

Comprehensive Wastewater Management
Planning (CWMP) Project

Needs Assessment Report

Volume 1 of 2
Report Text and Tables

Prepared for

TOWN OF BARNSTABLE, MASSACHUSETTS

Prepared by

STEARNS & WHEELER, LLC
Environmental Engineers & Scientists
1545 Iyannough Road, Route 132
Hyannis, Massachusetts 02601

July 2010

Project No. 8612474

TABLE OF CONTENTS

	<u>Page</u>
EXECUTIVE SUMMARY	
ACKNOWLEDGEMENTS	
GLOSSARY OF COMMON ACRONYMS	
CHAPTER 1- INTRODUCTION	
1.1 Project Purpose and Planning Area.....	1-1
1.2 Project Issues and Background.....	1-2
1.3 Town of Barnstable Vision and Goals as Articulated in the Barnstable Comprehensive Plan	1-11
1.4 Project Scope	1-13
1.5 Planned Public Review	1-16
1.6 Planned Environmental Review.....	1-17
1.7 Planning Period.....	1-17
1.8 Purpose and Organization of the Needs Assessment Report.....	1-17
CHAPTER 2 - DATA REVIEW	
2.1 Introduction.....	2-1
2.2 Technical Reports and Data.....	2-1
2.3 Mapping and Design Drawings	2-10
2.4 Town and Regional Data	2-11
2.5 Meetings and Telephone Contacts.....	2-11
2.6 Ongoing Town Projects	2-13
CHAPTER 3 - REGULATORY ISSUES	
3.1 Introduction.....	3-1
3.2 Federal and State Regulatory Issues	3-1
3.3 Regional Regulatory Issues.....	3-14
3.4 Town of Barnstable Ordinances and Regulations.....	3-15
CHAPTER 4 - EXISTING WASTEWATER AND WATER SUPPLY SYSTEMS	
4.1 Introduction.....	4-1
4.2 Hyannis Water Pollution Control Facility (WPCF)	4-2
4.3 Hyannis WPCF Collection System	4-12
4.4 Marston Mills WWTF.....	4-21
4.5 Red Lily Pond Cluster System.....	4-23
4.6 Private Wastewater Treatment Facilities	4-24
4.7 Individual Home I/A Systems.....	4-25
4.8 Individual Home Septic Systems	4-26
4.9 Communal Sewage Holding (Tight) Tank.....	4-26
4.10 Water Supply System Information.....	4-27
4.11 Water Conservation Efforts	4-30

TABLE OF CONTENTS
(continued)

CHAPTER 5 - EXISTING AND FUTURE CONDITIONS IN THE TOWN OF BARNSTABLE

5.1	Introduction.....	5-1
5.2	Planning Area and Component Delineations.....	5-1
5.3	Town Goals with Respect to Wastewater and Nutrient Management	5-2
5.4	Embayment Water Quality Related to Nitrogen Impacts and MEP Report Findings.....	5-3
5.5	Groundwater Hydrology and Quality	5-9
5.6	Ponds and Lakes.....	5-16
5.7	Bathing Beach Resources.....	5-22
5.8	Shellfish Resources.....	5-25
5.9	Additional Natural Resources and Physical Characteristics.....	5-27
5.10	Protected Cultural Areas.....	5-31
5.11	Population and Demographics.....	5-32
5.12	Land Use and Evaluations to Quantify Water Consumption and Wastewater Flows.....	5-33

CHAPTER 6 - NEEDS ASSESSMENT SUMMARY

6.1	Introduction.....	6-1
6.2	Wastewater and Nutrient Management Planning History in Barnstable and Related Needs	6-1
6.3	Regional Wastewater and Nutrient Management Issues and Related Needs	6-2
6.4	Town Vision and Goals with Respect to Wastewater and Nutrient Management Planning	6-3
6.5	Estimated Landuse Growth Projections in Barnstable and Related Needs.....	6-5
6.6	Water Quality Needs.....	6-5
6.7	Wastewater Treatment and Recharge Facilities and Related Needs.....	6-8
6.8	Informational Needs (Data Gaps).....	6-10
6.9	No Action Alternative.....	6-11
6.10	Next Steps to Identify Solutions for Wastewater Needs.....	6-11

TABLE OF CONTENTS
(continued)

LIST OF TABLES

<u>Table No.</u>	
2-1	Planning Conditions and Cost Summary of Sewer Extensions and Modifications Identified in 2007 WWFP
2-2	Capital and O&M Costs for Sludge System and Employee Locker Room Improvements Recommended in 2007 WWFP
2-3	Future Flows to the Hyannis WPCF Proposed in 2007 WWFP
4-1	Influent Flows (2006-2009) Hyannis WWTF
4-2	Hyannis WPCF Capacity Summary of Existing Hyannis WPCF Processes
4-3	Overview of Hyannis WPCF Sewer System
4-4	Hyannis WPCF Summary of Pump Stations and Force Mains
4-5	Listing of Private Pump Stations
4-6	Average-Monthly Water Supply Flows
4-7	Summary of Water Supplies, Pumping Rates and Capacities (2006-2008)
4-8	Summary of water Supplies, Pumping Rates, and Capacities, 2006 - 2008
5-1	Summary of Consumer Confidence Report (CCR) Data for Local Water Departments
5-2	Monitoring Well Sampling at Marstons Mills WWTF
5-3	Pond Summary of Existing Conditions, Management Priority, and Recommended Actions
5-4	Summary of Bathing Beach Closures by Village (2007-2009)
5-5	Land Use Summary per Village and Marine Watershed
5-6	Existing Dwelling Unit and Non-Residential Building Square Footage Evaluation by Village and Marine Watershed
5-7	Dwelling Unit and Non-Residential Building Square Footage Evaluation by Village and Marine Watershed at Buildout
5-8	Water Consumption and Wastewater Generation Calculation Summary by Village and Marine Watershed
5-9	Average Existing Residential Water Consumption Comparison
5-10	Residential Water Consumption and Wastewater Generation at Buildout by Village and Marine Watershed
5-11	Non-Residential Building Water Consumption and Wastewater Generation at Buildout by Village and Marine Watershed
5-12	Daily Future Wastewater Flows by Village and Marine Watershed
5-13	Summary of Existing and Buildout Water Consumption and Wastewater Generation for the Current WPCF
5-14	Summary of Existing and Buildout Water Consumption and Wastewater Generation for the Planned Sewer Extensions as illustrated in Figure 2-1
5-15	Summary of Projected Flows to the Hyannis WPCF at the Buildout Condition
5-16	Summary of Growth Trends from 1998 to 2010
5-17	Projected Land Use in 2036, and Estimate Year of Buildout
5-17	Projected Water Consumption and Wastewater Generation in 2035

TABLE OF CONTENTS
(continued)

LIST OF FIGURES

<u>Figure No.</u>	
ES-1	Project Location Map
ES-2	Existing Wastewater Nitrogen Removals to Meet TMDLs
1-1	Project Location Map
2-1	Wastewater Areas of Concern and Recommended Solutions from 2007 WWFP
2-2	Figure 2-2 is not used
2-3	Implementation Phasing of Sewer Extensions Proposed in Draft November 2008 Memorandum
4-1	Hyannis WPCF Site Plan
4-2	Hyannis WPCF BOD Concentrations
4-3	Hyannis WPCF TSS Concentrations
4-4	Hyannis WPCF Effluent Nitrogen Concentrations
4-5	Wastewater Flow Schematic for Hyannis WPCF
4-6	Septage Flow Schematic for Hyannis WPCF
4-7	Sludge Flow Schematic for Hyannis WPCF
4-8	Sand Infiltration Bed Identification
4-9	Hyannis WPCF Existing Collection System
4-10	Hyannis WPCF Pump Station / Force Main Schematic
4-11	Marstons Mills WWTF Site
4-12	Marstons Mills WWTF Flow Schematic
4-13	Marstons Mills WWTF Influent Flows
4-14	Marstons Mills WWTF Influent and Effluent BOD Concentrations
4-15	Marstons Mills WWTF Effluent TSS Concentrations
4-16	Marstons Mills WWTF Effluent Nitrogen Concentrations
4-17	Red Lily Pond Cluster System Site
4-18	Locations of Existing Wastewater Treatment Systems Designed for Nitrogen Removal
4-19	Barnstable Water Supplies and Areas Served
5-1	Existing Wastewater Nitrogen Removals to Meet TMDLs
5-2	Figure 5-2 is not used
5-3	Hydrology
5-4	Sensitive Habitat and Natural Areas
5-5	Shellfish Resources
5-6	Topography
5-7	Geology
5-8	Soils
5-9	Flood Zones
5-10	Open Space
5-11	Land Use
5-12	Historic Districts

TABLE OF CONTENTS (continued)

LIST OF APPENDICES

Appendix

- 1-1 Town of Barnstable Wastewater Facilities Plan and Final Environmental Impact Report, Executive Summary and Table of Contents
- 1-2 EOEEA Certificate for Town of Barnstable Final Wastewater Facilities Plan/FEIR, May 18, 2007
- 1-3 CCC DRI Decision on Town of Barnstable Wastewater Facility Plan, September 20, 2007
- 1-4 Regional Wastewater Evaluations for Yarmouth and Barnstable
- 1-5 Town of Barnstable Nutrient Management Project Scope, August 2008

- 2-1 Draft Memorandum on Sewer Phasing Evaluation and Implementation Schedule, November 2008
- 2-2 Hyannis WPCF Groundwater Discharge Permits: 1980 and 1990 Draft
- 2-3 Marstons Mills WWTF Groundwater Discharge Permit, March 2010

- 4-1 Hyannis WPCF Monthly Operating Data
- 4-2 Hyannis WPCF Typical Monthly Report
- 4-3 Inventory of Existing Process Facilities and Equipment at Hyannis WPCF
- 4-4 Marstons Mills WWTF Monthly Operating Data Summary

- 5-1 Action Plan for the Barnstable Ponds
- 5-2 Land Use Codes and Description
- 5-3 Summary of Procedures Used to Develop Buildout Estimates
- 5-4 Nitrogen Removal Information Suggested by MEP on a Sub-Watershed Basis
- 5-5 Regression Analysis of Land Use Data from 1998 through 2010 to Estimate Residential and Non-Residential Growth Rates in Barnstable

GLOSSARY OF COMMON ACRONYMS

ABF	Aerated Biological Filters
ACEC	Areas of Critical Concern
ACRE	Applied Coastal Research and Engineering, Inc.
AOC	Area of Concern
AOP	Advanced Oxidation Processes
APCC	Association to Preserve Cape Cod
ATAD	Autothermal Thermophilic Aerobic Digestion
BAC	Biological Activated Carbon
BAF	Biologically Active Filters
BCDHE	Barnstable County Department of Health and Environment
BCP	Barnstable Comprehensive Plan
BMP	Best Management Practices
BNR	Biological Nitrogen Removal
BOD	Biological Oxygen Demand
BOH	Board of Health
CCC	Cape Cod Commission
CCWPC	Cape Cod Water Protection Collaborative
CEC	Contaminants of Emerging Concern
CFR	Code of Federal Regulation
CMR	Code of Massachusetts Regulations
CNR	Cyclical Nitrogen Removal
COD	Chemical Oxygen Demand
CWA	Clean Water Act
CWMP	Comprehensive Wastewater Management Plan
CZM	Coastal Zone Management
DBP	Disinfection By-Products
DCPC	District of Critical Planning Concern
DCWMP/DEIR	Draft Comprehensive Wastewater Management Plan and Draft Environmental Impact Report
DMF	Division of Marine Fisheries
DO	Dissolved Oxygen
DOC	Dissolved Organic Carbon
DPW	Department of Public Works
DRI	Development of Regional Impact
EDC	Endocrine Disrupting Compounds
EIR	Environmental Impact Report
eMLE	enhanced Modified Ludzack-Ettinger
ENF	Environmental Notification Form
ENR	Enhanced Nitrogen Removal
FAST	Fixed Activated Sludge Treatment
FCWMP/FEIR	Final Comprehensive Wastewater Management Plan and Final Environmental Impact Report
FFL	Falmouth Friendly Lawn

Glossary of Common Acronyms (continued)

GAC	Granular Activated Carbon
GIS	Geographic Information System
gpd	gallons per day
gpd/im	gallons per day per inch-mile
gpd/sf	gallons per day per square foot
GWDP	Groundwater Discharge Permit Program
HAA	Haloacetic Acids
I/A	Innovative and Alternative
IFAS®	Integrated Fixed Film Activated Sludge
I/I	Infiltration/Inflow
LCP	Local Comprehensive Plan
MassDEP	Massachusetts Department of Environmental Protection
MBBR	Moving Bed Biofilm Reactors
MBR	Membrane Bioreactors
MCL	Maximum Contaminant Level
MEPA	Massachusetts Environmental Policy Act
MEP	Massachusetts Estuaries Project
MF	Microfiltration
MGL	Massachusetts General Law
mgd	million gallons per day
mg/L	milligrams per liter
MIEX	Magnetic Ion Exchange
MLE	Modified Ludzack-Ettinger
MLSS	Mixed Liquor Suspended Solids
MMMS	Marstons Mills middle School
MMR	Massachusetts Military Reservation
MSL	Mean Sea Level
NaOCl	Sodium Hypochlorite
N ₂	Nitrogen Gas
NEPA	National Environmental Policy Act of 1970
NERR	National Estuarine Research Reserve
NF	Nanofiltration
NHESP	Natural Heritage and Endangered Species Program
NH ₄	Ammonium Cation
NH ₃ -N	Ammonia Nitrogen
NO ₃ -N	Nitrate Nitrogen
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Units
OH	Hydroxyl
O&M	Operations & Maintenance

Glossary of Common Acronyms (continued)

PAC	Powdered Activated Carbon
PALS	Pond and Lake Stewardship
POTW	Publicly Owned Treatment Works
PPCP	Pharmaceuticals and Personal Care Products
ppm	parts per million
psi	per square inch
PSTF	Privately-owned Sewage Treatment Facility
RAS	Return Activated Sludge
RBC	Rotating Biological Contactor
RO	Reverse Osmosis
ROW	Right-of-Way
RPP	Regional Policy Plan
RSF	Recirculating Sand Filter
SBR	Sequencing Batch Reactor
SCADA	Computer system that stands for: Supervisory Control and Data Acquisition
SDWA	Safe Drinking Water Act
SMAST	School of Marine Science and Technology
STEG	Septic Tank Effluent Gravity
STEP	Septic Tank Effluent Pump
SWD	Solid Waste Division
TDS	Total Dissolved Solids
THM	Trihalomethane
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TOC	Total Organic Carbon
TSS	Total Suspended Solids
UCT	University of Capetown
UF	Ultrafiltration
ULPRO	Ultra Low Pressure Reverse Osmosis
UMass	University of Massachusetts
USDA	U.S. Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UV	Ultraviolet
VIP	Virginia Initiative Plant
WAS	Waste-Activated Sludge
WPA	Wetlands Protection Act
WPCD	Water Pollution Control Division
WPCF	Water Pollution Control Facility
WWTF	Wastewater Treatment Facility

ZOC Zone of Contribution