

Chapter 2

Data Review

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DATA REVIEW

2.1 INTRODUCTION

This chapter provides an overview of information used in preparing the Phase I Needs Assessment Report. The chapter includes a brief summary of past plans, reports, studies, and planning documents associated with wastewater planning in the Town of Mashpee.

2.2 COASTAL EMBAYMENT REPORTS AND DATA

The following coastal embayment-related technical reports and data were reviewed for this Needs Assessment Report:

A. **“Sources of Bacterial and Nutrient Contamination in the Mashpee River, Santuit River, and Shoestring Bay – Interim Report” October 1987, K-V Associates, Inc.**

This study looked into the sources of bacterial and other contamination in the Mashpee and Santuit River Corridors. The following summarizes the main points of the study:

- Bacterial contamination in the Mashpee River Corridor appears related to wildfowl sources.
- The major source of bacteria in Shoestring Bay appears to originate from a region just to the north of the School Street Bridge. The report was inconclusive, but presented the possibility that domestic sources could be the source.
- Septic source point discharges are uncommon along the river shorelines. However, septic leachate may be seasonally significant.
- Over 56 and 49 locations of surface runoff and visually apparent groundwater discharge were identified along the Mashpee and Santuit River Corridors, respectively.

B. “Winter Conditions, Storm Discharge and Recharge Zone Delineation for the Mashpee River, Quaker Run, and the Santuit River” May 1988, K-V Associates, Inc.

This study was undertaken as a supplement to the October 1987 study done by K-V Associates to more fully define the flow and water quality conditions along the river systems discharging into Shoestring Bay. The following conclusions were reached after water quality sampling and flow measurements:

- The river systems are largely dependent upon groundwater for flow with a discharge volume of 24 million gallons per day (mgd), 1.2 mgd, and 11 mgd respectively for the Mashpee River, Quaker Run, and Santuit River.
- In all three stream/estuarine systems, an increase in phosphorus concentration occurs as freshwater grades into brackish water.
- Generally, nitrogen decreases as freshwater changes to saltwater (the report did identify that this was not true for two regions along the Mashpee and Santuit Rivers).
- Bacterial concentrations in water samples were relatively low during winter compared to their summer conditions.

The recharge zones were delineated for the stream and river systems varying in size from the Mashpee River (2,053 acres), Santuit River (827 acres), to the small Quaker Run (106 acres).

C. “A Cumulative Impact Assessment Plan to Reduce and Control Sources of Contamination in the Mashpee and Santuit/Shoestring Bay River Estuaries” June, 1991, K-V Associates, Inc.

The purpose of this Mashpee River (and Shoestring Bay) Modeling Study was to provide long term management guidance for preserving the quality of the river. K-V Associates developed a simple linear model of the fresh water portion of the river, which was combined with the Ketchum Model for estuarine mixing. This model was combined with sampling results from previous studies to form a sensitivity matrix. This matrix could then be used to test the response

of water quality to engineering changes within the basin. All of the information was compiled to assess nutrient loadings and develop mitigation measures.

K-V Associates recommended the following mitigation measures to combat the adverse effects of nitrogen loadings in the river basins:

- Nitrogen Control – Recommendation included a 3-phase plan for achieving denitrification on large sewage systems, new residential homes, and existing homes.
- Bacterial Control – Recommendations included continued monitoring, roadway runoff control, and improved septic failure detection.
- River Eutrophication – Recommendation was planning and implementation of a riverbank improvement program.
- Harbor Management – Recommendations included limitations on in-water mooring areas and maintenance dredging to maintain flushing.
- Organizational – Recommendations were for modification of the Conservation Commission to a Conservation/Restoration Commission and creation of a Tree/River Warden position.

D. “The Technical Bulletin on Nitrogen Loading (TB91-001)” 1992, Eichner and Cambareri

This bulletin was developed by the Cape Cod Commission (CCC) to help identify sources of nitrogen and establish concentrations for nitrogen loading assessments of individual watershed parcels. It also provides justification for water quality standards for nitrogen that are found in the Regional Policy Plan (also developed by the CCC).

E. “Assessment of Coastal Nitrogen Loading and Nitrogen Management Alternatives: Popponesset Bay (Draft)” November 1995, Cape Cod Commission

The purpose of this study was to quantify the relative sensitivity of the Popponesset Bay subembayments to nitrogen loadings from wastewater, lawns, runoff, and precipitation.

Using a flushing load, the CCC determined the following critical loads for the subwatersheds:

- Shoestring Bay – 12,119 kilograms per year (kg/yr)
- Mashpee River – 1,020 kg/yr
- Entire Popponesset Bay system – 230,522 kg/yr

The Commission also evaluated current and projected land use provided by the Mashpee Planning Department for the various subwatersheds, and the additional nitrogen loading expected from future development based on water use (current density and average commercial water use) assumptions. The assessment determined that although Popponesset Bay as a whole has the assimilative capacity to accommodate existing and future nitrogen loads, the subembayments of Mashpee River and Shoestring Bay, when considered separately, already have nitrogen loads that exceed assimilative capacity. The CCC went on to recommend improved nitrogen removal during wastewater treatment and a reduction in nitrogen loading within these two subwatersheds to address this issue.

F. “The Ecology of the Waquoit Bay National Estuarine Research Reserve” 1996, Massachusetts Department of Environmental Management

This document discusses the ecology of the Waquoit Bay National Estuarine Research Reserve (WBNERR) including human and animal habitats, the geologic history and glaciation of the area, response to urban development, and management issues regarding eutrophication, nutrient loading, endangered species, and others.

The main points of the section entitled “Modeling Nitrogen-Loading to Coastal Waters” were most pertinent to this discussion and are discussed briefly below:

- Nitrogen-loading models under evaluation on Cape Cod differ with regard to the inclusion of wet and dry atmospheric deposition, the importance of losses of nitrogen in septic system plumes and the aquifer, and the effects of travel time of groundwater.

- The model used in this study included nitrogen contributions from atmospheric deposition (about 15 kg TDN/hectare/13 lb-acre), fertilizer inputs, and on-site septic systems (about 3-5 kg/person/day); and losses from volatilization, uptake, adsorption, and denitrification, depending on the travel pathway.
- Nitrogen loading to Waquoit Bay lags behind the rate of development by almost a decade due to the time of travel of groundwater, about 0.3-1 meter/year.
- Nitrogen loading has a direct effect on the organisms in an estuarine ecosystem, including *Phytoplankton*, *Microalgae*, *Gracilaria tikvahiae*, *Cladophora vagabunda*, Eelgrass, Shellfish, Amphipods, Isopods, and others.

G. “Nutrient Related Water Quality within the Popponesset Bay System, Part I: Summer Survey of Nutrient and Oxygen Levels” December 21, 1997, Brian L. Howes and David R. Schlezinger, School for Marine Science and Technology (SMAST).

The purpose of this study was to determine if there was currently any nutrient related water quality degradation of any of the Popponesset Bay’s component embayments. The results indicated that the component sub-embayments of Mashpee River, Ockway Bay, and Shoestring Bay showed a range of nutrient related water quality impacts from highly impacted (Mashpee River) to moderate-high impact (Ockway and Shoestring Bays).

The report also discusses the issue of nutrient related water quality degradation resulting from nitrogen loading, and the sources of this nitrogen.

H. “Nutrient Management of the Popponesset Bay System: Quantitative Assessment of Nitrogen Loading Tolerances of Component Sub-Embayments” June 12, 1999, Brian L. Howes, Ph.D., SMAST at the University of Massachusetts—Dartmouth

This report presented a progress report to the Town of Mashpee Watershed Committee on the on-going assessment of the Popponesset Bay System to support nutrient management and restoration plans. The preliminary results of the study were as follows:

- Total nitrogen and chlorophyll levels throughout the Popponesset Bay system were generally at least 2 times that of the water in Nantucket Sound.
- The Mashpee River showed oxygen depletion and some of the highest chlorophyll-a levels (indicative of high algae concentrations) reported for any Cape Cod embayment.
- The ecological and water quality data collected was to be used to determine nitrogen loading tolerances for each component system.

I. **Massachusetts Estuaries Project (MEP) Documents:**

The following reports were developed by MEP for watersheds in the PPA:

- “Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for Popponesset Bay, Mashpee and Barnstable, Massachusetts” Final Report – September 2004.
- “Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for the Quashnet River, Hamblin Pond, and Jehu Pond, in the Waquoit Bay System of the Towns of Mashpee and Falmouth, MA” Final Report – January 2005.
- “FINAL: Popponesset Bay total Maximum Daily Loads for Total Nitrogen” April 10, 2006.
- “FINAL DRAFT: Quashnet River, Hamblin Pond, Little River, Jehu Pond, and Great River in the Waquoit Bay System Total Maximum Daily Loads for Total Nitrogen” October 14, 2005.

The purpose, methodology, and findings of these reports are discussed in greater detail in Chapter 4.

In addition to the MEP reports listed above, the Technical Report and Draft Total Maximum Daily Load (TMDL) Report for the Three Bays estuary have been released (a small portion of the Town of Mashpee is included in the Three Bays watershed). The Technical Report was released in April 2006, and the Draft TMDL Report is dated December 28, 2006. The Draft TMDL Report presents one scenario to achieve the proposed TMDLs that would require removal

of varying amounts of wastewater-generated nitrogen. Some subwatersheds are identified as requiring as high as 100% septic nitrogen removal. The Three Bays reports were completed as part of the Town of Barnstable's nutrient management plan, which is in the process of developing nitrogen limits for all of the significant estuaries within Barnstable. Once the TMDLs for Barnstable's estuaries are completed, the nutrient management plan will be used to evaluate and implement wastewater and nitrogen management solutions to meet the specified goals and limits for restoring water quality.

2.3 WASTEWATER REPORTS AND DATA

The following wastewater-related technical reports and data were reviewed for this Needs Assessment Report:

A. "Town of Mashpee Facility Plan (Draft)" April 1988, Weston & Sampson, Inc.

This report was conducted by Weston & Sampson, Inc. (W&S) to evaluate the existing wastewater treatment and disposal facilities for the Town, predict future wastewater and septage volumes, and select and design a new wastewater management solution. At the time, residents of Mashpee utilized an on-lot disposal system of cesspools and septic tanks. Throughout the 1980's, monthly and annual septage volumes steadily increased and surpassed Board of Health (BOH) limitations. Results from a 1986 questionnaire answered by residents from Popponesset, New Seabury, Seconsett Island, Central Mashpee, and Pond Areas were also used in needs assessment. Based on this information and projected population and land use development, W&S determined existing and future wastewater flows for winter and summer conditions. After conducting an alternatives analysis of various wastewater treatment technologies, the recommendation was to haul sewage to a septage treatment facility located on the parcel of Town owned land on Ashers Path, which was occupied at the time by a sanitary landfill. The report also details a preliminary design of the facility, including a financial plan, recommended method of financing, and operation and maintenance of the facility.

B. “East Mashpee Subregional Treatment Facility Environmental Notification Form (ENF)” September 1988, DeFeo, Wait & Associates, Inc.

This ENF was submitted for the proposed East Mashpee Subregional Wastewater Treatment Facility (WWTF). Also included are the design report and feasibility study for the WWTF, and the Geohydrological/Environmental Evaluation Report prepared by Goldberg-Zoino and Associates, Inc.

The facility was designed to utilize Rotating Biological Contactor (RBC) technology along with secondary and tertiary processes to treat a maximum daily flow of 250,000 gallons per day (gpd) coming from the Willowbend, Dolphin Bay, Cranberry Hollow, and Stratford Ponds developments in East Mashpee. The following were evaluated as potential sites that could accommodate a WWTF and effluent disposal facilities:

- Landfill Site - Located on the north side of Ashers Path and currently occupied by the Town of Mashpee Solid Waste Transfer Station and Police Department firing range.
- Peck Site - Located on the north side of Quinaquisset Avenue west of the Santuit River. The site is undeveloped at this time, but mostly owned by the Mashpee Conservation Commission.
- Antunes Site – Located on the west side of Orchard Road at the intersection of Quinaquisset Avenue. This site is presently developed as a residential subdivision.
- Houston Site – Located on the east side of Mashpee Neck Road at Simons Narrows. The site consists of four parcels which have since been developed.
- Marsters Site – Located at the east side of Mashpee Neck Road, north of Dry Hollow Lane. A residential subdivision has been developed on this site.

The landfill site at Ashers Path was chosen as the most appropriate site for this design. A wastewater collection system was also designed, involving lift stations on the north side of Quinaquisset Avenue and on Noisy Hole Road, gravity sewers, and pressure sewers.

**C. “Wastewater Management Study for Seconsett and Monomoscoy Islands”
December 1990, Dames & Moore**

The purpose of this study was to evaluate wastewater management options for Seconsett and Monomoscoy Islands that would reduce organic and nutrient loadings to nearby Waquoit Bay. The study looked at 245 existing homes plus flow from the existing boat yard (using 1988 data) for a total residential and commercial average daily wastewater flow of 52,000 gpd. Future flow, including inflow and infiltration, was estimated at 75,370 gpd.

Based on these conditions, Dames & Moore evaluated two alternatives – collection system for off-island treatment and collection system with on-island treatment. The on-island option was estimated to cost \$4,700,000 in 1990 dollars. Based on this cost and the high land requirements for this option, the report recommended and provided the preliminary design for a collection system that would convey individual septic tank effluent to an off-island treatment facility. The facility was estimated to cost \$3,450,000 in 1990 dollars.

**D. “Feasibility Analysis of Septage Pretreatment at the MMR WWTF” May 1995,
Dufresne-Henry, Inc.**

This study evaluated the feasibility of implementing a septage pre-treatment facility at the wastewater treatment facility located on the Massachusetts Military Reservation (MMR) to accommodate septage generated in the towns of Sandwich and Mashpee. The following summarizes the findings of the study:

- At the time of the study, septage from the Town of Mashpee was transported to the Barnstable wastewater treatment facility or to facilities off Cape Cod for treatment.
- The report recommended a pretreatment train consisting of the following components: preliminary screening and grit chamber, flow equalization, sludge thickening and dewatering, filtrate equalization, odor control, and solids stabilization.

- The study provided preliminary designs and cost estimates for dewatering using the existing belt filter press and for dewatering through the installation of a recessed chamber press.

E. “Sewer Extension Permit Application Submittal Data – Shoestring Bay Estates Sewage Pump Station” August 17, 1998, Earth Tech

This document provides wet well calculations and curve data for the Shoestring Bay pumping station, which services the development at Willowbend. It also provides specifications for the grinder pumps, control panel, generator set, generator accessories, and transfer switch associated with the pumping station.

F. “New Seabury Development Project ENF” November 1999, Earth Tech, Inc.

This ENF details potential environmental impacts and permitting requirements for the New Seabury development project at the following locations:

- Spinnaker Cove
- Sea Quarters Condominium Complex
- Popponesset Inn
- Poppy Place
- New Seabury Country Club and vicinity
- Flat Pond Subdivision (including Promontory Point Condominium)
- Green Golf Course (site of existing WWTF)

Also included is the request for a Phase One waiver for construction of the golf course clubhouse, golf cart storage building, and the wastewater treatment facility. The determinations for this Phase One Waiver include:

- The potential impacts of the Phase One, taken alone, are insignificant.

- Ample and unconstrained infrastructure exists to support Phase One of the New Seabury redevelopment program.
- The project is severable.
- The Agency Action on Phase One will ensure due compliance with Massachusetts Environmental Policy Act (MEPA) and 301 CMR 11.00 prior to Commencement of any other phase of the Project.

The following approvals were required to construct the New Seabury Development Project:

- ENF and Environmental Impact Report (EIR) for MEPA approval
- Groundwater Discharge Permit under 314 CMR 5.00
- Sewer connection/extension permit under 314 CMR 7.00
- Massachusetts Department of Environmental Protection (MADEP) Approval to construct a WWTF under 314 CMR 12.00
- Order of Conditions under the Massachusetts Wetland Protection Act (WPA)

Attachment F of the ENF is the Preliminary Engineering Report for the Proposed WWTF and disposal facilities at New Seabury. This report details the wastewater collection, treatment, and disposal process, as well as calculations for design flow and sizing of tanks (See Chapter 6 of this report for a detailed description of this facility).

G. “The Neighborhoods of Mashpee Commons DEIR and Final DRI Submittal” March 15, 2000, Mashpee Commons, L.P.

The purpose of the Mashpee Commons Development of Regional Impact (DRI) Submittal is to demonstrate that the Mashpee Commons Master Plan meets the goals of the Cape Cod Commission’s Regional Policy Plan and the Town of Mashpee’s Local Comprehensive Plan in the following aspects of its development:

- Community Character
- Heritage Preservation

- Affordable Housing
- Transportation
- Natural Resources and Open Space
- Water Resources
- Solid and Hazardous Waste Management
- Construction Impacts

This document also includes the following Draft Environmental Impact Reports (DEIR) which are included as part of the MEPA review process:

- Transportation DEIR/DRI, Vanasse & Associates, Inc.
- Mesoscale Air Quality Analysis, Tech Environmental, Inc.
- Water Resources DEIR, Sanborn, Head & Associates (SHA)

Within the Water Resources section of the DEIR is a report prepared by SHA detailing the permit modification application, an estimation of future wastewater and nitrogen loadings, and stormwater best management practices. A report on Mashpee Commons WWTF expansion alternatives written by Dufresne-Henry is also included in this section.

**H. “Draft Environmental Impact Report – New Seabury Development Project”
October 2000, Earth Tech**

This report includes descriptions of the proposed developments at New Seabury as appropriate to the discussion of potential environmental impacts and mitigation of these impacts. The New Seabury development activities at the time were:

- Completion of the Sea Quarters Condominium – 50 units
- Completion of the Promontory Point Condominium – 24 units
- Development of the Flat Pond subdivision - +/- 30 single-family homes
- Development of Spinnaker Cove – 8 single-family units and a 4,000 square foot commercial building

- Redevelopment of the Popponesset Inn and associated recreation facilities
- Completion of the Bluff Lots east of the Popponesset Inn – 5 single-family homes
- Condominium development around Popponesset Inn – 51 units
- Poppy Place – 14 single-family lots
- Replacement of golf course clubhouse
- Condo development around the golf course clubhouse – 87 units
- Construction of the new golf course maintenance facility
- Upgrade of the Green Golf Course and a portion of the Blue Course
- Mixed use development in Section 5
- Construction of a 300,000 gpd WWTF to service the new development, clubhouse, and Popponesset Inn

Development in Section 5 of the New Seabury property is described in detail in this DEIR as it is a site of potential historic significance and also contains two public water supply wells and their corresponding Zone II Aquifer Protection Districts.

The following approvals and permits were required by the state for this project:

- ENF as part of the MEPA review process
- Phase I Waiver Request (MEPA)
- Draft EIR (MEPA)
- Groundwater Discharge Permit (MADEP)
- Chapter 91 License for Spinnaker Cove Development (MADEP)
- Disposal Works Construction Permit for WWTF and for temporary systems at clubhouse, maintenance facility, and recreation complex (BOH)
- Building Permits (Building Department)

Most of these developments will feed into the existing WWTF, which is permitted to handle 300,000 gpd. Additional mitigation measures include the use of Best Management Practices (BMPs), the implementation of a Stormwater Pollution Prevention Plan, limitations on the area of manicured lawn in developments that are adjacent to the Mashpee Water District wells, and

the installation of monitoring wells associated with the wastewater treatment facility discharge and public water supply wells.

The projected increase in water use resulting from the developments at New Seabury (16,000 gpd) is expected to be supplied by the addition of two water supply wells (at Mashpee Village and Turner Road #2), and possibly by the Upper Cape Regional Water Supply Cooperative on the Massachusetts Military Reservation.

I. “Master Plan for Mashpee Commons FEIR/DRI” January 2001, Mashpee Commons, L.P.

Water Resource impacts associated with earlier proposals for the development of Mashpee Commons such as stormwater runoff, increased domestic wastewater generation, and increased water supply demand were addressed in this document. The Master Plan proposes an upgrade to the existing treatment plant to accommodate the increased wastewater load resulting from new development, and also to include existing properties in the area. The capacity of the treatment system was based on the average daily flow during the peak month of the year (due to the seasonal variation of flows). For nitrogen removal, wastewater characteristics based on an average annual flow were used to design a “no net increase” in nitrogen loading into the Mashpee River watershed. The treatment plant will be upgraded to treat an anticipated 195,000 gpd and achieve an average of 4 milligrams per liter (mg/L) Total Nitrogen through tertiary treatment.

The Master Plan also details environmental impacts of the Mashpee Commons development project on the following:

- Natural Resources and Open Space
- Solid and Hazardous Waste
- Transportation
- Affordable Housing
- Heritage Preservation and Community Character

The development of the Mashpee Commons Neighborhoods and the upgrade of the WWTF are phased out over fifteen (15) years to allow the plans to evolve with changing needs of the community.

**J. “Final Environmental Impact Report (FEIR) – New Seabury Development Project”
March 2001, Earth Tech**

This report was written to address comments regarding the DEIR that was filed in October, 2000. The report presents the comments and responses, and updated the status of the project at the time. The questions that were addressed included some that are relative to the Watershed Nitrogen Management Plan (WNMP) process. One comment was in reference to Mashpee’s proposal to dispose of 500,000 gpd of wastewater at New Seabury. The response included the following comments:

- Although the area was identified as an ideal location for wastewater disposal, no firm proposals were in place to move forward with the plan.
- At the time, effluent disposal was intended to be by means of deep well injection, which “is not yet a fully accepted technology in Massachusetts”.
- The proposal would require large amounts of land acquisition by the Town, which would have to be bought from the owner or taken by eminent domain.

Additional comments recommended further groundwater modeling to determine the potential impacts on drinking water supply wells and the potential for groundwater mounding as a result of New Seabury’s proposed 300,000 gpd discharge. The response included the following comments:

- Wastewater-impacted groundwater would take several years to reach Zone II boundaries. Saltwater intrusion would be a much greater concern during extended pumping periods.

- The groundwater mound, with all irrigation wells off, was projected to be 0.8 feet. The elevation of the groundwater near the wells was still determined to be higher than the elevation of the projected mound. This would indicate that the potential for the wastewater to impact the drinking water supply was minimal.

Excerpts of the FEIR are attached in Appendix B. For detailed comments and responses, please refer to the actual document.

2.4 OTHER REPORTS AND DATA

The following other technical reports and data were reviewed for this Needs Assessment Report:

A. “Mashpee Water District Annual Reports,” Mashpee Board of Water Commissioners.

The addition of Pump Station #5 at Turner Road, designed by Dufresne-Henry, Consulting Engineers, added up to 600 gallons per minute (gpm) to the available water supply in Mashpee. Construction of the Belcher well pumping station was completed in 2006, providing an additional 1 mgd to Mashpee’s water supply.

B. “Stormwater Report on Runoff to Mashpee and Santuit Rivers from Public Ways” May 17, 2006, Charles L. Rowley & Associates

This report was written for the town of Mashpee Planning Board after several stormwater runoff sites were inspected. The runoff sites were located on public ways and discharged to either the Mashpee River or the Santuit River. The report summarizes observations, identifies discharge points, and presents conclusions for the following sites:

- Route 130 at the Mashpee River and Herring Run
- Santuit River at Quinaquisset Avenue

- Santuit River at Route 130 and Route 28
- Santuit River at Old Mill Road
- Quinaquisset Avenue at the Mashpee River Woodlands area