



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 of 321 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 sewerage) 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 | <ul style="list-style-type: none"> · Development of Regional Impact (DRI) | <ul style="list-style-type: none"> · Address non-construction issues during implementation. · Design review of DRI identified items. |
| MassDEP | <ul style="list-style-type: none"> · Groundwater Discharge Permit (GWDP) · Air Permitting (if required) · Emergency Generator (if required) · Chapter 91 License (if required) | <ul style="list-style-type: none"> · 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.

Water¹ 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 database², 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 American 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 public 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).

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 (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 Popponesset 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

| | Popponeset 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/SMASST Pilot Project Report (Nov 2008) Figure 2.15 "Equal Percentage for each town of Nitrogen Reduction Deposited as an Unattenuated Load to the Popponeset 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 (%) |
| Popponeset 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)

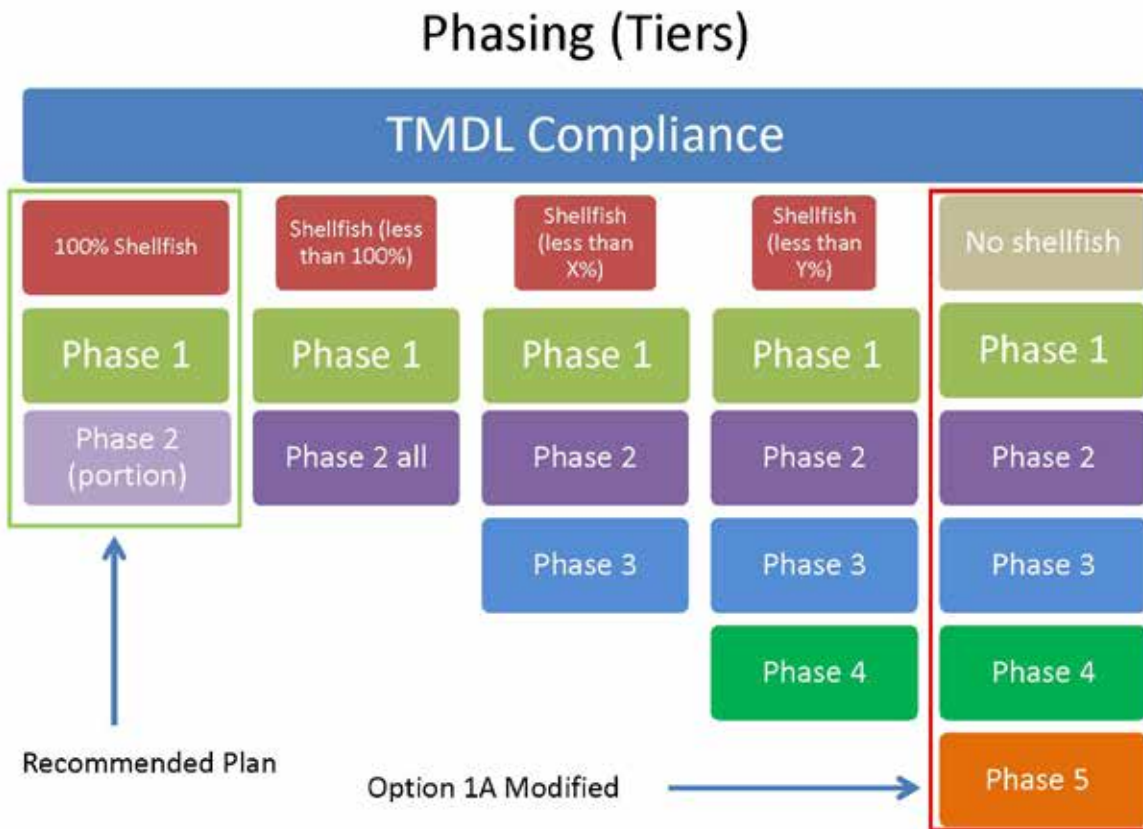


Figure 9-3 Implementation Plan Phasing to Achieve TMDLs

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 sewerage. 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):
 - conductivity (salinity)
 - chlorophyll a
 - dissolved oxygen (DO)
 - pH
 - turbidity
 - temperature
 - § MEP protocols:
 - conductivity (salinity)
 - chlorophyll a
 - dissolved oxygen (DO)
 - nitrogen (TN, NH₄, NO₂/NO₃, TDN, POC/N)
 - secchi disk visibility
 - suspended solids
 - 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:
 - length, width, and height
 - whole weight
 - dry shell mass
 - 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.