture presume that existing and future loads are managed through this adaptive management approach.
4. Total Capital costs based on an ENR index year of 2017.
5. Cost does not include Town staff, which is currently funded by the Town through their existing program.

As stated previously, Phase 1 (as is discussed in Chapter 9) is based on using shellfish aquaculture and Mashpee initiating traditional infrastructure in parts of the Quashnet River and Mashpee River watersheds where shellfish are not proposed or anticipated to achieve TMDL compliance.

Table 6-13 presents the O&M costs and estimated Total Present Worth of the Recommended Plan for TMDL compliance with and without considering shellfish aquaculture at a future build-out condition. These costs are also presented based on a 2017-year and a 20-year timeframe; however, implementation (design, construction, startup, and operation) of these types of facilities would be staggered and therefore the costs would be staggered as well, and this must be taken into consideration when considering the estimated costs.

Estimated costs and their distribution will also be a function of any Inter Municipal Agreements (IMAs), shellfish performance and adaptive management approaches that may result in a reduction in traditional infrastructure needs.

Table 6-13 Estimated Total Present Worth Cost of Recommended Plan at Build-out [1, 4]

Operation and Maintenance Costs	TMDL Compliance with Shellfish Aquaculture	TMDL Compliance without Shellfish Aquaculture
Town of Mashpee Estimate		
Shellfish Aquaculture[7]	$1,300,000	$0
Collection System	$540,000	$1,000,000
Treatment System[2]	$3,100,000	$4,600,000
Recharge Facility[2]	$530,000	$1,200,000
Mashpee Total	**$5,500,000**	**$6,800,000**
Neighboring Towns Estimate (Barnstable, Falmouth, Sandwich)[8]		
Shellfish Aquaculture[7]	$200,000	$0
Collection System	$350,000	$500,000
Treatment System[3]	$660,000	$1,600,000
Recharge Facilities[3]	$4,000	$21,000
Neighboring Town Total	**$1,200,000**	**$2,000,000**
O&M Annual Total [5]	**$6,700,000**	**$ 8,900,000**
Present Worth O&M	**$100,000,000**	**$140,000,000**
Total Capital Cost (Table 6-11) [6]	**$220,000,000**	**$360,000,000**
Total Present Worth	**$320,000,000**	**$500,000,000**

continued

1. Values rounded to two significant figures, and include allowances for fiscal, legal and engineering services, and contingency.
2. Treatment O&M costs include new facilities and improvements/upgrades to existing facilities.
3. Neighboring communities of Barnstable, Falmouth, and Sandwich collection, treatment, and recharge O&M costs were estimated for planning purposes only; actual location, technology type, and site considerations would need to be determined by each individual community.
4. Estimated annual costs with shellfish aquaculture presume that existing and future loads are managed through this adaptive management approach; that Joint Base Cape Cod is available, and no additional recharge capacity is required at JBCC.
5. Costs do not include existing O&M at Joint Base Cape Cod associated with those facilities existing operations.
6. Total Capital costs based on an ENR index year of 2017.
7. Cost does not include Town staff which is currently funded by the Town through their existing program.
8. Includes potential cost sharing of shellfish aquaculture projects.

7 Environmental Evaluations

7.1 Introduction

In accordance with the Massachusetts Environmental Policy Act (MEPA) review process, an Environmental Impact Report (EIR) is required as part of the Town of Mashpee's Watershed Nitrogen Management Planning (WNMP) Project and Comprehensive Wastewater Management Plan (CWMP). The Code of Massachusetts Regulations (301 CMR 11.00, as recently updated in May of 2013) provides the outline for the information required for the EIR and this information is presented therein as well as in the two previous submittals as part of this planning process (the Needs Assessment Report and Alternatives Screening Analysis Report).

This chapter identifies the potentially impacted resources and environments, and considers the impact of the Recommended Plan on both. This chapter will also review the impacts of the "No Action" alternative relative to the same resources.

The primary focus of this plan is to address the total nitrogen TMDLs for Popponesset Bay and Waquoit Bay East through nitrogen management within the Project Planning Area (PPA). The components of this plan are described in Chapter 6 and in general include:

- Expanded shellfish aquaculture in various portions of Popponesset Bay and Waquoit Bay East.
- Use of the wastewater treatment facilities (WWTFs) at Joint Base Cape Cod (JBCC).
- Use of existing facilities within the PPA (WWTFs, I/As, on-site septic systems).
- Potential new facilities at one or two sites, dependent on the shellfish aquaculture performance.
- Potential recharge facilities at existing golf courses using drip irrigation.
- Fallback location if JBCC is unavailable.
- Adaptive management, fertilizer/nitrogen/nutrient bylaw, continued use of storm water Best Management Practices (BMPs).

Mitigation measures for any of these impacts are discussed in Chapter 8 – Draft Section 61 Findings.

7.2 Existing Environment

7.2.1 Introduction

In comparing the potential impacts from the proposed planning efforts, the background information regarding the physical, biological, chemical, economic, and social conditions of the PPA must be outlined. This information was primarily provided as part of the 2007 Needs Assessment Report submitted to MEPA and as part of the Massachusetts Estuaries Project (MEP) Reports; these documents provide much of the background for this EIR. Therefore the section on Existing Environment will only briefly discuss these issues that have been previously discussed in the Needs Assessment Report (NAR) and MEP reports for the two watersheds and then focus on specifics related to existing site conditions of areas specifically called out for facilities as part of the Recommended Plan.

Figure 1-1 illustrates the PPA and its related watersheds. Figure 1-2 illustrates the estimated percentages of nitrogen to be removed by watershed based on the theoretical approaches shown in the MEP reports in order to meet the TMDLs.

7.2.2 Topography, Geology, and Soils

As stated previously, this was identified in Chapter 5 of the 2007 NAR. The general topography of the PPA is illustrated in Figure 7-1. Specific topographical features for each of the sites would be obtained through survey that would be performed during the detailed design phase. Topography is of greatest concern when considering the following:

- Location and type of collection system.
- Location and type of lift/pumping station.
- Effluent recharge system type and location.

Collection system technologies, namely gravity, vacuum, and septic tank effluent gravity (STEG) systems, are influenced the greatest by topography since they rely on some component of gravity in their design. Therefore, rolling topography can create limitations on the extent to which these systems can be installed and thus those areas with this type of topography could have greater impact in terms of road and land disturbance than those systems that rely on pumping (like grinder pump systems and septic tank effluent pump (STEP) systems). Topography can also be related to depth of groundwater and can create a temporary impact during construction in managing dewatering efforts. Topography also relates to the impacts of flood elevation and sea level rise that has to be taken into consideration.

Since topography varies throughout the Town, the mitigation measures (such as erosion control and flood control measures as discussed later) will be site-dependent and technology-dependent. These same types of issues will impact pumping station locations. Since the actual pumping station locations (as needed) would be determined during design (once the extent of the service areas are surveyed); the mitigation measures related to these sites will also be site-dependent.

Potential new recharge locations have been identified at the Willowbend Golf Course, New Seabury Golf Course, Site 4 and possibly the Back Road Site (if JBCC no longer is a viable option). The following summarizes the general topographic and soil conditions that are anticipated at each area.

<u>Willowbend Golf Course</u>

- Each of the fairways under consideration is relatively flat with typically less than 10-feet of elevation change across the fairway.
- The northern fairways range in elevation from 30 to 70 feet above mean sea level (MSL).
- The southern fairways are also relatively flat with elevations ranging from 20 to 50 feet above MSL.

<u>New Seabury Golf Course</u>

- Site 7 has a low area in the center of the fairway and a 10-foot elevation change with fairly steep slopes ranging from 30 to 40 feet above MSL.
- The other fairways also have varying topography and range from 20 to 40 feet above MSL.

Site 4

- Site 4 is a very flat wooded area that is roughly at elevation 70 +/-.
- Soil conditions are discussed in greater detail in the Technical Memorandum included in Appendix 6-2 and are based on the field observations made during the hydraulic loading test performed at the site in 2011.

Back Road Site

- The easternmost of these sites has topography that ranges between 68 and 88 feet with a large portion of the center of the site at roughly 68 to 70 feet in elevation in the form of a "bowl". The westernmost site has a slightly more varying change in elevation from 60 to 100 feet with topography generally sloping from west to east.

The general surficial geology and soils within the PPA are illustrated in Figures 7-2 and 7-3 respectively.

7.2.3 Surface and Groundwater Hydrology and Quality

Surface and groundwater hydrology and quality within the PPA are discussed in Chapter 5 of the 2007 NAR. Surface and groundwater water quality and hydrology are also discussed as part of the MEP reports for the two watersheds in the PPA. As part of the implementation of the Recommended Plan, additional study is required at the Willowbend Golf Course and New Seabury Golf Course regarding groundwater hydrology and the potential impacts to groundwater flow and mounding conditions. General groundwater flow modeling was performed as part of the USGS work documented previously in the NAR and Alternative Screening Analysis Report (ASAR). An additional study was performed as part of this project regarding potential use of Site 4, and this information is presented in Appendix 6-2. Additional work would be necessary if the Back Road Site is used in place of treatment and recharge at the JBCC facility.

Figure 7-4 provides estimated groundwater contours throughout the PPA. USGS is currently studying and developing models to look at the impact of sea-level rise on groundwater.

Volunteers in Mashpee have been monitoring six ponds within the Town since 2001, looking at the following pond characteristics: cholorphyl-a, phosphorus and nitrogen concentrations, and transparency. Samples are collected by the Mashpee Environmental Coalition (MEC) and the samples are tested at UMass Dartmouth. The ponds examined include Ashumet, John's, Santuit, Mashpee-Wakeby, and Moody ponds. The water quality results within each pond vary by year and depth. However, trends of the data appear to show degradation at various levels. Appendix 7-1 includes tables of data provided by this volunteer group.

7.2.4 Air Quality, Green House Gas, and Noise

Air Quality

Air quality data is limited for Mashpee, as we aren't aware of any major air quality studies having been identified. Based on United States Environmental Protection Agency (USEPA) data available at the "AirNow" web page (http://www.airnow.gov/), Barnstable County identified only 0.2 days in June of 2013 as "unhealthy days" for the general population. Summer months for Asthma or Other Lung Disease were also less than a day per month on average and only in the months of May through September.

As for local trends on common air quality levels, these are summarized below based on the graphical information available through the USEPA web page (www.epa.gov/airtrends) as follows:

- Sulfur Dioxide—no local trends available for Barnstable County.
- Carbon Monoxide—no local trends available for Barnstable County.
- Ozone—the closest available data for Barnstable County indicates trending just above the National Standard (most recent value of 0.079 ppm for 2012).
- Lead—no local trends available for Barnstable County.
- Nitrogen Dioxide—only one data point available in 2001 and well below the National Standard of 100 ppb (26 ppb).
- Particulate Matter—no local trends available for Barnstable County.

Greenhouse Gas (GHG)

This CWMP Project is subject to the GHG Emissions Policy and Protocol because the project is required to prepare an EIR in accordance with MEPA. The Project considered the use of the Environmental Protection Agency (EPA) Portfolio Manager as a way to quantify the increase in carbon dioxide equivalent from the proposed new facilities because it is the standard process developed for WWTFs[1]. It was also considered because it is viewed as suitable for WWTFs that are in a planning phase where preliminary or detailed design information has not yet been developed.

The EPA Portfolio Manager is an online tool designed to assess energy and water consumption at a facility. The tool provides a benchmark score which compares the performance of the facility analyzed with similar facilities. The tool also calculates GHG emissions for the facility based on the data entered.

For a municipal wastewater treatment plant, the following inputs are used to determine energy consumption at a facility:

- Zip code.
- Average influent flow.
- Average influent biological oxygen demand (BOD_5).
- Average effluent biological oxygen demand (BOD_5).
- Plant design flow rate.
- Presence of fixed film trickling filtration process.
- Presence of nutrient removal process.
- Annual electricity and fuel usage.

However, because this information for existing and private facilities is not readily available (the Town's one facility does not have its water or electrical usage separated from the school facility which it serves), an analysis on that specific system could not be performed.

[1] GHD has been a contributor to USEPA in the development of this GHG evaluation tool.

Another limitation is that the Portfolio Manager is designed for facilities larger than 0.61 mgd, which is larger than all proposed and existing facilities. As a result these analyses have not been performed and therefore these types (or comparable type) would be planned to be performed at the time of design. The Town plans to design facilities with an acceptable index score.

GHG evaluations are identified in the Section 61 Findings (in Chapter 8 of this report) to track them as any new or expanded Town/District-owned facilities proceed to preliminary or detailed design.

<u>Noise</u>

Similar to air studies, no major studies on noise in Mashpee have been identified, thus no specific data exists for the Planning Area.

In general, major noise within Town would typically be associated with traffic and construction activities in addition to emergency vehicles. Higher noise levels can be expected during the peak summer season when the population increases.

7.2.5 Plant and Animal Species and Habitat

As discussed in the 2007 NAR, there are several locations throughout Mashpee that have been identified as estimated habitats of rare species and wildlife by the Massachusetts Division of Fisheries & Wildlife, as shown in Figure 7-5. In addition, the estuarine habitats of Waquoit Bay and Popponesset Bay are detailed in the technical reports prepared by the MEP and included by reference; these include location and condition of eel grass beds, shellfish areas, and fish habitats. Information regarding shellfish beds proposed for expansion as part of the plan is discussed in Chapter 6.

As part of the initial site investigation, the three primary “greenfield” sites (previously undisturbed areas) were identified: Site 4, Site 6, and Site 2.

<u>Site 4</u>

The following species were identified in 2008 when the project was first discussed with Division of Fisheries and Wildlife:

- Eastern Box Turtle—Special Concern.
- Grasshopper Sparrow—Threatened.

Based on the phasing and implementation timing, an updated request will be made for this site. As stated in the letter from Natural Heritage and Endangered Species Program (NHESP) (included in Appendix 7-2), “We recommend rare species habitat concerns be addressed during the project design phase prior to submission of a formal MESA filing, as avoidance and minimization of impacts to rare species and their habitats is likely to expedite endangered species regulatory review.”

<u>Site 2 and Site 6</u>:

A similar review in 2009 for Sites 2 and 6 was performed, identifying only the Eastern Box Turtle as a Special Concern. The letter in Appendix 7-2 includes a similar statement regarding addressing habitat concerns during design.

Back Road Site:

It is unclear from looking at the aerial photos of the site and the topography if this site was formerly disturbed and used as a gravel pit or had other excavation activities. The location is within the mapped Estimated and/or Priority Rare Species Habitat; however at this time no formal request has been made on the site as it is only being considered if JBCC is not available. Only after the decision is made on that facility from MassDevelopment will the decision be made on whether the Back Road site will be pursued and a formal NHESP filing be made.

It is understood that each of these sites will need an updated review as the Town moves into implementation as part of the permitting process.

7.2.6 Traffic, Transit, Pedestrian, and Bicycle Transportation

In general, the towns of Cape Cod experience a large influx of tourists and visitors during the summer months which create high traffic and greater transit volumes. The Town of Mashpee experiences high traffic volume in the vicinity of the Mashpee Rotary and Mashpee Commons due to its commercial nature and hub of several major arteries entering and leaving Mashpee. Route 28 also experiences significant traffic volume as it is the main corridor from Falmouth to Barnstable.

Although no major traffic studies were included in the scope of this project (due to the nature of the project being focused on wastewater management planning), it is typical for Mashpee to experience (like other Cape towns) the height of traffic during the months of June, July, and August.

The Town has several walking trails, and the majority of its pedestrian traffic is focused in areas like Mashpee Commons. There is also a bike trail along Route 130 starting at Pickerel Cove Road and extending to the Barnstable town line; a bike trail from Route 28 which runs along Great Neck Road south to the Cape Cod Children's Museum; and a bike trail from Mashpee Commons west along Route 151 to Old Barnstable Road.

7.2.7 Scenic Qualities, Open Space, and Recreational Resources

As discussed in the NAR, Mashpee has vast areas of open space, and multiple ponds and salt water embayments providing a variety of scenic and recreational resources.

Mashpee has been very proactive in the purchase and protection of land throughout Town. Mashpee, working with other state and federal agencies, has preserved approximately 4,000 acres over the last 30+ years to: protect natural resources, limit development, and preserve open space for perpetuity.

7.2.8 Historic Structures or Districts and Archeological Sites

Historic Districts

The National register of historic places identifies the following two locations:

- Avant House – also known as Wampanoag Indian Museum (Route 130 at Mill Pond)
- Old Indian Meeting House (410 Meetinghouse Road)

The Mashpee Facility Plan (W&S, 1988) identified four (4) sites of prehistoric archaeological importance, listed on the State Register of Historic Places by the Massachusetts Historical Commission (MHC). These sites are in the vicinity of the Willowbend Development, although the exact locations are kept confidential by the MHC. The Town also performed a more recent Town-wide assessment of potentially sensitive archeological areas (presented in Figure 7-6).

The Mashpee Historical Commission identified and researched various sites within the Town. These sites were identified as important as archaeological sites, historic buildings, or burial grounds. As a result of these efforts, a historic district in the vicinity of the Mashpee Town Hall/Route 130 was accepted at the 2007 Town Meeting and a Historic District Commission was appointed.

In addition, a location-intensive survey was performed on Site 4, and a copy of the Management Abstract is included in Appendix 7-3. As part of that evaluation, the intensive survey did not identify any pre- or post-contact period resources or archaeological deposits. Therefore it was identified that the proposed project site will not affect any potentially significant cultural resources and no further archeological investigations were recommended (PAL, 2010).

Figure 7-6 displays the historical features, districts, and results of the Town-wide archeological work performed within the PPA.

7.2.9 The Built Environment and Human Use of the Project Site (Facilities)

The built environment and human use of the Project Planning Area was described in the NAR and is illustrated in Figure 7-7.

7.2.10 Rare or Unique Features

Some of the rare or unique features of the PPA as described in the NAR include:

- Waquoit Bay Area of Critical Environmental Concern.

7.3 Assessment of Impacts

7.3.1 General

An assessment of impacts is performed to provide a detailed description of the positive and negative potential environmental impacts as they pertain to the preferred plan and the No Action Alternative. The purpose of the EIR is to assess quantitatively, to the extent practicable, the direct and indirect potential environmental impacts of the planned project, as well as the short-term and long-term impacts.

A simple rating system was developed to aid in analyzing the two alternatives and their impacts on the existing conditions in the Project Planning Area. The rating system examines the impact on each parameter discussed previously in this Chapter and assigns it a numerical value of -2, -1, 0, 1, or 2. Negative values represent the magnitudes of the negative impacts of the parameter on the environment, and the positive represent positive impacts. A rating of zero indicates that there it is considered to have either no impact or the impact is considered negligible. Each of the parameters is described briefly in the following section of this chapter.

The ratings are summed for both alternatives to develop a total value and the final ranking of the alternative.

7.3.2 Description of Environmental Features for the Recommended Plan, the Recommended Plan with Shellfish, and No Action Alternative

7.3.2.1 Topography, Geology, and Soils—Soil Disturbance

The disturbance of the topography, geology, and soils for the various approaches is presented below.

1) Recommended Plan without Shellfish.

Existing Wastewater Treatment Facility: The existing WWTF sites throughout Town are located in various settings including residential areas (like New Seabury, Willowbend, Southport, Stratford Ponds, Windchime Point, Cotuit Meadows, and the Wampanoag Village WWTF); some are at schools like Forestdale, and the Mashpee High School; and some are in more commercial areas like Mashpee Commons, South Cape Village; and Joint Base Cape Cod is a special situation in that it is located on a State/Federal Military Reserve. These are all considered disturbed areas and no work is anticipated beyond the bounds of the existing WWTF facilities site footprint. The area should be considered already disturbed.

Sites 4 and 6: Both of these sites are located next to Town facilities (landfill/transfer station and fire station respectively), however the remainder of the sites are relatively undisturbed forested area. Site 4 did have limited clearing and excavation associated with the hydraulic load testing performed as part of this project. Establishment of facilities at these sites will modify the topography and soils in that fill and excavation will take place in order to level the landscape (as needed) to accommodate new wastewater treatment related structures and facilities. Surficial soils will be removed in order to expose the underlying sand. Although the extent of impact to topography and soils will be limited to the site level, the overall, landscape level impact will be minimal given the proximity to and abundance of similar topographical and soil features in the surrounding area. Figures 6-12 and 6-13 illustrate the general extent of site development for each location. Site disturbance during construction will depend on the final design layout with the intent of minimizing disturbance. Restoration and mitigation of each site will be part of final design.

Back Road Site: These sites are located in the northwest corner of Mashpee adjacent to JBCC. Topography of the western-most parcel is relatively flat with sloping sides indicating a possible use as a gravel or sand pit. The eastern-most parcels are relatively flat along their western edge with a sloping hillside to the east. The eastern parcels appear to be relatively undisturbed forest area; whereas the western parcel appears to be a formerly disturbed site. The eastern parcels may require a greater amount of soil disturbance in order to be considered for effluent recharge (open sand) beds because of the topography and relatively undisturbed nature of the site(s). The western site was previously disturbed and its “bowl”-like feature was a result of its previous use as a sand pit for the Otis AFB runway extension in the 1960s. This feature may aid in its use for proposed facilities shown in Figure 6-14 and provide a greater buffer to surrounding areas.

Site 7 / New Seabury / Willowbend Golf Course: These sites would require the installation of subsurface facilities at the two existing golf courses. The plan is calling for the use of drip irrigation to minimize disturbance of these areas. Drip irrigation also minimizes topographical changes as it can follow existing topography. The soils beneath these areas are already considered disturbed during the construction of these developments and golf courses, and therefore it is not considered a major impact. Figures 7-8, 7-9, and 7-10 show the proposed drip irrigation areas and key features and resources near those sites.

Sewer Expansion to Serve Subareas Identified in Chapter 6: This requires construction and expansion of the wastewater collection system, but the soil beneath the roadway is already considered disturbed; these facilities would not change the road surface elevations significantly and thus collection system construction is not considered a major impact.

The extent of soil disturbance and creation of new impervious surfaces (related to roof area, parking, and new access routes) would be determined at the time of design when final selection of the treatment technology and site layouts are made. It is also expected that the Town/District will look to use more compact/modular treatment facilities (like sequencing batch reactors (SBRs) or membrane bio-reactors (MBRs)) versus larger more conventional activated sludge or oxidation ditch type processes that require secondary clarifiers and typically larger tanks, creating larger disturbed sites for areas like Sites 4 or 6.

2) Recommended Plan with Shellfish.

The use of shellfish within the watersheds will allow the Town/District to reduce the amount of traditional infrastructure required for meeting the nitrogen TMDLs and therefore will reduce the amount of traditional infrastructure constructed, thus reducing impacts. There are no foreseen impacts from the addition of shellfish to existing bed areas.

3) No Action Alternative.

This alternative would not increase the level of soil disturbance in these areas over what the Town would expect relative to its development history.

7.3.2.2 Surface Hydrology and Quality

1) Recommended Plan.

The PPA has over 20 ponds and five rivers within its bounds. With proper erosion controls in place during construction, it is expected that negative impacts will be minimized. Implementation of this alternative will greatly benefit these resources as proper wastewater management will decrease the nutrient loadings into the Town’s surface water resources and improve water quality.

Wetlands, bogs, ponds (Johns, Ashumet, Santuit), the Mashpee and Quashnet Rivers, and both Waquoit Bay and Popponesset Bay represent the major surface water bodies (both fresh and salt) potentially impacted (benefited) by wastewater collection and treatment and shellfish aquaculture.

Wastewater collection and treatment at the existing and proposed WWTF and JBCC will produce a higher quality effluent than achievable with on-site septic systems and will improve the water quality by reducing the nitrogen discharged as required by the nitrogen TMDLs. Contaminants of Emerging Concern (CEC) are also better addressed at these types of facilities over conventional Title 5 systems. It is certain that wastewater collection and a high level of treatment will have positive impacts to the health of the water bodies within the PPA.

The treated water recharged at Site 7/New Seabury is outside of the Popponesset Bay and Waquoit Bay watersheds and would flow directly to Nantucket/Vineyard Sound to minimize impact to sensitive surface waters, and is well down-gradient of freshwater systems.

Treated water recharge at Willowbend would be at a higher level of treatment than currently seen at that facility; and as the downstream sensitive receptor is Popponesset Bay, the recharge was modeled through MEP in order to achieve the TMDL.

2) No Action Alternative.

This alternative will negatively impact the environment in terms of surface water hydrology and quality. Excess nitrogen loading and nutrient runoff have caused TMDL values to be assigned to subwatershed areas within the PPA. Without improved wastewater and nutrient management, current conditions will continue to contribute pollutants and degrade surface water conditions in violation of the TMDLs.

7.3.2.3 Groundwater Hydrology and Quality

1) Recommended Plan.

The Town of Mashpee has seven active public drinking water supply wells (at six sites) within the PPA. The increase in treated water recharge has been planned to recharge the groundwater away from these wells. The recharge will be monitored as part of an approved groundwater monitoring plan.

This alternative will improve the groundwater quality, especially in areas of dense development of the PPA, because the groundwater is no longer being impacted by the nutrients and overall recharge from on-site septic systems.

The recharge at the proposed sites is not into a public water supply recharge area. Recharges shall be in accordance with MassDEP groundwater discharge permit requirements.

The treated water recharge at all existing and proposed recharges will have an unknown impact with respect to CECs which are the pharmaceuticals, personal care products, and endocrine disruptors that have unknown impacts to humans and environmental health. However, those areas served by these facilities would be recharged outside Zone IIs or to higher levels as required by MassDEP regulations.

The following are the distances of proposed or potential effluent recharges from Zone II boundaries (from centroid of facility to closest edge of Zone II):

- Site 4—approximately 1,200 feet.
- Back Road Site 1 (Figure 6-11 western-most parcel)—approximately 3,700 feet.
- Back Road Site 3 (Figure 6-11 eastern-most parcel)—approximately 2,800 feet.
- Site 7/New Seabury—closest areas are between 150 and 1,500 feet (depending on the fairway).
- Willowbend—approximately 1,100 feet.

Each of these areas is depicted on Figures 7-8 through 7-11, and 7-13.

Detailed groundwater modeling of potential recharge sites will be completed as part of the groundwater discharge permitting process. Preliminary modeling through USGS and detailed modeling for Site 4 as part of the hydraulic load testing have been performed and are documented as part of this plan. See Appendices 1-3 and 6-2.

2) Recommended Plan with Shellfish.

The use of shellfish will have less of an impact on groundwater hydrology and quality as their use will not reduce the nitrogen sources or address other groundwater contaminants from stormwater or wastewater and therefore will have a negligible impact on groundwater.

3) No Action Alternative.

In terms of groundwater hydrology and quality, this alternative will likely negatively impact the future environmental condition as the continued use of cesspools, Title 5 systems, and existing WWTFs are currently contributing significantly to the nutrient impacts to the PPA groundwater that is ending up in the surface water bodies. These same systems currently located within Zone IIs also release unknown concentrations of CECs and the impacts related to CECs on drinking water supplies are relatively unknown or unquantified.

The Cape Cod Commission has identified the need for the Town to re-evaluate development within Zone IIs when water quality data indicates nitrogen levels over 1 mg/L. It is understood that groundwater quality may be impacted from additional build-out and/or fluxes in seasonal living and tourism in those areas upgradient of drinking water supply wells. Source removal through the recommended plan implementation can start to address this.

The Town has established a nitrogen control bylaw focused primarily on reduction in fertilizer use. This will provide some improvement if no action is taken, as will the Town's continued use of BMPs for stormwater nutrient management.

7.3.2.4 Air Quality and Noise

1) Recommended Plan.

During any construction, dust is often generated onsite. Emissions generated by construction equipment also have negative impacts on air quality. Proper pollution control measures are necessary to reduce these impacts, to provide a positive means to prevent airborne dust, and to reduce vehicle emissions.

Odors generated during operations at existing WWTFs and pumping stations can be limited through the implementation of odor control facilities, although the majority of small existing facilities are located in enclosed tanks below grade or within structures. Onsite systems typically only generate odors during pump-outs, repairs, or system failures. New facilities would be designed with appropriate odor control features to be determined during design.

The majority of noise impacts are generated during the construction phase of any project. The larger the extent of construction, the more noise associated with that work. In Mashpee and its neighboring towns, noise impacts from collection system construction will be greatest in areas of the PPA with narrow streets and where buildings are in close proximity to both the road and each other. Some of these impacts can be mitigated or reduced through local noise ordinances and appropriate construction equipment mufflers.

Construction at the existing WWTFs will typically generate minimal noise impacts on neighboring properties (depending on their remoteness). The greatest impacts would be to those located within residential areas and the least impacts to those at facilities like JBCC and Mashpee Commons (both of which are more isolated). The existing properties have varying degrees of buffer, and depending on the improvements required at each site, those impacts will vary as well.

Modifications to proposed wastewater treatment facilities will be engineered to minimize noise from pumps and blowers by designing the buildings accordingly.

2) Recommended Plan with Shellfish.

Similar to groundwater, shellfish will have a negligible impact on noise or air quality during operation; however it is anticipated that with the use of shellfish to remove nitrogen, the amount of traditional infrastructure will be reduced, which will reduce the amount of noise and dust generated during traditional construction activities. There may be some odor issues related to shellfish propagation but those should be localized to the various shellfish bed locations.

3) No Action Alternative.

This alternative would not decrease the air quality or increase noise due to the actual construction of the project. However, this alternative may actually decrease air quality in terms of odors from failing septic systems or surface waters that become eutrophic from the nitrogen and phosphorus in the septic system effluent.

7.3.2.5 Plant and Animal Species and Habitat

1) Recommended Plan.

As discussed above, GHD has submitted requests for information to NHESP in order to ascertain which protected species were known to be present within certain sites in the PPA (Sites 2, 4, and 6). The responses were discussed earlier in this chapter. Prior to construction, a permit will be filed with NHESP in order to obtain a site-specific determination with respect to the species in question. NHESP will also identify whether any mitigation effort is necessary. It is expected that this alternative will have limited negative impacts on plant and animal habitat with proper notifications and planning; and that the increase in environmental quality to surrounding habitat areas would outweigh the temporary construction impacts. Figure 7-5 illustrates the combined habitat areas that are present in the PPA.

Back Road site is also proposed in an area identified as a habitat area; however no information requests for that site have been submitted to date. If JBCC is no longer a viable option; the project proponent will file the necessary permitting.

Additionally, preliminary site plans are shown in Figures 6-12 through 6-14, and Figures 7-11 through 7-13 which outline various resources such as estimated habitat area, wetland delineations, vernal pools, 100-foot buffer zones, and flood zones for these sites.

The NHESP notes that wastewater collection systems within Priority and Estimated Habitat proposed within lawfully paved, developed, and or landscaped areas may be exempt from MESA review pursuant to 321 CMR 10.14, which states: "[t]he following Projects and Activities shall be exempt from the requirements of321 CMR 10.18 through 10.23 ... "

> [6] Construction, repair, replacement or maintenance of septic systems, private sewage treatment facilities, utility lines, sewer lines, or residential water supply wells within existing paved areas and lawfully developed and maintained lawns or landscaped areas, provided there is no expansion of such existing paved, lawn and landscaped areas;

It is expected that the increase in environmental quality to surrounding habitat areas would outweigh the temporary construction impacts. There will be positive benefits to the health of Waquoit Bay and Popponesset Bay with this alternative, and these benefits are expected to increase over time with the decreased nutrient loading to the environment.

Each site will also have to consider possible fragmentation of habitat. As the preliminary site plans are developed and as part of the initial planning process, proposed facilities would be located in order to minimize this, for example the Site 4 facilities are located closer to the existing transfer station to maximize buffer areas and minimize disturbance as much as possible. Compact site layouts are also being considered as shown for each site. These efforts during design will need to be in coordination with NHESP and CCC.

2) Recommended Plan with Shellfish.

The expanded use of shellfish has the potential to improve the sensitive habitats through the removal of nitrogen (and improved water quality). In addition there is potential for the added benefit of recreational shellfishing, expansion of lost shellfish habitat, and resources once native to the area. This also has the benefit of reducing the impact on habitat areas that might be necessary for collection, treatment, or recharge facilities related to a larger traditional approach. Oyster aquaculture increases habitat and species diversity. Bottom planting of quahogs leaves the sediment surface available for other species.

3) No Action Alternative.

This alternative would continue to increase the nutrient loading to the marine estuaries, rivers, and freshwater ponds in the area. The increase in nitrogen and phosphorus loading would have increased—and possibly irreversible—adverse effects on the marine plant and animal species, specifically shellfish species. It is unknown what other future development might occur on these properties in the future or their impacts on these sensitive habitats.

7.3.2.6 Traffic, Transit, and Pedestrian and Bicycle Transportation

1) Recommended Plan.

This alternative is expected to have limited short-term negative impacts on traffic and transit, and minimal short-term effects on pedestrian and bicycle transportation. This alternative is likely to increase traffic during various phases of the construction project. However, with regulated traffic control measures and the effective management of the traffic, the public burden will be decreased. It is not anticipated that there would be any significant increase in vehicle traffic associated with construction of new WWTFs.

Regardless of any new facility's(s) trip generation, Minimum Performance Standard (MPS) TR1.8 (Traffic) requires acceptable sight distances at all access and/or egress locations for DRIs. With a special concern to a site with a high percentage of truck traffic, it is recommended that the Town provide confirmation to the Commission that any new treatment facility(s) shall be sited such that any new driveway have sufficient sight distances that meet the stricter of the Massachusetts Department of Transportation and American Association of State Highway Transportation Officials guidelines for safe stopping sight distances.

2) Recommended Plan with Shellfish.

The addition of shellfish use will reduce the impacts of a larger traditional infrastructure approach.

3) No Action Alternative.

This alternative would have no effects on the traffic, transit, and pedestrian and bicycle transportation aspect of the existing environment.

7.3.2.7 Scenic Qualities, Open Space, and Recreational Resources

1) Recommended Plan.

With this alternative, it is unlikely that protected open space will be negatively disturbed. The implementation of this alternative would decrease overall negative environmental impacts to the protected open spaces in the PPA currently being created by the high nitrogen loadings, specifically to recreational water body areas such as ponds and beaches. These adverse nitrogen impacts are a direct contributor to scenic quality degradation, and therefore reduction/removal of nitrogen from the watershed will have a positive impact on these resources.

2) Recommended Plan with Shellfish.

The use of shellfish aquaculture is proposed to provide a positive water quality impact, similar to more traditional approaches for water quality improvement through source removal. However, shellfish aquaculture has the potential to have a limited impact on scenic qualities and recreation. This impact will depend on the type of systems used for upwelling, if artificial substrate (like bags or racks) are used for growth, and lastly how the shellfish growth and habitats are constructed/installed within the estuaries. Currently the Town of Mashpee shellfish program does not call for artificial substrate to be used, but may call for the use of cultch in the formation of oyster reefs. The level of impact is also dependent on the acreage of the area to be seeded within the embayments.

3) No Action Alternative.

With this alternative, no disturbance to protected open space is anticipated. However, by allowing the elevated nutrient loadings in the PPA to continue, they will increasingly impact the environment adversely in the long-term. With this alternative there is a potential that recreationally zoned resources or scenic qualities will be affected by the decreasing environmental health of the embayments, rivers, freshwater bodies, and the numerous public beaches and landings associated with those areas.

7.3.2.8 Historic Structures or Districts and Archaeological Sites

1) Recommended Plan.

Mashpee has a rich history and has several archeologically “significant” locations as discussed in the NAR. With this alternative, it is unlikely that historic structures, historic districts, or archaeological sites located within the PPA will be adversely affected by collection system installation.

Based on the work performed at Site 4, no impact is anticipated regarding future development of that property (see Appendix 7-3). Based on comments from Massachusetts Historical Commission, locational archeological surveys would be required at Site 2 or 6 similar to those performed at Site 4. Site 7 was also reviewed and although a disturbed site, it was requested that a qualified archaeologist monitor construction at this site. Therefore there is potential for disturbance of archaeologically significant sites, however it is less likely at a previously disturbed area like the existing golf courses.

2) Recommended Plan with Shellfish.

The use of shellfish, similar to other characteristics, reduces the potential for historic/archaeological impacts that could occur during a larger traditional construction approach.

3) No Action Alternative.

With this alternative, it is unlikely that historic structures, historic districts, or archaeological sites will be adversely impacted, unless other projects were recommended for these sites.

7.3.2.9 Built Environment and Demographics

1) Recommended Plan.

Improved wastewater treatment and extended collection system is perceived to increase growth in the PPA if the Town(s) are not prepared to integrate these improvements with their current zoning requirements, and potential future growth management approaches and controls. Unregulated growth due to sewer expansion would be considered a negative impact, unless an area has been identified as a growth-incentive type of zone or has already reached its build-out potential. In addition, the Town /District may be required to acquire land or establish right-of-ways in order to expand upon the existing collection systems, or for construction of new collection systems. This result may be considered a negative impact to the current owners of those properties.

Adversely, increased growth (without Town-wide sewering) in Mashpee and its neighbors within the PPA has contributed to an added strain on the current environmental condition and the surrounding natural resources. This alternative provides an effective solution to the nitrogen loading issue, manages wastewater nutrient loading positively, and can be done with appropriate community planning in mind.

The Town of Mashpee has done an excellent job tracking future development and in many cases the Plan will be addressing some of these already planned areas approved for development. In addition, if the Town/District seeks to apply for zero-percent loans through State Revolving Funds (SRF) they will need to develop a Flow Neutral Bylaw to aid in the management of future growth and wastewater flow.

2) Recommended Plan with Shellfish.

The expansion of shellfish resources can have many positive impacts such as attracting additional revenue and commercial uses as the resources are expanded. Because there is still some traditional infrastructure required, negative impacts remain, primarily due to the traditional infrastructure construction still required. However, unlike the other approaches, this has the potential for additional positive growth in business and economy.

3) No Action Alternative.

With this alternative, population growth is a likely key contributing factor to the negative impacts of this alternative. Existing data shows multiple watersheds in the PPA with increased cumulative nitrogen levels. Uncontrolled growth or growth without an appropriate plan to manage and foster it properly is a concern when working in towns on Cape Cod. Growth in Mashpee has continued over the years without extensive centralized wastewater treatment facilities with mixed results on the impacts to the embayments. If population is assumed to continue to grow, the Town will continue to see some level of negative environmental impacts to its resources without appropriate controls.

7.3.2.10 Rare or Unique Features of the Site and Environs

1) Recommended Plan.

This alternative is not expected to impose any negative impacts on the unique features of the Town of Mashpee. The Waquoit Bay vicinity was designated as an Area of Critical Environmental Concern (ACEC) by the Commonwealth in 1979 and as a National Estuarine Research Reserve by the United States government in 1988 (see Figure 7-5 for ACEC designation area). At that time the Waquoit Bay National Estuarine Research Reserve (WBNERR) was created and is jointly managed by the Massachusetts Department of Conservation and Recreation (DCR) and the National Oceanic and Atmospheric Administration (NOAA). It is both a State Park and research facility with a mission for the protection of representative natural resources, to facilitate research of the coastal environment, and promote education about management of coastal resources. (Source: http://www.waquoitbayreserve.org/about/)

Wastewater management and effective nitrogen management will be a positive impact to the ACEC in that estuarine health will begin to improve.

With proper mitigation measures and inter-municipal/interagency coordination, this alternative will have a long-term positive impact on the rare or unique features of the site and environment.

2) Recommended Plan with Shellfish.

This approach has the same relative impacts as the approaches without shellfish, positive towards the improved embayment qualities, and some developmental impacts related to the systems needed to support shellfish growth as they related to the areas like Waquoit Bay. Shellfish aquaculture will potentially provide a more rapid remediation and has potential long-term benefits to the benthic flux and benthic communities.

3) No Action Alternative.

With this alternative, there is no new direct threat or impact to the Waquoit ACEC; however impairments to the area will continue if no action is taken.

7.3.2.11 Public Health

1) Recommended Plan.

Use of traditional infrastructure will have the greatest positive impact to protect public health through the removal of a large number of standard Title 5 septic systems and replacing them with facilities designed for a higher level of treatment (including the potential benefit of CEC removal and other contaminants from within Zone II areas with septic systems). This will also provide a greater level of protection to private wells within the planning area.

2) Recommended Plan with Shellfish.

The primary differences with the use of shellfish is the public health benefits are potentially lower as its use does not target and reduce contaminate sources directly. There is also the potential risk of food contamination that could come with any food supply where not all outside influences are controlled (as would be the case of a natural system that could be impacted from groundwater or surface water contamination). In addition, under this approach fewer of the existing septic systems would be replaced (fewer sources removed) as the nitrogen is being addressed at the embayment directly by the shellfish.

3) No Action Alternative.

Septic systems provide a greater level of protection than not having them; but as with the no action alternative, failed septic systems, shellfish bed closures, CECs, nitrogen impacts to groundwater and Zone IIs, and beach closures due to those systems and stormwater impacts will continue.

7.4 Environmental Impact Assessment and Summary of Evaluations

The Recommended Plan (with and without shellfish aquaculture) and the No Action Alternative were rated and ranked based on the criteria established and discussed previously in this Chapter as required by The Code of Massachusetts Regulations (301 CMR 11.07). Table 7-1 summarizes simple ranking analysis for the "No Action Alternative" versus the Recommended Plan(s)[2], and although this ranking system is subjective, it does allow decision-makers a quantitative analysis of these approaches to addressing the nitrogen TMDLs.

Each potentially impacted feature is divided into three sections related to implementation: Acquisition, Development, and Operation. Acquisition is related to the site design, site ownership/purchase, and permitting field work. Development is typically related to the construction aspects or rollout of a particular option related to the feature. Operation is associated with long-term operation of the alternative whether it be traditional wastewater/stormwater treatment, alternative approaches like shellfish, or existing operational approaches associated with existing WWTF, septic systems, etc. A value of "0" is assigned to any feature with negligible impact either positive or negative. A "-1" or "+1" are assigned if there is a limited to moderate negative or positive impact related to the feature, and "-2" and "+2" indicate significant impact.

Table 7-1 shows that overall the Recommended Plan with shellfish as presented has the largest positive impact on the existing environment with a ranking of "5"[3] indicating a slight positive environmental impact. The No Action Alternative shows a significant overall negative impact on the existing environment ranking with "-24". The contingency plan (i.e. Recommended Plan without shellfish) has a slight negative environmental impact of "-2" but is still 22 points higher than the "No Action" and only 7 points lower than using shellfish.

[2] With and without shellfish aquaculture.
[3] Lowest possible score is -66, and highest possible score is +66; with a neutral (no significant positive or negative rating) score of "0".

Table 7-1 Environmental Impact Assessment

Impacted Feature	No Action	Recommended Plan (No Shellfish)	Recommended Plan (with Shellfish)
Soil Disturbance			
Acquisition	0	-1	0
Development	-1	-2	-1
Operation	0	0	0
Surface Quality and Hydrology			
Acquisition	0	0	0
Development	-2	0	-1
Operation	-2	2	2
Groundwater Quality and Hydrology			
Acquisition	0	0	0
Development	-2	0	0
Operation	-2	2	-1
Air Quality and Noise			
Acquisition	0	0	0
Development	-1	-2	-1
Operation	-1	0	0
Plant and Animal Species and Habitat			
Acquisition	0	-1	1
Development	-1	-2	1
Operation	-1	1	2
Traffic, Transit, and Pedestrian and Bicycle Transportation			
Acquisition	0	0	0
Development	-1	-2	-1
Operation	-1	-1	0
Scenic Qualities, Open Space and Recreational Resources			
Acquisition	0	0	-1
Development	-1	-1	-1
Operation	-2	2	2
Historic Structures or Districts, and Archaeological Sites			
Acquisition	0	0	0
Development	-1	-1	0
Operation	0	0	0

Impacted Feature	No Action	Recommended Plan (No Shellfish)	Recommended Plan (with Shellfish)
Built Environment and Demographics			
Acquisition	0	1	2
Development	-1	-2	-1
Operation	0	0	1
Rare or Unique Features of the Site and Environs			
Acquisition	0	0	0
Development	-1	-1	-1
Operation	-2	2	2
Public Health			
Acquisition	0	0	0
Development	0	0	0
Operation	-1	2	1
Total:	***-24***	***-2***	***5***
RANK	**3**	**2**	**1**

The positive impacts related to operation of the proposed Recommended Plan in regards to Public Health, Rare or Unique Features of the PPA and Environs, Scenic Quality, Open Space and Recreation, and Groundwater make the difference in the various alternatives. This is consistent with the findings of the previous studies and evaluations, indicating that the historic and current growth/development within the PPA has resulted in negative impacts from nutrients and other wastewater/stormwater contaminants to groundwater, coastal estuaries, and freshwater systems and their related habitats for all species (endangered, protected, or neither). However, the positive impacts will only come following the related short-term disturbances of construction, specifically sewers. These short-term impacts are then reduced/ minimized through the implementation of shellfish aquaculture, application of Best Management Practices for stormwater and fertilizer, and other mitigation measures.

Factors of cost and other non-monetary issues developed in the Alternative Screening Analysis Report (ASAR) and as discussed in Chapter 6 of this report must be used in combination with the Environmental Impact Analysis ranking.

7.5 Regulation Standards

7.5.1 General

A detailed outline of the regulatory issues associated with the Town of Mashpee's WNMP/CWMP was discussed in Chapter 3 of the NAR developed for this project in 2007. This section summarizes the major regulatory issues associated with this phase of the project and discusses in more detail any regulations which may have changed since the 2007 NAR. Draft Section 61 Findings for State Agency Actions are outlined in Chapter 8, which provides a summary of permits and approvals that will likely be required for implementation of the Recommended Plan.

Federal regulations are contained in the Code of Federal Regulations (CFR) and are enforced by USEPA. Massachusetts regulations are contained in the Code of Massachusetts Regulations (CMR) and

Massachusetts General Law (M.G.L.) and are enforced by the Massachusetts Department of Environmental Protection (MassDEP). There are also regional and local regulations which may be enforced by the Cape Cod Commission (CCC), the Town of Mashpee and related departments, and those similar departments from neighboring communities as it relates to work performed within their town borders.

7.5.2 Federal Regulatory Issues

7.5.2.1 NEPA

The National Environmental Policy Act of 1970 (NEPA) provides the basis for the protection of the environment. The NEPA process is designed to aid public officials in the decision-making process regarding the use of federal property and provide an understanding of the environmental consequences of that use. The NEPA process would require the filing of an Environmental Impact Statement (EIS) with regards to any proposed site usage on or adjacent to federal property which could potentially impact that property.

7.5.2.2 TMDLs

The Federal Clean Water Act requires states to develop a list of impaired waters, which are waters that are unable to meet state-established water quality standards for their intended use (i.e., drinking water supply, fishing, recreational swimming and boating, or healthy ecosystems for plants and animals). States are then required to develop TMDLs for the impaired waters that are affected by pollutants. A TMDL is a determination of the maximum amount of pollutants that a body of water can withstand.

Once TMDLs are determined, MassDEP develops a draft TMDL report, followed by a public review and comment period. After addressing public comments, MassDEP submits the TMDL report to USEPA for formal approval. The TMDL development process requires that communities develop plans to restore the health of water bodies and then make progress toward implementation of the plans. MassDEP monitors the progress of communities in achieving TMDLs. Restoration of water bodies is an extended process, so MassDEP looks for reasonable progress; if no reasonable progress is being made, enforcement actions may be taken.

7.5.3 State Regulations

7.5.3.1 MEPA Environmental Review

CWMP projects in Massachusetts include an environmental review process that is governed by MEPA and Cape Cod Commission's DRI review process. In general, the MEPA process, as described in 301 CMR 11.00, establishes thresholds, procedures, and timetables for a multi-level review process. If a project exceeds review thresholds or if state funding is requested for a project, the project proponent begins the review process by preparing and filing an Environmental Notification Form (ENF) with the Secretary of Environmental Affairs. A 30-day review period follows, during which the Secretary of Environmental Affairs receives agency and public comments, and holds a site visit and consultation session. At the close of the ENF review period, the Secretary of Energy and Environmental Affairs determines whether an Environmental Impact Report is necessary and issues a MEPA certificate. If an Environmental Impact Report is required, it is prepared by the proponent and submitted to the Secretary of Energy and Environmental Affairs. The Environmental Impact Report is reviewed at both draft and final stages by agencies and the public. After completion of the Secretary's review, state agencies may act on the project.

The CCC through the development of the updated 208 Plan has identified that some of the regulatory processes related to CWMPs are or will be changing including the development of Targeted Watershed Management Plans and watershed-based permits at the State level. As these regulations are finalized they will become part of the review process moving forward.

There are several more specific state regulations which apply to this WNMP/CWMP. These include: The Wetlands Protection Act (M.G.L. c.131, s.40) and parallel state regulations (310 CMR 10.00) and amendment (Massachusetts Rivers Protection Act); Title 5 of the Massachusetts State Environmental Code (310 CMR 15.00); MassDEP regulation of Water Resources, Treatment and Supply of Potable Water as they closely parallel the Federal regulations of 40 CFR 141, 142, and 143 which are maintained and enforced by the USEPA (310 CMR 22.00); Surface Water Discharge Permit Program (314 CMR 3.00); proposed revisions to the Ground Water Discharge Permitting Program Regulations (314 CMR 5.00) which will incorporate the Ground Water Quality Standards (314 CMR 6.00) which will eliminate the need for 314 CMR 6.00; Sewer Extension and Connection Permit Program (314 CMR 7.00); the Reclaimed Water Permit Program and Standards Regulations (314 CMR 20.00); and the Massachusetts Natural Heritage & Endangered Species Program.

7.5.4 Regional

7.5.4.1 The Development of Regional Impact (DRI) Review Process

In accordance with the Cape Cod Commission Act, Chapter 716, the Cape Cod Commission has the authority to review and regulate DRIs. This review is carried out by the Commissioners and the Cape Cod Commission staff in accordance with Administrative and Enabling regulations.

The project has entered the MEPA/CCC joint review process and will enter the DRI process after the project has received the Secretary's Certificate on the review of the WNMP/CWMP/FEIR document.

7.5.4.2 Cape Cod Commission Regional Policy Plan

The Cape Cod Commission Act calls for an update to the plan every five years (previous editions were released in 1991, 1996, and 2002). The current Regional Policy Plan went into effect October 30, 2008. The Commission is currently working on an update to the Regional Policy Plan.

The minimum performance standards and other development review policies of the Regional Policy Plan are intended to be used by both the Cape Cod Commission and local regulatory authorities once they have adopted a Local Comprehensive Plan (LCP) and it has been certified by the Cape Cod Commission. The goal of the water resources minimum performance standards is to preserve the high quality of the groundwater (the source of Cape Cod's drinking water) as well as the marine and fresh surface waters, which are connected to and dependent on the groundwater for ecological health and sustenance. The water resources classification system includes the following: drinking water, coastal embayments, ponds, sewage treatment facility standards, stormwater management standards, and natural resources standards. The reader is directed to the most current Regional Policy Plan for further information specifically relating to the minimum performance standards developed for each goal. Overall, the water resources minimum performance standards state a maximum nitrogen load of five parts per million unless there will be no adverse impacts on resources.

The Cape Cod Commission is also in the process of updating the 1978 Section 208 Water Quality Management Plan for Cape Cod. The CCC through the development of the updated 208 Plan has identified that some of the regulatory processes related to CWMPs are or will be changing including the development of Targeted Watershed Management Plans and watershed based permits at the Regional level. As these regulations are finalized they will become part of the review process moving forward.

7.5.5 Local

In addition to those identified in the Needs Assessment, the Town of Mashpee has developed a fertilizer Nitrogen Control Bylaw designed to reduce the amount of excess nitrogen entering the Town's Resource Areas and to improve the water quality in Waquoit Bay and Popponesset Bay. A copy of this bylaw is included in Appendix 4-3.

8 Draft Section 61 Findings and Mitigation Measures

8.1 Introduction

The purpose of this Chapter is to discuss and summarize the Draft Section 61 Findings for State Agency Action. It also identifies planned mitigation measures for those impacts identified in Chapter 7 of this report.

Draft Section 61 Findings are outlined in the Massachusetts Environmental Policy Act (MEPA) Regulations 301 CMR 11.07, in accordance with M.G.L. c. 30, Section 61 for all State agency actions. These regulations require that each agency, department, board, commission, and authority of the Commonwealth "review, evaluate, and determine the impact on the natural environment of all works, project or activities conducted by them and shall use all practicable means and measures to minimize damage to the environment." The regulation also states that "Any determination made by an agency of the Commonwealth shall include a finding describing the environmental impact, if any, of the project and a finding that all feasible measures have been taken to avoid or minimize said impact."

This Chapter first identifies the various regulatory agencies and general review requirements anticipated to be part of the implementation of the proposed Recommended Plan. Following the identification of those requirements, the various mitigation measures anticipated during implementation and operation of the Recommended Plan are discussed. It should be understood that because of the length of time anticipated for the implementation of such a plan, both regulations and anticipated impacts may change and therefore this is intended to capture the main requirements and provide an overview of mitigation. Detailed mitigation measures will be formalized during permitting and final design of any particular component of the plan.

8.2 Draft Section 61 Findings for State Agency Actions

The anticipated State agency actions are listed below. These actions summarize permits and approvals that will likely be required for implementation of the Recommended Plan.

- U.S. Environmental Protection Agency (USEPA), National Pollutant Discharge Elimination System (NPDES) Permitting Program (as applicable), under 40 CFR Chapter 1, Section 122.26 (15) for NPDES Stormwater Permit for Construction Activities and review of developed Stormwater Pollution Prevention Plan (SWPPP).
- Department of the Army, New England District, Corps of Engineers (as applicable), Permit requirement under Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403); Permit requirement under Section 404 of the Clean Water Act; Massachusetts Programmatic General Permit (PGP) or Category II or III Individual Permit.
- Massachusetts Executive Office of Energy and Environmental Affairs (EOEEA) approval of the CWMP/FEIR Document.
- Massachusetts Department of Environmental Protection, Ground Water Discharge Permit Program, pursuant to M.G.L. c. 21 s. 43 and its regulations at 314 CMR 5.00, including an array of various permit applications depending on whether it's a new or existing facility, and whether modifications to existing permits require plan approval or not.

- Massachusetts Department of Environmental Protection, Clean Water State Revolving Fund (CWSRF) Program, Project Evaluation Form, and CWSRF Application, for projects the Town or District will seek funding for.
- Massachusetts Department of Environmental Protection, Sewer System Extension and Connection Permit Program, pursuant to M.G.L. c. 21 s. 43 and its regulations at 314 CMR 7.00, BRP WP 13, 17, or 18. Typically SRF related projects are exempt from applying. According to 314 CMR 7.05. "Activities Not Requiring a Permit" under Paragraph 1.d states, "New Sewer Extensions Approved by the Department for Funding under the Clean Water State Revolving Fund Loan Program. Any new sewer extension for which the Department has issued a project approval certificate pursuant to 310 CMR 44.00 (the Clean Water State Revolving Fund Program Regulations.)"
- Massachusetts Department of Environmental Protection, Chapter 91 License (as applicable), pursuant to M.G.L. c. 91, the waterways licensing program.
- Massachusetts Department of Environmental Protection, Notice of Intent (NOI) Wetland Protection Act (WPA) Form 3 (as applicable) and Mashpee (or other adjacent Town's) Conservation Commission approvals (as applicable) for work within the 100-foot buffer to a wetland, per the wetlands regulations at 310 CMR 10.00 within the PPA.
- Massachusetts Department of Environmental Protection, Air Quality Permits (as applicable), BWP AQ 04 - Asbestos Removal Notification that may be required for Asbestos Pipe removal and BWP AQ 06 Construction/Demolition Notification.
- Massachusetts Department of Environmental Protection, Emergency Engine and Emergency Turbine Compliance. The program applies to all new emergency or standby engines with a rated power output equal to or greater than 37 kW or emergency turbine with a rated power output less than one megawatt constructed, substantially reconstructed, or altered after March 23, 2006.
- Massachusetts Department of Environmental Protection, Air Quality Permit BWP AQ 14, 15, 16, 17 Operating Permits. These are mandated for major sources of air pollution by the Clean Air Act Amendments of 1990. Massachusetts has incorporated this program in 310 CMR 7.00 Appendix D of its Air Pollution Control Regulations. In some cases, emissions from WWTFs or odor control systems trigger this requirement.
- Massachusetts Department of Environmental Protection Bureau of Waste Site Cleanup, Filing of Utility Release Abatement Plan (as applicable), for excavation within known contaminated sites.
- Office of Coastal Zone Management (CZM) Federal Consistency Review, pre-consultation to determine applicability.
- Commonwealth of Massachusetts Department of Public Works Permit for work within State Highway Layouts. These will be required for any work along Route 28, Route 130, and Route 151 under state jurisdiction required as part of the Recommended Plan.
- Massachusetts Division of Fisheries & Wildlife, The Natural Heritage & Endangered Species Program (NHESP), MESA (321 CMR 10.00) and/or the WPA (310 CMR 10.00) for work below mean high water line, in a fish run, or in priority or estimated habitats.

- Massachusetts Division of Marine Fisheries (DMF) as appropriate. DMF shall include consultation on potential impacts to diadromous fish species and mitigation measures as appropriate. DMF shall include consultation on the shellfish aquaculture programs being recommended. Shellfish Propagation Permits are issued by DMF and will be obtained for the seeding in the plan. They are renewed annually after review by DMF.
- Massachusetts Historical Commission (MHC) consultation/reviews for any collection system components, pumping/lift stations, and wastewater treatment and recharge facilities to be constructed outside of road right-of-ways.
- Cape Cod Commission (CCC) approval of the CWMP/FEIR as part of the Development of Regional Impact (DRI) approval process.
- Town of Mashpee building permits for the construction of structures as part of the Recommended Plan.
- Town of Mashpee local board requirements.
- Town of Mashpee self certification of GHG mitigation measures related to the Stretch Energy Code 780 CMR 120.AA on January of 2010.

The assessment of impacts to the environment as they pertain to the Recommended Plan are discussed in Chapter 7 of this report, and the resulting planned mitigation measures are discussed in this Chapter. The following section summarizes proposed mitigation measures, and may be used as the basis of development of Section 61 Findings for federal and/or state permits necessary for construction and operation of the Recommended Plan.

8.3 Draft Section 61 Findings for Phase 1

Phase 1 which includes the expansion of the shellfish propagation, design and construction of Site 4, and the first phase of the associated collection system adjacent to that proposed facility will require the following permits and filings as outlined in Table 8-1.

Table 8-1 Phase 1 Permitting Actions

Agency	Permitting Action	General Timing/Schedule
Cape Cod Commission	· Development of Regional Impact (DRI)	· Address non-construction issues during implementation. · Design review of DRI identified items.
MassDEP	· Groundwater Discharge Permit (GWDP) · Air Permitting (if required) · Emergency Generator (if required) · Chapter 91 License (if required)	· GWDP: Developed during design, completed prior to construction. · Chapter 91 may be required as it relates to shellfish aquaculture, however these uses may be exempted. · Other permits: Developed during design, completed prior to, during or at the completion of construction depending on the requirement.

Agency	Permitting Action	General Timing/Schedule
Massachusetts Department of Transportation	· Access Permit	· Developed during design.
Division of Marine Fisheries	· Shellfish aquaculture/propagation	· Permitted prior to implementation.
Coastal Zone Management	· Federal consistency review	· Completed prior to completion of design.
Massachusetts Division of Fish and Wildlife	· Natural Heritage Endangered Species Program Filing	· Design review during SRF Application process and during design.
Massachusetts Historical Commission	· Environmental Review and Public Planning	· Design review during SRF Application process and during design.
Local Conservation Commission	· Notice of Intent · Request for Determination	· Developed during design · Order of Conditions typically implemented with NPDES and as part of construction requirements.
USEPA	· NPDES General Construction Permit	· Developed during design and implemented during construction.
Town of Mashpee	· Building · Self-certification (GHG) · Other board requirements	· Planning and site considerations completed as part of design. · Reviews during design. · Self-certification and building permits: Implemented or executed typically during or following construction.

Mitigation measures related to each of these areas are discussed in the following sections. Due to the size and complexity of this type of planning project, mitigation measures are discussed as they relate to various types of construction expected during the course of the plan's implementation. Mitigation measures related to climate change are also discussed.

8.4 Proposed Mitigation Measures During Design and Construction

As part of the Environmental Impact Report (EIR) process outlined in 301 CMR 11.07, mitigation measures as described below were identified. These measures were outlined and identified to limit negative environmental impacts and/or create positive environmental impacts during development and operation of the Recommended Plan.

8.4.1 General Construction/Implementation Measures

During construction, each wastewater treatment facility/recharge or pumping/lift station site shall be secured to prevent unauthorized entry to the construction area, and to protect existing and adjacent facilities and properties. Supplemental lighting, signs, railings, and construction barriers shall be used as necessary to provide safety to employees, construction workers, visitors, and the general public during the construction process in accordance with Occupational Safety and Health Administration (OSHA) and other applicable regulations. Collection system and force main (underground utility construction proposed outside of a distinct site) is discussed in the subsequent section.

Water[1] used or generated at the site during the construction process or from runoff will be controlled by proper site grading and by providing temporary berms, drains, silt fencing, hay bales, detention basins, and other means to prevent soil erosion. These means will also be used to reduce puddling and runoff at the site. Existing and new catch basins will be protected from siltation using hay bales, siltation fence, and catch basin inserts. At no time will the pumping of silt-laden water to surface waters, stream corridors, or wetlands be allowed. Pollution controls will also be provided to prevent the contamination of soils, water, and the atmosphere from the discharge of noxious, toxic substances, and pollutants during the construction process. All erosion and stormwater control methods shall be in accordance with the USEPA NPDES General Permit requirements, Commonwealth of Massachusetts regulations, and the Town/District’s regulations. A Stormwater Pollution Prevention Plan (SWPPP) will be required as part of the NPDES General Permit.

Erosion control measures including hay bales, siltation fencing, and erosion control fabric will be used to provide sedimentation barriers where required. Temporary seeding and mulching may also be used to minimize soil erosion and provide soil stabilization on slopes. Diversion trenches may also be used on the uphill side of disturbed areas to divert surface runoff. Land disturbances will be kept to a minimum to reduce impacts and erosion. All erosion and stormwater control methods shall be in accordance with the USEPA NPDES General Permit requirements, Commonwealth of Massachusetts regulations, and the Town/District’s regulations. A SWPPP will be required as part of the NPDES General Permit.

The site will be maintained free of waste materials, debris, and trash following each day of work. Waste and other debris will be collected and periodically disposed of off-site. At no time during construction will the dumping of spoil material, waste, trees, brush, or other debris be allowed into any stream corridor, any wetland, any surface waters, or any unspecified location. The permanent or unspecified alteration of stream flow lines is not allowed during construction. Recycling of waste and construction debris will likely be required by the Town or District as well and should always be considered during construction. Associated mitigation measures will also be documented in the SWPPP as they relate to potential impacts to surface waters and wetlands.

Construction noise from heavy equipment will normally be limited to within normal operating hours of 7:00 a.m. to 5:00 p.m., will be adjusted in accordance with Town regulations, and will consider public input based on the location and duration of the proposed work. Dust controls, including the use of street sweepers and/or watering trucks and the application of calcium chloride, will be used to minimize air-borne dust as necessary.

Regardless of any new facility’s trip generation, MPS TR1.8 requires acceptable sight distances at all access and/or egress locations for DRIs. Therefore, with a special concern to a site with a high percentage of truck traffic, any new treatment facility is to be sited such that any new driveway provide sight distances that meet the stricter of the Massachusetts Department of Transportation and American Association of State Highway Transportation Officials guidelines for safe stopping sight distances.

[1] Such as flushing water, stormwater, or groundwater from dewatering.

Construction is proposed to remain outside resource areas and wetlands unless the buffer areas extend over previously disturbed areas like existing roads, parking areas, constructed sites. During implementation any necessary permitting required for work within buffer areas or resource areas will be obtained as allowed by law and work will be performed within the constraints of the Order of Conditions issued for the proposed work.

Shellfish propagation areas are proposed in existing permitted shellfishing areas and therefore site access will be through the currently allowable areas, thereby minimizing or eliminating any potential impact to wetland areas or resource areas.

8.4.2 Collection and Effluent Discharge (Underground Utility) Construction

In addition to the measures identified in the general construction section, police details and other traffic controls will be necessary to minimize traffic problems during utility construction. Detours and trucking routes will need to be identified prior to construction and designed to minimize impacts to surrounding residential areas not accustomed to heavy construction and increased vehicle traffic. Construction within the PPA will have to allow for safe travel of both pedestrians and vehicle traffic.

Sewer mains, laterals, and force mains are planned in the road layouts to avoid impacts to animal habitats, wetlands, historic areas, or potential archaeological sites. Construction in these areas will impact traffic (vehicle, pedestrian, and bicycle) in the roadways during construction. Construction procedures for traffic control, erosion protection, dust control, noise prevention, and wetland protection will be implemented as appropriate. Use of trench boxes, bracing, and other shoring methods will be utilized to provide the necessary safety for workers and others at the construction site. To the extent practicable, any private property, including trees and vegetation, that is damaged during construction is to be repaired or replaced. All roads, both publicly and privately owned, impacted by construction associated with the implementation of the collection system shall be restored to a condition safe and appropriate for vehicular traffic. Special requirements will be necessary for work within Massachusetts DOT roads.

Any collection system components and pumping stations to be constructed outside of road right-of-ways will be reviewed with the Massachusetts Historical Commission and Massachusetts Natural Heritage & Endangered Species Program.

The collection system pumping/lift stations typically need to be located in low-elevation areas to be able to utilize gravity pipes for collection and subsequent pumping. Wetland regulations and permitting will be followed to minimize impacts to any adjacent wetlands.

The Secretary's Certificate also identified the concern over other hazards. Therefore, if soil contaminated with oil and/or hazardous material is identified during the implementation of this project, notification pursuant to the Massachusetts Contingency Plan (310 CMR 40.0000) will be made to MassDEP, if necessary. A Licensed Site Professional (LSP) would be retained to determine if notification is required and, if need be, to render appropriate opinions. The LSP may evaluate whether risk reduction measures are necessary or prudent if contamination is present. The Boston Water and Sewer Commission (BWSC) may be contacted for guidance if questions arise regarding cleanup.

A review of potential hazard areas was made and 35 sites were identified in the MassDEP database[2], the majority of which were for "oil" release. Five of the 35 sites were identified for a "hazardous materials" release. During preliminary and final design, if proposed facilities are in the vicinity of these releases, appropriate measures and additional investigations (as identified above) may be required in order for construction activities to minimize disruption or avoid those areas. All sites were currently (as of November 2013) identified as "closed".

Stormwater and construction runoff will be managed through the implementation of construction SWPPPs established prior to construction and regulated under USEPA NPDES General Permits for Construction.

Areas requiring sewers located within parts of Town identified as barrier beach will have to be designed and constructed to meet specific state requirements for work within these areas (Executive Order 181), and will have the following stringent requirements for the construction of sewers on a barrier beach:

1) All infrastructures must be protected from coastal flood hazards.
2) The sewers cannot promote additional growth on the barrier beach that would not have otherwise been allowed.

Previous discussions held with Massachusetts CZM, the agency that upholds Executive Order 181, regarding other Cape communities' projects have indicated that the water quality benefits provided by the collection system extensions often will outweigh the slight risk that a catastrophic coastal hazard could damage some of the infrastructure; however, further project-specific discussions and reviews would be required during permitting and design to identify site-specific concerns and mitigation measures necessary to design facilities in these areas. Collection system extensions will be designed to withstand reasonably expected coastal flood hazards; pumping stations will be designed to withstand a 100-year storm; and all pipes and equipment suitably protected from wave action. Pumping stations will be located outside of flood zones when possible and protected with a system of check valves in critical areas, and generally protected from floods and natural hazards to the extent reasonable and should be consistent with the Town's/District's Multi-Hazard Mitigation Plan.

8.4.3 New Wastewater Treatment Facility Sites and Recharge Sites Construction

In addition to those mitigation measures identified previously, the following measures will be provided at the proposed Sites 4, 6, and possibly Back Road (if JBCC is not an option), and infiltration areas (like Willowbend Golf Course and New Seabury Golf Course). The wastewater treatment facilities will process the wastewater collected from the areas of the PPA identified in the Recommended Plan. Removal of this local source of nitrogen will significantly reduce the amount of nitrogen entering Waquoit Bay and Popponesset Bay in order to make substantial progress towards achievement of the TMDLs during the 20 (plus)-year planning period.

Each site will require additional coordination through NHESP and MHC as outlined in correspondence documented in Appendices 7-2 and 7-3.

Similar to construction of collection system and pumping stations, if contaminated soils are located at any of the proposed sites a LSP would be retained to determine if notification is required and, if need be, to render appropriate opinions. The LSP may evaluate whether risk reduction measures are necessary or

[2] Using their "Reportable Release Lookup" online. Data presented as of November 2013.

prudent if contamination is present. Based on the listings reviewed (as stated in the previous section) none of the proposed sites (4, 6, Back Road, or the recharge locations at the golf courses) were identified as known sites in the MassDEP database.

The greatest mitigation measure is the operation of an improved advanced wastewater treatment system designed for consistent nitrogen removal to 3 mg/L total nitrogen. Improvements to the WWTFs within the PPA that discharge within these watersheds will also provide significant removal of suspended solids and Biochemical Oxygen Demand (BOD) in the effluent. These systems will increase the production of biosolids (sludge) and increase the volume of treated water recharged (locally) to the water table. The sludge will be disposed of or reused at approved off-site facilities in accordance with MassDEP guidelines. The recharges are and will continue to be monitored as part of an approved groundwater monitoring plan for each facility. Odor and noise mitigation measures will also be considered as part of the final design to minimize the impacts to adjacent properties during construction and operation for any new facilities or facility improvements.

Energy efficient design features to minimize greenhouse gas (GHG) release from the WWTFs should be considered during preliminary and detailed design for Town or District owned facilities to maintain a high rating index of 50 or greater (as appropriate depending on the facility size). The following mitigation measures will be observed to avoid or minimize adverse environmental impacts:

- Any new pumping stations will have exterior façades which will complement and be consistent with neighborhood aesthetics.
- Vegetative screens will be employed if it is determined that they are necessary for aesthetic reasons.
- Consultation with expert agencies during the design phase and continued contact during construction if there is a resource that may be affected.
- Work will be halted if archaeological resources are uncovered during construction.
- The contractor will be required to thoroughly clean up the site before the contract is considered complete.
- Proper handling and storage of possible contaminants and hazardous substances will be required of the contractor, in addition to proper notifications.
- Temporary access roads will be constructed to minimize dust and may be periodically dampened to minimize construction dust if required.
- Debris will not be burned as a means of disposal. Debris will be recycled or disposed of in accordance with local, State, and Federal requirements.
- No construction work will normally be performed during evening, holiday, or weekend hours without written approval from the Town.
- Resident Project Representative(s) will be employed to ensure that the project area is kept clean and that mitigation measures are met in addition to observing construction activities of the contractor in accordance with the contract documents.

8.4.4 Climate Change Mitigation

The following provides a broader view of mitigation measures that could be evaluated or implemented in preparation for climate change planning. Given the significance of the Town's beaches and coastal wetlands as both a tourism and revenue draw, and also as natural buffers to coastal wave action, it is in the Town's best interest to implement strategies to protect these areas from detrimental impacts associated with climate change. As presented in Lewsey et. al. (2003) and the September 2011 *Massachusetts Climate Change Adaptation Report*, several ways to protect beaches and coastal wetlands includes the following:

- Development of a Town-wide Hazard Mitigation Plan (in the case of Mashpee this is being accomplished through the development of an updated Town-wide Multi-Hazard Mitigation Plan);
- Continue with long-term beach and coastal area monitoring;
- Strengthen regulations to protect ecological buffers such as coastal wetlands and estuaries;
- Use land acquisition and conservation restrictions to protect headwater streams and associated buffer areas in order to protect downstream conditions during periods of warming;
- Adapt permitting and regulatory criteria to protect and maintain natural stream flow as well as incorporate potential climate change impacts;
- Develop comprehensive land use plans which incorporate the protection of coastal natural resources such as beaches and wetlands;
- Employ land use protection tools to maintain, preserve, and restore ecological buffers; and
- Enhance engineered coastal protection systems where inland retreat or other accommodation is not an option.

As presented by Lewsey et. al. (2003), there are several ways in which the Town can protect shoreline residential and commercial infrastructure development, including:

- Introduce building codes that account for climate change effects such as sea level rise;
- Implement comprehensive land use planning to account for the impacts associated with sea level rise and climate change;
- Identify high hazard areas, i.e. those areas most likely to be subjected to detrimental effects of climate change such as sea level rise, and introduce regulations to phase out development in high hazard areas;
- Link coastal property insurance with construction quality, i.e. ability to accommodate sea level rise, increased flooding, more frequent storm events;
- Implement economic and market-based incentives that promote sustainable development in coastal areas and/or deter development from high hazard areas; and
- Enhance coastal protection where retreat or other accommodation is not an option.

The Town/District has not made final decisions on these options.

CZM believes that these storm damage risks can be minimized through careful design considerations. CZM recommends specific design considerations to address these risks, including the locating of pump stations and other critical infrastructure outside of the 100-year floodplain if possible, protecting the collection system from potential wave action, and incorporating a system of check valves into sections of the collection system within flood zones. This would help minimize impacts from a storm-related breach to the collection system. Given the historic rate of sea level rise (i.e., 1-foot over 100 years), it is recommended that sea level rise be considered during design. Flood zones based on the most recent (July 2014) mapping are shown on Figure 8-1.

In general, considerations for flood zones and sea level rise will be taken into consideration during design. As stated above, effort will be made to minimize or eliminate the location of critical infrastructure within the 100-year flood zone; however, in cases where this cannot be avoided, structures will be designed for flood resilience including consideration for locating the entry points above both flood elevation and estimated sea level rise in addition to a 1-foot freeboard elevation. Per the CZM document regarding sea level rise (CZM 2013) the mean sea level rise rate is roughly 1-foot per 100 years. The US Army Corp of Engineers has developed an online tool called “Sea Level Change Curve Calculator” which allows you to use the nearest NOAA gauge station to estimate sea level rise near a possible project site.

Using the FEMA guidance on America Society of Civil Engineers (ASCE) Structural Engineering Institute’s ASCE/SEI 24-05 Flood-Resistant Design and Construction (FEMA, 2013), pumping stations may be classified as a structure category II or III and would require elevation to be set 1-foot above base flood elevation (BFE). This document, in conjunction with FEMA’s Guidance for Applying ASCE 24 Engineering Standards to HMA Flood Retrofitting and Reconstruction Projects, will be used as part of the design process to mitigate the effects of flooding and sea level rise.

These measures will be considered during preliminary and final design, and the CZM recommendations can be addressed through minimizing the number of pumping stations located in or near these hazards and the consideration of alternative collection system technologies in flood hazard areas. The design features with isolation values would be included as part of the design of facilities in those areas.

8.4.5 GHG Emissions Reduction Approaches

Several options will need to be considered during preliminary and final design in order to potentially reduce the GHG emissions at WWTFs within the PPA.

The Town adopted the “Stretch Energy Code” 780 CMR 120.AA in January of 2010. The Town would at a minimum adopt these same code requirements for future development related to the CWMP and related facilities as they apply. In addition, any GHG analysis at this time would be predicated upon assumptions of technology to be applied at the time final design is complete, therefore it is recommended that a GHG analysis should be required at the time the Town enters into preliminary and final design and construction phases for each phase related to any proposed new facilities for wastewater treatment.

The section goes further to identify items that may be considered either good practice or better than the standard practice. Each of these items is categorized below as one of the following options:

- The measure to be considered in preliminary and final design—more analysis is required on these items in order to determine whether these are recommended items.
- Not recommended measure—these items are not recommended for implementation.

8.4.5.1 Incorporate On-Site Renewable Energy Systems to Provide Some WWTF Base Electrical Needs

The Town of Mashpee has already made significant efforts to incorporate photovoltaic (PV) energy use into the Town. The following is a list of the Town's recent renewable energy projects:

- 1.83 MW system at closed Mashpee landfill
- 312 kW roof-mounted system at Mashpee High/Middle School
- 20 kW roof-mounted system at Mashpee Public Library
- 10 kW roof-mounted system at Mashpee DPW
- 10 kW roof-mounted system at Mashpee Council on Aging
- One 1.5 kW 30-foot vertical axis wind turbine

Based on discussions with the Town Manager's office, these facilities provide close to 90% of the total Town facilities power supply. These projects were completed with a combination of Federal and State grants as well as Public-Private Partnerships, and demonstrate the Town's commitment to renewable energy efforts.

As part of any future proposed structures the Town will consider further evaluation for cost benefit of adding PV to new structures. Any future PV systems can either be roof-mounted or ground-mounted depending on site conditions. South-facing roofs with minimal shadow interference provide the most ideal conditions for a roof-mounted solar array. However, wind energy typically provides a quicker cost recovery, but location and operational considerations for these types of facilities are often more complex than PV. **This is an item to be considered in preliminary and final design.**

8.4.5.2 Energy Recovery

Typical wastewater effluent contains sufficient heat, extractable through a heat exchanger, to be considered as a heating or cooling source for a building. Effluent heat pumps have a relatively low impact on energy consumption at a facility. Biosolids management through composting, digestion, or other methods should be evaluated for potential energy/cost saving and recovery. **This is an item to be considered in preliminary and final design.**

8.4.5.3 Hydroelectric Potential

If adequate head is present (amongst other favorable conditions) in an effluent pipe, a hydro-turbine could be utilized to recover a portion of the potential energy in the flow. It is anticipated that the flows and pipe sizes would be too restrictive to make this an effective means of energy recovery; however, additional analysis would be required to determine this. Due to the low energy gradients expected, this possibility seems unlikely for this project. **This is an item that will likely not be considered in preliminary and final design.**

8.4.5.4 System Monitoring

Energy usage can be minimized through system monitoring. Sub-metering will allow the facility to track the energy usage of individual processes and equipment. Installing dissolved oxygen (DO) probes in aerations systems allows operators to closely match the air supplied by the blowers to the system's need, thereby reducing excess energy consumption. **This is an item to be considered in final design.**

8.4.5.5 Optimize Lighting

Energy efficiency measures to be considered for the lighting system include adding motion sensors on lights in non-process buildings, using high-efficiency fixtures, and maximizing the use of natural light through the use of windows, translucent panels, skylights, etc., to reduce reliance on artificial lighting. In order to limit light pollution, light sensors or light timers should be considered and exterior lighting should be limited to what is required by local codes or for safety. **This is an item to be considered in final design.**

8.4.5.6 Reduce Ventilation and Heating Requirements

Codes should be examined for provisions that allow for lower heating requirements and fewer air changes when an area is unoccupied in order to reduce energy consumption for ventilation and heating. Geothermal is another option that, at a minimum, should be investigated to see if there is potential for use in any new facilities. **This is an item to be considered in final design.**

8.4.5.7 Upgrade Existing Motors to Variable Frequency Drives

Variable frequency drives (VFDs) should be considered at existing and proposed facilities to the extent practicable based on the size and use of that facility. Some of the smaller facilities with limited operational ranges would not necessarily be appropriate for the installation of VFDs. Some facilities may already have VFDs installed. **This is an item to be considered in final design.**

8.4.5.8 Process Optimization

Most WWTFs are designed with oversized equipment in order to account for uncertainty in influent variations, to provide additional capacity for future growth, and to meet state and local regulatory criteria. Process models can be used to develop operational strategies for the current influent flow conditions. VFDs and the use of smaller modular units should be considered. The new facilities proposed at Sites 4 and 6 are based on a modular design for future expansion. **This is an item to be considered in preliminary and final design.**

8.4.5.9 Reducing Infiltration and Inflow (I/I)

For the existing WWTFs throughout the PPA, additional study to reduce I/I should be considered as the Town/District looks to take over these facilities, as a future cost savings from both a treatment and electrical usage perspective. At JBCC, this is a serious issue that would need to be addressed to increase available treatment capacity at the plant. In addition, the reduction of I/I will help to improve performance and reduce long-term operation and maintenance costs. I/I at all of Mashpee's existing facilities would need to be evaluated as each privately owned facility is turned over to the Town/District. **This is an item to be considered in preliminary and final design.**

8.4.6 Shellfish Concerns—Division of Marine Fisheries

The Division Marine Fisheries (DMF) is the state agency responsible for the regulation of shellfish, finfish, and algae aquaculture and propagation. Several comments and concerns raised for comprehensive wastewater planning projects in other local towns are listed below and their relevance to the Mashpee CWMP/WNMP are provided in brackets [ ]:

- Remediation of nitrogen via shellfish growth has met with mixed success. Any demonstration projects need to rigorously assess nitrogen removal estimates, and should do so for a variety of species. [Oyster remediation in the Mashpee River has been successful with up to 5% of the target nitrogen load being removed and fish kills have been avoided.]
- The quantity of shellfish required for meaningful nitrogen remediation could create user conflict in the saltwater ponds. Provision needs to be made to balance the public's right to shellfish with the needs of the nitrogen removal goals. [This would not apply to the Mashpee plan which is sub-tidal and out of sight in Town propagation {areas} for pubic fisheries and the Tribe’s existing shellfish farm.]
- Waters in Massachusetts are managed under the National Shellfish Sanitation Program (NSSP) sanitation guidelines. Planting in waters contaminated with bacteria can increase risk to public health. Furthermore, the NSSP requires that there be sufficient enforcement to prevent illegal harvesting or the Shellfish Authority must conduct shellfish depletion (removal). [This would not apply as the Mashpee plan calls for shellfish only in approved waters.]
- Violating shellfish sanitation guidelines could risk the participation of Massachusetts harvesters in interstate and international commerce. [This would not apply as the Mashpee plan calls for shellfish only in approved waters.]
- The Town should consider using indigenous shellfish species not consumed by people to eliminate risk to public health and avoid enforcement issues. [The Mashpee plan uses only indigenous species—oysters and quahogs.]
- The DMF Shellfish Planting Guidelines will be used by DMF as the template for approval of any local shellfish restoration or planting program.

As part of the Town’s shellfish program, and in coordination with the Town’s DPW department’s MS4 stormwater program and DMF requirement, stormwater runoff improvements and best management practices will be implemented to protect shellfish resource areas that may be impacted by these contamination sources.

8.5 Summary

The implementation of the Recommended Plan and its mitigation measures will be controlled through various measures including:

- Regulatory permitting requirements and “Order of Conditions”.
- Construction Contract Documents.
- Stormwater Pollution Prevention Plan.
- Adaptive Management Plan.
- Monitoring programs (related to groundwater, drinking water, estuaries, and shellfish).

9 Phasing and Implementation

9.1 Introduction

This chapter outlines the phases of implementation of the plan over a 20- to 30-year period and summarizes the estimated financial resources required to implement the project. Phasing is considered adjustable based on the implementation of an Adaptive Management program. Several components of the Recommended Plan are integral parts of the Adaptive Management approach as outlined in Chapter 10.

Another key component to implementation will be the implementing authority within the project boundaries. When considering that the project extends into four communities with the primary community of this project being the Town of Mashpee, there will need to be agreements, “Memorandums of Understanding” (MOUs), or other mechanisms for these entities to work together to achieve the TMDLs. Barnstable, Falmouth, and Sandwich are all in different phases of their own planning processes regarding these and their other watersheds; their management structures will not be discussed here.

As for the Town of Mashpee, they are currently considering two approaches for the management and implementation of the Recommended Plan:

1. *Development of a Water and Sewer District.* The District would be responsible for the implementation, operation, and maintenance of wastewater collection, treatment, and recharge facilities in addition to its existing responsibilities as the Town’s public drinking water purveyor. Under this approach the Town of Mashpee would continue to be responsible for the shellfish aquaculture portions, fertilizer management, stormwater management, growth policies, and implementation of any non-traditional nitrogen reduction approaches.
2. *Town of Mashpee Management.* Under this approach all responsibilities of implementation of the plan would fall under the Town’s purview. The Town is currently considering what this structure would look like and how it would be managed under either a new department or departments or within the existing structure of the Town’s Sewer Commission, Board of Health, DPW, and Shellfish Constable (depending on the component of the plan being considered).

Since the issuance of the Draft Recommended Plan report, the Town is reconsidering creation of the Mashpee Water & Sewer District; and discussions between the Town and Mashpee Water District regarding an MOU—except regarding metering and billing—have been halted by the Board of Selectmen. This was a change in the Selectmen’s previous position regarding the District formation, and at the end of 2014 the Board voted to recommend against creation of the District. At this time, the district will only come into existence upon a favorable ballot vote at the May 16, 2015 Town election; however the Mashpee Selectmen are now recommending a “no” vote. Regardless of the outcome, the structure and management authority will be known prior to implementation of this plan.

In addition, the CCC 208 Planning process is required to identify the responsible party or waste management agency (WMAs) for each watershed; however the final determination and acceptance of these recommendations by USEPA is not expected until September 15, 2015.

9.2 Subarea Matrix Evaluation Part 2

As discussed in Chapter 4, as part of this process and for use in the development of long-term phasing and implementation strategies, a subarea matrix was developed to summarize key aspects of each subarea and ultimately assign a weighted value to allow the ranking and prioritization of areas. The roughly 50 subareas were then broken into groups of 15 and then examined to see what percentage of the total flow of the Project Planning Area (PPA) would be served by this area and where those flows would be treated and recharged. These areas were then compared against the alternative approaches identified in Chapters 4 and 5 and used to formulate the Recommended Plan. Using this priority ranking and the Draft Recommended Plan, the PPA was divided into groups and implementation phases, with an eye towards adaptive management and how programs like the shellfish aquaculture would be integrated with traditional methods for the final plan. Following the MEPA comments and scheduling input regarding the potential use of JBCC and other proposed Phase 1 work, the schedule has been adjusted from the Draft to the Final and is summarized in this Chapter.

9.3 Schedule

The schedule is built upon the following factors:

- Early implementation of shellfish
- Results of matrix rankings discussed in Chapter 4
- Infrastructure needs in areas not projected to be addressed through the use of shellfish
- Sewer Commission recommendations
- Short and long term implementation and adaptive management
- Uncertainty surrounding Joint Base Cape Cod and the Quashnet/Moonakis River evaluation(s)

As discussed previously in the report, the Town is actively maintaining and pursuing expansion of shellfish aquaculture within Popponesset Bay (namely Mashpee River) in collaboration with the Wampanoag Tribe, MEP, and others. Additional initiatives and grant incentive programs are being pursued to expand this program; therefore this is the first part of the Recommended Plan’s implementation. The shellfish program will work to fast-track the water quality improvement needed in the waterbodies as it relates to nitrogen impacts.

At the same time, efforts related to Ownership of several existing wastewater treatment facilities within the PPA and the potential opportunity to work with MassDevelopment and Joint Base Cape Cod (JBCC) on a regional facility are critical ongoing tasks related to implementation.

The following is a brief summary of the schedule (as shown in Figure 9-1).

The implementation is envisioned in the following three categories:

1. Short-Term Initiatives: Current/2015-2016
2. Phase 1 Implementation (5 Year): approximately 2017 to 2021
3. Long-Term Implementation and Adaptive Management: 2022 to 2041 and beyond

2015-2016

- MEPA/DRI approval.
- Possible establishment of Mashpee Water and Sewer District. {Legislation passed April 14, 2014 – awaiting subsequent action – Spring 2015 Election}.

- MOU between the Mashpee Water and Sewer District and the Town of Mashpee (if needed), or creation/organization of Town departments for implementation and oversight.
- Shellfish Propagation (Current/Existing Program).
- WWTF Ownership Discussions
  - Joint Base Cape Cod/MassDevelopment
  - Private Facilities
    - New Seabury
    - Willowbend
    - Mashpee Commons
    - Wampanoag
    - Stratford Ponds
- Continue development of Regional Memorandums of Understanding (this will also influence long-term implementation of areas within the neighboring communities).
- Fertilizer management/bylaw implementation.
- Continued use of stormwater BMPs.

The following Phases 1 through 5 (divided into 5-year increments) are depicted in Figure 9-2 and were included into various phases based on considerations for areas targeted for shellfish and on each subareas relative rankings established in Chapter 4 (Table 4-22).

<u>2017-2021: Phase 1</u>

- File Notices of Project Change and Development of Regional Impact (DRI) modifications (as needed/if required) to inform (and gain approval from) the environmental review process on the agreements and funding that will allow the next steps to proceed.
- Shellfish Propagation (expansion in related sections of Popponesset Bay (Barnstable and Mashpee), and addition in Jehu Pond and Hamblin Pond).
- Feasibility Study: Implementing Soft Solutions for Restoring the Quashnet/Moonakis River.
- Feasibility study on connection of Quashnet and Coombs Schools to Mashpee Commons WWTF.
- Implement findings of Quashnet/Moonakis River soft solutions (if favorable).
- Design and Construction of Site 4 facility (Phase 1) to serve sections of Subarea S (within Mashpee River Watershed) adjacent to Falmouth Road/Route 28. (Approximately 0.1 mgd average annual).
- Design and Construction of related collection system to serve Site 4 WWTF.
- Design and Construction of collection system to extend to properties neighboring the Wampanoag WWTF.
- End of Phase compliance reporting—consider updating MEP Model runs (landuse and hydrodynamic models) and MEP calibrate with water quality and benthic flux sampling as needed.

- Determine additional evaluations of existing wastewater treatment facilities leading into next phase of proposed improvements.
- Coordinate with 208 Plan and potentially run CCC MVP tool in conjunction with MEP Model runs to check on updated water data and possible adaptive management approaches.

2022-2026: Phase 2

- File Notices of Project Change and DRI modifications (as necessary) to inform (and gain approval from) the environmental review process on the agreements and funding that will allow the next steps to proceed.
- Shellfish Propagation (continuation and future expansion).
- Design and Construction of JBCC Improvements (or Back Road Site facility if agreement cannot be reached on a regional facility).
- Design and Construction of JBCC/Back Road Sewer Extensions (Mashpee) to serve Subarea H.
- If Quashnet/Moonakis soft solutions will not address 100% nitrogen TMDL and regional facility at JBCC is available, Sand-1, -2, and -3 should begin process of being connected to address the Quashnet River area, as should portions of Falmouth (in coordination/conjunction with any efforts regarding their plan and their demonstration projects being considered in that area).
- Connection of Quashnet and Coombs Schools to Mashpee Commons WWTF, upgrade as required.
- If shellfish propagation is not advancing as fast or to the levels anticipated:
    - Site 4 facility expansion (Phase 2) development to serve additional Mashpee River and Popponesset Bay Watershed Mashpee (south of Route 28); with new recharge facilities at Willowbend.
    - Upgrade of Willowbend facility. Upgrade of Stratford Ponds, South Cape Village, and Windchime Point to improve nitrogen removal performance in conjunction with age of system improvements.
    - Mashpee River sewer extension (south of Route 28).
    - Popponesset Bay sewer extension (south of Route 28, south of Willowbend).
    - In conjunction with their planning efforts, Barnstable to address portions of Cotuit peninsula (possibly start with Barn-39).
- End of Phase compliance reporting—consider updating MEP Model runs (landuse and hydrodynamic models) and MEP calibrate with water quality and benthic flux sampling as needed.
- Coordinate with 208 Plan and potentially run CCC MVP tool in conjunction with MEP Model runs to check on updated water data and possible adaptive management approaches.
- Determine additional evaluations of existing wastewater treatment facilities leading into next phase of proposed improvements.

2027-2031: Phase 3

- File Notices of Project Change and DRI modifications (as necessary) to inform (and gain approval from) the environmental review process on the agreements and funding that will allow the next steps to proceed.
- Shellfish Propagation (continuation and future expansion).
- If shellfish propagation continues to lag or is not advancing as fast as or to the levels anticipated:
  - Upgrade of Southport to improve nitrogen removal performance.
  - Site 4 facility expansion with sewer extension to serve Mashpee River and Popponesset Bay Watershed Mashpee (north of Route 28) with associated sewer extensions.
  - Expansion of Willowbend WWTF service area.
  - Site 6 facility development initially to serve Ockway Bay area.
  - New Seabury recharge facilities construction to support treated effluent from Mashpee Commons and Site 6.
  - Barnstable and Sandwich to begin provisions to address their remaining portions of the Popponesset Bay Watersheds.
- End of Phase compliance reporting—consider updating MEP Model runs (landuse and hydrodynamic models) and MEP calibrate with water quality and benthic flux sampling as needed.
- Coordinate with 208 Plan and potentially run CCC MVP tool in conjunction with MEP Model runs to check on updated water data and possible adaptive management approaches.
- Determine additional evaluations of existing wastewater treatment facilities leading into next phase of proposed improvements.

2032-2036: Phase 4

- File Notices of Project Change and DRI modifications (as necessary) to inform (and gain approval from) the environmental review process on the agreements and funding that will allow the next steps to proceed.
- Upgrade of Cotuit Meadows and Wampanoag Village to improve nitrogen removal performance (dependent on MEP modeling results and permit requirements).
- If shellfish propagation continues to lag or is not advancing as fast or to the levels anticipated:
  - Site 6 facility expansion with associated sewer extensions to serve Hamblin/Jehu Pond areas of Mashpee.
  - Collection system expansion to Site 6.
  - Collection system expansion on Great Neck Road North to Mashpee Commons.
  - Collection system expansion for Hamblin and Jehu Pond Areas, upgrade/expansion of New Seabury WWTF.
- End of Phase compliance reporting—consider updating MEP Model runs (landuse and hydrodynamic models) and MEP calibrate with water quality and benthic flux sampling as needed.

- Coordinate with 208 Plan and potentially run CCC MVP tool in conjunction with MEP Model runs to check on updated water data and possible adaptive management approaches.
- Determine additional evaluations of existing wastewater treatment facilities leading into next phase of proposed improvements.

2037-2041: Phase 5

- File Notices of Project Change and DRI modifications (as necessary) to inform (and gain approval from) the environmental review process on the agreements and funding that will allow the next steps to proceed.
- If shellfish propagation continues to lag or is not advancing as fast or to the levels anticipated:
  - Remaining wastewater nitrogen from Barnstable (B-37 and parts of B-38) and Sandwich Subareas (Sand-4, -5, and -6) within the Popponsesset Bay watersheds will need to be removed outside of the watershed or treated to the levels required based on the MEP modeling results.
  - Collection system expansion (Main Street /Route 130) Subarea T to Site 4.
  - Collection system expansion to Subareas A and C (Seconsett and Monomoscoy Islands).
  - Collection system expansion to Childs River watershed portion of Subarea H.
- End of Phase compliance reporting—consider updating MEP Model runs (landuse and hydrodynamic models) and MEP calibrate with water quality and benthic flux sampling as needed.

This schedule represents one possible future where the PPA is forced to implement traditional infrastructure to serve those areas outside of the Quashnet River Watershed where shellfish aquaculture is being pursued to reduce nitrogen loadings within the affected bays. Development of MOUs with neighboring towns will be necessary to establish a potential phasing strategy based on each town's specific needs. Town's may address other "neighborhoods" within the watersheds based on each individual town's planning efforts and approach. Monitoring and modeling efforts at the five-year intervals will be necessary to establish the extent of nitrogen removal following shellfish aquaculture implementation.

The Town of Mashpee participated in a Massachusetts DEP project that looked at fair-share distribution of nitrogen load. The primary finding of that Pilot study for Popponesset Bay was if each Town reduced their total nitrogen load by 49.2% in the Popponesset Bay watershed the TMDLs could be achieved. This was considered as part of the CWMP/RP and a similar approach was established for Waquoit Bay East contributions. For Waquoit Bay East, since individual town distributions were not established like they were in the Popponesset Pilot Project, MEP reports and flow data used in the GHD analysis were used to establish the estimated embayment loads by town. An estimation of allowable load within the watersheds was calculated based on the MEP existing total load and the estimated TMDL compliance load. Based on that information an estimate of a 60% reduction was necessary to accomplish the same fair-share distribution (updated from an estimated 63% noted in the Draft Alternatives Analysis Report).

Using these assumptions the following fair-share distributions of nitrogen load were established for use in the percent reductions by Town and Phase (discussed in the following tables).

Table 9-1 Estimated Fair Share Removal of Unattenuated Nitrogen Load

	Popponesset Bay (kg/y) (~50% removal)		Waquoit Bay East (kg/y) (~60% removal)	
	Total Deposited Unattenuated Load[1]	Estimated Maximum Unattenuated Load to Sustain[1]	Total Estimated Deposited Unattenuated Load[2]	Estimated Maximum Unattenuated Load to Sustain[3]
Town of Mashpee	31,700	16,100	15,700	6,300
Town of Barnstable	6,200	3,200	-	-
Town of Falmouth	-	-	3,400	1,300
Town of Sandwich	10,600	5,400	4,900	2,000
Total	**48,500**	**24,700**	**24,000**	**9,600**

1. Values based on MassDEP/SMAST Pilot Project Report (Nov 2008) Figure 2.15 "Equal Percentage for each town of Nitrogen Reduction Deposited as an Unatteunated Load to the Popponesset Watershed", rounded to the nearest hundreds, and MassDEP Pilot Project.
2. Values estimated based on total load and wastewater load distributions and approximately 45% ratio of non-wastewater load to wastewater load. Total watershed values based on MEP tables (January 2005).
3. Estimated reduction of 60% based on scenario runs applied across Waquoit Bay East watershed and using the same estimated distribution of load across the three Towns used to estimate the Total Deposited Unattenuated Load.

It should be noted that Table 9-1 is presenting unattenuated loads and that depending on where loads are removed or remain will impact the "sustainable" load assumed for each town. It is understood that these loads do not include build-out that has occurred during or will occur since the completion of the MEP reports or TMDL development and therefore any additional load in each town, regardless of the percent distribution above these estimated values, would need to be removed.

Table 9-2 presents the load reduction estimated by Phase and Town and also includes one possible scenario where shellfish and or other adaptive management approaches do not perform to the standards necessary for TMDL compliance and therefore a traditional infrastructure approach is used (i.e. "Plan B"). It should be noted that load distribution by Town is currently being discussed and developed as part of the Cape Cod Commission 208 Planning efforts and will ultimately be established in either a watershed permit issued by MassDEP and/or an IMA between the Towns in the PPA. Therefore, Tables 9-2 and 9-3 are presenting an approximate allocation under estimated "existing" and "build-out" conditions based on the Unified Database used for this project and previous MEP and Pilot Project reports developed for MassDEP. The Cape Cod Commission is also working to refine their tools (including MVP) to assist towns if they chose to update their landuse data for modeling as part of their planning (or implementation efforts in the case of Mashpee). This updated information is presumably to be used in the future identification of load allocation by watershed as stated previously.

When comparing Tables 9-2 (MEP Existing Conditions) and 9-3 (Projected Build-out Conditions) areas where future development is anticipated will result in a need for load reduction, therefore under existing conditions the values only represent the point at which 100% of the "existing" load is removed. Table 9-3 indicates the phase where TMDL compliance would be achieved if build-out conditions are reached. When considering shellfish, some areas not anticipated for nitrogen removal under existing conditions may require some form of additional nitrogen removal to address future build-out loads that may or may not be able to be addressed with an increase in shellfish.

Table 9-2 Estimated Percent Attenuated Load Reduction by Phase and Town (MEP Existing Condition)

Watershed/Town	Estimated Load to Remove (attenuated) Kg/y	Estimated Percent of Removal (No Shellfish/ Shellfish)				
		Phase 1 (%)	Phase 2 (%)	Phase 3 (%)	Phase 4 (%)	Phase 5 (%)
Popponesset Bay(2)						
Town of Sandwich	1,400	(0/0)	(0/0)	(0/0)	(32/32)	(100/100)
Town of Mashpee	9,000	(34/97)	(72/100)	(100/100)	(100/100)	(100/100)
Town of Barnstable	2,500	(0/47)	(29/47)	(56/73)	(56/73)	(100/100)
Subtotal	12,900	(20/73)	(44/92)	(96/100)	(100/100)	(100/100)
Waquoit Bay						
Town of Sandwich	1,000	(0/0)	(100/100)	(100/100)	(100/100)	(100/100)
Town of Mashpee	8,500	(0/69)	(44/100)	(46/100)	(75/100)	(100/100)
Town of Falmouth	2,000	(0/15)	(58/74)	(58/74)	(100/100)	(100/100)
Subtotal	11,500	(0/51)	(51/100)	(53/100)	(83/100)	(100/100)
Total	24,400	(10/62)	(47/99)	(76/100)	(96/100)	(100/100)

Notes:
1. Values have been rounded.
2. Watershed splits are only considered approximate, since subareas cross watershed lines estimates were used in representing % removals for planning purposes. Areas were run through MEP model which looks which watersheds each load is removed from or added to for more precise results.
3. Results for shellfish include a modest 10% increase in natural growth or additional seeding over the life of the project.
4. Values only shown up to 100% - some areas addressed for future load may exceed 100% of the “existing” MEP estimates.

(continued)

Table 9-3 Estimated Percent Attenuated Load Reduction by Phase and Town (Projected Build-out Conditions)

Watershed/Town	Estimated Load to Remove (attenuated) Kg/y	Estimated Percent of Removal (No Shellfish/ Shellfish)				
		Phase 1 (%)	Phase 2 (%)	Phase 3 (%)	Phase 4 (%)	Phase 5 (%)
Popponesset Bay						
Town of Sandwich	1,900	(0/0)	(0/0)	(0/0)	(27/27)	(100/100)
Town of Mashpee	20,000	(25/54)	(53/81)	(95/100)	(100/100)	(100/100)
Town of Barnstable	4,100	(0/29)	(23/29)	(45/51)	(45/51)	(100/100)
Subtotal	26,000	(17/44)	(37/61)	(71/81)	(79/83)	(100/100)
Waquoit Bay						
Town of Sandwich	1,200	(0/0)	(100/100)	(100/100)	(100/100)	(100/100)
Town of Mashpee	17,300	(0/34)	(36/69)	(41/75)	(62/75)	(90/100)
Town of Falmouth	4,000	(0/8)	(45/52)	(45/52)	(100/89)	(100/100)
Subtotal	22,500	(0/26)	(41/66)	(45/71)	(71/96)	(83/100)
Total	48,400	(9/35)	(39/65)	(59/85)	(75/100)	(91/100)

Notes:

1. Values have been rounded.
2. Watershed splits are only considered approximate, since subareas cross watershed lines estimates were used in representing % removals for planning purposes. Areas were run through MEP model which looks which watersheds each load is removed from or added to for more precise results.
3. Results for shellfish include a modest 10% increase in natural growth or additional seeding over the life of the project.
4. Values only shown up to 100% - some areas addressed for future load may exceed 100% of the “existing” MEP estimates.
5. Future compliance without shellfish will depend on the actual build-out values in the future and performance of shellfish and other nitrogen reduction efforts. Any remaining balance of nitrogen removal will be identified during the 5 year reporting periods and addressed as part of adaptive management.

Cumulative percentages are shown based on phasing, indicating approximately when TMDL compliance could be achieved. It is noted that under shellfish approaches, town’s that may not achieve their fair share removal as soon as others may either be required to achieve compliance or have MOUs that state when they are required to achieve compliance. As stated previously, future conditions may result in some areas that benefit from shellfish, requiring additional nitrogen removal to counter build-out growth and the potential increase in nitrogen that can result from that. That is why it is expected that Phase 1 would move forward and its performance and implementation of future phases to address nitrogen will be a function of regulations, adaptive management, and MOU requirements and will dictate when efforts of Phases 2 through 5 would be completed.

It should be clear that the “no shellfish” percent removals shown in Table 9-3 presume that there are no shellfish used; nitrogen reductions are not a result of fertilizer regulations and improved BMPs for stormwater; and that each Town reaches its complete build-out potential in the next 25 years. Although there appears to be a balance remaining – the recommended plan calls for shellfish use, among the other adaptive management approaches to address this. The goal of the 5-year monitoring periods is to identify the nitrogen reduction trends and determine if additional areas need to be addressed and if the build-out potential is being reached or approached.

As shown in Figure 9-3, to achieve the TMDLs in the planning area, the plan focuses on a limited infrastructure component in conjunction with the shellfish aquaculture program. As the phasing timetables are reached an evaluation is performed:

- Consider expansion of shellfish within historical habitat limits.
- Expand traditional infrastructure as called out in the subsequent phases.
- Consideration of other adaptive management approaches that can allow further delay of more traditional infrastructure:
  - Impacts of fertilizer management
  - Growth in the planning area
  - Inlet/improved flushing of Quashnet River/Moonakis River with Falmouth
  - Other 208 Plan approaches

If the non-traditional options do not succeed, then, as shown throughout the plan, the traditional sewer infrastructure program would be built out to achieve nitrogen TMDL compliance.

In the following figure, phasing is tracked from left to right, representing shellfish performance. The left side represents shellfish achieving 100% of their estimated performance, and the right side represents a plan where the shellfish failed to achieve any nitrogen removal and therefore a fully traditional infrastructure approach ("Plan B") is used. The figure demonstrates that if the shellfish performance is not sustainable or performing to proscribed levels, additional phases of traditional or alternative approaches need to be applied to achieve the TMDLs.

(continued)

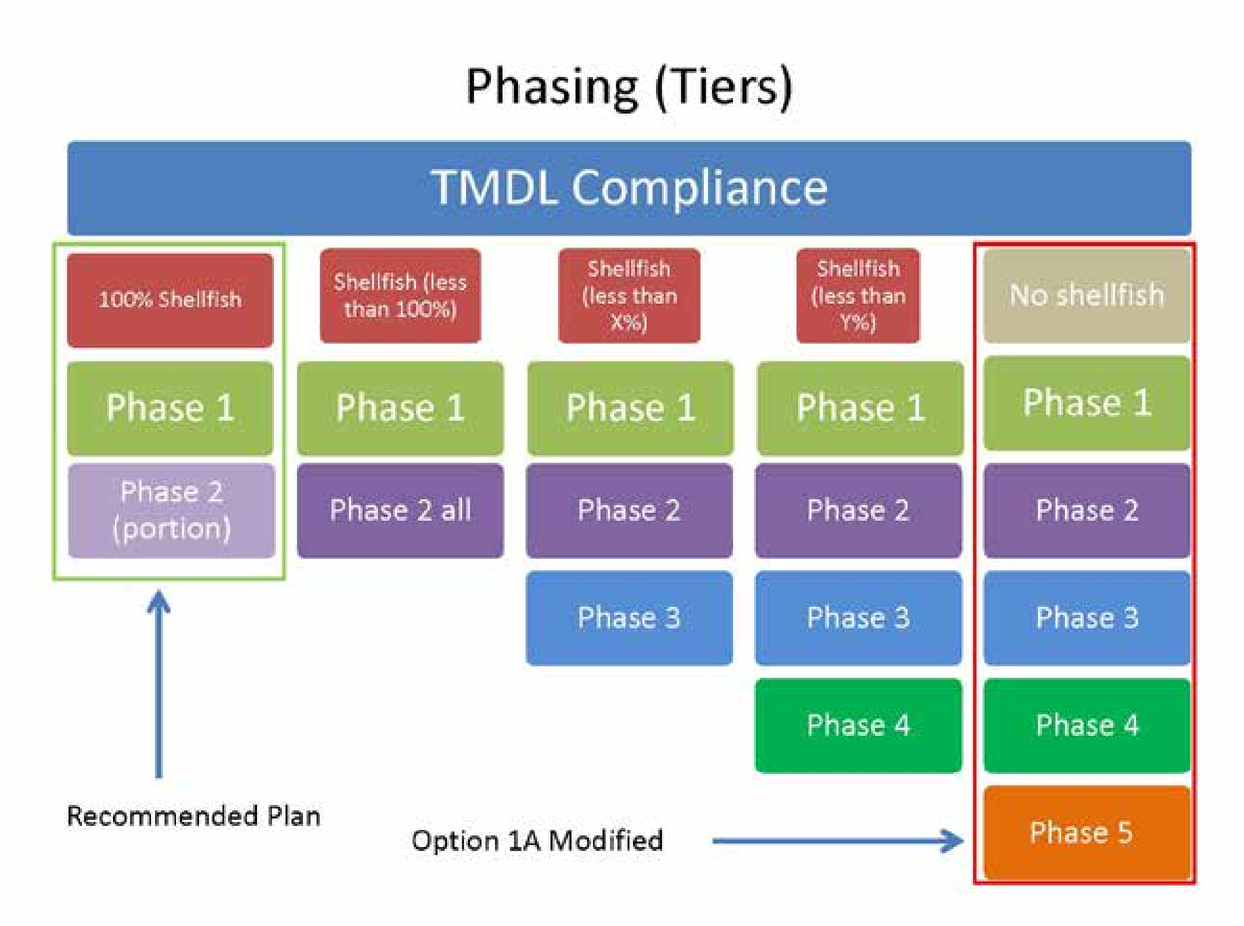


Figure 9-3 Implementation Plan Phasing to Achieve TMDLs

9.4 Monitoring and Modeling

A detailed monitoring program will be an integral part of the implementation schedule, and will be closely tied to the type of nutrient management approach being implemented at the time and its long-term performance goals. The program is outlined in Chapter 10 as part of the Adaptive Management Program. Groundwater and WWTF effluent quality will be monitored through the MassDEP Groundwater Discharge Permit (GWDP) program every five years. The shellfish aquaculture program being proposed is outlined in Chapter 6 and briefly described in Chapter 10. The program schedule will be based on input from the State and Cape Cod Commission 208 Plan and their guidance policies currently under development, and closely tied to the MEP model runs. At this time, the Town is proposing these be performed on a 5-year basis.

Shellfish aquaculture performance on nitrogen removal will be based on the commercial harvest data reported electronically by shellfish dealers to Division of Marine Fisheries (DMF) and the recreational harvest data monitored by the Town. Shellfish will be sampled and analyzed for nitrogen content and quantified. The water quality data will follow the same on-going protocols through the Mashpee Water Quality Monitoring Program and will document the various water column characteristics that are key in determining estuary health. In addition the oyster reefs will be monitored and assessed based on the protocols established in the Oyster Habitat Monitoring and Assessment Handbook (2014); this data will be reported in the TMDL compliance reports to be generated every five years.

In general, the total shellfish weight removed each year would be compared to the proposed shellfish removal rates proposed in Table 6-2. The average annual sample data results regarding the nitrogen content per shellfish species would also be compared to the estimated nitrogen content identified in Chapter 6 for each species considered; those two values would be used as the indicator at the five-year intervals that the shellfish program is proceeding as planned. The 3-year average MEP water quality data (as currently being collected by MEP) would then be used to establish nitrogen concentration trending in the water column at the sentinel station(s). Because water quality will be dependent on all of the nitrogen loading and reduction efforts throughout the watersheds, actual TMDL compliance will depend on results closer to the end of the planning period of 20 to 25 years (approximately 2014). This attempts to take into consideration groundwater time of travel and other factors, although compliance could be achieved sooner.

Determination on whether subsequent phases of traditional infrastructure are required will be based on the following criteria:

- Shellfish data as outlined in Tables 9-4 and 9-5.
- Total nitrogen water quality data.
- Results of Quashnet River/Moonakis River study.
- Joint Base Cape Cod evaluation and findings.
- Periodic (5-year intervals) updates of landuse data through the MEP modeling and MVP tools established by CCC.
- Local decision-making.

The shellfish harvest and total nitrogen in water data from water quality monitoring will be used as a basis for starting the decision-making process and Tables 9-4 and 9-5 are proposed as a means of identifying shellfish harvest goals. These goals can be used as decision points, where harvest at or above these values will indicate in the first phase of implantation if the harvest is tracking in the appropriate direction. As more data is collected and averaged in similar intervals as collected now for MEP, the nitrogen concentration in the water column can be trended such that by year 10 if the harvest numbers are in line with Tables 9-4 and 9-5, and the water column N concentration is trending down towards TMDL compliance levels that, again, the project can continue as presented. However if harvest quantities, or N trending is flat or increasing, other more traditional methods and additional adaptive management strategies will need to be implemented in order to compensate for the lack of performance by the shellfish. Water quality monitoring should also indicate if nitrogen reduction is also being achieved through deposition and denitrification caused by the increase in shellfish. Denitrification studies reported in the literature describe this for oysters and this could also be the case with quahogs. If this is the case, nitrogen reduction levels in the water column could be achieved sooner or a smaller shellfish harvest rates.

Table 9-4 Estimated Shellfish Live Harvest Goals for Decision Points [(1)]

Area	Shellfish Harvest MT Live/year (50% Year 5)	Shellfish Harvest MT Live/year (90 % Year 10)[(3)]	Estimated Annual Harvest MT Live/year [(2,3)] Range (Ave) (Year 2041)
SC19 + SC20			
Popponesset Creek	150	260	260 - 320 (290)
Ockway Bay	85	160	160 - 195 (175)
Mashpee River	250	450	450 - 550 (500)
Shoestring Bay	200	360	360 – 440 (400)
SC16			
Hamblin Pond	340	615	615 – 750 (680)
Little River	30	60	60 – 70 (65)
Jehu Pond	105	190	190 – 230 (210)
Great River	100	180	180 - 220 (200)
Total Oyster Weight	**450**	**810**	**810 – 990 (900)**
Total Quahog Weight	**810**	**1470**	**1470 – 1790 (1630)**

1. Estimates in year 5 assume 50% of shellfish harvest goal. Year 10 90% of shellfish harvest goal. TMDL compliance between 90% and 110% of harvest goal with an average of 100%.
2. Values from Table 6-2 are rounded to the nearest 5.
3. Shellfish harvest weight targets may be reduced if total nitrogen in the water column from monitoring reports shows greater reductions than predicted based on the potential for deposition and denitrification.

Table 9-5 Estimated Shellfish Harvest Nitrogen Goals for Decision Points [(1, 2)]

	Ave. % N per weight by species	Est. Removal (MT N/year) (Year 5)	Est. Removal (MT N/year) (Year 10)[(4)]	Est. Removal (MT N/year) Range (Year 2041)[(4)]
Oyster Weight	0.50	225	405	405 - 495
Quahog Weight	0.50	405	730	730 - 890
Average removal anticipated at end of planning period		**630**	**1,140**	**1260 (avg.)**

1. Estimates in year 5 assume 50% of shellfish harvest goal. Year 10 90% of shellfish harvest goal. TMDL compliance between 90% and 110% of harvest goal with an average of 100%.
2. Values from Table 6-2 are rounded to the nearest 5.
3. Removals calculated by multiplying average % weight (N) by the totals from Table 9-4.
4. Shellfish harvest weight targets may be reduced if total nitrogen in the water column from monitoring reports shows greater reductions than predicted based on the potential for deposition and denitrification.

Following each phase of shellfish implementation, shellfish harvest data will be reviewed to characterize the amount of nitrogen load removal expected; those results will then be used to evaluate implementation of the next phase of either infrastructure or other nitrogen reduction approaches to achieve the TMDLs. If average nitrogen percent per weight changes significantly based on the harvest sample data, or the metric tons of shellfish removed is significantly different, these two values would have to be compared to estimate the impact on nitrogen reduction overall. A decrease in percent nitrogen by weight (as shown in Table 9-5) combined with a larger harvest may offset each other and vice versa.

The premise of adaptive management is to allow the Town(s) to remain flexible in their implementation to take advantage of expected or advanced performance and shift resources to other areas of need or areas where the Town(s) can get a larger return on their investment or pair it with another capital improvements project in the same area.

9.5 Funding

There are several different funding opportunities available to the Town/District when they look to implement the plan including low interest loans through SRF and grants through various programs. The following is a brief summary of some of the various funding opportunities that may be available.

The estimated cost for Phase 1 infrastructure (Site 4) and long-term shellfish implementation is summarized in Table 9-6. Costs do not include proposed Feasibility Study for Quashnet/Moonakis River or other evaluations or studies. The plan also has deferred work associated with Joint Base Cape Cod until both the feasibility study of the Quashnet/Moonakis River is completed and MassDevelopment has completed its evaluation of the JBCC facility and has provided additional feedback to the neighboring communities about that facility's future use.

(continued)

Table 9-6 Estimated Total Present Worth Cost of Recommended Plan—Phase 1

Estimated Costs [1]	Phase 1 Implementation with Shellfish Aquaculture
Capital Costs	
Shellfish Aquaculture (yr1)[6]	$1,500,000
Collection System	$20,000,000
Treatment System [2, 3]	$11,000,000
Recharge facility [3, 4]	$1,500,000
Total	**$34,000,000**
O&M Costs	
Shellfish Aquaculture	$1,500,000
Collection System	$100,000
Treatment System	$1,300,000
Recharge Facilities	$30,000
Total	**$2,900,000**
Present Worth O&M [5]	$44,000,000
Total Present Worth	**$78,000,000**

1. Values rounded to two significant figures, and include allowances for fiscal, legal and engineering services, and contingency. Based on an ENR year of 2017.
2. Treatment costs include new facilities and improvements/upgrades to existing facilities. For neighboring communities of Barnstable and Sandwich, collection, treatment, and recharge costs were estimated for planning purposes only; actual location, technology type, and site considerations would need to be determined by each individual community.
3. Allowances for facilities located in Sandwich (not including those proposed to connect to JBCC) and Barnstable (Falmouth assumed to go to JBCC).
4. Estimated costs with shellfish aquaculture presume that existing and future loads are managed through this adaptive management approach, Joint Base Cape Cod is available, and no additional recharge capacity is required.
5. Based on 20 years and 3% interest.
6. Cost does not include Town staff which is currently funded by the Town through their existing program(s).

There are several different approaches on how a project like this might be funded, and the approach taken will depend on how many individual projects are taken on at any one time and what types of funding opportunities are available. The following is a listing of several different types of funding opportunities and also includes opportunities for other adaptive management approaches including stormwater BMPs.

As stated in Chapter 6, Phase 1 will not achieve the TMDL but will allow the Town/District to assess performance after year five and begin addressing areas of need within the Town of Mashpee. It will further allow the development of IMAs/MOUs with Barnstable, Falmouth, and Sandwich regarding TMDL compliance within the waterbodies where less than 100% of nitrogen removal is proposed through shellfish (Quashnet River, Mashpee River, and Shoestring Bay). Costs do not include monitoring and modeling as the extents of those programs are to be determined, in addition the Cape Cod Commission has stated as part of the 208 goals of establishing some regional monitoring to assist communities with these costs.

Funding approaches are discussed in the subsequent sections.

9.4.1 State and Federal

1 State Revolving Loan Program (administered through MassDEP and funded by USEPA):

- Two-percent (low interest) loans available for both water (drinking water) and wastewater (clean water) projects.
- Zero-percent loans available for qualifying programs under the Clean Water SRF.
- State is considering how to apply SRF funding to “alternative” or “non-traditional” projects that are used in nutrient reduction.
- Filing of Project Evaluation Forms (PEF) to get on an Intended Use Plan (IUP). Those programs listed on the IUP then can apply for the loan.
  - i. PEF (August)
  - ii. IUP (January)
  - iii. SRF Application with Design (October)

2 Hazard Mitigation:

- Typical projects include those that protect infrastructure from storms.
- Values of grants depend on funding amount allocated each year.
- Town should include projects in their hazard mitigation plans (these are FEMA {Federal Emergency Management Agency} approved documents).
- Typical application milestone dates of:
  - August (Massachusetts Emergency Management Agency {MEMA}) and September (FEMA)

9.4.2 State

1 MassWorks Infrastructure Program:

- Typical projects include: those seeking public infrastructure funding to support economic development and job creation and retention; housing development at a density of at least four units to the acre (both market and affordable units); and transportation improvements to enhance safety in small, rural communities. There are several grants housed under this one program.
- No maximum size projects.
- Only projects that are prepared to proceed to construction during upcoming construction season should apply.
- Match not required.
- Typical application milestone dates of:
  - Early June online applications open.
  - Early September applications are submitted electronically.

- Mid November applicants are notified of the decision.

2 Massachusetts Coastal Zone Management (CZM) Coastal Pollution Remediation (CPR) Program:

- Typical projects include those that improve coastal water quality by reducing or eliminating nonpoint source (NPS) pollution (i.e. stormwater). Categories of projects that are fundable include assessments, design and construction of BMPs, and design and construction of commercial boat-waste pump-out facilities
- Maximum of $125,000 grant funding.
- Town must provide 25% match.
- Match can include Town "force account" work.
- Typical application milestone dates of:
  - RFR announcement in summer or fall, contingent on funding.
  - Application due date varies on funding schedule.
  - Design and construction projects need to be completed by June 30.

3 319 Grants:

- Typical projects include implementation projects that address the prevention, control, and abatement of NPS pollution (i.e. stormwater). 604b-funded assessment work is often the basis for 319 implementation proposals.
- No maximum size projects.
- Town needs to pay 40% non-federal match.
- Good for 3-year projects and NPDES MS4 non-regulated communities.
- Typical application milestone dates of:
  - Program announcement in early April.
  - Proposals due in late May.

4 604b Grants:

- Typical projects include those for water quality assessment and management planning (typically for stormwater).
- No maximum size projects.
- 100% grant paid.
- Good for 2-year projects and NPDES MS4 non-regulated communities.
- Grant typically used for watershed or sub-watershed based nonpoint source assessment activities and design.
- Typical application milestone dates of:
  - Program announcement in late January.
  - Proposals due in mid-March.

5 Massachusetts Environmental Trust (MET) Grant Program:

- Typical projects include those that protect and restore the water and related resources of the Commonwealth. The program accepts proposals for programs and initiatives that address threats to the health of water bodies. There are four program funding portfolios within the

Trust. One example of this program is the Sustainable Water Management Initiative—these cover water supply and some wastewater and stormwater projects if they protect water supplies.

- Grants range from $5,000 to $100,000.
- One to three year awards.
- Range from 25% match to no match.
- Typical application milestones:
  - Applications open in mid-August.
  - Applications due in mid-October.

6 Community Engagement Grants:

- Most awards are given to regional or community ventures.
- Awarded $6 million in two years.
- Potential for follow-up grants.
- Deadline in November.

9.4.3 Renewable Energy/Massachusetts Clean Energy Center (MassCEC)

1 Commonwealth Solar Rebate program (for 15kW and smaller) with the following details:

- Typical projects include photovoltaic panels for energy production.
- Base Incentive: $0.40/watt.
- Massachusetts Company Components Adder: $0.05/watt.
- Natural Disaster Relief Adder: $1.00/watt.
- Typical application milestone dates of:
  - Programs change frequently.

2 Thermal Renewable Energy grants:

- The Department of Energy Resources and the Massachusetts Clean Energy Center have launched a program to support construction of renewable energy heating and cooling projects in municipal buildings, schools, and other structures.
- A total of $4.3 million is available for projects such as low-emission biomass heating systems, ground source heat pumps, and central heating or cooling units that serve multiple buildings and make use of a renewable energy source. Grants are also available for feasibility, design, and engineering studies.
- The grants can be used for projects involving municipal buildings, schools, and nonprofit organizations as well as commercial greenhouses.
- Applications will be accepted on a rolling basis through March 28 or until the funding is exhausted, whichever comes first. Applications will be reviewed on a first-come, first-served basis.

3 Commonwealth Wind for Community and Commercial Wind Projects—grants for site assessment, feasibility studies, and development:

- Typical projects include wind turbines for energy production.

The following tables are excerpts from Commonwealth Wind Solicitation:
(http://www.masscec.com/solicitations/commonwealth-wind-development-grants)

Table 2: Development Grant Maximum Grant Levels, Minimum Cost Shares, and Pre-Construction Grant Allocation

Project Type	Public Entity			Non-Public Entity		
	Maximum Grant	Minimum Cost Share	Pre-Construction Grant Allocation	Maximum Grant	Minimum Cost Share	Pre-Construction Grant Allocation
Community Wind	$400,000*	5%	50%	$260,000*	25%	20%
Commercial Wind	Not Applicable	Not Applicable	Not Applicable	$250,000	40%	100%

* Varies by project size

Table 1: Maximum Grant Levels and Required Cost Shares

Program Offering	Public Entity		Non-Public Entity	
	Maximum Grant	Cost Share	Maximum Grant	Cost Share
Feasibility Study	$50,000	5%	$40,000	20%
Wind Monitoring Equipment Adder	$20,000	5%	$15,000	20%
Acoustic Study Grant	$15,000	None	$12,000	20%
Business Planning Adder	$15,000	5%	NA	NA

4 Organics to Energy Pilot or Construction

Typical projects include those that use anaerobic digestion to combine food waste with sludges.

Table 3: Maximum Grant Funding Levels per Project

	Construction	Pilot
Dollar Cap	$400,000	$200,000
Percentage Cap	25% of total Contract Budget (i.e., minimum 75% Grantee cost-share)	50% of total Contract Budget (i.e., minimum 50% Grantee cost-share)
Grant Cost-Effectiveness Ratio Requirement	<$1.5 per kilowatt-hour Equivalent of electricity and/or Useful Thermal Energy per year	N/A

9.6 Summary

The Recommended Plan is proposed over a 25- to 30-year time period which will depend heavily on the performance of shellfish aquaculture and the securing of treatment and recharge capacity at JBCC. As shown, TMDL compliance/MEP modeling points will be used to track performance and allow for mid-course corrections through adaptive management.

10 Adaptive Management Plan Framework

10.1 Introduction

This chapter summarizes the framework of the Adaptive Management Plan that will need to be created as a follow-up to the development of the Recommended Plan as typically required by the CCC DRI review. Adaptive management allows for communities to implement, monitor and make mid-course corrections as needed to achieve the nitrogen TMDL goals. This chapter also identifies various adaptive management approaches that could be implemented in an effort to reduce nitrogen to help mitigate the need for sewering. These efforts would include those non-traditional methods discussed in Chapter 4 and Chapter 6. The following were specifically identified in the Recommended Plan (Chapter 6):

- Shellfish Propagation (key aspect of Recommended Plan).
- Stormwater Mitigation.
- Fertilizer Management.

The following are other technologies and approaches discussed in the planning effort that may be considered through adaptive management. This list includes but is not limited to the following:

- Demonstration Projects:
  - Permeable Reactive Barriers
  - Wetland Restoration
  - Eco Toilets
- Land Management.
- Floating Wetlands.
- Ocean Outfall.
- CCC 208 Plan technologies as appropriate.

10.2 Monitoring and Modeling

It is understood that environmental changes may be observed from ongoing and proposed environmental monitoring activities, and mid-course corrections to the plan implementation may be necessary. This understanding of possible mid-course corrections is often referred to as “Adaptive Management”. The following components of the compliance monitoring of this plan are identified. It is understood that as time progresses the plan will need to be adjusted to account for changes in permitting requirements and to take into consideration the changes in the environment. The monitoring and modeling results will assist in verification of performance of the Recommended Plan.

Initial/Short-Term Monitoring and Modeling

- Shellfish/estuary baseline monitoring.
- Estuary short-term (ongoing) intensive water quality and shellfish quality monitoring to check near-term performance following MEP established protocols for estuary water quality and health.
- MEP flushing and stream gauge monitoring necessary to update MEP TMDL compliance points.

- Groundwater/drinking water supply quality.
- Groundwater mounding analysis through localized modeling.

Long-Term Monitoring and Modeling

- Each of the existing and proposed treatment facilities that have MassDEP groundwater discharge permits has various monitoring requirements. Monitoring shall be in accordance with each specific permit and may include the following:
  - Daily monitoring of:
    - § Flow
    - § pH
    - § disinfection
    - § turbidity (if required).
  - Weekly/monthly monitoring of (influent/effluent):
    - § flow
    - § biochemical oxygen demand (BOD)
    - § total solids (TS)
    - § total suspended solids (TSS)
    - § total nitrogen (TN)
    - § ammonia nitrogen
    - § oil and grease (effluent)
    - § fecal coliform (effluent)
    - § UV intensity (if used)
    - § volatile organic compounds (VOC – annually)
    - § possibly total phosphorus (TP) (if required)
  - Process monitoring (periodically or as required) of:
    - § temperature (daily)
    - § precipitation (daily)
    - § influent and or effluent nitrogen (TKN, NH4, NO2/NO3)
    - § COD
    - § total organic carbon (TOC) (if required)
    - § mixed liquor suspended solids (MLSS)
  - Groundwater monitoring well data (typically quarterly); up-gradient and down-gradient of recharge facilities:
    - § nitrogen (various species)
    - § phosphorus
    - § level
    - § specific conductance
    - § DO
    - § pH
    - § TOC (annual)
    - § VOCs (annual)

§ metals (if required)

· MEP estuary monitoring and modeling (land and hydrodynamic):

- TMDL compliance:
  - § Year-round (monitoring instruments):
    - o conductivity (salinity)
    - o chlorophyll a
    - o dissolved oxygen (DO)
    - o pH
    - o turbidity
    - o temperature
  - § MEP protocols:
    - o conductivity (salinity)
    - o chlorophyll a
    - o dissolved oxygen (DO)
    - o nitrogen (TN, NH4, NO2/NO3, TDN, POC/N)
    - o secchi disk visibility
    - o suspended solids
    - o temperature
- Long-term trending of standard MEP water quality parameters. MEP is working on the development of Standard Operating Procedures for sampling and analysis to provide to the Towns that are going to be performing their long-term monitoring.
- Eel grass surveys typically provided by MassDEP.
- Benthic habitat surveys (if required).

· Shellfish/Estuary Monitoring:

- Long-term compliance monitoring performed following the same MEP protocols to measure estuary health.
- Shellfish monitoring in compliance with DMF requirements depending on end use of shellfish.
- Recreational harvest data will be collected from existing surveillance cameras and patrols by the Shellfish Constable and assistants.
- Sampling and analysis:
  - § Shellfish harvest data (both recreational and commercial).
  - § Shellfish sample analysis (annual testing for average analysis). General parameters including:
    - o length, width, and height
    - o whole weight
    - o dry shell mass
    - o nitrogen content

- Groundwater quality monitoring through existing drinking water supply wells as required by MassDEP and EPA; and groundwater monitoring wells as required by groundwater discharge permits issued by MassDEP for wastewater treatment facilities.

The Mashpee Water Quality Monitoring program is continuing the same sampling protocols, stations, and analytical methods that were used to provide data for the MEP and TMDL reports for the Popponesset Bay and Waquoit Bay systems. The stations are listed and mapped in the reports (Howes et al. 2004, pp. 88 and 89/Howes et al. 2011, p. 117). Water samples are analyzed at the UMass Dartmouth SMAST certified lab. The protocols, analytical methods documents, and reports from ongoing monitoring are available from Dr. Brian Howes, UMass Dartmouth SMAST. This existing information will form the basis for some of the baseline data for the waterbodies as well.

The Mashpee Water Quality Monitoring Program that provided the data used to establish the TMDL-N is ongoing and will supply the data needed for TMDL-N compliance and determination of water quality. Shellfish harvest and nitrogen content data will give the amount of nitrogen removed by shellfish. Other data—such as upstream and downstream from alternatives such as shellfish beds—is supplementary and subject to variability, requiring large numbers of samples in some cases.

10.3 Compliance Reporting

As part of the implementation of the plan, each implementation phase will be incorporated into a compliance document related to Mashpee's efforts in achieving the TMDLs. Depending on the requirements established by the regulators, this document may need to reference or be referenced by the neighboring communities as part of their compliance reporting. This document, which will need to be negotiated with the Town, District, and associated regulators would then be available to MassDEP, DMF, CZM, MEP, CCC, neighboring communities, and other agencies as so identified in that effort.

This report is anticipated to be tied directly to the monitoring efforts and "modeling" plan necessary to demonstrate compliance with the TMDLs and performance of those efforts implemented to date. Due to the long-term nature of the implementation, it is anticipated that this document would be prepared and issued every five years, similar to the MassDEP groundwater discharge permit program.

10.4 Adaptive Approaches

The WNMP/CWMP identified several approaches that are either proposed as a component of the plan or reflect current efforts of the Town to mitigate nitrogen including:

- Shellfish propagation
- Fertilizer management
- Land management practices
- Stormwater BMPs

In addition, other approaches as identified in the CCC 208 planning process may be implemented following their demonstrated performance, public acceptance, and feasibility for use in Mashpee.

As the plan is currently crafted, existing infrastructure will be utilized to its fullest extent. Several small "Phase 1" and "Phase 2" projects requiring extension of sewers in areas within the Mashpee River watershed and south of Johns/Ashumet Ponds, respectively, are proposed in addition to shellfish aquaculture.

As the monitoring and modeling demonstrates performance (especially as it relates to shellfish aquaculture), adjustments in additional shellfish or other nitrogen removal measures, or advancement or delay in sewer extensions as outlined in Chapter 9 will be implemented as needed to address nitrogen removal performance. This will be done in consideration of future development within the watersheds and also shellfish health and advancement of other mitigation approaches allowing the Town to make mid-course adjustments to their implementation approach; those will be documented through Notices of Project Change.

Since the ocean outfall option was not a possibility during the majority of the planning stage of the project, it has not been evaluated. At this time, it is not clear if this would be a cost-effective option. The project does not have a central facility planned therefore may require multiple outfalls or means of conveyance into one outfall. The planning and construction of outfalls are costly. It is not clear what requirements—operational or monitoring—would be placed on the facility, and it would be anticipated that the permitting process would be long and potentially contentious.

Should development of Phases 3 and 4 facilities be required and the proposed discharge site at the New Seabury golf course be implemented, detailed analysis of the impacts of sea level rise on groundwater levels will be done to determine whether an ocean outfall might be required as an alternative at some future date.

The Town of Mashpee will be developing a Growth/Flow Neutral policy regarding the nitrogen TMDLs. As discussed in Chapter 2, Mashpee is at or approaching its build-out, however does have development permitted going back to the 1970s and 80s. In addition, with the consideration of sea level rise and future flooding, Mashpee's current regulations are in place to control growth within areas subject to flooding in addition to CCC's, CZM's and DEP's rules and regulations regarding this. Provisions discussed in the planning are not made to encourage growth and these would be further defined in the Growth/Flow Neutral policies.

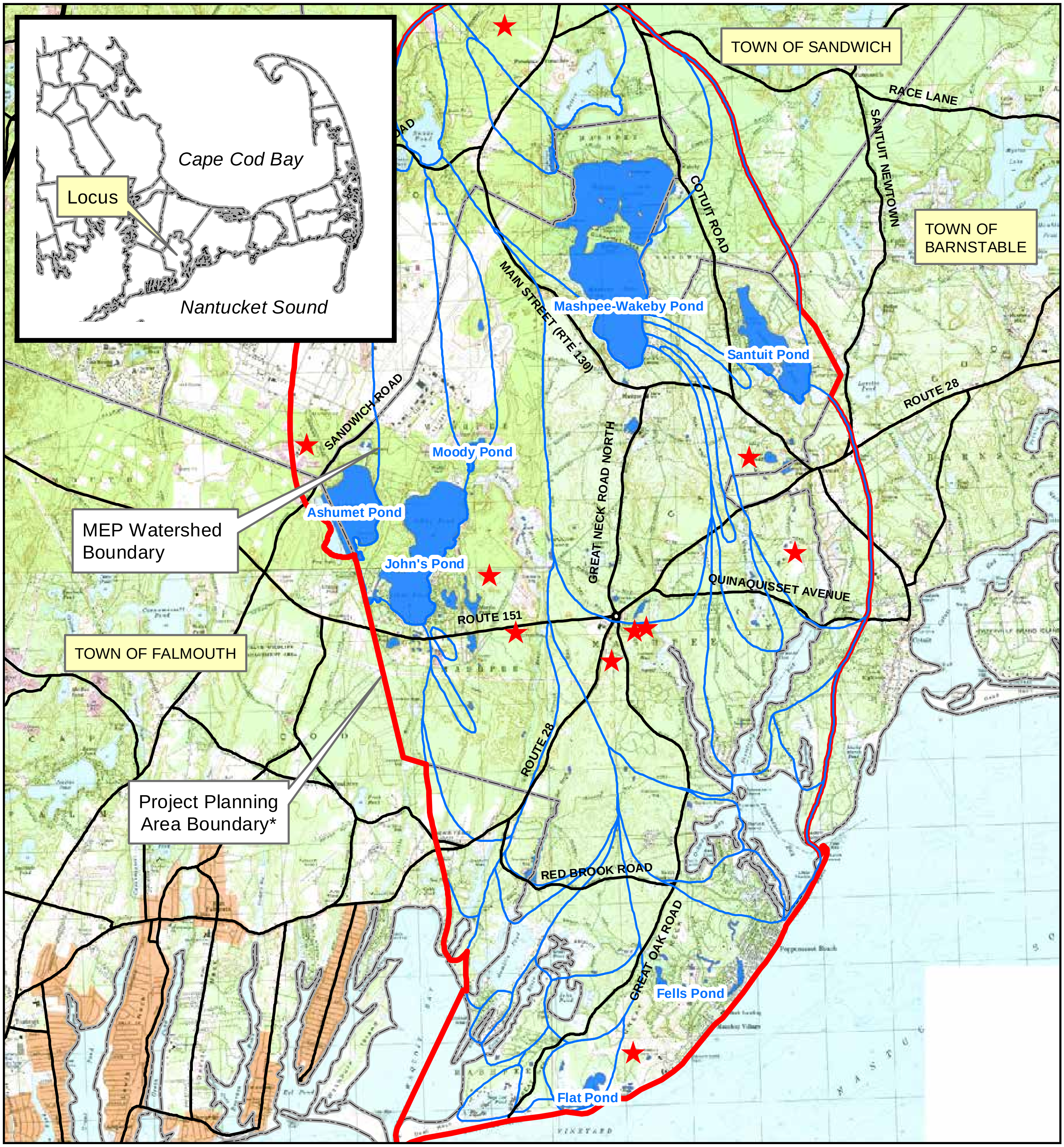
10.5 Regional Coordination

As discussed previously, planning efforts of the neighboring communities for TMDL compliance and other water quality (fresh, salt, ground) are expected to have positive impacts on the estuary water quality; and as a result, Towns need to be able to make mid-course adjustments in their implementation related to these impacts.

10.6 Summary

As discussed in Chapter 9, this monitoring program will have several components. The components include the more traditional ones associated with MassDEP GWDPs and those of MEP estuary monitoring. These monitoring efforts will be performed in conjunction with the efforts proposed in Chapter 6 regarding shellfish aquaculture. Other programs will come out of state guidance efforts and the CCC 208 planning efforts—both currently underway.

Figures



LEGEND

MEP Watershed

WWTF Location

Major Roadway (For Location Reference)

***The Project Area is the combination of the entire Town of Mashpee and the watersheds of Popponesset Bay and Waquoit Bay-East as delineated by the Massachusetts Estuaries Project (MEP) extending into the Towns of Barnstable, Falmouth and Sandwich.**

Paper Size ANSI A

0 0.375 0.75 1.5 Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001

N

GHD

Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

PROJECT PLANNING AREA

Job Number 86-12001
Revision A
Date 07 May 2015

Figure 1-1

1545 Iyannough Road, Hyannis Massachusetts 02601 USA T 1 508 362 5680 F 1 508 362 5684 E hyamail@ghd.com W www.ghd.com

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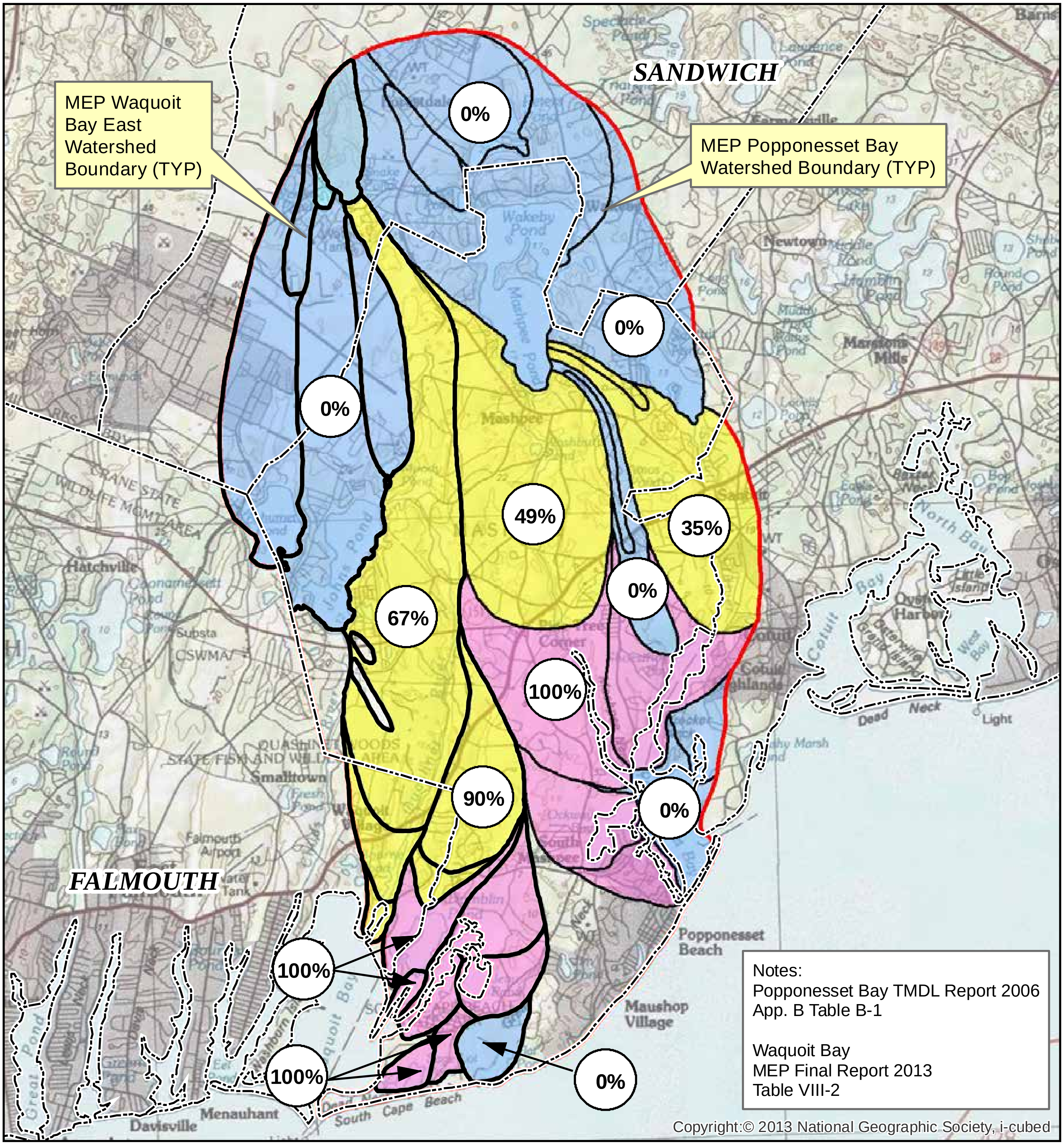

LEGEND

100% Percentage of Wastewater Nitrogen Removal Suggested by MEP (Septic Only)

0% Removal | 1-99% Removal | 100% Removal

The "Project Area" is the combination of the Town of Mashpee and the watersheds of Popponesset Bay and Waquoit Bay East as delineated by the Massachusetts Estuaries Project (MEP).

Paper Size ANSI A

0 0.5 1 2 Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001

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Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

MEP Estimated Percent Septic (only) Removals

Job Number 86-12001
Revision A
Date 04 May 2015

Figure 1-2

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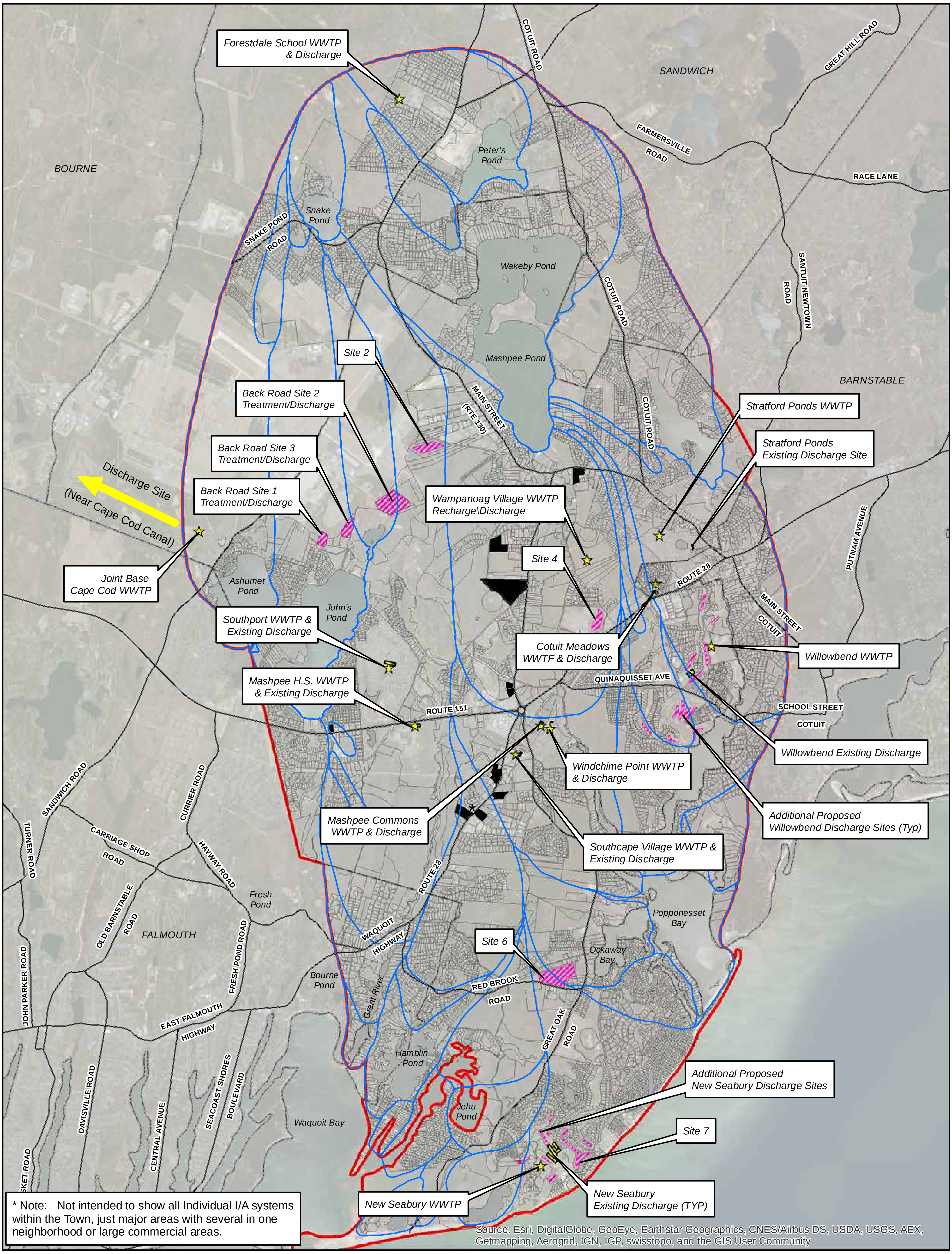

LEGEND

Parcel Boundary	Proposed Treatment/Discharge Site
Planning Area Boundary	Existing Discharge Site
Town Boundaries	☆ Existing WWTPs
MEP Watersheds	I/A

Note: Parcel boundaries on this map represent fiscal years 2011/2012 data based on Level 3 deliveries to MassGIS. The last updated parcel file for the Town of Mashpee, Ma was 2011. The other municipalities within the planning area may have since re-assessed parcels since 2012 but are not currently available on MassGIS.

Paper Size ANSI B

0 0.375 0.75 1.5 Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

N

Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

Job Number 86-12001
Revision A
Date 06 May 2015

KEY TREATMENT & RECHARGE SITES

Figure 4-1

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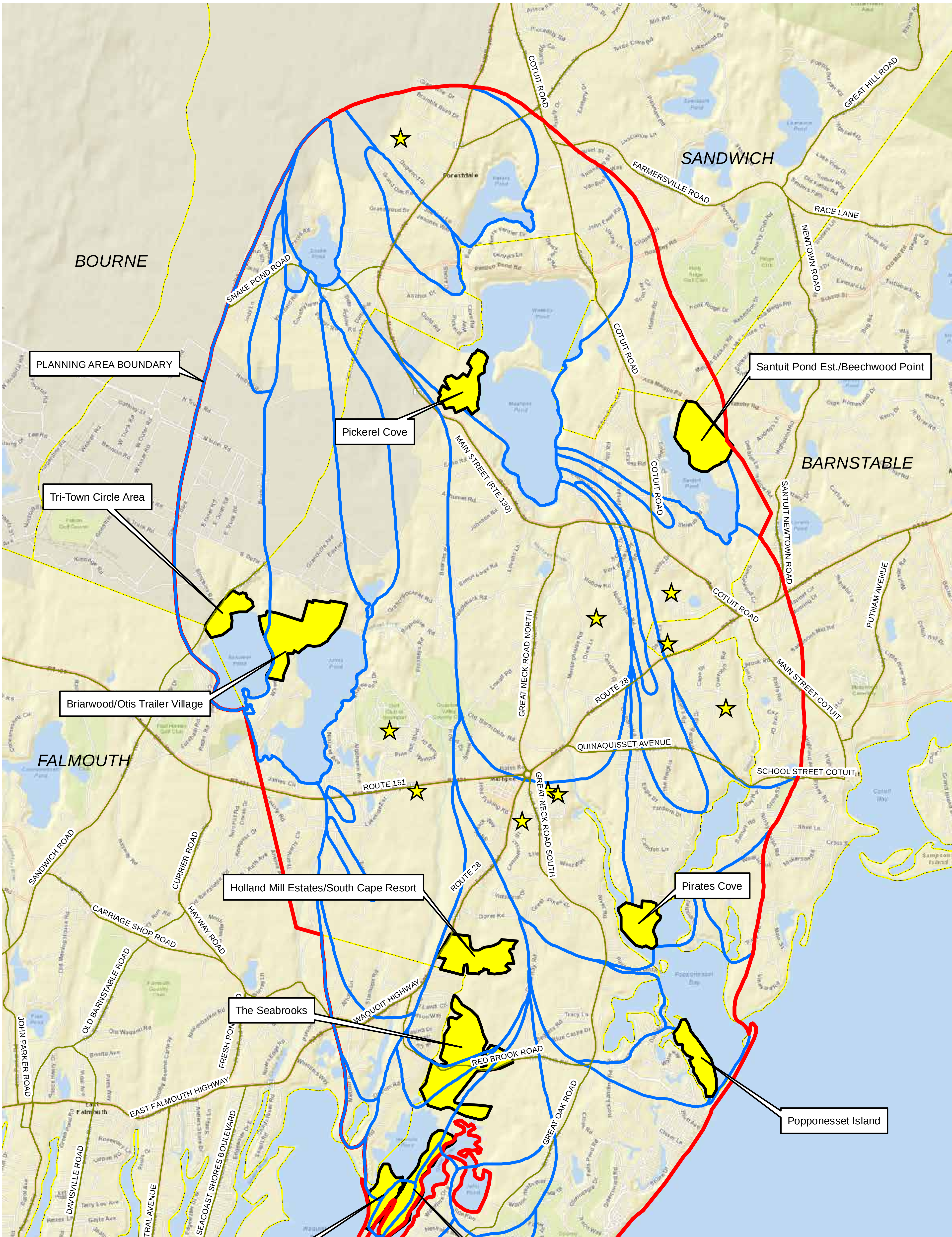

Legend

Planning Area Boundary | Existing Private WWTP | Potential Cluster System

Paper Size ANSI B

0 0.375 0.75 1.5 Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

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Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

Job Number	86-12001
Revision	A
Date	06 May 2015

POTENTIAL CLUSTER SYSTEM LOCATIONS

Figure 4-2

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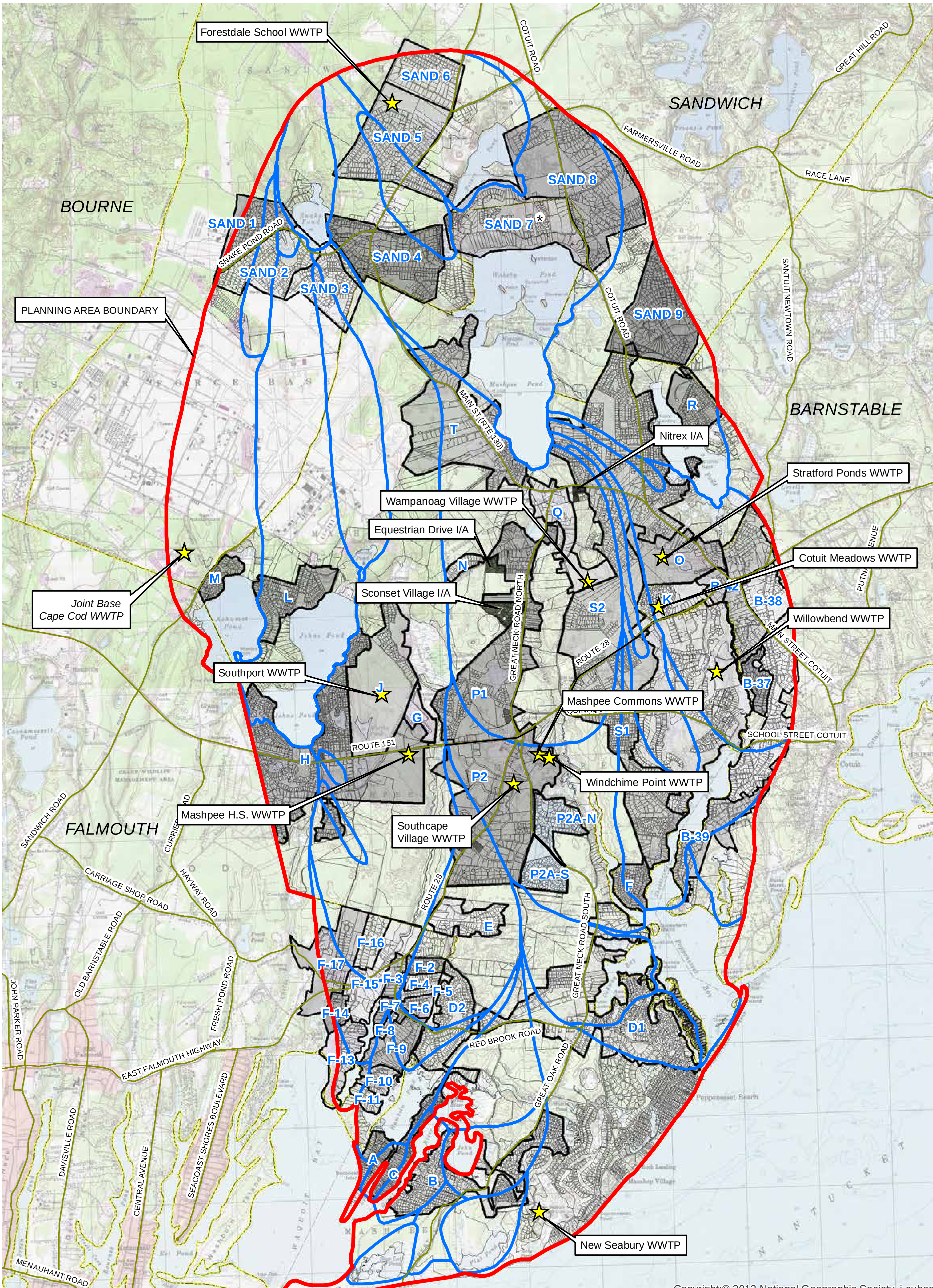

Notes:
1. Some future areas not shown.
2. Map does not show all I/A locations.
3. Some areas have been further subdivided for analysis purposes (Not shown for clarity)
4.Greyscales and colors shown on map for clarity purposes only.
5. *"Sand 7" includes a portion of Mashpee

Note: Parcel boundaries on this map represent fiscal years 2011/2012 data based on Level 3 deliveries to MassGIS. The last updated parcel file for the Town of Mashpee, Ma was 2011. The other municipalities within the planning area may have since re-assessed parcels since 2012 but are not currently available on MassGIS.

Paper Size ANSI B

0 0.375 0.75 1.5 Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

N

Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

SUB AREAS

Job Number	86-12001
Revision	A
Date	06 May 2015

Figure 4-3

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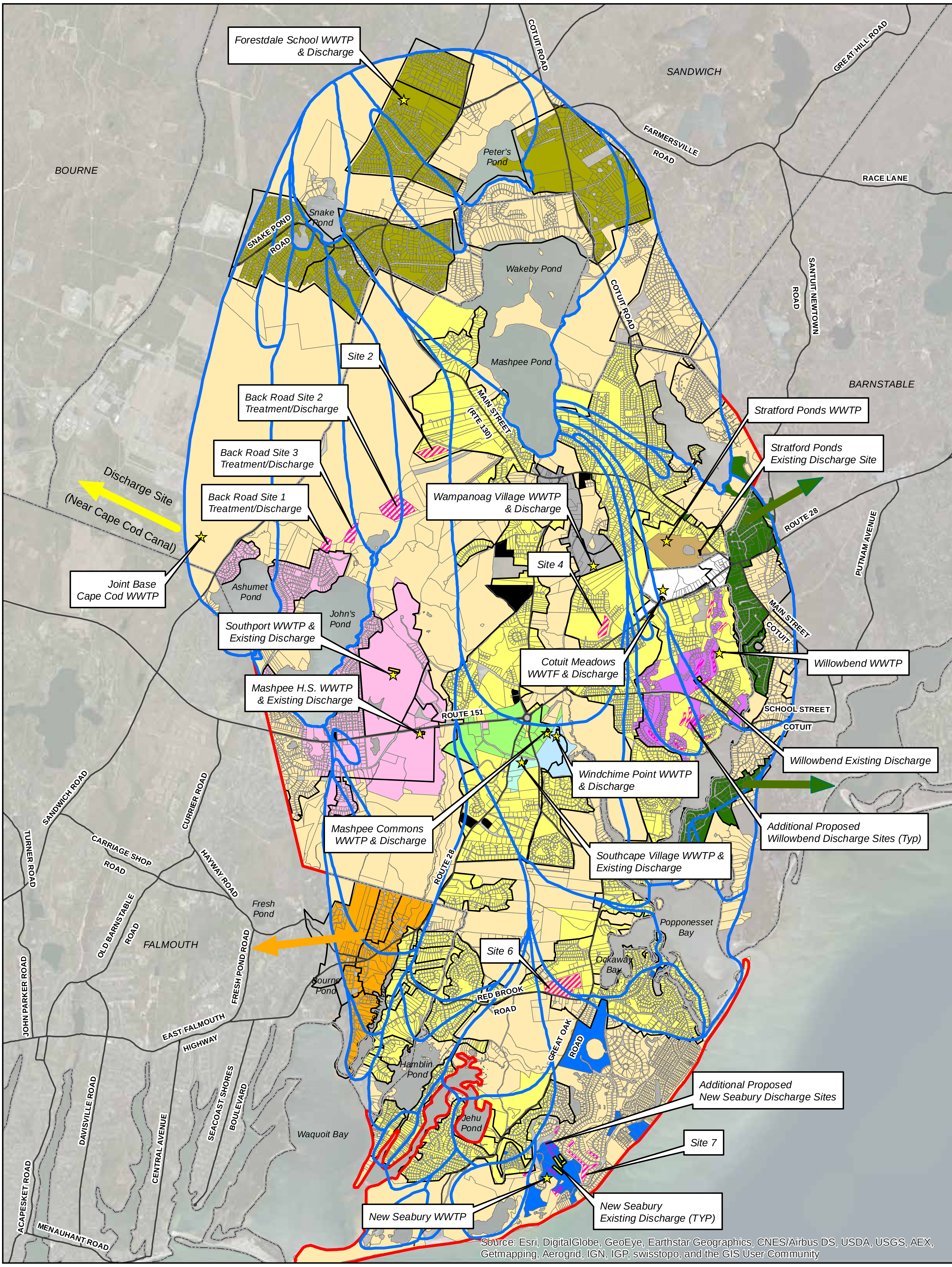

LEGEND

- Planning Area Boundary
- Town Boundaries
- Proposed Treatment/Discharge Site
- Existing Discharge Site
- Existing WWTPs
- MEP Watersheds
- Barnstable Outside Watershed
- Cotuit Meadows WWTF
- Falmouth Outside Watershed
- I/A Systems (Cluster Only)
- Johns Pond Region
- MSPA
- Mashpee Commons WWTF
- New Seabury Existing and Future connections
- Sandwich Outside Watershed
- Septic
- South Cape Village WWTF
- Stratford Ponds
- Wampanoag Village WWTF
- Willowbend WWTF
- Windchime Point

Paper Size ANSI B

0 0.375 0.75 1.5 Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

N

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Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

OPTION 1A (From ASAR)

Job Number	86-12001
Revision	A
Date	06 May 2015

Figure 4-4

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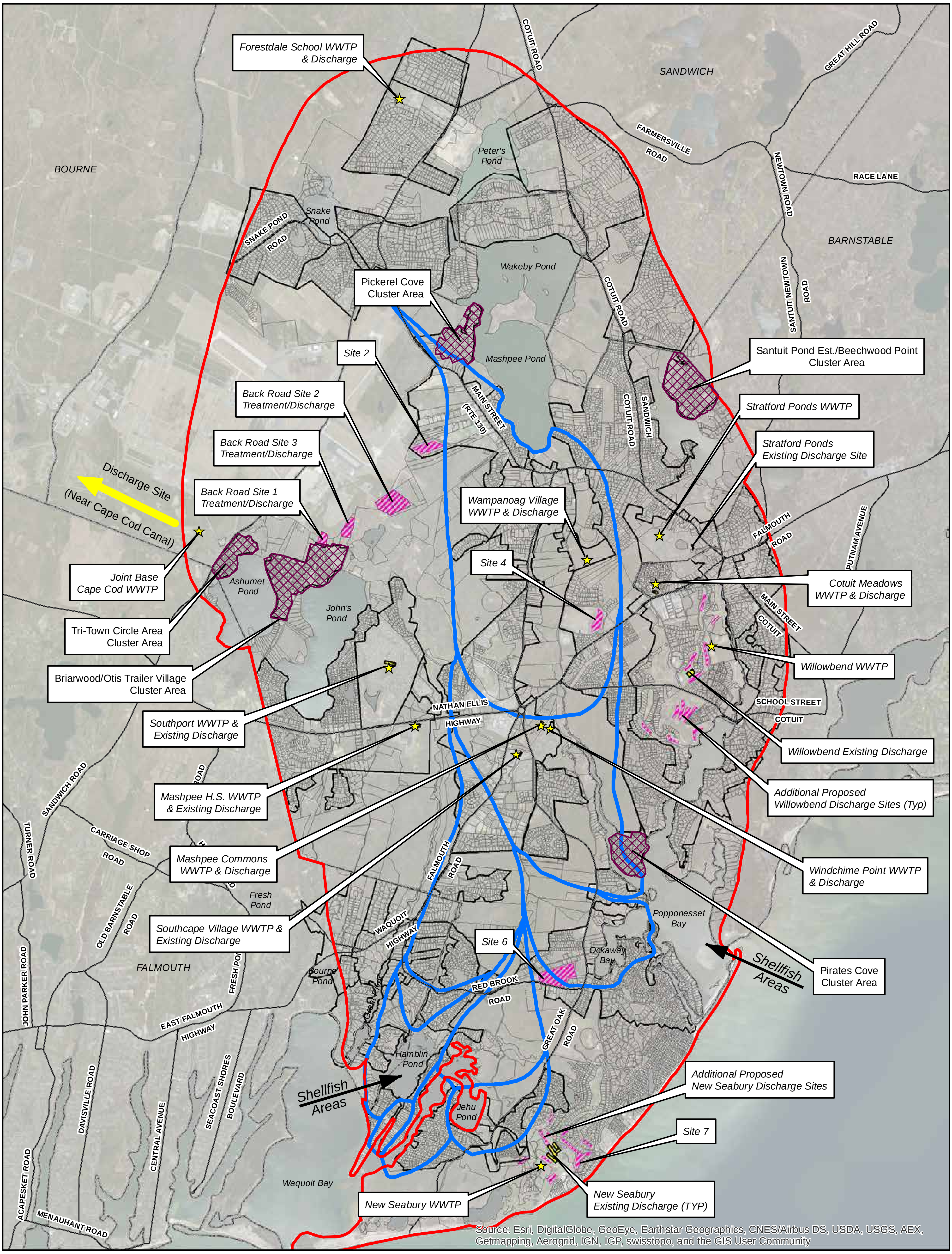

LEGEND

- Potential Cluster System
- Planning Area Boundary
- Watersheds to Shellfish Areas
- Town Boundaries
- Existing WWTPs
- Proposed Treatment/Discharge Site
- Existing Discharge Site
- Parcel Boundary

Note: Parcel boundaries on this map represent fiscal years 2011/2012 data based on Level 3 deliveries to MassGIS. The last updated parcel file for the Town of Mashpee, Ma was 2011. The other municipalities within the planning area may havesince re-assessed parcels since 2012 but are not currently available on MassGIS.

Paper Size ANSI B

0 0.375 0.75 1.5 Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

N

Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

OPTION 1A - ALTERNATIVE EVALUATION AREAS

Job Number	86-12001
Revision	A
Date	29 Apr 2015

Figure 4-5

G:\86\12001\GIS\00074 Mashpee\2014\Final Report Figures\8612001F5-3_1A Option - Alternatives Evaluation.mxd

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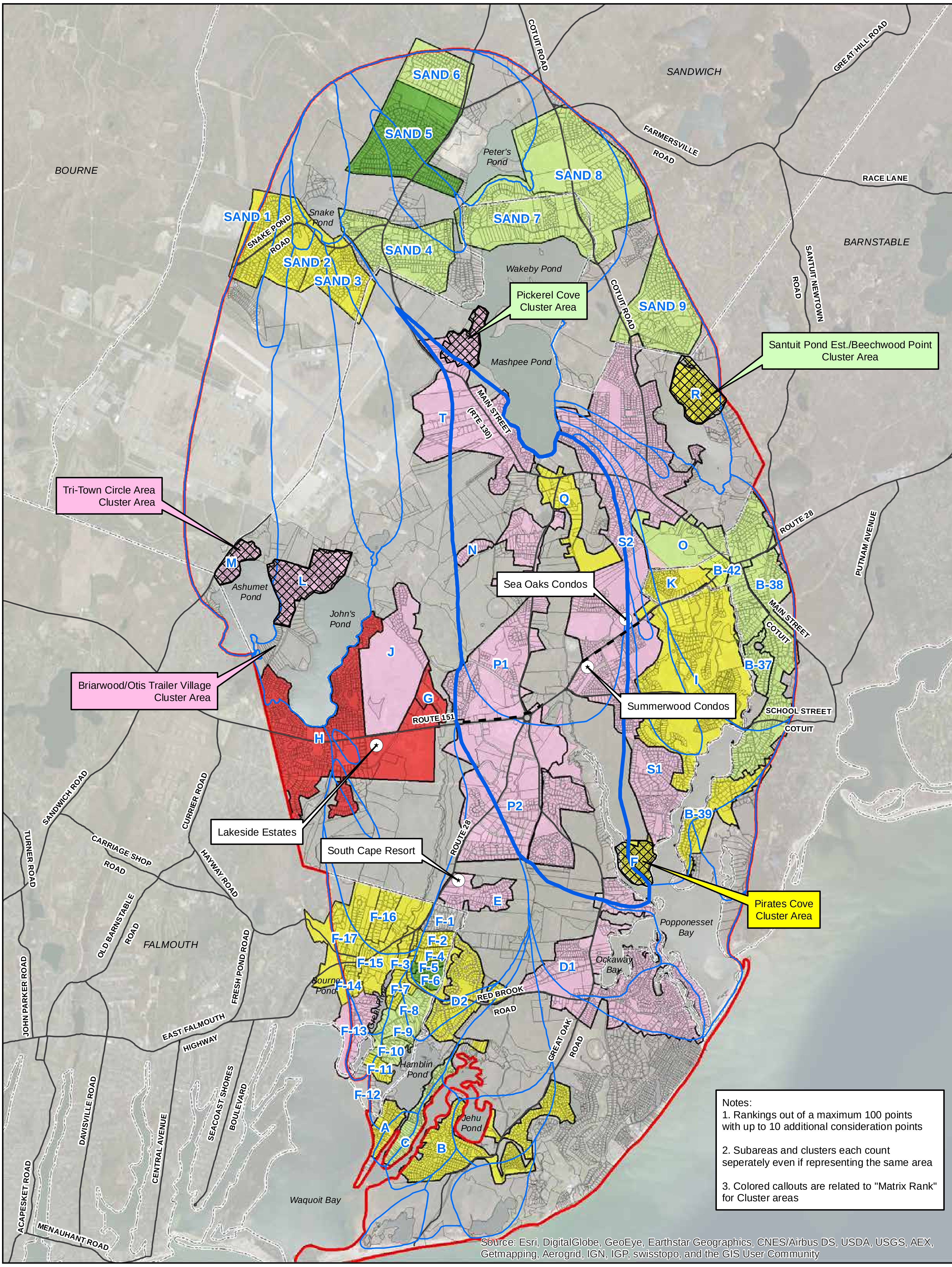

LEGEND

Matrix Point Rating

High
Low

Mashpee River Additional Area of Consideration
Additional Area of Consideration
Potential Cluster System
MEP Watersheds
Parcel Boundary
Planning Area Boundary
Town Boundaries

Note: Parcel boundaries on this map represent fiscal years 2011/2012 data based on Level 3 deliveries to MassGIS. The last updated parcel file for the Town of Mashpee, Ma was 2011. The other municipalities within the planning area may have since re-assessed parcels since 2012 but are not currently available on MassGIS.

Paper Size ANSI B
0 0.375 0.75 1.5 Miles
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

N

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Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

Job Number	86-12001
Revision	A
Date	06 May 2015

MATRIX RESULTS BY SUBAREA OR CLUSTER WITH SHELLFISH

Figure 4-6

G:\86\12001\GIS\00074 Mashpee\2014\Final Report Figures\New folder\8612001F4-6_Matrix Results-wShell.mxd

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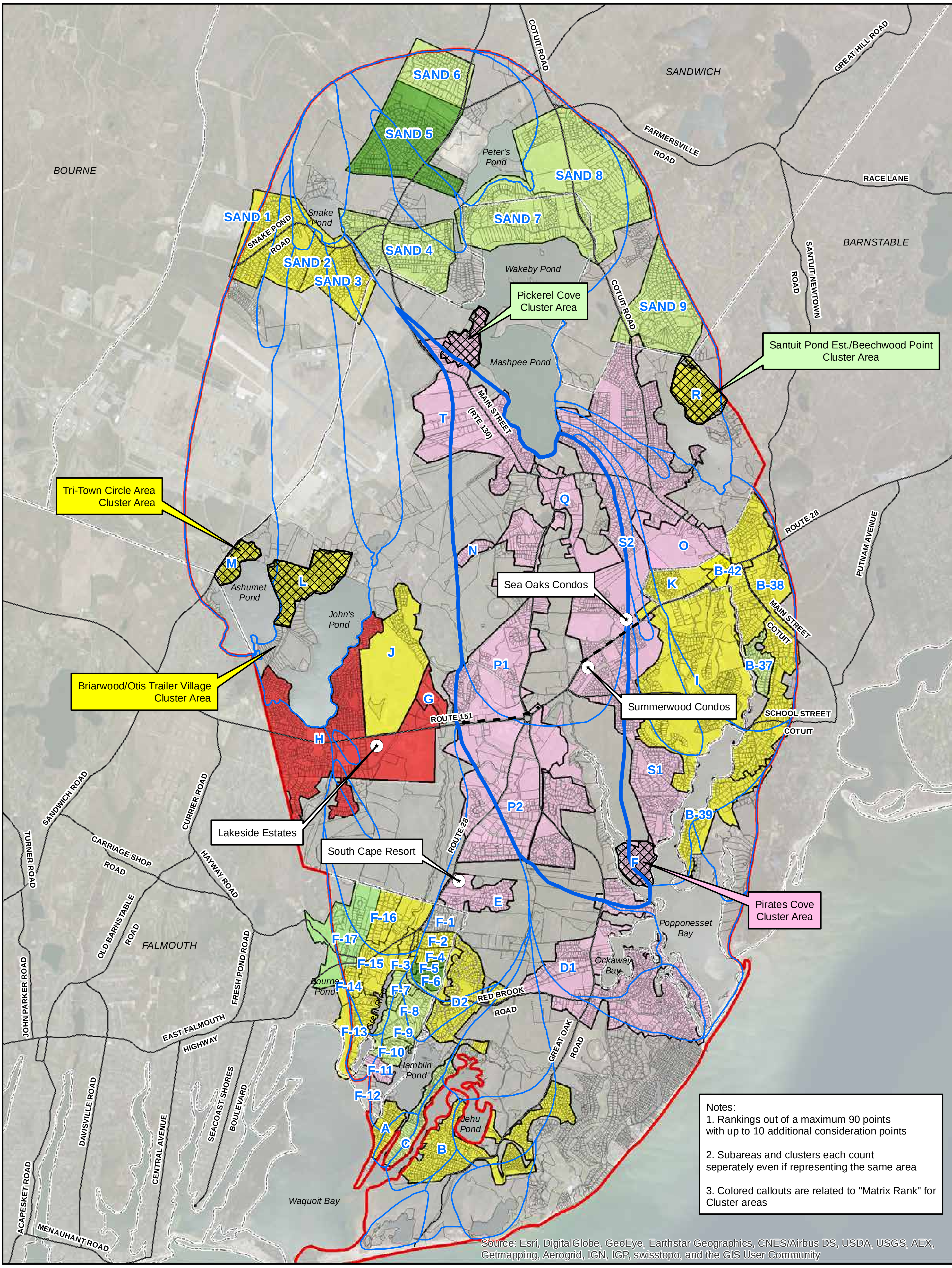

LEGEND

Matrix Point Rating

High ↓ Low

- Additional Area of Consideration
- Mashpee River Additional Area of Consideration
- Potential Cluster System
- MEP Watersheds
- Parcel Boundary
- Planning Area Boundary
- Town Boundaries

Note: Parcel boundaries on this map represent fiscal years 2011/2012 data based on Level 3 deliveries to MassGIS. The last updated parcel file for the Town of Mashpee, Ma was 2011. The other municipalities within the planning area may have since re-assessed parcels since 2012 but are not currently available on MassGIS.

Paper Size ANSI B

0 0.375 0.75 1.5 Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

N

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Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

MATRIX RESULTS WITHOUT SHELLFISH

Job Number	86-12001
Revision	A
Date	06 May 2015

Figure 4-7

G:\86\12001\GIS\00074 Mashpee\2014\Final Report Figures\New folder\8612001F4-7_Matrix Results-woShell.mxd

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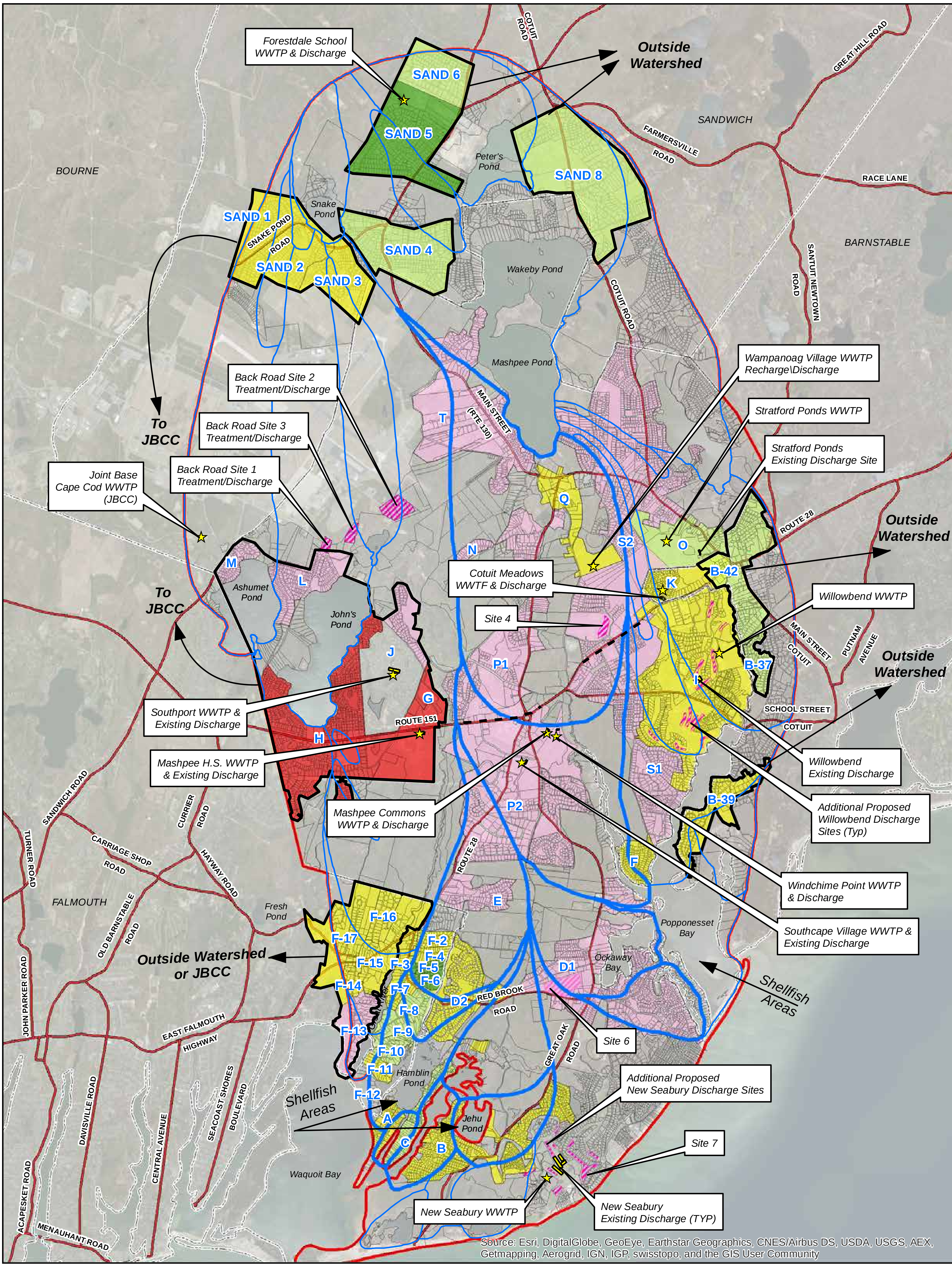

LEGEND

Matrix Rating

High
Low

Existing WWTPs
Shellfish Area
Planning Area Boundary
Town Boundaries
Existing Discharge Site
Parcel Boundary
Proposed Discharge Site

Note: Parcel boundaries on this map represent fiscal years 2011/2012 data based on Level 3 deliveries to MassGIS. The last updated parcel file for the Town of Mashpee, Ma was 2011. The other municipalities within the planning area may have since re-assessed parcels since 2012 but are not currently available on MassGIS.

Paper Size ANSI B

0 0.375 0.75 1.5 Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

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Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

Job Number 86-12001
Revision A
Date 06 May 2015

DRAFT- RECOMMENDED PLAN
PRIORITY RANKING WITH SHELLFISH

Figure 5-1

G:\86\12001\GIS\00074 Mashpee\2014\Final Report Figures\New folder\8612001F5-1_Priority Ranking.mxd

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TOWN OF MASHPEE SEWER COMMISSION
Watershed Nitrogen Management

SC-16 QUAHOG RESTORATION AREAS

Job Number	86-12001
Revision	A
Date	12 May 2015

Figure 6-1

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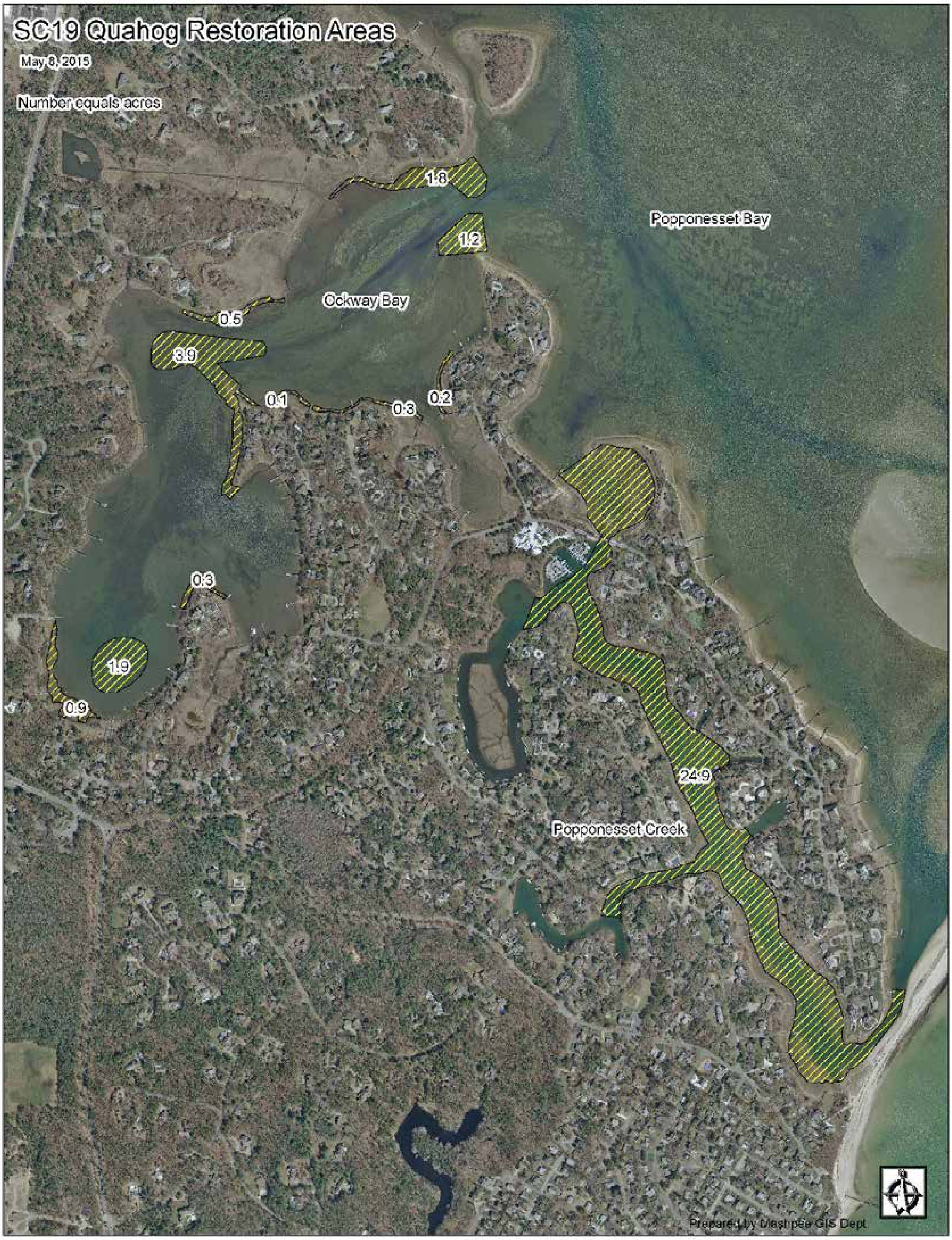

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N

TOWN OF MASHPEE SEWER COMMISSION
Watershed Nitrogen Management

SC-19 QUAHOG RESTORATION AREAS

Job Number	86-12001
Revision	A
Date	12 May 2015

Figure 6-2

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TOWN OF MASHPEE SEWER COMMISSION
Watershed Nitrogen Management

SC-20 OYSTER PROPAGATION AREAS

Job Number	86-12001
Revision	A
Date	13 May 2015

Figure 6-3

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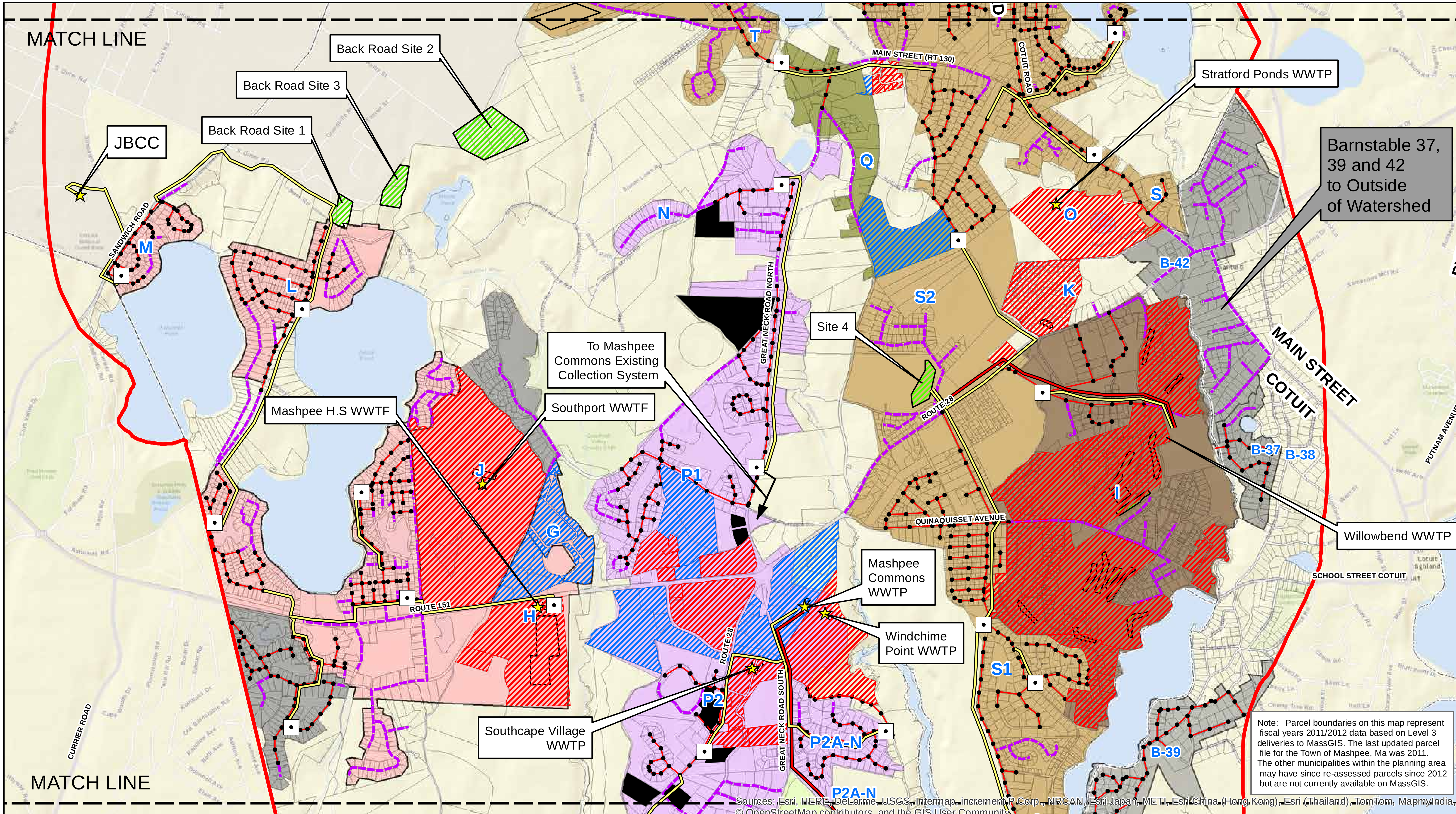

Paper Size ANSI B

0 1,000 2,000 4,000 Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

N

- MMR_Site
- I/A -Large Individual or Neighborhood Only
- Proposed Treatment/Discharge Site
- Planning Area Boundary
- Parcel Boundary
- Existing Private Sewer
- Proposed Private Sewer
- Proposed Gravity MH
- Proposed Gravity Sewer
- Proposed Low Pressure Sewer
- Proposed Pump Station
- Dual Force Main
- Single Force Main
- Proposed Force Main to PS or WWTP

Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

Job Number	86-12001
Revision	A
Date	06 May 2015

PRELIMINARY INFRASTRUCTURE BY SUBAREA (CENTRAL PPA)

Figure 6-4

G:\86\12001\GIS\00074 Mashpee\2014\Final Report Figures\New folder\8612001F6-4_Treatment Sites.mxd

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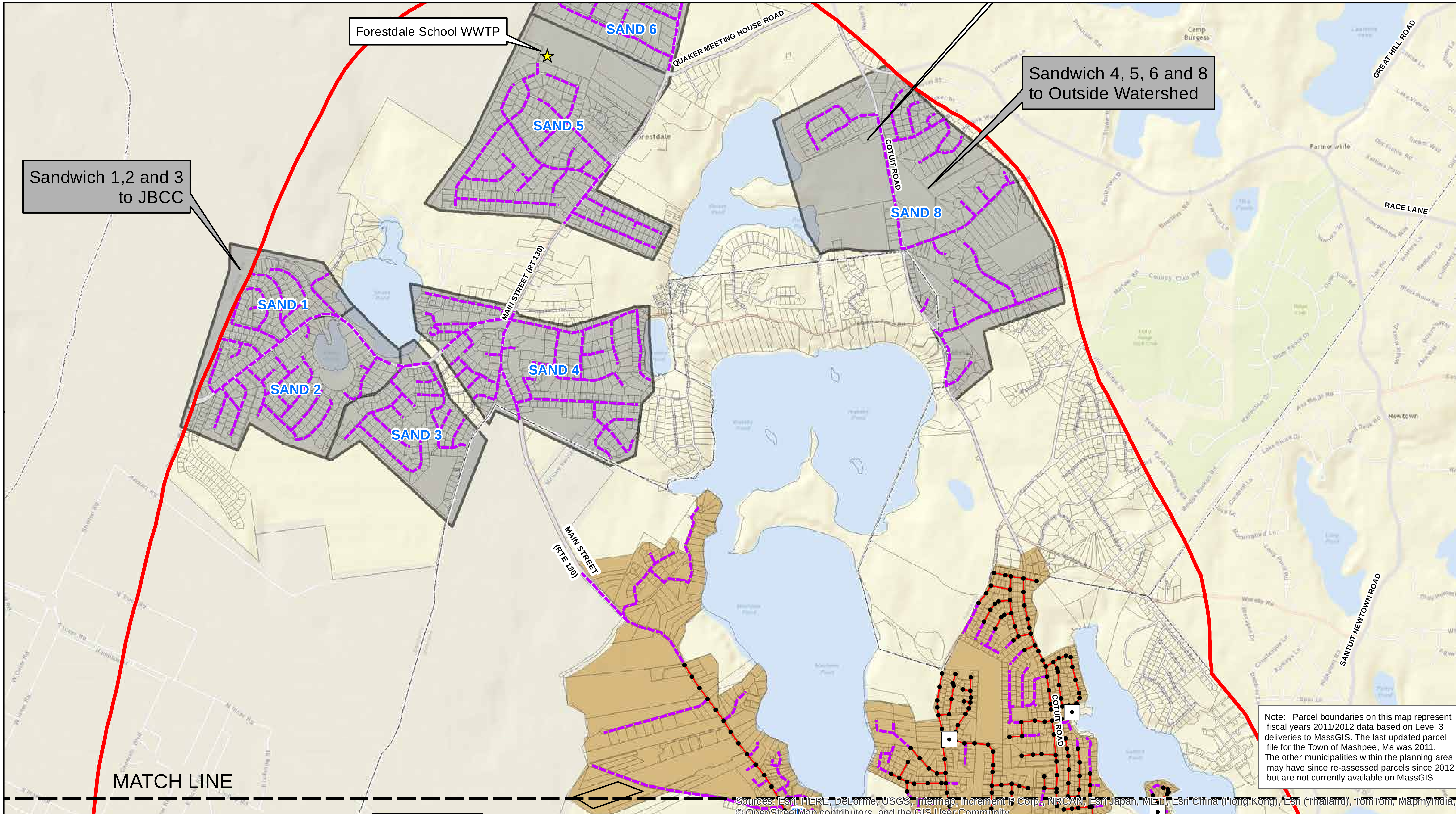

Paper Size ANSI B

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Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

N

- MMR_Site
- I/A -Large Individual or Neighborhood Only
- Proposed Treatment/Discharge Site
- Planning Area Boundary
- Parcel Boundary
- Existing Private Sewer
- Proposed Private Sewer
- Proposed Gravity MH
- Proposed Gravity Sewer
- Proposed Low Pressure Sewer
- Proposed Pump Station
- Dual Force Main
- Single Force Main
- Proposed Force Main to PS or WWTF

Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

Job Number	86-12001
Revision	A
Date	06 May 2015

PRELIMINARY INFRASTRUCTURE
BY SUBAREA (NORTH PPA)

Figure 6-5

G:\86\12001\GIS\00074 Mashpee\2014\Final Report Figures\New folder\8612001F6-5_Sewer North.mxd

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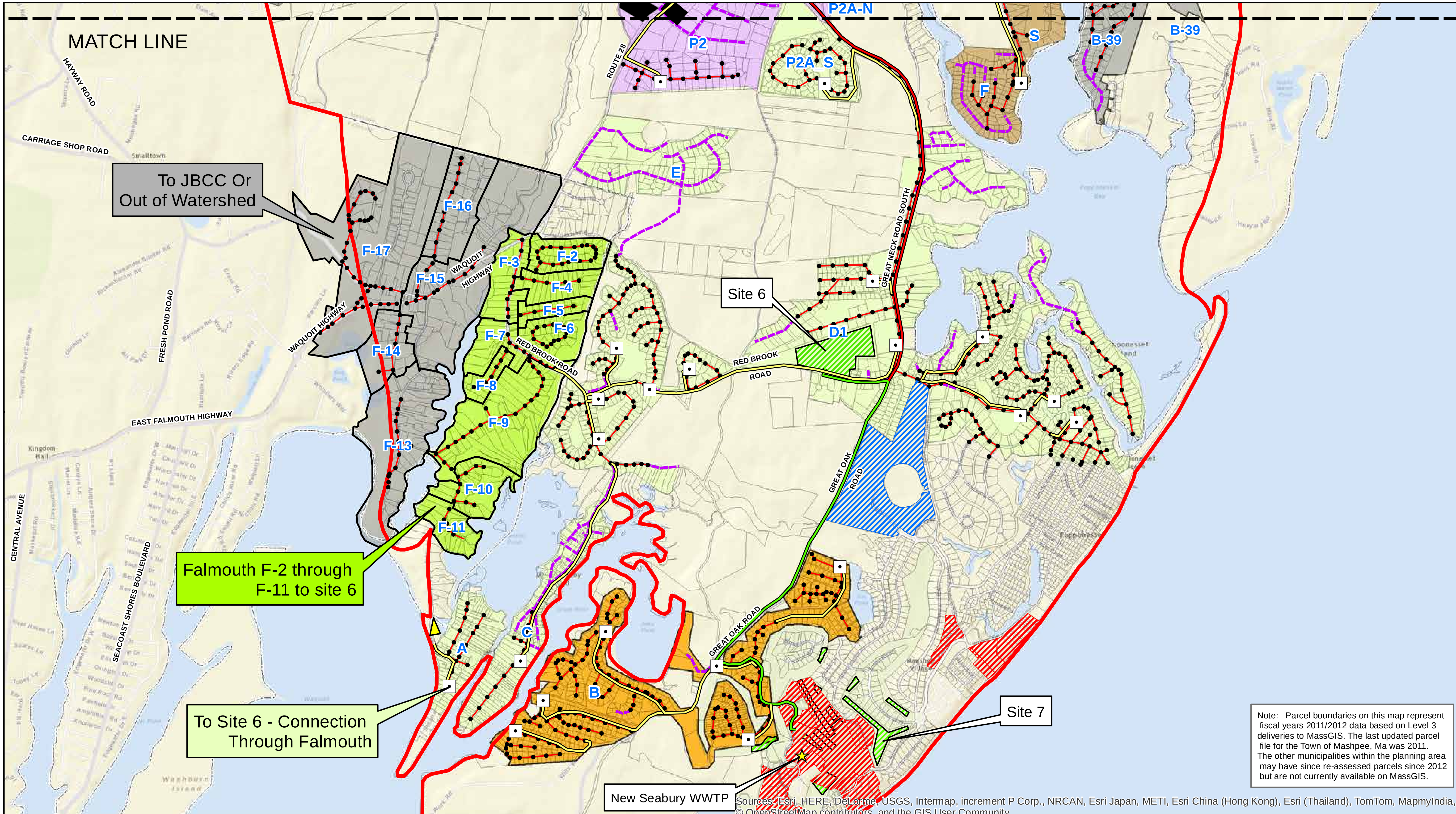

Paper Size ANSI B

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Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

N

- MMR_Site
- I/A -Large Individual or Neighborhood Only
- Proposed Treatment/Discharge Site
- Planning Area Boundary
- Parcel Boundary
- Existing Private Sewer
- Proposed Private Sewer
- Proposed Gravity MH
- Proposed Gravity Sewer
- Proposed Low Pressure Sewer
- Proposed Pump Station
- Dual Force Main
- Single Force Main
- Proposed Force Main to PS or WWTF

Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

Job Number	86-12001
Revision	A
Date	06 May 2015

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PRELIMINARY INFRASTRUCTURE BY SUBAREA (SOUTH PPA)

Figure 6-6

G:\86\12001\GIS\00074 Mashpee\2014\Final Report Figures\New folder\8612001F6-6_Sewer South.mxd

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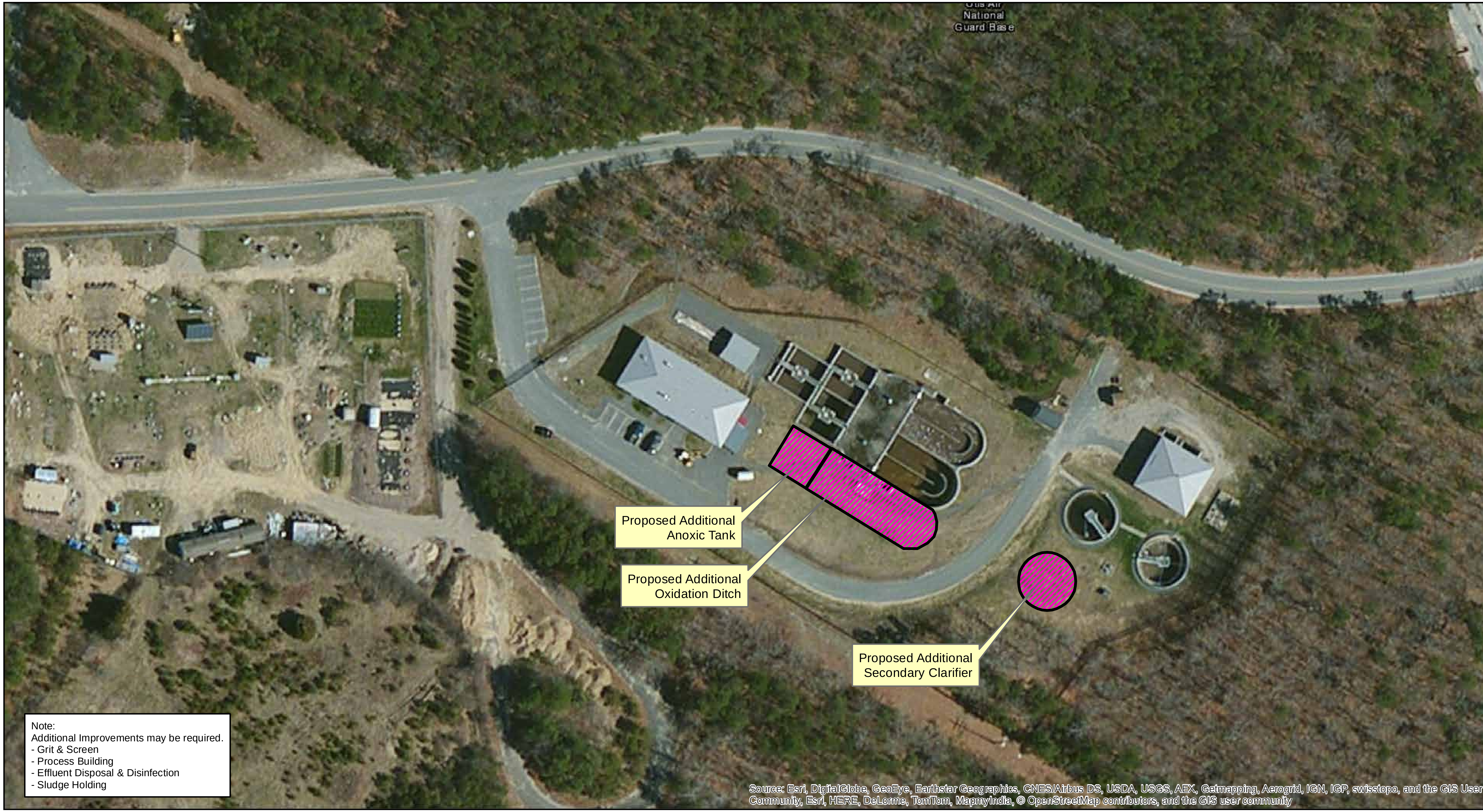

Paper Size ANSI B

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Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

LEGEND

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Town of Mashpee Sewer Commision
Watershed Nitrogen Management Plan

Job Number	86-12001
Revision	A
Date	06 May 2015

PROPOSED JBCC EXPANSION

Figure 6-7

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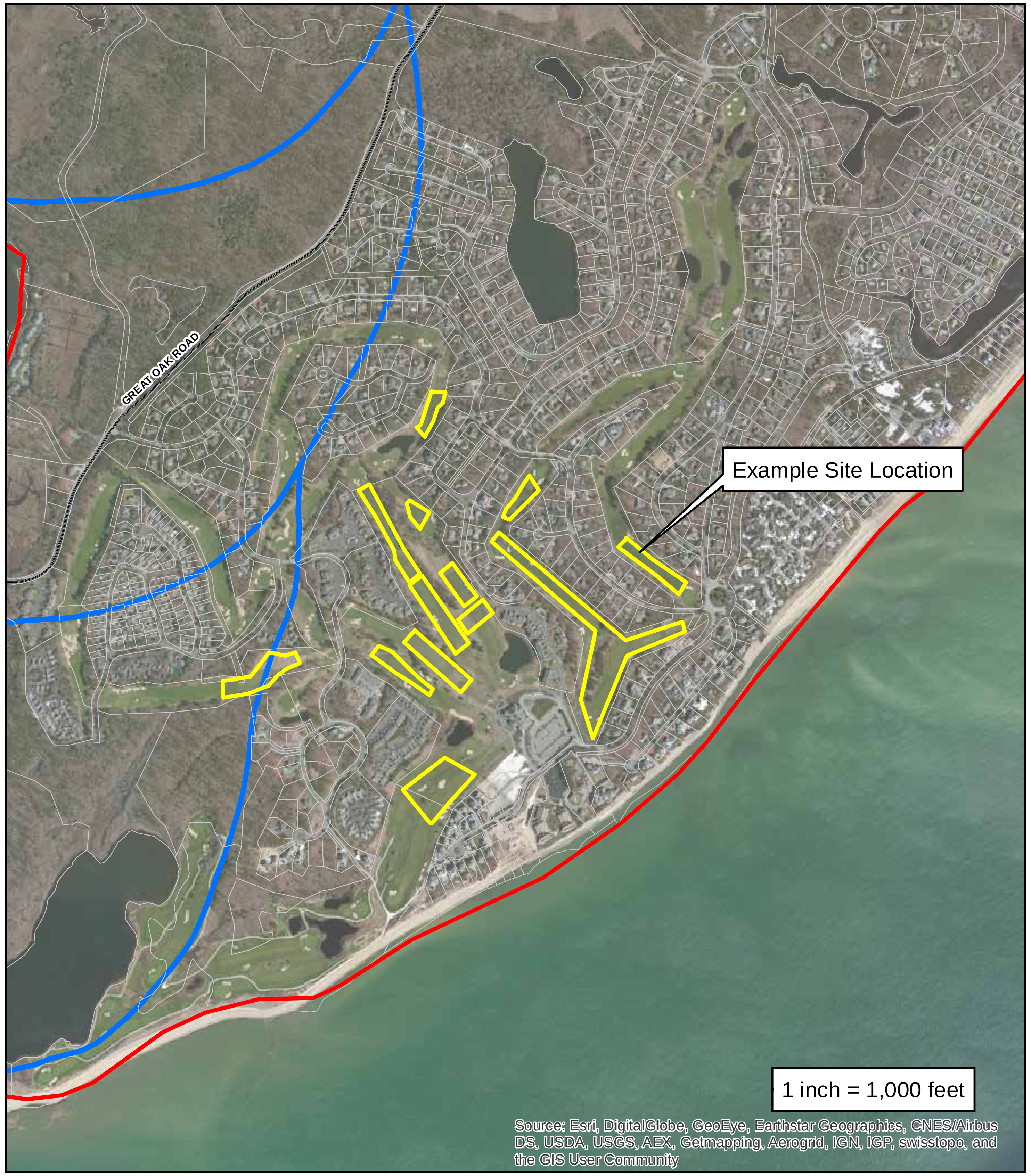

Paper Size ANSI B

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Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

N

LEGEND

- Proposed Treatment/Discharge Site
- MEP Watersheds

GHD

Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

Job Number	86-12001
Revision	A
Date	06 May 2015

POTENTIAL NEW SEABURY
DRIP IRRIGATION LAYOUT

Figure 6-8

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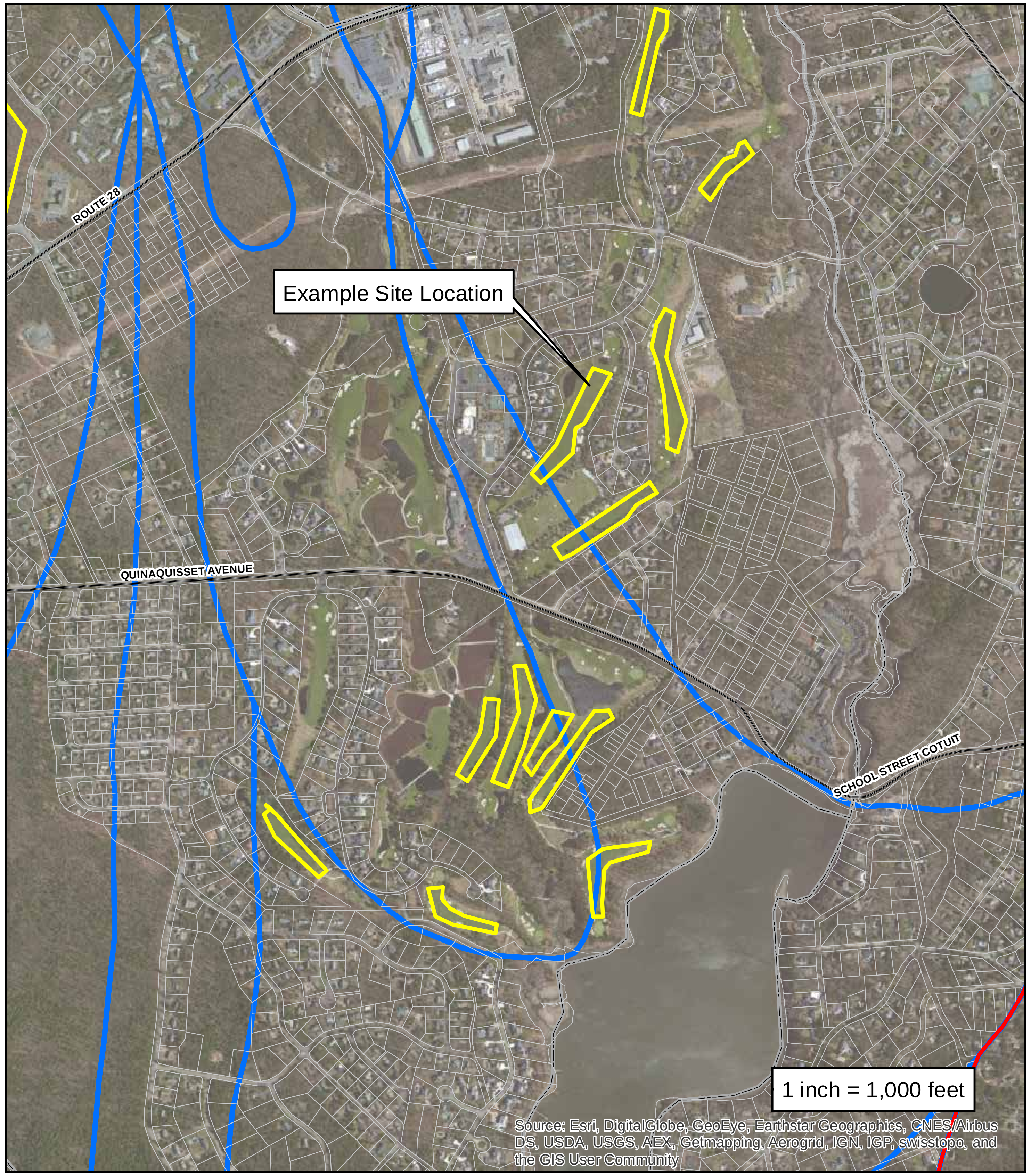

Paper Size ANSI B

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Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

N

LEGEND

- Proposed Treatment/Discharge Site
- MEP Watersheds

GHD

Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

Job Number	86-12001
Revision	A
Date	12 May 2015

POTENTIAL WILLOWBEND DRIP IRRIGATION LAYOUT

Figure 6-9

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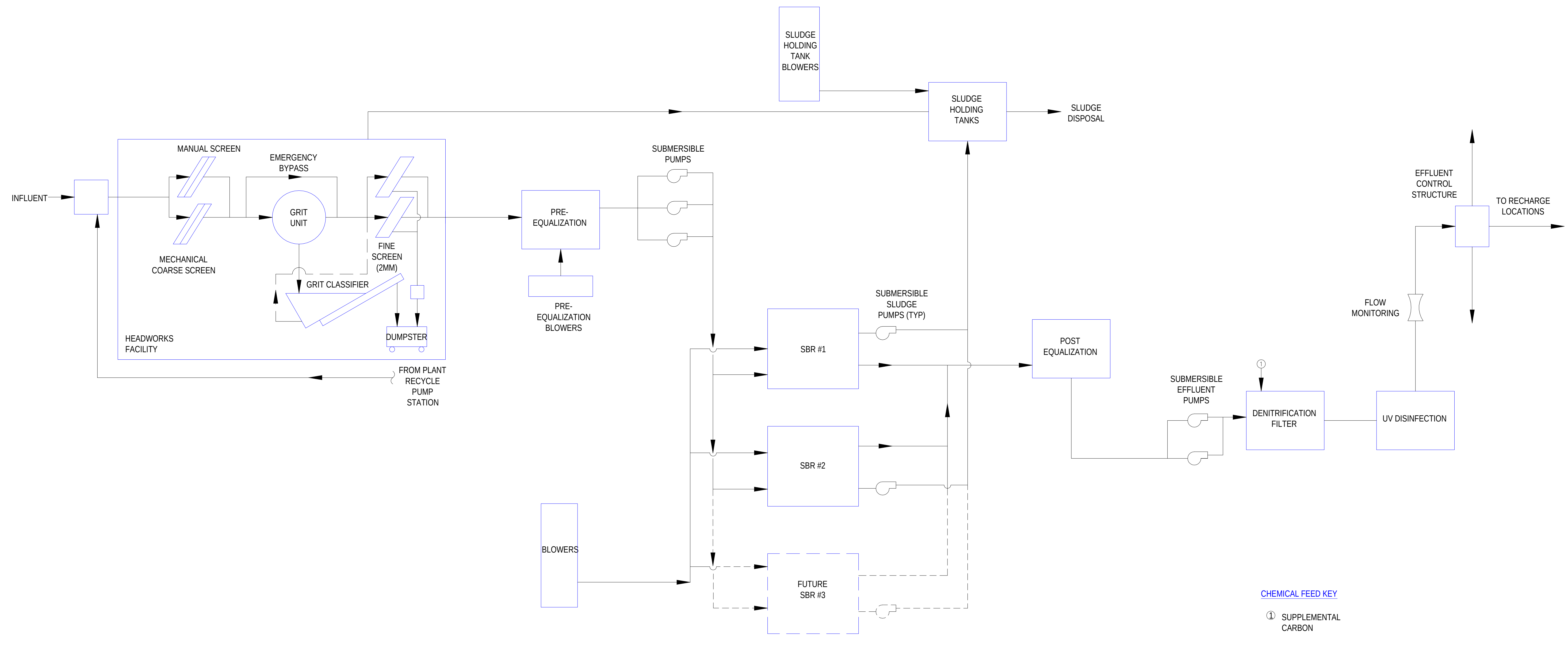

PROCESS FLOW DIAGRAM

NOT TO SCALE

N

LEGEND

Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

Job Number	86-12001
Revision	A
Date	06 May 2015

Conceptual SBR Process Flow Schematic

Figure 6-10

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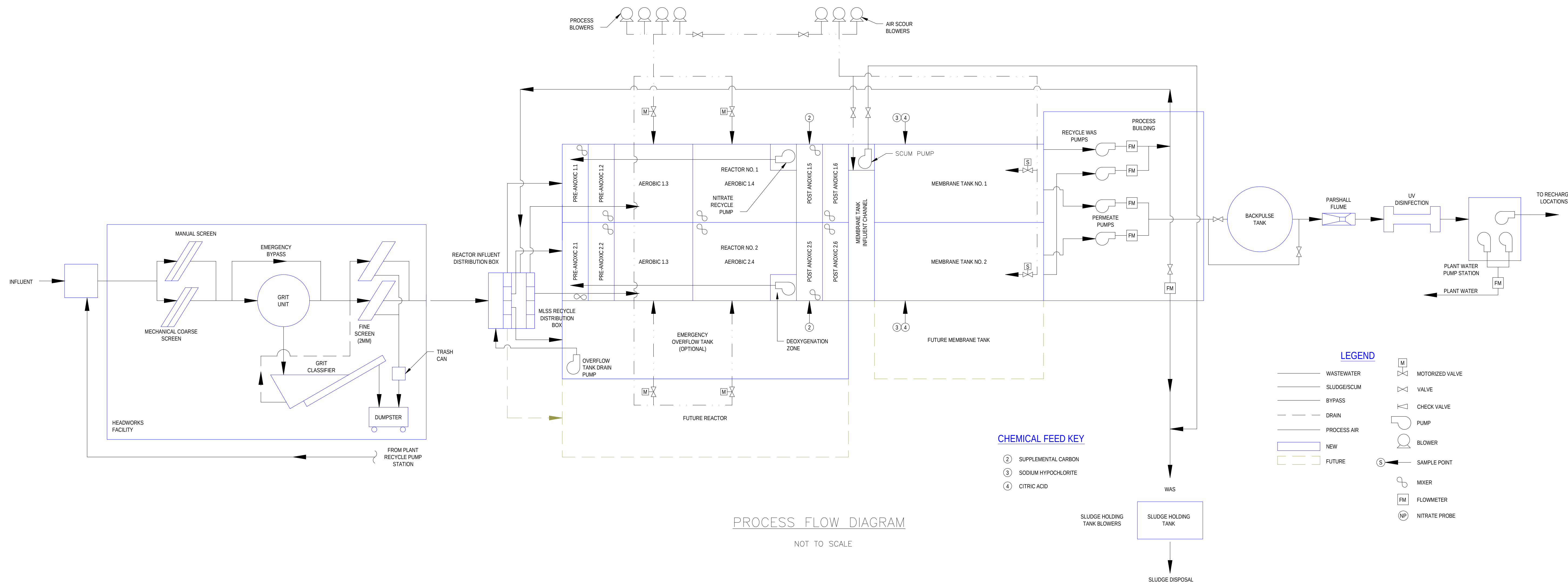

N

LEGEND

Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

Job Number	86-12001
Revision	A
Date	06 May 2015

Conceptual MBR
Process Flow Schematic

Figure 6-11

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Data Source: Mass GIS, Town of Mashpee GIS Dept,GHD

Paper Size ANSI B

0 125 250 500 Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

N

LEGEND

GHD

Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

Job Number	86-12001
Revision	A
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Site 4
Conceptual WWTF Layout

Figure 6-12

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Data Source: Mass GIS, Town of Mashpee GIS Dept,GHD

Paper Size ANSI B

0 62.5 125 250 Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

N

LEGEND

GHD

Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

Job Number	86-12001
Revision	A
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Site 6
Conceptual WWTF Layout

Figure 6-13

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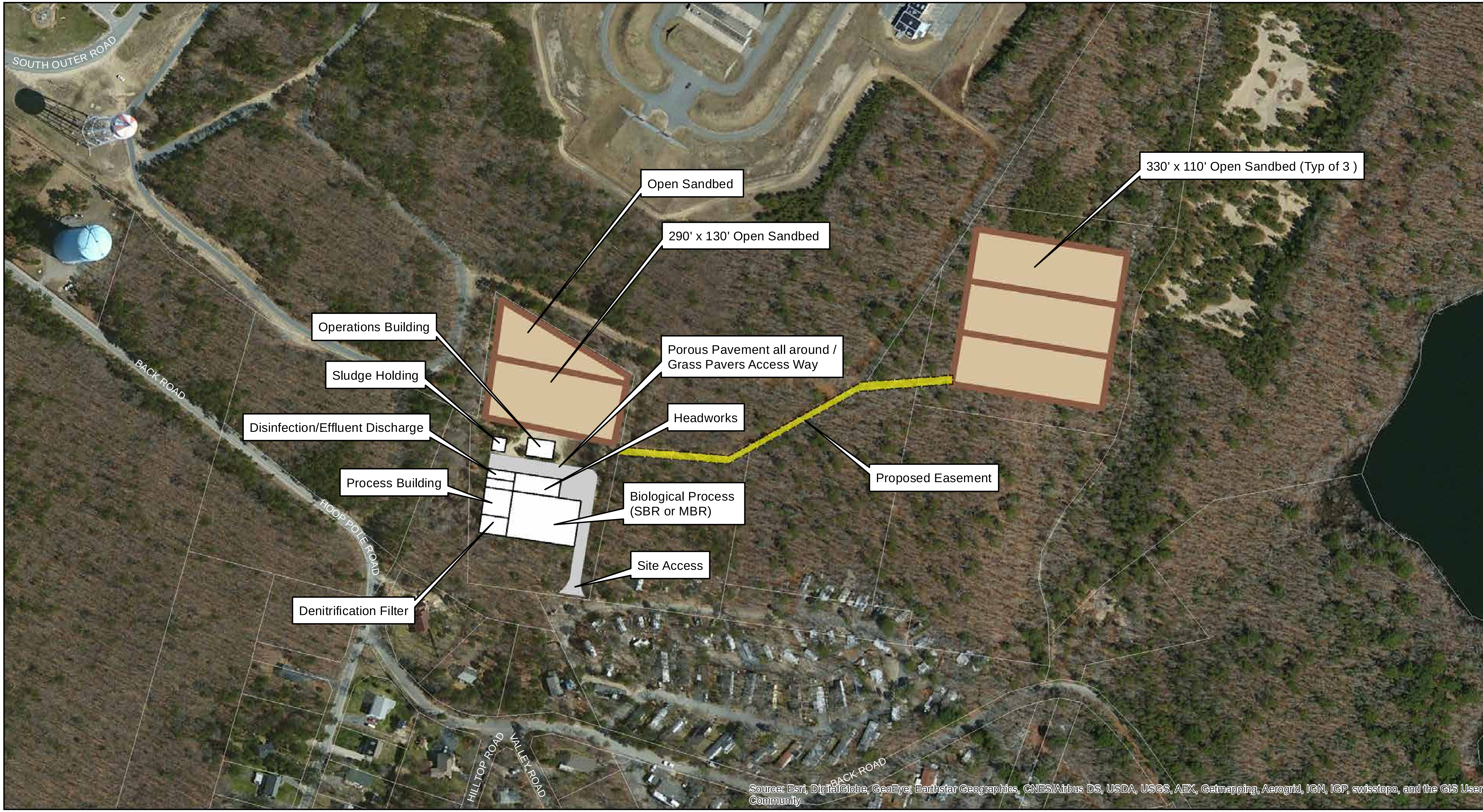

Data Source: Mass GIS, Town of Mashpee GIS Dept,GHD

Paper Size ANSI B

0 100 200 400 Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

N

LEGEND

Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

Job Number	86-12001
Revision	A
Date	06 May 2015

Back Road Sites
Conceptual WWTF Layout

Figure 6-14

G:\86\12001\GIS\00074 Mashpee\2014\Final Report Figures\New folder\8612001F6-14 Back roads.mxd

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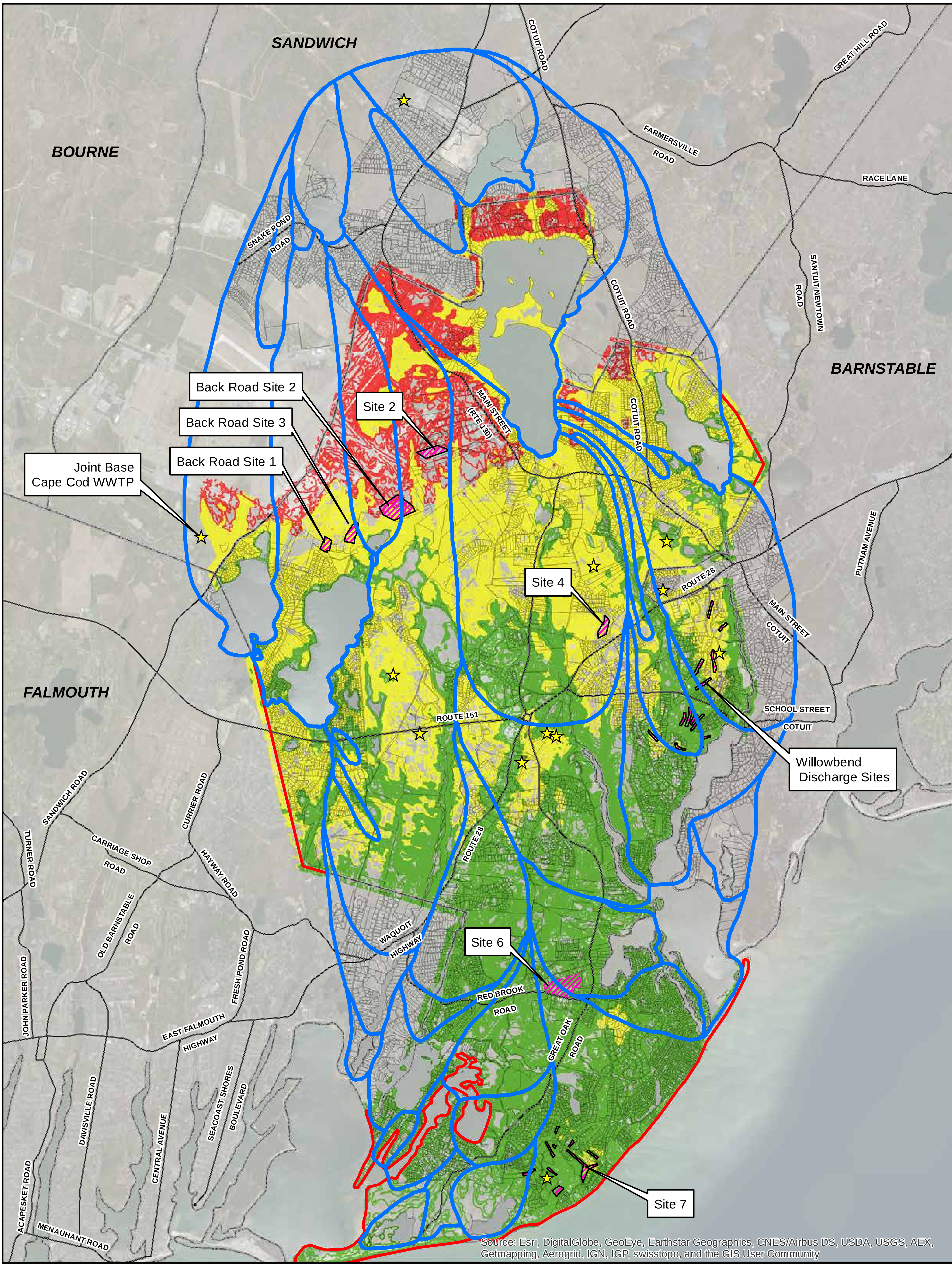

LEGEND

Elevation (FT)

- 0 - 49
- 50 - 99
- 100 - 150

- Proposed Treatment/Discharge Site
- Planning Area Boundary
- Existing WWTPs
- Parcel Boundary
- Town Boundaries

Note: Parcel boundaries on this map represent fiscal years 2011/2012 data based on Level 3 deliveries to MassGIS. The last updated parcel file for the Town of Mashpee, Ma was 2011. The other municipalities within the planning area may have since re-assessed parcels since 2012 but are not currently available on MassGIS.

Paper Size ANSI B

0 0.375 0.75 1.5 Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

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Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

Job Number 86-12001
Revision A
Date 06 May 2015

PROJECT PLANNING AREA
GENERAL TOPOGRAPHY MAP

Figure 7-1

G:\86\12001\GIS\00074 Mashpee\2014\Final Report Figures\New folder\8612001F7-1 Topo.mxd

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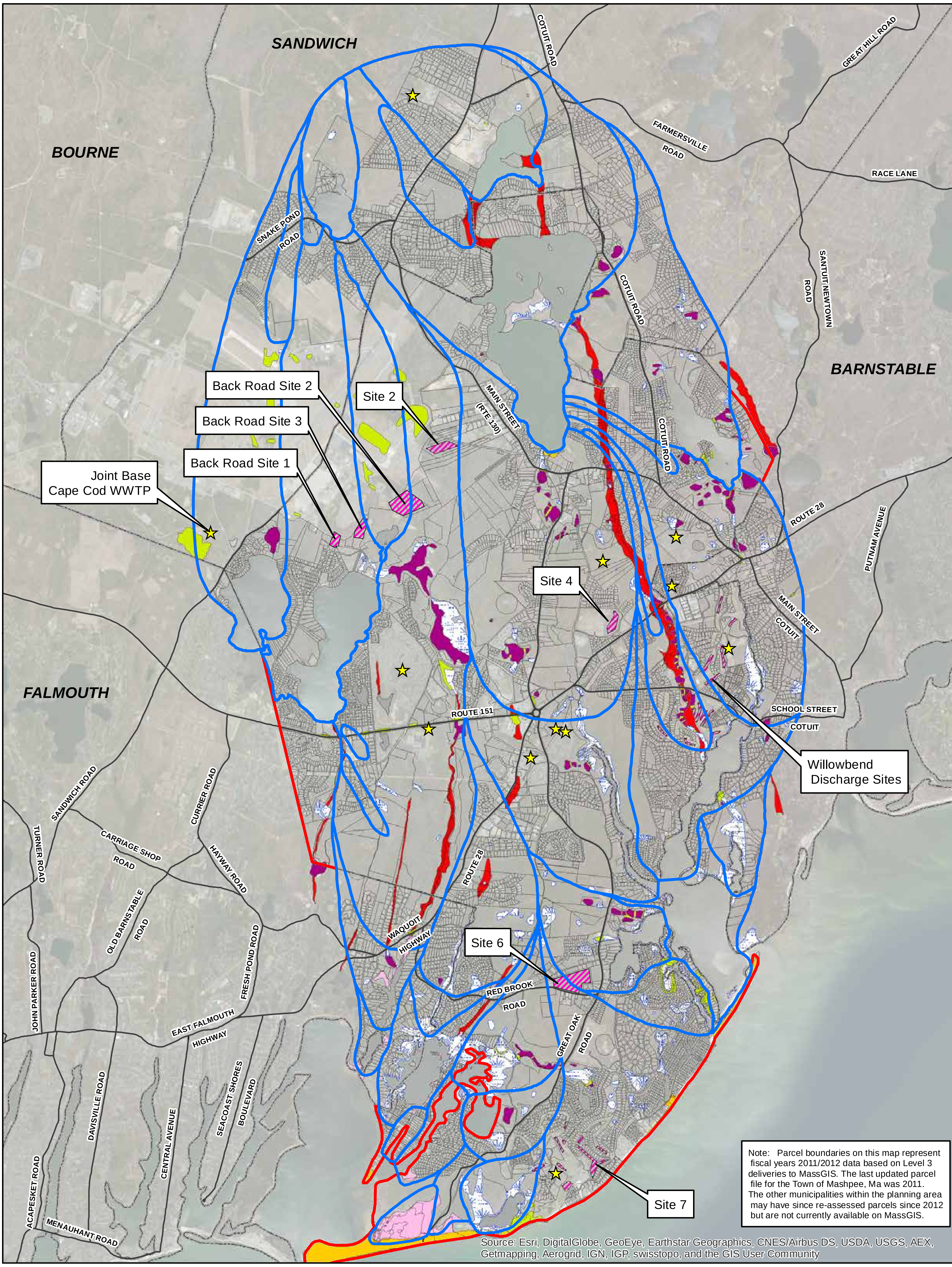

Surficial Geology Legend

- artificial fill
- beach and dune deposits
- cranberry bog
- salt-marsh deposits
- swamp and marsh deposits
- valley-floor fluvial deposits

Map Legend

- Proposed Treatment/Discharge Site
- Town Boundaries
- Planning Area Boundary
- Existing WWTPs
- Parcel Boundary

Paper Size ANSI B

0 0.375 0.75 1.5 Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

N

Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

Job Number	86-12001
Revision	A
Date	06 May 2015

SURFICIAL GEOLOGY MAP

Figure 7-2

G:\86\12001\GIS\00074 Mashpee\2014\Final Report Figures\New folder\8612001F7-2 Geology.mxd

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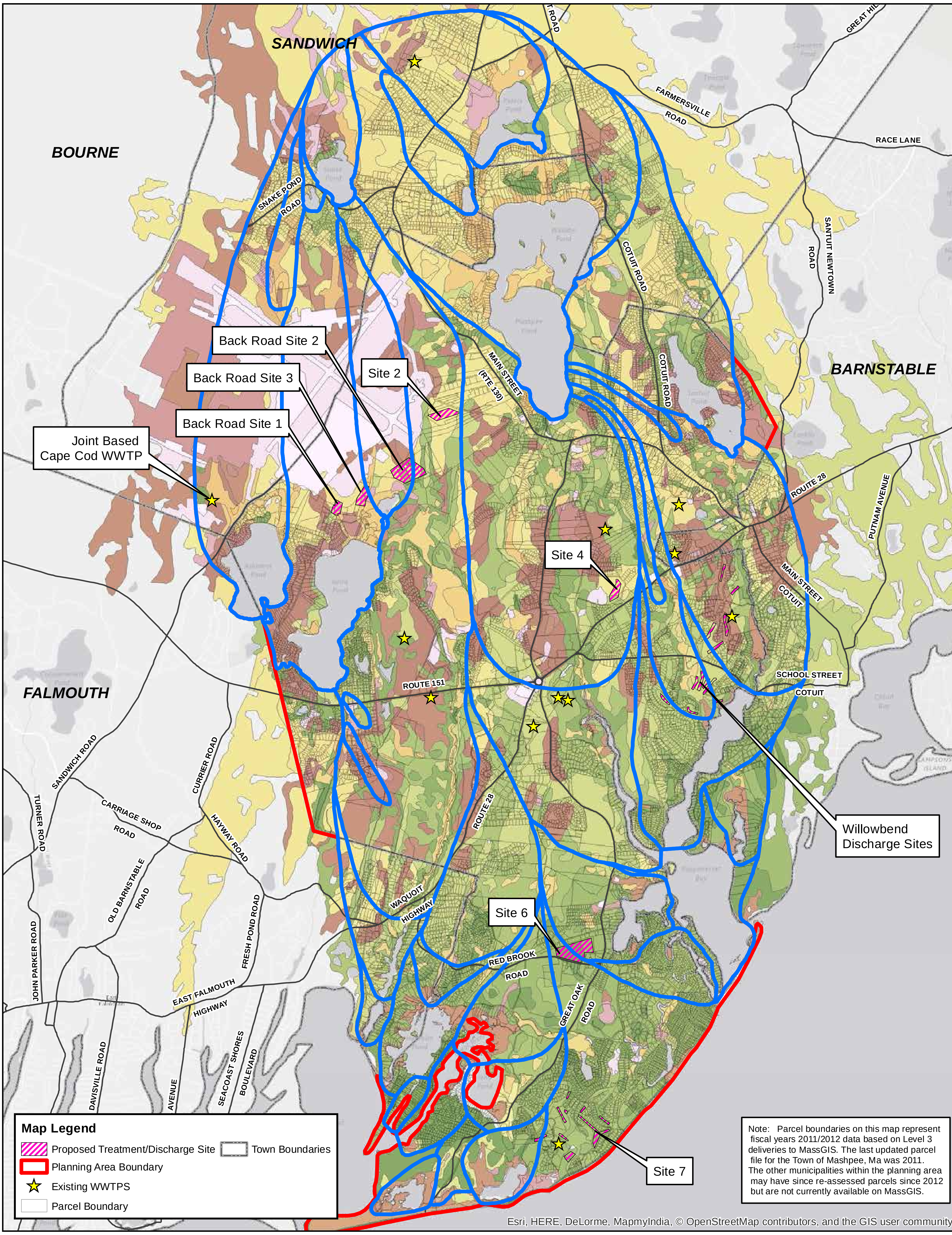

Soils Legend

- Beaches
- Berryland mucky loamy coarse sand, 0 to 2 percent slopes
- Carver coarse sand, 0 to 3 percent slopes
- Carver coarse sand, 15 to 35 percent slopes
- Carver coarse sand, 3 to 8 percent slopes
- Carver coarse sand, 8 to 15 percent slopes
- Carver loamy coarse sand, 0 to 3 percent slopes
- Carver loamy coarse sand, 3 to 8 percent slopes
- Deerfield loamy fine sand, 0 to 5 percent slopes
- Eastchop loamy fine sand, 0 to 3 percent slopes
- Eastchop loamy fine sand, 3 to 8 percent slopes
- Eastchop loamy fine sand, 8 to 15 percent slopes
- Enfield silt loam, 0 to 3 percent slopes
- Enfield silt loam, 3 to 8 percent slopes
- Enfield silt loam, 8 to 15 percent slopes
- Freetown and Swansea mucks, 0 to 1 percent slopes
- Freetown coarse sand, 0 to 1 percent slopes
- Freetown mucky peat, 0 to 1 percent slopes, ponded
- Hinckley gravelly sandy loam, 15 to 35 percent slopes
- Hinckley gravelly sandy loam, 8 to 15 percent slopes
- Hinckley sandy loam, 0 to 3 percent slopes
- Hinckley sandy loam, 3 to 8 percent slopes
- Hinesburg sandy loam, 3 to 8 percent slopes
- Hooksan sand, rolling
- Hooksan-Dune land complex, hilly
- Ipswich, Pawcatuck, and Matunuck peats, 0 to 1 percent slopes
- Merrimac sandy loam, 0 to 3 percent slopes
- Merrimac sandy loam, 15 to 25 percent slopes
- Merrimac sandy loam, 3 to 8 percent slopes
- Merrimac sandy loam, 8 to 15 percent slopes
- Merrimac-Udipsamments-Urban land complex
- Pipestone loamy coarse sand, 0 to 3 percent slopes
- Pits, sand and gravel
- Plymouth loamy coarse sand, 15 to 35 percent slopes
- Plymouth loamy coarse sand, 8 to 15 percent slopes
- Sudbury fine sandy loam, 0 to 3 percent slopes
- Udipsamments, smoothed
- Urban land

Paper Size ANSI B

0 0.375 0.75 1.5 Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

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Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

Job Number	86-12001
Revision	A
Date	06 May 2015

SOILS MAP

Figure 7-3

G:\86\12001\GIS\00074 Mashpee\2014\Final Report Figures\New folder\8612001F7-3 Soils.mxd

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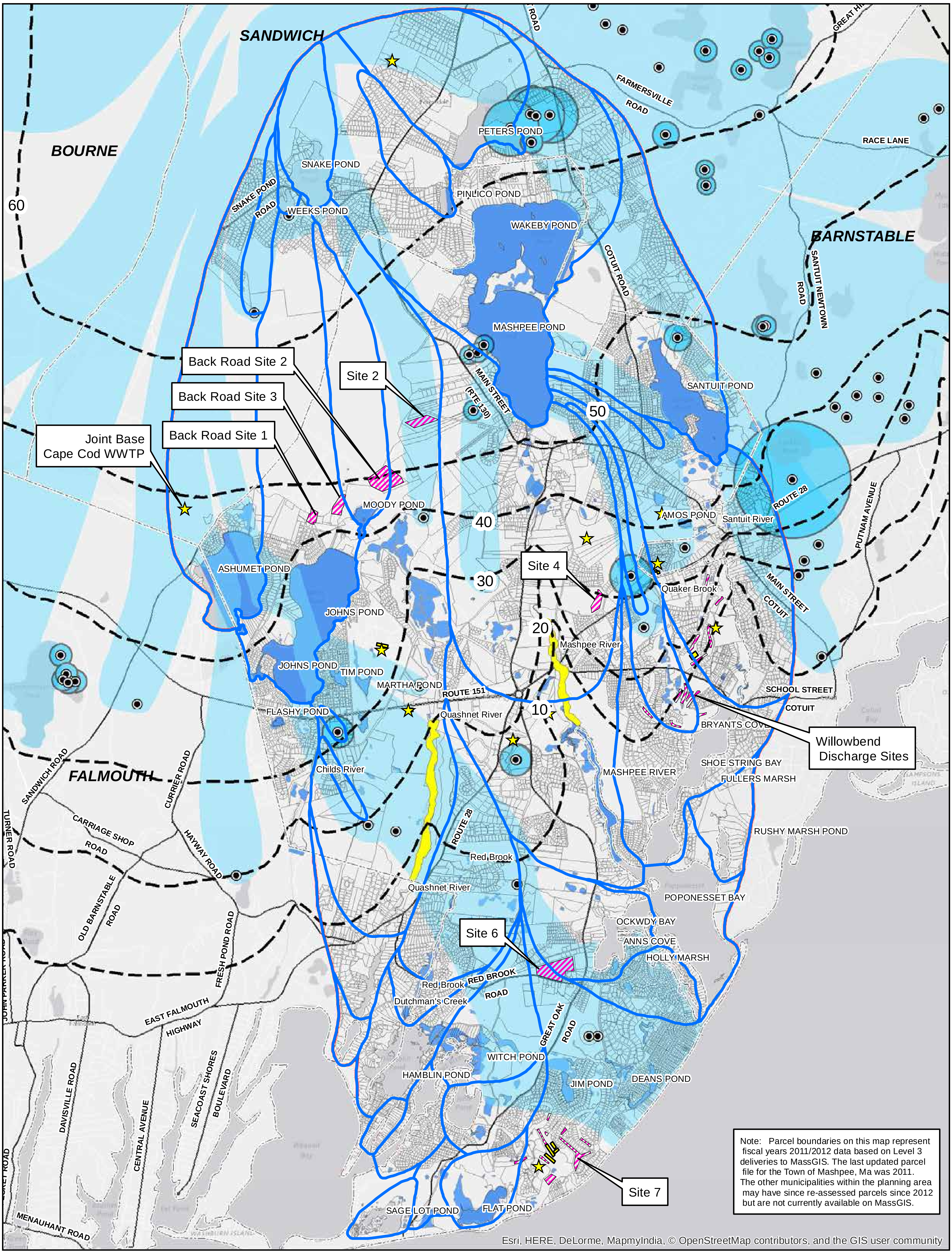

Legend

- Public Water Supply Well
- Ground Water Contours (Ft)
- River Protection District
- Zone I & II w/Wellhead Protection
- Waterbodies
- Proposed Treatment/Discharge Site
- Town Boundaries
- Planning Area Boundary
- Parcel Boundary
- Existing WWTPs

Paper Size ANSI B

0 0.375 0.75 1.5 Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

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Job Number	86-12001
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WATER RESOURCE MAP

Figure 7-4

G:\86\12001\GIS\00074 Mashpee\2014\Final Report Figures\New folder\8612001F7-4 Water.mxd

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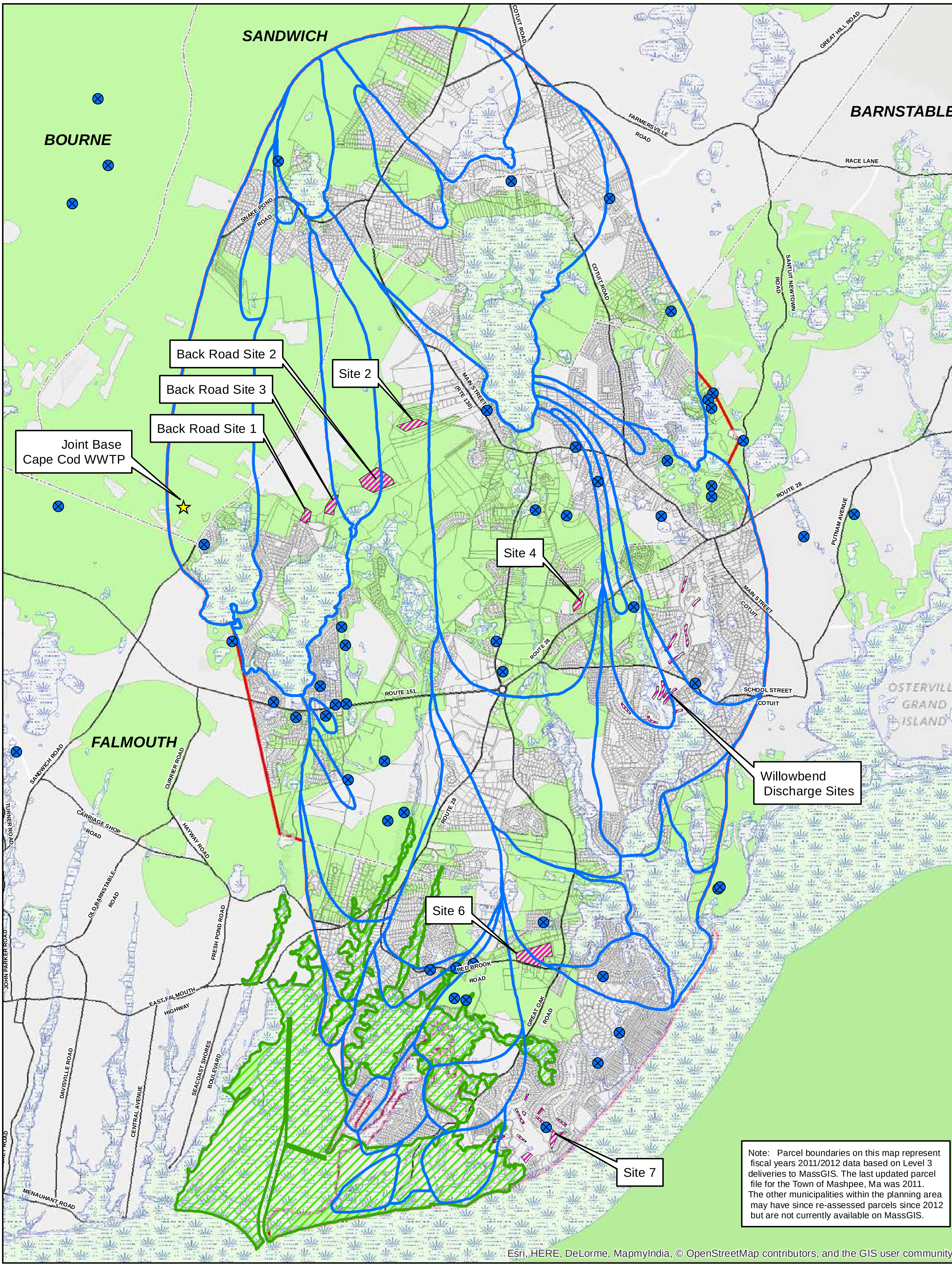

Legend

Data Source: MassGIS, NHESP Oct 2008/2009

- Vernal Pools
- Areas of Critical Environmental Concern
- DEP Wetland
- NHESP Estimated Habitats of Rare Wildlife
- Planning Area Boundary
- Town Boundaries
- Parcel Boundary
- Existing WWTPs
- Proposed Treatment/Discharge Site

Paper Size ANSI B

0 0.5 1 2 Miles

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

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Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

Job Number	86-12001
Revision	A
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SENSITIVE HABITAT AREAS

Figure7-5

G:\86\12001\GIS\00074 Mashpee\2014\Final Report Figures\New folder\8612001F7-5 Habitat.mxd

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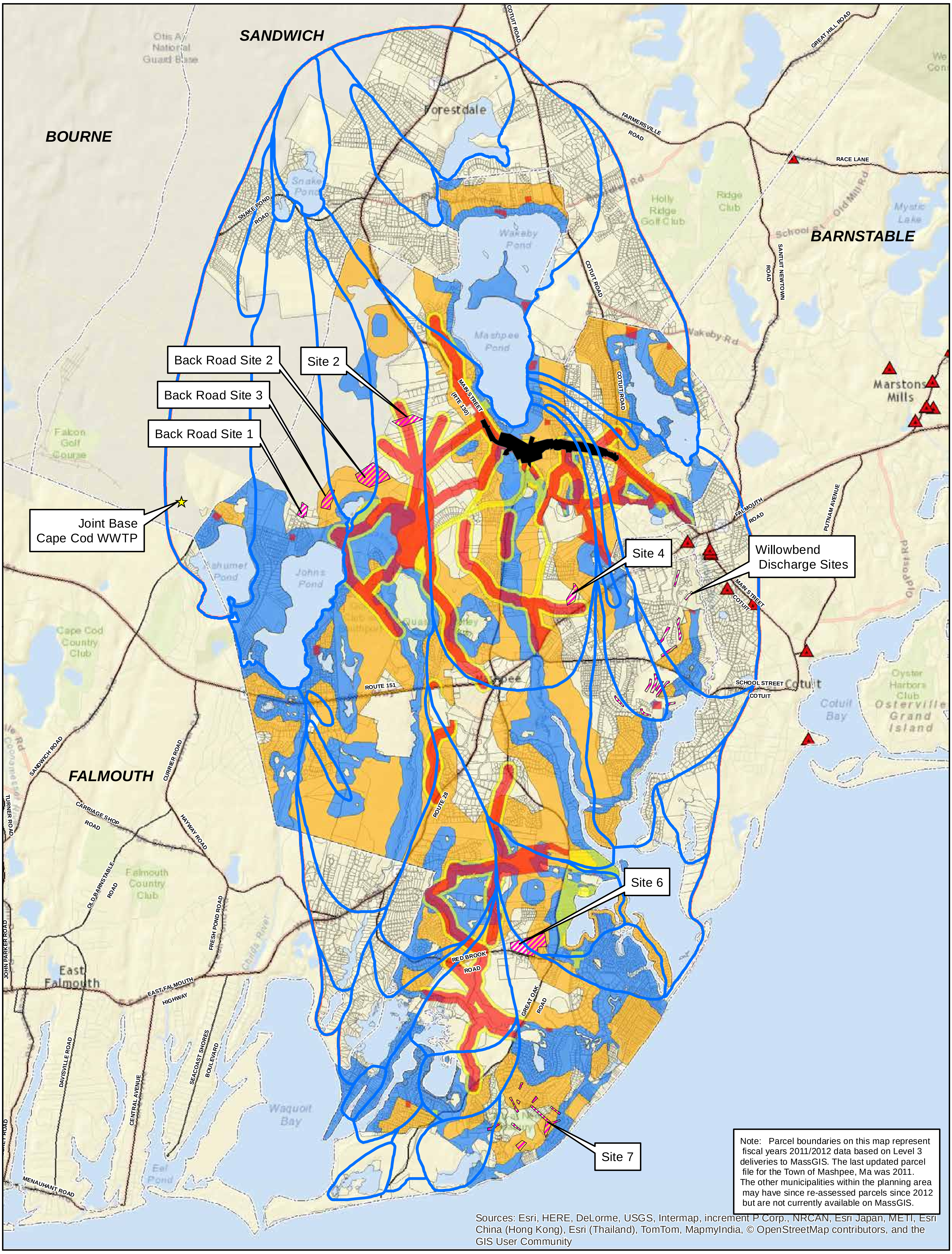

Legend

Archaeological Post Contact Sensitivity (PAL Study)
- High
- Low

Archaeological Precontact Sensitivity (PAL Study)
- High
- Moderate

Note: Archaeological data from Mashpee GIS/PAL Study

- Historic District
- Planning Area Boundary
- Historic Site
- Existing WWTPs
- Proposed Treatment/Discharge Site

Paper Size ANSI B

0 0.5 1 2 Miles

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

Job Number	86-12001
Revision	A
Date	06 May 2015

HISTORIC DISTRICTS AND POTENTIALLY SENSITIVE ARCHAEOLOGICAL AREAS

Figure 7-6

G:\86\12001\GIS\00074 Mashpee\2014\Final Report Figures\New folder\8612001F7-6 Historic.mxd

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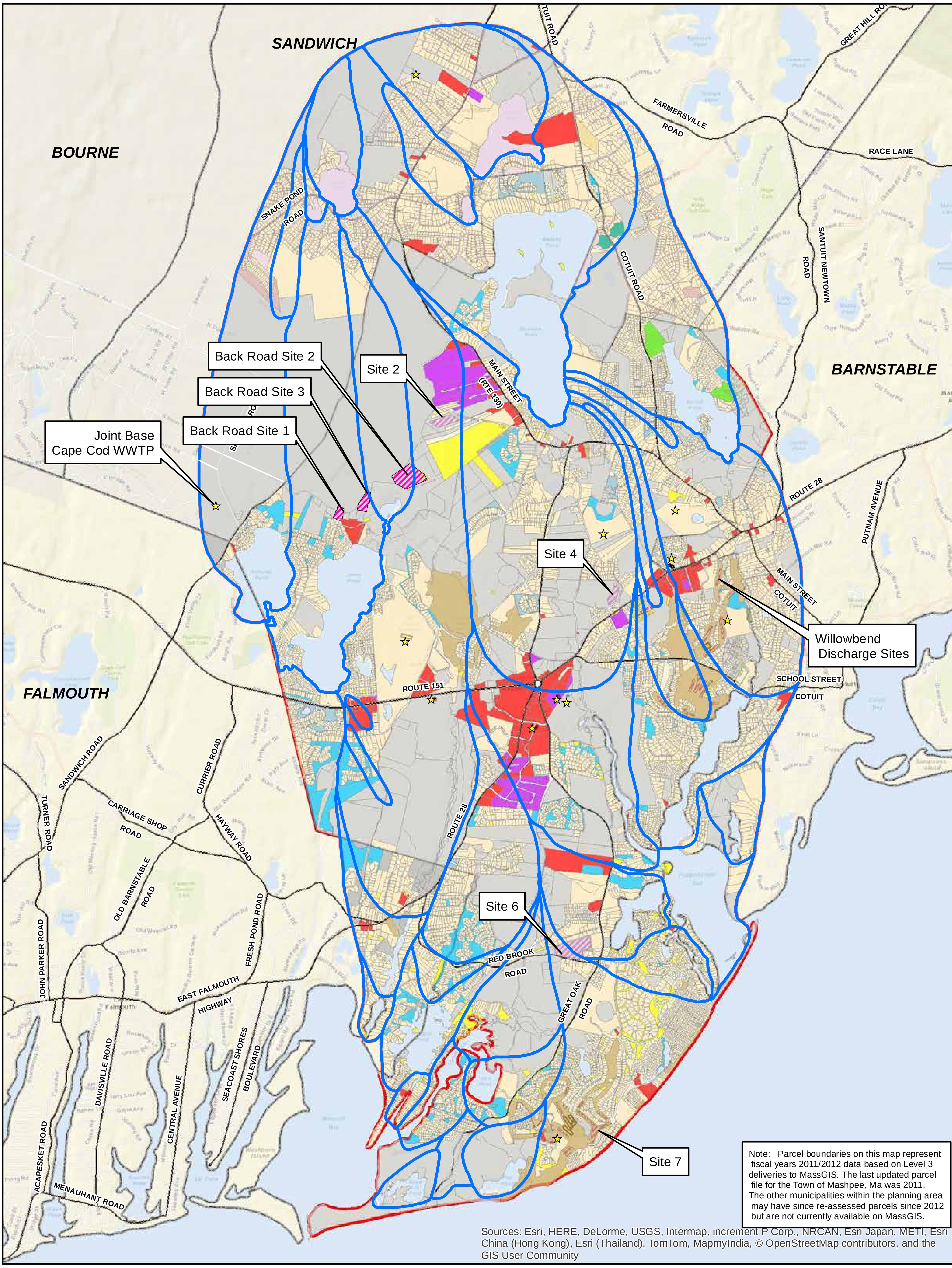

LEGEND

- Existing WWTPs
- Proposed Treatment/Discharge Site
- Planning Area Boundary
- Town Boundaries
- MEP Watersheds

Landuse - State Class Code

- Residential
- Undevelopable Land
- Open Space
- Commercial
- Industrial
- Agriculture
- Recreation
- Exempt

Paper Size ANSI B

0 0.4 0.8 1.6 Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

N

Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

Job Number	86-12001
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OPEN SPACE & LANDUSE PLANNING

Figure 7-7

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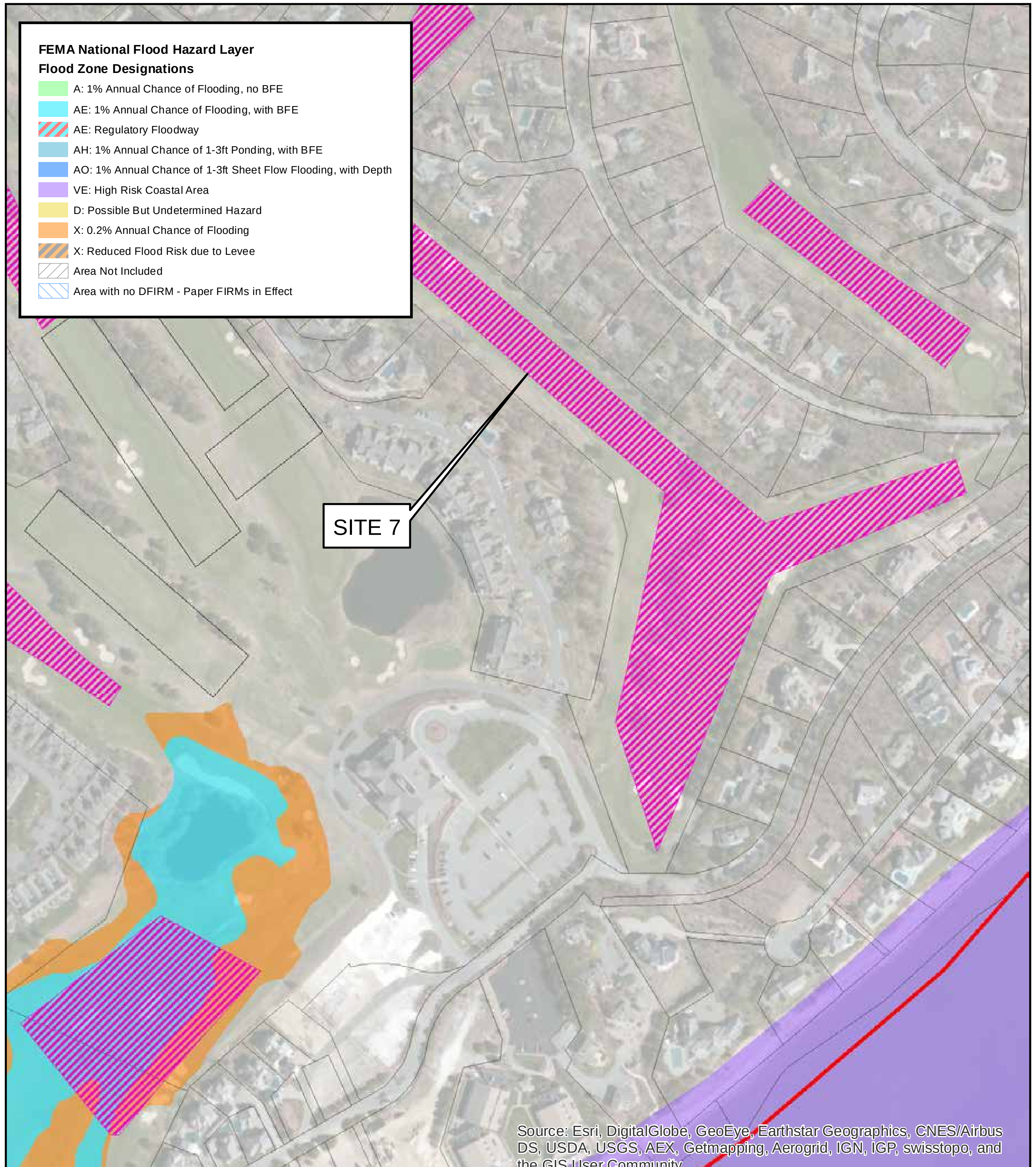

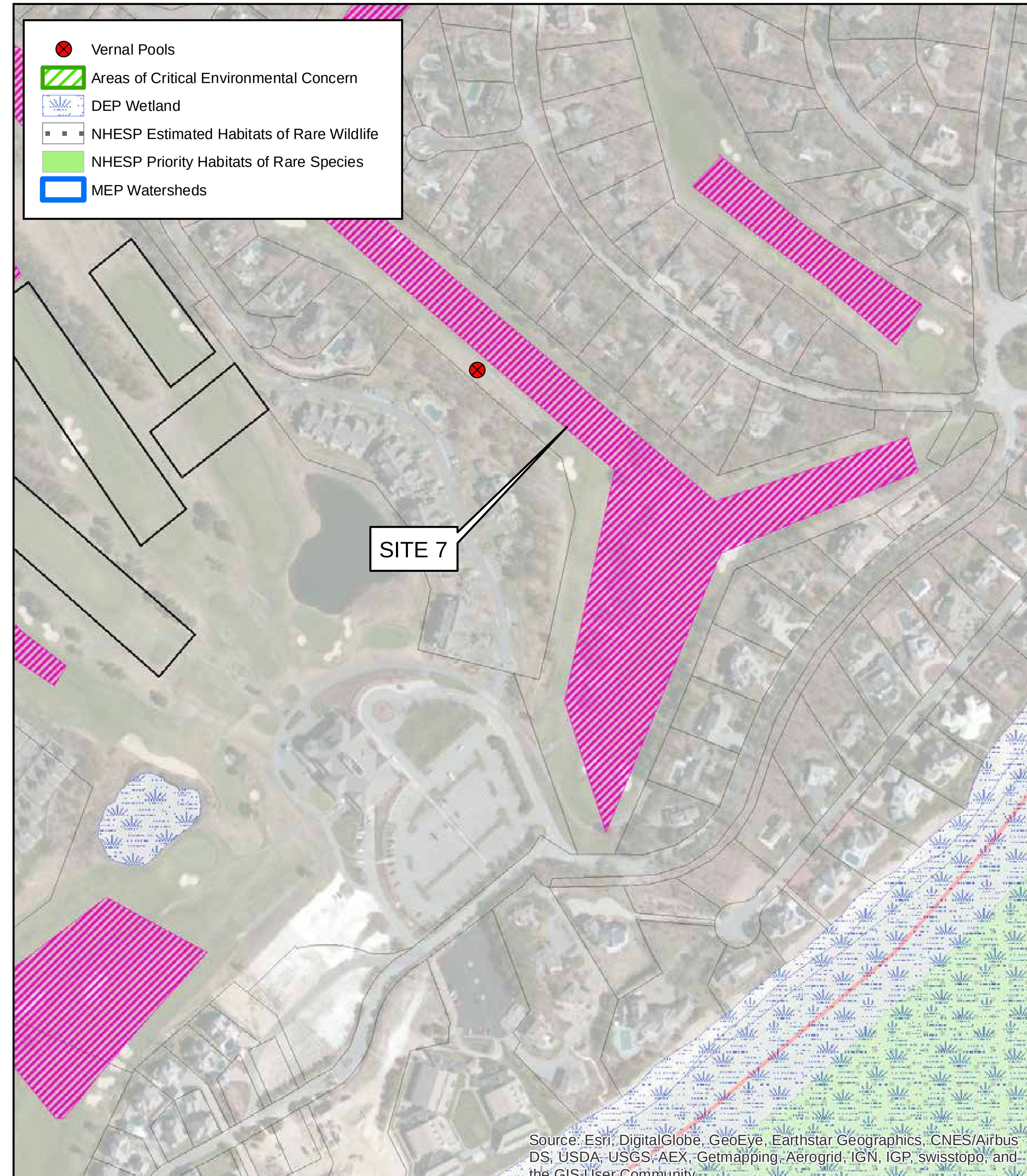

Paper Size ANSI B

0 75 150 300 Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

N

LEGEND

Proposed Treatment/Discharge Site

GHD

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Watershed Nitrogen Management Plan

Job Number	86-12001
Revision	A
Date	06 May 2015

SITE 7 - FEATURES

Figure 7-8

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Data source: MassGIS

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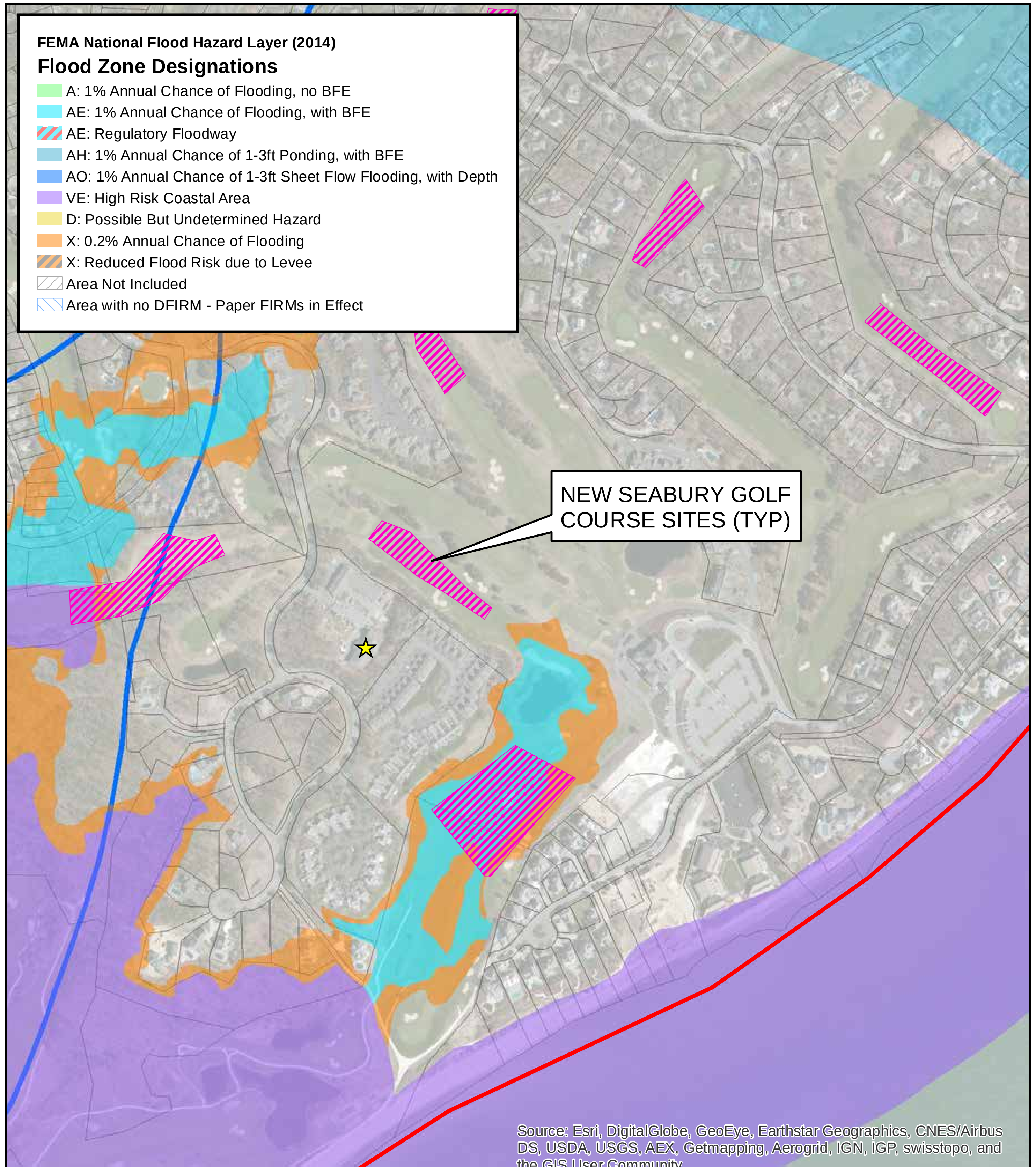

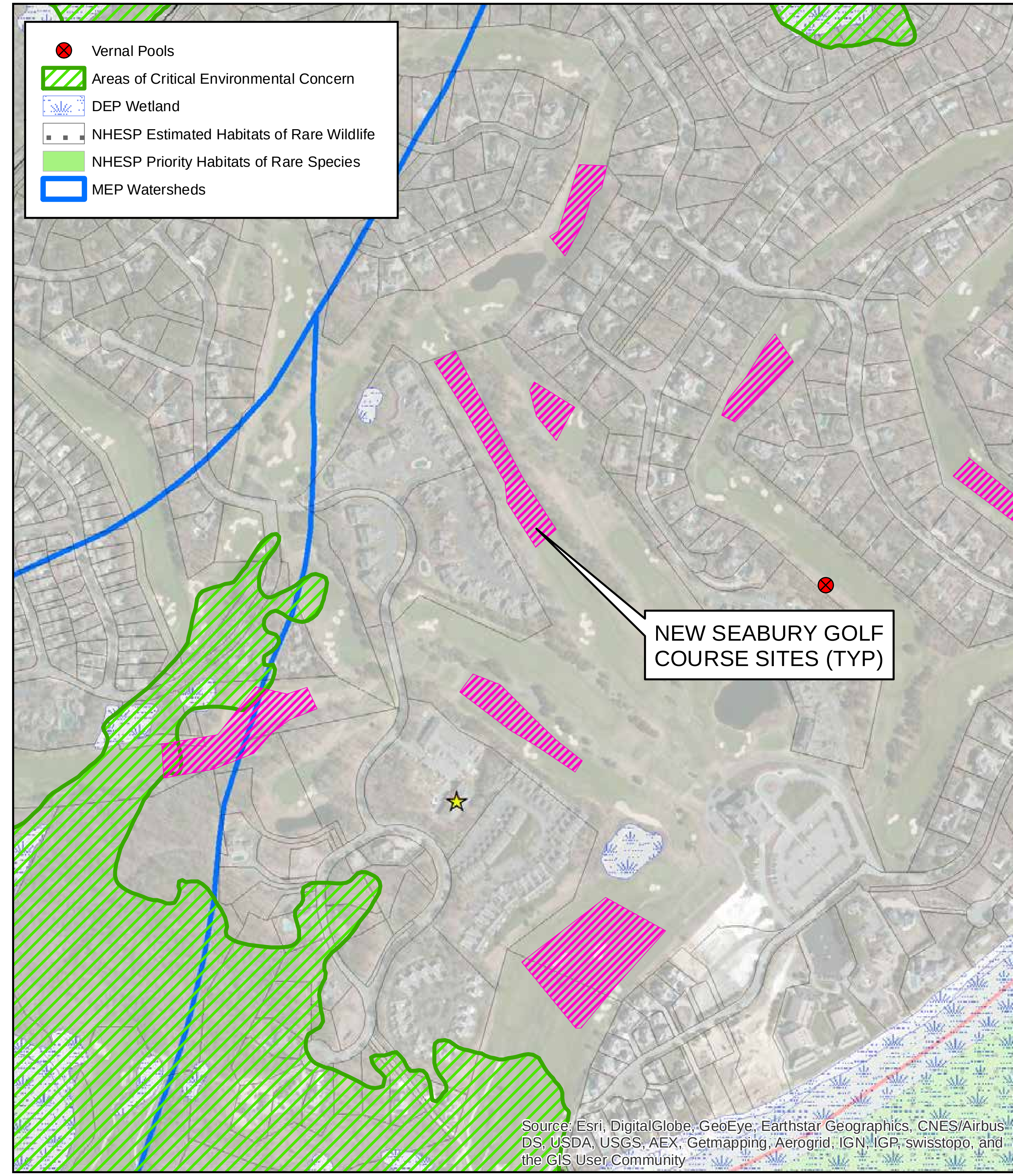

Paper Size ANSI B

0 125 250 500 Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

N

LEGEND

Proposed Treatment/Discharge Site

Zone II

Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

Job Number	86-12001
Revision	A
Date	06 May 2015

NEW SEABURY GOLF COURSE FEATURES

Figure 7-9

G:\86\12001\GIS\00074 Mashpee\2014\Final Report Figures\New folder\8612001F7-9 new seabury.mxd

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Data source: MassGIS

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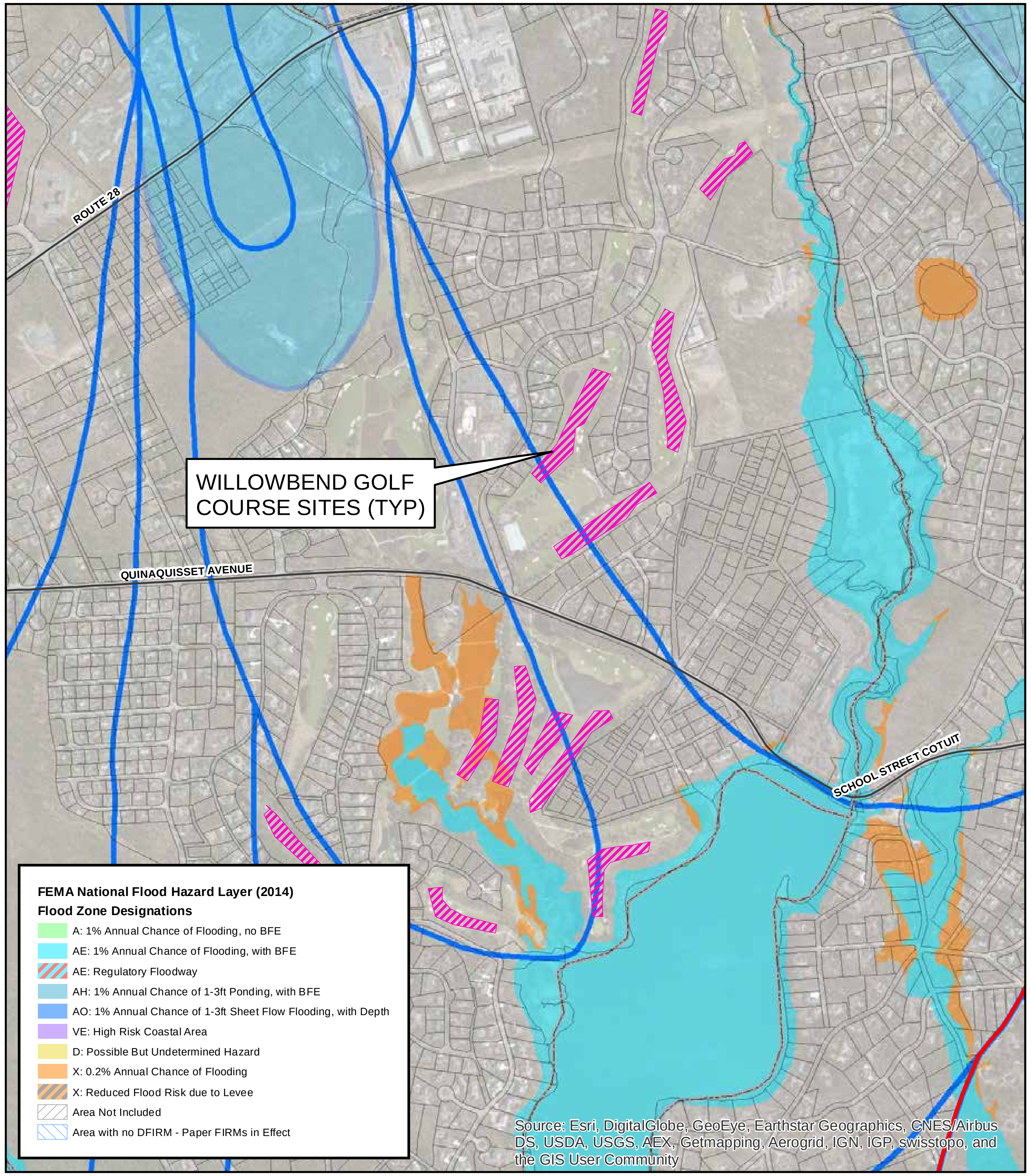

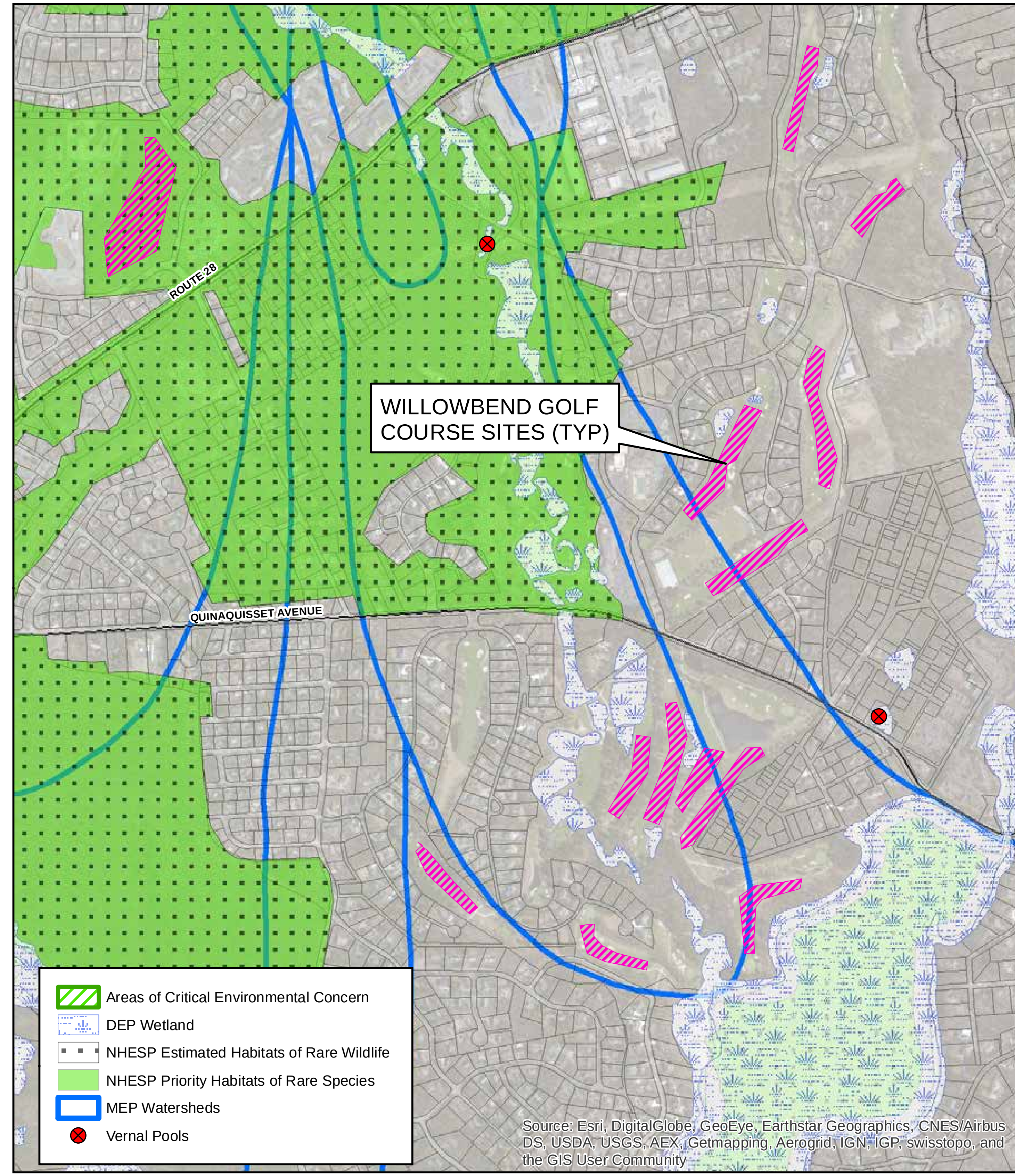

Paper Size ANSI B

0 250 500 1,000 Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

N

LEGEND

- Proposed Treatment/Discharge Site
- MEP Watersheds
- Zone II

Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

Job Number	86-12001
Revision	A
Date	06 May 2015

WILLOWBEND GOLF COURSE FEATURES

Figure 7-10

G:\86\12001\GIS\00074 Mashpee\2014\Final Report Figures\New folder\8612001F7-10 willowbend.mxd

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Data source: MassGIS

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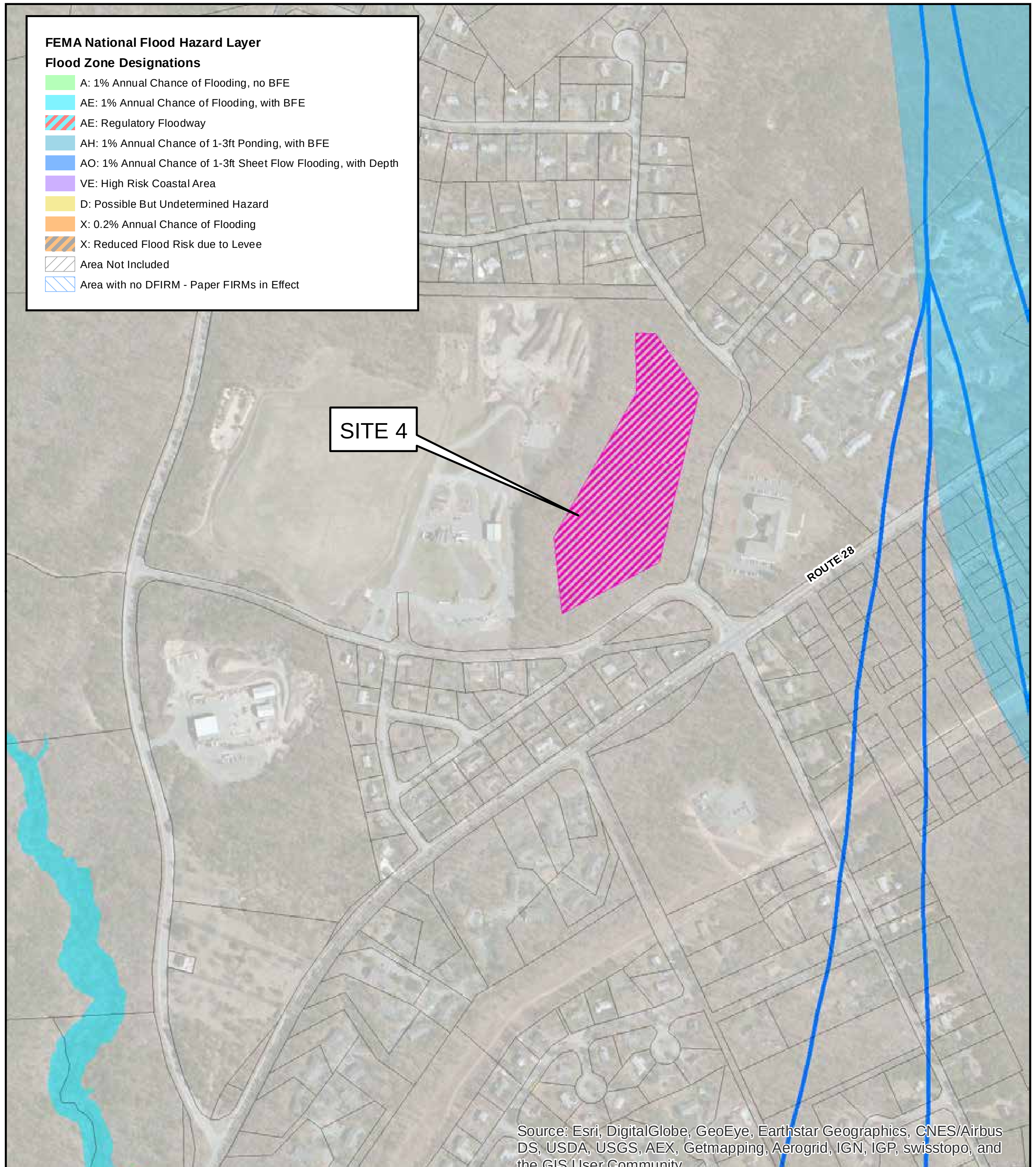

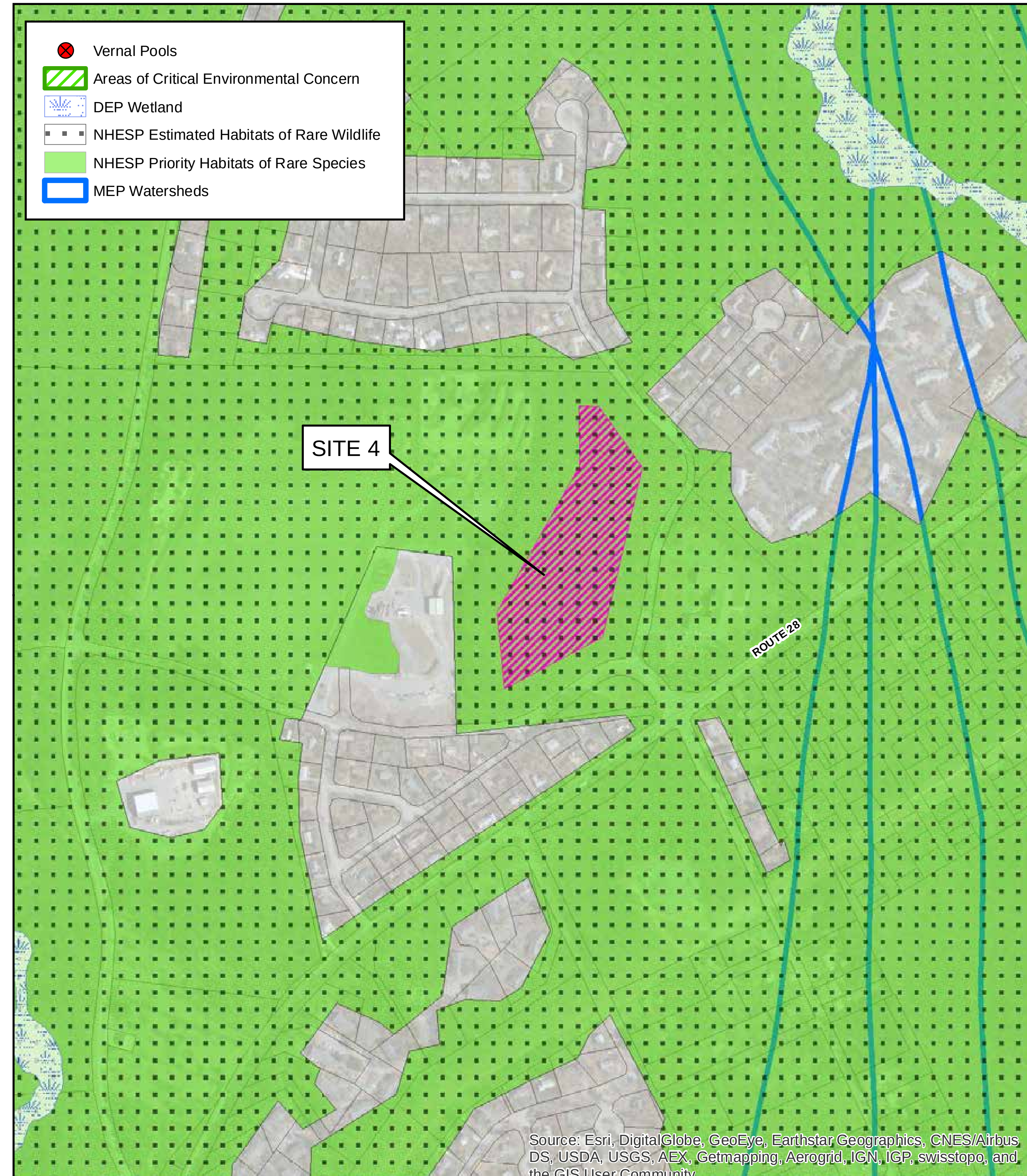

Paper Size ANSI B

0 125 250 500 Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

N

LEGEND

Zone II

Proposed Treatment/Discharge Site

GHD

Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

Job Number	86-12001
Revision	A
Date	06 May 2015

SITE 4 - FEATURES

Figure 7-11

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Data source: MassGIS

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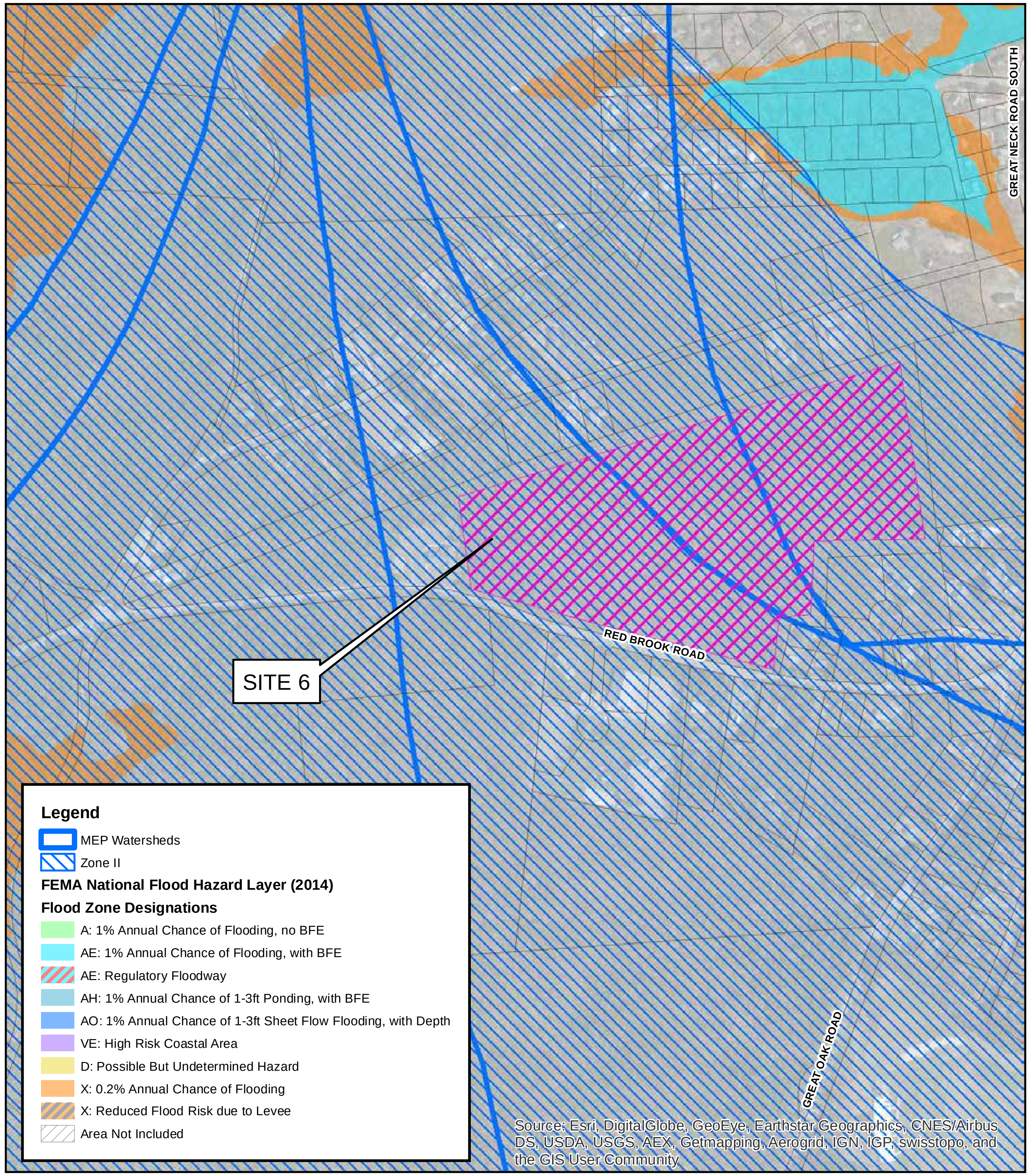

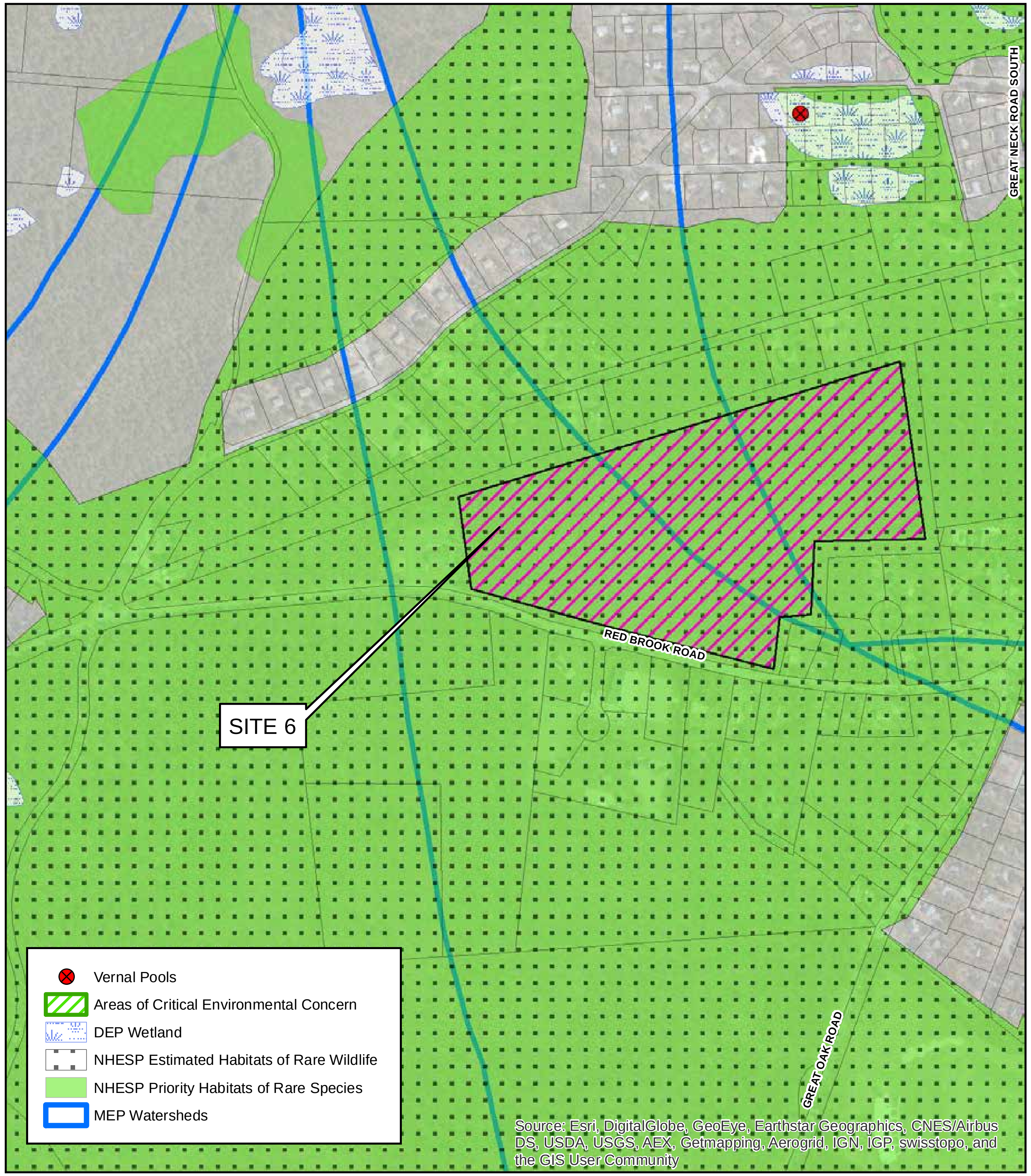

Paper Size ANSI B

0 125 250 500 Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

N

LEGEND

Proposed Treatment/Discharge Site

GHD

Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

Job Number	86-12001
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SITE 6 - FEATURES

Figure 7-12

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Data source: MassGIS

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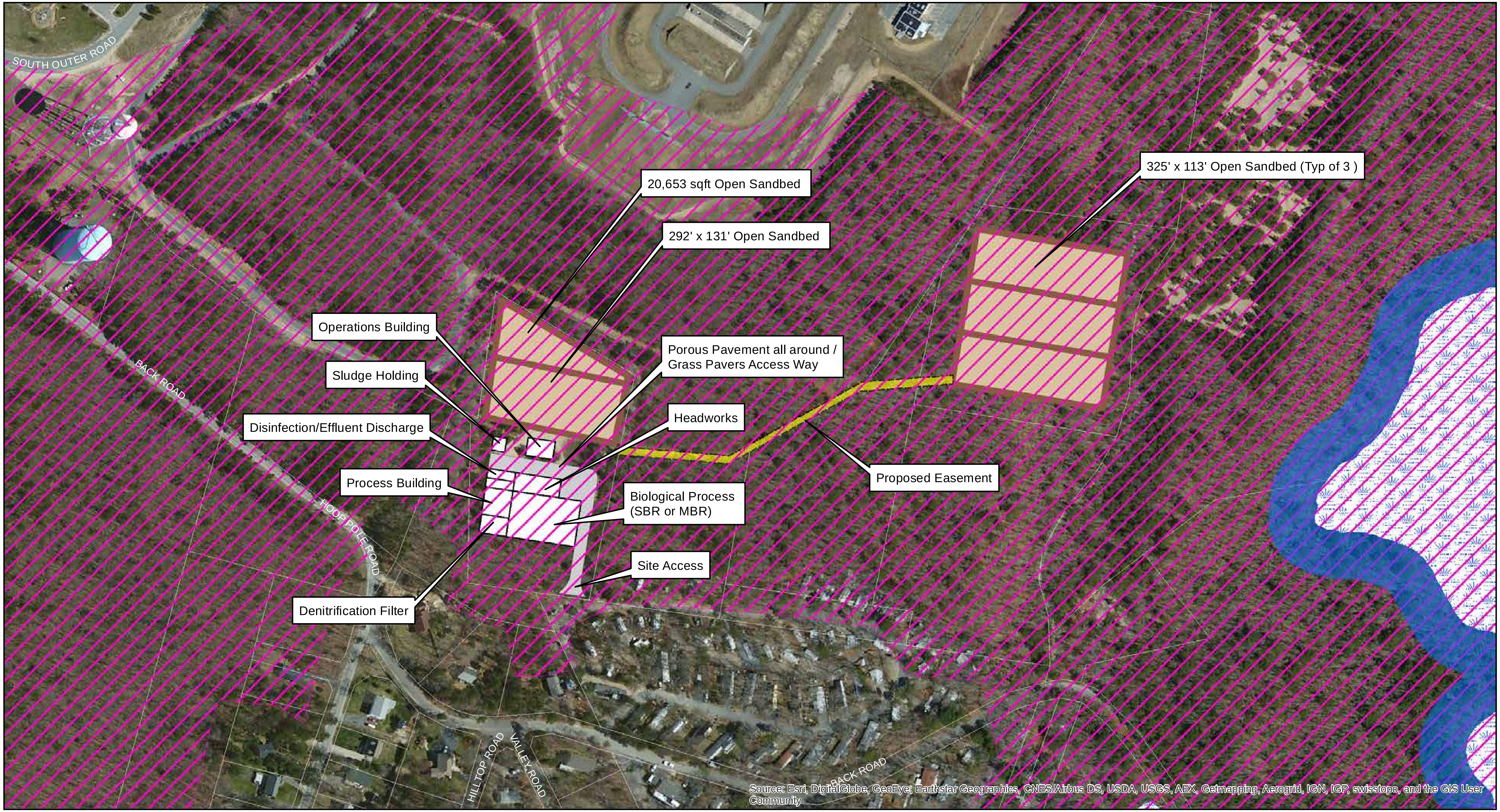

Data Source: Mass GIS, Town of Mashpee GIS Dept,GHD

Paper Size ANSI B

0 100 200 400 Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

N

LEGEND

- DEP Wetland
- Estimated and Priority Rare Species Habitat
- 100' Wetland Buffer

GHD

Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

Job Number	86-12001
Revision	A
Date	06 May 2015

Back Road Sites Features

Figure 7-13

G:\86\12001\GIS\00074 Mashpee\2014\Final Report Figures\New folder\8612001F7-13 Back roads nhesp.mxd

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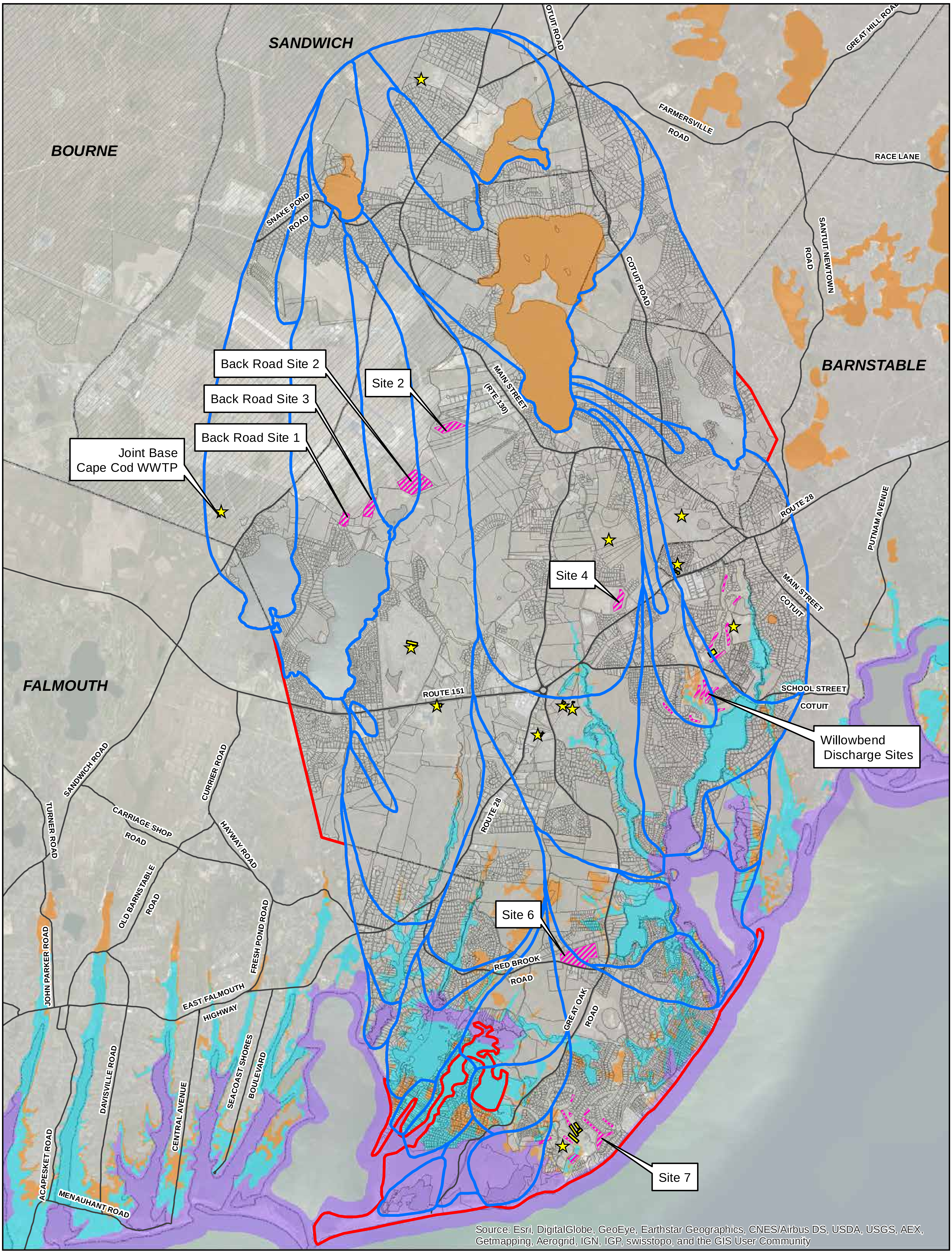

LEGEND

FEMA National Flood Hazard Layer (2014)

Flood Zone Designations

- A: 1% Annual Chance of Flooding, no BFE
- AE: 1% Annual Chance of Flooding, with BFE
- AE: Regulatory Floodway
- AH: 1% Annual Chance of 1-3ft Ponding, with BFE
- AO: 1% Annual Chance of 1-3ft Sheet Flow Flooding, with Depth
- VE: High Risk Coastal Area
- D: Possible But Undetermined Hazard
- X: 0.2% Annual Chance of Flooding
- X: Reduced Flood Risk due to Levee
- Area Not Included
- Area with no DFIRM - Paper FIRMs in Effect
- Planning Area Boundary
- Parcel Boundary
- Town Boundaries
- Proposed Treatment/Discharge Site
- Existing WWTPs

Paper Size ANSI B

0 0.375 0.75 1.5 Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

N

Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

Job Number	86-12001
Revision	A
Date	06 May 2015

FLOOD ZONES

Figure 8-1

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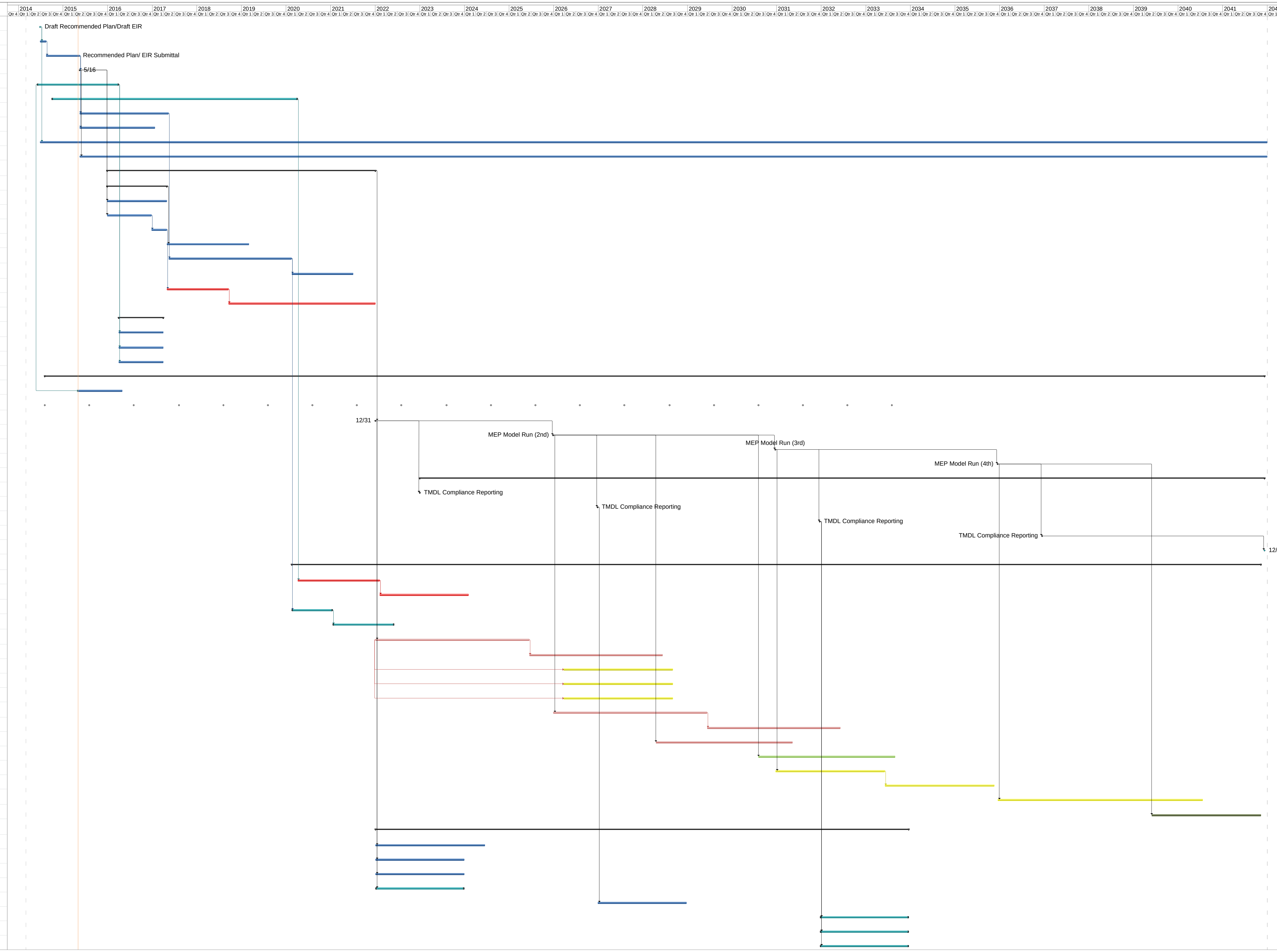
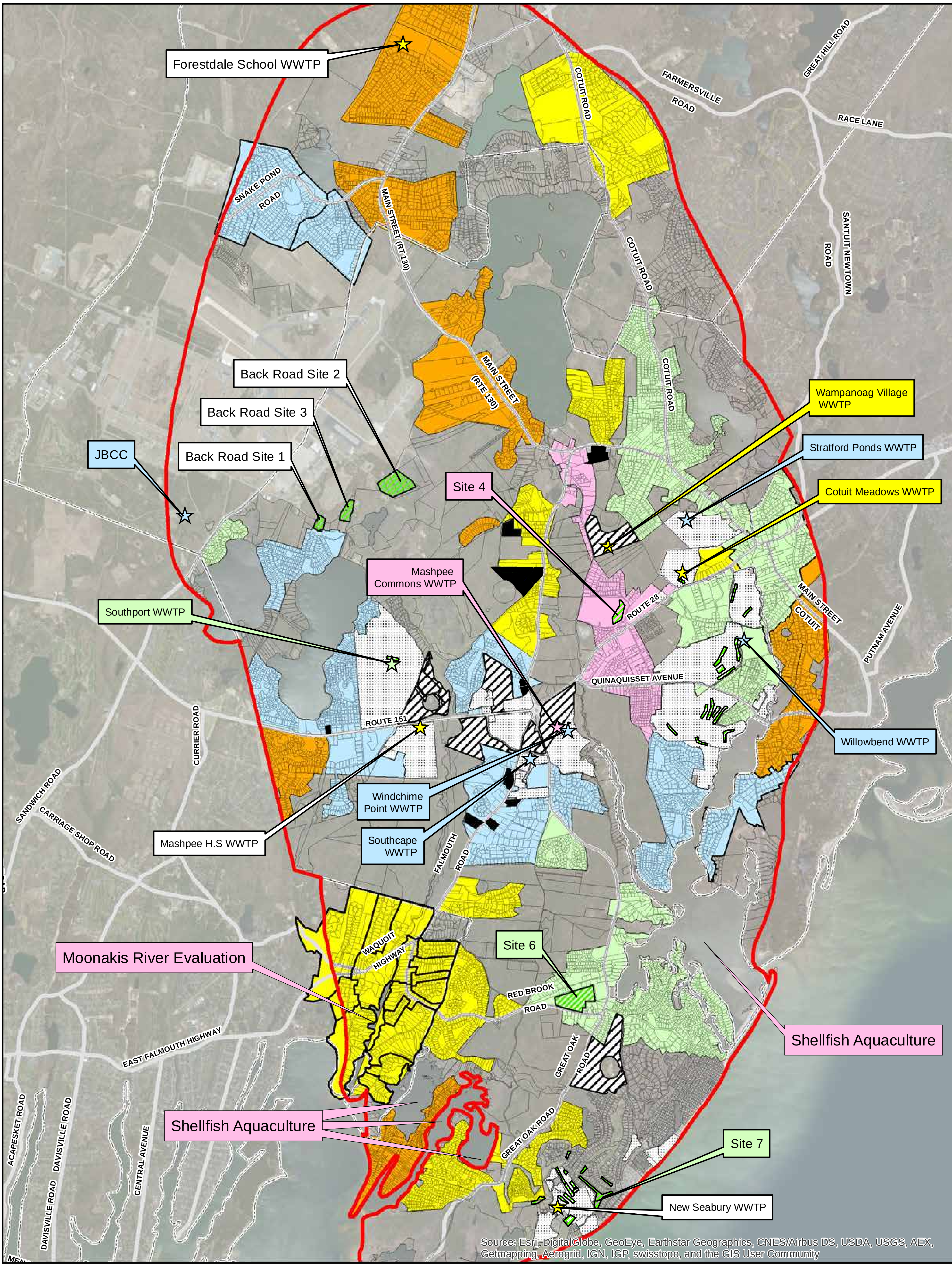
FIGURE 9-1 - PROPOSED IMPLEMENTATION SCHEDULE

ID	Task Name
1	Draft Recommended Plan/Draft EIR
2	MEPA Findings
3	Recommended Plan/ EIR Submittal
4	Town Meeting - Water/Sewer District Formation
5	Shellfish Propogation -Initiation
6	Joint Base Cape Cod Facility Ownership
7	Private WWTF Ownership Discussions
8	Regional Memorandums of Understanding
9	Stormwater BMPs
10	Fertilizer Management
11	**Phase 1 Implementation - Traditional Infrastructure**
12	**Site 4 WWTF Design**
13	Permitting
14	Design
15	Review
16	Site 4 WWTF Construction
17	Mashpee Commons Wampanoag Evaluation and Expansion
18	Wampanoag Upgrade and Sewer Extension Construction
19	Sewer Extensions Design
20	Sewer Extensions Construction
21	**Phase 1 Implementation - Non Traditional**
22	Phase 1 Implementation - Shellfish Popponesset Bay
23	Phase 1 Implementation - Shellfish Jehu Pond
24	Phase 1 Implementation - Shellfish Hamblin Pond
25	**Compliance Monitoring and Reporting**
26	Pre-Implementation Embayment Monitoring
27	**Annual Monitoring of Shellfish and Embayment Quality**
48	MEP Model Run (1st)
49	MEP Model Run (2nd)
50	MEP Model Run (3rd)
51	MEP Model Run (4th)
52	**TMDL Compliance Reporting**
53	TMDL Compliance Reporting
54	TMDL Compliance Reporting
55	TMDL Compliance Reporting
56	TMDL Compliance Reporting
57	TMDL Compliance Reporting
58	**Post Phase 1 TMDL Implementation (and Adaptive Management)**
59	JBCC/Back Road WWTF Improvements Design
60	JBCC /Back Road WWTF Improvements Construction
61	Mashpee Commons Sewer Extension Design
62	Mashpee Commons Sewer Extension Construction
63	Mashpee River Watershed Areas (South of Route 28)
64	Popponesset Bay Areas (South of Route 28)
65	Quashnet River (Falmouth)
66	JBCC (Sandwich)
67	Popponesset Bay (Barn-39)
68	Mashpee River Watershed Areas (North of Route 28)
69	Popponesset Bay Areas (North of Route 28)
70	Site 6 WWTF to serve Ockway Bay
71	Popponesset Bay (Barn-42 and Sand-8)
72	Jehu Pond Area
73	Hamblin Pond Area
74	Balance of Subareas (A, C, H, N, T and Barn-37,38)
75	Popponesset Bay (Sandwich)
76	**Existing WWTF Upgrade for improved nitrogen removal or Expansion**
77	Willowbend
78	Stratford Ponds
79	Windchime Point
80	South Cape Village
81	Southport
82	Cotuit Meadows
83	Wampanoag Village
84	New Seabury





LEGEND

- I/A
- Planning Area Boundary
- Parcel Boundary
- Wastewater WWTP (Color per Phase)
- Existing Private Sewer
- Proposed Private Sewer
- Proposed Treatment/Discharge Site

Implementation Phase

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5

Paper Size ANSI B

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

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GHD

TOWN OF MASHPEE SEWER COMMISSION
Watershed Nitrogen Management Plan

Job Number	86-12001
Revision	A
Date	07 May 2015

Implementation Phasing Plan

Figure 9-2

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Appendix 1-1

MEPA Certificate Dated September 12, 2014 and Response to Comments Document

MEMORANDUM

May 11, 2015

To	Town of Mashpee		
Copy to	F. Thomas Fudala		
From	J. Jefferson Gregg, P.E., BCEE	Tel	774-470-1640
Subject	MEPA – Draft Environmental Impact Comment Response	Job No.	8612001

This memo is written to address comments received from the public and environmental review process for the Town's Watershed Nitrogen Management Planning (WNMP) Project.

The September 12, 2014 Certificate of the Secretary of Energy and Environmental Affairs provided written comments on the Draft Environmental Impact Report. The written comments are attached at the end of this memo and are discussed in the memo. Excerpts from the comment letters are provided in standard type and then addressed with numbered responses (A.1, A.2, etc.) in ***bold italics***. This memo will be attached in an appendix to the Final Comprehensive Wastewater Management Plan and Final Environmental Impact Report with the Secretary's Certificate and the associated comment letters. Reviewers will be able to read these items to understand how we have addressed their comments.

We have prepared this Comment Response memo with a broad perspective that is appropriate for the broad scope of this project.

INDEX:

A. MASSACHUSETTS SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS—DATED 9-12-14

B. COASTAL ZONE MANAGEMENT—LETTER DATED 9-5-14

C. MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION—LETTER DATED 9-5-14

D. CAPE COD COMMISSION—STAFF REPORT DATED 9-5-14

E. DIVISION OF MARINE FISHERIES—LETTER DATED 9-5-14

F. DIVISION OF FISHERIES & WILDLIFE—LETTER DATED 9-5-14

G. ASSOCIATION TO PRESERVE CAPE COD—LETTER DATED 9-5-14

MEPA COMMENTS

A. COMMENTS FROM THE MASSACHUSETTS SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS, DATED SEPTEMBER 12, 2014.

Scope for the FEIR

This Scope identifies the additional information and analysis necessary to complete MEPA review and ensure that impacts and issues are analyzed to a degree commensurate with this planning document. The Town should prepare a FEIR in accordance with this Scope. The FEIR should build on the Recommended Plan provided in the DEIR and supplement it with more detailed information, preliminary design and refined environmental impact estimates, in particular for elements proposed in the early phases of the Plan. In particular, the FEIR should better characterize the incremental nitrogen reduction of various phases of the plan and support assignment of priorities and demonstrate that, if necessary, the contingency plan can meet the nitrogen reduction targets. It should address how the NPC process will be used in the context of Adaptive Management to provide additional information and analysis of Plan components and opportunities for public comment.

A1. Notices of Project Change (NPC) will depend on the performance of shellfish at removing nitrogen. If some areas are working better than others are, this may change how the "Phasing" is outlined in the Recommended Plan, and therefore a NPC would be used to advance some areas and delay others as required. The plan is designed to meet the TMDL limits in two ways: (1) by the construction and use of traditional wastewater treatment facilities, and (2) by the use of aquaculture. It is the expectation of the Town that the aquaculture component alone may be enough to meet the TMDL limits, except in certain sub-embayments (Mashpee River, Shoestring Bay, Moonakis/Quashnet River), or reduce the nitrogen in the target bays enough to require a small investment in traditional infrastructure. This approach is in compliance with the Draft 208 Plan that is nearing finalization. The Town anticipates an evaluation phase, and possible course-correction in the adaptive management plan, at five-year increments, or sooner if necessary, and will make those through the NPC process. The construction of all the facilities identified in the plan (the contingency path) will meet the TMDL limits on their own.

Project Description

The FEIR should provide a Final Recommended Plan and a detailed description of its elements. It should describe how transition of responsibility for the planning and implementation of the CWMP will be addressed between the Sewer Commission and the Mashpee Water and Sewer District. It should provide an update on public participation activities and consultation with CCC, State Agencies and adjacent communities. It should include a revised schedule for phases of the Plan that addresses benchmarks for planning, design, environmental permitting and review, and construction. It should provide an update on project permitting and specifically address how elements of the project are designed to meet applicable performance standards, including the Wetlands Regulations and associated Stormwater Management Standards, the Waterways Regulations and 401 Water Quality Certification requirements.

A2. The schedule provided as Figure 9-1 in the DEIR has been updated to reflect a further breakdown of the design phase to call out permitting and review. It was initially anticipated that a Water and Sewer District would be created based on a ballot question scheduled for the May 2015 Annual Town Election, and would share the responsibilities of implementing the plan to meet the TDMLs through the implementation of an Intermunicipal Agreement. Some parts of the plan will transition to the District; other parts will be retained by the Town. It is expected that the aquaculture and monitoring portion will be retained by the Town. Should the ballot question fail, the Town will retain responsibility for all implementation responsibilities through its Sewer Commission and other departments and committees.

Draft 208 Water Quality Plan and Regional Management

The FEIR should include a summary of the Draft 208 Water Quality Plan and how its development and recommendations have influenced the Final Recommended Plan. In particular, it should consider use of watershed tools to better account for nitrogen load reductions, assign and select priorities and take advantage of additional regional efforts. Comments from the CCC indicate that the traditional components of the Recommended Plan identified as contingencies for underperformance of shellfish aquaculture are appropriate; however, subsequent phases may benefit through use and evaluation of the modeling tool. In addition, the work emerging from the 208 planning process may support the development of a Targeted Watershed Management Plan for Waquoit Bay.

A3. A summary of the Cape Cod Commission's 208 Plan is included in Chapter 2. Mashpee will integrate recommendations from the 208 Plan into their adaptive management protocol as appropriate. Communication with the Cape Cod Commission is ongoing and the planning tools will be considered in future phases.

The FEIR should provide an update on consultation with municipalities regarding coordination of nitrogen reduction efforts and identify any progress towards development of the JBCC as a regional facility. To the extent possible, it should identify development of MOUs between municipalities and any regional commitments.

A4. Information on coordination with adjacent communities and JBCC are included in Chapter 3 of the CWMP report. Mashpee reviews JBCC status every month at Sewer Commission meetings. The Town is continuing outreach to, and communication with, surrounding communities and regional entities with a draft MOU for the Popponesset Bay watershed having been prepared and discussed with Barnstable and Sandwich, based on the recommendations of the EPA-funded DEP Popponesset Bay Pilot Project regarding fairly shared responsibility for current and future nitrogen loads to the Bay and future reductions. A similar MOU will be proposed using similar methodology regarding shared responsibility for the "Waquoit East" watersheds, for which TMDLs have been established, or for the Waquoit Bay watershed at such time as a TMDL is finalized.

Wastewater Treatment

The FEIR should provide a more detailed evaluation of proposed wastewater facilities, recharge locations and expansion of collections systems and associated environmental impacts. It should demonstrate progress on developing and securing agreements with private facilities. It should indicate whether incorporation of private facilities into the District is being proposed.

A5. Detailed evaluations were performed at several sites during the planning process including in the Needs Assessment and the Site 4 hydraulic load testing and site investigation work presented in previous documents. Based on the formation of the recommended plan and the reliance on shellfish, additional evaluations would be part of the adaptive management program and implementation schedule and would be based on the compliance results; therefore, it is not appropriate to preform additional evaluations at this time as part of the FEIR. Mashpee is pursuing both "agreements" and acquisitions. The specific facilities—presently private—are fully integrated in the Mashpee CWMP. The Sewer Commission has received the attached letters from New Seabury, Willowbend, and Mashpee Commons indicating their willingness to work with the Sewer Commission/District toward implementing the portions of the plan involving their properties.

It is unclear if the contingency measures included in the plan, on their own, could meet the removal targets necessary for TMDL compliance and what the incremental nitrogen reduction is for each phase of the plan. The FEIR should clarify nitrogen reduction associated with each phase of the Plan and describe what elements are necessary to achieve TMDLs. For instance, part of the Plan includes phasing in upgrades to achieve higher levels of treatment (i.e. 3 mg/L TN compared to 6 to 10 mg/L of TN). It is unclear whether that level of treatment is assumed to achieve the TMDL or if a certain level of treatment would be targeted as a contingency measure.

A6. The implementation of additional incremental changes to the plan will be driven by observing the effectiveness of previous steps in removing nitrogen from the estuaries. The contingency measures were developed based on achieving the TMDLs and this is clarified in Chapter 6 Section 6.4. Due to the complexity of using shellfish to achieve TMDL compliance, the plan is not able to project beyond the initial phase of nitrogen removal as shellfish are anticipated to be able at a minimum to remove some portion of the load; therefore, nitrogen loading is evaluated continually in order to see what amount of traditional or other approaches would be needed in the subsequent phases. Lacking the aquaculture mitigation aspect of the plan, all phases of the contingency plan (facilities construction) will be necessary to meet the Town's share of nitrogen load to the impacted bays. The Town is committed to reaching the TMDL limits as prescribed by law. It is difficult to forecast from this point what particular levels of removal, methods, or areas will be necessary to implement in order to attain the required levels. There are many variables and sequences open to reach that goal. There is a lot of discussion as to the efficacy of the proposed aquaculture plan as discussed later. It is intended that the phasing of the project in five-year parts will provide the opportunity to assess progress and redirect, if necessary, effort to a needed area.

Shellfish Propagation

The FEIR should include a revised and more detailed shellfish propagation plan to address comments on the DEIR. The FEIR should identify permitting and review requirements associated with the shellfish propagation program. It should describe associated infrastructure, management and maintenance requirements. It should include plans at a reasonable scale that include infrastructure, identify resource areas and demonstrate that sufficient bottom habitat is available to support identified densities. It should confirm that amount of shellfish seed can be obtained within the proposed timeframes. The FEIR should identify measures to avoid, minimize and mitigate impacts, including impacts to recreation and navigation.

A7. The triggers for implementing future phases beyond Phase 1 are further described in Chapter 9; and will be dependent on adaptive management and data review from the ongoing shellfish evaluations. The aquaculture portion of this plan is one of the areas receiving the most discussion. It is also the part of the plan that holds the most promise in reaching the project's goal affordably and in compliance with the Draft 208 Plan. Additional mapping of habitat areas is ongoing and the expectation is that aquaculture may provide even more of a role in the future project. Coordination with DMF, WHOI, the Wampanoag tribe, and surrounding communities, is ongoing. Shellfish Propagation Permits are issued by DMF and will be obtained for the seeding in the plan. They are renewed annually after review by DMF. The infrastructure for implementation, management, and maintenance is in place and will be expanded as needed. The Board of Selectmen, Town Manager, Shellfish Constable, Waterways Assistants, Shellfish Commission, and Masphee Wampanoag Tribe work together to manage the existing propagation programs and are committed to full implementation of the plan. Existing infrastructure including Carolina Skiffs, barges, and propagation gear will be upgraded as needed. The Shellfish Constable asked Richard Kraus, president of the Aquaculture Research Corporation hatchery if they could supply the quantities of oyster and quahog seed needed to implement the plan. Mr. Kraus responded they could with enough lead-time.

Because of the significant reliance on this program to reach targets, close consultation with MassDEP, CCC and DMF is warranted prior to the filing of the FEIR. The FEIR should include a detailed protocol to ensure that the sampling and monitoring program yields appropriate verifiable data that will be accepted by MassDEP and DMF for evaluation, and will support the Town's evaluation of the effectiveness of the program. In addition, the triggers for implementing contingency plans should be more explicitly stated in the FEIR, including identification of thresholds and amount/duration of data required.

A8. Meetings are scheduled with each of these organizations as well as others for identifying procedures and protocols for the program.

The identification of timetables and thresholds may work against the efficient and cost-effective implementation of the plan. Clearly, new facilities built up in the watershed will not show immediate results in the bay until the groundwater is flushed through. Those results may be difficult to attribute to the facility. Results in one subwatershed may require more effort to bring it in line with the TMDLs. These factors require that the plan be flexible in meeting the required goals.

The Mashpee Water Quality Monitoring program is continuing the same sampling protocols, stations, and analytical methods that were used to provide data for the MEP and TMDL reports for the Popponesset Bay and Waquoit Bay systems. The stations are listed and mapped in the reports (Howes et al. 2004, pp. 88 and 89/Howes et al. 2011, p. 117). Water samples are analyzed at the UMass Dartmouth SMAST certified lab. The protocols, analytical methods documents, and reports from ongoing monitoring (after the MEP reports) are available from Dr. Brian Howes, UMass Dartmouth SMAST.

Non-Wastewater Nutrient Management Projects and Programs

The Recommended Plan will be strengthened through additional consideration of other non- wastewater nutrient management strategies and assessment of the potential effectiveness of such strategies. The FEIR should provide more discussion regarding other non-traditional projects and programs identified in the DEIR, including the growth neutral/flow neutral policy, stormwater management, conversion of abandoned cranberry bogs and shallow ponds including Santuit Pond, open space acquisition and additional public drinking water supply well locations, and fertilizer management. In addition, it should indicate when such elements would be incorporated into the Recommended Plan. In particular, it should provide more specificity regarding the framework of a growth neutral/flow neutral bylaw and, if available, provide a draft bylaw for review. If certain elements or analysis of elements will be deferred to later phases or subsequent NPCs, the Plan should clearly identify this.

A9. The Recommended Plan will summarize the findings of the CCC 208 Plan, however the plan is focused on three areas: (1) Shellfish Aquaculture/Propagation; (2) Traditional Infrastructure (wastewater); and (3) will include a flow/growth neutral policy. The Town has already spent significant funds and made significant efforts over the last 30+ years to purchase open space and protect it in order to protect its resources including its waterbodies and water supplies. The Town has adopted its fertilizer management (nitrogen reduction) bylaw and has been implementing best management practices regarding stormwater improvements for nitrogen removal since the 1990s both through its zoning requirements for new development and through Town-constructed stormwater projects. Additional non-traditional methods of nitrogen reduction may be implemented in future years following expanded efforts in adjacent communities regarding pilot programs and the CCCs implementation of the 208 Plan, but no other efforts are being considered as a formal part of the plan at this time; these other programs would be part of Adaptive Management.

Water Quality Monitoring and Adaptive Management

The Recommended Plan is based on Adaptive Management to provide incremental and targeted reductions in nitrogen with regular evaluation and re-evaluation of Plan components based upon a robust water quality monitoring program and associated modeling. As noted previously, the Proponent has committed to provide TMDL compliance reports to MassDEP, DMF, CZM, and other agencies/organizations. The FEIR should clarify that the reports will be provided to the CCC as well. The DEIR identifies regulatory requirements for monitoring and identifies parameters that will be monitored; however, it does not provide a specific monitoring protocol for evaluation. The FEIR must include a detailed protocol for evaluation by MassDEP, DMF and CZM. I strongly encourage the Proponent to consult with State Agencies and CCC regarding the development of this protocol prior to filing the FEIR.

A10. The Cape Cod Commission is added to the list of those to be notified. See Section 10.3 of the report.

The Mashpee Water Quality Monitoring program is continuing the same sampling protocols, stations, and analytical methods that were used to provide data for the MEP and TMDL reports for the Popponesset Bay and Waquoit Bay systems. The stations are listed and mapped in the reports (Howes et al. 2004, pp. 88 and 89/Howes et al. 2011, p. 117). Water samples are analyzed at the UMass

Dartmouth SMAST certified lab. The protocols, analytical methods documents, and reports from on–going monitoring are available from Dr. Brian Howes, UMass Dartmouth SMAST.

<u>Wetlands and Rare Species</u>

The Recommended Plan will impact inland and coastal wetland resources. Overall, the Plan should improve water quality with related improvements in estuary health and habitat. The DEIR provides conceptual plans for proposed facilities and collection systems and identifies on-and off-site resources including wetlands, floodplains, vernal pools, water supply protection areas, and rare species habitat. The Town has sited facilities to avoid significant impacts. The FEIR should provide an assessment of wetlands impacts associated with the shellfish propagation project and, to the extent feasible with projects proposed is early phases of the Recommended Plan, which may be limited to the expansion of sewer service areas. The DEIR should describe measures that will be implemented to avoid and minimize, or mitigate, adverse impacts to wetlands and buffer zones.

A11. The shellfish impacts are positive (water quality improvement) with no adverse impacts. Oyster aquaculture increases habitat and species diversity. Bottom planting of quahogs leaves the sediment surface available for other species. The Recommended Plan mitigation measures discuss minimizing wetlands impacts and buffer zones, and mitigation measures; see Chapter 7.

The FEIR should describe how the proposed stormwater management systems for new and/or expanded facilities will be designed and constructed consistent with MassDEP's stormwater management regulations and standards. The FEIR should describe proposed best management practice (BMP) measures to manage stormwater during project construction.

A12. This was discussed in Section 6.3.1 of the DRP/DEIR and additional description has been added into Chapter 6 discussing BMPs used by the Town of Mashpee.

The sites for new facilities, and many of the expansions, are located within *Estimated* and *Priority Habitat* for rare species. The FEIR should consult with NHESP regarding the design of facilities and identify construction and post-construction commitments to avoid adversely impacting habitats of state-listed rare species.

A13. This will be done as part of the next steps of design and as part of the permitting process for any proposed facilities.

<u>Climate Change</u>

The FEIR must demonstrate that the Town will take meaningful steps to reduce GHG emissions and is well positioned to address impacts of climate change, including sea level rise and more frequent and severe storms. The Recommended Plan represents a significant investment of State and local resources and is the basis for design and construction of long-term infrastructure. As a coastal community, it is critical that these resources are sited, designed and constructed to adapt to sea level rise and associated impacts so that the targeted benefits and investments will be protected over the long-term. Planning for energy efficiency, long-term water quality improvements and infrastructure should be addressed in the FEIR and subsequent NPCs, to the extent reasonable and feasible, rather than deferring these considerations to permitting.

A14. Other than shellfish propagation efforts and some portions of later-phase wastewater collection systems, no facilities are proposed in areas that would be impacted by even the highest predicted levels of sea-level rise by 2100. Regarding GHG emissions and Solar PV, see below.

<u>Greenhouse Gas Emissions</u>

The Town should present a GHG analysis that clearly demonstrates what measures will be adopted to achieve a high level of energy efficiency for proposed facilities and treatment processes and to quantify potential GHG emissions reductions (in tons per year (tpy) of C02) associated with the measures. Staff from the MEPA Office, MassDEP and the Department of Energy Resources (DOER) are available to provide guidance and technical assistance for this effort.

A15. The Town adopted the "Stretch Energy Code" 780 CMR 120.AA in January of 2010. The Town would at a minimum adopt these same code requirements for future development related to the CWMP and related facilities as they apply. In addition, any GHG analysis at this time would be predicated upon assumptions of technology to be applied at the time final design is complete, therefore it is recommended that a GHG analysis should be required at the time the Town enters into preliminary and final design and construction phases for each phase related to any proposed new facilities for wastewater treatment.

Inaddition, the FEIR should evaluate the feasibility of incorporating solar PV into the Recommended Plan. Installation of PV systems on municipal buildings or on municipal properties may achieve cost-savings beneficial to the community and can offset ongoing operational costs. The DEIR should consider ground-mounted and building-mounted systems and ownership structures, including third-party ownership/lease scenarios. MassDEP, DOER and the Clean Energy Center (CEC) can provide resources to assist with the analysis, including a DOER spreadsheet to calculate potential project cost, payback periods and returns on investment. The DEIR should state assumptions with regard to available area for PV equipment, efficiencies, etc.

A16. The Town of Mashpee has already made significant efforts to incorporate PV systems into the Town. The following is a list of the Town's recent renewable energy projects:

- ***1.83 MW system at closed Mashpee Landfill***
- ***312 KW roof mounted system at Mashpee High/Middle School***
- ***20 KW roof mounted system at Mashpee Public Library***
- ***10 KW roof mounted system at Mashpee DPW***
- ***10 KW roof mounted system at Mashpee COA***
- ***(1) 1.5 KW 30-foot vertical axis wind turbine***

Based on discussions with the Town Manager's office, these facilities provide close to 90% of the total Town facilities power supply. As part of any future proposed structures, the Town will consider further evaluation for cost benefit of adding PV to those new structures. These projects were completed using a combination of Federal and State grants as well as Public-Private Partnerships, and demonstrate the Town's commitment to renewable energy efforts.

Upon completion of the construction of proposed improvements and upgrades and new wastewater management systems and facilities, the Town will be required to provide a certification to the MEPA Office signed by an appropriate professional (e.g., engineer, architect, general contractor) indicating that the all of the GHG mitigation measures committed to by the Town as described in the DEIR, or as modified as part of the MassDEP permitting process, have been incorporated into the projects. This certification should be supported by project plans. For those measures that are operational in nature the Town will be required to provide an updated plan identifying the measures, the schedule for implementation and how progress towards achieving the measures will be obtained. The proposed draft Section 61 Findings in the DEIR should include this self-certification requirement.

A17. The self-certification requirement has been added to Chapter 8 Section 8.2.

Adaptation, Resiliency and Coastal Hazards

Current rates of sea level rise, as well as projections for accelerated rates of sea level rise, pose significant threats to coastal development and resource areas by increasing storm surge heights and coastal flooding events. The DEIR provided sufficient information to identify many elements of the project that are clearly outside of flood zones and unlikely to be affected. Other areas warrant further analysis as revised floodplain mapping (July 16, 2014) and incorporation of sea level rise projections may identify project elements that will be located within flood zones.

The FEIR should include revised flood zone maps that incorporate effects of sea level rise and identify vulnerable facilities or infrastructure. The FEIR should identify specific measures that can be incorporated into the design or operation to facilitate adaptation and create resiliency. In addition, the Town should consider model results produced by USGS and modeling being conducted by APCC to assess potential changes to groundwater elevations associated with sea level rise and address any potential impacts to project elements.

Comments provide a list of resources to support these efforts. In addition, State Agencies and CCC have offered to provide technical assistance to support these efforts. The Town should refer to the CZM report, *Sea Level Rise: Understanding and Applying Trends and Future Scenarios for Analysis and Planning,* to guide selection of appropriate sea level rise scenarios.

Additional resources include:

- FIRM maps through the National Oceanic and Atmospheric Administration viewer
- the CCC Sea Level Rise Viewer available on the Commission website
- dynamic models created by the Woods Hole Group
- StormSmart Coasts -Visualizing Sea Level Rise on the CZM website

A18. The FEIR includes updated FEMA flood maps as shown on Figures referenced in Chapters 7 and 8. Additional description of mitigation measures has been added to Chapter 8.

Construction Period Impacts

The FEIR should identify any changes to construction management and potential construction period impacts (including but not limited to land disturbance, noise, vibration, dust, odor, nuisance, vehicle emissions, construction and demolition debris, impacts on trees and other vegetation, and construction-related traffic). The Town should identify any changes or addition of measures to avoid, minimize and mitigate impacts.

A19. Mitigation measures were discussed in Chapter 8 of the DEIR and any additional measures can be found in Chapter 8.

Mitigation and Section 61 Findings

The DEIR includes a separate chapter on mitigation measures and Section 61 Findings; however, it consists of general commitments and deferral of specific commitments to subsequent design and permitting. It does not include a specific draft Section 61 Finding for each agency action. As a long-term planning document, it is not feasible to identify specific commitments for every project element; however, the Town should revise and update the mitigation section to provide a summary of all mitigation commitments and to identify specific commitments where feasible and appropriate, in particular for early phases of the Plan (e.g. shellfish propagation program, construction of Site 4 WWTF).

A20. The Section 61 findings have been expanded for Phase 1 and are discussed in Chapter 8 Section 8.3.

In addition, draft Section 61 Findings must be developed for each State Permit (e.g. Groundwater Discharge Permit, c.91 Permit, 401 Water Quality Certification). Draft Section 61 Findings will serve as the primary template for subsequent permitting conditions and should address specific regulatory program standards and requirements. The Section 61 Findings should describe proposed mitigation measures, contain clear commitments to mitigation and a schedule for implementation based on the construction phases of the project, estimate the individual cost of each proposed measure, and identify parties responsible for funding and implementing the mitigation measures. The draft Section 61 Findings will serve as the primary template for permit conditions.

A21. Additional description has been provided to the Draft Section 61 Findings presented in the DEIR. The Draft Section 61 findings can be found in Chapter 8.

Responses to Comments

The FEIR should include a copy of this Certificate and a copy of each comment letter received. In order to ensure that the issues raised by commenters are addressed, the FEIR should include a response to comments received on the DEIR to the extent that the subject matter of the comment is within the Scope. The FEIR should include either an indexed response to comment format, or direct narrative response. The FEIR should present any additional narrative or quantitative analysis necessary to respond to the comments received. This directive is not intended to, and shall not be construed to enlarge the scope of the DEIR beyond what has been expressly identified in this Certificate.

A22. This memorandum is presented as the requested Response to Comments and is included in the FEIR in Appendix 1-1.

Circulation

The FEIR should be circulated in compliance with Section 11.16 of the MEPA regulations and copies should also be sent to the list of "comments received" below and to town officials in Barnstable, Falmouth and Sandwich. A copy of the FEIR should be made available for public review at the public libraries in the Towns of Mashpee, Barnstable, Falmouth and Sandwich.

A23. Final copies of the FEIR shall be provided to the public libraries of the communities of Barnstable, Falmouth, Mashpee, and Sandwich.

B. COASTAL ZONE MANAGEMENT – LETTER DATED 9/5/14

Flood Zone Mapping

Figure 8-1 in the DEIR depicts flood zones in the planning area including the 100-year flood, the 100-year flood with velocity hazard, and the 500-year flood. A note on the figure states that "Digital Q3 Flood data was obtained through MassGIS (1997)". Updated FEMA Flood Hazard Layers are currently not available for this area." As of July 16, 2014, new data and maps are now available. The Town can access these data via the National Oceanic and Atmospheric Administration's viewer or can contact CZM. These maps should be consulted to ensure that the proposed infrastructure is outside of all flood zones. While it appears that the existing New Seabury wastewater treatment plant and Site 7 discharge location are outside the current 1% and 0.2% flood zones (i.e., 100 and 500-year floods, respectively), the Town should evaluate the flood risk given the expected sea level rise over the design life of the proposed structures.

B1. See Response A18.

In addition, the U.S. Geological Survey (USGS) has just completed a model of how groundwater will migrate upward as sea level rises on Cape Cod. We encourage the Town to use the results of this model to evaluate the long-term (20, 40, 60-year) viability of proposed and existing treated wastewater discharge sites and to plan for and acquire any necessary additional discharge sites as the Town moves toward build-out and as rising groundwater affects existing sites.

B2. Depth to groundwater tables may be available based on existing monitoring wells in the vicinity of existing leaching facilities or historic data in those areas and will be considered during final design permitting of each site.

Bivalve Propagation as a Nutrient Remediation Strategy

A major component of the Town's proposed nutrient remediation plan is to remove nitrogen from watersheds via bivalve propagation. While the Town provides some estimate of the ability of bivalves to remove nitrogen in various watersheds (e.g., Tables ES-1 and 5-16), the assumption that littlenecks contain 60 g of nitrogen and that oysters contain 100 g of nitrogen (see Notes at the bottom of ES-1) appears to be significantly higher than published estimates. For example, the January 2014 Woods Hole Sea Grant Program Marine Extension Bulletin described Cape Cod quahogs (littlenecks) as containing 0.22 g of nitrogen on average and Cape Cod oysters as containing 0.28 g nitrogen on average.1 Using the Woods Hole Sea Grant Program values to revise the values in Table 5-16, 5 million oysters have the potential to remediate 1.4 metric tons of nitrogen (only 28% of the Mashpee

River Watershed load, not 50% as stated in the DEIR) and 4.87 million quahogs have the potential to remediate 1.07 metric tons of nitrogen (only 71% of the Popponesset Bay Watershed load, not 100% as stated in the DEIR). CZM suggests that the Town revise its estimates of the number and cost of bivalve propagation proposed for remediation in each sub watershed. Further, the costs associated with bivalve aquaculture (e.g., Table 5-18) appear to make several assumptions that do not appear to be realistic. For example, the Town's approach assumes that no individuals are lost to predators, weather, parasites, poaching, or low dissolved oxygen associated with eutrophication.

B3. ***There is a typographic error in the notes at the bottom of Table 2 (referred to as Table ES-1 in the comment above) in Appendix 5-1 Shellfish Aquaculture/Fisheries for Water Quality Restoration of the DRP/DEIR 06-24-14 in which "littleneck quahogs @ 60 g N" should be "littleneck quahogs @ 60 g live weight". "Live weight" should also be added to the "oysters @ 100 g". This will be corrected in the FEIR. This does not affect the numbers in Table 2 or Table 5-16 in Chapter 5 of the DRP/DEIR (or anywhere else) which were calculated using a nitrogen content of 0.5% of live weight of shellfish. This is calculated from the relevant data from oysters and quahogs collected from Mashpee in 2012 by Extension Agent Josh Reitsma that are in the data set used for the January 2014 Woods Hole Sea Grant Marine Extension Bulletin. Nitrogen content of Mashpee shellfish was higher than the average of shellfish from all towns. The nitrogen content data from Mashpee is in the "Shellfish Sample Data" table in Appendix 5-1. At the nitrogen content of 0.5% live weight, a 100 g oyster would contain 0.5 g nitrogen, and a 60 g littleneck quahog would contain 0.3 g nitrogen. Harvest data by live weight is used to calculate nitrogen removed from the estuary. The number of shellfish harvested is needed to estimate the number of seed to be planted. This does include loss due to predators, etc. The numbers of seed to be planted exceeds the number of shellfish to be harvested to account for these losses.***

Bivalve aquaculture removes nitrogen from the water column by consuming the plankton that presently erodes the health of Mashpee estuaries. The potential effectiveness of one, or millions of bivalves, in removing nitrogen can only be estimated. Effective planning requires that their contribution, like other parts of Mashpee's CWMP, will be managed proactively through adaptive management. Mashpee's plan seeks to harvest bivalve aquaculture potential while recognizing and providing for whatever efficiencies, or lack thereof, are achieved. The actual performance of the aquaculture portion of the project remains to be demonstrated; however, it is viewed at this time that, barring a massive failure of the program to reduce nitrogen, this aspect of the project will remain cost-effective to implement.

In addition, it is not clear if the costs include the costs of replacing lost individuals, the cost of hiring staff, or all costs associated with bivalve husbandry (vessels, gas, cages, upwellers), and the cost of enforcement. CZM also notes that several of the water bodies (Mashpee River, Shoestring Bay, Hamblin Pond) proposed for shellfish propagation are impaired by high bacteria concentrations and are on the Massachusetts Department of Environmental Protection (MassDEP) "Integrated List." Nowhere in the DEIR is there mention that the shellfish propagation approach is supported by Massachusetts Division of Marine Fisheries (MarineFisheries). If the Town intends to move forward with bivalve propagation, CZM would expect that the Final EIR (FEIR) would contain specific itemizations of all costs as well as a letter of support from MarineFisheries. While it appears that there are many logistical hurdles to using bivalve propagation as a successful nutrient remediation strategy in waters that are already impaired, we applaud the Town for beginning to discuss alternative nutrient remediation and for considering a contingency plan should the proposed scheme for remediating nutrients via bivalve aquaculture not be adequate. We believe this contingency plan should be more explicitly stated in the FEIR (e.g., how many years of study would be needed and what would the threshold level be in order for the Town and MassDEP to consider bivalve propagation to be an inadequate remedy.

B4. DMF has sent a letter of support—see comment letter dated September 5, 2014 included in this Appendix. In addition, the Mashpee Shellfish Constable (Rick York) met with DMF in December 2014 to review their comments and confirm their support.

The costs do not include staff, which is funded by the Town. The areas of water bodies proposed for shellfish propagation are approved for the harvest of shellfish by DMF as shown in the DMF Shellfish Area Classification Maps in Appendix 5-1 of the DEIR. After implementation, the success of shellfish propagation should be demonstrated within the first 5-year period.

Lastly, should the Town move forward with bivalve propagation as a nutrient remediation strategy, CZM suggests that the Town describe how the nitrogen will be removed from the greater Cape Cod watershed. If the proposal is simply to harvest the clams and oysters and sell them to Cape Cod residents or use them in some other fashion on Cape Cod, the nutrients may not truly be leaving the impaired watersheds.

B5. This is not proposed as a source removal approach, but a mitigation approach at the water body. Nutrients are coming from other watersheds and regions and traveling to other watersheds and regions as part of the nature of Cape Cod and its tourist population. It is understood as part of the plan that if the shellfish (or any other new source or load) are creating new impacts or such that nitrogen isn't being reduced in the water column, it will be apparent in the long-term monitoring and will require other approaches to reduce nitrogen at the source. Even if shellfish were sold to Cape Cod residents for consumption, this would represent a net loss of nitrogen since the locally consumed shellfish would not be new nitrogen, but rather would replace other sources of nitrogen from edibles that come from outside of the watershed (e.g. food from supermarkets).

<u>Nitrogen Source Reduction</u>

CZM looks forward to seeing the Town develop and implement a fertilizer bylaw to help reduce the sources of nutrients to coastal water bodies. We agree with the DEIR that purchasing open space and developing a growth neutral/flow neutral policy are important tools to reducing future sources of nitrogen. It is clear from Table 1-1 that the Town will need to address 100% of the existing septic system load in at least half of the sub watersheds of the planning area; this indicates that any additional load to these areas will also need to be addressed. Even if sewered areas appear to be built out, additional nutrient loads are expected in sewered areas because relief from Title 5 constraints can expand occupancy on built properties and allow development on previously undevelopable properties. If the Town does not plan for future sources of nutrients, then the great public investment proposed in the DEIR related to sewering, building treatment and discharge facilities, and shellfish propagation would be at risk for not achieving the desired water quality and ecological goals. We look forward to seeing the Town further develop source reduction strategies in the FEIR.

B6. Appendix 4-2 of the DEIR included a copy of the Town's Nitrogen Bylaw regarding fertilizer, which was adopted at the October 20, 2014 Town Meeting and has been approved by the Cape Cod Commission under the Cape-wide fertilizer management DCPC. The plan is also based on a build-out condition which is intended to project future nitrogen loads from the development allowed or expected throughout the community. The Town is in the process of developing a flow/growth neutral bylaw to address this future loading concern as well.

Nitrogen Removal and Long-Term Monitoring

In our comments on the Daft Alternative Scenarios Analysis and Site Evaluation Report, CZM requested that information be presented in the DMP/DEIR relating to the efficacy and fate of nutrients in the water quality models. This requested information included the following:

- A description of the modeling and monitoring that will be used to establish the efficacy of the proposed alternative at removing nitrogen from the watershed,
- A description of the modeling and groundtruthing efforts that will be used to determine the ultimate fate of the nitrogen load, and
- The long-term monitoring program upstream and downstream of the project that will be used to ensure that the selected alternative continues to remove nitrogen at the required rate for the duration of the project

CZM believes this information is an important part of the Town's Comprehensive Wastewater Management Plan, the results of this modeling and monitoring will guide the Town in its proposed adaptive management approach, and will ultimately be used to determine the success of the Town's nitrogen removal efforts. CZM recommends this information be provided prior to final development of the FEIR.

B7. We agree that modeling and monitoring are key components and should represent the current conditions at the time of sampling in order to track progress. Additional details on the modeling and monitoring program are provided in Chapter 10 Section 10.2. The Mashpee Water Quality Monitoring Program that provided the data used to establish the TMDL-N is ongoing, and will supply the data needed for TMDL-N compliance and determination of water quality. Shellfish harvest and nitrogen content data will determine the amount of nitrogen removed by shellfish. Other data such as that collected upstream and downstream from alternatives such as shellfish beds is supplementary and subject to variability requiring large numbers of samples in some cases.

C. MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION – LETTER DATED 9-5-14

General Comments

MassDEP would expect Mashpee to initiate discussions with these and any other entities over which the town has no ownership or control to establish agreements for use of property for any uses relative to the contingency plan. Such agreements and their status, or alternatives should agreements be unobtainable, should be more fully discussed in the Final EIR. MassDEP also notes that it is not specifically stated in the DEIR if this contingency plan alone will meet the nitrogen removal targets necessary for TMDL compliance. The Final EIR should clarify this point. As an alternative to effluent recharge at these sites, recent changes to the Ocean Sanctuaries Act may make an ocean outfall feasible which could possibly negate the need for effluent recharge at these sites. The Final EIR should explore this option in more detail.

C1. The FEIR clarifies that the contingency plan is established to address nitrogen removal through traditional means in the absence of a working shellfish program. This is discussed in Chapter 6. Since the ocean outfall option was not a possibility during the majority of the planning stage of the project, it has not been evaluated. At this time, it is not clear if this would be a cost-effective option. The project does not have a central facility planned; therefore it may require multiple outfalls or means of conveyance into one outfall. The planning and construction of outfalls are costly. It is not clear what the operational or monitoring requirements placed on the facility would be, and it would be anticipated that the permitting process would be long and potentially contentious.

Should development of facilities in Phases 3 and 4 be required and the proposed discharge site at the New Seabury golf course be implemented, detailed analysis of the impacts of sea level rise on groundwater levels will be done to determine whether an ocean outfall might be required as an alternative at some future date.

The DEIR provides a detailed phasing plan that extends from 2016 to 2040. The interim timeframe from the present through 2015 includes establishing an MOU between the Town and the District. The Final EIR should provide more detail with respect to the MOU in outlining responsibilities of each party and the means by which they will coordinate their efforts in refining the recommended plan. Other actions proposed during this period are to continue with the shellfish propagation program, continue with ownership discussions regarding JBCC and the use of private wastewater treatment facilities, continued discussion for regional MOUs with the towns of Barnstable, Falmouth and Sandwich, implementation of fertilizer management and/or bylaw and continued use of stormwater BMPs.

C2. Recent developments have made the creation of the Mashpee Water & Sewer District unlikely and discussions between the Town and Mashpee Water District regarding an MOU (except regarding metering and billing) have been halted by the Board of Selectmen, who have also reversed their position and voted to recommend against creation of the District. In addition, the District will only come into existence upon a favorable ballot vote at the May 16, 2015 Town election; however, the Mashpee Selectmen are now recommending a "no" vote. Results of that meeting will be known before implementation of this plan.

Monitoring will be an important part of the recommended plan so that progress and effectiveness of its various elements can be properly documented. The DEIR acknowledges that wastewater treatment facility performance will be monitored through MassDEP's Groundwater Discharge Permit Program. Performance of the shellfish propagation program is proposed to be evaluated through commercial harvest data reported to the Division of Marine Fisheries (DMF) and recreational harvest data monitored by Mashpee. Shellfish will be analyzed for nitrogen content and quantified. While water quality monitoring data will follow the same protocols through the ongoing Mashpee Water Quality Monitoring Program, Mashpee and MassDEP need to discuss the details of the shellfish aquaculture program to insure that all monitoring and data collection is adequate and appropriate for use in determining nitrogen removal credits assigned to shellfish aquaculture.

C3. It is understood that the monitoring program (of the stated components: shellfish, wastewater treatment, adaptive management programs, etc.) will be reviewed with several agencies, including MassDEP, in relation to the various goals of each agency. This monitoring program will also be developed such that it will work with the proposed modeling programs anticipated to be used in the compliance process, however these too may change with technology, time, and adaptive management approaches that may be implemented in the future.

The approach taken in the DEIR appears to be consistent with the spirit and intent of the Cape Cod Commission's ongoing 208 planning process. The plan addresses a nitrogen mitigation and management plan with respect to watersheds and sets the groundwork for a regional approach among four municipalities. It also embraces the use of non- traditional approaches while at the same time recognizing the need for core areas of traditional infrastructure. The DEIR clearly lays out an adaptive timeline with decision points allowing the plan to pivot to various options as needed. Through the 208 process, the Cape Cod Commission has developed watershed tools to help assess proposed nitrogen load reductions, assign and select priorities, and take advantage of regional efforts. MassDEP recommends that Mashpee coordinate closely with the Commission as the FEIR is developed.

C4. The Town/Sewer Commission will continue to coordinate with the CCC in the completion of this FEIR and subsequent phases of work.

<u>Specific Comments</u>

Table 1-1 does not reference removal requirements for the Child's River subwatershed. However, Phase 5 does reference nitrogen management in the Child's River portion of Subarea H. The Final EIR should clarify or reconcile the level of removal anticipated for this subwatershed.

C5. Childs River Watershed is not part of the project planning area; however, the small portion of Mashpee that falls within the watershed is part of the planning area. This portion of Mashpee was identified for sewering based on its location relative to other areas requiring service. It is unclear under the most recent modeling by MEP whether they accounted for the nitrogen removal in this area for Childs River when considering the larger Waquoit Bay watershed. We do not plan to address this entire watershed as part of this project. A note will be added to Table 1-1 clarifying the project planning area watersheds listed.

Section 4.2 discusses various options for source removal. As part of the discussion an existing town policy for eco-toilets is mentioned. The Final EIR should provide a brief synopsis of the policy or, alternatively, provide the policy as an appendix.

C6. A copy of the Town's Board of Health Regulation regarding Eco-toilets (composting) has been included in Appendix 4-2.

Section 4.5.2.2 references construction of wastewater treatment facilities initially designed to treat to 6 to 10 mg/L of total nitrogen (TN) with the capability of adding denitrification filters to achieve a level of 3 mg/L. It is unclear if the TMDL compliance is achievable at the 6 to 10 mg/L TN level or if it is necessary to treat to 3 mg/L. Perhaps the different levels of treatment relate to the effectiveness of the shellfish propagation program. The Final EIR should clarify this point.

C7. This is clarified in Chapter 6 Section 6.4. The performance of the facility will depend on the shellfish program and its effectiveness. The first step is to construct or improve facilities to a higher level of treatment. Ultimately, if the shellfish aquaculture program is not as successful as estimated in the CWMP, these facilities will need to achieve 3 mg/L total nitrogen removal and therefore improvements made to these facilities will need to be done so with this taken into consideration.

Section 4.5.2.6 references BMPs for stormwater. The Final EIR should clarify if Mashpee intends to require BMPs for new development or redevelopment only or if it will embark on a program of retrofits for existing stormwater structures.

C8. The existing bylaws were included in the DEIR in Appendix 4-2 and apply to all new residential and non-residential developments. The Town through its own DPW efforts is making improvements to stormwater structures, but at this time does not require existing private residential property owners to implement BMPs, although the Town would encourage BMPs be employed.

Section 5.4 and Table 5-2 reference wastewater treatment for Briarwood/Otis trailer Village and Tri-Town Circle which are in areas ostensibly not requiring nitrogen removal. MassDEP understand that inclusion of these areas is in anticipation of future build-out loads. The Final EIR should clarify this point.

C9. This is clarified in Chapter 4. However all of the watersheds within the planning area contribute nitrogen load to one of the embayments of interest and although the MEP report identified "one" scenario for nitrogen removal, removal in other portions of the watershed is not a negative and shouldn't be flagged as "not-requiring" nitrogen removal—it is a function of cost-effectiveness, coordination, and addressing other needs as well. It should also be noted that reduction of phosphorus impacts on freshwater bodies, such as Ashumet and Johns Ponds, is of importance to the Town.

Table 5-17 suggests that shellfish aquaculture may account for 100% or the required nitrogen removal in some subwatersheds. MassDEP acknowledges that these are projections and will be evaluated for verification as part of adaptive management; however, MassDEP cautions against over optimistic expectations for effectiveness.

C10. That is understood and is why there is such a "robust" traditional fallback plan to address nitrogen if shellfish do not achieve the nitrogen removal levels estimated.

Section 5.9 references the extension of the Wampanoag Village wastewater treatment facility to pick up an additional 7,000 gpd from adjacent areas. It is not clear if this 7,000 gpd is in addition to the offset required under the existing GWDP. The Final EIR should clarify this point.

C11. The expansion is required to offset 237 lbs N/yr produced by the housing development. In addition, the constructed treatment plant has significant capacity in excess of that needed for Wampanoag Village and the 237 lbs N/yr GWDP requirement, regarding which the Town and Tribe have begun discussions about extending the collection system served by the facility to include Town Hall and the surrounding area.

Section 6.2.1 discusses shellfish aquaculture and references Appendix 5-1. The figures presented in the Appendix are presented in kg/d. In looking at total loads incorporating benthic flux, it should be recognized that benthic flux is not exerted throughout the entire year. It is not clear if the values are annualized. This should be clarified in the Final EIR.

C12. Table 1 in Appendix 5-1 and the discussion in the Draft under section 6.2.1 focus on the present septic load in kg N/day and the threshold septic load in kg N/day, and therefore the reduction does not consider benthic flux in the evaluation. Based on discussions with MassDEP, it is understood that the benthic flux exerted is typically over a 60 to 90 day period and septic loads in kg N/day are representative of an annualized load (i.e. could be multiplied by 365 days whereas benthic flux would not be). Values reported in Table 1 are those from MEP Table ES-2 with the note "(2) Composed of combined natural background, fertilizer, runoff and septic system loadings." Benthic flux is discussed because it can be a significant percentage of the total N load in some cases, and shellfish can remove nitrogen from that source, but the calculations are not based on removal of benthic nitrogen.

Section 6.2.2 discusses the use of JBCC relative to this DEIR. As discussions with JBCC proceed, considerations for all potential future needs for Barnstable, Bourne, Falmouth, and Sandwich should be considered.

C13. The Town of Mashpee is not in a position to "project" what other communities may or may not want or need for treatment or recharge at JBCC. Our plan is based on addressing the needs of the watersheds related to Mashpee, which does consider adjacent communities. In consideration of Barnstable, their connection to JBCC would need to be through either Mashpee or Sandwich in order to use the facility; therefore that is a larger unknown or possibly an unlikely consideration. If other communities are planning to use that facility as well (as stated in previous JBCC/MassDevelopment reports) then the larger regional effort will be necessary to distribute capacity appropriately. At this time, the Town is simply stating their needs, with potential fallback provisions if JBCC is not available.

Section 6.2.3 discusses wastewater treatment alternatives including effluent recharge. Proposals for the use of drip irrigation at the New Seabury and Willowbend golf courses are good ideas, but the specifics of design, location loading rates, etc. will have to be evaluated during the permitting process.

C14. This would be done as part of the permitting process as you state and will be called out in the revised Draft Section 61 findings.

Section 6.2.4 discusses improvements to existing wastewater treatment facilities. In addition to securing agreements with the facilities not under Mashpee's control, a complete evaluation of capacity for expansion will have to be conducted.

C15. It is expected that this would be done prior to each implementation phase as it related to each facility. A level of evaluation was performed as part of the Needs Assessment Report; however, due to the number of years that have passed a review needs to be done again closer to the implementation phase.

Section 6.2.7 discusses management of onsite I/A systems. MassDEP agrees that a management entity is required and suggests that the entity could be developed as a municipal function or within the water and sewer district. It may not necessarily require a separate management district.

C16. The Town has not established what type of structure if foresees for the limited number of I/A systems in town.

Section 6.3.1 discusses stormwater management. It appears that the DEIR is not seeking credit for nitrogen removal from stormwater BMPs.

C17. That is correct, it is assumed that through future modeling efforts, any benefits from fertilizer reductions and stormwater improvements will show up in the water quality of the estuaries and therefore the extent of traditional wastewater infrastructure and shellfish can be adjusted through the adaptive management program without specifically having to claim credit for other nitrogen reductions.

Section 6.3.3 discusses future demonstration projects. MassDEP encourages the town to keep its options open as various non-traditional approaches are piloted and based on results, these could be incorporated into the recommended plan as part of the adaptive management process.

C18. That is our approach in using adaptive management.

Section 7.2.2 makes reference to the hydrogeologic investigations at Site 4. Further evaluation of these findings will be part of the groundwater discharge permitting process.

C19. It is understood that additional evaluations of any of the sites may be required as part of the permitting process.

Construction Stormwater Permit

The project construction activities may disturb one or more acres of land and therefore, may require a NPDES Stormwater Permit for Construction Activities. The proponent can access information regarding the NPDES Stormwater requirements and an application for the Construction General Permit at the EPA website: http://cfpub.epa.gov/npdes/stormwater/cgp.cfm

C20. This was identified in DEIR Chapter 8 – Draft Section 61 Findings.

Bureau of Waste Site Cleanup

The Project Proponent is advised that if oil and/or hazardous material are identified during the implementation of this project, notification pursuant to the Massachusetts Contingency Plan (310 CMR 40.0000) must be made to MassDEP, if necessary. A Licensed Site Professional (LSP) should be retained to determine if notification is required and, if need be, to render appropriate opinions. The LSP may evaluate whether risk reduction measures are necessary or prudent if contamination is present. The BWSC may be contacted for guidance if questions arise regarding cleanup.

C21. This was discussed in Chapter 8 of the DEIR Section 8.3.2 regarding LSPs and review of sites within the Project Planning Area (PPA) as defined in the previous MEPA submittals.

Proposed s.61 Findings

The “Certificate of the Secretary of Energy and Environmental Affairs on the Draft Environmental Impact Report” may indicate that this project requires further MEPA review and the preparation of a Final Environmental Impact Report. Pursuant to MEPA Regulations 301 CMR 11.12(5)(d), the Proponent will prepare Proposed Section 61 Findings to be included in the EIR in a separate chapter updating and summarizing proposed mitigation measures. In accordance with 301 CMR 11.07(6)(k), this chapter should also include separate updated draft Section 61 Findings for each State agency that will issue permits for the project. The draft Section 61 Findings should contain clear commitments to implement mitigation measures, estimate the individual costs of each proposed measure, identify the parties responsible for implementation, and contain a schedule for implementation.

C22. Chapter 8 of the DEIR included this information with the exception of a cost breakout for mitigation measures as it is impossible to determine the cost or extent of those measures until a design is prepared and the impacts are fully identified. An expanded section will be prepared for the recommended Phase 1 work, however we do not believe it is appropriate to try to be more specific on permitting that is many years out. We do believe that the chapter prepared as part of the DEIR covered this information at a similar level of detail as the Easton CWMP /EIR (as referenced in previous comments/statements as part of the MEPA review) and similar EIRs filed by GHD for other Cape Cod approved projects, although organized differently.

D. CAPE COD COMMISSION – STAFF REPORT DATED 9-5-14

LAND USE

Goal LU2 is to use capital facilities and infrastructure efficiently and in a manner that is consistent with Cape Cod’s environment, character, and economic strengths, and that reinforces traditional village- centered development patterns. MPS LU2.1 states that proposed or expanded infrastructure shall support compact development patterns. It is recommended that the FEIR include a more detailed discussion of how proposed wastewater infrastructure will support compact development patterns in the Town consistent with RPP Land Use goals, local planning goals and current Mashpee zoning which includes but is not limited to mandatory cluster, transfer of development rights (TDR), and two acre zoning.

D1. Mashpee is essentially built-out as regards its development pattern, with the only significant property remaining to be developed being the Mashpee Commons project, which is/will be a compact New Urbanist development supported by a private sewer system which may become part of the municipal system. All other remaining development is either infill lots in existing subdivisions or remaining portions of compact developments (New Seabury, Southport, Quashnet Valley) which were permitted in the 1960s and 1970s and are “grandfathered” from current or future zoning requirements. Remaining development at New Seabury and Southport is being connected to their private wastewater systems, which may become part of the municipal system. Otherwise, the proposed early-phase wastewater facilities have been targeted at high-density existing developed areas.

Land Use Control Mechanisms

As these strategies are a key component of reducing future growth potential, the FEIR should either include those not currently in existence (i.e. Growth Neutral) or elaborate on how they are already included in the proposed phasing plan for implementation and provide additional information on each of the proposed strategies, including a description of near-term solutions for seasonal areas. It would also be helpful to provide a summary of past and ongoing land management activities (e.g. past land acquisitions protective of the Mashpee River, adoption of mandatory cluster and TDR bylaws, etc.) as well as a characterization of the how close the town is to reaching buildout.

D2. The Town intends to propose a Growth Neutral bylaw similar to that adopted by the Town of Falmouth.

Regarding past land acquisitions protective of the Mashpee River it should be noted that, building on the extensive ownership of lands along the River by TTOR since 1949, the Town and Mass DFW have, beginning in the mid-1980s, acquired every undeveloped parcel of land along the River at a cost of over $8 million. Mashpee has protected over 1,826 acres of land under the control of the Conservation Commission and an additional 405 acres under the Land Bank Act, which are controlled by the Board of Selectmen, along with more than 159 acres of other Town-owned land with open space restrictions. In addition, 266 acres are owned by the US Fish & Wildlife Service, 265 acres are owned or restricted from development by the US military in clear zones related to the aviation activities at Joint Base Cape Cod, 1,170 acres are owned by Mass DFW or DCR, 1,331 acres is private condo or cluster subdivision protected open space, 177 acres are protected well sites owned by the Mashpee Water District, 474 acres is owned by land conservation trusts, 64 acres of Falmouth Rod & Gun Club land are subject to a conservation restriction, and 482 acres are subject to Chapter 61 current use taxation restrictions, for a total of 6,619 protected acres, of the total town land area of 14,894 acres (44.4%). Another 1,160 acres owned by the US government lies within Joint Base Cape Cod and approximately 1,000 acres lies within the layouts of public and private roadways.

The Town's TDR zoning bylaw (Open Space Incentive Development) was adopted in 1987, requiring 50% open space in specific mapped areas and targeting the resulting development to other specific areas; as well as providing density bonuses as an incentive for transfers, including a bonus for sewering. Mandatory cluster subdivision, with a minimum of 50% open space and incentives for a larger prercentage, was adopted in 2006 (replacing cluster zoning provisions that dated back to 1963 and 1971 which were used in the large majority of non-condo developments since then).

The year-round population in 2014 was 14,842; the summer peak day population was 33,847; 6,384 homes were occupied year-round; and 3,558 were only occupied during the summer. Projected build-out population is 22,704 in 9,790 year-round occupied homes, with summer build-out population of 35,928 and 3,046 summer-only homes. Total private housing units are projected to increase from 10,313 in July 2014 to 12,836 at build-out, or 24.5%.

Water Resources

The Mashpee CWMP includes innovative aspects that the Commission finds consistent with the draft 208 Plan Update and could be found as consistent with the Regional Policy Plan. However, additional work is needed to better characterize the incremental nitrogen reduction of the Phased plan and its prioritization. The Commission can provide technical assistance for these characterizations and will devote staff and new tools, including the WatershedMVP, to assist the town upon request.

D3. Additional clarification is provided in Chapter 9, and Tables 9-2 and 9-3. The Mashpee Sewer Commission will coordinate with the CCC as part of the Adaptive Management Plan to determine what additional characterization may be requested.

The DEIR/CWMP retains and modifies Option 1A, which continues to propose Site 7 and additional areas of New Seabury and no longer proposes use of the Rock Landing well site for wastewater disposal, as the default traditional plan. Because this option rests on the results of the 2012 MEP results, it is assumed that the previous discharge distribution conceptually conforms to the new discharge configuration of the 2014 Modified Option 1A below, but the FEIR should clarify.

D4. The recharge configuration does conform to the results developed as part of Option 1A and is further clarified in Chapter 6, Section 6.2.3 of the FEIR.

However, in a plan that will be incrementally implemented, a cost premium for an independent facility may be desirable. The plan compares potential advantages and disadvantages of both approaches but does not conclude which may be the best option. An additional detail that should be considered is the total nitrogen contribution to the overall and sub-embayment load of the watershed. Staff used the Watershed/MVP tool to list the nitrogen flow through factor associated with each of these areas accounting for natural attenuation. In some cases like Tri-Town, only 20% of the nitrogen will get to the embayment. In the case of Pirates Cove 100% of the nitrogen load gets to the embayment. Use of the Commission's tools provides an ability to rank explicit nitrogen reduction benefits for making decisions on priorities and staff is available to work with the town to further explore these options.

D5. The DEIR did examine the impacts of attenuation in the nitrogen loading and cost per pound nitrogen removed for that very reason. Because these areas are in later phases of the project they can be reviewed with the CCCs MVP tool as those Phases are approached.

Several of the proposed discharge sites of the DEIR/CWMP will require further negotiations and agreements; contingencies within the plan for alternative sites may have an effect on nitrogen reduction targets and anticipated treatment levels. Given the uncertainty of New Seabury as a major discharge site further evaluation of expanding the potential for use of JBCC for regional discharge is warranted. The site characterizations appear to indicate the suitability of the discharge sites. Discharge sites located north of the John's Ponds area should be further evaluated for potential impacts on the downgradient fresh water ponds.

D6. The additional evaluations necessary for the sites north of Johns/Ashumet Ponds presuming that JBCC were not available would be determined during the Adaptive Management Program and as part of preliminary and final design and site evaluations.

Shellfish Aquaculture

Because this option rests on the results of the 2012 MEP results, it is assumed that the previous discharge distribution conceptually conforms to the new discharge configuration of the Recommended Plan as outlined below, but the FEIR should clarify.

D7. See D4.

Total Plan Cost and Phasing

The town submitted a matrix of parameters as a supplement to the EENF/ DEIR that compares and selects potential sewer areas for collection and accumulated wastewater treatment flows for existing and proposed WWTF. The matrix ranks the priority of the previously delineated Planning Areas. It is not clear how the matrix assigned nitrogen loads, either existing or attenuated, to the areas. Commission will review and comment more fully on this matrix pursuant to the FEIR.

D8. Attenuation was considered in the matrix analysis; however, the matrix does not evaluate nitrogen loading, it only prioritizes areas identified for nitrogen removal as determined in the analysis using the MEP rainbow spreadsheet land use model which includes attenuated loads. This is clarified in Chapter 6 and 9 of the FEIR. Nitrogen loads are determined by detailed identification of individual properties and modeling of the nitrogen from each property through the watersheds to each of the estuaries.

Adaptive Management

The DEIR/CWMP incorporates the elements of an Adaptive Management Plan for monitoring, and reviewing data and making adjustments and modifications of the plan. The Commission will provide additional comments and direction on the proposed adaptive management plan for the Phase 1 Plan in the DRI review. It is suggested that the Town appropriately budget for the necessary evaluations and adaptive management provisions within the aquaculture component of the Phase 1 project.

D9. The Town is considering how they will budget for the program and how much.

Coastal Resources/Natural Resources

The RPP generally prohibits impacts to wetlands and the 100ft buffer to wetland resources, though utility infrastructure installation may be allowed where there is no other feasible alternative. During CWMP implementation, project planners should avoid direct and indirect wetland and buffer impacts wherever possible. Indirect impacts could include actions that may be expected to alter the natural functions of the wetland. At the same time, alterations that include associated wetland restoration are supported in the RPP.

D10. This is discussed in Chapter 8 of the DEIR.

The RPP also generally prohibits activities that would impact rare species or their habitats. According to the DEIR, three of the plan's potential "greenfield" sites (Sites 4, 2, and 6) are located in mapped habitat of two state listed species, the Eastern Box Turtle and the Grasshopper Sparrow. The Natural Heritage and Endangered Species Program indicated in correspondence on the project in 2008 that efforts to minimize impacts to these habitats should be addressed during the design phase of the project. As the town moves forward with selecting sites for wastewater implementation they will need to coordinate with the NHESP for additional guidance on avoiding or mitigating impacts to rare species.

D11. Additional coordination at any of the proposed sites will be conducted as the Town/District moves forward with the implementation of the plan.

With the exception of the shellfish restoration aspects of the proposal, the Mashpee CWMP appears to propose limited impacts to coastal resources (section 8.3.2. To the greatest extent feasible, collection system components should be located within existing roadways or disturbed areas wherever feasible in coastal resource areas. In addition, the RPP permits new non water- dependent public infrastructure within land subject to coastal storm flowage where there is no feasible alternative, a public benefit is demonstrated, and provided that the infrastructure will not promote new growth and development in flood hazard areas. The staff recognizes the public benefit of nitrogen reduction activities and suggests that the FEIR address how new growth and development will be controlled in flood hazard areas.

D12. See D1 regarding build-out in Mashpee. The FEIR discusses this in Chapter 10.

Commission staff sought comments from the Cape Cod Cooperative Extension/WHOI SeaGrant staff with regard to the shellfish restoration components of the plan. CCCE staff commented that the proposed sites are feasible, but that it would be advisable to pre-identify actual areal coverage of bottom habitat suitable for planting shellfish in order to accurately assess available space for the proposed shellfish densities. Potential concerns raised by CCCE staff deal with the availability of appropriate shellfish seed to undertake the aquaculture project. Commission staff assumes that consideration for location/design of shellfish proposals will not conflict with vessel navigation. Figure 1.2: Provided by CCCE staff, the locations are feasible and identified as approved shellfish growing/harvest areas by the MA Division of Marine Fisheries. Exceptions include the upper reaches of Hamblin Pond, Mashpee River, and Shoestring Bay which are designated prohibited areas.

D13. Additional mapping showing the proposed locations is provided in Chapter 6, Figures 6-1 through 6-3.

Effluent Recharge Sites

The potential new effluent discharge sites 4 and 6 are all mapped for rare species habitat, as noted above, and are greenfield sites. However, they are not mapped for other sensitive resources, including wetlands, certified or potential vernal pools, or BioMap2 Core Habitat. Additionally, selection of these parcels for development over others within the town will serve to minimize additional fragmentation of habitat in Mashpee, as these parcels are already disconnected from large contiguous open space tracts, and/or are adjacent to existing development. Commission staff recommend that fragmentation of habitat and open space at all of the sites considered should be minimized by siting the disposal beds as close to existing development as is feasible, given other land use values, concerns and interests.

D14. Figures 7-11 and 7-12 of the DRP/DEIR show the mapping for vernal pools, DEP wetlands, and other sensitive habitats, and these same figures will be carried forward for the maps in the FRP/FEIR. Fragmentation of habitat will need to be considered as the preliminary site plans are

developed, as part of the initial planning process, and in coordination with NHESP and CCC as discussed in Section 7.3.2.5.

<u>Collection System</u>

To the extent possible, pump stations should be located near roads and away from wetlands and wetland buffer areas, to minimize the footprint of additional disturbance. Also, as a general matter, the collection system network should be installed within existing road networks to the extent feasible, and avoid “overland” installations that will result in large, new additional areas of disturbance and habitat fragmentation where economically feasible.

D15. This will be considered during design.

<u>TRANSPORTATION RESOURCES</u>

Regardless of any new facility’s(s) trip generation, MPS TR1.8 requires acceptable sight distances at all access and/or egress locations for DRIs. With a special concern to a site with a high percentage of truck traffic, it is recommended that the Town confirm to the Commission that any new treatment facility(s) be sited such that any new site driveway provides sight distances that meet the stricter of the Massachusetts Department of Transportation and American Association of State Highway Transportation Officials guidelines for safe stopping sight distances.

D16. Additional statements regarding sight distances have been added to Section 7.3.2.6 and Section 8.3.1 of the FEIR (Mitigation Measures and Draft 61 Findings)

<u>HISTORIC PRESERVATION/COMMUNITY CHARACTER</u>

The Comprehensive Watershed Nitrogen Management Plan for Mashpee includes a variety of methods to address nitrogen. Several of the proposed methods are unlikely to affect historic or archaeological resources due to their limited ground disturbance or their location in previously disturbed areas. None of the proposed methods appear to impact structures within the Mashpee Historic District. In order to be consistent with RPP Standards HPCC1.1 (Historic Resources) and HPCC1.2 (Cultural Landscapes), the town will need to work with Massachusetts Historical Commission (MHC) and local historic boards to insure that final design plans for new infrastructure will avoid impacts to these resources.

D17. This would be done as part of the next steps of plan implementation during detailed site planning and design.

Potential new facilities proposed at Site 4 and Site 6 appear to be located outside of highly sensitive archaeological resource areas, but additional archaeological reconnaissance survey work will be necessary if construction (treatment facilities, pumping stations, and collection systems) is proposed beyond already surveyed areas. The same is true of other undisturbed sites being considered for construction of new treatment facilities. Installation of sewer lines and ground-disturbing infrastructure should occur in previously disturbed areas as much as possible in order to avoid possible impacts to historic and archaeological features. As the final design of other project elements is completed, MHC review is needed to assess areas where ground disturbance is proposed and to determine whether additional archaeological survey work is needed, consistent with RPP Standard HPCC1.3 (archaeological sites).

D18. As stated previously, this is done as part of the design process.

Permittee Responsibilities

The Town of Mashpee filed this CWMP/DEIR with the MEPA Unit. The Sewer Commission may be absorbed into a new entity if a town referendum passes next spring to create a new Mashpee Water and Sewer Commission. The town should explain who will be the responsible party for future permitting, implementation, operation and management, and provide details about how Sewer Commission activities might be succeeded via the new entity. In addition, it is staff's understanding that the existing and potential new commission will control traditional collection, treatment and disposal facilities. The FEIR should address how the town will be responsible for implementing traditional and non-traditional proposals contained in the CWMP/DEIR whether or not the new entity is approved in the Spring of 2015.

D19. Text has been provided in Chapter 9 Section 9.1 discussing this process.

E. DIVISION OF MARINE FISHERIES – LETTER DATED 9-5-14

MarineFisheries offers the following comments for your consideration:

- MarineFisheries commends the proponent for designing a shellfish remediation plan that is consistent with the MarineFisheries Shellfish Planting Guidelines [6]. The proposed shellfish planting regions are all in areas currently listed as Approved for shellfish harvest, thus avoiding potential health risks associated with illegal harvest.

MarineFisheries is supportive of shellfish restoration and the inclusion of shellfish aquaculture and propagation in nitrogen remediation efforts. The town will need to modify their existing municipal propagation permit with MarineFisheries to conduct these activities.

E1. The Town will submit permit modifications to DMF.

- While we are supportive of shellfish propagation for the purposes of augmenting harvest opportunities and maintaining and increasing local populations, we caution against relying on shellfish as a primary nutrient remediation technique. Past research has demonstrated that nitrogen removal varies among estuaries and years due to differences in environmental conditions (e.g., food availability, temperature, nitrogen loading) [7,8]. Nitrogen removal from shellfish propagation can be negatively impacted by factors leading to reduced growth rates or increased mortality (e.g., hypoxia events, reduced food availability). Given the ambitious scale of the shellfish remediation component, MarineFisheries requests further information on this component and also provides comments below on the approach outlined in the DEIR:

E2. Please see Chapter 6 for updated/additional information regarding the program.

- The general approach of quantifying nitrogen removal through shellfish harvest consists of multiplying total shellfish harvest by an average estimate of individual shellfish nitrogen content. The former will be based on both commercial and recreational harvest data. While collection of commercial data involves a relatively straightforward use of DMF catch reports, non-commercial harvest will likely be more challenging to quantify. Particularly given the ambitious scope of the shellfish component, proposed recreational harvest data collection methods should be explained in greater detail.

E3. Recreational harvest data will be collected from surveillance cameras and patrols by the Shellfish Constable and assistants.

- Since the seed to be used in this effort will be coming from outside sources, the initial weight of the seed shellfish should be subtracted from the harvest weight used to calculate nitrogen removal. While individual initial seed weight will be quite small, this overall weight for all shellfish seed could be relevant at the proposed scope of planting and removal.

E4. The weight of oyster seed from the hatchery at about a millimeter in size is insignificant. The weight of 1-inch quahog seed from the hatchery is about 6 grams each which is 10% of the 60 g average harvest size of littleneck quahogs. In areas seeded with 1-inch quahogs, the weight of littleneck quahogs harvested the following year needed to remove the required amount of nitrogen would be increased by 10% in Table 2 of Appendix 5-1 of the DRP/DEIR (Shellfish Aquaculture/Fisheries for Water Quality Restoration 06-24-14). Seed planted would have to be increased by 10% for the estimated survival rate in the plan. If the quahog seed is grown in an aquaculture system from small (~1 mm) seed in the water body that it is to be planted in, then the initial weight is insignificant. In addition, if the population becomes self-sustaining through spawning, then the initial weight is not relevant.

- Shellfish aquaculture and propagation is proposed as a tool to address 50% (Mashpee River, Shoestring Bay) to 100% (Popponesset Bay, Ockway Bay, Great River, Jehu Pond, Hamblin Pond) of the of the nitrogen load exceeding the threshold set through the Massachusetts Estuaries Project (MEP). A recent study on Cape Cod concluded that the likely range of land-derived nitrogen that could be removed by shellfish bioremediation was 1-15% [7]. Proposed nitrogen removal by shellfish should be reported in terms of total estimated nitrogen load to these systems. The approximate numbers of shellfish required to reach the MEP thresholds are included in the report. The estimated total area required to house these numbers of shellfish, associated shellfish densities, and the planting area locations should also be included in the report. This information is needed to better understand the likelihood of attaining nitrogen removal goals through the proposed intensive shellfish bioremediation approach.

E5. Based on the draft MEP Report for the Waquoit Bay system, the amount of nitrogen to be removed by shellfish to achieve the TMDL-N and restore water quality in the Great River, Little River/Hamblin Pond, and Jehu Pond area (DMF area SC16) is about 15% of the total land-derived present watershed nitrogen load, see MEP Report Table ES-1 (Howes, et.al 2012, page ES-12). In the Popponesset Bay system, the removal by shellfish is approximately 25% of the total land-derived present watershed nitrogen load, see MEP Report Table ES-1 (Howes, et.al 2004, page ES-9). The numbers are included in the FEIR Chapter 6, Section 6.2.1.1 "Nitrogen Removal". In a review of published studies, Carmichael, et al, 2012, found that shellfish have been reported to remove up to 25% of the total daily nitrogen load. Shellfish densities and planting area location maps (Figures 6-1 through 6-3) are included in the text.

- The “nitrogen removal” section of the Shellfish Aquaculture/Fisheries for Water Quality Restoration component of the DEIR refers to higher historic shellfish carrying capacities. If habitat conditions have declined, these historic densities may no longer be supported in the current environments of these systems.

  Consequently, intensive planting may have high rates of mortality if seed shellfish are being introduced to areas that no longer can sustain high shellfish densities.

E6. Oyster aquaculture uses gear and/or habitat enhancement (culch) to make up for historic habitat loss. For quahogs, there is enough good habitat remaining in the areas proposed. Habitat maps have been updated by the Mashpee GIS Department with GPS data collected by the Shellfish Constable and will be included in the FEIR. For example, more than 102 acres of good quahog habitat have been mapped in the SC16 area. The 20 million littleneck quahogs needed to remove the required amount of nitrogen there would only be at an average density of about 3 to 7 per square foot, which is well below historical limits and high densities at which quahogs can grow.

- Both oysters and quahogs are proposed for use in the nitrogen remediation plan. For more eutrophic water bodies where food supply to filter feeders tends to be higher, shellfish growth tends to increase. However, mortality rates can also increase under these conditions, likely due to hypoxia. Oysters, which have high feeding and assimilation rates as well as high survivorship in hypoxic conditions, would be better suited than quahogs for nitrogen remediation in such areas [7,8].

E7. As described in Appendix 5-1 of the DPR/DEIR, risks for oyster propagation are minimized in lower salinity areas where diseases and most predators are eliminated. In areas with higher salinities such as most of the Waquoit Bay system, oyster losses due to predation and disease are problems. Quahogs are the best option for higher salinity areas because disease is not a problem for them in the warm waters in Mashpee and predation is not a problem for quahogs larger than an inch in size. Both species do well in eutrophic waters and can survive short-term hypoxic conditions.

F. DIVISION OF FISHERIES & WILDLIFE – LETTER DATED 9-5-14

Portions of the Town of Mashpee are mapped as Priority and Estimated Habitat for twenty-seven (27) state-listed rare species, in accordance with the 13th Edition of the MA Natural Heritage Atlas, including but not limited to the Eastern Box Turtle (Terrapene carolina, state-listed as “Special Concern”) and Grasshopper Sparrow (Ammodramus savannarum, state-listed as “Threatened”) provided in Section 7.2.5 of the DIR. All projects proposed within Priority and Estimated Habitat, which are not otherwise exempt pursuant to 321 CMR 10.14, will require review through a direct filing with the Division for compliance with the Massachusetts Endangered species Act (MGL c. 131A) and its implementing regulations (MESA; 321 CMR 10.18) and/or the rare species provisions of the Wetlands Protection Act Regulations (WPA; 310 CMR 10.37 & 10.59).

The Division would encourage the Town to incorporate design and implementation alternatives that avoid and minimize impacts to state-listed species and their habitats, and to initiate consultations with the Division during the design phase. Division staff are available to evaluate alternatives and work proactively with the Town to address any concerns related to state-listed species prior to submission of a formal MESA filing.

F1. As site plans are more fully developed, they will be coordinated through NHESP in order to evaluate alternatives and work to protect these habitats.

G. ASSOCIATION TO PRESERVE CAPE COD – LETTER DATED 9-5-14

Targeted Watersheds- One of the core principles of the 208 Plan is a targeted watershed approach. While the Popponesset Bay portion of this plan is arguably a targeted approach (Barnstable remains missing), the portion of the plan addressing Waquoit Bay is anything but a targeted watershed approach. Falmouth has the largest contribution of nitrogen to Waquoit Bay and is essentially absent from the plan. 1 This is simply not a watershed based plan, but is instead the usual plan based upon municipal boundaries and singular municipal action. Mashpee is not completely at fault here as Falmouth has been reluctant to address Waquoit Bay and has focused more in the central portion of that town. Additionally a Total Daily Maximum Load (TMDL) for Waquoit Bay came late in the Massachusetts Estuaries Program watershed evaluation process.

G1. We understand your concern, however when the project was developed it was to address the areas identified in the PPA. Although the Waquoit Bay portions of Mashpee's plan do not consider the entire embayment, they are steps in the right direction to address this need. Waquoit Bay was evaluated on a "fair share" basis to identify how much nitrogen would need to be managed by Falmouth and Mashpee. This plan reflects the commitment that Mashpee needs to put forth to manage their nitrogen contribution to Waquoit Bay. This approach also does not eliminate the ability to adaptively address this entire area in the future.

Waquoit Bay is the one Area of Critical Environmental Concern (ACEC) covered by this plan and deserves a fully targeted plan involving Sandwich, Falmouth and Mashpee. The 208 plan and planning process identified both the need and the cost savings for towns to cooperate on a watershed basis as opposed to each town sticking to its municipal boundaries. The Secretary should require a targeted watershed approach for Waquoit Bay-making the three towns work toward a solution for this severely impaired ACEC.

G2. See response G1. The issue of requiring each town to deal with Waquoit Bay is now an issue to be addressed by the Commonwealth of Massachusetts.

Land use initiatives -The Secretary's Certificate dated November 1, 2013 stated that "[t]he DEIR include a detailed discussion of potential land use control mechanisms that can be employed to limit secondary growth impacts associated with implementation of the CWMP."

Mashpee has done a good job in dealing with new development. Currently, Mashpee has several growth management bylaws in place that do go beyond many towns in controlling the rate of growth and protecting natural resource areas. The challenge will be to bring redevelopment and expansion of existing structures and uses into a sound and equitable regulatory environment.

Mashpee's zoning should reflect the goal of directing compact development to targeted areas where infrastructure can support the growth, but at the same time, offset that growth with a balanced, growth-neutral reduction in development potential outside of the targeted growth areas.

The town adopted a permit phasing requirement that allows no more that 20 percent of the lots in a new subdivision to receive building permits each year. The town-wide limit is 90 building lot permits per year. Mashpee has an optional Open Space Incentive Development bylaw for subdivisions on 20 acres or more of land, and a mandatory cluster subdivision bylaw for subdivisions on five or more acres. Both bylaws require a special permit, as opposed to being by right. The minimum open space set-aside for both is 50 percent. A Transfer of Development Rights option is available with the Open Space Incentive Development bylaw.

While these bylaws are more progressive than cluster bylaws in many other Cape towns, there are innovative natural resource protection bylaws being used on the Cape and elsewhere in Massachusetts that are very effective in managing growth and protecting resources. APCC adds the following initiatives to the discussion of Mashpee's growth management strategy:

- Natural Resource Protection Zoning (NRPZ)
- Open Space Residential Design (OSRD)
- Managing Expansion of New and Existing Uses
- Floor Area Ratio
- "Sliding Scale" FAR Hybrid (Wellfleet Example)
- Maximum Site Coverage in the National Seashore Park (Wellfleet)
- Lot Area Maximum
- Site Coverage

G3. While the Town appreciates these suggestions, most are merely other towns' versions of bylaws that have been in place for many years and were pioneered on the Cape by Mashpee. While the Town does have maximum lot coverage requirements, the suggested Floor Area Ratio examples will be studied to determine their efficacy for Mashpee. It must be noted that the vast majority of existing and potential new development in Mashpee is protected from such dimensional zoning changes by the "grandfathering" provisions of G.L. Chapter 40A, Section 6 regarding separately owned lots and protection of rights vested under existing Special Permits; and that a large portion of new potential development has been permitted, or is proposed to be permitted, under G.L Chapter 40B.

Sewer Hookup Cap

Some Massachusetts towns have adopted or are considering regulations that place a ceiling on the number of allowable sewer hookups within a sewer district. If desired by the town, additional building permits may be allowed only through a special permit. These caps allow for targeted zones of contribution.

G4. This is not an issue in Mashpee, as almost all proposed sewers are to serve existing development which is contributing nitrogen to our estuaries and which must be hooked up to the sewer system to achieve our nitrogen TMDLs.

Growth Management Bylaw (Provincetown Example)

The purpose of this bylaw is to maintain a sustainable rate of residential and commercial development in the town in order to ensure that adequate infrastructure continues to be available to meet current and future demand without overburdening the town's natural resources or infrastructure capacity. A limited number of annual permits are issued for any new or expanding uses that will increase Title 5 flow. Issuance of these pe1mits is based on a predetermined hierarchy of priority types of uses, with affordable housing being the highest priority. The types of uses that are higher in priority go to the top of the waiting list.

G5. As noted above by APCC itself, Mashpee has had a growth management bylaw in place since the 1980s.

Wetland Setback Requirements

Mashpee has a 100-foot setback requirement for development along the Mashpee and Quashnet rivers, while development near other wetlands and water bodies in town must observe a 50-foot setback requirement. The town should consider expanding the 100-foot setback requirement to all ponds and other wetlands. In addition, the board of health should consider expanding the current 100-foot setback requirement for septic leaching systems near pond s and other fresh water bodies to 300 feet.

G6. Although this could potentially reduce the number of future buildable lots, it would not impact existing properties (beyond redevelopment) and would be a policy issue that would need to be taken up by the Town. In addition, given the size of most waterfront lots in Mashpee—most of which were laid out as many as 90 years ago—the 300-foot proposal would be impossible to meet in the vast majority of cases.

Special Permits

The town should evaluate whether the Board of Appeals should be required to make a specific finding of more or less nutrient loading in all special permits decisions related to redevelopment or existing structures and uses in determining whether or not a project is "substantially more detrimental, "with the goal being net reductions.

G7. Although we question the legal basis for such a requirement under zoning, this proposal will be considered.

Mandatory Advanced Wastewater Treatment

Mashpee should consider a mandatory requirement for advanced wastewater treatment for all upgrades or replacement of existing systems, such as, all cluster or conventional subdivisions of four units or greater must be connected to an advanced wastewater treatment system if those subdivisions are in areas that do not have sewer service, or that are in designated water protection districts. The Harwich board of health has adopted this requirement in its regulations.

Fertilizer Management

In addition to examining new growth management bylaw and regulation options, Mashpee hopefully will adopt the Cape Cod Commission's fertilizer management model bylaw at its fall town meeting. The Secretary should send a strong message of the value of adopting this proposed bylaw and its potential for inexpensive water quality improvement.

G8. The Town has already adopted a nitrogen management bylaw at its October 20, 2014 Town Meeting and a copy of this document is included in Appendix 4-3.

Reliance on aquaculture - Mashpee has assembled one of the best teams imaginable to carry out its aggressive shellfish program. The cooperation and collaboration of the Mashpee Wampanoag Tribe is an added bonus and an addition to the likelihood of success. Mashpee Shellfish Constable Rick York is regarded as one the preeminent experts on shellfish management and has a track record of success of utilizing shellfish as a tool for water quality improvement. The plan has a heavy reliance upon this approach, which is subject to wide range of challenges from the environment including disease, predation, weather, ocean acidification and climate change. The town has embraced adaptive management and is prepared to move to a more conventional approach if shellfish efforts disappoint. However, how success or failure are to be quantified and determined is not established in the CWMP with the necessary degree of certainty.

G9. The shellfish potential contribution to the CWMP will evolve from monitoring of the estuaries prior to the implementation of later stages; however, the CWMP is based on a traditional infrastructure approach to achieve the TMDL supported by an adaptive approach to reduce this infrastructure through the implementation of shellfish use to help remove nitrogen from the impacted waterbodies and take advantage of the cost savings through reduction in traditional infrastructure.

That shellfish take up nitrogen and convert it into shell and tissue is not in question. However, the use of shellfish to take up and remove nitrogen from eutrophic coastal waters, on a scale that would provide noticeable improvement in water quality, is a new area of environmental management. It is critical that we advance this potentially important management tool with a clear understanding of the risks and benefits and a sound means of evaluating success and failure. APCC's main concerns relate to: 1) accurately estimating the concentration and amount of nitrogen removed by shellfish, 2) contingency planning to address limitations on nitrogen removal that may occur if shellfish are impacted by disease, predation, harmful algal blooms, climate change, ocean acidification, cessation or slowing of harvesting, 3) the reliability of this method of removing nitro gen from estuaries, and 4) monitoring to ensure performance.

G10. The CWMP will only include "the actual" contribution attained by shellfish implementation. These concerns are addressed in Chapters 6 and 9.

1) The 2012 study was performed over one growing season. Pilot tests should be conducted for at least two or more years in order to obtain enough data to yield robust estimates of the amount and concentration of N in shellfish. Two years is also preferable because older shellfish will generally be larger and contain more nitrogen than younger oysters.

G11. Mashpee will have five years or more of background data before significant capital infrastructure is installed in the CWMP. The results of the 2012 sampling confirm earlier data on the nitrogen content of oysters sampled previously from Mashpee. The shellfish sampled in 2012 were more than a year old and representative of shellfish that are harvested. The nitrogen content of quahogs and oysters will be analyzed annually for more data in the future.

2) The 2012 study was apparently not used to differentiate nitrogen uptake according to different size classes. Reitsma et al. (2014) and the Falmouth pilot study (Karplus, personal communication) showed that size class is an important factor in determining the percent of nitrogen in shellfish-generally the older the shellfish, the larger it is and the more nitrogen it

contains. Using one number for the percent of N could result in over- estimating or under-estimating the amount of nitrogen removed by shellfish, particularly when extrapolated to five million shellfish.

G12. Mashpee's inclusion of shellfish effectiveness is on a "results only" basis. The sizes of shellfish sampled in the 2012 study were representative of the sizes that are harvested.

3) Mashpee's assumption of 0.5 g of N removed per oyster assumes a 100-g oyster (0.5% N times 100 g oyster = 0.5 g N per oyster). The 2012 study tested oysters whose whole weights ranged from 37.26 g wet weight to 97.46 g wet weight, with the average being 59g. If harvested shellfish are smaller than 100 g, the town's assumptions may result in overestimating the amount of N removed. Again, characterization of N content based on size classes would help the town to more accurately estimate the amount of N that could potentially be removed. Reporting of N concentrations and amounts in terms of dry weight would facilitate comparison with published values.

G13. Mashpee's inclusion of shellfish effectiveness is on a "results only" basis. The nitrogen removal estimates from harvest data are based on weight, not size, for the reasons stated in the comment. The 2012 data includes dry weight but percentage of N in live weight is used for the calculations because the harvest data is live weight.

4) Variation in N concentration and amount in shellfish should be characterized in order to bracket the upper and lower bound s of N-removal. Variation could occur due to seasonality, size classes (as indicated above), estuary conditions, species, shellfish health, and other factors. This is important for judging whether shellfish aquaculture will meet regulatory standards for N removal.

G14. Mashpee's inclusion of shellfish effectiveness is on a "results only" basis. This plan is based on the nitrogen content of shellfish where and when they are harvested and at the sizes harvested as calculated from the relevant Mashpee data from the 2012 sampling. As noted above, more sampling is planned.

5) When N concentrations, amounts and estimates are being discussed, the narrative should be clear whether this refers to oysters, quahogs or a combination of both.

G15. This will be clear in the FEIR, but the results of the 2012 sampling are that the nitrogen content of Mashpee oysters and quahogs are both 0.5 % of live weight.

Recommendation 1:

Because there is much riding on using shellfish to remove nitrogen, Mashpee should conduct additional pilot testing for at least a second and probably a third year, to provide more accurate estimates of the amount of N to be removed . Additional testing should characterize the mean, median, variation (maximum, minimum, standard deviation) in nitrogen concentration and amount according to species, size class, estuary, seasonality, and growing configuration. The results should be used to re-estimate the amount of nitrogen that may be removed by oysters or shellfish.

G16. See response G9. More sampling and analysis is planned.

Recommendation 2:

Provide backup plan if shellfish cannot be harvested or populations are reduced (in addition to other contingencies).

G17. The traditional infrastructure outlined in the phasing plan is the backup plan to shellfish, in addition to any future adaptive management approaches shown to be effective in nitrogen removal. The plan is predicated on the fact that if shellfish aren't successful, or show promise but then are wiped out for some reason or another, then traditional infrastructure (or other adaptive management programs) will be put in place to reduce the sources of nitrogen.

Stormwater - The nexus of stormwater management to edible, sustainable shellfish does not seem to be captured/appreciated in the plan. APCC believes that a successful shellfish program is dependent upon sound stormwater management. Moreover, protecting water quality is critical to maintaining the integrity of Cape Cod's public water supplies, swimming beaches, and recreational resources. While water pollution is often associated with industrial activities and maritime accidents, stormwater runoff from developed areas is a major contributor to the problem. Excess fertilizers and insecticides and the harmful chemicals that accumulate on roofs, pavement and other impervious surfaces, are transported by stormwater to surface and ground waters. This runoff severely degrades water quality, harming the ecology of coastal waters and threatening public health. While federal and state water quality standards require communities to treat and manage stormwater, municipal sto1mwater management requires an investment in trained staff, infrastructure improvements, maintenance, and management systems. Finding the funding to manage stormwater runoff to meet water quality standards is often a challenge. Traditional sources of funding (state and federal grants) are typically not enough to address all of a community's stormwater management needs. In recent years, communities across the country have adopted stormwater utilities as a way to create adequate funding for comprehensive municipal stormwater management programs. These utilities have proven to be a successful way for cities and towns to fund stormwater programs that will b1ing communities into compliance with federal regulations for non-point source pollution under the Clean Water Act. APCC recommends that Mashpee evaluate the creation of a stormwater utility.

G18. Additional discussion regarding stormwater improvements to further protect shellfish resources is discussed in Chapter 8. The reliance on stormwater management for nitrogen removal can be a significant management cost for minimal benefit. The USEPA is addressing some of this in their updated MS4 program in Massachusetts. The creation of another utility beyond the Town's Department of Public Works is a more complex endeavor with minimal benefit to the community relative to nutrient removal.

Failure of on-site systems -There is compelling evidence that some on-site septic systems are failing and not being detected as failing. The Silent Spring Institute, which is studying the levels and impacts of pharmaceutical s in the groundwater on Cape Cod, has noted that a functioning Title 5 system does an excellent job of breaking down acetaminophen. The Provincetown Center for Coastal Studies is currently monitoring bays and estuaries surrounding Cape Cod for pharmaceuticals, and has detected acetaminophen in our bays, estuaries and sounds. The only potential source for detectable acetaminophen is from failing on-site systems. There are a number of explanations including the failure of Title 5 to eliminate the use of cesspools. APCC has assembled anecdotal information that the majority of existing cesspools have a direct hydraulic connection with groundwater. APCC believes that CWMPs should address both cesspools and monitoring of on-site systems (which often escape inspection under current regulations). The Secretary can take a lead in this endeavor by ordering an update of Title 5 regulations that phase out cesspools and require periodic inspection of on-site systems (not just at sale or an identifiable problem like frequent pumping).

G19. Due to the age of Mashpee's development, there are very few cesspools located within Town. The Town also has the largest number of I/A systems on Cape Cod. The DEIR discusses the benefits of increased management and monitoring of their existing systems; however, this comes at a cost and is a Town decision. The suggested update to Title 5 would provide a necessary underpinning to such Town efforts and would be welcomed.

Sea level rise and the efficacy of on-site systems in low lying areas - While the plan addresses climate change, it overlooks some of the critical dynamics ultimately impacting wastewater decision making. APCC is coordinating a multi-level, multi-year modeling project to determine the impact of sea level rise on groundwater elevation and flow. One of the major climate challenges facing Cape Cod is sea level rise. Cape Cod is one of the global "hot spots" for sea level rise, meaning Cape Cod will face well-above global average sea level rise. This could be as much as a seven-foot increase over the next century. Cape Cod has a sole source aquifer that is significantly affected by sea level. On the outer Cape our freshwater floats entirely on top of salt water. On the upper Cape, sea level will have the same impact as if the fresh water were completely afloat: groundwater elevation will rise as sea level rises. As sea level rises it will impact a wide range of ecosystems and infrastructure. On-site septic systems work because of the separation of leaching fields from groundwater. According to the Department of Environmental Protection, the number one cause of on-site septic system failure is groundwater infiltration. Rising sea level will mean rising groundwater elevations and more on-site septic systems will fail. Working with the U.S. Geological Survey, and the Cape Cod Commission, work is underway in this modeling effort. The model will predict where sea level rise will have the greatest impact on the ground water dynamic, which includes groundwater elevations, stream flow, pond size, and vernal pools, as well as human infrastructure (e.g. basements, septic systems, roads and underground utilities). Sea level rise will likely increase the rate of on-site septic systems and add to the cost of all in-ground infrastructure. This reality needs to be better integrated into the plan and priorities may have to be readjusted.

G20. The Town looks forward to the results of APCCs study and ongoing work by USGS, which will provide a guide for potential amendments to the CWMP. These could potentially include expansion of sewered areas to deal with areas likely to be impacted by septic system failure induced by sea-level/groundwater table rise as a driver of the Plan in addition to dealing with nutrient issues and potential impacts on proposed wastewater facilities at the first scheduled 5-year review.

Environmental Justice Issues -The plan should more formally address the affordability challenges facing an older demographic often living on fixed incomes and the low income community in Mashpee. These residents may not be able to carry the full cost of implementation. While the Commonwealth has made adjustments to the state revolving fund program which should benefit those least likely to afford the cost of improvements, the town must take a more creative approach. APCC recommends the town consider income from commercial shellfishing associated with the plan be used to offset some of the financial impacts on those least able to afford costs associated with wastewater improvements.

G21. Representatives of the town of Mashpee, from the conception of the need for a CWMP, have endeavored to develop the most cost-effective methodologies to address the affordability and implementation issues. As a "green" community having implemented progressive policies preserving open spaces, limiting development, harvesting solar power, educating on and regulating the limiting of fertilizer use, managing stormwater runoff, and expanding bivalve production, Mashpee has offset costs associated with wastewater management and will continue to do so.

At this time the Town only receives revenue from permit fees and is not currently in a position to charge shell fishermen (commercial or otherwise) a portion of their proceeds beyond implementing a new tax and therefore requiring special legislation to do so. Revenue from Shellfish Permit Fees is used for shellfish propagation. Fees are increased at times, but would not be a significant percentage of the cost to implement the plan.

In addition, the Sewer Commission believes that, as a matter of fairness based on the fact that all households within our watersheds contribute to our nutrient overload problem, capital costs should be funded through bonds supported by the general property tax and that betterment fees should not be used for that purpose. Doing so ensures that higher valued properties—often waterfront—will pay a higher share of such costs than lower-valued properties more likely to be occupied by lower-income residents. Other assistance programs for low income households required to make connections to proposed sewers will also be considered.

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September 12, 2014

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
DRAFT ENVIRONMENTAL IMPACT REPORT

PROJECT NAME	: Comprehensive Watershed Nitrogen Management Plan
PROJECT MUNICIPALITY	: Mashpee
PROJECT WATERSHED	: Cape Cod
EEA NUMBER	: 12615
PROJECT PROPONENT	: Town of Mashpee
DATE NOTICED IN MONITOR	: July 9, 2014

As Secretary of Environmental Affairs, I hereby determine that the Draft Environmental Impact Report (DEIR) – Draft Recommended Plan ***adequately and properly complies*** with the Massachusetts Environmental Policy Act (M.G.L. c. 30, ss. 61-62I) and with its implementing regulations (301 CMR 11.00). The Proponent may prepare and submit the Final EIR (FEIR) for review. The Scope included in this Certificate identifies additional analysis and information required in the FEIR.

Project Description

The Draft Comprehensive Watershed Nitrogen Management Plan (CWMP) presents the Town of Mashpee's recommendations to manage wastewater and remove nitrogen to address the Total Maximum Daily Loads (TMDLs) established for Popponesset Bay and eastern Waquoit Bay. The DEIR summarizes the Town's wastewater management planning process and identifies planning, programs and projects that will be implemented over a 25-year period. It addresses the environmental impacts and costs associated with elements of the Recommended Plan. It proposes a combination of traditional and non-traditional wastewater management approaches, including expansion of wastewater treatment facilities (WWTFs) for treatment and discharge, new treatment facilities, shellfish aquaculture for nitrogen removal, land use controls, fertilizer management, and demonstration projects. The latter projects include permeable reactive barriers (PRB), wetland restoration projects and a feasibility study for the Quashnet/Moonakis River.

Planning has emphasized consideration of more cost-effective approaches, compared to traditional wastewater management, and approaches better suited to the seasonal fluctuations of wastewater generation. The Adaptive Management approach to implementation will result in changes to the Plan based on opportunities, changing technology, long-term monitoring and results of modeling and monitoring. Planning, programs and projects will be phased and monitoring and modeling data will be evaluated in conjunction with the phasing to support evaluation of the effectiveness of the Plan. Notable elements of the plan include:

- The Plan relies heavily on potential for aquaculture to remove nitrogen loads and meet TMDLs for many of the embayments. Infrastructure components of the plan are identified to supplement the attainment of TMDLs through aquaculture and are deferred until necessary to meet TMDLs in the Mashpee River and Quashnet River watersheds.
- Use of existing capacity or expansion and upgrades to create capacity for treatment and discharge at existing private WWTFs (New Seabury, Willowbend, Mashpee Commons, Southport and Stratford Ponds in Mashpee; Cotuit Meadows in Barnstable; and Forestdale School in Sandwich). This approach may minimize environmental impacts and should reduce infrastructure costs significantly.
- Expansion and modifications to Joint Base Cape Cod (JBCC) (formerly Massachusetts Military Reservation) WWTF for regional wastewater management, including Quashnet (Areas H, G) and Sandwich (Sand-1,-2,-3).
- Construction of new wastewater treatment and recharge facilities.
- Development of a framework for regional cooperation with Barnstable, Falmouth and Sandwich. The Plan identifies PPA subareas within each town and associated wastewater treatment facilities that could be accommodated within the Plan.
- Development of a management structure for areas where septic systems and Innovative/Alternative systems will remain in use.

The project is proposed in phases from 2016 to 2040. Each phase includes the filing of an NPC with MEPA and Development of Regional Impact (DRI) modifications to the Cape Cod Commission (CCC). The phases incorporate evaluation of the effectiveness of shellfish propagation and contingency plans that will be implemented if aquaculture does not attain the identified targets. It identifies what facilities and associated capacity will be constructed. At the end of each phase, the MEP models (land use and hydrodynamic) are updated to calibrate with water quality and benthix flux sampling and compliance reports are provided.

Phase 1: 2016-2020
- File NPC and DRI modifications
- Shellfish propagation in Popponesset Bay (including the subwatersheds of Mashpee River, Shoestring Bay, Ockway Bay), and in Jehu Pond and Hamblin Pond (including Great River)
- Design and construction of JBCC for Area H (0.2 mgd), or Back Road if JBCC is not feasible
- Design and construction of Site 4 WWTF and related collection system for Subarea S2 (0.1 mgd)
- Connection of the Quashnet and Combs schools to the Mashpee Commons WWTF
- Feasibility study for Restoration of the Quashnet/Moonakis River
- MEP model updates and compliance reporting

Phase 2: 2021-2025

- File NPC and DRI modifications
- If expansion of the JBCC is feasible, then construct sewer collection system and connect Mashpee (0.20 mgd from H, L, M) and Sandwich (0.1 mgd from 1, 2 and 3)[1]
- Continue shellfish propagation
- If shellfish removal targets are not achieved, the following projects will be implemented:
  - Site 4 expansion with recharge to Willowbend
  - Upgrade private WWTF at Willowbend, Stratford Ponds, South Cape Village, Windchime Point
  - Sewer S1 P1 south of Route 28 (to Mashpee River and Popposnesset Bay)
  - Coordinate with Barnstable regarding incorporation of sections of Cotuit
- MEP model updates and compliance reporting

Phase 3: 2026 to 2030

- File NPC and DRI modifications
- Continue shellfish propagation
- If shellfish removal targets are not achieved, the following projects will be implemented:
  - Upgrade Southport private WWTF
  - Site 4 expansion (0.39 mgd) including extension of sewer service area to Mashpee River and Popponesset Bay subwatersheds
  - Expand Willowbend WWTF service area
  - Design and construct WWTF at Site 6 to serve Ockway Bay Area (0.27 mgd)
  - Construct new discharge beds at New Seabury for Mashpee Commons and Site 6 effluent. 0.71 MGD
  - Coordinate with Barnstable and Sandwich regarding incorporation of remaining areas within the Popponesset watershed
- MEP model updates and compliance reporting

Phase 4: 2031 to 2035

- File NPC and DRI modifications
- Evaluate and implement if necessary the upgrade of Cotuit Meadows and Wampanoag Village private WWTF
- If shellfish removal targets are not achieved, the following projects will be implemented:
  - Expansion of Site 6 and sewer collection systems
  - Collection expansion to Site 4
  - Collection expansion of Great Neck Road to Mashpee Commons
  - Collection expansion of Hamblin and Jehu D2 and B
  - Upgrade and expand New Seabury WWTF
- MEP model updates and compliance reporting

Phase 5: 2036 to 2040

- File NPC and DRI modifications
- Continue shellfish propagation

[1] Future service area could include Falmouth (0.05 mdg from 13--17)

- If shellfish removal targets are not achieved, the following projects will be implemented:
  - Remaining flow from Barnstable (B-37) and Sandwich (Sand-4, -5, -6) recharged outside of watershed
  - Expand collection system to Subarea T (Main St/ Rt 130) to Site 4
  - Expand collection system to Area A and C
  - Expand collection system to Childs River Subarea H
- MEP model updates and compliance reporting

The Recommended Plan is estimated to cost $140 Million for Mashpee and $35 Million for the three neighboring towns for a total capital cost of $180 million dollars. Alternative estimates are provided if aquaculture is not included and these include a capital cost of $260 Million for Mashpee and an additional $97 Million for the neighboring towns for a total of $360 million dollars. The DEIR indicates that the Recommended Plan is results in a 50% cost reduction compared to traditional infrastructure, although it is unclear whether the projected results can be obtained and costs of aquaculture may be underestimated. The DEIR also identifies cost estimates for Phase 1 - $49 Million with a present worth estimate of $92 Million over 20 years at 3% interest. Evaluation of the benefits and costs of Phase 1 will support development of the long-term plan and refinement off cost estimates.

Procedural History

An Environmental Notification Form (ENF) was submitted in October of 2001 to identify the planning process for the development of a CWMP. The Certificate on the ENF identified the four phases of the planning process and provided a Scope for the Needs Assessment Report (Phase 1). The Certificate on the ENF directed the Town to prepare and submit for review the first two reports prior to the submission of the Phase 3 (DEIR) and Phase 4 (FEIR) documents.

The Town submitted a Notice of Project Change (NPC) and a Needs Assessment Report to the MEPA Office in October 2007 in accordance with the MEPA regulations for a lapse of time, at 301 CMR 11.10(2). The NPC indicated that planning was delayed to support incorporation of the results of the MEP reports, which were released in 2004 and 2005. The NPC identified the nutrient loading limits and TMDLs developed through the (MEP) for coastal embayments located in Mashpee including Popponesset Bay, Waquoit Bay East, Hamblin Pond, Jehu Pond, the Mashpee River, Quashnet River, Great River, and Little River. It defined the Project Planning Area (PPA) and identified the amount of wastewater flow from the PPA to be approximately 2.7 million gallons per day (mgd). It provided information on existing wastewater facilities; physical features, land use and regulatory issues affecting wastewater facilities; and existing conditions related to environmental resources, nitrogen loadings and on-site septic systems. The Needs Assessment Report also identified the impacts of population growth in the PPA on wastewater collection, treatment and disposal facilities.

A second NPC was filed in 2012 because of a lapse in time in accordance with the MEPA regulations (301 CMR 11.10(2)). It indicated that EPA established TMDLs for nitrogen for the Popponesset Bay and the East Waquoit Bay estuaries (Quashnet River, Hamblin Pond, Little River, Jehu Pond and Great River). The TMDLs for Waquoit Bay (Childs River, Eel River) were being reviewed by EPA at the time the second NPC was filed.

The ASAR (Phase 2) was submitted in September of 2013. It projected that build-out of the PPA will result in approximately 2.9 mgd of wastewater flow. Approximately 2.2 mgd of future wastewater flow is attributed to the Town of Mashpee, 0.18 mgd to the Town of Barnstable, 0.39 mgd to the Town of Sandwich, and 0.12 mgd to the Town of Falmouth. It included an evaluation of alternative wastewater and nutrient management technologies to meet the wastewater management and TMDL reduction targets. Three potential alternative wastewater management options were presented for further evaluation:

1. Option 1A: Maximization of recharge outside the watersheds of the project planning area. Continued use and expansion of existing WWTFs, and the construction of new WWTFs to treat the estimated future build-out wastewater flows from the PPA (2.7 mgd). Under Option 1A, approximately 1.55 mgd of treated effluent would be conveyed to recharge sites located out of the watersheds, including the proposed New Seabury and Rock Landing discharge sites. The Rock Landing discharge site would require the Town's abandonment of its Rock Landing water supply wells and corresponding Zone II water supply protection areas for use as a recharge site for treated wastewater flow. Most of the estimated future wastewater flows from those areas of Barnstable, Falmouth and Sandwich located in the Popponesett and Waquoit Bay East watersheds would be recharged outside of the watersheds. Approximately 0.5 mgd of flow from on-site I/A and Title 5 septic systems would be recharged in the watersheds.

2. Option 1B: Recharge within the watersheds and address flows from outside the community within Mashpee. This option assumes that the Town's Rock Landing water supply wells and Zone II areas would be preserved for continued water supply and would not be available for recharge of wastewater flow from the PPA. Option 1B involves the expansion of existing WWTFs and the construction of new WWTFs to treat the future wastewater flow from the PPA and the recharge of 2.0 mgd of treated wastewater flow at existing and new recharge sites located in the watersheds. Most of the treated wastewater flows from Sandwich and Falmouth would be recharged in the watersheds. This option also incorporates continued use of Title 5 and I/A systems to recharge approximately 0.34 mgd of wastewater flow in the PPA watersheds, which is less compared to the other alterantives.

3. Option 1C: Outside communities handled the same, all Mashpee flows recharged within the watershed. Similar to Option 1B, this option also assumes the Town's Rock Landing water supply wells and Zone II areas would not available for recharge of wastewater flow from the PPA. Option 1C includes the expansion of existing WWTFs and construction of new WWTFs to treat the wastewater flows from the PPA. Approximately 1.51 mgd of wastewater flow would be conveyed to recharge sites located in the watersheds and .423 mgd outside of the watersheds (including flows from Barnstable, Falmouth and Sandwich). This option also incorporates the continued use of Title 5 and I/A systems to recharge approximately 0.5 mgd of wastewater flow in the watersheds.

A Certificate on the ASAR was issued on November 1, 2013 and it included the Scope for the DEIR.

Permits and Jurisdiction

The project was required to undergo MEPA review and prepare a Mandatory EIR pursuant to Sections 11.03(5)(a)(3) of the MEPA regulations, because the project would likely involve the construction of sewer mains ten or more miles in length. The project will require a Groundwater Discharge Permit, a Chapter 91 License, and a 401 Water Quality Certificate from MassDEP. It will undergo review by the Natural Heritage Endangered Species Program (NHESP) and the Massachusetts Historical Commission (MHC) because portions of the project will occur within Priority Habitat and within or adjacent to recorded archaeological sites and archaeologically sensitive areas, respectively. It may also require a Construction Access Permit from the Massachusetts Department of Transportation (MassDOT).

The project will require an Order of Conditions from the Mashpee Conservation Commission (and, on appeal only, a Superseding Order from MassDEP). The project may require Federal Consistency Review from the Massachusetts Coastal Zone Management (MCZM) Office. The project may need to obtain a Section 404 Permit from the U.S. Army Corps of Engineers. The project will require a National Pollutant Discharge Elimination System (NPDES) General Permit from the U.S. Environmental Protection Agency (EPA) for stormwater discharges from a construction site.

Because the Town is seeking Financial Assistance from the Commonwealth through the State Revolving Fund (SRF), MEPA jurisdiction is broad in scope and extends to all aspects of the project that may cause Damage to the Environment, as defined in the MEPA regulations. The project is being reviewed under a Joint Environmental Review Process established between the Executive Office of Energy and Environmental Affairs (EEA) and the CCC.

Review of the DEIR

The Recommended Plan represents a targeted and incremental approach to wastewater management with an emphasis on identifying lower cost solutions compared to traditional wastewater management solutions. Implementation will be driven through adaptive management, and includes alternative strategies that will be employed based on the results of monitoring and modeling. The Plan identifies opportunities for regional cooperation, including potential expansion of the JBCC WWTF. The Draft 208 Water Quality Plan Update was released during review of the CWMP; however, its development has been shaped by principles of the 208 Plan such as regional cooperation and development of targeted watershed plans. Information gleaned from other CWMP Plans, including the Town of Falmouth's CWMP, has also been employed in the development of the Recommended Plan.

The DEIR includes a comprehensive description of the Recommended Plan, identifies required permits and approvals, identifies phasing and scheduling, identifies alternative strategies for nitrogen reductions, and provides cost estimates for the Plan, Phase 1 and individual elements. The DEIR identifies potential environmental impacts, and measures that will be taken to avoid, minimize and mitigate impacts. It is supported by technical appendices and conceptual plans for infrastructure projects. The MEP watershed embayment model and the CCC's watershed management tool (Watershed–MVP) were used to evaluate nitrogen loading and reductions associated with proposed strategies. It identifies criteria developed to evaluate strategies, including costs (capital, operation and maintenance), effluent quality, consistency with regulatory requirements, energy use, and ease of implementation and operation. It also includes a Response to Comments and identifies measures to avoid, minimize and mitigate environmental impacts.

The DEIR identifies several critical issues that must be addressed to finalize the Recommended Plan and implement it effectively. These issues are also identified in comment letters and include:

- Continued coordination with the CCC and MassDEP regarding enforcement, permitting and planning to ensure that each municipality understands its obligations to nitrogen reductions and receives technical and financial assistance to support management efforts.

- Development of a detailed long-term monitoring plan in cooperation with CCC, MassDEP and other municipalities to track effectiveness of plans and progress in attaining reductions.

- Evaluate ownership of collection systems, management options, related costs and strategies to support successful public/private initiatives and regional approaches.

Comments provided on the DEIR indicate support for the Recommended Plan and recognize the time and effort the Town has invested in this process. MassDEP, CZM, DMF, the CCC, and the Association for the Preservation of Cape Cod (APCC) provide constructive and detailed comments to guide the preparation of the FEIR, identify additional information and/or questions that should be addressed to ensure projections and assumptions are realistic and accurate, and identify issues that warrant additional consideration. State Agencies and the CCC also emphasize the availability of technical assistance and resources to support the Town's continued efforts.

Wastewater Treatment and Discharge

The Recommended Plan includes a combination of expansion and upgrades to existing WWTFs (public and private) and construction of new facilities. In addition, the Plan identifies expansion of and upgrades to the JBCC WWTF to increase capacity and identifies associated flows from subareas in Mashpee, Sandwich and Falmouth. The DEIR identifies sites proposed for new or expanded recharge. The previously identified Rock Landing site has been eliminated from consideration because it would have required abandonment of the existing high quality drinking water supply wells that supplies nearly 50 percent of the Town's water use. The DEIR provides a general characterization of the site's suitability for proposed uses. Additional analysis of Willowbend Golf Course and New Seabury Golf Course are required to address groundwater hydrology and potential impacts to groundwater flow and mounding conditions.

New Facilities

New WWTFs are considered for Site 4, Site 6 and the Back Road Sites. Site 4 would provide a central treatment location within Mashpee and the PPA. It would receive flow from Subareas S, F, N, and T and would require the installation of 30 miles of collections system, five miles of force main, and up to nine pumping stations. Estimated average annual capacity would be 0.39 but it would be phased in over time. Phase 1 would consist of 0.1 mgd from Subarea S1. Recharge is proposed at Site 4; Willowbend Golf Course is identified as a backup recharge location. It would require three recharge beds (240 ft x 240 ft each to recharge 5 gpd/sf) and occupy approximately 4 acres. Open sand beds are proposed.

Site 6 is located within the southern area of Mashpee and would serve Subareas A, C, D1, D2, E and Fal-2 through Fal-11. It would require the installation of 18 miles of collections system, three miles of force main and up to 11 pumping stations (not including Falmouth). If Falmouth were to contribute flow to the facility, it would require five miles of collection system and force main and up to 10 pumping stations. Estimated average annual capacity would be 0.27 mgd. Expansion of existing recharge beds at Site 7/New Seabury Golf Course is proposed to recharge treated effluent from Site 6. New facilities would consist of drip irrigation at eight potential fairways and associated distribution pumping, filtration, backwash facilities and receiving /storage tanks. The system is sized to provide 0.74 gpd/sf based on rates for drip irrigation.

The Plan considers either a Sequencing Batch Reactor (SBR) or membrane bio-reactor for the Site 4 and Site 6 treatment process because of the limited area available for the facilities and proximity to neighborhoods. Modular designs would support gradual expansion of the facilities consistent with the overall Plan approach.

Both facilities are proposed on undeveloped sites and would require significant clearing and land alteration. Layout of the Site 6 WWTF would include a 100-foot buffer from its property line, with the exception of the access road.

Existing Facilities

The Plan identifies improvements, expansions and/or modifications to existing WWTFs, including JBCC, Mashpee Commons (expand treatment and recharge capacity from 0.18 mgd to 0.33 mgd), New Seabury (expand recharge capacity from existing 0.3 mgd to 1.0 mgd to serve other WWTF sites), Willowbend (improve performance to 3 mg/L TN and expand recharge capacity from existing 0.13 mgd to 1.0 mgd), Mashpee High School (abandon facility and convert to a pump station or pump treated effluent to JBCC), Cotuit Meadows (limited expansion of service area to collect up to 5,000 gpd), and Wampanoag Village (expansion of service area to collect up to 25,000 gpd). In addition, it identifies opportunities to improve performance of existing WWTFs (3 to 6 mg/L TN) including: Forestdale School, Southport, South Cape Village, Stratford Ponds, Windchime Point, and Mashpee Village.

The DEIR/CWMP includes several options for use of the JBCC WWTF and its disposal capacity near the Cape Cod Canal. The primary goal of addressing these areas is to reduce nitrogen load in the Quashnet River watershed, which requires a high level of nitrogen removal to achieve the TMDLs and is not an area conducive to shellfish for nitrogen removal. The subareas to be served would include the northwestern sections of the PPA in Mashpee (H, L, M) and portions of Sandwich (SAND-1, -2, and -3) adjacent to the WWTF. Flow from Falmouth along the western side of the Moonakis/Quashnet River (FAL 13–17) could also be directed to the JBCC WWTF. Expansion would be based on 200,000 gpd from Mashpee, 110,000 gpd from

Sandwich and 50,000 gpd from Falmouth for a total of 350,000 gpd. It would require upgrades to increase the average annual design flow to 600,000 gpd and provide a design peak flow of 1.6 mgd.

The JBCC WWTF was constructed in 1996. It consists of an extended aeration type oxidation ditch system. The headworks provide grit and screening removal. It is followed by the secondary biological process of anoxic tanks prior to preceding the oxidation ditch system. The secondary process is followed by secondary clarifiers and disinfection and effluent disposal at open sand beds or "rapid infiltration basis" (RIBs). Solids handling consists of storage in aerated sludge holding tanks prior to hauling to an offsite facility. Upgrades include improvements to the SCADA system in 2006. The average annual design flow is 360,000 gpd and the peak day design flow is 800,000 gpd. It has a recharge capacity of 670,000 gpd (with the largest bed out of service) and a capacity of 960,000 gpd if all beds are in service. Existing flow is identified as 200,000 gpd and it is permitted for 360,000 gpd of discharge, which results in 160,000 gpd of existing excess capacity. The Plan indicates that improvements would include; addition of a parallel treatment train; addition of a secondary clarifier, anoxic tank and oxidation ditch; and, upgrades to the SCADA system, the headworks, and sludge handling facilities.

Wastewater from the subareas would be pumped directly into the headworks of the JBCC facility; however, recent information indicates that connection of Falmouth and Sandwich to the collection system may be viable because portions of existing collections system need repair to address operational issues and remove I/I. Removal of I/I would provide additional capacity. Mashpee would require approximately 15 miles of collection system, 2 miles of force main, and seven lift stations. Sandwich would require eight miles of collections system and forcemain and potentially three lift stations. Falmouth would require four miles of collection system and force main and approximately five pumping stations.

The Recommended Plan identifies 0.50 mgd of flow that will be continue to be managed treated through Innovative/Alternative (I/A) systems and Title 5 septic systems and would continue to be recharged in the watersheds. These include I/A facilities in Mashpee (0.02 mgd) and septic systems in Mashpee (0.27 mgd), Sandwich (0.13 mgd), Barnstable (0.07 mgd) and Falmouth (0.01 mgd). The Plan recommends consideration of operation, maintenance and monitoring of denitrifying on-site systems and establishment of decentralized management districts. At a minimum, the Plan identifies tracking of these systems through an operation/maintenance and monitoring database.

Non-Traditional Wastewater Management

The DEIR identifies land use controls and non-traditional wastewater management projects and programs, including demonstration projects, to provide targeted and incremental nitrogen removal. These include an ambitious shellfish aquaculture program, conversion of abandoned cranberry bogs and shallow ponds including Santuit Pond, open space acquisition and additional public drinking water supply well locations, fertilizer management, stormwater management; and zoning to address growth neutral requirements for 0% loans under the SRF program.

Use of shellfish aquaculture is the primary non-traditional means of nitrogen removal associated with the project. The DEIR includes a conceptual plan to implement a shellfish aquaculture project in multiple embayments. It builds on the Town's experience with shellfish propagation, including projects in the Mashpee River (2004) and Great River (2013), which were developed by the Mashpee Shellfish Constable, in association with the Wampanoag Tribe. The DEIR identifies the amount of nitrogen uptake associated with quahogs and oysters (based on data collected in Mashpee in 2012), and estimates the ability of aquaculture to achieve nitrogen reduction targets (e.g., Tables ES-1 and 5-16). Approximately 35.5 million shellfish will be required for the program (16 million in Popponesset Bay and 19 million in the eastern portion of Waquoit Bay). The Plan indicates that shellfish will provide 50% of nitrogen removal within the Mashpee River and Shoestring Bay and will provide 100% of removal for Popponesset Bay, Ockway Bay, Great River, Jehu Pond, and Hamblin Pond. The Plan assumes that no individuals are lost to predators, weather, parasites, poaching, or low dissolved oxygen associated with eutrophication. Aquaculture is targeted towards critical embayments that have the characteristics necessary to support success of the program, such as a significant benthic flux associated with the nitrogen load.

Aquaculture has been identified as a viable alternative to complement and augment source reduction efforts but it has not been attempted on such a widespread scale to achieve the measure of significant required nitrogen removal anticipated in this plan. The aquaculture program and budget was developed based on shellfish planting and harvest data, and associated costs. The Town's experience with these projects and active participation by the Shellfish Constable and the Wampanoag Tribe's will support its overall effectiveness. However, comments indicate that the ability for aquaculture to provide reductions identified in the Plan may be overly optimistic and that program costs may be understated. Commenters express caution regarding the reliance on shellfish as a primary nutrient remediation technique. Comments from DMF indicate that the plan is consistent with its *Shellfish Planting Guidelines* and indicate that projects are proposed in areas listed as Approved for shellfish harvest, thus avoiding potential health risks associated with illegal harvest. DMF notes that the projects will require a modification to the Town's municipal propagation permit.

Comments from CZM indicate that the January 2014 Woods Hole Sea Grant Program Marine Extension Bulletin described Cape Cod quahogs (littlenecks) as containing 0.22 g of nitrogen on average and Cape Cod oysters as containing 0.28 g nitrogen on average. CZM indicates that application of these rates would result in much lower nitrogen removal: 5 million oysters could remediate 1.4 metric tons of nitrogen which would address 28% of the Mashpee River Watershed load, not 50%; and, 4.87 million quahogs have the potential to remediate 1.07 metric tons of nitrogen which would address 71% of the Popponesset Bay Watershed load, not 100%.

As noted previously, the Town has developed and will implement contingency plans if the aquaculture program does not achieve projected reductions. Comments request that the contingency plan be described in more detail in the FEIR and include specifics regarding monitoring and triggers for action.

The DEIR notes that the CCC has developed model regulations for fertilizer management that can be adopted by local Boards of Health. The Town of Mashpee has drafted a Nitrogen Control Bylaw for the Town of Mashpee. It identifies exempt activities, restricts the application of nitrogen fertilizer between October 30 and April 14 and before or during a heavy storm, and identifies a buffer zone to resource areas where application is prohibited. It recommends the judicious use of fertilizer and use of organic, slow release, water-insoluble forms of nitrogen.

The DEIR briefly address other alternatives, including use of PRBs, bog and wetlands restoration, and composting toilets. It indicates that these elements are not specifically incorporated into the Recommended Plan; however, the Town will consider results of several demonstration projects proposed in Falmouth and, if necessary to attain nitrogen reductions, may incorporate these approaches into later phases of the Recommended Plan.

The DEIR includes a brief discussion of strategies to reduce future growth potential. These include: development of a growth neutral/flow neutral policy, open space acquisition, acquisition of water supply and/or treatment and disposal site. The DEIR indicates that stormwater Best Management Practices (BMPs) will continue to be implemented on a case-by-case basis, with nutrient removal considered in the most sensitive watersheds and the Town will continue to ensure conformity with stormwater standards included in existing zoning bylaws and subdivision regulations. These strategies are critical to reducing nitrogen loading from future growth.

Adaptive Management

The Recommended Plan is centered on an Adaptive Management Plan (AMP) to provide incremental and targeted reductions in nitrogen with regular evaluation and re-evaluation of Plan components based upon a robust water quality monitoring program and associated modeling.

The DEIR identifies the existing Mashpee Water Quality Monitoring Program (MWQMP) which documents improvements in total nitrogen concentration, chlorophyll (salinity), dissolved oxygen (DO) and other parameters at the sentinel and other stations consistent with the protocols, sampling stations and analysis used to prepare MEP and TMDL reports. Water quality parameters measured including conductivity, chlorophyll, DO, Nitrogen (TN, NH_4, NO_2/NO_3, TDN, POC/N), phytoplankton (microscopic identification and count), Secchi disk visibility, suspended solids, and temperature. In addition, monitoring instruments (YSI sondes) are maintained at several locations in the estuaries. They collect data every 15 minutes and measure conductivity, chlorophyll, DO, pH, turbidity and temperature.

The DEIR includes a commitment to provide compliance documents, including monitoring data and reports, to MassDEP, DMF, CZM, MEP, neighboring communities and other agencies. The reports will be provided every five years. The DEIR identifies components of the monitoring and modeling program for the Recommended Plan; however it does not include a specifics or details that clearly identify what data will be collected and frequency of sampling and collection. The monitoring plan will include the following components:

<u>Short-Term Monitoring and Modeling</u>

- Shellfish/estuary baseline monitoring
- Estuary short-term (on-going) intensive water quality and shellfish quality monitoring to check near-term performance following MEP protocols for estuary water quality and health
- MEP flushing and stream gauge monitoring necessary to update MEP TMDL compliance points

- Groundwater/drinking water supply quality
- Ground water mounding analysis through localized modeling

<u>Long-Term Monitoring and Modeling</u>

- Monitoring associated with groundwater discharge permits for treatment facilities:
- Daily monitoring of flow, pH, disinfection, and turbidity
- Weekly/monthly monitoring of flow, biochemical oxygen demand (BOD), total suspended solids (TSS), total nitrogen (TN), and possibly total phosphorus (TP)
- Groundwater monitoring well data typically quarterly; upgradient and downgradient of recharge facilities

- MEP estuary monitoring and modeling (land and hydrodynamic)
- TMDL compliance
- Long-term trending of standard MEP water quality parameters
- Eelgrass surveys typically provided by MassDEP
- Benthic habitat surveys

- Shellfish/Estuary Monitoring
- Long term compliance monitoring performed following the same MEP protocols to measure estuary health
- Shellfish monitoring in compliance with DMF requirements

- Groundwater quality monitoring through existing drinking water supply wells as required by MassDEP and EPA and groundwater monitoring wells as required by groundwater discharge permits issued by MassDEP for wastewater treatment facilities.

The DEIR includes a phasing plan with identified evaluation points. Through the development of the 208 Plan process, the CCC has developed watershed tools to help assess proposed nitrogen load reductions, assign and select priorities, and take advantage of regional efforts. MassDEP recommends that Mashpee coordinate closely with the CCC as the FEIR is developed.

Regional Strategies

The Recommended Plan is based on reducing nitrogen loads from watersheds within the PPA. The PPA extends beyond Town lines to areas of Falmouth, Sandwich and Barnstable. The Plan acknowledges areas outside of Mashpee that contribute nitrogen to its embayments and it identifies opportunities for regional approaches to wastewater management. The information provided in the Plan, in addition to the Draft 208 Water Quality Plan developed by CCC, provides a framework for regional cooperation and will guide subsequent filings.

In particular, expansion of the JBCC WWTF provides an opportunity to eliminate nitrogen loads and flows out of the watershed, which provides additional flexibility to each of the Towns. Although progress has been made on development of regional use of JBCC, significant additional work will be required. Comments from CCC indicate that it has applied for funding from the Department of Defense to study the feasibility of transferring the JBCC wastewater and water supply systems to a regional entity, or another public entity. CCC is also seeking funding to make an economic case for future ownership and operation by Mass Development.

The Plan includes recharge of wastewater outside of the PPA consisting of 0.08 mgd (average annual) from Barnstable (Barn-37, -39 and -42) and 0.2 from Sandwich (Sand-4, -5, -6 and -8). In addition, it identifies 0.05 mgd from Falmouth (Fal-13 through -17) to JBCC. Project costs for neighboring communities are included to provide a rough estimate. They are dependent upon how each community addresses nitrogen removal within these estuaries and development of regional agreements. Their viability depends upon site availability, successful negotiations, establishment of nitrogen loading responsibilities, and extent of nitrogen removal required based upon actual build-out within the PPA. Again, adaptive management and monitoring and modeling will support the identification of each community's contribution. The DEIR indicates that the Town will consider entering into MOUs with Barnstable and Sandwich to support the shellfish aquaculture program in the spirit of a "fair-share" approach.

The approach taken in the DEIR appears to be consistent with the spirit and intent of the CCC's ongoing 208 planning process. I recognize comments from APCC which identify an interest in developing a Targeted Watershed Management Plan for Waquoit Bay to ensure that each municipality takes responsibility for their contributions and works cooperatively to identify effective and cost-effective approaches.

Wetlands and Rare Species

The Recommended Plan will impact inland and coastal wetland resources. Overall, the Plan should improve water quality with related improvements in estuary health and habitat. The DEIR provides conceptual plans for proposed facilities and collection systems and identifies on-and off-site resources including wetlands, floodplains, vernal pools, water supply protection areas, and rare species habitat. The DEIR does not address potential wetland impacts in detail nor does it identify stormwater management systems for proposed facilities. Based on the conceptual plans, the majority of the collection system is proposed within existing roadways and disturbed areas. New WWTFs are proposed on sites that, while adjacent to existing municipal facilities, have not been developed. Based on review of the conceptual plans, it does not appear that the sites include wetland resource areas or, they are, they are well outside of the buffer zone. The proposed WWTFs are located within *Estimated* and *Priority Habitat.* The expansion of shellfish aquaculture will occur within wetland resource areas and will require Orders of Conditions from the Conservation Commission and may require State Permits (c.91, 401 WQC, Superseding Orders of Conditions).

Greenhouse Gas Emissions (GHG)

The project is subject to the MEPA Greenhouse Gas Emissions Policy and Protocol ("the Policy"). The Policy requires projects to quantify carbon dioxide (CO_2) emissions and identify measures to avoid, minimize or mitigate such emissions. Unlike many projects reviewed under the Policy, wastewater treatment process energy loads and subsequent CO_2 emissions are the primary source of GHG emissions, rather than the buildings that contain the facilities. The Policy directs proponents to use applicable building codes to establish a project emissions baseline that is code-compliant; however, there is no building energy code equivalent that applies specifically to wastewater management systems and facilities or a readily available energy use model (such as eQUEST) to estimate the projected energy use of wastewater processing energy loads. The DEIR indicates that the Town is considering the use of EPA's Energy Star Portfolio Manager (ESPM). The ESPM modeling program can quantify the energy usage associated with wastewater treatment technologies and compare it to similar facilities using a rating index. However, the DEIR notes that the program is designed for larger facilities (0.61 mgd) and may not be scalable to the smaller proposed facilities (0.27 – 0.39 mgd). The DEIR indicates that the Town will consider how to improve the efficiency of proposed facilities to achieve an acceptable index score; however, analysis of efficiency and performance will be deferred to preliminary or detailed design.

The DEIR identifies measures that could be employed to improve energy efficiency and reduce GHG emissions including: energy recovery, biosolids management, energy management and sub-metering, optimized lighting, reduced ventilation and heating requirements, use of variable frequency drives (VFDs), process optimization, and additional investment in the removal of I/I from municipal systems. No specific commitments are identified in the DEIR and further consideration is deferred to preliminary and final design.

The DEIR also identifies the potential incorporation of on-site renewable energy (e.g., solar (photovoltaic (PV)), wind, geothermal) and identifies loan, grant and tax credit programs that could defray associated costs. The DEIR does not include a feasibility analysis of solar PV installations. Installation of PV systems on municipal buildings or on municipal properties may achieve cost-savings beneficial to the community and offset ongoing operational costs as well as support the Commonwealth's related renewable energy goals.

Climate Change Adaptation and Coastal Hazards

The DEIR includes a general assessment of the Plan's consistency with Executive Order 181 and CZM Coastal Hazards Policy #3 to ensure that the Plan does not promote growth and development in high hazard areas designated in Flood Insurance Rate Maps (FIRMs) as V zones, AO zones and specific A zones that are accompanied by moderate wave action capable of structural damage (MoWa). It notes that the Town is developing a Multi-Hazard Mitigation Plan which includes research on climate change and identification of risks, impacts, and mitigation efforts. It provides the following general commitments to address potential impacts from climate change and minimize risks to facilities and infrastructure: expansion of collection systems will be designed to withstand reasonable expected coastal flood hazards; pumping stations will be designed to withstand a 100-year storm, and all pipes and equipment will be protected from wave action. In addition, pumping stations will be located outside of flood zones when possible and protected with a system of check valves in critical areas consistent with the Town's Multi-Hazard Mitigation Plan.

The DEIR identifies flood zones (100-year flood, 100-year flood with velocity hazard, and 500-year flood) within the PPA based on 1997 data obtained from MassGIS (Figure 8-1). Based on the information provided and a review of conceptual facilities and infrastructure plans, it appears that the majority of infrastructure is not proposed within existing flood zones or high hazard areas. New facilities are sited well outside of potential flood zones and high hazard areas (Site 4, Site 6, JBCC and Back Road Sites) and the DEIR indicates that pumping stations will be located outside of flood zones wherever possible. Additional analysis of facility, collection system and recharge area expansion is warranted based on the conceptual information provided in the DEIR and the availability of new floodplain mapping (effective July 2014). The plans suggest that some areas which are currently outside of the 100 and 500-year flood zones, could be located within them based on revised floodplain mapping and accounting for sea level rise projections (over the design life of the structures).

The DEIR does not address the potential increase in groundwater levels associated with sea level rise; however, this issue is identified in comment letters and warrants consideration. Specifically, the results of the model could be used to evaluate the long-term (20, 40, 60-year) viability of new and existing wastewater discharge sites and to plan for and acquire any necessary additional discharge sites.

Historic and Archaeological Resources

The DEIR identifies potential impacts to historic and archaeological resources, provides an update on completed or ongoing investigations and identifies measures to avoid and minimize, or mitigate impacts to cultural resources. An archaeological reconnaissance survey was conducted for the entire Town and was used to identify historic districts and potentially sensitive archaeological areas (Figure 7-6) within the PPA and in relation to proposed facilities and recharge beds. The majority of the projects included in the Plan are unlikely to impact historic or archaeological resources because ground disturbance is limited and/or they are located in previously disturbed areas (e.g. roadways, golf courses).

The DEIR indicates that an intensive (locational) archaeological survey was conducted for Site 4. Based on the results of the survey, no impacts are anticipated at Site 4. Locational archaeological surveys will be required at Site 2 and Site 6, but have not been conducted. Additional analysis of Site 7 (a previously disturbed site) is not required; however, a qualified archaeologist will monitor construction.

Construction Period Impacts

The DEIR includes measures to address construction period impacts. Stormwater runoff will be controlled by proper site grading and by providing temporary berms, drains, silt fencing, hay bales, detention basins and other means to prevent soil erosion. Existing and new catch basins will be protected from siltation using hay bales, siltation fence, and catch basin inserts. Temporary seeding and mulching may be used to minimize soil erosion and provide soil stabilization on slopes. Dust control measures including street sweeping or watering trucks will be used to minimize dust. Police details and other traffic controls, including detours, will be required during construction of utilities. If soil contaminated with oil and/or hazardous material is identified during the implementation of this project, notification pursuant to the Massachusetts Contingency Plan will be made to MassDEP.

Conclusion

Based on a review of the DEIR, the Scope for the DEIR, consultation with public agencies and comment letters, I have determined that the DEIR adequately and properly complies with MEPA and its implementing regulations.

Scope for the FEIR

This Scope identifies the additional information and analysis necessary to complete MEPA review and ensure that impacts and issues are analyzed to a degree commensurate with this planning document. The Town should prepare a FEIR in accordance with this Scope. The FEIR should build on the Recommended Plan provided in the DEIR and supplement it with more detailed information, preliminary design and refined environmental impact estimates, in particular for elements proposed in the early phases of the Plan. In particular, the FEIR should better characterize the incremental nitrogen reduction of various phases of the plan and support assignment of priorities and demonstrate that, if necessary, the contingency plan can meet the nitrogen reduction targets. It should address how the NPC process will be used in the context of Adaptive Management to provide additional information and analysis of Plan components and opportunities for public comment.

Project Description

The FEIR should provide a Final Recommended Plan and a detailed description of its elements. It should describe how transition of responsibility for the planning and implementation of the CWMP will be addressed between the Sewer Commission and the Mashpee Water and Sewer District. It should provide an update on public participation activities and consultation with CCC, State Agencies and adjacent communities. It should include a revised schedule for phases of the Plan that addresses benchmarks for planning, design, environmental permitting and review, and construction. It should provide an update on project permitting and specifically address how elements of the project are designed to meet applicable performance standards, including the Wetlands Regulations and associated Stormwater Management Standards, the Waterways Regulations and 401 Water Quality Certification requirements.

Draft 208 Water Quality Plan and Regional Management

The FEIR should include a summary of the Draft 208 Water Quality Plan and how its development and recommendations have influenced the Final Recommended Plan. In particular, it should consider use of watershed tools to better account for nitrogen load reductions, assign and select priorities and take advantage of additional regional efforts. Comments from the CCC indicate that the traditional components of the Recommended Plan identified as contingencies for underperformance of shellfish aquaculture are appropriate; however, subsequent phases may benefit through use and evaluation of the modeling tool. In addition, the work emerging from the 208 planning process may support the development of a Targeted Watershed Management Plan for Waquoit Bay.

The FEIR should provide an update on consultation with municipalities regarding coordination of nitrogen reduction efforts and identify any progress towards development of the JBCC as a regional facility. To the extent possible, it should identify development of MOUs between municipalities and any regional commitments.

Wastewater Treatment

The FEIR should provide a more detailed evaluation of proposed wastewater facilities, recharge locations and expansion of collections systems and associated environmental impacts. It should demonstrate progress on developing and securing agreements with private facilities. It should indicate whether incorporation of private facilities into the District is being proposed.

It is unclear if the contingency measures included in the plan, on their own, could meet the removal targets necessary for TMDL compliance and what the incremental nitrogen reduction is for each phase of the plan. The FEIR should clarify nitrogen reduction associated with each phase of the Plan and describe what elements are necessary to achieve TMDLs. For instance, part of the Plan includes phasing in upgrades to achieve higher levels of treatment (i.e. 3 mg/L TN compared to 6 to 10 mg/L of TN). It is unclear whether that level of treatment is assumed to achieve the TMDL or if a certain level of treatment would be targeted as a contingency measure.

Shellfish Propagation

The FEIR should include a revised and more detailed shellfish propagation plan to address comments on the DEIR. The FEIR should identify permitting and review requirements associated with the shellfish propagation program. It should describe associated infrastructure, management and maintenance requirements. It should include plans at a reasonable scale that include infrastructure, identify resource areas and demonstrate that sufficient bottom habitat is available to support identified densities. It should confirm that amount of shellfish seed can be obtained within the proposed timeframes. The FEIR should identify measures to avoid, minimize and mitigate impacts, including impacts to recreation and navigation.

Because of the significant reliance on this program to reach targets, close consultation with MassDEP, CCC and DMF is warranted prior to the filing of the FEIR. The FEIR should include a detailed protocol to ensure that the sampling and monitoring program yields appropriate verifiable data that will be accepted by MassDEP and DMF for evaluation, and will support the Town's evaluation of the effectiveness of the program. In addition, the triggers for implementing contingency plans should be more explicitly stated in the FEIR, including identification of thresholds and amount/duration of data required.

Non-Wastewater Nutrient Management Projects and Programs

The Recommended Plan will be strengthened through additional consideration of other non-wastewater nutrient management strategies and assessment of the potential effectiveness of such strategies. The FEIR should provide more discussion regarding other non-traditional projects and programs identified in the DEIR, including the growth neutral/flow neutral policy, stormwater management, conversion of abandoned cranberry bogs and shallow ponds including Santuit Pond, open space acquisition and additional public drinking water supply well locations, and fertilizer management. In addition, it should indicate when such elements would be incorporated into the Recommended Plan. In particular, it should provide more specificity regarding the framework of a growth neutral/flow neutral bylaw and, if available, provide a draft bylaw for review. If certain elements or analysis of elements will be deferred to later phases or subsequent NPCs, the Plan should clearly identify this.

Water Quality Monitoring and Adaptive Management

The Recommended Plan is based on Adaptive Management to provide incremental and targeted reductions in nitrogen with regular evaluation and re-evaluation of Plan components based upon a robust water quality monitoring program and associated modeling. As noted previously, the Proponent has committed to provide TMDL compliance reports to MassDEP, DMF, CZM, and other agencies/organizations. The FEIR should clarify that the reports will be provided to the CCC as well. The DEIR identifies regulatory requirements for monitoring and identifies parameters that will be monitored; however, it does not provide a specific monitoring protocol for evaluation. The FEIR must include a detailed protocol for evaluation by MassDEP, DMF and CZM. I strongly encourage the Proponent to consult with State Agencies and CCC regarding the development of this protocol prior to filing the FEIR.

Wetlands and Rare Species

The Recommended Plan will impact inland and coastal wetland resources. Overall, the Plan should improve water quality with related improvements in estuary health and habitat. The DEIR provides conceptual plans for proposed facilities and collection systems and identifies on-and off-site resources including wetlands, floodplains, vernal pools, water supply protection areas, and rare species habitat. The Town has sited facilities to avoid significant impacts. The FEIR should provide an assessment of wetlands impacts associated with the shellfish propagation project and, to the extent feasible with projects proposed is early phases of the Recommended Plan, which may be limited to the expansion of sewer service areas. The DEIR should describe measures that will be implemented to avoid and minimize, or mitigate, adverse impacts to wetlands and buffer zones.

The FEIR should describe how the proposed stormwater management systems for new and/or expanded facilities will be designed and constructed consistent with MassDEP's stormwater management regulations and standards. The FEIR should describe proposed best management practice (BMP) measures to manage stormwater during project construction.

The sites for new facilities, and many of the expansions, are located within *Estimated* and *Priority Habitat* for rare species. The FEIR should consult with NHESP regarding the design of facilities and identify construction and post-construction commitments to avoid adversely impacting habitats of state-listed rare species.

Climate Change

The FEIR must demonstrate that the Town will take meaningful steps to reduce GHG emissions and is well positioned to address impacts of climate change, including sea level rise and more frequent and severe storms. The Recommended Plan represents a significant investment of State and local resources and is the basis for design and construction of long-term infrastructure. As a coastal community, it is critical that these resources are sited, designed and constructed to adapt to sea level rise and associated impacts so that the targeted benefits and investments will be protected over the long-term. Planning for energy efficiency, long-term water quality improvements and infrastructure should be addressed in the FEIR and subsequent NPCs, to the extent reasonable and feasible, rather than deferring these considerations to permitting.

Greenhouse Gas Emissions

The Town should present a GHG analysis that clearly demonstrates what measures will be adopted to achieve a high level of energy efficiency for proposed facilities and treatment processes and to quantify potential GHG emissions reductions (in tons per year (tpy) of CO2) associated with the measures. Staff from the MEPA Office, MassDEP and the Department of Energy Resources (DOER) are available to provide guidance and technical assistance for this effort.

In addition, the FEIR should evaluate the feasibility of incorporating solar PV into the Recommended Plan. Installation of PV systems on municipal buildings or on municipal properties may achieve cost-savings beneficial to the community and can offset ongoing operational costs. The DEIR should consider ground-mounted and building-mounted systems and ownership structures, including third-party ownership/lease scenarios. MassDEP, DOER and the Clean Energy Center (CEC) can provide resources to assist with the analysis, including a DOER spreadsheet to calculate potential project cost, payback periods and returns on investment. The DEIR should state assumptions with regard to available area for PV equipment, efficiencies, etc.

Upon completion of the construction of proposed improvements and upgrades and new wastewater management systems and facilities, the Town will be required to provide a certification to the MEPA Office signed by an appropriate professional (e.g., engineer, architect, general contractor) indicating that the all of the GHG mitigation measures committed to by the Town as described in the DEIR, or as modified as part of the MassDEP permitting process, have been incorporated into the projects. This certification should be supported by project plans. For those measures that are operational in nature the Town will be required to provide an updated plan identifying the measures, the schedule for implementation and how progress towards achieving the measures will be obtained. The proposed draft Section 61 Findings in the DEIR should include this self-certification requirement.

Adaptation, Resiliency and Coastal Hazards

Current rates of sea level rise, as well as projections for accelerated rates of sea level rise, pose significant threats to coastal development and resource areas by increasing storm surge heights and coastal flooding events. The DEIR provided sufficient information to identify many elements of the project that are clearly outside of flood zones and unlikely to be affected. Other areas warrant further analysis as revised floodplain mapping (July 16, 2014) and incorporation of sea level rise projections may identify project elements that will be located within flood zones. The FEIR should include revised flood zone maps that incorporate effects of sea level rise and identify vulnerable facilities or infrastructure. The FEIR should identify specific measures that can be incorporated into the design or operation to facilitate adaptation and create resiliency. In addition, the Town should consider model results produced by USGS and modeling being conducted by APCC to assess potential changes to groundwater elevations associated with sea level rise and address any potential impacts to project elements.

Comments provide a list of resources to support these efforts. In addition, State Agencies and CCC have offered to provide technical assistance to support these efforts. The Town should refer to the CZM report, *Sea Level Rise: Understanding and Applying Trends and Future Scenarios for Analysis and Planning,* to guide selection of appropriate sea level rise scenarios.

Additional resources include:

- FIRM maps through the National Oceanic and Atmospheric Administration viewer
- the CCC Sea Level Rise Viewer available on the Commission website
- dynamic models created by the Woods Hole Group
- StormSmart Coasts – Visualizing Sea Level Rise on the CZM website

Construction Period Impacts

The FEIR should identify any changes to construction management and potential construction period impacts (including but not limited to land disturbance, noise, vibration, dust, odor, nuisance, vehicle emissions, construction and demolition debris, impacts on trees and other vegetation, and construction-related traffic). The Town should identify any changes or addition of measures to avoid, minimize and mitigate impacts.

Mitigation and Section 61 Findings

The DEIR includes a separate chapter on mitigation measures and Section 61 Findings; however, it consists of general commitments and deferral of specific commitments to subsequent design and permitting. It does not include a specific draft Section 61 Finding for each agency action. As a long-term planning document, it is not feasible to identify specific commitments for every project element; however, the Town should revise and update the mitigation section to provide a summary of all mitigation commitments and to identify specific commitments where feasible and appropriate, in particular for early phases of the Plan (e.g. shellfish propagation program, construction of Site 4 WWTF).

In addition, draft Section 61 Findings must be developed for each State Permit (e.g. Groundwater Discharge Permit, c.91 Permit, 401 Water Quality Certification). Draft Section 61 Findings will serve as the primary template for subsequent permitting conditions and should address specific regulatory program standards and requirements. The Section 61 Findings should describe proposed mitigation measures, contain clear commitments to mitigation and a schedule for implementation based on the construction phases of the project, estimate the individual cost of each proposed measure, and identify parties responsible for funding and implementing the mitigation measures. The draft Section 61 Findings will serve as the primary template for permit conditions.

Responses to Comments

The FEIR should include a copy of this Certificate and a copy of each comment letter received. In order to ensure that the issues raised by commenters are addressed, the FEIR should include a response to comments received on the DEIR to the extent that the subject matter of the comment is within the Scope. The FEIR should include either an indexed response to comment format, or direct narrative response. The FEIR should present any additional narrative or quantitative analysis necessary to respond to the comments received. This directive is not intended to, and shall not be construed to enlarge the scope of the DEIR beyond what has been expressly identified in this Certificate.

Circulation

The FEIR should be circulated in compliance with Section 11.16 of the MEPA regulations and copies should also be sent to the list of "comments received" below and to town officials in Barnstable, Falmouth and Sandwich. A copy of the FEIR should be made available for public review at the public libraries in the Towns of Mashpee, Barnstable, Falmouth and Sandwich.

September 12, 2014
Date

Maeve Vallely Bartlett

Comments Received:

9/8/14 Coastal Zone Management
9/5/14 Massachusetts Department of Environmental Protection
9/5/14 Department of Fish and Game/Division of Marine Fisheries
9/5/14 Cape Cod Commission
9/5/14 Association to Preserve Cape Cod

MVB/CDB/cdb

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
OFFICE OF COASTAL ZONE MANAGEMENT
251 Causeway Street, Suite 800, Boston, MA 02114-2136
(617) 626-1200 FAX: (617) 626-1240

MEMORANDUM

TO:	Maeve Valery Bartlett, Secretary, EEA
ATTN:	Deirdre Buckley, MEPA Unit
FROM:	Bruce Carlisle, Director, CZM
DATE:	September 5, 2014
RE:	EEA-12615, Comprehensive Watershed Nitrogen Management Plan; Mashpee

The Massachusetts Office of Coastal Zone Management (CZM) has completed its review of the above-referenced Draft Recommended Plan/Draft Environmental Impact Report, noticed in the *Environmental Monitor* dated July 9, 2014, and offers the following comments.

Project Description

The purpose of the Draft Recommended Plan/Draft Environmental Impact Report (DRP/DEIR) is to present the recommendations of Mashpee's wastewater management planning process to address the nitrogen Total Maximum Daily Loads (TMDLs) established for Popponesset Bay and Waquoit Bay's eastern basin, and to present the mitigation measures and implementation approach for the Town of Mashpee. These recommendations will be managed and implemented through the Mashpee Water and Sewer District and the Town of Mashpee. The DRP/DEIR is the most recent document submitted as part of the joint MEPA/Cape Cod Commission Joint Review Process, which began in 2001.

These previously submitted reports include: Needs Assessment Report; Technology Screening Report; Daft Alternative Scenarios Analysis and Site Evaluation Report; Two (2) Notices of Project Change; and the Alternatives Screening Report, issued in August 2013. Following the Alternatives Screening Report, the Draft Recommended Plan proposes a variety of management actions including shellfish aquaculture for nitrogen removal, expansion of wastewater treatment at existing facilities, and at new facilities, and the implementation of future Demonstration Projects. The latter projects include permeable reactive barrier options, wetland restorations projects, and a feasibility study for the Quashnet/Moonakis River.

Project Comments

CZM recognizes that the impact caused by the discharge of nitrogen through both private septic and municipal sewer systems to surrounding water bodies is a significant issue for the towns on Cape Cod. These impacts have both environmental and economic consequences. CZM supports the comprehensive planning for wastewater management and applauds the effort that has gone into the development of this plan. CZM is committed to working with the Town and assisting with the development of the final Plan and offers the following comments.

Flood Zone Mapping

Figure 8-1 in the DEIR depicts flood zones in the planning area including the 100-year flood, the 100-year flood with velocity hazard, and the 500-year flood. A note on the figure states that "Digital Q3 Flood data was obtained through MassGIS (1997)". Updated FEMA Flood Hazard Layers are currently not available for this area." As of July 16, 2014, new data and maps are now available. The Town can access these data via the National Oceanic and Atmospheric Administration's viewer or can contact CZM. These maps should be consulted to ensure that the proposed infrastructure is outside of all flood zones. While it appears that the existing New Seabury wastewater treatment plant and Site 7 discharge location are outside the current 1% and 0.2% flood zones (i.e., 100 and 500-year floods, respectively), the Town should evaluate the flood risk given the expected sea level rise over the design life of the proposed structures. In addition, the U.S. Geological Survey (USGS) has just completed a model of how groundwater will migrate upward as sea level rises on Cape Cod. We encourage the Town to use the results of this model to evaluate the long-term (20, 40, 60-year) viability of proposed and existing treated wastewater discharge sites and to plan for and acquire any necessary additional discharge sites as the Town moves toward build-out and as rising groundwater affects existing sites.

Bivalve Propagation as a Nutrient Remediation Strategy

A major component of the Town's proposed nutrient remediation plan is to remove nitrogen from watersheds via bivalve propagation. While the Town provides some estimate of the ability of bivalves to remove nitrogen in various watersheds (e.g., Tables ES-1 and 5-16), the assumption that littlenecks contain 60 g of nitrogen and that oysters contain 100 g of nitrogen (see Notes at the bottom of ES-1) appears to be significantly higher than published estimates. For example, the January 2014 Woods Hole Sea Grant Program Marine Extension Bulletin described Cape Cod quahogs (littlenecks) as containing 0.22 g of nitrogen on average and Cape Cod oysters as containing 0.28 g nitrogen on average.[1] Using the Woods Hole Sea Grant Program values to revise the values in Table 5-16, 5 million oysters have the potential to remediate 1.4 metric tons of nitrogen (only 28% of the Mashpee River Watershed load, not 50% as stated in the DEIR) and 4.87 million quahogs have the potential to remediate 1.07 metric tons of nitrogen (only 71% of the Popponesset Bay Watershed load, not 100% as stated in the DEIR). CZM suggests that the Town revise its estimates of the number and cost of bivalve propagation proposed for remediation in each sub watershed. Further, the costs associated with bivalve aquaculture (e.g., Table 5-18) appear to make several assumptions that do not appear to be realistic. For example, the Town's approach assumes that no individuals are lost to predators, weather, parasites, poaching, or low dissolved oxygen associated with eutrophication.

In addition, it is not clear if the costs include the costs of replacing lost individuals, the cost of hiring staff, or all costs associated with bivalve husbandry (vessels, gas, cages, upwellers), and the cost of enforcement. CZM also notes that several of the water bodies (Mashpee River, Shoestring Bay, Hamblin Pond) proposed for shellfish propagation are impaired by high bacteria concentrations and are on the Massachusetts Department of Environmental Protection (MassDEP) "Integrated List." Nowhere in the DEIR is there mention that the shellfish propagation approach is supported by Massachusetts Division of Marine Fisheries (*MarineFisheries*). If the Town intends to move forward with bivalve propagation, CZM would expect that the Final EIR (FEIR) would contain specific itemizations of all costs as well as a letter of support from *MarineFisherie*s. While it appears that there are many logistical hurdles to using bivalve propagation as a successful nutrient remediation strategy in waters that are already impaired, we applaud the Town for beginning to discuss alternative nutrient remediation and for considering a contingency plan should the proposed scheme for remediating nutrients via bivalve aquaculture not be adequate. We believe this contingency plan should be more explicitly stated in the FEIR (e.g., how many years of study would be needed and what would the threshold level be in order for the Town and MassDEP to consider bivalve propagation to be an inadequate remedy.

Lastly, should the Town move forward with bivalve propagation as a nutrient remediation strategy, CZM suggests that the Town describe how the nitrogen will be removed from the greater Cape Cod watershed. If the proposal is simply to harvest the clams and oysters and sell them to

[1] http://www.whoi.edu/fileserver.do?id=175985&pt=2&p=88928

Cape Cod residents or use them in some other fashion on Cape Cod, the nutrients may not truly be leaving the impaired watersheds.

Nitrogen Source Reduction

CZM looks forward to seeing the Town develop and implement a fertilizer bylaw to help reduce the sources of nutrients to coastal water bodies. We agree with the DEIR that purchasing open space and developing a growth neutral/flow neutral policy are important tools to reducing future sources of nitrogen. It is clear from Table 1-1 that the Town will need to address 100% of the existing septic system load in at least half of the sub watersheds of the planning area; this indicates that any additional load to these areas will also need to be addressed. Even if sewered areas appear to be built out, additional nutrient loads are expected in sewered areas because relief from Title 5 constraints can expand occupancy on built properties and allow development on previously undevelopable properties. If the Town does not plan for future sources of nutrients, then the great public investment proposed in the DEIR related to sewering, building treatment and discharge facilities, and shellfish propagation would be at risk for not achieving the desired water quality and ecological goals. We look forward to seeing the Town further develop source reduction strategies in the FEIR.

Nitrogen Removal and Long-Term Monitoring

In our comments on the Daft Alternative Scenarios Analysis and Site Evaluation Report, CZM requested that information be presented in the DMP/DEIR relating to the efficacy and fate of nutrients in the water quality models. This requested information included the following:

- A description of the modeling and monitoring that will be used to establish the efficacy of the proposed alternative at removing nitrogen from the watershed,
- A description of the modeling and groundtruthing efforts that will be used to determine the ultimate fate of the nitrogen load, and
- The long-term monitoring program upstream and downstream of the project that will be used to ensure that the selected alternative continues to remove nitrogen at the required rate for the duration of the project

CZM believes this information is an important part of the Town's Comprehensive Wastewater Management Plan, the results of this modeling and monitoring will guide the Town in its proposed adaptive management approach, and will ultimately be used to determine the success of the Town's nitrogen removal efforts. CZM recommends this information be provided prior to final development of the FEIR.

Federal Consistency

The proposed project may be subject to CZM federal consistency review. For further information on this process, please contact, Robert Boeri, Project Review Coordinator, at 617-626-1050 or visit the CZM web site at www.state.ma.us/czm/fcr.htm.

BC/sm/tc/rlb

cc: Stephen McKenna, CZM Cape & Islands Regional Coordinator

MEMORANDUM

TO: Deirdre Buckley, Environmental Reviewer, MEPA Unit

THROUGH: Jonathan Hobill, Regional Engineer, Bureau of Resource Protection
Philip Weinberg, Regional Director
David Johnston, Deputy Regional Director, BRP
Maria Pinaud, Deputy Regional Director, BWP
Millie Garcia-Serrano, Deputy Regional Director, BWSC
Brenda Chabot, Deputy Regional Director, ADMIN

CC: Elizabeth Kouloheras, Chief, Wetlands and Waterways
Jeffrey Gould, Chief, Wastewater Management Program
Brian Dudley, Wastewater Management Program
Pamela Truesdale, Municipal Facilities
Leonard Pinaud, Chief, Site Management
Allen Hemberger, Site Management
Gary Moran, Deputy Commissioner

FROM: Sharon Stone, SERO MEPA Coordinator

DATE: September 5, 2014

RE: DEIR EOEEA #12615 – MASHPEE – Comprehensive Watershed Nitrogen Management Plan (CWMP)

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"For Use in Intra-Agency Policy Deliberations"

The Southeast Regional Office of the Department of Environmental Protection (MassDEP) has reviewed the Environmental Notification Form (ENF) for the proposed CWMP developed for the Town of Mashpee, Massachusetts (EOEEA #12615).

<u>Wastewater Management Program</u>
Introduction

The Town of Mashpee Sewer Commission has prepared a Recommended Plan/Draft Environmental Impact Report (DEIR) for addressing nitrogen impairment in the Popponesset and the Quashnet River, Hamblin Pond, Little River, Jehu Pond and Great River subwatersheds in the Waquoit Bay system (East Waquoit watersheds) which incorporates elements of traditional and non-traditional approaches all within an adaptive management framework. The DEIR also provides significant opportunity for regional cooperation with Mashpee's neighboring communities of Barnstable, Falmouth Sandwich all within a well-defined, flexible phased schedule over a 25 year period.

With legislation passed in April 2014 establishing the Mashpee Water and Sewer District (District), the Town will be in transition with regard to responsibilities for management and oversight of planning, designing and managing infrastructure. The DEIR proposed a Memorandum of Understanding (MOU) between the Town and the District; however, there will have to be close coordination between the two entities since non-traditional approaches that normally would fall out of the purview of a water and sewer district are going to be employed.

The Popponesset and East Waquoit watersheds have been assessed and evaluated under the auspices of the Massachusetts Estuaries Project (MEP) and found to be nitrogen impaired and are both subject to Total Maximum Daily Loads (TMDLs) developed pursuant to the Federal Clean Water Act. To address the TMDLs, the DEIR focuses on a combination of nitrogen control strategies falling within the categories of 1) source reduction, 2) direct environmental mitigation and 3) land management strategies.

Traditional approaches for source reduction include integrating several privately owned wastewater treatment facilities within the two watersheds into the overall approach either by utilizing existing excess capacity or by expanding existing capacity. To accommodate areas within the watershed not accessible to the private plants, the DEIR provides options for constructing new wastewater facilities or, pending appropriate management agreements, expanding the wastewater treatment facility at Joint Base Cape Cod (JBCC) to provide treatment for some of the proposed sewer services areas. In addition to these approaches, the DEIR recommends continued Best Management Practices (BMPs) for stormwater, development of a fertilizer by-law, continued use of innovative/alternative onsite systems (I/A) and potential consideration of composting and/or urine diversion toilets (eco-toilets).

The Town of Mashpee's Shellfish Constable, in association with the Wampanoag Tribe has initiated shellfish propagation projects in the Mashpee River (2004) and Great River (2013) and proposes to expand into Popponesset Bay, Shoestring Bay, Jehu Pond and Hamblin Pond. This is proposed as the major component of the DEIR's direct environmental mitigation. Other approaches considered are permeable reactive barriers (PRBs) and bog/wetland restoration to remove or attenuate groundwater nitrogen and dredging/inlet opening to improve flushing within the embayment systems.

Land management strategies are intended to reduce the potential of build out conditions adversely impacting other nitrogen reduction efforts as opposed to considering them a strategy for immediate nitrogen mitigation. The approaches considered are a Growth/Flow Neutral by-law (required for eligibility of a 0% interest State Revolving Fund (SRF) loan), land purchases, phasing implementation with respect to maximizing near term improvements to minimize initial investments in infrastructure.

General Comments

The DEIR is well prepared and follows a logical progression allowing for flexibility in its mix of traditional and non-traditional approaches. It maintains a focus on a manageable timeline with appropriate decision points built in to the schedule to evaluate what options should be pursued or abandoned at various stages of implementation.

The DEIR focuses on traditional wastewater infrastructure coupled with shellfish aquaculture. While acknowledging that traditional approaches will be required, the DEIR anticipates that, shellfish aquaculture, if successfully documented, may augment nitrogen reductions and reduce the amount of infrastructure, with concomitant cost reductions, necessary for TMDL compliance. Several innovative approaches emerge from the plan. The first is that several existing private wastewater treatment facilities within Mashpee (New Seabury, Willowbend, Mashpee Commons, Southport and Stratford Ponds) as well as in the neighboring towns of Barnstable (Cotuit Meadows) and Sandwich (Forestdale School) figure prominently in the overall implementation strategy. The DEIR acknowledges that issues of ownership must be satisfactorily addressed, but the hope is that by utilizing excess capacity or expanding existing capacity, infrastructure costs for source reduction can be minimized.

In addition to the private facilities, use of the wastewater treatment facility at JBCC is included in the overall plan. JBCC is in the midst of a MassDevelopment evaluation to determine best uses for the site. Among the proposals is the potential for expanding JBCC's wastewater treatment facility to accommodate additional flow from the proposed project area (PPA). As with the private wastewater treatment facilities, ownership issues have to be discussed and resolved.

A second innovative consideration is the option for comprehensive inclusion of the neighboring towns of Barnstable, Falmouth and Sandwich. The DEIR clearly identifies subareas within the PPA throughout the four towns, along with the associated wastewater treatment facilities, which have the potential for accommodation in the overall implementation strategy. While no formal agreements have been finalized, the phasing plan allows for ongoing discussions among the communities to explore appropriate options for inter-municipal cooperation.

Third among the innovative strategies is the inclusion of shellfish aquaculture. As this falls outside the normal approach of source control and is considered direct environmental mitigation, the DEIR quite appropriately approaches this alternative with cautious optimism. MassDEP considers source reduction as the preferred method for nitrogen mitigation; however, approaches such as shellfish aquaculture are recognized as viable alternatives to complement and augment source reduction efforts. The DEIR documents the ongoing efforts by the town of Mashpee in piloting this approach, and provides some estimated projections of effectiveness. MassDEP would advise caution in suggesting that shellfish aquaculture alone may be able to address required nitrogen reductions in some of subembayments such as Popponesset Bay (including Popponesset Creek), Ockway Bay, Great River, Jehu Pond, Hamblin Pond and Little River. MassDEP is encouraged that Mashpee recognizes that ongoing monitoring is necessary to evaluate the ultimate effectiveness of this approach. As part of an ongoing piloting and demonstration program, Mashpee must consult with MassDEP on its proposed protocol in order to insure that the sampling and monitoring program yields appropriate verifiable data that can be accepted for MassDEP's review and evaluation of the demonstration projects. While recognizing the potential cost savings associated with shellfish aquaculture, Mashpee should balance the certainty of traditional source control methods with the uncertainty of more non-traditional approaches to strike an appropriate balance between the two. As discussed later, the DEIR does provide several opportunities within its phased timeline to evaluate and reevaluate the effectiveness of all options proposed.

The DEIR appropriately provides a contingency plan in the event that shellfish aquaculture does not yield the removals projected in the DEIR. Construction of wastewater treatment plants at Sites 4 and 6, so-called, with effluent recharge at various sites both publicly and privately owned is proposed. The major uncertainty in this plan is that Mashpee does not appear to have established appropriate agreements with either Willowbend or New Seabury for use of their property for effluent recharge. While Willowbend's special permit from the town does allow for the town to assume ownership of the "sewage treatment facility, collection system and any other appurtenant items…" it is not clear if this extends to the areas identified for effluent recharge. Furthermore, no such provision seems to exist for New Seabury. MassDEP would expect Mashpee to initiate discussions with these and any other entities over which the town has no ownership or control to establish agreements for use of property for any uses relative to the contingency plan. Such agreements and their status, or alternatives should agreements be unobtainable, should be more fully discussed in the Final EIR. MassDEP also notes that it is not specifically stated in the DEIR if this contingency plan alone will meet the nitrogen removal targets necessary for TMDL compliance. The Final EIR should clarify this point. As an alternative to effluent recharge at these sites, recent changes to the Ocean Sanctuaries Act may make an ocean outfall feasible which could possibly negate the need for effluent recharge at these sites. The Final EIR should explore this option in more detail.

The DEIR provides a detailed phasing plan that extends from 2016 to 2040. The interim timeframe from the present through 2015 includes establishing an MOU between the Town and the District. The Final EIR should provide more detail with respect to the MOU in outlining responsibilities of each party and the means by which they will coordinate their efforts in refining the recommended plan. Other actions proposed during this period are to continue with the shellfish propagation program, continue with ownership discussions regarding JBCC and the use of private wastewater treatment facilities, continued discussion for regional MOUs with the towns of Barnstable, Falmouth and Sandwich, implementation of fertilizer management and/or bylaw and continued use of stormwater BMPs.

Phase 1 covering the period from 2016 to 2020 includes expansion of the shellfish propagation program to related sections of Popponesset Bay and new sites in Jehu Pond and Hamblin Pond. This phase also proposes the design and construction of improvements at JBCC, (or at the Town owned Back Road site if there is no agreement on a regional facility at JBCC) design and construction of the Site 4 Facility or 0.1 MGD and related collection system and connection of the Quashnet and Combs schools to the Mashpee Commons wastewater treatment facility. Culminating this phase will be an update of the MEP models (land use and hydrodynamics) to calibrate with water quality and benthic flux sampling.

Phase 2 covers the period from 2021-2025. If the JBCC facility is available, then connection of some of the Falmouth and Sandwich sections of the PPA would begin to start to address Quashnet River TMDL requirements. Shellfish propagation efforts would continue to be expanded. At this point, as part of the adaptive management process, existing shellfish propagation efforts would be evaluated and if removals have not met anticipated levels then the Site 4 facility would be expanded to serve Mashpee River and Popponesset Bay, upgrade the private facilities at Willowbend, Stratford Ponds, South Cape Village and Windchime Point, extend the sewer in the Mashpee River and Popponesset Bay. In conjunction with Barnstable's planning efforts, certain sections of Cotuit within the PPA could be addressed at this time. Culminating this phase will be an update of the MEP models (land use and hydrodynamics) to calibrate with water quality and benthic flux sampling.

Phase 3 will initiate in 2026 and end in 2030. IF proven successful, additional shellfish propagation will proceed. If the shellfish program is not meeting expectations then the private wastewater treatment facility at Southport will be upgraded, the Site 4 wastewater treatment facility will be expanded along with expansion of the sewer service area to serve the Mashpee River and Popponesset Bay subwatersheds, the Willowbend wastewater treatment facility service will be expanded, the Site 6 wastewater treatment facility will be designed and constructed to serve the Ockway Bay area, New Seabury recharge facilities will be constructed to receive effluent from Mashpee Commons and Site 6. This phase would also anticipate Barnstable and Sandwich addressing the remaining portions in the Popponesset watershed. Culminating this phase will be an update of the MEP models (land use and hydrodynamics) to calibrate with water quality and benthic flux sampling.

Phase 4, from 2031 to 2035 will evaluate the need to upgrade the privately owned Cotuit Meadows and Wampanoag Village wastewater treatment facilities to provide additional nitrogen removal. If the shellfish propagation program is not meeting expected levels of performance, then expansion of the Site 6 wastewater treatment facility and associated sewer, Site 4 collection system, collection system on Great Neck Road to Mashpee Commons, and collection system Hamblin and Jehu Pond areas will be initiated. Upgrade and expansion of the New Seabury wastewater treatment facility is also anticipated at this time. Culminating this phase will be an update of the MEP models (land use and hydrodynamics) to calibrate with water quality and benthic flux sampling.

The final phase, Phase 5, will occur from 2035-2040. Based on performance of the shellfish propagation effort, the options are to complete collection system expansion within Mashpee. Remaining portions of Barnstable and Sandwich would be removed outside the watershed or treated to appropriate levels as determined by MEP modeling. Culminating this phase will be an update of the MEP models (land use and hydrodynamics) to calibrate with water quality and benthic flux sampling.

Monitoring will be an important part of the recommended plan so that progress and effectiveness of its various elements can be properly documented. The DEIR acknowledges that wastewater treatment facility performance will be monitored through MassDEP's Groundwater Discharge Permit Program. Performance of the shellfish propagation program is proposed to be evaluated through commercial harvest data reported to the Division of Marine Fisheries (DMF) and recreational harvest data monitored by Mashpee. Shellfish will be analyzed for nitrogen content and quantified. While water quality monitoring data will follow the same protocols through the ongoing Mashpee Water Quality Monitoring Program, Mashpee and MassDEP need to discuss the details of the shellfish aquaculture program to insure that all monitoring and data collection is adequate and appropriate for use in determining nitrogen removal credits assigned to shellfish aquaculture.

MassDEP believes that the phased program over a 25 year period strikes the appropriate balance between the need to provide flexibility in evaluating innovative nitrogen reduction strategies that may help reduce costs while allowing for defined decision points to determine if more traditional approaches need to be pursued.

The approach taken in the DEIR appears to be consistent with the spirit and intent of the Cape Cod Commission's ongoing 208 planning process. The plan addresses a nitrogen mitigation and management plan with respect to watersheds and sets the groundwork for a regional approach among four municipalities. It also embraces the use of non-traditional approaches while at the same time recognizing the need for core areas of traditional infrastructure. The DEIR clearly lays out an adaptive timeline with decision points allowing the plan to pivot to various options as needed. Through the 208 process, the Cape Cod Commission has developed watershed tools to help assess proposed nitrogen load reductions, assign and select priorities, and take advantage of regional efforts. MassDEP recommends that Mashpee coordinate closely with the Commission as the FEIR is developed.

Specific Comments

Table 1-1 does not reference removal requirements for the Child's River subwatershed. However, Phase 5 does reference nitrogen management in the Child's River portion of Subarea H. The Final EIR should clarify or reconcile the level of removal anticipated for this subwatershed.

Section 4.2 discusses various options for source removal. As part of the discussion an existing town policy for eco-toilets is mentioned. The Final EIR should provide a brief synopsis of the policy or, alternatively, provide the policy as an appendix.

Section 4.52.2 references construction of wastewater treatment facilities initially designed to treat to 6 to 10 mg/L of total nitrogen (TN) with the capability of adding denirification filters to achieve a level of 3 mg/L. It is unclear if the TMDL compliance is achievable at the 6 to 10 mg/L TN level or if it is necessary to treat to 3 mg/L. Perhaps the different levels of treatment relate to the effectiveness of the shellfish propagation program. The Final EIR should clarify this point.

Section 4.5.2.6 references BMPs for stormwater. The Final EIR should clarify if Mashpee intends to require BMPs for new development or redevelopment only or if it will embark on a program of retrofits for existing stormwater structures.

Section 5.4 and Table 5-2 reference wastewater treatment for Briarwood/Otis trailer Village and Tri-Town Circle which are in areas ostensibly not requiring nitrogen removal. MassDEP understand that inclusion of these areas is in anticipation of future build-out loads. The Final EIR should clarify this point.

Table 5-17 suggests that shellfish aquaculture may account for 100% or the required nitrogen removal in some subwatersheds. MassDEP acknowledges that these are projections and will be evaluated for verification as part of adaptive management; however, MassDEP cautions against over optimistic expectations for effectiveness.

Section 5.9 references the extension of the Wampanoag Village wastewater treatment facility to pick up an additional 7,000 gpd from adjacent areas. It is not clear if this 7,000 gpd is in addition to the offset required under the existing GWDP. The Final EIR should clarify this point.

Section 6.2.1 discusses shellfish aquaculture and references Appendix 5-1. The figures presented in the Appendix are presented in kg/d. In looking at total loads incorporating benthic flux, it should be recognized that benthic flux is not exerted throughout the entire year. It is not clear if the values are annualized. This should be clarified in the Final EIR.

Section 6.2.2 discusses the use of JBCC relative to this DEIR. As discussions with JBCC proceed, considerations for all potential future needs for Barnstable, Bourne, Falmouth, and Sandwich should be considered.

Section 6.2.3 discusses wastewater treatment alternatives including effluent recharge. Proposals for the use of drip irrigation at the New Seabury and Willowbend golf courses are good ideas, but the specifics of design, location loading rates, etc. will have to be evaluated during the permitting process.

Section 6.2.4 discusses improvements to existing wastewater treatment facilities. In addition to securing agreements with the facilities not under Mashpee's control, a complete evaluation of capacity for expansion will have to be conducted.

Section 6.2.7 discusses management of onsite I/A systems. MassDEP agrees that a management entity is required and suggests that the entity could be developed as a municipal function or within the water and sewer district. It may not necessarily require a separate management district.

Section 6.3.1 discusses stormwater management. It appears that the DEIR is not seeking credit for nitrogen removal from stormwater BMPs.

Section 6.3.3 discusses future demonstration projects. MassDEP encourages the town to keep its options open as various non-traditional approaches are piloted and based on results, these could be incorporated into the recommended plan as part of the adaptive management process.

Section 7.2.2 makes reference to the hydrogeologic investigations at Site 4. Further evaluation of these findings will be part of the groundwater discharge permitting process.

Summary Remarks

The DEIR is a solid mix of traditional planning with an openness to new ideas. MassDEP believes that through adaptive management, regional cooperation, public/private partnerships and a watershed focus the recommended plan can serve as a model for future nitrogen mitigation planning for all of Cape Cod. These comments have identified areas that require further investigation where Mashpee needs further consultation with MassDEP. Furthermore, where contingency plans rely on facilities outside Mashpee's control, those issues should be more fully explored and documented for inclusion in the Final EIR. In relation to this option, the feasibility of an ocean outfall should be evaluated.

Given the magnitude and complexity of the issues addressed in the DEIR, MassDEP commends the Town of Mashpee for developing a coherent, well thought out plan and looks forward to working with the town to make it come to fruition.

Municipal Facilities

The CWNMP/DEIR presents recommendations to address the Total Maximum Daily Loads (TMDLs) as established for Popponesset Bay and eastern Waquoit Bay through the Massachusetts Estuaries Project (MEP) in 2006. The Town of Mashpee initiated their work on a Watershed Nitrogen Management Plan in 1999 to address the nitrogen impacts to their coastal embayments and evaluate options for restoring them through the development of a Comprehensive Wastewater Management Plan (CWMP). The task was complex, as the watersheds to these embayments include portions of the adjacent communities of Barnstable, Falmouth and Sandwich. The Town had eight previous scenarios/options for nitrogen removal modeled through MEP to produce the resulting plan, which will address implementation in 5 phases over a 20 year plus scenario.

The plan reflects a multiple approach to reducing nitrogen in the Town's two primary salt water embayments. The identified possible components include shellfish aquaculture; sending additional flow and expanding the capacity at the WWTF for treatment at Joint Base Cape Cod; construction of new wastewater treatment as well as recharge facilities at the New Seabury and Willowbend Golf Courses; improvements/expansions and modifications to accommodate additional flows at the existing WWTFs at Mashpee Commons, New Seabury, Willowbend Golf Course, Mashpee High School, Cotuit Meadows and Wampanoag Village; continued use of existing smaller wastewater

treatment facilities; coordination and regional assistance with neighboring communities of Barnstable, Falmouth and Sandwich in addressing nitrogen sources within their town boundaries; developing a management structure for areas where on-site septic systems and alternative/innovative (I/A) systems will remain in use; non-wastewater management components, i.e. stormwater and fertilizer management; and possible future demonstration projects like permeable reactive barriers, wetlands restoration projects and eco-toilets and advancement of the Cape Cod Commission's 208 planning efforts.
The Town has clearly put many years worth of time and effort in refining the possible approaches to meeting the TMDLs in Popponesset and Waquoit Bays. Regional approaches are a large part of the planning efforts, which makes sense as watersheds do not follow political boundaries. Use of neighboring communities and their cooperation to reduce nitrogen levels are a creative way to approach a solution that cannot be obtained wholly within Mashpee town lines. MassDEP has been encouraging this "outside of the box" solution thinking for long term wastewater planning. The Town of Easton recently utilized this innovative approach with their Final CWMP. The Town of Falmouth's recent CWMP has also taken a multi-faceted approach to their long term wastewater needs. In particular, Mashpee will be watching closely the Town of Falmouth's pilot projects and adaptive management approaches, i.e. permeable reactive barriers, wetland restoration projects and eco-toilets, and how successful they are in reducing nitrogen in embayments, before making any final decision on their use.

Final implementation of the plan addresses three major categories:
1) Short term initiatives: Current/2014. This includes completion of the CWMP/FEIR, establishment of a Mashpee Water & Sewer District, current shellfish propagation project, WWTF ownership discussions, development of regional Memorandums of Understanding and local fertilizer management bylaw and stormwater BMPs.

2) Phase 1 implementation: 2016-2020. This includes a long list of specific projects to design and construct to connect collection systems to various WWTFs and expand shellfish propagation areas.

3) Long Term Implementation and Adaptive Management, Phases 2 through 5: 2020 to 2040 and beyond.

The CWNMP/DEIR is a thorough and thoughtful plan to address the nitrogen impacts, and long term remediation of the nitrogen impacts to Mashpee's embayments to achieve their TMDLs. MassDEP-SERO recommends that this document proceed to completion of the CWMP/FEIR.

Construction Stormwater Permit
The project construction activities may disturb one or more acres of land and therefore, may require a NPDES Stormwater Permit for Construction Activities. The proponent can access information regarding the NPDES Stormwater requirements and an application for the Construction General Permit at the EPA website:
http://cfpub.epa.gov/npdes/stormwater/cgp.cfm

Bureau of Waste Site Cleanup
Based upon the information provided, the Bureau of Waste Site Cleanup (BWSC) searched its databases for disposal sites and release notifications located within and near the proposed project area. A disposal site is a location where there has been a release to the environment of oil and/or hazardous material that is regulated under M.G. L. c. 21E, and the Massachusetts Contingency Plan [MCP – 310 CMR 40.0000].

The proposed project involves development of a town-wide comprehensive watershed nitrogen management plan for the Town of Mashpee. The project area includes the watersheds of Popponesset Bay and Waquoit Bay-East.

Please be advised that there are many BWSC disposal sites located within and near the proposed planning area. Many of the sites have been closed under the MCP, but many other disposal sites are open, and require continued environmental response actions under the MCP. A listing and discussion of the status of these MCP sites will not be presented here. The Project Proponent is encouraged to consult the BWSC Waste Sites/Reportable Release Lookup at: http://public.dep.state.ma.us/SearchableSites2/Search.aspx
In addition, the Project Proponent can view a map showing BWSC disposal sites located within and near the proposed planning area using the MassGIS online data viewer (Oliver) at: http://maps.massgis.state.ma.us/map_ol/oliver.php Under "Available Data Layers" select "Regulated Areas", and then "DEP Tier Classified 21E Sites".

The Project Proponent is advised that if oil and/or hazardous material are identified during the implementation of this project, notification pursuant to the Massachusetts Contingency Plan (310 CMR 40.0000) must be made to MassDEP, if necessary. A Licensed Site Professional (LSP) should be retained to determine if notification is required and, if need be, to render appropriate opinions. The LSP may evaluate whether risk reduction measures are necessary or prudent if contamination is present. The BWSC may be contacted for guidance if questions arise regarding cleanup.

Proposed s.61 Findings
The "Certificate of the Secretary of Energy and Environmental Affairs on the Draft Environmental Impact Report" may indicate that this project requires further MEPA review and the preparation of a Final Environmental Impact Report. Pursuant to MEPA Regulations 301 CMR 11.12(5)(d), the Proponent will prepare Proposed Section 61 Findings to be included in the EIR in a separate chapter updating and summarizing proposed mitigation measures. In accordance with 301 CMR 11.07(6)(k), this chapter should also include separate updated draft Section 61 Findings for each State agency that will issue permits for the project. The draft Section 61 Findings should contain clear commitments to implement mitigation measures, estimate the individual costs of each proposed measure, identify the parties responsible for implementation, and contain a schedule for implementation.

The MassDEP Southeast Regional Office appreciates the opportunity to comment on this proposed project. If you have any questions regarding these comments, please contact Sharon Stone at (508) 946-2846.

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CAPE COD
COMMISSION

Via EMAIL

September 5, 2014

Secretary Maeve Vallely Bartlett
Executive Office of Energy and Environmental Affairs (EEA)
Attn: MEPA Office, Deirdre Buckley, Project Analyst
100 Cambridge Street, Suite 900
Boston MA 02114

Re: Comment Letter EENF/ DEIR
EEA No. 12615
Mashpee Comprehensive Watershed Nitrogen Management Plan

Dear Secretary Bartlett:

On June 27, 2014, the Cape Cod Commission (Commission) received a copy of an Expanded Environmental Notification Form (EENF)/Draft Environmental Impact Report (DEIR) prepared by GHD for the above-referenced project. As described in the EENF/DEIR, the project proposes a comprehensive wastewater and nitrogen management plan for the Town of Mashpee, intended to achieve reductions of wastewater nitrogen loading and meet Total Maximum Daily Loads (TMDLs) for nitrogen loading to the Town's coastal embayments, including Popponesset Bay and Waquoit Bay's eastern basin.

Commission staff reviewed the EENF/DEIR, and held a public hearing thereon at the Mashpee Town Hall on August 26, 2014, pursuant to the MOU between the Commission and EEA. Please find attached a copy of the staff report prepared for the hearing, which serves as the Commission's comment letter on the EENF/ DEIR.

Please feel free to contact Commission staff with any questions on this comment letter.

Sincerely,

Patty Daley
Deputy Director

ENC
Cc: Project File
Tom Fudala, Mashpee Town Planner by email
Paul R. Gobell, Mashpee Sewer Commission Administrator by email
J. Jefferson Gregg, GHD, by email

STAFF REPORT

CAPE COD COMMISSION

PROJECT: **Comprehensive Wastewater Management Plan/Draft Recommended Plan/Draft Environmental Impact Report**
Town of Mashpee for a Watershed Nitrogen Management Plan for the Town of Mashpee
(Commission Project: JR20076, MEPA EEA Project No.: 12615)

TO: Jonathon Idman, Chief Regulatory Officer (Hearing Officer)

STAFF: Caroline Harper, Energy Specialist
Jeffrey Ribeiro, Regulatory Officer
Garry Meus, Regulatory Officer
Glenn Cannon, Technical Services Director
Heather McElroy, Natural Resources Specialist
Lev Malakhoff, Senior Transportation Engineer
Patty Daley, Deputy Director
Sarah Korjeff, Planner & Historic Preservation Specialist
Scott Michaud, Hydrologist
Sharon Rooney, Chief Planner
Tom Cambareri, Water Resources Program Manager

DATE: September 5, 2014

INTRODUCTION

The Cape Cod Commission (Commission) has received a Comprehensive Wastewater Management Plan (CWMP), Draft Recommended Plan/ Draft Environmental Impact Report (DEIR), from the Town of Mashpee Sewer Commission (Applicant). The CWMP/DEIR proposes to achieve reductions of wastewater nitrogen loading and meet Total Maximum Daily Loads (TMDLs) for nitrogen loading to the Town's coastal embayments including Popponesset Bay and Waquoit Bay's eastern basin and has been noticed in the Massachusetts Environmental Policy Act (MEPA) Environmental Monitor. As the project will require the preparation of an Environmental Impact Report (EIR), it is also subject to Commission Development of Regional Impact (DRI) review pursuant to the Cape Cod Commission Act and Section 2(d)(i) of the Commission's DRI Enabling Regulations (revised March 2013) as "[a]ny proposed development for which an Environmental Impact Report (EIR) is required to be prepared under the provisions of MEPA shall be deemed a DRI."

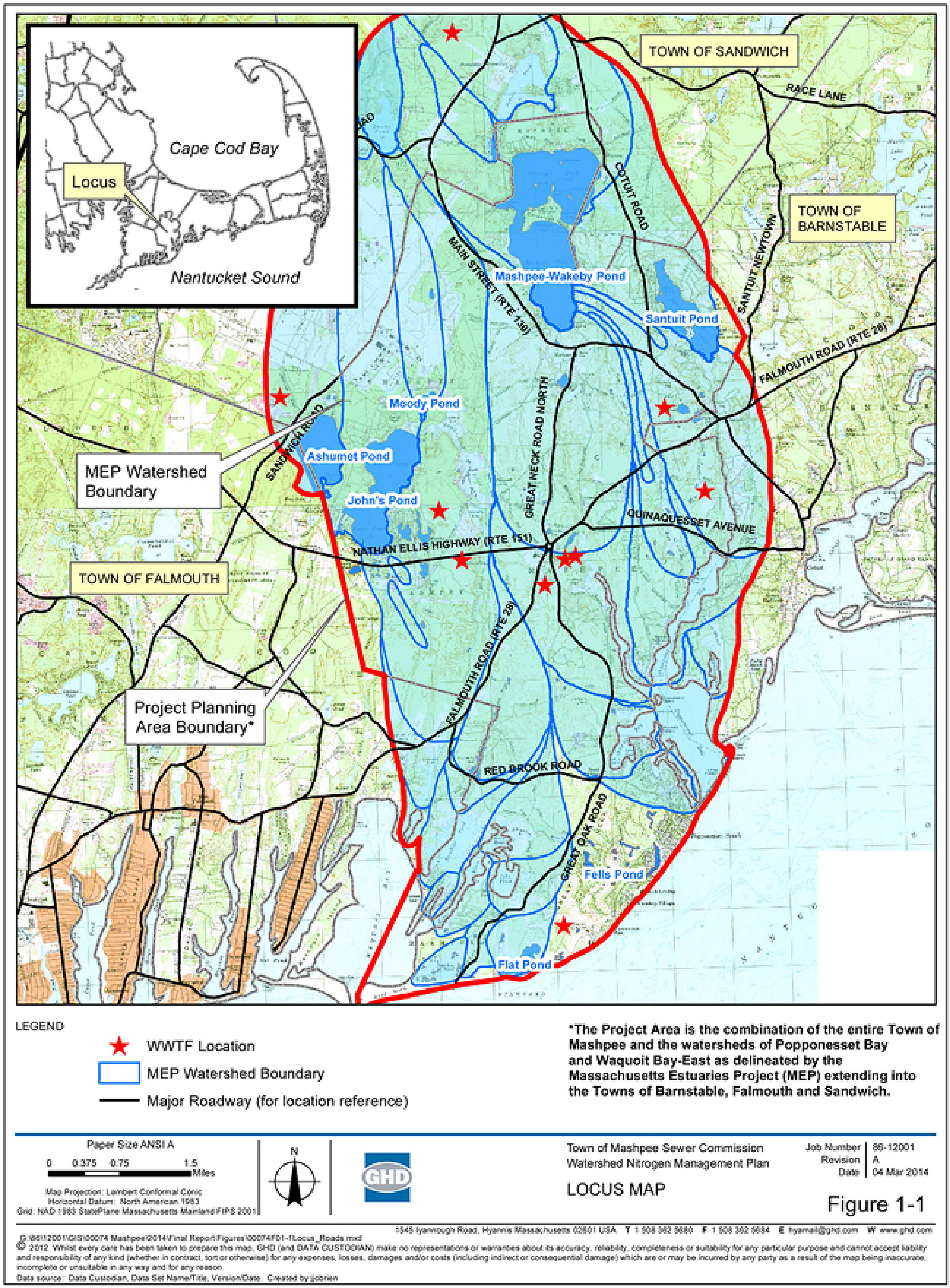

Figure 1.1: Project Planning Area depicting watershed boundaries for the Mashpee Comprehensive Wastewater Management Plan (CWMP) as provided by the Town of Mashpee.

Pursuant to the Massachusetts Environmental Policy Act (G. L. c. 30, ss. 61-62H) and section 11.03 of the MEPA regulations (301 CMR 11.00), the Secretary of Energy and Environmental Affairs (Secretary) issued a Certificate on November 9, 2001 on the Environmental Notification Form (ENF) for the Comprehensive Nitrogen and Wastewater Management Plan for the Town of Mashpee, requiring the preparation of an EIR. The Secretary then issued a Certificate on November 26, 2007 on an initial Notice of Project Change following the Applicant's submittal of a final Needs Assessment report in October 2007 in accordance with the MEPA regulations for a lapse of time, at 301 CMR acknowledging that the project was under a joint MEPA/Cape Cod Commission review. The Secretary then issued a Certificate on a second Notice of Project Change on July 6, 2012 in accordance with the MEPA regulations for a second lapse of time, according to 301 CMR 11.10(2). The Secretary issued a Certificate on November 1, 2013 following the Phase 2 Submittal of the Final Alternatives Screening Analysis Report.

The Commission received the Draft Environmental Impact Report (DEIR) on June 24, 2014 from the Applicant's representative, J. Jefferson Gregg, P.E., BCEE, of GHD. A Joint MEPA/DEIR public hearing was held on August 26th at the Waquoit Meeting Room at Mashpee Town Hall for the purpose of gathering information and public comment on the DEIR and to recommend a scope for the Final EIR (FEIR).

PROJECT DESCRIPTION

The Town of Mashpee's proposed CWMP is intended to achieve reductions of wastewater nitrogen loading and meet Total Maximum Daily Loads (TMDLs) for nitrogen loading to the Town's coastal embayments including Popponesset Bay and portions of Waquoit Bay. The project involves the development of a comprehensive nitrogen and wastewater management plan for the Town of Mashpee including the entire watershed of Popponesset Bay and the eastern Waquoit Bay basin. The DEIR/CWMP addresses those portions of the watershed in the adjacent towns of Barnstable, Falmouth and Sandwich.

The CWMP/DEIR includes a summary of the Town's identification and screening of alternative solutions to meet its wastewater needs and summaries of its detailed evaluations of scenarios for wastewater and nitrogen management. As indicated in the CWMP/DEIR, the Mashpee Sewer Commission identified eight different scenarios for evaluation and analysis to develop the Recommended Plan.

The initial scenarios developed in 2008 include:

- Scenario 1 – No expansion of existing wastewater treatment facilities.
- Scenario 2 – Upgrade and expansion of existing facilities to practical extent.
- Scenario 3/3R – Cluster scenario (prepared by Lombardo Associates, Inc.).
- Scenario 4 – Fair Share.
- Scenario 5 – Centralized approach.

The initial 5 (five) scenarios were fine-tuned through significant additional work resulting in the following three options as submitted in 2013:

- Option 1A – maximization of recharge outside the watersheds of the project planning area
- Option 1B – recharge within the watersheds and addressing flows from outside the community within Mashpee
- Option 1C – a modification of Option 1A – outside communities handled the same, all Mashpee flows recharged within the watersheds

The proposed 2014 recommended plan was then constructed from Option 1A with additional considerations and evaluations including use of a Regional facility at Joint Base Cape Cod and shellfish aquaculture in several of the projects subwatersheds.

The CWMP/DEIR also identifies Subareas to be addressed for nitrogen removal, monitoring and modeling, and a preliminary implementation schedule establishing five year planning and implementation increments. It also describes estimated costs of the recommended Plan including Phase 1 of Implementation with shellfish aquaculture, as well as environmental evaluations on impacted resources.

The Town of Mashpee CWMP presents recommendations to address the nitrogen TMDLs established for Popponesset Bay and Waquoit Bay's eastern basin. The EENF/ DEIR delineates a planning area boundary for the CWMP, within which the location of existing discharge sites and wastewater treatment facilities (WWTFs), and proposed locations for new treatment and discharge sites, are detailed.

COMMENTS ON THE DEIR

Commission staff has reviewed the DEIR for consistency with the 2009 Regional Policy Plan (RPP), as amended in August 2012, and offers the following comments on the project and DEIR. These comments are intended to inform future Development of Regional Impact (DRI) review of the CWMP.

LAND USE

RPP Land Use Goal LU1 is *to minimize adverse impacts on the land by using land efficiently and protecting sensitive resources, and to create vibrant communities by directing growth and redevelopment to appropriate locations*. The Regional Land Use Vision Map (RLUVM) adopted as part of the 2009 RPP identifies the town's vision for desired land uses. The Town of Mashpee has not adopted a Land Use Vision Map and therefore MPS LU1.1 does not apply. Goal LU2 is *to use capital facilities and infrastructure efficiently and in a manner that is consistent with Cape Cod's environment, character, and economic strengths, and that reinforces traditional village-centered development patterns*. MPS LU2.1 states that *proposed or expanded infrastructure shall support compact development patterns*. It is recommended that the FEIR include a more detailed discussion of how proposed wastewater infrastructure will support compact development patterns in the Town consistent with RPP Land Use goals, local planning goals and current Mashpee zoning which includes but is not limited to mandatory cluster, transfer of development rights (TDR), and two acre zoning.

<u>Buildout Analysis</u>

In order to obtain a Town-wide, long range view of the nitrogen and other issues in Mashpee, a buildout analysis was performed by the Mashpee Planning Department in 2009 for use in the CWMP assessment. The buildout analysis was completed on a parcel basis based on existing building permits, known (proposed) projects, zoning, and numerous other aspects that impact development. The Town's analysis also provided estimates of possible future uses (retail, office, warehouse, etc.) and potential building sizes. Both the MEP analysis (to an extent) and the 2011 analysis used the Town's buildout estimates to determine future wastewater flows and nitrogen loads. Buildout for Falmouth and Sandwich were based on MEP efforts associated with those towns; Barnstable buildout estimates were based on information from the Barnstable Town Planner.[1] The town has provided Commission staff further details from the2009buildout and

[1] *Mashpee Sewer Commission, Final Needs Assessment Report.* 00074.7 7-2

about potential buildout for residential and commercial development within the Town of Mashpee, which staff will analyze and address in its subsequent comments on the FEIR.

Land Use Control Mechanisms

The Secretary's Phase 2 Certificate dated November 1, 2013 stated that the DEIR should include a detailed discussion of potential land use control mechanisms that can be employed to limit secondary growth impacts associated with implementation of the CWMP. The DEIR includes a brief discussion of potential and ongoing land management strategies to reduce future growth potential in Section 4.4 including:

- Growth Neutral/flow neutral policy (to be adopted)
- Purchase of open space/development buildout properties
- Potential well and/or treatment and disposal sites
- Phasing that targets year-round developments and applies near-term solutions to seasonal areas
- Nutrient Management/ Fertilizer Control By-law

As these strategies are a key component of reducing future growth potential, the FEIR should either include those not currently in existence (i.e. Growth Neutral) or elaborate on how they are already included in the proposed phasing plan for implementation and provide additional information on each of the proposed strategies, including a description of near-term solutions for seasonal areas. It would also be helpful to provide a summary of past and ongoing land management activities (e.g. past land acquisitions protective of the Mashpee River, adoption of mandatory cluster and TDR bylaws, etc.) as well as a characterization of the how close the town is to reaching buildout.

Joint Base Cape Cod

The Final Alternatives Screening Analysis report includes discussion of potential use of Joint Base Cape Cod (JBCC), formerly Massachusetts Military Reservation (MMR) for wastewater disposal and treatment. The DEIR includes a letter from the Board of Selectmen dated March 27, 2013 stating the Town's interest in the use of facilities at JBCC. The DEIR acknowledges that because a local/regional plan has yet to be developed or agreed upon with JBCC, the details of its use may need to be addressed as part of the adaptive management approach with the neighboring towns of Falmouth and Sandwich.

Staff supports continued efforts by the Town to work with the 102nd Intelligence Wing and neighboring towns to pursue planning efforts for shared wastewater services. The Commission has applied for funding from the Department of Defense, Office of Economic Adjustment, to examine the feasibility of long-term potential transfer of the wastewater and water supply systems to a regional or other public entity. OEA funding is also being sought to conduct a business case analysis for future ownership and operation of the wastewater and water supply systems at JBCC by MassDevelopment. The Upper Cape towns, including Mashpee, will be key stakeholders in these joint planning efforts as this project proceeds.

Additional discussion of the JBCC facility is discussed below in the Water Resources section.

WATER RESOURCES

The Mashpee DEIR/CWMP presents a mosaic of both traditional and non-traditional solutions that will be implemented over the course of 25 years to attain compliance with the required nitrogen removal to restore water quality in Popponesset Bay, and eastern Waquoit Bay, consisting of Hamblin Pond, Jehu Pond and the Quashnet/ Moonakis River. The Plan is a town-wide plan and strives to address water quality restoration in the shared Popponesset and Waquoit embayments, but could be construed as a Targeted Watershed Management Plan (TWMP) because it does not completely address Waquoit Bay (eastern Waquoit is segmented from west Waquoit because west Waquoit is to a large degree within the boundaries of the Town of Falmouth). Because shellfish aquaculture has a significant nitrogen reduction potential, the immediate traditional infrastructure components of the plan are targeted to supplement the proposed aquaculture projects to specifically meet TMDLs in the Mashpee River and Quashnet River watersheds. Otherwise, traditional infrastructure solutions are deferred over a 25 year period with five year milestones of review of shellfish aquaculture performance review under an adaptive management plan.

The Mashpee CWMP includes innovative aspects that the Commission finds consistent with the draft 208 Plan Update and could be found as consistent with the Regional Policy Plan. However, additional work is needed to better characterize the incremental nitrogen reduction of the Phased plan and its prioritization. The Commission can provide technical assistance for these characterizations and will devote staff and new tools, including the WatershedMVP, to assist the town upon request.

The Alternatives Screening Assessment Report presented Options 1A, B and 1C. These options were run by the MEP to confirm the ability of the option to reduce nitrogen by the required amount to restore water quality. They are briefly summarized by the following:

> Option 1A – Collect and treat 2.7 MGD of wastewater. Send a majority of wastewater flow (1.03 MGD) to the outside of the watersheds (multiple sites were considered) for disposal. One of the sites initially considered was Rock Landing under the assumption that the public supply wells could be relocated in the future. Continued and expanded use of four existing WWTFs, and use of two proposed WWTFs. Assumption that wastewater from portions of Falmouth, Sandwich and Barnstable would be treated by those towns out-of – watershed. A component of Falmouth is treated within Mashpee.
>
> Option 1B – Collect and treat 2.7 MGD of wastewater. Manage wastewater flow within the watersheds that generate the flow. This option assumes that 4 new WWTF sites would receive 1.67 MGD with the majority of discharge in the eastern portion of town going to Willowbend. This option includes Sandwich and Barnstable flows remaining in the Popponessett watershed, with the latter flows being treated at Willowbend (except for the Barn-39 sector) and Falmouth flows being addressed the same way as Option 1A. Less flow remains to be treated with Title 5 system in this alternative.
>
> Option 1C – This is similar to Option 1A but includes wastewater in the neighboring towns being managed like Option 1B.

These three scenarios were modeled by the MEP to confirm their ability to achieve the required nitrogen reductions and appropriate nitrogen concentration at the Sentinel stations. The MEP used the "universal database of 2009" within the previous Linked Water Quality Models. The Town had the MEP use the nitrogen load from the 2009 estimated buildout conditions to model achievement of the water quality goals at buildout. The scenarios achieved the sentinel station required nitrogen concentrations in the Popponesset system and its embayments, but they were not reached for the Waquoit subembayments. The MEP scenario report indicates that the more recent whole Waquoit Bay MEP Technical report shows that the loading throughout the entire watershed contributes more than can be reduced by the scenarios in the watersheds to just the eastern embayments. The MEP report indicates that the solution for Waquoit Bay will require targeted reductions throughout the watershed. Since buildout will not occur until an undetermined future date, and the Modeling did not account for any other reductions in the western parts of Waquoit Bay, it is possible that the scenarios might be closer to achieving the targets under present conditions. These MEP results are applied to the Modified and default Option 1A below

The DEIR/CWMP retains and modifies Option 1A, which continues to propose Site 7 and additional areas of New Seabury and no longer proposes use of the Rock Landing well site for wastewater disposal, as the default traditional plan. Because this option rests on the results of the 2012 MEP results, it is assumed that the previous discharge distribution conceptually conforms to the new discharge configuration of the 2014 Modified Option 1A below, but the FEIR should clarify.

- 2014 Modified Option 1A Use of existing private and public WWTF (< 3 ppm NO3) at:
  - South Cape Village
  - New Seabury
  - Willowbend
  - Windchime Point
  - Stratford Ponds
  - Mashpee High School
  - Southport
  - Mashpee Commons
- Use and expansion of private and public collection area to the WWTFs at:
  - Cotuit Village
  - Wampanoag Village
- Three new WWTF (1.2 MG combined @ < 10 ppm NO3) to be located at:
  - Site 4 – Transfer Station
  - Site 6 - Red Brook Road
  - Site Bk Rd 1 – Back Road (< 3 ppm NO3)
- New Effluent Disposal Sites (1.48 MGD combined) at:
  - Site 7 – New Seabury (1.0 MGD)
  - Site 4- Transfer Station (0.1 MGD)
  - BkRd – Back Road Site (0.3 MGD)
- Neighboring Towns
  - Falmouth – collected and treated out of watershed (50,000 gpd)
  - Barnstable – collected and treated out of watershed (80,000 gpd)
  - Sandwich – collected and treated out of watershed (300,000 gpd)
- Title 5 and Innovative Alternative Septic Systems
  - Existing IAs to continue
  - Title 5 to continue ~0.5 MGD

<u>DEIR/CWMP Evaluations and Recommended Plan Development</u>

In the FEIR, components of the Modified 2014 Option 1A are compared to several potential alternatives including: Centralized vs Cluster Solutions, Regional solutions involving the WWTF at Joint Base Cape Cod (JBCC), and the use of non-traditional technologies including Shellfish aquaculture, Permeable Reactive Barriers and Bog/Wetland restoration. The results of these evaluations are used to form the draft Recommended Plan.

Centralized vs Clustered Assessment

Centralized vs cluster treatment was evaluated for the five areas listed below.

Location	Flow	Parcels	MVP Flow through
Briarwood/Otis Trailer Park	34K	320	44%
Pickerel Cove	6.2K	60	25%
Pirates Cove	13K	150	100%
Tri-Town Circle	6.3K	90	20%
Santuit Pond	29K	180	26%

The DEIR includes a comparative analysis that evaluates cost, collection, treatment, and a range of various treatment locations and discharge sites from an individual cluster facility to one where the wastewater flow is combined into a larger Option 1A treatment scheme. From a cost per kilogram of nitrogen removal perspective the lowest cost option is always the larger facility. However, in a plan that will be incrementally implemented, a cost premium for an independent facility may be desirable. The plan compares potential advantages and disadvantages of both approaches but does not conclude which may be the best option. An additional detail that should be considered is the total nitrogen contribution to the overall and sub-embayment load of the watershed. Staff used the Watershed/MVP tool to list the nitrogen flow through factor associated with each of these areas accounting for natural attenuation. In some cases like Tri-Town, only 20% of the nitrogen will get to the embayment. In the case of Pirates Cove 100% of the nitrogen load gets to the embayment. Use of the Commission's tools provides an ability to rank explicit nitrogen reduction benefits for making decisions on priorities and staff is available to work with the town to further explore these options.

Joint Base Cape Cod

The DEIR/CWMP includes several options for use of the JBCC WWTF and its disposal capacity near the Cape Cod Canal. The options include the Back Road areas, Area H and G near Johns and Ashumet Pond and several Sandwich areas in the vicinity of Snake Pond. The main advantage to this regional solution is that it gets nitrogen load and flow out of the watershed completely allowing for more flexibility for remaining watershed solutions. The disadvantage is the uncertainty of dealing with the military on issues of ownership and allocation. Sharing of military infrastructure continues to be evaluated by the JBCC. The DEIR indicates that the areas to be connected will generate 310,000 gpd of wastewater flow. When added to the existing JBCC flow of 200,000 gpd, the flow exceeds the existing capacity. The DEIR/CWMP provides a cost evaluation of the necessary upgrades for the JBCC to accommodate the additional proposed flow. Based on an analysis the watershed MVP tool, Staff believes additional refinements could be made to reduce anticipated need in the watershed. For example, in the case of the Sandwich Areas, 1, 2, and 3, nearly half the load is derived from 20% of the parcels which occur in Area 3, the upper Quashnet River watershed, which is approximately 560 kilograms. Other Sandwich 1, 2, and 3 areas are contributing less than 20% to 44% of their load to either Mashpee River or Waquoit Bay. These differences are also evident in the matrix. Also half of Area H to the southwest of John's Pond is in the Childs River watershed, not the prioritized Quashnet River.

Several of the proposed discharge sites of the DEIR/CWMP will require further negotiations and agreements; contingencies within the plan for alternative sites may have an effect on nitrogen reduction targets and anticipated treatment levels. Given the uncertainty of New Seabury as a major discharge site further evaluation of expanding the potential for use of JBCC for regional discharge is warranted. The site characterizations appear to indicate the suitability of the discharge sites. Discharge sites located north of the John's Ponds area should be further evaluated for potential impacts on the downgradient fresh water ponds.

Shellfish Aquaculture

The non-traditional assessments evaluated PRBs, bog and wetlands restoration and shellfish aquaculture. The plan defers to the PRB effort in Falmouth to provide additional data prior to further consideration of this technology. The DEIR/CWMP indicates the use of shellfish aquaculture promises to remove a substantial amount of the nitrogen from the embayment water column (in the form of algae). The DEIR/CWMP indicates the number of required shellfish at 35.5 million with distribution being approximately 16 million in Popponesset and 19 million in the eastern portion of Waquoit. The Mashpee DEIR/CWMP has provided a detailed conceptual plan to implement a shellfish aquaculture project in multiple embayments. In many cases the use of shellfish is indicated as removing 100% of the required nitrogen. Where removal is only 50% for Mashpee River and Shoestring Bay, the Plan prioritizes those areas for additional removal by traditional means. The more recent Waquoit Bay MEP report treats the eastern and western portions together as one complete embayment system indicates that additional options should be investigated, such as potential improvements to tidal flushing for the Quashnet River.

Shell fish Removal Estimates by percent:

Mashpee River	50%
Popponesset Bay	100%
Ockway Bay	100%
Shoestring Bay	50%
Great River	100%
Jehu Pond	100%
Hamblin Pond	100%
Quashnet	0% (not estimated)

Following these evaluations a Draft Recommended Plan is established as outlined as follows. Because this option rests on the results of the 2012 MEP results, it is assumed that the previous discharge distribution conceptually conforms to the new discharge configuration of the Recommended Plan as outlined below, but the FEIR should clarify.

Following the evaluations the Draft Recommended Plan as proposed is summarized below:

- Shellfish Aquaculture
- Wastewater Treatment and disposal at Joint Base Cape Cod for Quashnet Areas H, G and Sandwich 1,2,&3)
- Wastewater Treatment at Existing WWTF with needed improvement/expansion/modification
  - New Seabury (0.3 mgd treatment approx~ 1.0 mgd recharge), <10 mg/L TN
  - Willowbend (treatment at 0.18 mgd, recharge of up to 0.8 mgd), <3 mg/L TN
  - Mashpee Commons (treatment and recharge approx~ 0.5 mgd), <5 mg/L TN
  - Mashpee High School – treatment and recharge to JBCC or Back Road Site (fallback)
  - Cotuit Meadows – pick up additional service area
  - Wampanoag Village – pick up additional service area
- Wastewater Treatment at Existing WWTF (potential future upgrade to improve performance – shellfish dependent) – 3 to 6 mg/L TN

- Forestdale School
    - Mashpee Village
    - Southport (if JBCC is not an option)
    - Stratford Ponds
    - Windchime Point
- Coordination with Adjoining Towns
    - Barnstable (0.08 mgd)
    - Falmouth (0.05 mgd)
    - Sandwich (0.19 mgd)

Total Plan Cost and Phasing

The town submitted a matrix of parameters as a supplement to the EENF/ DEIR thatcompares and selects potential sewer areas for collection and accumulated wastewater treatment flows for existing and proposed WWTF. The matrix ranks the priority of the previously delineated Planning Areas. It is not clear how the matrix assigned nitrogen loads, either existing or attenuated, to the areas. Commission will review and comment more fully on this matrix pursuant to the FEIR.

The DEIR/CWMP includes the total capital cost of the Default plan at $260 Million for Mashpee and additional $97 Million for the 3 neighboring towns for a total of $360 million dollars. The total aquaculture based recommended plan cost is estimated at$140 Million for Mashpee and $35 Million for the three neighboring towns for a total capital cost of $180 million dollars. The aquaculture-based non-traditional technology results in a 50% cost reduction of traditional infrastructure.

The DEIR/CWMP also provides a Phase 1 cost of the aquaculture modified plan of $49 Million with a present worth estimate of $92 Million over 20 years at 3% interest. The Phases of the DEIR/CWMP are summarized below.

Phase 1: 2016-2020

Shellfish propagation in Popponesset Bay (including its subwatersheds of Mashpee River, Shoestring Bay, Ockway Bay), and in Jehu Pond and Hamblin Pond (including Great River)
Quashnet and Combs schools to Mashpee Commons
Design/Construction of Back Road or JBCC for Area H 0.2 MGD
Design / Construction of Site 4 for Subarea S2 0.1 MGD

Phase 2: 2021-2025

Continued Shellfish propagation
If JBCC, then Sand 1, 2 & 3 should be collected
If shellfish not performing:

- Site 4 expansion -recharge to Willowbend
- Upgrade PWWTF Stratford Ponds, South Cape Village, Windchime Point
- Sewer S1 P1 south of Rt28

Phase 3: 2026 to 2030

Continued Shellfish propagation
If shell fish does not perform:

- Upgrade Southport
- Site 4 expansion up to 0.39 MGD
- Expand Willowbend service area
- Site 6 design/construction Ockway Bay Area 0.27 MGD

- New Seabury Disposal construction for Mashpee Commons and Site 6 effluent. 0.71 MGD
- Barnstable and Sandwich to address

Phase 4: 2031 to 2035
Upgrade Cotuit Meadows and Wampanoag WWTF
If shell fish does not perform:

- Site 6 expansion for Hamblin Pond and Jehu Pond
- Collection expansion to Site 4
- Collection expansion of Great Neck
- Collection expansion of Hamblin and Jehu D2 and B
- Upgrade and Expand New Seabury WWTF

Phase 5: 2036 to 2040
If shellfish does not perform:

- Barnstable and Sandwich treatment and recharge out of watershed
- Collection Main St/ Rt 130 Area T to Site 4
- Collection expansion to Area A and C
- Childs River Subarea H

The use of shellfish aquaculture on such a wide spread scale to achieve the measure of significant required nitrogen removal anticipated in this plan has not been attempted on Cape Cod. Aquaculture is a non-traditional technology that several towns including Wellfleet and Falmouth are pursuing. The Mashpee aquaculture plan makes use of actual shellfish planting and harvest data and associated costs combined with researched nitrogen uptake amounts to formulate a program and budget. The Plan also targets nitrogen removal on sectors of critical embayments that have the characteristics that make success more probable. The program will require further details and review in the FEIR. The Commission will provide further comments from the 208 Monitoring Subcommittee on the proposed aquaculture project in the interim, and through the DRI process.

<u>Adaptive Management</u>
The DEIR/CWMP incorporates the elements of an Adaptive Management Plan for monitoring, and reviewing data and making adjustments and modifications of the plan. The Commission will provide additional comments and direction on the proposed adaptive management plan for the Phase 1 Plan in the DRI review. It is suggested that the Town appropriately budget for the necessary evaluations and adaptive management provisions within the aquaculture component of the Phase 1 project.

<u>Conclusion</u>
The traditional components of the Modified 2014 Option 1A plan is a reasonable fallback if shellfish aquaculture underperforms and comprehensively ties many years of the Town's effort together, but its later phases can benefit by further evaluation from using the Commission's 208 watershed tools to better account for proposed nitrogen load reductions, assign and select priorities and take advantage of additional regional efforts.

Additionally, Commission staff suggests that the town continue to participate in a regional strategy for addressing nitrogen load in the entirety of Waquoit Bay prior to prioritizing a traditional infrastructure approach for areas G and H in Phase 1.

COASTAL RESOURCES/ NATURAL RESOURCES

The Mashpee CWMP presents four general elements of or actions for a proposed approach to managing wastewater and/or nitrogen loading, including expanded shellfish aquaculture in Popponesset and Waquoit Bays; use of the wastewater treatment facilities at Joint Base Cape Cod; use of existing facilities within the project planning area (for collection/treatment/effluent disposal); and potential development of new facilities (for collection/treatment/effluent disposal) at one or two sites. The following comments address considerations to reduce impacts to wetlands, wildlife, open space, and coastal resources as the town proceeds with alternatives analyses.

The RPP generally prohibits impacts to wetlands and the 100ft buffer to wetland resources, though utility infrastructure installation may be allowed where there is no other feasible alternative. During CWMP implementation, project planners should avoid direct and indirect wetland and buffer impacts wherever possible. Indirect impacts could include actions that may be expected to alter the natural functions of the wetland. At the same time, alterations that include associated wetland restoration are supported in the RPP.

The RPP also generally prohibits activities that would impact rare species or their habitats. According to the DEIR, three of the plan's potential "greenfield" sites (Sites 4, 2, and 6) are located in mapped habitat of two state listed species, the Eastern Box Turtle and the Grasshopper Sparrow. The Natural Heritage and Endangered Species Program indicated in correspondence on the project in 2008 that efforts to minimize impacts to these habitats should be addressed during the design phase of the project. As the town moves forward with selecting sites for wastewater implementation they will need to coordinate with the NHESP for additional guidance on avoiding or mitigating impacts to rare species.

With the exception of the shellfish restoration aspects of the proposal, the Mashpee CWMP appears to propose limited impacts to coastal resources (section 8.3.2. To the greatest extent feasible, collection system components should be located within existing roadways or disturbed areas wherever feasible in coastal resource areas. In addition, the RPP permits new non water-dependent public infrastructure within land subject to coastal storm flowage where there is no feasible alternative, a public benefit is demonstrated, and provided that the infrastructure will not promote new growth and development in flood hazard areas. The staff recognizes the public benefit of nitrogen reduction activities and suggests that the FEIR address how new growth and development will be controlled in flood hazard areas.

Commission staff sought comments from the Cape Cod Cooperative Extension/WHOI SeaGrant staff with regard to the shellfish restoration components of the plan. CCCE staff commented that the proposed sites are feasible, but that it would be advisable to pre-identify actual areal coverage of bottom habitat suitable for planting shellfish in order to accurately assess available space for the proposed shellfish densities. Potential concerns raised by CCCE staff deal with the availability of appropriate shellfish seed to undertake the aquaculture project. Commission staff assumes that consideration for location/design of shellfish proposals will not conflict with vessel navigation.

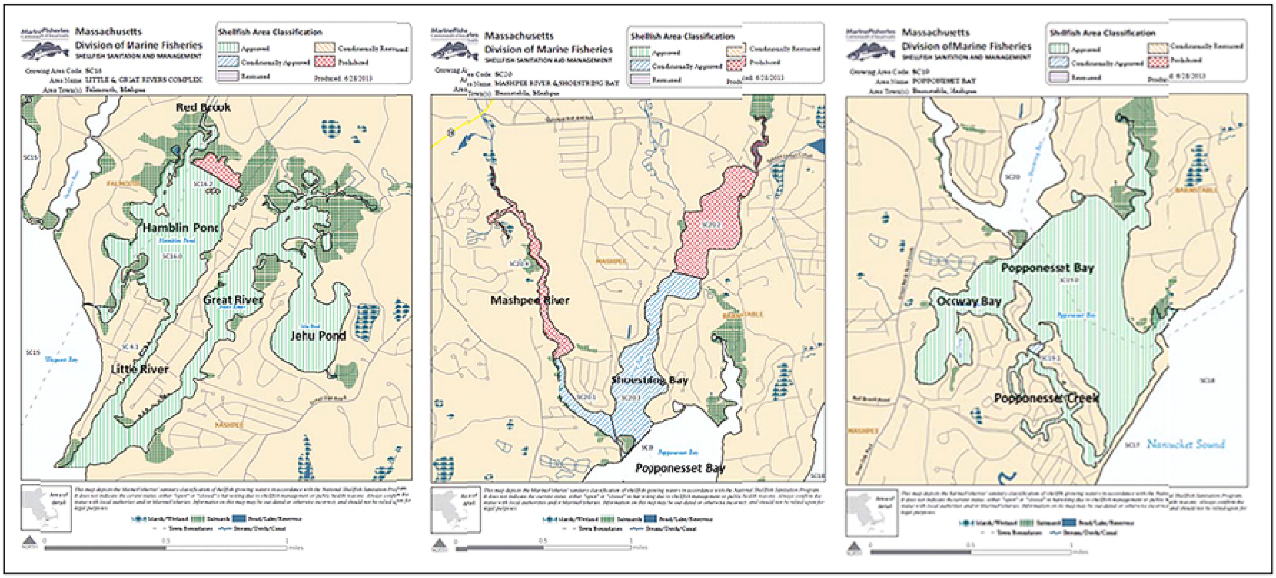

Figure 1.2: Provided by CCCE staff, the locations are feasible and identified as approved shellfish growing/harvest areas by the MA Division of Marine Fisheries. Exceptions include the upper reaches of Hamblin Pond, Mashpee River, and Shoestring Bay which are designated prohibited areas.

Effluent Recharge Sites

The potential new effluent discharge sites 4 and 6 are all mapped for rare species habitat, as noted above, and are greenfield sites. However, they are not mapped for other sensitive resources, including wetlands, certified or potential vernal pools, or BioMap2 Core Habitat. Additionally, selection of these parcels for development over others within the town will serve to minimize additional fragmentation of habitat in Mashpee, as these parcels are already disconnected from large contiguous open space tracts, and/or are adjacent to existing development. Commission staff recommend that fragmentation of habitat and open space at all of the sites considered should be minimized by siting the disposal beds as close to existing development as is feasible, given other land use values, concerns and interests.

Collection System

To the extent possible, pump stations should be located near roads and away from wetlands and wetland buffer areas, to minimize the footprint of additional disturbance. Also, as a general matter, the collection system network should be installed within existing road networks to the extent feasible, and avoid “overland” installations that will result in large, new additional areas of disturbance and habitat fragmentation where economically feasible.

ECONOMIC DEVELOPMENT

Commission staff reserves comment on Economic Development issues, particularly with respect to RPP MPS ED4.1, until a DEIR certificate issues.

ENERGY RESOURCES

The Energy Section of the Regional Policy Plan (RPP) focuses attention on energy intensive building and land use practices that contribute to climate change. Thus, the goal of the Energy Section is to “promote a healthy and sustainable environment by reducing greenhouse gas emissions and energy consumption through design and construction practices that increase energy conservation, promote energy efficiency, and promote self-efficiency through the use of locally distributed renewable energy" (Technical Bulletin 09-002, available on Cape Cod Commission website).

To meet this goal, the Regional Policy Plan Energy section provides minimum performance standards for several different types of development projects. Though the RPP specifically provides that the Energy MPS's do not apply to wastewater treatment facilities (and thus, in the Commission's practice, to CWMP's), the DEIR does contain a discussion of renewable energy systems associated with the CWMP in Section 8.3.5 therein. Specifically, the applicant has already considered options to improve energy efficiency, such as energy recovery systems, hydroelectric potential, and lighting optimization. These options are consistent with the goals set out in the Energy section of the RPP.

Climate Change Mitigation

In the DEIR, the applicant expressed interest in protecting infrastructure in the Proposed Planning Area (PPA) against sea level rise and flooding. Staff suggests that there are several research tools available to the applicant to model the effect of water level rise (in the form of sea level rise or flooding) on the PPA:

- The Cape Cod Commission's Sea Level Rise Viewer available on the Commission website
- Dynamic models created by the Woods Hole Group in Falmouth, MA

The RPP does not contain an issue area specific to Climate Change, though there are goals, standards and practices in the Coastal and Marine Resource sections of the RPP that relate directly or indirectly to sea level rise, which is associated with Climate Change. Best practices for climate change mitigation efforts are described in several other public documents as well:

- Cape Cod Commission Energy Technical Bulletin 09-002
- Multi-Hazard Mitigation Plan for the Town of Mashpee
    - Beginning in March 2014, the Town of Mashpee started a 24-month process to update their Multi-Hazard Mitigation Plan. The previous hazard plan and update will be a valuable resource to the applicant because it contains research on climate change for the Town of Mashpee as well as risks, extent, impacts, and mitigation efforts for climate change in the PPA:
- National Climate Assessment (http://nca2014.globalchange.gov/report) Chapter 27 on Mitigation
- Climate Change Adaptation Resources available through the MA office of Coastal Zone Management (CZM)

Staff would be available to assist the Town in ensuring that proposed wastewater infrastructure addresses potential impacts from climate change.

AFFORDABLE HOUSING

This is a Town-sponsored wastewater planning and infrastructure project. As this is not a residential project, Commission staff suggests that none of the RPP Minimum Performance Standards under Goal AH1 and Goal AH2 would apply. As this is a Town project and not a commercial DRI, staff also suggests that none of the Minimum Performance Standards under Goal AH3 would apply. Therefore, staff suggests the Regional Policy Plan's Affordable Housing issue area would not apply to the CWMP, and ultimately, to the Development of Regional Impact review of the CWMP.

TRANSPORTATION RESOURCES

The potential transportation impacts that may arise from development of projects identified in the CWMP/DEIR are related to new trip generation from potentially new or expanded

Wastewater Treatment Facility(s) (WWTF). Once the Town determine whether it will pursue new or expanded facilities, staff can conduct an analysis of whether the trip generation from the facility will warrant additional review and/or potential conditions.

Regardless of any new facility's(s) trip generation, MPS TR1.8 requires acceptable sight distances at all access and/or egress locations for DRIs. With a special concern to a site with a high percentage of truck traffic, it is recommended that the Town confirm to the Commission that any new treatment facility(s) be sited such that any new site driveway provides sight distances that meet the stricter of the Massachusetts Department of Transportation and American Association of State Highway Transportation Officials guidelines for safe stopping sight distances.

HISTORIC PRESERVATION/COMMUNITY CHARACTER

The Comprehensive Watershed Nitrogen Management Plan for Mashpee includes a variety of methods to address nitrogen. Several of the proposed methods are unlikely to affect historic or archaeological resources due to their limited ground disturbance or their location in previously disturbed areas. None of the proposed methods appear to impact structures within the Mashpee Historic District. In order to be consistent with RPP Standards HPCC1.1 (Historic Resources) and HPCC1.2 (Cultural Landscapes), the town will need to work with Massachusetts Historical Commission (MHC) and local historic boards to insure that final design plans for new infrastructure will avoid impacts to these resources.

Potential new facilities proposed at Site 4 and Site 6 appear to be located outside of highly sensitive archaeological resource areas, but additional archaeological reconnaissance survey work will be necessary if construction (treatment facilities, pumping stations, and collection systems) is proposed beyond already surveyed areas. The same is true of other undisturbed sites being considered for construction of new treatment facilities. Installation of sewer lines and ground-disturbing infrastructure should occur in previously disturbed areas as much as possible in order to avoid possible impacts to historic and archaeological features. As the final design of other project elements is completed, MHC review is needed to assess areas where ground disturbance is proposed and to determine whether additional archaeological survey work is needed, consistent with RPP Standard HPCC1.3 (archaeological sites).

PERMITTEE RESPONSIBILITIES

The Town of Mashpee filed this CWMP/DEIR with the MEPA Unit. The Sewer Commission may be absorbed into a new entity if a town referendum passes next spring to create a new Mashpee Water and Sewer Commission. The town should explain who will be the responsible party for future permitting, implementation, operation and management, and provide details about how Sewer Commission activities might be succeeded via the new entity. In addition, it is staff's understanding that the existing and potential new commission will control traditional collection, treatment and disposal facilities. The FEIR should address how the town will be responsible for implementing traditional and non-traditional proposals contained in the CWMP/DEIR whether or not the new entity is approved in the Spring of 2015.

Consistency with 208 Plan Update

The approach taken in the DEIR is consistent with the spirit and intent of the Draft 208 Plan Update in that it seeks lower cost solutions through the selection of alternative technologies and proposes an adaptive management approach phased in over five year increments. The Commission reserves the right to conduct additional consistency analysis as local plans develop and the 208 Plan Update is finalized.

Commonwealth of Massachusetts
Division of Marine Fisheries
251 Causeway Street, Suite 400
Boston, Massachusetts 02114
(617)626-1520
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Paul J. Diodati
Director

Deval Patrick
Governor
Maeve Vallely Bartlett
Secretary
Mary B. Griffin
Commissioner

September 5, 2014

Secretary Maeve Vallely Bartlett
Executive Office of Energy and Environmental Affairs (EEA)
Attn: MEPA Office
Deirdre Buckley, EEA No. 12615
100 Cambridge Street, Suite 900
Boston, MA02114

Dear Secretary Bartlett:

The Division of Marine Fisheries (*MarineFisheries*) has reviewed the Draft Recommended Plan/Draft Environmental Impact Report by the Town of Mashpee Sewer Commission. The proposed Recommended Plan includes shellfish aquaculture, wastewater treatment at existing and new facilities, coordination with adjoining towns, continued use of septic systems, development of future demonstration projects, and coordination with the Cape Cod 208 planning efforts. Future demonstration projects include permeable reactive barriers, wetlands restoration, and eco-toilets. The project area comprises Hamblin Pond, Jehu Pond, Popponesset Bay, Ockway Bay, Shoestring Bay, the Great River, the Little River, the Mashpee River, John's Pond, Mashpee-Wakeby Pond, Santuit Pond, and the Quashnet River. Existing marine fisheries resources and potential project impacts to these resources are outlined in the following paragraphs.

The rivers and embayments within the Popponesset Bay and Waquoit Bay East watersheds provide foraging, spawning, and/or nursery habitat for a variety of diadromous fish species, winter flounder, horseshoe crabs, and shellfish [1]. These areas also contain mapped eelgrass *(Zostera marina*) beds, one of the most productive habitats for numerous marine species [2,3]. Mapping of eelgrass in these regions has demonstrated significant reductions in eelgrass bed area in Hamblin and Jehu Ponds as well as the Great/Little River systemover the past decade [4].These declines are likely due to nitrogen loading to these systems [5].

MarineFisheries offers the following comments for your consideration:

- *MarineFisheries* commends the proponent for designing a shellfish remediation plan that is consistent with the *MarineFisheries* Shellfish Planting Guidelines [6]. The proposed shellfish planting regions are all in areas currently listed as Approved for shellfish harvest, thus avoiding potential health risks associated with illegal harvest.

MarineFisheries is supportive of shellfish restoration and the inclusion of shellfish aquaculture and propagation in nitrogen remediation efforts. The town will need to modify their existing municipal propagation permit with *MarineFisheries* to conduct these activities.

- While we are supportive of shellfish propagation for the purposes of augmenting harvest opportunities and maintaining and increasing local populations, we caution against relying on shellfish as a primary nutrient remediation technique. Past research has demonstrated that nitrogen removal varies among estuaries and years due to differences in environmental conditions (e.g., food availability, temperature, nitrogen loading) [7,8]. Nitrogen removal from shellfish propagation can be negatively impacted by factors leading to reduced growth rates or increased mortality (e.g., hypoxia events, reduced food availability). Given the ambitious scale of the shellfish remediation component, *MarineFisheries* requests further information on this component and also provides comments below on the approach outlined in the DEIR:

    - The general approach of quantifying nitrogen removal through shellfish harvest consists of multiplying total shellfish harvest by an average estimate of individual shellfish nitrogen content. The former will be based on both commercial and recreational harvest data. While collection of commercial data involves a relatively straightforward use of DMF catch reports, non-commercial harvest will likely be more challenging to quantify. Particularly given the ambitious scope of the shellfish component, proposed recreational harvest data collection methods should be explained in greater detail.
    - Since the seed to be used in this effort will be coming from outside sources, the initial weight of the seed shellfish should be subtracted from the harvest weight used to calculate nitrogen removal. While individual initial seed weight will be quite small, this overall weight for all shellfish seed could be relevant at the proposed scope of planting and removal.
    - Shellfish aquaculture and propagation is proposed as a tool to address 50% (Mashpee River, Shoestring Bay) to 100% (Popponesset Bay, Ockway Bay, Great River, Jehu Pond, Hamblin Pond) of the of the nitrogen load exceeding the threshold set through the Massachusetts Estuaries Project (MEP). A recent study on Cape Cod concluded that the likely range of land-derived nitrogen that could be removed by shellfish bioremediation was 1-15% [7]. Proposed nitrogen removal by shellfish should be reported in terms of total estimated nitrogen load to these systems. The approximate numbers of shellfish required to reach the MEP thresholds are included in the report. The estimated total area required to house these numbers of shellfish, associated shellfish densities, and the planting area locations should also be included in the report. This information is needed to better understand the likelihood of attaining nitrogen removal goals through the proposed intensive shellfish bioremediation approach.
    - The "nitrogen removal" section of the Shellfish Aquaculture/Fisheries for Water Quality Restoration component of the DEIR refers to higher historic shellfish carrying capacities. If habitat conditions have declined, these historic densities may no longer be supported in the current environments of these systems. Consequently, intensive planting may have high rates of mortality if seed shellfish are being introduced to areas that no longer can sustain high shellfish densities.
    - Both oysters and quahogs are proposed for use in the nitrogen remediation plan. For more eutrophic water bodies where food supply to filter feeders tends to be

higher, shellfish growth tends to increase. However, mortality rates can also increase under these conditions, likely due to hypoxia. Oysters, which have high feeding and assimilation rates as well as high survivorship in hypoxic conditions, would be better suited than quahogs for nitrogen remediation in such areas [7,8].

Questions regarding this review may be directed to John Logan in our New Bedford office at (508) 990-2860 ext. 141.

Sincerely,

Paul J Diodati

Paul J. Diodati
Director

cc: Mashpee Conservation Commission
Christopher Boelke, Alison Verkade, NMFS
Rick York, Shellfish Constable
Robert Boeri, CZM
Ed Reiner, EPA
Ken Chin, DEP
Richard Lehan, DFG
Kathryn Ford, Tom Shields, John Mendes, Christian Petitpas, DMF

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PD/JL/sd

Commonwealth of Massachusetts

Division of Fisheries & Wildlife

MassWildlife

Wayne F. MacCallum, *Director*

September 3, 2014

Maeve Vallely Bartlett, Secretary
Executive Office of Energy and Environmental Affairs
Attention: MEPA Office
Nicholas Zavolas, EEA No. 12615
100 Cambridge St.
Boston, Massachusetts 02114

Project Name:	*Comprehensive Watershed Nitrogen Management Plan*
Proponent:	*Sewer Commission, Town of Mashpee*
Location:	*Town of Mashpee*
Document Reviewed:	*Draft Recommended Plan / Draft Environmental Impact Report*
EEA No.:	*12615*
NHESP No.:	*12-31134 (formerly 01-9528)*

Dear Secretary Bartlett:

The Natural Heritage & Endangered Species Program of the Massachusetts Division of Fisheries & Wildlife (the "Division") has received and reviewed the proposed the *Draft Recommended Plan / Draft Environmental Impact Report* (DEIR) for the Town of Mashpee Sewer Commission's Comprehensive Watershed Nitrogen Management Plan and would like to offer the following comments regarding state-listed species and their habitats.

The ponds, bays, and estuarine waters of the Town of Mashpee provide critical foraging, breeding, migration, and over-wintering habitats for a suite of state-listed species that rely on aquatic and/or marine habitats for at least one stage of their life cycle. These species and their habitats may directly benefit from reduced levels of dissolved nitrogen and improved water quality, and we commend the Town for its efforts to improve water quality within these critical habitats.

Portions of the Town of Mashpee are mapped as *Priority* and *Estimated Habitat* for twenty-seven (27) state-listed rare species, in accordance with the *13th Edition of the MA Natural Heritage Atlas*, including but not limited to the Eastern Box Turtle (*Terrapene carolina*, state-listed as "Special Concern") and Grasshopper Sparrow (*Ammodramus savannarum*, state-listed as "Threatened") provided in Section 7.2.5 of the DIR. All projects proposed within *Priority* and *Estimated Habitat*, which are not otherwise exempt pursuant to 321 CMR 10.14, will require review through a direct filing with the Division for compliance with the Massachusetts Endangered species Act (MGL c. 131A) and its implementing regulations (MESA; 321 CMR 10.18) and/or the rare species provisions of the Wetlands Protection Act Regulations (WPA; 310 CMR 10.37 & 10.59).

The Division would encourage the Town to incorporate design and implementation alternatives that avoid and minimize impacts to state-listed species and their habitats, and to initiate consultations with

Division of Fisheries and Wildlife
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An Agency of the Department of Fish and Game

the Division during the design phase. Division staff are available to evaluate alternatives and work proactively with the Town to address any concerns related to state-listed species prior to submission of a formal MESA filing.

We appreciate the opportunity to comment on this project and look forward to working with the Town to proactively address any potential concerns related to state-listed species and their habitats. If you have any questions about this letter, please contact Jesse Leddick, Endangered Species Review Biologist, at 508-389-6386 or jesse.leddick@state.ma.us.

Sincerely,

Thomas W. French

Thomas W. French, Ph.D.
Assistant Director

cc: Thomas Fudala, Town of Mashpee, Sewer Commission Chair
Town of Mashpee, Department of Public Works
Town of Mashpee, Conservation Commission
DEP Southeastern Regional Office, Wetlands Program
J. Jefferson Gregg, GHD Engineering

via electronic delivery

September 5, 2014

Secretary Maeve Vallely Bartlett,
Executive Office of Energy and Environmental Affairs
Attn: MEPA Office – Deirdre Buckley
100 Cambridge Street, Suite 900
Boston, MA 02114

**Re: Mashpee Comprehensive Watershed Nitrogen Management Plan
EEA No. 12615**

Dear Secretary Bartlett:

Mashpee's proposed Comprehensive Wastewater and Nitrogen Management Plan (CWMP) is the first CWMP from a town on Cape Cod the Secretary is reviewing since the release of the Draft Clean Water Act Section 208 Plan for Cape Cod. It is the Association to Preserve Cape Cod's (APCC) hope that the Secretary will accept the core principles of the 208 plan in evaluating CWMPs beginning with this Mashpee plan.

Founded in 1968 and representing more than 5,000 members, the mission of APCC is to promote policies and programs that enhance the protection of the natural resources of Cape Cod. Underlying all of the work that APCC does is the understanding that Cape Cod is a single geographic and hydrogeological unit, and that the Cape's natural resources and economic vitality cannot be adequately protected based on arbitrary political borders.

Mashpee must be applauded for its proactive approach addressing nutrient pollution in a multi-tiered approach that integrates conventional solutions (sewering), existing infrastructure (Joint Base Cape Cod) and innovative technologies. Most importantly, Mashpee has fully committed itself to adaptive management. While the effort is overall quite laudable, APCC does have a number of comments and concerns we believe the Secretary should consider in allowing this plan to proceed toward permitting.

Targeted Watersheds- One of the core principles of the 208 Plan is a targeted watershed approach. While the Popponesset Bay portion of this plan is arguably a targeted approach (Barnstable remains missing), the portion of the plan addressing Waquoit Bay is anything but a targeted watershed approach. Falmouth has the largest contribution of nitrogen to Waquoit Bay

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and is essentially absent from the plan.[1] This is simply not a watershed based plan, but is instead the usual plan based upon municipal boundaries and singular municipal action. Mashpee is not completely at fault here as Falmouth has been reluctant to address Waquoit Bay and has focused more in the central portion of that town. Additionally a Total Daily Maximum Load (TMDL) for Waquoit Bay came late in the Massachusetts Estuaries Program watershed evaluation process. Waquoit Bay is the one Area of Critical Environmental Concern (ACEC) covered by this plan and deserves a fully targeted plan involving Sandwich, Falmouth and Mashpee. The 208 plan and planning process identified both the need and the cost savings for towns to cooperate on a watershed basis as opposed to each town sticking to its municipal boundaries. The Secretary should require a targeted watershed approach for Waquoit Bay—making the three towns work toward a solution for this severely impaired ACEC.

Land use initiatives – The Secretary's Certificate dated November 1, 2013 stated that "[t]he DEIR include a detailed discussion of potential land use control mechanisms that can be employed to limit secondary growth impacts associated with implementation of the CWMP."

Mashpee has done a good job in dealing with new development. Currently, Mashpee has several growth management bylaws in place that do go beyond many towns in controlling the rate of growth and protecting natural resource areas. The challenge will be to bring redevelopment and expansion of existing structures and uses into a sound and equitable regulatory environment. Mashpee's zoning should reflect the goal of directing compact development to targeted areas where infrastructure can support the growth, but at the same time, offset that growth with a balanced, growth-neutral reduction in development potential outside of the targeted growth areas.

The town adopted a permit phasing requirement that allows no more that 20 percent of the lots in a new subdivision to receive building permits each year. The town-wide limit is 90 building lot permits per year. Mashpee has an optional Open Space Incentive Development bylaw for subdivisions on 20 acres or more of land, and a mandatory cluster subdivision bylaw for subdivisions on five or more acres. Both bylaws require a special permit, as opposed to being by right. The minimum open space set-aside for both is 50 percent. A Transfer of Development Rights option is available with the Open Space Incentive Development bylaw.

While these bylaws are more progressive than cluster bylaws in many other Cape towns, there are innovative natural resource protection bylaws being used on the Cape and elsewhere in Massachusetts that are very effective in managing growth and protecting resources. APCC adds the following initiatives to the discussion of Mashpee's growth management strategy:

Natural Resource Protection Zoning (NRPZ)
The town should consider adopting a modified Natural Resource Protection Zoning bylaw that protects large areas of open space, reduces density from what current zoning allows, and offers density bonuses based on the level of nitrogen removal from the new development's wastewater

[1] APCC is aware that there has been discussion and good cooperation at the wastewater superintendent level but the towns do not have a targeted watershed plan at this point.

treatment. NRPZ is by right, while other types of development, including conventional grid-style subdivision, require a special permit. NRPZ includes a base density reduction from what current zoning allows, cluster development with no minimum lot size requirement, and significant open space preservation of the most environmentally important features of the land. Density bonuses are awarded as incentive for such things as utilization of an advanced wastewater treatment system, and connecting pre-existing neighboring development that currently uses Title 5 to the new development's advanced treatment system to achieve a net nitrogen load reduction for the area. NRPZ can be an effective offset to other regions in town where compact growth is being encouraged due to the presence of supporting infrastructure. A natural resource protection bylaw was adopted in the town of Brewster in 2009 for the purposes of protecting sensitive water resources.

Open Space Residential Design (OSRD)

Like NRPZ, Open Space Residential Design also relies on cluster and natural resource-based open space preservation. It places an emphasis on protecting natural resources in the design of the subdivision, but OSRD typically does not include a reduction in the current zoning's base density allowances.

Managing Expansion of New and Existing Uses

Mashpee has a 20 percent lot coverage maximum for residential uses, but this is not necessarily an effective tool for discouraging oversize residential units on very large lots. Potential options for addressing out-of-scale development, or mansionization, are discussed below.

Floor Area Ratio

Floor area ratio, or FAR, regulates the amount of gross floor area that can be built on a lot. It is a ratio of gross floor area to lot size, or:

FAR = Total floor area of a building on a lot / lot size

The purpose of FAR is to regulate the above-ground mass of a building that can be seen from the street or a neighboring property. It has been used increasingly in residential situations to discourage mansionization in communities. In regulating the mass, FAR may also help minimize the number of bedrooms that could be accommodated within a residence.

"Sliding Scale" FAR Hybrid (Wellfleet Example)

Wellfleet has adopted residential size restrictions in the National Seashore for the purpose of minimizing visual impacts. This "sliding scale" site coverage provision relies on several lot area and site coverage fixed thresholds to keep the size of development in balance with its surroundings. A maximum limit is placed on the size that a structure can reach. As an option for Mashpee, expansion beyond the maximum threshold could be made possible through a special permit. As with conventional FAR, a similar bylaw in Mashpee may help limit the number of bedrooms per residence. This could reduce the nitrogen load in unsewered areas, conserve sewer capacity in sewered areas, and address tendencies for "mansionization" throughout the town.

Maximum Site Coverage in the National Seashore Park (Wellfleet)

Lot Area Maximum	Site Coverage
Less than 10,500 sq. ft. (just under ¼ acre)	5% Maximum Building Coverage
10,501 sq. ft. to 21,000 sq. ft. (≈ ¼ to .48 acre)	1,050 sq. ft. plus 7.4% of lot area over 10,500
21,001 to 42,000 sq. ft. (.48 to .97 acre)	1,825 sq. ft. plus 3.2% of lot area over 21,000
42,001 to 84,000 sq. ft. (.97 to 1.92 acre)	2,500 sq. ft. plus 1.43% of lot area over 42,000
84,001 to 126,000 sq. ft. (1.92 to 2.89 acres)	3,100 sq. ft. plus 1.2% of lot area over 84,000
126,001 sq. ft. (2.89 acres and above)	3,600 sq. ft.

Sewer Hookup Cap

Some Massachusetts towns have adopted or are considering regulations that place a ceiling on the number of allowable sewer hookups within a sewer district. If desired by the town, additional building permits may be allowed only through a special permit. These caps allow for targeted zones of contribution.

Growth Management Bylaw (Provincetown Example)

The purpose of this bylaw is to maintain a sustainable rate of residential and commercial development in the town in order to ensure that adequate infrastructure continues to be available to meet current and future demand without overburdening the town's natural resources or infrastructure capacity. A limited number of annual permits are issued for any new or expanding uses that will increase Title 5 flow. Issuance of these permits is based on a predetermined hierarchy of priority types of uses, with affordable housing being the highest priority. The types of uses that are higher in priority go to the top of the waiting list.

Wetland Setback Requirements

Mashpee has a 100-foot setback requirement for development along the Mashpee and Quashnet rivers, while development near other wetlands and water bodies in town must observe a 50-foot setback requirement. The town should consider expanding the 100-foot setback requirement to all ponds and other wetlands. In addition, the board of health should consider expanding the current 100-foot setback requirement for septic leaching systems near ponds and other fresh water bodies to 300 feet.

Special Permits

The town should evaluate whether the Board of Appeals should be required to make a specific finding of more or less nutrient loading in all special permits decisions related to redevelopment or existing structures and uses in determining whether or not a project is "substantially more detrimental," with the goal being net reductions.

Mandatory Advanced Wastewater Treatment

Mashpee should consider a mandatory requirement for advanced wastewater treatment for all upgrades or replacement of existing systems, such as, all cluster or conventional subdivisions of four units or greater must be connected to an advanced wastewater treatment system if those subdivisions are in areas that do not have sewer service, or that are in designated water protection districts. The Harwich board of health has adopted this requirement in its regulations.

Fertilizer Management
In addition to examining new growth management bylaw and regulation options, Mashpee hopefully will adopt the Cape Cod Commission's fertilizer management model bylaw at its fall town meeting. The Secretary should send a strong message of the value of adopting this proposed bylaw and its potential for inexpensive water quality improvement.

<u>Reliance on aquaculture</u> – Mashpee has assembled one of the best teams imaginable to carry out its aggressive shellfish program. The cooperation and collaboration of the Mashpee Wampanoag Tribe is an added bonus and an addition to the likelihood of success. Mashpee Shellfish Constable Rick York is regarded as one the preeminent experts on shellfish management and has a track record of success of utilizing shellfish as a tool for water quality improvement. The plan has a heavy reliance upon this approach, which is subject to wide range of challenges from the environment including disease, predation, weather, ocean acidification and climate change. The town has embraced adaptive management and is prepared to move to a more conventional approach if shellfish efforts disappoint. However, how success or failure are to be quantified and determined is not established in the CWMP with the necessary degree of certainty.

That shellfish take up nitrogen and convert it into shell and tissue is not in question. However, the use of shellfish to take up and remove nitrogen from eutrophic coastal waters, on a scale that would provide noticeable improvement in water quality, is a new area of environmental management. It is critical that we advance this potentially important management tool with a clear understanding of the risks and benefits and a sound means of evaluating success and failure. APCC's main concerns relate to: 1) accurately estimating the concentration and amount of nitrogen removed by shellfish, 2) contingency planning to address limitations on nitrogen removal that may occur if shellfish are impacted by disease, predation, harmful algal blooms, climate change, ocean acidification, cessation or slowing of harvesting, 3) the reliability of this method of removing nitrogen from estuaries, and 4) monitoring to ensure performance.

APCC's staff scientists compared some of the Mashpee information with recent studies conducted in Cape Cod waters (Reitsma et al., 2014; Karplus and Falmouth Water Quality Management Committee, 2014 draft data from pilot test). Because of geographic differences in nitrogen uptake that are described in the literature, these Cape Cod studies are most relevant.

Mashpee's 2012 study is used as the basis for estimating N removal from estuaries by oysters. Because estuaries have different characteristics, local pilot studies should be used as the basis for designing shellfish aquaculture projects to remove nitrogen (N), whether nitrogen is removed via uptake into shellfish tissue and shell, or through denitrification and other biogeochemical and microbial processes. In 2012 Mashpee conducted testing to measure weight, size, and nitrogen content of wild and cultured oysters at several locations (see data in the Table entitled "Shellfish Sample Data – Barnstable County Extension"). It appears that the results were used in the CWMP application to estimate the concentration of nitrogen in shellfish (e.g., percent of wet weight due to N in all shellfish tested averaged 0.5 % N), to estimate the amount of N in a 100-

gram oyster (0.5% N x 100 g/oyster = 0.5 g N/oyster), and finally to estimate the amount of N that could be removed in an estuary. There are several concerns with using these numbers, as described below.

1) The 2012 study was performed over one growing season. Pilot tests should be conducted for at least two or more years in order to obtain enough data to yield robust estimates of the amount and concentration of N in shellfish. Two years is also preferable because older shellfish will generally be larger and contain more nitrogen than younger oysters.

2) The 2012 study was apparently not used to differentiate nitrogen uptake according to different size classes. Reitsma et al. (2014) and the Falmouth pilot study (Karplus, personal communication) showed that size class is an important factor in determining the percent of nitrogen in shellfish—generally the older the shellfish, the larger it is and the more nitrogen it contains. Using one number for the percent of N could result in over-estimating or under-estimating the amount of nitrogen removed by shellfish, particularly when extrapolated to five million shellfish.

3) Mashpee's assumption of 0.5 g of N removed per oyster assumes a 100-g oyster (0.5% N times 100 g oyster = 0.5 g N per oyster). The 2012 study tested oysters whose whole weights ranged from 37.26 g wet weight to 97.46 g wet weight, with the average being 59 g. If harvested shellfish are smaller than 100 g, the town's assumptions may result in overestimating the amount of N removed. Again, characterization of N content based on size classes would help the town to more accurately estimate the amount of N that could potentially be removed. Reporting of N concentrations and amounts in terms of dry weight would facilitate comparison with published values.

4) Variation in N concentration and amount in shellfish should be characterized in order to bracket the upper and lower bounds of N-removal. Variation could occur due to seasonality, size classes (as indicated above), estuary conditions, species, shellfish health, and other factors. This is important for judging whether shellfish aquaculture will meet regulatory standards for N removal.

5) When N concentrations, amounts and estimates are being discussed, the narrative should be clear whether this refers to oysters, quahogs or a combination of both.

Recommendation 1:

Because there is much riding on using shellfish to remove nitrogen, Mashpee should conduct additional pilot testing for at least a second and probably a third year, to provide more accurate estimates of the amount of N to be removed. Additional testing should characterize the mean, median, variation (maximum, minimum, standard deviation) in nitrogen concentration and amount according to species, size class, estuary, seasonality, and growing configuration. The results should be used to re-estimate the amount of nitrogen that may be removed by oysters or shellfish.

Recommendation 2   Provide backup plan if shellfish cannot be harvested or populations are reduced (in addition to other contingencies).

Appendix 5.1 in the CWMP expresses confidence that shellfish diseases, storm damage, harmful algal blooms, and ocean acidification will not pose risks to shellfish aquaculture because Mashpee has not experienced these. Nevertheless, environmental conditions are changing throughout the world, locally and regionally. In the Pacific Northwest, beginning in 2007, ocean acidification affected oyster hatcheries and by 2008 the oyster harvest had declined by 80%. Accidents such as major oil spills and harmful algal blooms have occurred elsewhere on Cape Cod, causing closure of shellfish beds. The fact that such events have not happened in the past in Mashpee is no guarantee that they will not happen in the future. The town should develop a specific plan for addressing these potential risks and have a backup plan for removing nitrogen if such disasters were to reduce or eliminate shellfish populations or if harvesting were to be stopped or curtailed for some reason. The backup plan should specify concrete actions to provide backup removal of nitrogen if shellfish aquaculture or harvesting partially or completely halted for some reason. The town's Geographic Response Plan may serve as a basis for identifying appropriate response actions for spills or other disasters. In the event that shellfish are rendered unsafe to consume, backup plans for harvesting inedible shellfish and properly disposing of the inedible harvest should be implemented to prevent dead shellfish from re-entering the nitrogen cycle. Monitoring of suitable parameters should be conducted. The Cape Cod Commission is working with a subcommittee to develop recommendations for monitoring different N-removal alternatives, and Mashpee is urged to adopt these recommendations when they are published.

Adding to the mix is that there are other elements occurring in a changing world that might skew results and cloud the success or failure of aquaculture. Standardized measurements for the success or failure of shellfish aquaculture must be adopted for the region and state. Ultimately, the town must qualify/quantify its success or failure. It is unclear in the plan how Mashpee will determine or measure the success or failure of its proposed shellfish program. APCC recommends that the town create a decision matrix to guide adaptive management decisions and actions.

Stormwater – The nexus of stormwater management to edible, sustainable shellfish does not seem to be captured/appreciated in the plan. APCC believes that a successful shellfish program is dependent upon sound stormwater management. Moreover, protecting water quality is critical to maintaining the integrity of Cape Cod's public water supplies, swimming beaches, and recreational resources. While water pollution is often associated with industrial activities and maritime accidents, stormwater runoff from developed areas is a major contributor to the problem. Excess fertilizers and insecticides and the harmful chemicals that accumulate on roofs, pavement and other impervious surfaces, are transported by stormwater to surface and ground waters. This runoff severely degrades water quality, harming the ecology of coastal waters and threatening public health. While federal and state water quality standards require communities to treat and manage stormwater, municipal stormwater management requires an investment in trained staff, infrastructure improvements, maintenance, and management systems. Finding the funding to manage stormwater runoff to meet water quality standards is often a challenge. Traditional sources of funding (state and federal grants) are typically not enough to address all of a community's stormwater management needs. In recent years, communities across the country have adopted stormwater utilities as a way to create adequate funding for comprehensive municipal stormwater management programs. These utilities have proven to be a successful way for cities and towns to fund stormwater programs that will bring communities into compliance with federal regulations for non-point source pollution under the Clean Water Act. APCC recommends that Mashpee evaluate the creation of a stormwater utility.

Failure of on-site systems – There is compelling evidence that some on-site septic systems are failing and not being detected as failing. The Silent Spring Institute, which is studying the levels and impacts of pharmaceuticals in the groundwater on Cape Cod, has noted that a functioning Title 5 system does an excellent job of breaking down acetaminophen. The Provincetown Center for Coastal Studies is currently monitoring bays and estuaries surrounding Cape Cod for pharmaceuticals, and has detected acetaminophen in our bays, estuaries and sounds. The only potential source for detectable acetaminophen is from failing on-site systems. There are a number of explanations including the failure of Title 5 to eliminate the use of cesspools. APCC has assembled anecdotal information that the majority of existing cesspools have a direct hydraulic connection with groundwater. APCC believes that CWMPs should address both cesspools and monitoring of on-site systems (which often escape inspection under current regulations). The Secretary can take a lead in this endeavor by ordering an update of Title 5 regulations that phase out cesspools and require periodic inspection of on-site systems (not just at sale or an identifiable problem like frequent pumping).

Sea level rise and the efficacy of on-site systems in low lying areas – While the plan addresses climate change, it overlooks some of the critical dynamics ultimately impacting wastewater decision making. APCC is coordinating a multi-level, multi-year modeling project to determine the impact of sea level rise on groundwater elevation and flow. One of the major climate challenges facing Cape Cod is sea level rise. Cape Cod is one of the global "hot spots" for sea level rise, meaning Cape Cod will face well-above global average sea level rise. This could be as much as a seven-foot increase over the next century. Cape Cod has a sole source aquifer that is significantly affected by sea level. On the outer Cape our freshwater floats entirely on top of salt water. On the upper Cape, sea level will have the same impact as if the fresh water were completely afloat: groundwater elevation will rise as sea level rises. As sea level rises it will impact a wide range of ecosystems and infrastructure. On-site septic systems work because of the separation of leaching fields from groundwater. According to the Department of Environmental Protection, the number one cause of on-site septic system failure is groundwater infiltration. Rising sea level will mean rising groundwater elevations and more on-site septic systems will fail. Working with the U.S. Geological Survey, and the Cape Cod Commission, work is underway in this modeling effort. The model will predict where sea level rise will have the greatest impact on the groundwater dynamic, which includes groundwater elevations, stream flow, pond size, and vernal pools, as well as human infrastructure (e.g. basements, septic systems, roads and underground utilities). Sea level rise will likely increase the rate of on-site septic systems and add to the cost of all in-ground infrastructure. This reality needs to be better integrated into the plan and priorities may have to be readjusted.

Environmental Justice Issues – The plan should more formally address the affordability challenges facing an older demographic often living on fixed incomes and the low income community in Mashpee. These residents may not be able to carry the full cost of implementation. While the Commonwealth has made adjustments to the state revolving fund program which should benefit those least likely to afford the cost of improvements, the town must take a more creative approach. APCC recommends the town consider income from commercial shellfishing associated with the plan be used to offset some of the financial impacts on those least able to afford costs associated with wastewater improvements.

Thank you for providing an opportunity to review and comment on this important step forward for Cape Cod.

Sincerely,

Edward J. DeWitt
Executive Director

cc: Mashpee Sewer Commission
Cape Cod Commission

Appendices 1-2 through 7-3 (on CD)

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