COMPREHENSIVE WASTEWATER MANAGEMENT PLAN

Town of Manchester-by-the-Sea

A Report to: Town of Manchester-by-the-Sea

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Comprehensive Wastewater Management Plan

Table of Contents

Comprehensive Wastewater Management Plan

List of Figures

Comprehensive Wastewater Management Plan

List of Tables

Comprehensive Wastewater Management Plan

List of Acronyms

A

Administrative Consent Order (ACO)

B

Base Flood Elevation (BFE)
BioMap2 (BM2)
Biological Oxygen Demand (BOD)
Board of Health (BOH)

C

Clean Water Act (CWA)
Clean Water State Revolving Fund (CWSRF)
Coastal Zone Management (CZM)
Code of Massachusetts Regulations (CMRs)
Colony Forming Units (cfu)
Comprehensive Wastewater Management Plan (CWMP)
Core Habitat (CH)
Critical Natural Landscape (CNL)

D

Department of Public Works (DPW)
Division of Fisheries and Wildlife (DFW)

E

F

Federal Emergency Management Authority (FEMA)
Flood Insurance Rate Map (FIRM)

G

Gallons per capita per day (gpcd)
Gallons per day (gpd)
Geographic Information Systems (GIS)

H

I

Infiltration and Inflow (I/I)
Innovative / Alternative (I/A)
Intended Use Plan (IUP)

J

K

L

Limited Commercial District (LCD)
Low Impact Development (LID)

M

Massachusetts Bay Transit Authority (MBTA)
Massachusetts Department of Environmental Management (MassDEM)
Massachusetts Department of Environmental Protection (MassDEP) or (DEPs)
Massachusetts Department of Public Health (MDPH)
Massachusetts Endangered Species Act (MESA)
Massachusetts Executive Office of Energy and Environmental Affairs (EEA)
Massachusetts General Laws (M.G.L.)
Massachusetts Information Technology (MassIT)
Massachusetts Office of Geographic and Environmental Information (MassGIS)
Metropolitan Area Planning Council (MAPC)
Milliliters (mL)
Million gallons per day (MGD)or (mgd)

N

National Ambient Air Quality Standards (NAAQS)
National Flood Insurance Program (NFIP)
National Pollutant Discharge Elimination System (NPDES)
Natural Heritage and Endangered Species Program (NHESP)
Natural Heritage and Endangered Species Program / The Nature Conservancy's Massachusetts Program (NHESP/TNC BioMap2)
Natural Resource Conservation Service (NRCS)
Northshore Task Force (NTF)

O

Ocean Act of 2008(OA)
Ocean Management Plan (OMP)
Ocean Sanctuaries Act (OSA) or (Act)
Ocean Sanctuaries Limit (OSL)
Open Space and Recreation Plan (OSRP)
Operations and Maintenance (O&M)
Outstanding Resources Water (ORWs)

P

Peak flow (pf)

Q

R

S

Sanctuary Sewer Overflow (SSO)
Sanitary Sewer Evaluation Survey (SSES)
Sanitary Sewer Overflow (SSO)
Septage Management Plan (SMP)
Soil Absorption System (SAS)
Soil Survey Geographic (SSURGO)
South Essex Sewer District (SESD)
Special Flood Hazard Areas (SFHA)
Square Feet (sq.ft.)
State Revolving Fund (SRF)
Supervisory Control & Data Acquisition (SCADA)

T

Total Maximum Daily Loads (TMDLs)
Total Suspended Solids (TSS)
Town of Manchester-by-the-Sea (the town) or (MBTS)

U

United States Department of Agriculture (USDA)
United States Environmental Protection Agency (USEPA) or (EPA)
United States Geological Survey (USGS)

V

W

Wastewater Treatment Facility (WWTF)
Water Quality Management (WQM)
Water Quality Standards (WQS)
Wetlands Protection Act (WPA)

X

Y

Z

Comprehensive Wastewater Management Plan

Acknowledgements

Manchester-by-the-Sea
Comprehensive Wastewater Management Plan

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Executive Summary

This Comprehensive Wastewater Management Plan (CWMP) report is the result of a collaborative work effort between the Town of Manchester–by-the-Sea (MBTS) and its Wastewater Steering Committee, local town officials, and the town's CWMP consultant CDR Maguire. Information obtained from various previous reports and studies along with updated local Board of Health and Wastewater Treatment Facility records served as the basis for this report required by the Massachusetts Department of Environmental Protection (MassDEP) Administrative Consent Order (ACOPE-NE-1N003).

Key findings for the CWMP are as follows:

1) Reliance on on-site systems as the primary method of wastewater treatment is and will remain the main strategy for all areas of town outside of the current sewer collection area. Inspections, maintenance, repairs and replacement of these systems will be performed. The Board of Health operates a highly effective Title 5 monitoring system which it continues to improve. The Board anticipates the number of I/A systems to expand.
2) Town growth projections are very modest. Recent trends are expected to continue with overall population declining slightly over the planning period while there is anticipated a slight uptick in the number of households as household size continues to decrease.
3) The Town's WWTP has operated at approximately 70% of permitted capacity for the past five years (0.47 mgd vs 0.67 mgd). The plant can readily handle additional capacity in the range of 96,000 gpd to 200,000 as shown in Table ES-2. As the Town continues to remove unwanted infiltration and inflow, additional capacity will become available.
4) WWTP capacity is targeted to serve the following needs:
    a. Existing sewer service area infill
    b. Possible sewer service area extension to the town's LCD zoning area
    c. Possible sewer service area extension to the Raymond Street area (if on-site solutions prove unsuccessful)
    d. Minor sewer service area extensions to the West Manchester area and the Smith's Point area.

    The total estimated wastewater flow expected for the targeted service needs for the planning period is 67,870 gpd while at full build-out the maximum expected additional wastewater flow is approximately 122,360 gpd. The capacities for each targeted service area are detailed in Table ES-8 in this section.
5) The Town will continue its aggressive removal of infiltration and inflow sources as well as implement a pro-active WWTP equipment replacement program.

Manchester-by-the-Sea's overall Comprehensive Wastewater Management Plan project has been divided into the following four phases. The last phase includes the development of the Recommended Plan and preparation of this CWMP along with findings from the previous three phases:

- Phase I: Existing Conditions
- Phase II: Needs Projections
- Phase III: Development and Screening of Alternatives
- Phase IV: CWMP and Recommended Plan

The CWMP is divided into the following sections based upon this guidance.

- Section I is an introduction into the CWMP which defines the purpose and scope, background, wastewater planning, and report organization.
- Section II evaluates the regulatory considerations and planning objectives through the documentation of the planning strategy, previous CWMP related planning efforts, and water quality and wastewater management. It also includes brief discussions of existing and future permitting requirements, the quality of the treatment plant effluent under existing treatment and flow conditions, and facility permit compliance.
- Section III discusses the public participation programs, as well as ongoing projects, groups, and efforts relevant to the development of this CWMP.
- Section IV summarizes existing planning area conditions relative to existing physical, environmental, and demographic conditions within the planning study area. The delineation of the study area into five assessment areas during the Phase I report and the addition of another study area was part of this investigation.
- Section V identifies existing wastewater collection and treatment systems within the town through an examination of the findings of the infiltration and inflow analysis. This section also includes analysis of unsewered areas, existing sewered collection system, the existing wastewater treatment facility (WWTF) system, a summary of recommended improvements to the WWTF, and analysis of operation and maintenance programs. System deficiencies, operational characteristics, and future system needs are also outlined.
- Section VI summarizes anticipated future conditions within the town as related to development, population projections, water and wastewater need projections and flow reduction over the next 20-year planning period.
- Section VII describes the alternatives evaluation process through an assessment of the wastewater needs, the identification of alternatives, the screening of alternatives, the development of solutions, and the plan selection.
- Section VIII identifies the recommended CWMP for MBTS through the use of on-site sewage management areas, sewer service areas, and the WWTF. This section concludes with an overview of the recommended plan and an implementation/phasing plan along with a discussion of direct and indirect environmental impacts associated with the selected alternatives.

- Appendices contain permits, backup analyses, and reports as identified in this CWMP.

The following presents a brief summary of the pertinent information included in each of the above sections relative to the development of the recommended comprehensive wastewater plan.

Section I - Introduction and Purpose of CWMP

The purpose of this CWMP is to evaluate wastewater collection, treatment and disposal needs of the Town of Manchester-by-the-Sea and to determine the adequacy of wastewater facilities for the next 20 years. The goal is to develop alternatives for managing the wastewater collection, treatment and disposal needs projected from 2015 to 2035. Ultimately this plan demonstrates the current and future wastewater needs throughout the town, identifies possible alternatives to accommodate those needs, evaluates the cost effectiveness, feasibility and environmental impact of the alternatives, demonstrates that the final plan is achievable from legal, institutional, financial, and management perspectives, and provides the basis for subsequent design and construction. The Recommended Plan section of the CWMP serves as MBTS's wastewater management plan addressing the town's needs going forward.

Section II – Planning Objectives

This CWMP is intended to provide wastewater planning for the Town of Manchester that is consistent with regional and local planning objectives and goals. Over the years the town has undertaken various studies identifying and evaluating its wastewater needs which provide a basis and background for the development of wastewater planning alternatives. The development of this CWMP builds upon the findings of these studies.

<u>Regional and Local Planning</u>

The Town of Manchester-by-the-Sea is part of the Metropolitan Area Planning Council (MAPC) which coordinates regional planning strategies and activities. The MAPC has published documents and studies covering regional planning, economic development, transportation, housing, land use, protection of natural resources, and public safety. One of the more significant regional planning efforts impacting the town's wastewater planning is the Ocean Act (OA) of 2008, which amended the Ocean Sanctuaries Act (OSA), through the Massachusetts Coastal Zone Management (CZM) program. The Massachusetts Executive Office of Energy and Environmental Affairs (EOEA) which administers the Ocean Act recently published the 2015 Massachusetts Ocean Management Plan. The OA limits the quantity of municipal wastewater that can be discharged to the ocean.

Manchester-by-the-Sea's last Master Plan was completed in 2000. The town is currently in the process of developing and preparing an update of the 2000 Master Plan for MBTS. Additional significant planning efforts are The Open Space and Recreation Plan (OSRP) and the Zoning By-Law of the Town of Manchester-by-the-Sea which were recently prepared in 2014, and the

Town of Manchester-by-the-Sea Wetlands Regulation for Administering General By-Law Article XVII which was adopted in 2013. Compliance with the goals and objectives of these guidance documents are an essential part of the development of this CWMP particularly with regards to preservation of the character of the town.

Previous Studies

The development of this CWMP was built upon previous plans and studies of wastewater management planning completed, in the past, by MBTS. Wastewater planning studies used as a basis for this CWMP were the Town of Manchester-by-the-Sea Phase I Wastewater Facilities Plan (1994), the Wastewater Needs Assessment Manchester-by-the-Sea (2003), the 2008 GIS Data Update of the 2003 Wastewater Needs Assessment Report (2008), and the Town of Manchester-by-the-Sea Sewer Task Force Final Study (2009), among several others.

Regulatory Issues

The Town of Manchester-by-the-Sea is currently operating under the U.S. Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) Permit No. MA0100871 issued on June 28, 2011. The Manchester WWTF current NPDES permit limits the wastewater flow to 1.20 million gallons per day monthly average flow (December through May), 0.67 million gallons per day monthly average flow (June through November), and 0.67 million gallons per day annual average flow (consistent with the Ocean Sanctuaries Act Limit).

ACO's

Mass DEP has issued two Administrative Consent Orders (ACO) to the town in reference to the wastewater collection system. A 1992 ACO led to the expansion and upgrade of the Manchester WWTF. The town, however, still remains restricted from further extensions of the sewer system until it demonstrates compliance with removal of Infiltration and Inflow (I/I) within the collection system. Additionally, Mass DEP issued an ACO (ACOP-NE-13-1N003) more recently on February 15, 2013. This ACO was issued in response to the NPDES Permit requirement to complete a CWMP when plant flows exceed 80% of the design flows. Wastewater management within the town is also regulated by Title 5 of the State Environmental Code, 310 CMR 15.000, local sewage disposal guidelines and regulations, and the town's Board of Health.

Section III – Public Participation

The CWMP process requires a public participation program as it is an essential part of sewer planning. An important part of the public participation program for this CWMP was the creation of a CWMP Steering Committee, established in 2014 charged with guiding the writing of the CWMP report. The Steering committee, consisting of several members from Town Boards as well as local citizens, generally met on a monthly basis throughout the CWMP process to discuss progress and to guide and provide local input to the CWMP.

Two public workshops and a public hearing were held by the town during the development of the CWMP. The first two workshops were used to introduce the public to the project and its purpose to evaluate sewage collection, treatment, and disposal needs of the town for the next 20 years and to present various wastewater planning alternatives for the town to consider. A formal Public Hearing was held on June 15, 2015 presenting a summary of the Draft CWMP plan highlighting the recommendations of the plan for the management of wastewater in MBTS.

A CWMP website containing all information pertaining to the report including the draft and final reports, information from public forums and hearings, frequently asked questions, and the project purpose was established to provide public access to the CWMP process and information. The website provided an additional portal for receipt of public comments on the CWMP.

Section IV – Existing Conditions

Town Overview

MBTS is a coastal community comprised of 9.2 square miles of land, considered part of Cape Ann. It is located 25 miles north of Boston in Essex County. The zoning of the town indicates that the general business district is located along the northern border of the town; residential development on large 40-80k square foot lots are on the east, west and south; smaller 15-40k square feet residential lots are located in the center of town with a small section of more densely populated residential in the center; and a light industrial district located north of the center section of the Manchester Harbor.

Concentrations of dense development are clustered near the center of the town and harbor extending north from Central Street along Pine and School Streets. Medium sized lots generally abut the smaller density lot areas throughout the center of town. A majority of the parcels along the outer limits of the town and the coastline are made up of large sized lots.

Soil Characteristics

Much of the soils and underlying geology found in Manchester are not ideal for on-site wastewater disposal. Soil groups in town have been listed as having severe limitations for sewage effluent disposal from septic systems by the USDA Soil Conservation Service. These soils have the potential to create problems in disposal due to the fact that the majority of the town is covered by glacial till and bedrock, restricting the infiltration rate of water and wastewater. In other areas of town, exposed bedrock and steep slopes also limit the use of on-site systems.

Water Quality

Water resources in Manchester include a variety of surface and groundwater resources ranging from coastal resources to ponds and streams; aquifers and wells; and wetlands and vernal pools. Manchester is part of the North Shore Region of the Massachusetts Office of Coastal Zone Management (CZM). The Manchester coastal zone extends north from the shore to Route 127 (Bridge and Summer Streets). The coastal features associated with the shore are a combination of: Beaches and Dunes; Tidal Flats; Sea Cliff and Coastal Bluff; and Rocky Intertidal Shore.

The Massachusetts Department of Public Health (MDPH) administers the "Beach Program" for all beaches in the Commonwealth. Beaches are tested by the Board of Health (BOH) with weekly monitoring during the summer of all public beaches. The program measures colonies of *Escherichia coliform* ("E. coli") and enterococci as indicator organisms for water quality, per state regulations listed in 214 CMR 4.00. As a result of the sampling program findings, several closings of all public beaches with the exception of Singing Beach have occurred over the last decade.

Needs Areas

Assessments completed in previous reports identified five areas as potential needs areas for more in-depth analysis and assessment. These five general study areas, with area refinements, were again evaluated as potential wastewater needs areas in order to ensure consistency in CWMP planning and to best maximize data collected and developed by the town.

This CWMP added a sixth area identified as the LCD area for the town's Limited Commercial District zone. The LCD was incorporated into the study areas as a result of town official's input regarding the potential for commercial development in town. There are currently no definite plans in place for future development in the LCD area; however it is included in this for possible future town planning as may be provided for in the town's current Master Plan update.
The following is a brief description of the delineated needs assessment areas:

Study Area 1 – West Manchester, located at the southwest corner of the town and borders the City of Beverly. Roads included within this area are Boardman Avenue, Bridge Street, Brookwood Road, Forster Road, Harbor Street, Highland Avenue, Jersey Lane, Norton's Point Road, Ox Pasture Road and Tuck's Point Road.

Study Area 2 – Smith's Point, located on the most southern point in the center of town. This study area is east of Manchester-by-the-Sea Harbor as well as West Manchester. Roads included within this area are Beach Street, Blossom Lane, Cobb Avenue, Eaglehead Road, Gales Point Road, Masconomo Street, Old Neck Road, Proctor Street, Sea Street, Smith's Point, and Tappan Street.

Study Area 3 – Coolidge Point Road, located in the eastern part of town which borders the City of Gloucester. Roads in this area are Big Rock Road, Crow Island, Magnolia Avenue, Overledge Road, Summer Street and University Lane.

Study Area 4 – Raymond Street Area, located to the south in the most eastern area of town, which abuts the City of Gloucester. Roads within this area include Butler Avenue, Raymond Street and Summer Street.

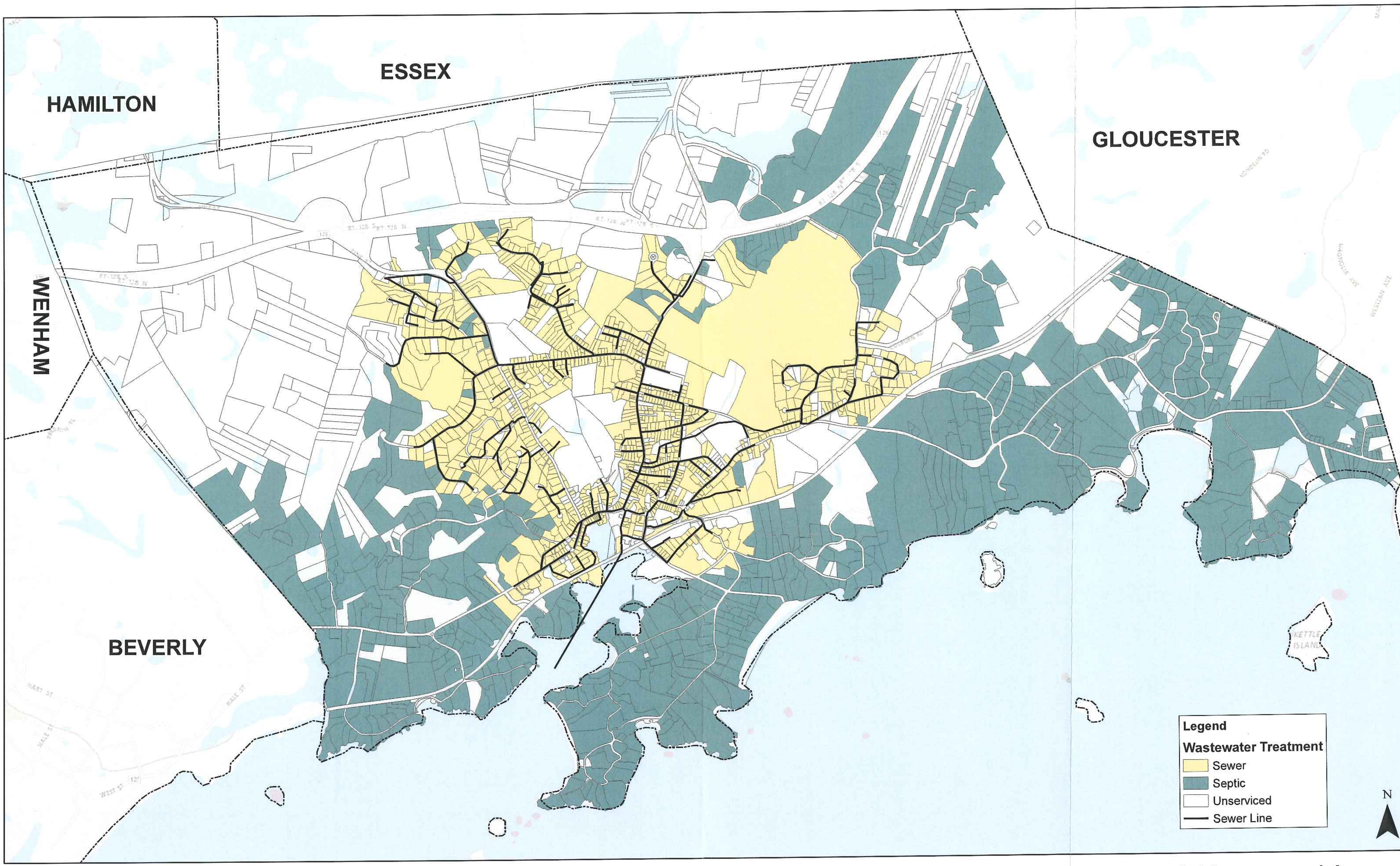
Study Area 5 – Hickory Hill, located in a south east area of town, west of Kettle Cove and Coolidge Point Road. Roads within this area include Ocean Street, Summer Street, and Hickory Hill Road.

Study Area 6 – LCD Area, located in the northeast part of town above Route 128. Roads within this area include School Street and Atwater Avenue.

Section V – Existing Collection and Treatment Facilities

Sewered and Non-Sewered Areas

The Town of Manchester-by-the-Sea wastewater treatment and disposal needs are currently provided by a combination of on-site treatment Title 5 septic systems and sewer collection and treatment at the Manchester WWTF. By parcel count, the breakdown by wastewater treatment is 1099 sewered and 737 septic. There are also 526 additional land parcels that currently do not provide for wastewater management. The existing sewer and unsewered areas can be viewed in Figure ES-1.



Manchester-by-the-Sea

Data Sources: Town of Manchester-by-the-Sea, MassGIS

Existing Sewer & Unsewered Areas

Figure ES-1

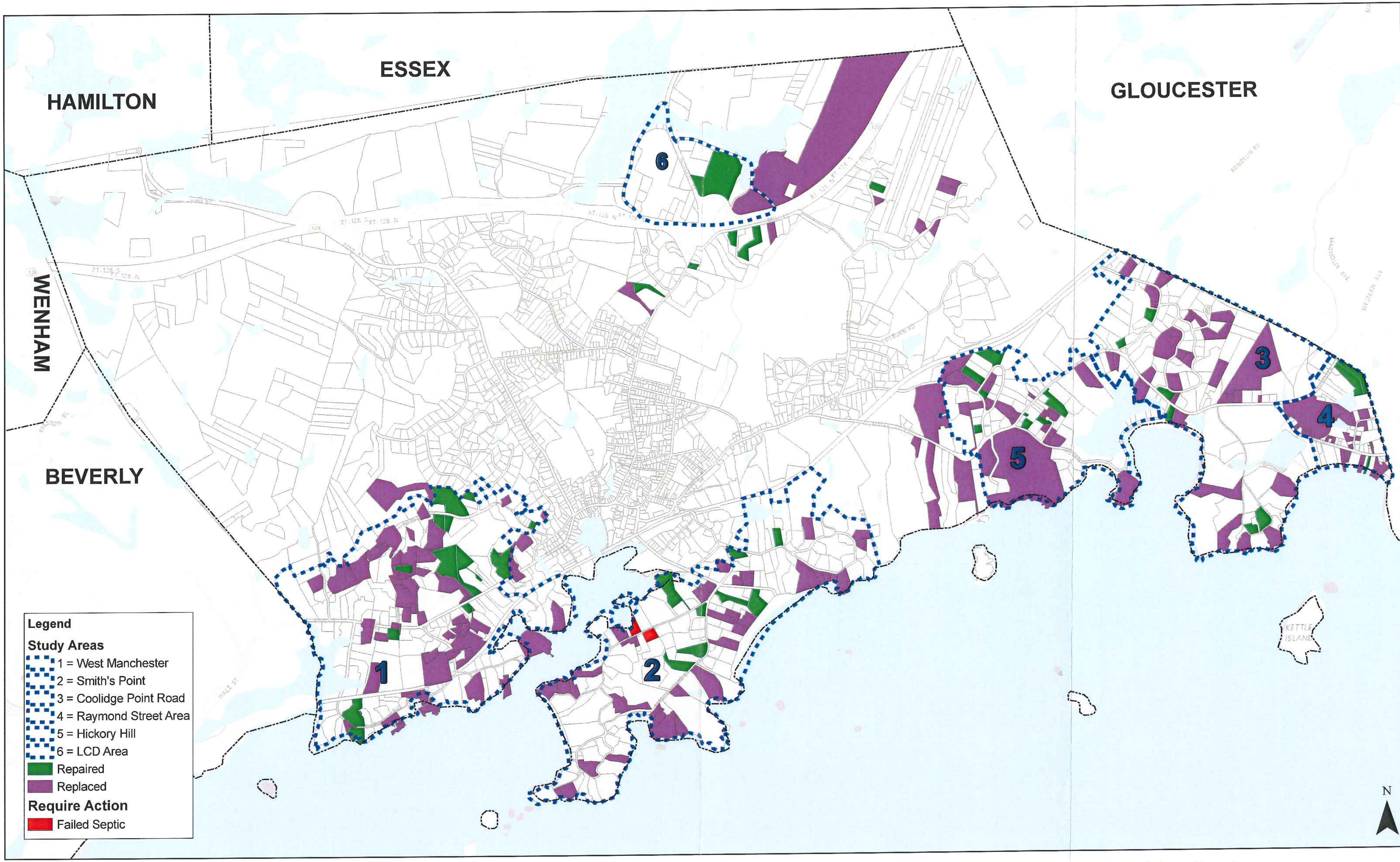
CDR MAGUIRE

The town's Board of Health works closely with their consultants Clean Water Industries and MassDEP, in the managing of permitting and inspecting on-site wastewater disposal systems and their subsequent septage. The majority of unsewered areas are characterized as having steep to very steep slopes with many limiting factors.

The local BOH administers the program overseeing all on-site septic systems within the town. A complete review of the town's files including data gathering and interviews with the BOH was conducted to document the existing conditions within these study areas. This file review identified all septic systems that were inspected, any failed systems, and any repaired or replaced systems.

Areas of Title V Concern

Throughout the town there are a number of parcels classified as "Lots of Title 5 Concern" which tend to occur primarily on small lots in densely developed areas with shallow depth-to-groundwater conditions. These parcels are of concern because existing conditions may limit the ability to design and construct Title 5 compliant septic system upgrades on these parcels. Due to the generally poor soils in town, there has been an influx of Innovative Alternative (IA) systems being installed which are generally better than conventional septic systems at removing solids and other pollutants from wastewater before it is absorbed into the soil absorption system. Figure ES-2 shows on-site systems which have been repaired or replaced in recent past or are currently failed while the parcels identified as "Lots of Title 5 Concern" can be viewed in Figure ES-3.



Manchester-by-the-Sea

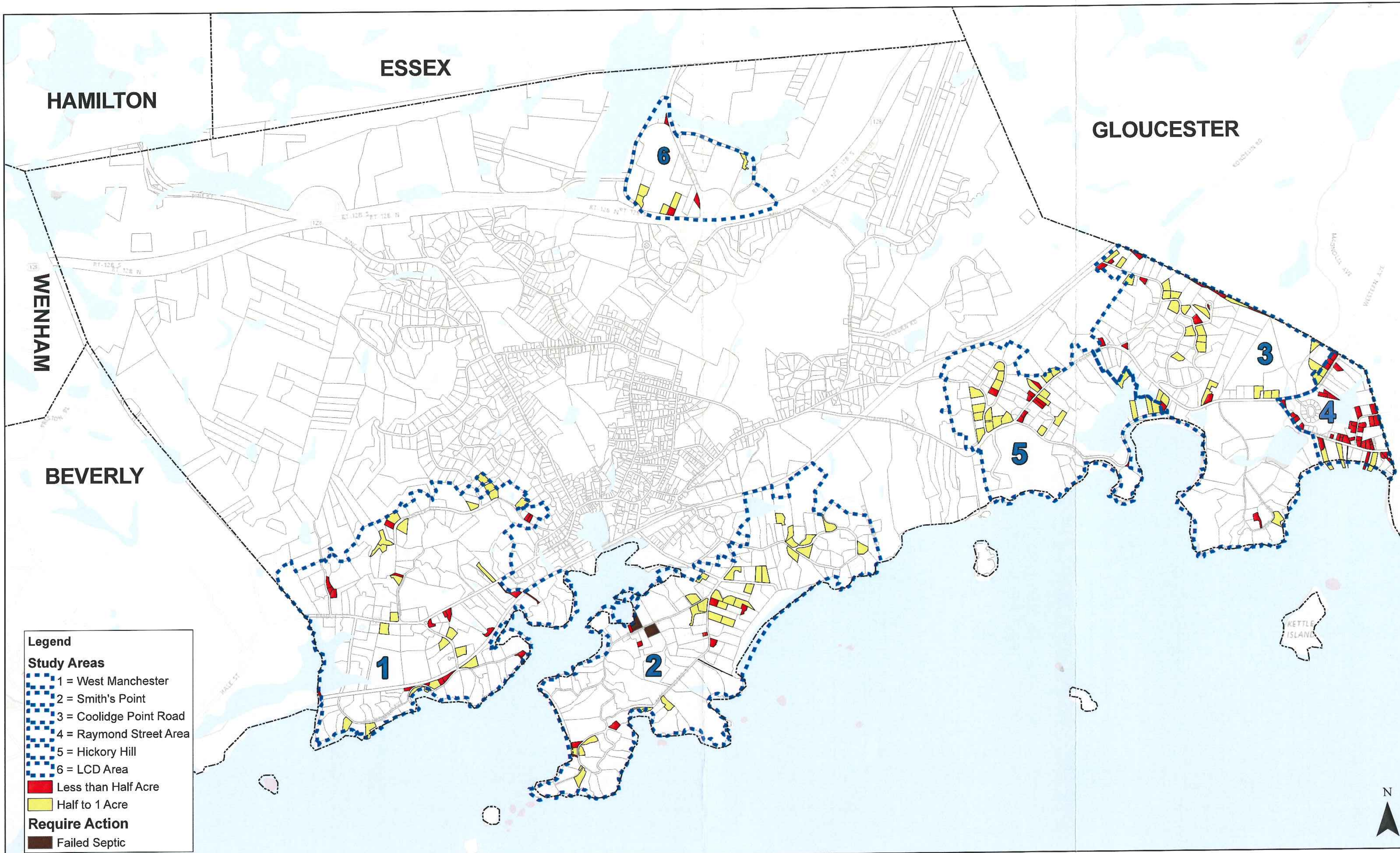
Data Sources: Town of Manchester-by-the-Sea, MassGIS, MBTS Board of Health

0 0.5 1 Miles

On-Site Systems

Figure ES-2

CDR MAGUIRE



Manchester-by-the-Sea

Data Sources: Town of Manchester-by-the-Sea, MassGIS, Board of Health

Lots of Title 5 Concern

Figure ES-3

CDR MAGUIRE

Lot-by-Lot Analysis

A detailed lot-by-lot analysis of non-sewered parcels was completed for the lots in each of the study areas. Table V-1 presents a summary of that analysis which has been updated from the 2009 Sewer Task Force Final Report.

Table ES-1. Non-Sewer Parcels Estimates by Study Areas			
Study Areas	**Total Parcels**	**Lots of Concern**	**Repaired/Replaced**
West Manchester	180	41	58
Smith's Point	172	37	44
Coolidge Point Road	151	40	36
Raymond Street Area	114	45	29
Hickory Hill	98	31	27
Total Study Areas	715	194	194

Existing Wastewater Facilities

The town's current sewer service area generally covers the downtown area surrounding the Manchester Harbor area with sewer lines extending out to Pine Street, School Street, and Summer Street. The collection system consists of over 23 miles of municipal sewer pipe ranging in size from 6 to 18 inches in diameter.

The Town of MBTS currently owns, operates and maintains one WWTF. The WWTF is located behind the Town Hall on town property. The facility was constructed in 1972 and last upgraded in 1999.

The 1999 upgrades to the WWTF were designed and permitted to treat an average daily flow of 1.2 mgd, a maximum daily flow of 3.0 mgd, and an instantaneous flow of 5 mgd. The wastewater is discharged to Manchester Harbor through a 9,000 foot long 20-inch outfall pipe that was installed in 1992. A section of this outfall pipe was recently repaired.

The plant's NPDES discharge permit requires the plant to treat the incoming wastewater to secondary treatment limits, what is commonly referred to as a 30/30 limit. The 30/30 limit is a measure of the quality of the effluent and is defined as 30 mg/l BOD (BOD is a measure of the Biological Oxygen Demand of the waste stream) and a 30 mg/l TSS (TSS is Total Suspended Solids and is a measure of the solids remaining in the treated effluent).

The Manchester WWTF (NPDES) Permit # MA 0100871 (Permit) has the following discharge flow limits:

- Annual Average Daily Flow: 0.67 mgd (measured as a 12 month rolling average)
- Summer Monthly Average Flow: 0.67 mgd (June - November)
- Winter Monthly Average Flow: 1.20 mgd (December - May)

These limits were enacted largely due to the Ocean Sanctuaries Act (OSA) that limits discharges into the ocean.

In the last 5 year period between 2010 and 2014, the flow has averaged approximately 0.47 mgd, which is about 70% of the permitted annual average flow of 0.67 mgd. A review of the plant flow data indicates that while average flows are in line with design parameters and the permitted flows, maximum day and peak flows are outside what would normally be expected for a system of this size. This is indicative of a collection system with higher than normal infiltration and inflow (I/I).

Available WWTF Capacity Analysis

Despite the issue with excessive infiltration and inflow (I/I) in the system, it is apparent that there is some available capacity at the Manchester WWTF which may allow for extension of sewers beyond the current sewer collection service area or expansion of sewers to some of the study areas. Some noted items that support this conclusion include:

- The annual average flow over the past 5 years was 470,000 gpd compared to the permitted annual average flow of 670,000 gpd. The highest annual average flow over the past 5 years occurred in 2011 and was 550,000, still well below the permitted annual average flow amount.
- Based on 2.5 persons/household (1229 parcels), the current estimated service population is 3070. This population is less than not only the 2014 future residential service population of 4600 but also the 1994 residential service population of 3500 as documented in the 1994 Wastewater Treatment Facility Preliminary Design Documentation Report.
- The 2014 future design flows accounted for planned development and future growth that has not happened; particularly of note were possible future extensions into the Raymond Street and Hickory Hill areas.

A comparison between the 5 year average of the annual average flow to the plant to the permitted flow indicates that there is approximately 200,000 gpd of flow capacity available at the plant. However, the annual average flow to the plant is heavily influenced by the I/I entering the system and a significant string of storm and rainfall events could diminish the available capacity for additional domestic flows. Therefore, using the highest annual average flow over the past 5 years may be a better measure of the available flow capacity of the plant. By that analysis, there is approximately 120,000 gpd of flow capacity available.

Table ES-2. Estimated Available Flow Capacity	
Basis of Estimate	Gpd
Permitted Annual Average Flow	670,000
2010-2014 Annual Average Flow	470,000
HIGH Estimate Available Flow Capacity	200,000
Permitted Annual Average Flow	670,000
2011 Annual Average Flow (high value last 5 years)	550,000
MODERATE Estimate Available Flow Capacity	120,000
2014 Design Base Domestic Flow	382,000
2010-2014 Average Flow September	265,000
MODERATE Estimate Available Flow Capacity	117,000
2014 Design Base Domestic Flow	382,000
2010-2014 Summer Average Flow (3 months, Jul-Sep)	286,000
LOW Estimate Available Flow Capacity	96,000

Infiltration/Inflow

Extraneous water entering the collection system reduces the capacity and capability of sewer systems and treatment facilities to transport and treat wastewater. Removal of this "clean water" from the sewerage system would allow for additional sewer connections to the system without the need for future addition of unnecessary treatment capacity or modification of permit conditions.

The town completed the Phase I I/I Investigation and Analysis Report in December 2013. The report determined that there was a total of 273,000 gpd of peak infiltration entering the collection system. The report also estimated that 1,473,000 gallons of inflow would enter the system during a design storm event. The I/I Investigation and Analysis report targeted several sub-systems for completing Phase II investigations to identify sources of excessive I/I.

The second phase of the I/I program, Phase II Sanitary Sewer Evaluation Survey (SSES) includes a detailed site investigation to locate sources of clean water entering the sanitary system. The town completed a portion of the first SSES study concurrent with the Phase I I/I report and the remainder in September 2014. The reports identified specific recommendations for sewer repair and rehabilitation to eliminate I/I sources. Additional SSES investigations into other sub-systems are continuing concurrently with this report.

The third phase of the I/I program is sewer rehabilitation. Based on the SSES work the town has already identified and removed one direct inflow source that was estimated to remove approximately 30,000 gpd of I/I from the system. The town also issued an initial sewer rehabilitation contract for bid which is ongoing and expected to reach completion by June 2016. The work provided for the rehabilitation of 8,300 linear feet of sewer and repair of 25 manholes. According to the SSES reports this work should remove over 50,000 gpd of I/I from the system although the actual work completed is more extensive than that recommended in the SSES report.

Conditions Assessment – WWTF

A review of the existing wastewater treatment facilities was conducted in order to assess what would be required to ensure that they would be fully functional to provide the required treatment over the twenty year planning period of the CWMP.

The Manchester WWTF currently meets its performance requirements and, barring changes in influent wastewater loads or permit conditions, modifications to plant processes are not necessary to continue to meet permit conditions. The plant is also in generally good condition. The recommended improvements for the WWTF include:

- Operational performance and efficiency improvements for Influent Pumps, Air Blowers, Effluent Pumps, and Diaphragm Sludge Pumps
- Replacing aging equipment – Waste Sludge Pump and SCADA Panels
- Operational and maintenance improvements of Chlorine Valves and Refrigerated Continuous Samplers

The town is currently undergoing a program to rehabilitate the pumping stations. This work is expected to include repairs/replacement of pumps and controls, and installation of emergency generators.

Section VI – Future Conditions

Population Projections

Population projections provided by the Metropolitan Area Planning Council through 2030 during an anticipated *Status Quo Scenario* predict an insignificant decrease in the population of the town to just under 5,000 at 4,915 residents during next 15 years. MAPC projections for the same time frame under a *Stronger Region Scenario* indicate similar population trends with the number being slightly above 5,000 at 5,028. The projections take into account current birth, death and migration patterns. US Census Bureau statistics collected in 2010 confirm this minimal decreasing population trend.

Of more relevance to this study is the slight projected increase in housing units during this same timeframe for both scenarios. The number of households are expected to increase from 2,147 in 2010 to 2,244 in 2020 and 2,298 in 2030, while the number of housing units are expected to increase to 2,476 and 2,533 during the same 2020 and 2030 projection intervals. This anticipated increase in the need even during a population decline is indicative of changing household preferences.

The Manchester-by-the-Sea Planning Board is currently in the process of a 2-year community planning initiative to develop a Comprehensive Master Plan for the town. The town currently has very limited plans for future growth and development. The main development area being discussed for potential expansion is within the LCD area which is considered as a study area for purposes of this CWMP.

Wastewater Flow Projections

Wastewater flow estimates were developed for the following future conditions:

- Infill within the existing sewer service area of those lots not currently connected to the wastewater collection system
- The five identified Study Areas
- The Limited Commercial District (Area 6)

Wastewater flow projections were developed for existing lots and households not currently connected to the sewer collection system. This is due to the fact expected future development is minimal and the town's overall population is not expected to increase.

Table ES-3. Summary of Wastewater Flow Projections		
Study Area	Full Build-out ADF (gpd)	Planning Period ADF (gpd)
Infill	15,000	11,250
Study Area 1 West Manchester	37,800	17,115
Study Area 2 Smith's Point	36,120	17,325
Study Area 3 Coolidge Point	31,710	16,275
Study Area 4 Raymond Street	23,940	13,650
Study Area 5 Hickory Hill	20,580	10,710
Study Area 6 LCD	62,000	31,000
TOTAL	227,150	117,325

The wastewater treatment plant has 96,000 to 200,000 gpd of capacity available for additional domestic wastewater flows. It is not viable for all of the study areas to be connected to the wastewater collection and treatment system under the full build-out scenario and still remain within currently permitted capacity of the plant.

Climate Change

Climate change is not expected to have an impact on the plant during the 20-year planning period of this CWMP, however its impact on wastewater facilities is a growing concern. This is particularly important for facilities located in close proximity to the coast such as the Manchester WWTF where sea rise issues may impact the ability of the facilities to operate and perform as intended. The town is currently part of an ongoing pilot program, Massachusetts Climate Resilience Evaluation and Awareness Tool (CREAT) Exercise Report, initiated by the Environmental Protection Agency (EPA) which assesses the risk and considers "the impact of intense precipitation events and coastal storm surge in 2035 and sea level rise in 2060" on the Manchester WWTF. The report suggests options to avoid or greatly reduce potential consequences that may be caused by future coastal storm surge events and precipitation events. The solutions include constructing a sea wall on Manchester Harbor to protect the WWTF or relocating the facility to a higher elevation.

Section VII Evaluation of Alternatives

A range of alternatives for wastewater collection, treatment, and disposal were developed as part of the initial screening process as a starting point for discussion and preliminary screening with town representatives. These alternatives included:

1. **On-site Systems -** This alternative would entail continued reliance on on-site system for wastewater disposal needs of each of the needs areas. This alternative would include both individual innovative alternative (I/A) or conventional Title 5 systems.
2. **Communal Treatment Systems -** Communal treatment systems involve the use of a conventional or alternative septic system that serve a group of properties.
3. **Connecting to Neighboring Systems -** This alternative entails conveying wastewater to the nearest town or other political subdivision for treatment and disposal.
4. **Sewer Expansion to Manchester WWTF –** This alternative involves expanding the sewer collection system to the needs area to service existing parcels within the study areas for treatment at the Manchester WWTF.
5. **Sewer Extension to Other Facilities –** This alternative would involve the collection of wastewater in the study areas either individually or collectively and conveyance to a new treatment facility.

A preliminary screening of these alternatives was conducted in order to determine feasibility as it relates to water quality, capital costs, land requirements, town planning objectives, and regulatory requirements. The results of the preliminary screening of the wastewater alternatives are summarized in Table ES-4.

Table ES-4. Screening of Preliminary Alternatives			
Alternative	**Pros**	**Cons**	**Assessment**
On-Site Systems	➢Reasonable Costs/Household ➢Limits Development & Growth in concurrence with town planning ➢Recharges groundwater locally	➢Possibility of failure and future water quality issues ➢Town Wastewater Management Program for monitoring & maintenance advised	Feasible for further consideration
Communal Treatment Systems	➢Reasonable Costs/Household ➢Limits Development & Growth in concurrence with town planning ➢Recharges groundwater locally	➢Generally "poor" soils limits possible sites ➢Limited available parcels of suitable size to service an entire needs area	Limited Feasibility May be an option for small neighborhoods or portions of a needs area
Connecting to Neighboring Systems		➢No adjacent municipal collection systems within reasonable distance ➢Requires long term agreement with neighboring community	Not Feasible
Sewer Expansion to Manchester WWTF	➢May be cost comparable to On-lot systems ➢Some WWTF capacity available ➢Improves long-term water quality	➢Sewer Extensions not currently permitted per Consent Order ➢Limited Available WWTF capacity ➢WWTF Capacity increase not permitted per Ocean Sanctuaries Act ➢May promote development growth along proposed sewers ➢Water "lost" in discharge to ocean	Feasible for further consideration
Sewer Expansion to New WWTF		➢ Ocean Sanctuaries Act permit limits any new WWTF to a groundwater disposal system ➢ Limited suitable sites available ➢ Costs prohibitive as compared to other options ➢ New facility would require extensive permitting	Not Feasible

Based upon the preliminary screening process it was determined that the on-site systems, communal systems, and sewer expansion/extensions would be further investigated for each study area. A conceptual sewer expansion plan for each area was developed that would extend sewer service to all lots of concern within a study area. Estimated wastewater flows and a comparison of cost/lots served between sewer expansion and on-lot systems were developed for each area. The results of this analysis are shown in Table ES-5. While Study Areas 1 and 2 were evaluated individually, Study Areas 3, 4 and 5 were combined when developing a possible conceptual sewer expansion plan.

Table ES-5. Cost Comparison of Sewer Expansion and On-Lot Systems			
	Study Area 1	Study Area 2	Study Areas 3, 4, & 5
Estimated Lots Serviced	58	64	155
Estimated Flow (gpd)	12,180	13,440	32,550
Alternatives	Cost per Lot	Cost per Lot	Cost per Lot
Conventional System	$20,000-$30,000	$20,000-$30,000	$20,000-$30,000
I/A system	$35,000-$45,000	$35,000-$45,000	$35,000-$45,000
Sewer Expansion	$77,000-$101,000	$70,000-$90,000	$52,000-$68,000

Note: Assumption is that all lots less than an acre and not fixed or replaced and 50% of remaining non-fixed lots would be serviced

When developing the estimated lots serviced for each sewer expansion scenario, it was determined that sewers should be extended only as necessary to reach the lots of concern for a given area. It was then anticipated that, on average, about 50% of the remaining non-fixed lots along the conceptual sewer expansion lines would likely tie-in to be serviced as a result of the installation.

A discussion of the final wastewater alternatives evaluated for each Study Area is provided below.

Study Area 1 - West Manchester

On-Site Systems The majority of lots in the West Manchester's area are greater than 1 acre in size. When discounting those lots that have already been repaired or replaced (approximately 20%), there are only 43 lots of concern, or 23% of all the lots in the area.

Communal Treatment Systems A preliminary analysis of lots in the West Manchester study area identified one town owned site of sufficient size for possible use to site a communal treatment and disposal system. A review of the site indicated that the site is not favorable for use for siting a communal treatment and disposal system due to its soil characteristics and restricted use.

Sewer Expansion This conceptual sewer expansion plan extends sewers to all lots of concern in the area servicing approximately 58 lots and would send an estimated 12,180 gpd to the WWTF. On a cost per lot basis, sewer expansion for the entire West Manchester area is not cost comparable to remaining with on-site systems in the future.

A more detailed street-by-street sewer extension analysis identified one sewer extension option on Forster Road that was considered to be cost comparable to relying on on-site systems.

Smith's Point

On-Site Systems About 13% of on-site systems in the Smith's Point area have recently been repaired or replaced with most of those being lots greater than 1 acre in size. As in West Manchester area, most of the lots in the Smith's Point area are greater than 1 acre in size. When accounting for repaired or replaced lots, there are only 37 lots of concern in the area which is just 21% of all the lots in the study area.

Communal Treatment Systems A preliminary analysis identified two town-owned sites in the Smith's Point area with potential for siting a communal treatment and disposal system. After review and site inspection it was concluded that the sites are not favorable for use for siting a communal treatment and disposal system due to history of poor soils, ledge, and wetlands.

Sewer Expansion The overall conceptual sewer expansion plan would service approximately 64 lots and would add 13,440 gpd to the WWTF. On a cost per lot basis, sewer expansion for the entire Smith's Point area was not found to be cost comparable to remaining on on-site systems due to the relatively long lengths of sewer required to handle only a few lots of concern.

A more detailed street-by-street sewer extension analysis identified one sewer extension option on Beach Street that was considered to be cost comparable to relying on on-site systems.

Coolidge Point Road

On-Site Systems More than 2/3 of the lots in the Coolidge Point area are greater than 1 acre in size and 14% of the area has had recent repairs or replacements. When discounting those lots that have already been repaired or replaced, there are only 43 lots of concern, which is almost 30% of all the lots in the area.

Communal Treatment Systems with Subsurface Disposal A preliminary review of the property in the Coolidge Point area did not identify any lots with the available land area, suitable soils and water table conditions to support a communal treatment and subsurface disposal system.

Raymond Street Area

On-Site Systems The Raymond Street area has the greatest percentage of lots of concern. Almost 80% of the area consists of lots less than 1 acre in size, with the majority of those being less than ¼ acre in size which makes repair or replacement of failed systems a difficult task, more than likely requiring an I/A system. In total there are 78 lots of concern still remaining in the Raymond Street area which represents almost 70% of all the lots in the area.

Communal Treatment Systems with Subsurface Disposal A preliminary review identified two sites with potential for use for siting a communal treatment and disposal system. After review and site visits, these properties were determined undesirable due to extreme wetness, high groundwater, or rocky soils.

A more expansive communal system option for the Raymond Street Area would entail treating the entire area of Magnolia Beach in conjunction with the City of Gloucester. The MBTS Raymond Street Area makes up about 19% of the entire Magnolia Beach area compared to 81% of the area that is located in Gloucester. After removing the lots that have recently been replaced or repaired, the Raymond Street area has approximately 85 parcels to be considered for a communal system. A preliminary review of developing a communal treatment system for the entire Magnolia Beach area together with Gloucester indicates that such a system may be more cost effective than continuing to rely on the replacement of individual on-lot systems for lots of concern in the area. This option is not currently considered viable as Gloucester is not planning to address wastewater concerns in this area at this time. However, if Gloucester does begin to address wastewater issues in this area, it may be in the Town's interest to work with Gloucester to develop a mutually beneficial wastewater solution for the entire are, presuming that the Town has not developed other solutions before that time.

A more expedient alternative would be to develop a number of decentralized neighborhood community systems throughout the area. This would involve the town implementing a program where they would be responsible for performing investigations to determine locations for systems, determining any easements or agreements necessary, and controlling all legal matters involved with the sharing of the system by users. By facilitating the neighborhood communal systems, the town would then be able to monitor, operate and maintain the systems allowing for a higher quality treatment. Although it may be an environmentally beneficial and cost comparable solution, local communal systems may prove to be difficult to implement due to the legalities and ownership issues involved, public interest required, as well as the limiting physical characteristics of the land.

Hickory Hill

On-Site Systems Approximately 50% of the lots in the area of Hickory Hill are less than 1 acre in size. The area is characterized by steep slopes further diminishing the ability of the lots to support conventional Title 5 systems. There are 37 remaining lots of concern in the Hickory Hill area, which is almost 40% of the total lots in the area.

Communal Treatment Systems with Subsurface Disposal After investigating potential vacant lots, it was determined that there were no lots in the area with suitable conditions to support a communal system for the area present.

Sewer Expansion Study Areas 3, 4, and 5

The development of a conceptual sewer expansion plan was done concurrently for Study Areas 3, 4, and 5 due to the location of these study areas in proximity to each other and the existing collection system. The overall sewer expansion plan for servicing the entire 3, 4, and 5 study areas would service approximately 155 lots and would add 32,550 gpd to the WWTF. The costs per lot served for a sewer expansion plan that serves all of Study Areas 3, 4, and 5 are generally comparable, although slightly higher, than relying on future replacement of on-site systems (I/A) for treatment.

A more detailed street-by-street sewer extension analysis indicated that extending sewers to the entire Raymond Street area was the least costly sewer expansion plan and just slightly more costly on a lot served basis than relying on individual I/A replacement system for treatment.

Limited Commercial District Area

On-Lot Innovative Alternative/Conventional Title 5 Systems This area consists mainly of adequate lot sizes to maintain on-site systems. Remaining with on-site systems, however, may inhibit growth and development in the area which has been identified as potentially being used for planned future commercial development in the town.

Communal Treatment System Wastewater would be conveyed to a community treatment and subsurface disposal facility located in the vicinity of the LCD Area and serving only the study area. Preliminary analysis shows one prospective site that may have a suitable area large enough for a communal system. Further investigation of the site would need to be completed to determine if the site has a large enough area of suitable soil to accommodate expected flows from the LCD Area.

Sewer Expansion This alternative would require constructing sewers across Route 128 to convey wastewater from the LCD to the town's collection system at the upper end of School Street. Connecting to public sewer would create opportunity for growth in the potential LCD development. The maximum potential flow projected for the entire buildable LCD area is approximately 62,000 gpd. For purposes of this CWMP it is assumed that if the town moves toward development for the LCD Area, only around 50% of the area would be developed during the 20-year planning period with approximately 31,000 gpd.

Environmental Assessment

An Environmental Assessment of the various elements of the recommended plan outlining the comparative environmental impacts of the proposed solutions is summarized in Table ES-6 and discussed in more detail below.

Table ES-6. Environmental Assessment of Alternatives

Alternative	Pros	Cons	Assessment
On-Site Systems	➢ Recharges groundwater locally	➢ Possibility of failing systems and improper O&M could result in local water quality issues ➢ Dependant on homeowner care ➢ Town Wastewater Management Program for monitoring & maintenance advised	Can manage potential water quality impacts with stringent OSWMP implemented by the town.
Communal Treatment Systems	➢ Recharges groundwater locally ➢ Town has ability to monitor, maintain and operate	➢ Possibility of failing systems and improper O&M could result in local water quality issues	Likely better managed systems and less potential for water quality issues than on-site systems.
Sewer Expansion/Extension to Manchester WWTF	➢ Well monitored and maintained at treatment facility ➢ High degree of treatment ➢ Improves long-term water quality	➢ Water "lost" in discharge to ocean. ➢ Potential for unwanted growth that could have negative impacts on the community. ➢ Temporary impacts due to construction activities (noise, traffic, etc.).	Least likely impact on water quality as all flows are treated. Negatively impacts quantity of water recharged to aquifer.

On-site and Communal Systems

An abundance of failing on-site systems can cause local water quality issues (i.e. beach closures etc.) in an area and negatively impact the quality of life. Properly maintained individual on-site systems should not negatively impact local water quality. Innovative/Alternative (I/A) on-site systems typically provide a higher level of treatment before discharged. I/A systems also require frequent monitoring and reporting which significantly reduces the potential for systems failing and resulting in water quality issues. An OSWMP can be made sufficiently stringent to ensure proper monitoring and maintenance of on-site system high water quality management.

Communal treatment systems generally provide a higher level of treatment versus individual on-site systems. The water quality is generally better due to the fact that the town has the ability to monitor, operate, and maintain the system rather than depending on homeowners to properly care for their systems.

One positive environmental benefit for both on-site and communal system alternatives is that these systems are not connected to a centralized wastewater treatment facility which in turn keeps the water in the town local. Discharge from on-site and communal systems is recharged to the ground and underlying groundwater aquifers. By using on-site systems, the groundwater stays within the community which is environmentally beneficial.

Sewer Expansion to Manchester WWTF

Extending sewers to needs areas will provide for the best treatment of the wastewater with minimal risk to water quality presuming that the additional flows do not exceed the treatment capacity of the plant and the plant operates in conformance with its NPDES discharge permit. Regulated wastewater treatment facilities are well monitored, maintained and operated and can provide the highest level of wastewater treatment. However, wastewater that is treated at a facility is ultimately pumped out of the town and not recharged back into the local water aquifers.

MEPA Thresholds

After an examination of MEPA review thresholds, there does not seem to be any aspects of the CWMP or its recommended alternatives that would require filing an ENF or EIR.

VIII- Recommended Plan

The long-term Recommended Plan for management of the town's wastewater is to generally continue to rely on replacement of on-site systems, with either conventional or I/A systems as needed, as the primary wastewater management tool. Limited sewer extensions into certain needs areas may be considered where determined to be cost-effective given the number of lots that may be served and as long as the wastewater generated from the extensions do not exceed the available capacity at the WWTF.

If problems with on-site systems persist and there is a need to further solve wastewater issues, the town should further explore the viability of communal systems for the Raymond Street area. A communal system, either in conjunction with the City of Gloucester for the entire Magnolia Beach area, or as a series of smaller neighborhood system managed by the town may prove to be a more beneficial, long-term environmental solution than continued reliance on replacement systems. A communal system in conjunction with Gloucester, although ideal, is not considered viable at the current time, however may be a possibility down the line. Should communal systems prove to be difficult or unreasonable to implement, the final option the town should consider is extending sewers to the Raymond Street area. This is the least desirable alternative because it could spur unwanted growth in the area and negatively impact the town's stated goals to maintain the current character of the town.

The town is however advised to reserve capacity at the treatment plant in the event that all options prove ineffective and the Raymond Street area must be tied into the collection system.

The outline of the Recommended Plan with both the primary or preferred alternative and a secondary alternative is summarized in Table ES-7.

Table ES-7. Recommended Plan

Study Area	Preferred/Primary	Alternative/Secondary
Study Area 1 West Manchester	On-Site Wastewater Management with Limited Sewer Extensions	-
Study Area 2 Smith's Point	On-Site Wastewater Management with Limited Sewer Extensions	-
Study Area 3 Coolidge Point Road	On-Site Wastewater Management	-
Study Area 4 Raymond Street	On-Site Wastewater Management *	Sewer Expansion
Study Area 5 Hickory Hill	On-Site Wastewater Management	-
Study Area 6 LCD Area	Sewer Expansion	On-Site Wastewater Management

* The town should consider small neighborhood communal systems or a more expansive communal system with Gloucester should that opportunity arise.

The elements of the overall Recommended Plan are outlined below.

On-Site Systems

Reliance on on-site systems as the primary method of wastewater treatment is the main strategy for all areas of town outside of the current sewer collection area. Inspections, maintenance, repairs and replacement of these systems will be performed as required to comply with existing regulations until such time as new regulations are adopted by the town.

Communal Systems

While there is limited potential for the development of communal systems, the option should be investigated more thoroughly especially in the vicinity of the Raymond Street Study Area. Of particular interest is a combined on-site communal system with the City of Gloucester for the Raymond Street / Magnolia Beach area which would significantly benefit both communities. Although this is not a viable solution for the near future as Gloucester is not currently planning management in the area, it could potentially be an option down the line. Alternatively the town should also explore and consider a series of smaller neighborhood communal systems managed by the town as a means to improve wastewater treatment and water quality in the area if conditions worsen.

Sewer Expansion or Extensions

The plan recommends that limited sewer extensions be considered for the West Manchester and Smith's Point study areas. Initial analysis indicates that some limited sewer extensions into these areas would be comparable in costs to the installation of on-site I/A system as a means to address long-term wastewater needs along the proposed sewer extension routes. Depending on the number of lots served by the extensions they could actually end up being cost-beneficial. Estimated flows anticipated from the proposed extensions are within available capacity limits of the WWTF.

Expansion of the sewer system into the Raymond Street study area is not the desired option of the town for the area, but is a potential option if problems persist in the area and communal treatment systems prove infeasible. Potential sewer expansion plans are shown in Figures ES-4 through ES-6. Capacity should be reserved at the wastewater treatment plant in the event that all other alternatives are exhausted and sewer expansion to the Raymond Street study area is necessary.

Should the town's current Master Planning efforts determine that the Limited Commercial District is part of their overall commercial growth plan, the wastewater needs of the LCD would be best served through a sewer extension to that area. Sewer extension into this area would increase the attractiveness of the area to prospective developers as compared to reliance on on-site systems or a communal system. Capacity should be reserved at the wastewater treatment plant in the event that the development is pursued in the future.

The estimated wastewater flows that would be added to the system from the recommended limited sewer extensions and sewer expansion to the Raymond Street area are summarized in Table ES-8.

Table ES-8. Wastewater Flow Projections for the Recommended Plan		
Study Area	Full Build-out ADF (gpd)	Planning Period ADF (gpd)
Infill	15,000	11,250
Study Area 1 West Manchester (Forster & Wood Crest Sewer Ext)	3,360	2,100
Study Area 2 Smith's Point (Beach Street Sewer Extension)	6,930	3,990
Study Area 3 Coolidge Point	-	-
Study Area 4 Raymond Street Sewer Expansion	35,070	19,530*
Study Area 5 Hickory Hill	-	-
Study Area 6 LCD	62,000	31,000*
TOTAL	122,360	67,870

*Capacity for these flows should be reserved at the WWTF.

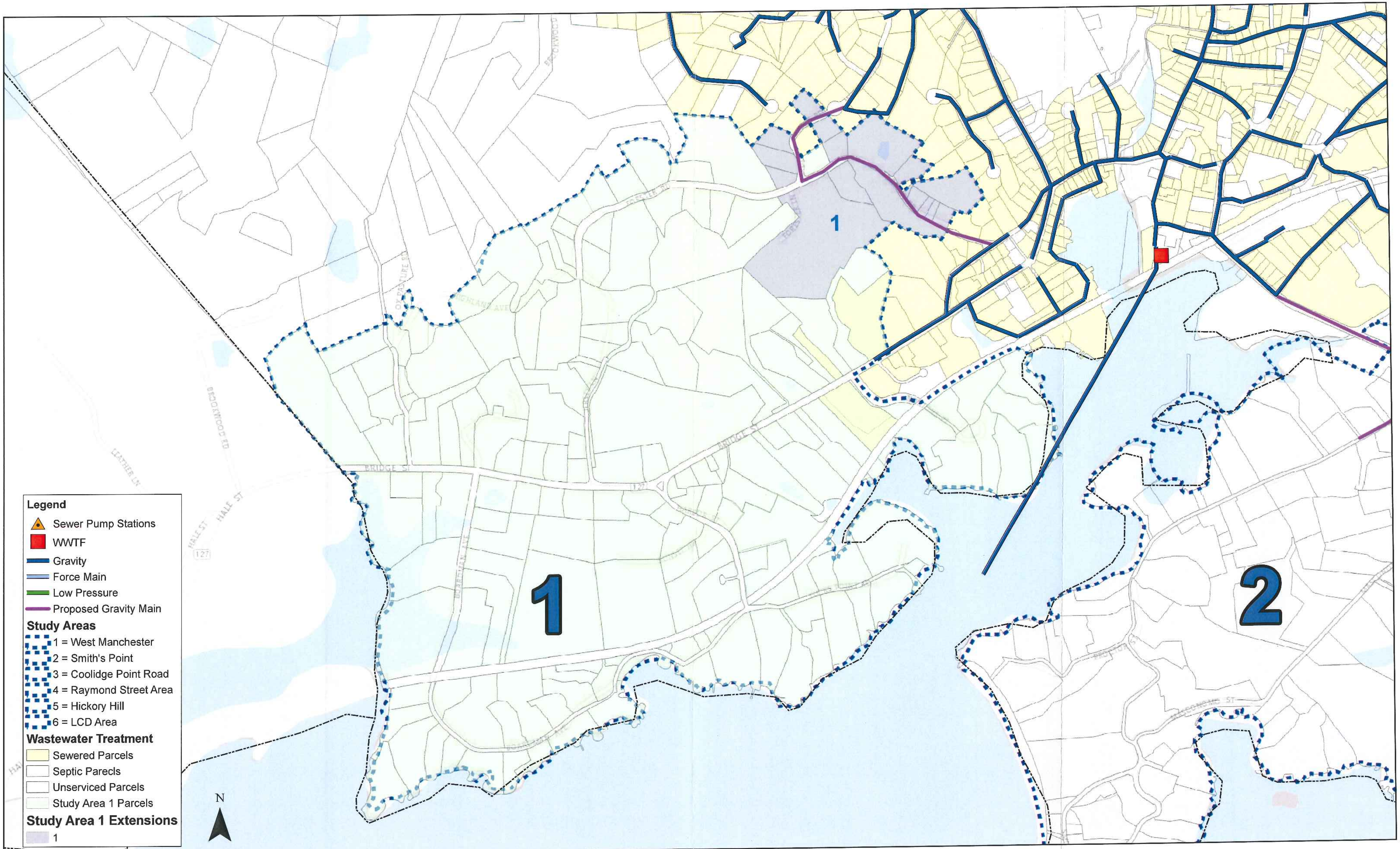
Manchester WWTF

The existing Manchester WWTF does not require upgrade or expansion to meet current NPDES permit conditions and projected wastewater flows from planned sewer extension and sewer expansions. However, improvements and equipment replacement are recommended to improve operational performance and efficiency of the plant. The upgrades would improve the operating range and efficiency of the key pumps and equipment, replace aging equipment; as well as improve operator control and maintenance requirements. Some of the more significant recommended improvements include: to replace and re-size influent and effluent pumps; adding VDF controls to the influent and effluent pumps; replace and re-sizing aeration blowers; replace and re-sizing of diaphragm sludge pumps; replacement of waste sludge pumps; upgrade and replacement of SCADA panels. Further, it is recommended that the town begin to plan for and evaluate potential climate change impacts at the Manchester WWTF.

Infiltration and Inflow (I/I) Removal Program

A formal infiltration and inflow (I/I) removal program should be continued to address the issues documented in the town's December 2013 Infiltration/Inflow Analysis report. Ongoing efforts to reduce I/I and eliminate possible salt water intrusion sources are currently underway in order to reduce peak flows at the WWTF, maintain compliance with the NPDES permit, and ensure available flow capacity for any proposed or planned sewer extensions in the future.

The "Infiltration and Inflow (I/I) Removal Program 2015" report details the Sewer Rehabilitation and investigations being completed as well as the recommendations and plans for the town's continued efforts toward I/I removal.



Manchester-by-the-Sea

Data Sources: Town of Manchester-by-the-Sea, MassGIS

Study Area 1 Sewer Extensions

Figure ES-4

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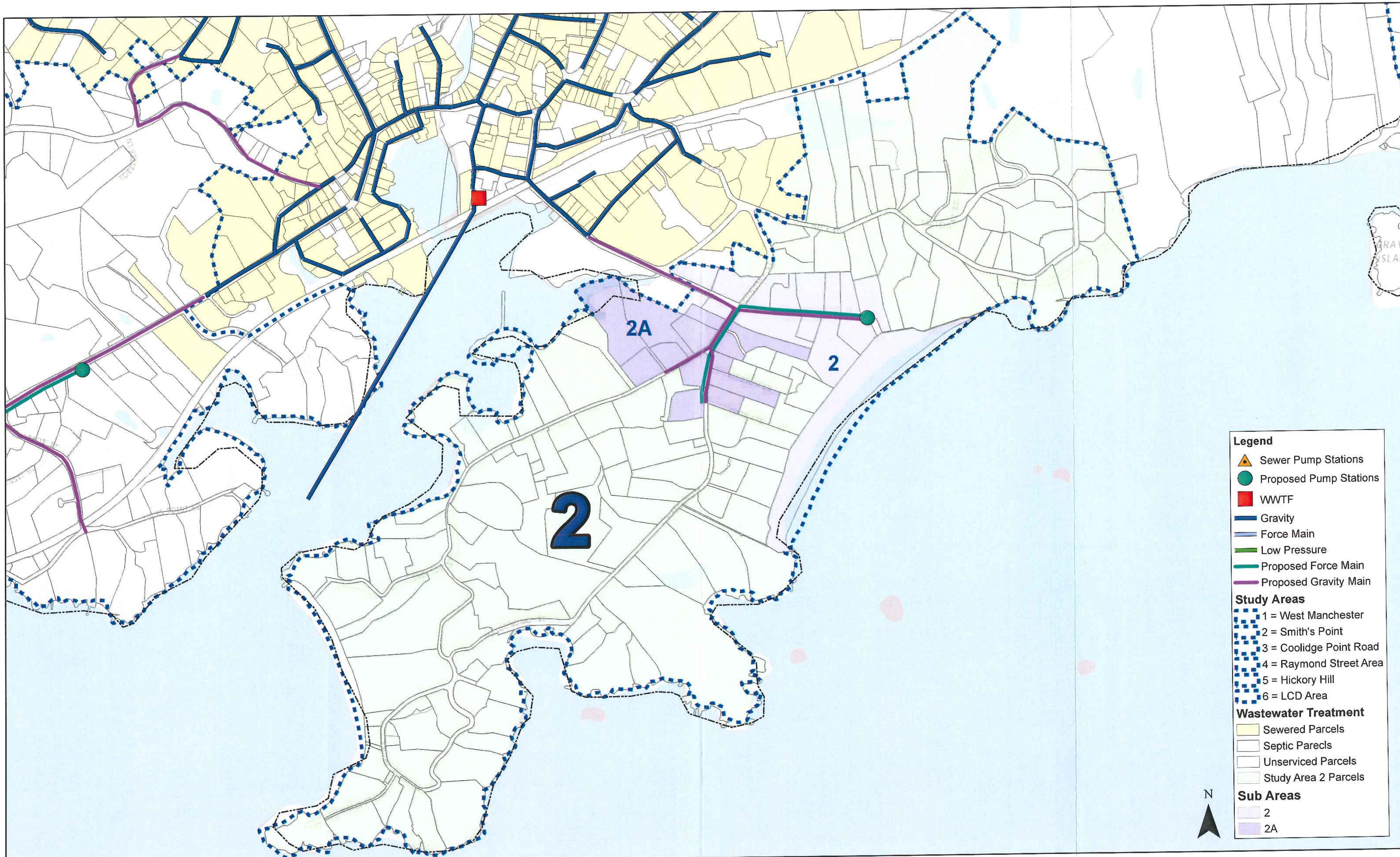

Manchester-by-the-Sea

Data Sources: Town of Manchester-by-the-Sea, MassGIS

0 0.2 0.4 Miles

Study Area 2 Sewer Extensions

Figure ES-5

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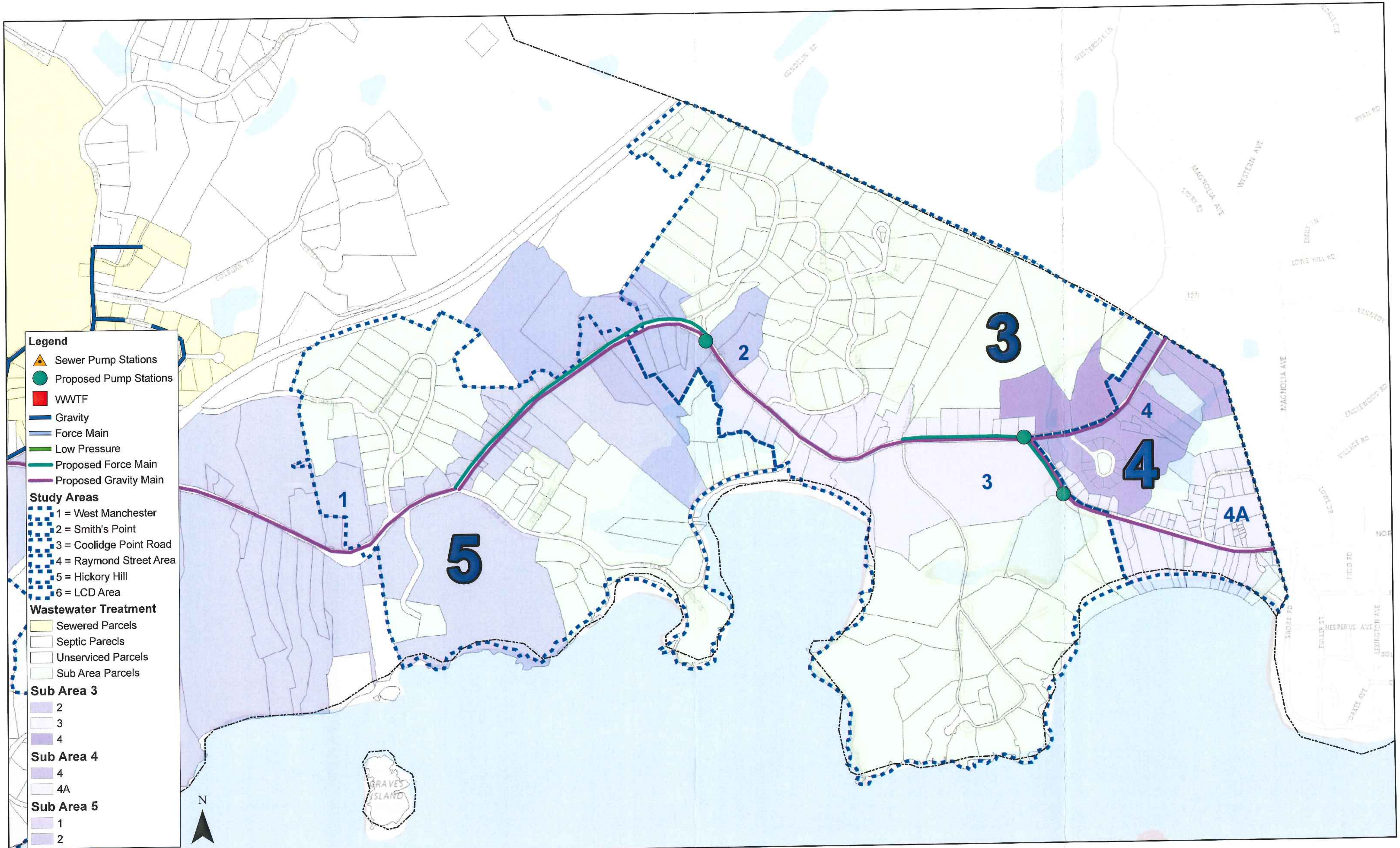

Manchester-by-the-Sea

Data Sources: Town of Manchester-by-the-Sea, MassGIS

Study Areas 3, 4, & 5 Sewer Extensions

Figure ES-6

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On-Site Wastewater Management Program (OSWMP)

Adoption of a more formal OSWMP would ensure that the use, inspection, maintenance and rehabilitation of all on-site wastewater systems relying on subsurface disposal to safeguard against system malfunctions that could result in groundwater pollution, water quality issues and public health hazards.

Costs and Financing

While some of the Recommended Plan strategies will need to be addressed immediately to ensure compliance with permits, it is important to note that others will require more time to achieve if at all. Either way the financial component of the Recommended Plan is strictly for budgetary purposes only. Estimated costs are based on conceptual level plans. It is further anticipated that only some of the options will be implemented throughout the 20-year planning period. Table ES-8 and ES-9 show the estimated project cost summaries for future planning and facilities improvements.

Table ES-9. Project Cost Summary – Future Planning

Study Area or Location	Description	Estimated Cost	Notes
West Manchester	Sewer Extension Forster Road and Wood Crest Road	$560,000	
Smith's Point	Sewer Extension Beach Street	$1,400,000	
Raymond Street Area	Sewer Expansion or Communal System w/Gloucester	$5,600,000 or $3,000,000	
LCD Area	Sewer Expansion	$2,400,000	Assume directional drilling required to cross RT 128

Existing Collection Area	Sewer Rehabilitation	$1,500,000	$0.5M per year for 3 years
WWTF	WWTF Improvements	$2,250,000	
Pump Stations	Generators and Improvements	$325,000	

Project Completion and Implementation Schedule

The implementation and timing of the various elements of the Recommended Plan is a critical component of the 20 year wastewater management strategy for the town which needs to be considered. The Recommended Plan is a combination of strategies, some of which must be completed in order to retain permit approvals for the WWTF while others will be required to meet the immediate needs of the town. In addition some proposed strategies are presented to accommodate for growth and development while also putting regulations in place to protect town residents and the environment over the long term.

Summary

This document further explores and develops strategies and alternatives, as well as recommendations and solutions to the town's wastewater management challenges for the 20-year planning period. It is important to remember that the document presents strategies for wastewater management but that it should be ever evolving with the Town of Manchester-by-the-Sea.

Section I. Introduction

I-1 PURPOSE AND SCOPE

This document was developed for the Town of Manchester-by-the-Sea ("the town" or MBTS) in response to a Massachusetts Department of Environmental Protection (MassDEP) Administrative Consent Order (ACOP-NE-13-1N003) to prepare a Comprehensive Wastewater Management Plan (CWMP) for the study and evaluation of current and future wastewater needs within the town and the development of recommended solutions. Appendix A contains a copy of the MassDEP Administrative Consent Order which documents the actions taken to date by the town and MassDEP with regard to the permitting of pollutant discharge from the Manchester Wastewater Treatment Facility (WWTF) into Manchester Bay.

The goal of the CWMP is to develop alternatives for managing the wastewater collection, treatment and disposal needs projected over a 20-year planning period. The plan demonstrates the current and future wastewater needs throughout the town, identifies possible alternatives to accommodate those needs, evaluates the cost-effectiveness, feasibility and environmental impact of the alternatives, demonstrates that the final plan is achievable from legal, institutional, financial, and management perspectives, and provides the basis for subsequent design and construction.

In addition to a comprehensive evaluation of existing facilities and future system needs within the study area, the plan also evaluates existing and projected demographic characteristics, topographic, hydrologic, and institutional features of the study area and evaluates their impact on wastewater needs.

The information contained in this CWMP is consistent with State and Federal regulations regarding the Clean Water Act (CWA) and also complies with the requirements of the financial assistance program of the Massachusetts Water Pollution Abatement Trust.

The future planning period includes the 20-year period beginning in 2015 and extending through the year 2035. It is within this time frame that future wastewater needs are evaluated. This CWMP outlines a number of wastewater facilities alternatives which have been identified for meeting the town's needs, and meeting State and Federal regulatory requirements during the future planning period.

I-2 PROJECT STUDY AREA

The CWMP study area is the Town of Manchester-by-the-Sea. The town is a residential community on Cape Ann in Essex County, located on the northeastern Massachusetts coast. The town was incorporated in 1645 and is bordered by Beverly and Wenham to the west, Hamilton to the northwest, Essex to the north, Gloucester to the east, and the Atlantic Ocean to the south (Figure I-1). The total area of the town is approximately 18.3 square miles, half of the area comprised of water, with elevations ranging from 100 to 160 feet above sea level.

The town is 32 miles from Boston with its major commercial access roads being state highways 128 and 127. Route 128 runs west to east through the northern part of town and Route 127 runs west to east through the southern part of the town. The town is serviced by the Massachusetts Bay Transit Authority (MBTA) Commuter rail on the Newburyport line, running from Rockport along the North Shore to North Station in Boston. Major airlines can be accessed from Logan International Airport located in Boston.

A detailed description of existing conditions in the planning study area is presented in Section IV of this document.

I-3 WASTEWATER PLANNING PROJECT SCOPE

The scope of the Manchester's Comprehensive Wastewater Management Planning Project has been divided into four general phases, the last of which includes this Comprehensive Wastewater Management Plan (CWMP) which incorporates results of the other three phases into the document. Below is a list of the phases:

- Phase I: Existing Conditions
- Phase II: Needs Projections
- Phase III: Development and Screening of Alternatives
- Phase IV: CWMP and Recommended Plan of Action

I-4 ORGANIZATION OF THIS COMPREHENSIVE WASTEWATER MANAGEMENT PLAN

According to the Massachusetts Department of Environmental Protection (MassDEP) Bureau of Municipal Facilities guide to Comprehensive Wastewater Management Planning (January 1996), the CWMP should be in compliance with the scope, schedule, and costs defined in the Plan of Study. This CWMP is an update of the planning process and summarizes the findings of tasks identified in previous efforts. The CWMP is divided into the following sections based upon this guidance.

- Executive Summary presents an overview of the report and its findings by summarizing the town's future wastewater collection and treatment needs over the next twenty years.
- Section I is an introduction into the CWMP which defines the purpose and scope, background of the study area (the entire town of Manchester-by-the-Sea), wastewater planning, and the report organization.
- Section II evaluates the regulatory considerations and planning objectives through the documentation of the planning strategy, previous CWMP related planning efforts, water quality management, and wastewater management. This section also includes brief

discussions of existing and future permitting requirements, the quality of the treatment plant effluent under existing treatment and flow conditions, and facility permit compliance.

- Section III discusses the public participation programs, as well as ongoing projects, groups, and efforts relevant to the development of this CWMP.
- Section IV summarizes existing planning area conditions relative to existing physical, environmental, and demographic conditions within the planning study area. The delineation of the study area into five assessment areas during the Phase I report in 1994 and the addition of another study area, 6 LCD Area, as part of this investigation is also discussed within this section.
- Section V identifies existing wastewater collection and treatment systems within the town through an examination of the findings of the infiltration and inflow desktop analysis. This section also includes analysis of unsewered areas, the existing collection system (sewered areas), the existing WWTF treatment system, a summary of recommended improvements to the WWTF, and analysis of operation and maintenance programs. System deficiencies, operational characteristics, and future system needs are outlined.
- Section VI summarizes anticipated future conditions within the town as related to development, population projections, water and wastewater need projections and flow reduction over the next 20-year planning period.
- Section VII describes the alternatives evaluation process through an assessment of the wastewater needs, the identification of alternatives, the screening of alternatives, the development of solutions, and the plan selection.
- Section VIII identifies the recommended CWMP for Manchester-by-the-Sea through the use of on-lot sewage management areas, sewer service areas, and the WWTF. This section concludes with an overview of the recommended plan and an implementation/phasing plan along with a discussion of direct and indirect environmental impacts associated with the selected alternative(s).

Appendices contain permits, backup analyses, and reports as identified in this CWMP.

Manchester-by-the-Sea

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS

Manchester-by-the-Sea

Figure I-1

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Section II. Planning Objectives

II-1 PLANNING STRATEGY

Regional Planning

The Town of Manchester-by-the-Sea is part of the Metropolitan Area Planning Council (MAPC) regional planning agency. In addition to Manchester-by-the-Sea, the planning organization region includes 100 cities and towns of Metro Boston including coastal communities, older industrial centers, rural towns and modern cities.

The MAPC coordinates regional planning strategies and activities and has published a number of documents and studies over the past several decades covering regional planning, economic development, transportation, housing, land use, protection of natural resources, and public safety. The Northshore Task Force (NTF), within MAPC, is a task force comprised of representatives of 16 north shore communities including MBTS that meets regularly to discuss regional issues such as shared drinking water resources.

Another regional planning effort impacting the town is the Ocean Act of 2008 (OA) which works through the Massachusetts Coastal Zone Management (CZM) program with enforcement under the Massachusetts Department of Environmental Management (MassDEM). The Massachusetts Executive Office of Energy and Environmental Affairs (EEA) which administers the Oceans Act of 2008 recently published the 2015 Massachusetts Ocean Management Plan. MBTS along with all other Commonwealth coastal communities is located within the Massachusetts Ocean Management Planning Area.

The Sewer Task Force Final Report (2009) recognized that the Manchester Wastewater Treatment Facility (WWTF) discharge pipe terminates within the ocean sanctuary as defined by the Oceans Sanctuaries Act (OSA). The Act is intended to protect ecologically significant resource areas for their contributions to marine productivity and value as natural habitats and storm buffers. Legislation associated with the OSA, limits the amount of municipal waste that can be discharged by permit from the WWTF to an annual average of 0.67 million gallons per day (mgd).

Local Planning

Manchester–by-the-Sea Master Plan (2000 with 2015 Update Underway)

While the current Master Plan rewrite is being undertaken during the same timeframe as this report, the goals set forth in the 2000 Master Plan for land use, housing, economic development, open space, and natural and cultural resources are still key components of planning for the future needs of the town. The goals statements presented at that time are as follows:

1. **Character** - Preserve the character of Manchester as exemplified by its scale, density and the inherent charm of its diverse architecture, shops, streets and natural and historic features.
2. **Conservation** - Continue to be vigilant in the protection and acquisition of environmentally sensitive areas such as land contributing to the water supply, flood plains and wetlands, as well as aesthetic or otherwise significant parcels of land.
3. **Commercial** - Work to make the downtown more accessible and attractive and support the vitality of local businesses.
4. **Coastal Areas** - Develop an overlay plan for the preservation, management and improvement of the beaches, harbor and coastal areas.
5. **Growth** - Adopt policies that balance growth with the limitations of the Town's infrastructure and natural resources, and respect its character and the quality of life of its residents.

Compliance with these goal statements or new statements identified during the update are an essential part of the development of this CWMP.

Manchester–by-the-Sea Open Space and Recreation Plan (August 2014)

The Open Space and Recreation Plan (OSRP) serves as a recently completed assessment of the town's open space and recreation lands. It also serves as a seven year action plan with seven key goals for managing and improving these areas through recommended enhancements and programs while promoting their use through a combination of recommended *Resource Protection Needs* and *Community Needs.*

> Goal 2 of the OSRP to "Protect Land Significant to Drinking Water Protection, Wildlife Habitat and Natural Resource Protection" relates directly to the CWMP and as such should be supported by the Plan.

Zoning By-Law of the Town of Manchester-By-The-Sea (Revised through April 2014)

In accordance with the By-Law the Town is divided into the following zoning districts:

- Single Residence District A (minimum lot area 22,500 sq.ft.)
- Single Residence District B (minimum lot area 15,000 sq.ft.)
- Single Residence District C (minimum lot area 45,000 sq.ft.)
- Residence District D (minimum lot area 6,000 sq.ft.)
- Single Residence District E (minimum lot area 90,000 sq.ft.)
- General District (minimum lot area 96,000 sq.ft.)
- Limited Commercial District

Overlay Districts identified in the By-Law to be considered as part of this plan include:

- Flood Control District
- Flood Plain District
- Ground and Surface Water Resource Overlay Protection Districts

The Zoning By-Law also includes a stipulation for Development Scheduling with a Sewer Connection Limitation which is intended "to ensure that a harmonious pattern and rate of development occurs in Manchester-by-the-Sea which protects the welfare of current and future Manchester-by-the-Sea residents." Section 6.11.1 of the regulation clearly documents the town's concern regarding its increasing inability to provide public water and sewer to those residents seeking access. The By-Laws include the following statement clearly defining the concern:

> *"The Water and Sewer Department has provided evidence that the municipal sewer system can accommodate no more than 200 additional dwelling units and the public water supply is at or near capacity. The rate of residential and commercial development in Manchester-by-the-Sea is determined by and should not exceed the ability of the town to provide adequate public services to safeguard the health, welfare and safety of current and future residents."*

The regulations also govern the Division of Land and Development of Multiple Dwellings as well as Residential Conservation Clusters.

<u>Town of Manchester-by-the-Sea Wetlands Regulations for Administering General By-Law Article XVII (Adopted February 26, 2013)</u>

The purpose of the Wetlands Regulations and the enacting By-Law are to establish guidelines for the application submission process and the Manchester-by-the-Sea Conservation Commission's review process for proposed activities within the Resource Areas and Resource Area Buffer Zones. A recent change, among others, was the inclusion of additional protection requirements for salt marsh, freshwater wetlands, streams, coastal banks, and vernal pools. Updates adopted in 2013 also include revisions required to meet the Massachusetts Stormwater Standards.

Unless specified herein, all of the standards, requirements, procedures, definitions and performance standards set forth in the Massachusetts Wetlands Protection Act, M.G.L.c. 131, 40 and the regulations in the Massachusetts Department of Environmental Protection (Mass DEP), 310 C.M.R. 10.00 et seq. are hereby incorporated and made part of these Regulations. Special Permits related to the CWMP are governed through stormwater management and topographical changes and land clearing under current regulations.

II-2 WATER QUALITY MANAGEMENT

The Clean Water Act (CWA) is the key federal regulation controlling activities which affect surface water. The overall objective of the CWA is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." Sections 106, 205(j), 208, and 303 of the Act provide the basis for State and regional Water Quality Management. Water Quality Management (WQM) is aimed at achieving the water quality goals of the Act through the prevention and control measures supported by pollution control programs including permitting, development of Water Quality Standards (WQS) and Total Maximum Daily Loads (TMDLs) in addition to monitoring, enforcement, agency assistance, training, and public awareness.

Public water supply to the town is operated within the town's Department of Public Works (DPW). The Town of Manchester-by-the-Sea is serviced by two water supply sources. Two surface-water ponds located in the Town of Hamilton, Gravelly Pond and Round Pond, provide approximately 65.4 percent of the town's drinking water; the Lincoln Street well provides the remaining approximately 34.6 percent. The total number of parcels on the municipal system equates to 1,868. The remaining areas of the town, 51 parcels, are serviced by individual wells.

The WQM planning process is implemented through a number of state and federal environmental programs. The following components of the CWA are essential to the WQM and planning process:

Development of Water Quality Standards (WQS) Regulations Necessary to Enforce

Section 303 of the Federal Clean Water Act (CWA) requires the state to adopt surface water quality standards and review and modify these standards at least every three years. Federal law defines surface water quality standards as the identification of water quality goals through the assignment of designated uses to be made of the water and by setting criteria necessary to protect those uses. Federal regulations state that water quality standards should, wherever attainable, provide water quality for the protection and propagation of fish, shellfish and wildlife and for recreation in and on the water.

MassDEP has adopted several Code of Massachusetts Regulations (CMRs) that address the following: Surface Water Quality Standards (314 CMR 4.00), Groundwater Discharge Permit Program (314 CMR 5.00), and Ocean Sanctuaries (302 CMR 5.00). Below is a description of each code:

- ***Surface Water Quality Standards*** serve to designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained and protected; which prescribe the minimum water quality criteria required to sustain the designated uses; and which contain regulations necessary to achieve the designated uses and maintain existing water quality including the prohibition of discharges where appropriate.
- ***Groundwater*** regulations serve to control the discharge of pollutants into the groundwater in order to protect the groundwater for actual and potential use as a source of potable water, that surface waters are protected for their existing and designated uses, and to assure the attainment of the Surface Water Quality Regulations.
- ***Ocean Sanctuaries*** are designed to work through the Massachusetts Office of Coastal Zone Management (CZM) in order to protect ecologically significant resource areas for their contributions to marine productivity and value as natural habitats and storm buffers.

Formulation of State and Area-Wide Water Quality Management (WQM) Plans

Water Quality Management (WQM) plans are required by the Clean Water Act (CWA) to provide a basis for regulatory control, enforcement of water pollution abatement activities, and comprehensive analysis of the actions necessary to meet the WQS. Effluent limitations which are incorporated into a National Pollutant Discharge Elimination System (NPDES) permit have dramatically reduced the amount of raw sewerage and point source pollutants entering into our nation's water.

MassDEP Bureau of Water Resources is responsible for "protecting critical inland and coastal water resources by:

- controlling point and nonpoint sources of pollution,
- safeguarding public drinking water supplies,
- ensuring public access to the waterfront, and
- administering revolving loan programs that help the state's towns and cities improve their environmental infrastructure."

The Division of Watershed Management provides the monitoring and regulatory programs required to ensure that water quality and quantity within the state's major river basins are achieved through a partnership between: Drinking Water, Wetlands & Chapter 91 Waterways, Wastewater Management, and Watershed Planning programs.

Issuance of permits for point and non-point source discharges

In Massachusetts, the U.S. Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) permitting program for wastewater discharges to surface waters in the state are issued by EPA New England. The Town of Manchester WWTF is currently operating under NPDES Permit No. MA0100871 issued on June 28, 2011 (Appendix B). As is the case for most NPDES permits, this permit is issued for a five-year period. It specifically addresses operating restrictions, physical and chemical discharge limitations, and monitoring and reporting requirements.

Nonpoint sources of pollution such as stormwater, septic systems and erosion are now being addressed through MassDEP on a watershed basis.

Ocean Act

The Ocean Act of 2008 (OA) requires that the Massachusetts Executive Office of Energy and Environmental Affairs (EEA), which administers the Act, create a Massachusetts Ocean Management Plan to be updated every 5 years. The first official formal plan entitled the 2015 Massachusetts Ocean Management Plan (2015 ocean plan) was recently published. The 2015 ocean plan expands upon the 2009 version of the ocean plan with a pragmatic management structure enabling the "Commonwealth to proactively balance current and future uses of ocean waters while protecting critical ocean habitats and promoting sustainable economic development." MBTS along with all other Commonwealth coastal communities is located within the Massachusetts Ocean Management Planning Area.

The Ocean Sanctuaries Act (OSA) and regulations designate five ocean sanctuaries one of which is the North Shore Ocean Sanctuary that MBTS is a part of. The OSA is unique in that it serves to protect and preserve coastal resources through ecology, aesthetic interests, and water quality.

Coastal Pollutant Remediation Grant Program Awards FY15 - Town of Manchester-by-the-Sea
Downtown Improvement Phase 2-Stormwater Management, Award: $112,036.00
As part of a multi-faceted downtown improvement project, the Town of Manchester-by-the-Sea will conduct a feasibility study for using Low Impact Development (LID) elements to remediate stormwater inputs to Sawmill Brook/Cat Brook and Manchester Harbor. Sawmill Brook is a rare spawning habitat for rainbow smelt, a nationally rated species of concern, and is also listed as impaired due to pathogens in Manchester Harbor. This project hopes to serve as a model for other communities with aging infrastructure and urban landscapes on how to effectively treat and reduce stormwater using LID technologies, with the ultimate goal of improving water quality, habitat, and de-listing impaired waters.

State Revolving Fund
This CWMP is funded in part under the Final 2014 Intended Use Plan (IUP) of the MassDEP program through the Clean Water State Revolving Fund (CWSRF) program.

II-3 WASTEWATER MANAGEMENT

At present, the town relies on a combination of wastewater management strategies including both on-site septic systems and municipal sewer collection, treatment, and disposal at the Manchester Wastewater Treatment Facility (WWTF). The WWTF provides removal and treatment services to approximately two-thirds of residents in and around the center of town. It is important to note that wastewater treatment does not include stormwater which is treated under different collection system. All other developed or developable parcels rely on septic systems. Local Board of Health (BOH) officials are responsible for administering State Environmental Code (Title 5) and local regulations associated with septic systems.

The town is served at present by 23 miles of municipal sewer leading to the WWTF. In accordance with the town's DPW records, the municipal system is utilized by approximately 1,229 parcels compared with the 707 septic system parcels. There are approximately 500 more parcels which are undevelopable through conservation and/or other restrictions.

Manchester Wastewater Treatment Facility
The Manchester WWTF provides secondary treatment to wastewater flows from those properties within the sewer collection service area. The plant currently operates under the following NPDES permitted flow limits:

- 1.20 million gallons per day monthly average flow (December through May)

- 0.67 million gallons per day monthly average flow (June through November)
- 0.67 million gallons per day annual average flow (Ocean Sanctuaries Act Limit)

The Manchester WWTF underwent a major upgrade and expansion project in 1999. Plant upgrades at the time of the 1999 expansion were designed to treat average daily flows of 1.2 million gallons, a maximum daily flow of 3.0 million gallons and an instantaneous flow of 5.0 million gallons. Even though the WWTF is designed to treat an average daily flow of the 1.2 million, its NPDES permit limits flow from the plant to 0.67 million gallons per day on an annual average gallons per day basis. This flow limit was imposed under the Ocean Sanctuaries Act. Operating under the OA effectively limits any future expansion of the system beyond current flow levels.

<u>Administrative Consent Orders</u>
MassDEP has issued two Administrative Consent Orders (ACO) to the town in reference to the wastewater collection system. A 1992 ACO led to the expansion and upgrade of the Manchester WWTF. Although the 1992 ACO has been substantially met and subsequently lifted, the town remains under certain requirements of that ACO, namely the town remains restricted from further extensions of the sewer system until it demonstrates compliance with removal of I/I within the collection system to limit peak flows at the plant.

More recently, MassDEP issued Administrative Consent Order (ACOP-NE-13-1N003) on February 15, 2013. The new 2013 ACO requires completion of this CWMP. In accordance with the Manchester WWTF's NPDES permit, the town is required to complete "a report describing: (i) plans for further flow increases; and (ii) any actions needed to sustain compliance with the terms and conditions of the 2011 Permit" when plant flows exceed 80% of the design flows. The 2011 calendar average flow was 0.55 mgd which is over 80% of the 0.67 mgd annual average permitted flow limit. Correspondence on behalf of the town to MassDEP indicates that Conditions of this Consent Order are being addressed.

<u>Title 5 - State Environmental Code</u>
Title 5 of the State Environmental Code, 310 CMR 15.000 is the MassDEP regulation for the siting, construction, inspection, upgrade and expansion of on-site sewage treatment and disposal systems and for the transport and disposal of septage, the waste generated and pumped from septic systems. Local BOH officials regulate septic systems within the Commonwealth under the guidance of MassDEP Title 5 regulations.

<u>Board of Health</u>
As previously stated, local Board of Health (BOH) officials regulate septic systems within the cities and towns of the Commonwealth under the guidance of MassDEP Title 5 regulations. MassDEP oversees local implementation of the program as well as provides technical support and training of local officials along with some regulatory approvals. The BOH provided the town septic system records used in this report.

Local Sewage Disposal Guidelines and Regulations

Article VIII Board of Water and Sewer Commissioners of the Town's local bylaw states that the Board of Water and Sewer Commissioners adopts the regulations for the carrying on of the business of the Board and for the regulation of town water and sewer systems.

A Sewer Task Force was formed as a result of a 2008 Special Town Meeting vote seeking funding for emergency sewer repairs on Beach Street. The Board of Selectmen appointed the Sewer Task Force in 2009 and charged the committee with the review and evaluation of the town's municipal sewer system and to make action and/or policy changes via a study to the Board.

One of the major concerns discussed is the 1994 town policy for the allocation of bonded sewer capital costs with 75% being paid by the sewer users and 25% being paid by the taxpayers as a whole, resulting in sewer users paying in both instances since they are included in both groups.

Recommendations resulting from the task force findings are documented in the Sewer Task Force Final Report dated September 10, 2009 and are detailed in the Section II-4 below.

II-4 SUMMARY OF PREVIOUS CWMP RELATED DOCUMENTS, REPORTS, AND STUDIES

The development of this CWMP is intended to build upon the plans and studies related to wastewater management planning previously completed by Town of Manchester-by-the-Sea over the years. The following is a selective listing of previous plans and studies with a brief description of the findings and recommendations.

Wastewater Planning Studies

- ***Town of Manchester-by-the-Sea Phase I Wastewater Facilities Plan*** prepared by Wright-Pierce (1994). The plan was completed in response to the Administrative Consent Order issued by DEP in 1992 in order to complete treatment facility improvements and restore compliance with the discharge permit NPDES program, Permit No. MA 0100871 (federal), M-18 (state). The plan identified that approximately 66% of the current population was serviced by municipal sewer. Five developed areas outside of the existing sewer area were identified as having the potential for on-site system failures due to severe site limitations.
- ***Wastewater Needs Assessment Manchester-by-the-Sea*** prepared by Earth Tech, Inc. (2003). The purpose of the report was to determine the ability of the existing sewer collection sewer to accommodate additional wastewater flow. The report evaluated whether or not conventional Title 5 septic systems would be effective in the disposal of wastewater within non-sewered sections of the town over the next twenty years. Study areas most at risk for failure/noncompliance were Smith's Point and Coolidge Point while West Manchester, Raymond Street Area, Hickory Hill and the remainder of the town met at least two of the 5 criteria for all failure/noncompliance. As a result of findings in this report, the replacement or repair of conventional on-site Title 5 septic

systems were not recommended and that suggested alternatives be examined. Furthermore a Septage Management Plan (SMP) should be required for all on-site systems developed until the issue is resolved.

- ***Manchester-by-the-Sea, MA Executive Order 418 Community Development Plan*** prepared by Horsley Witten Group (2004). Five overall tasks were examined as part of the plan. They are as follows: Open Space and Resource Protection; Housing; Economic Development; Transportation; and Final Plan Development. Proposed land use and zoning recommendations were compiled together as a means of documenting merits of various recommendations and to solicit further discussion and community input.
- ***2008 GIS Data Update of the 2003 Wastewater Needs Assessment Report*** prepared by Woodard & Curran (September 2008). The report, in the form of a "Letter Report", detailed the creation of a new Geographic Information Systems (GIS) based Study Area map utilizing delineated areas from the 2003 report. Updates to sewered parcel and land use information for the town were added to the GIS database during this time. In response to the MassDEP 1992 Consent Order (ACO) a detailed analysis of the steps taken by the town from 1992-2008 were also documented within the Letter as an additional means of preparation for the eventual completion of a CWMP. Lastly, *Appendix C of the Letter defined a proposed Draft Limited Sewer Moratorium By-Law (September 26, 2008), which is included in Zoning By-Law 6.11 of the town revised through April 2014.
- ***Town of Manchester-by-the-Sea Sewer Task Force Final Study*** prepared by the Sewer Task Force (2009). The study was undertaken to review and evaluate the town's municipal sewer system and to recommend necessary actions and policies to the Board of Selectman. Recommendations included a survey of the existing system and repairs as required; a study of sewer expansion options and costs; and town policy changes. Recommendations presented in the study were contingent on the concerns that the Administrative Consent Order may have been rescinded or substantially modified.
  As an update the Administrative Consent Order with Penalty and Notice of Noncompliance was jointly re-issued by the EPA and MassDEP on June 28, 2011 with the requirement for a Final CWMP being submitted by July 1, 2015 and the order set to expire July 31, 2016.
- ***Town of Manchester-by-the-Sea Infiltration/Inflow Analysis*** was prepared by Woodard & Curran in December 2013 as required by the Administrative Consent Order with Penalty and Notice of Noncompliance (ACOP/NON, File No. ACOP-NE-13-1N003 is attached as Appendix C. The report presented the Infiltration and Inflow (I/I) Identification and Removal Plan (I/I Plan). The plan identified a series of immediate investigation and implementation strategies which have been completed or are currently being undertaken by the town. The long range recommendation identified in this study is for the town to rehabilitate "the priority defective areas of the collection system which contribute the highest levels of I/I in order to optimize the use of the WWTF capacity, while minimizing the potential for sanitary sewer overflow (SSO) events and avoiding process operation problems. The need to address salt water intrusion into the system is another recommendation documented in the report some of which can be

addressed through the grouting of manholes. Smoke Testing and Dyed Water Flooding indicated minimal peak inflow entering the system at present.

- ***Manchester-by-the-Sea Wastewater Treatment Facility Operation and Maintenance Manual*** prepared by Wright–Pierce. The purpose of the manual is to make sure that certain procedures and methods of operation and maintenance are followed to insure that town wastewater treatment facilities function as intended. As an aside to this plan, CDR Maguire is in the process of preparing an update/markup of the current conditions portion of the plan per DEP's request of the town.

Semi-Annual Status Report as required by Paragraph 23. d) of the Administrative Consent Order with Penalty and Notice of Noncompliance (ACOP), File No. ACOP-NE- 13-1N003.

Actions taken by the town in meeting the requirements of the ACOP, include Infiltration/Inflow (I/I) activities and efforts to develop and finalize the Comprehensive Wastewater Management Plan (CWMP). In accordance with requirements the following Semi-Annual Status Reports have been submitted to date:

- Semi-Annual Status Report for the period of July 1, 2014 to December 31, 2014
- Semi-Annual Status Report for the period of January 1, 2014 to June 30, 2014
- First Semi-Annual Status Report for the period of April 1, 2013 to December 31, 2013

Section III. Public Participation

III-1 PUBLIC PARTICIPATION PROGRAM

The public participation program is an integral part of the sewer management planning process. MassDEP guidelines for Comprehensive Wastewater Management Planning require the inclusion of a public participation program within the Comprehensive Wastewater Management Plan (CWMP). The process must include at a minimum one public hearing to discuss the alternatives and environmental impacts and another on the recommended plan and its environmental impact. CWMP guidance further states that the public participation efforts should be utilized throughout the CWMP process. This section of the CWMP serves to document the required public participation program.

Additional conversations and meetings were held with the Manchester-by-the-Sea Town Planner, WWTF Superintendent, and other town representatives to address any of their respective concerns during the development of the CWMP in order to ensure town guidance.

III-2 LOCAL INITIATIVES

<u>Sewer Task Force</u>

The Sewer Task Force came about in response to a 2008 Special Town Meeting seeking funding for emergency sewer repairs. The committee was charged with completing a review and evaluation of the town's municipal sewer system and to recommend to the Board of Selectmen any actions or policies that resulted from the study. Subjects addressed in the report included:

- Determining current geographical layout of sewer system and number of users.
- Review of the number of non-users who could tie into the system at that time.
- Assessment of feasibility and costs of possible expansion to non-sewered areas.
- Determination of costs related to replacement/repair of current sewer infrastructure.
- Evaluation of the apportionment formulas for operational and capital improvement costs.
- Review status of current "cap" at the treatment plant as determined by the Ocean Sanctuaries Act.
- Meeting with DPW Director, Board of Health, Town Accountant, Town Administrator, and others as necessary for input to all the above.
- Preparation of a final report.

The resulting report, serves as the basis for this CWMP.

<u>Comprehensive Wastewater Management Plan Steering Committee</u>

The Comprehensive Wastewater Management Plan Steering Committee established in 2014 was charged with guiding the writing of the CWMP. Committee Members are as follows:

- Eli Boling - Board of Selectmen
- Gary Russell - Conservation Commission
- Gerry MacDonald - Board of Health

- Rebecca Jaques - Planning Board
- Ronald Mastrogiacomo - Planning Board
- Alida Bryant - Citizen At Large
- Brian Balukonis - Citizen at Large

Joined by Town Staff:

- Greg Federspiel - Town Administrator
- Sue Brown – Town Planner

III-3 PUBLIC PRESENTATIONS AND HEARINGS

Public participation in the development of the CWMP has primarily been through a series of monthly Steering Committee meetings beginning in October 2014. All meetings were open to the public with meeting times and locations advertised and posted on the town's website under the Town Clerk's Public Meeting Calendar under the Comprehensive Waste Management Project heading.

Public Forums/Hearings

In conjunction with the development of this CWMP, three Public Forums/Hearings were held by the town.

The first public forum was held on December 15, 2014. The forum introduced the CWMP project, the MassDEP requirement for the plan and its purpose to evaluate sewage collection, treatment, and disposal needs of the town for the next 20 years. The primary areas of need defined during previous studies were reintroduced and refined as Study Areas during this forum.

The second public forum was held on March 30, 2015. A review of the alternatives being screened during the development of the CWMP was presented. The five alternatives presented included: on-lot alternative/conventional Title 5 systems; communal treatment systems; connecting neighboring systems; sewer expansion to Manchester WWTF; and sewer expansion to new WWTF. Expansion and extension of sewer into Study Areas were presented along with cost comparisons to other proposed alternatives.

The third public hearing was a formal hearing held on June 15, 2015. A review of the Draft CWMP plan detailing the recommendations for the town's wastewater management was presented during this hearing. An overview of the project, the alternatives analysis, and a recommended plan was discussed. Some recommendations highlighted were the continued use of on-site sewer management with possibilities of small extensions to the sewer system in some areas and improvements to the WWTF.

Presentation Materials

In accordance with State Revolving Fund (SRF) Loan Application a website pertaining to the development of the CWMP was established. Development of the website occurred during the time frame of the first two public forums. The website, which is accessible from the "Quick Links" tab on the town's homepage, was made "live" approximately 45 days prior to the June 15^{th} public hearing. The Draft CWMP was made available on the site on May 20, 2015. Public comment regarding the plan was submitted via a link on the website. The required 30-day comment period was extended two weeks past the public hearing for a total comment submission opportunity of 45 days.

Information from the public forums/hearings, frequently asked questions, and the project purpose can also be found on the town website and in Appendix D.

Section IV. Existing Planning Area Conditions

The information contained in this section describes the existing conditions in the planning study area, which encompasses the entire town. Geographic Information System (GIS) data layers were gathered for existing conditions within the Town of Manchester-by-the-Sea from the Office of Geographic and Environmental Information (MassGIS), the United States Geological Survey (USGS) topographic maps, and the United States Department of Agriculture (USDA) Soil Conservation Service – Essex County Soil Survey. Table IV-1 lists all of the GIS data sources utilized in this report along with the year that the data was obtained.

Town planning data for this CWMP was obtained directly from the Manchester-by-the-Sea (MBTS) data reports as well as the United States Census Bureau. The Zoning By-Law of Manchester-by-the Sea (revised April 2014) as presented on the website served as a data source in this report.

Table IV-1. Summary of GIS Data Sources
Manchester-by-the-Sea

Information	Source	Date
Orthophotos (Aerial Photos)	MassGIS	2008/2009 & 2014
Wells & Zone IIs	MassGIS	2014
Floodplain	FEMA &MassGIS	2014
Wetlands	MassGIS	2014
Natural Heritage & Endangered Species Program Priority Habitat Areas	MassGIS	2008
Surficial Geology	MassGIS	2007
Soils	USDA	2011
Groundwater Contours	USGS	2008

Source: *Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, Massachusetts Office of Information Technology (MassIT)*

The information sources described above provide the basis for the analysis of alternatives presented in Section VII and the recommended CWMP presented in Section VIII.

IV-1 LAND USE AND ZONING

General Land Use

Manchester-by-the-Sea is a coastal community comprised of 7.84 square miles (5000 acres) of land located approximately 25 miles north of Boston on what is considered Boston's North Shore, in Essex County. The Town of Manchester-by-the-Sea (MBTS) is considered part of Cape

Ann which includes the communities of Essex, Gloucester, Rockport and Manchester-by-the-Sea. The town is bordered by Beverly and Wenham on the west, Hamilton and Essex on the north, Gloucester on the east, and the Atlantic Ocean on the south. Two state highways, Route 127 and Route 128, traverse the town from Beverly to the west and Gloucester to the east, as does the Rockport branch of the Massachusetts Bay Transit Authority (MBTA) commuter rail line. Two local roads link the town with neighboring Essex to the north and Hamilton to the northwest.

The land cover in the region has changed from forest of the pre-European settler era to a combination of undeveloped forested and wetland forested areas along the eastern, northern, and western town boundaries and low density residential development along the southern coast. Small pockets of limited commercial and industrial development are concentrated in the middle third of the town.

Zoning

Zoning indicates that a general business district is located along the northern border of the town; residential development on 40-80k square foot lots resides to the east, west, and south; 15-40k square foot residential lots are located in the center of town with a small section of more densely populated residential in the center; and a light industrial district located just north of the center section of the Manchester Harbor. Areas of land use by acre are listed in Table IV-2 while zoning by primary use type are depicted in Figure IV-1.

Table IV-2. Areas of 2005 Land Use
Manchester-by-the-Sea

Land Use Type	Acres (approximate)	Percent of Total (approximate)
Low & Very Low Density Residential	645	10
Medium& High Density Residential	208	4
Industrial	8	1
Commercial	17	3
Urban Public/Institutional	37	1
Transportation Communication & Utilities (TCU)	77	1
Open Space (w/Cemeteries)	542	9
Recreation	134	2
Undeveloped	4,100	69
Total Acres in Town	5,888	100.00%

Source: MassGIS Land Use 2005.

Lot Density and Size

Lot density and size are depicted in Figure IV-2. Parcels are classified under the following four designations: less than a quarter acre; quarter acre to half an acre; half to one acre; and greater than one acre in size.

As is consistent with the town's history, concentrations of dense development are clustered near the center of town at the harbor. These smaller lots primarily extend north from Central Street along Pine and School streets. Medium sized lots, those between a quarter acre and one acre, are depicted on the corresponding figure in yellow and orange. With minor exceptions these medium density lots immediately abut smaller density lot areas throughout the center of town. Municipal sewer boundaries are consistent with these lot size designations. Larger sized lots make up the majority of the parcels along the outer limits of the town as well as along the coastline.

Potential sewer line extension study areas that are being examined in this report contain many of the medium density lots not currently served by the system. Extension of the system to some of these locations may be important to the overall groundwater protection plan of the town, while the use of on-site systems that are in full compliance with state and local regulations on many of the larger sized lots in town control growth within the community. Overall lot size and density should be a key factor in determining how the town proceeds in the extension of such things as municipal services and permitting.

IV-2 GEOLOGY AND TOPOGRAPHY

Surficial Geology and Soils

The Town of Manchester is entirely underlain by granite rocks of the Cape Ann Plutonic Series. These granites and similar rocks were formed from the crystallization of magma approximately 400 million years ago. A series of northeast-southwest trending faults and a series of northwest-southeast trending joint fractures dissect the bedrock. Compared to the less fractured rock in the town the weakness of these faults and fractures lead to more erosion and created valleys filled by swamps, ponds, and streams. Accordingly the land of Manchester-by-the-Sea can be described as hills and ridges comprised of bedrock and till and low-lying areas comprised of wetlands.

The ice sheets of the Wisconsinian Continental Glaciation covered this area approximately 50,000 years ago. As the ice sheets advanced, a thin layer of till, an unsorted and unconsolidated mixture of boulders, cobbles, pebbles, gravel, sand, silt, and clay was deposited over the surface of the bedrock. Thousands of years later, the ice sheets melted and withdrew, the meltwater streams deposited layers of sand and gravel as outwash deposits over the till. These outwash deposits are mainly concentrated in the town's bedrock valleys.

A series of unconsolidated deposits lie beneath the largest wetlands compound in the town, Cedar, Millets and Beaverdam Swamps located in the north central part of Manchester-by-the-Sea. These deposits are glacial till, sand and gravel, overlain by silt and clay, followed lastly by organic muck and peat. The composition of these wetlands was formed from ice contact outwash that was deposited by meltwater streams, subsequently silt deposits and clay which filled a shallow lake that became wetlands containing the organic muck and peat.

As the glaciers continued to melt, debris clogged a considerable amount of the original drainage with the exception of a small opening that is presently Sawmill Brook. As the sea level rose, the low lying parts of the town were flooded depositing a layer of fine grained marine clay and silt on the bottom of the sea in these areas. These distinctive "blue" clays are widespread in southern and eastern parts of the town at elevations below 50 feet mean sea level.

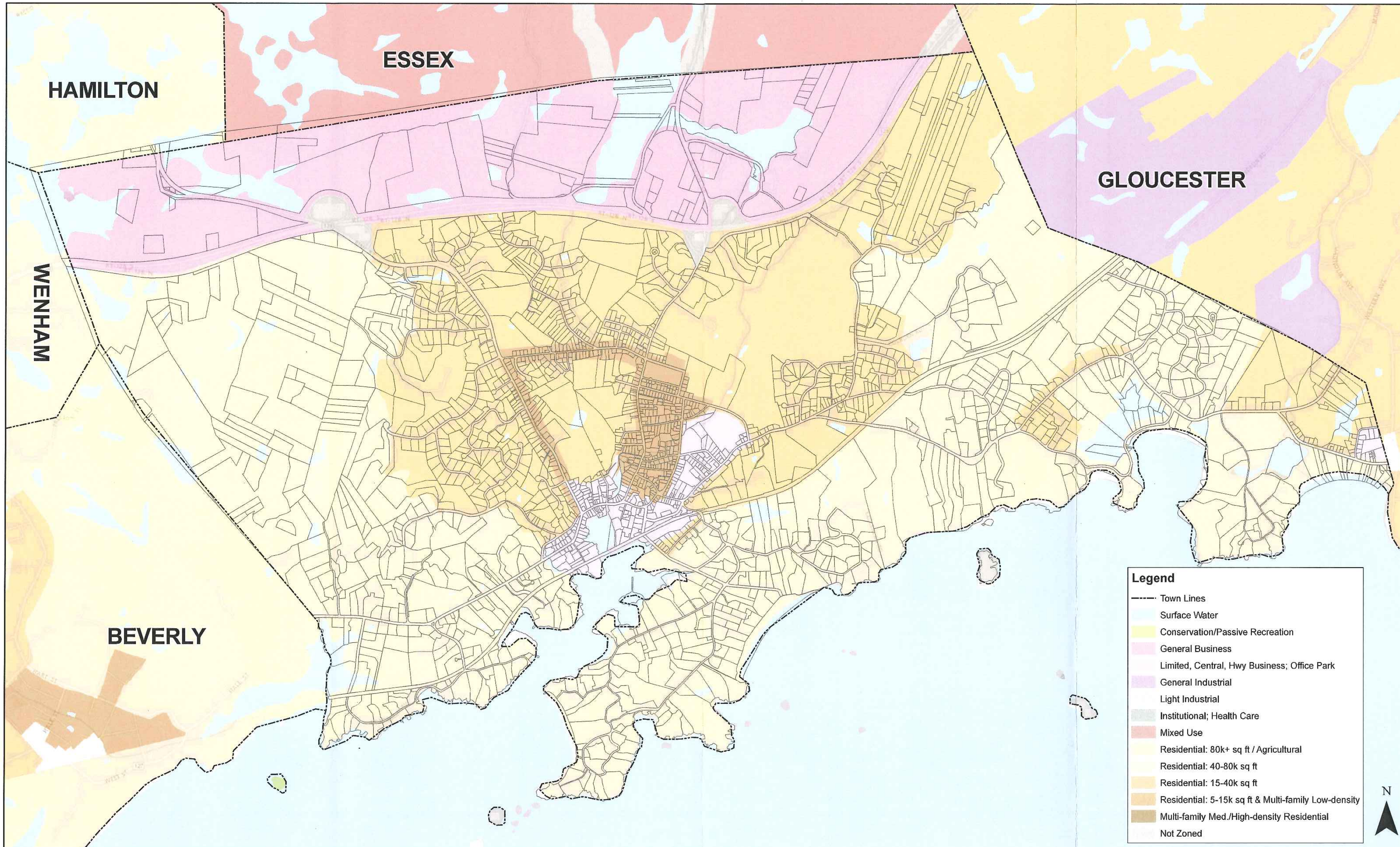
A Surficial Geology Map showing the distribution of the various deposits at the land surface is shown in Figure IV- 3.

Manchester-by-the-Sea generally consists of sloping, thin and rocky soils (Figure IV-4). The majority of the soils in the town are classified as shallow bedrock. These rocky soils in particular make up most of the undeveloped areas of the town. The most common soil type found in town is the Chatfield-Hollis-Rock-outcrop complex. This soil type makes up approximately 60 percent of the town of Manchester-by-the-Sea and 28 percent of the southern Essex County survey area. The Chatfield-Hollis-Rock-outcrop complex consists of low, irregular hills, ridges, plains; common bedrock exposures; and depressions of very poorly drained, organic soils. This soil consists of Chatfield and Hollis silt loams that are moderately to excessively drained, and formed from the glacial till overlying bedrock throughout the town. The Chatfield soils are moderately deep to bedrock, and the Hollis are shallow.

More permeable soils that are found in the town are ones formed in alluvial or outwash deposits, such as excessively drained Hinckley soils, and somewhat excessively drained Merrimac soils. Most of these soils are found within the sewered area, in the Sawmill Brook and Cat Brook valleys in the center of town. Other prominent soils found in the town are well drained Canton soils, moderately well drained Scituate and Woodbridge soils, poorly drained Ridgebury soils, and very poorly drained Freetown, Whitman, Ipswich, and Swansea soils (mucks).

Mucks are found in wetlands and along waterways in the town. These mucks have well drained soil on the top and firmly packed fine loamy sands called hardpan beneath. Due to the thickness of the underlying hardpan soil, the amount of water it can contain is restricted. These areas are prone to drainage and absorption problems from the saturation of the soil, topography, and precipitation amount.

When examining soils within the town, whether for onsite systems or full scale wastewater treatment facilities, the main focus of concern is on the suitability of the soil for disposal or recharge of the treated wastewater effluent. Soils defined as having only slight and moderate limitations will be sufficient in supporting an on-site wastewater disposal system. These soils will generally be characterized as well-drained to excessively well-drained, made up of sand and gravel with few stones, and good permeability within 5 feet of the ground surface.



Manchester-by-the-Sea

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS

Zoning by Primary Use

Figure IV-1

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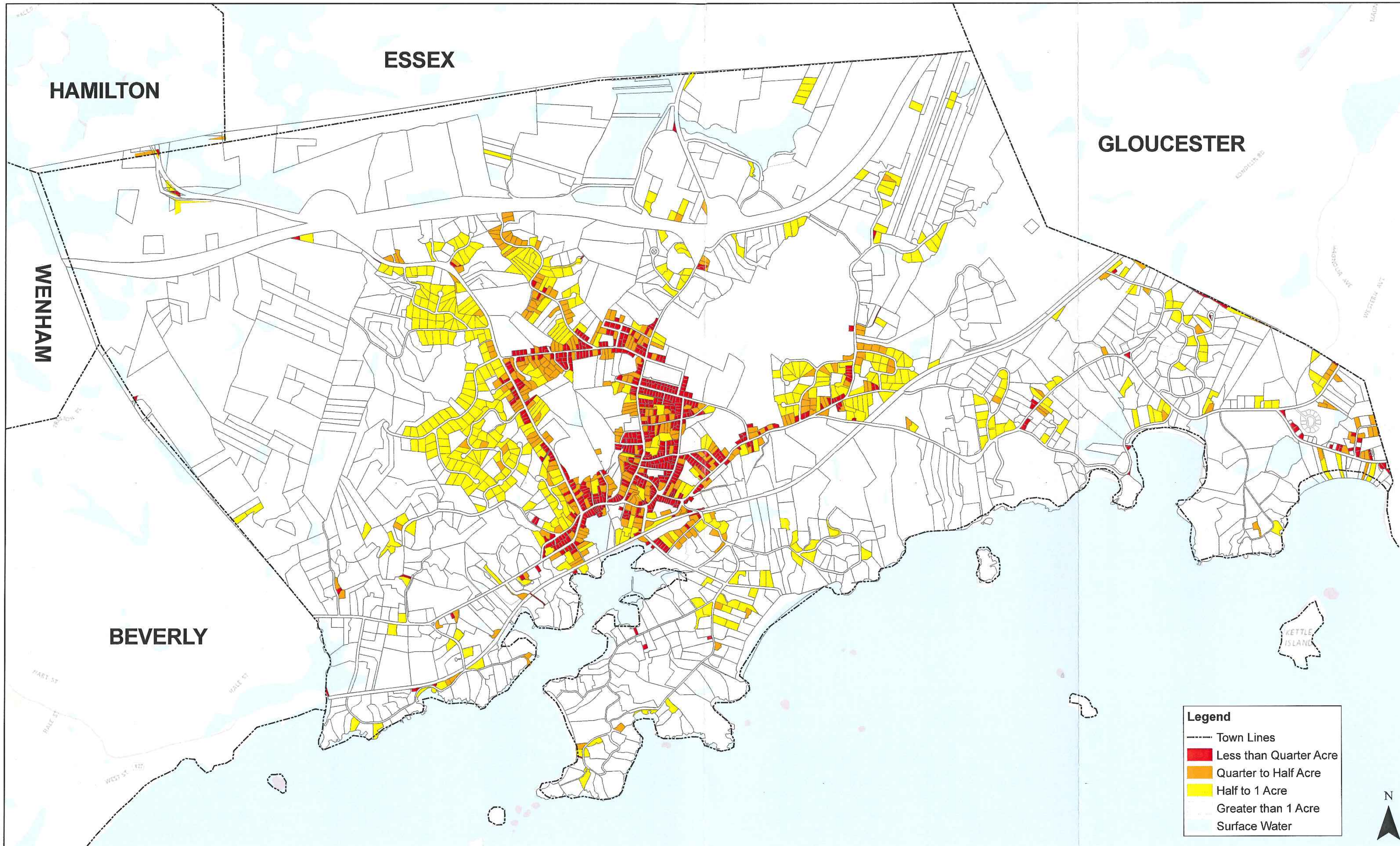


Manchester-by-the-Sea

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS

Lot Density and Size

Figure IV-2

CDR MAGUIRE

If soils in an area are unfavorable, absorption issues and difficulty with installation of systems can occur. Some determining factors in evaluating sites for wastewater management will be the permeability, depth to bedrock, slope and height of the water table.

Examples of soil absorption problems that can arise in land with excessive sloping, or slope gradients greater than 15 percent, are seepage of the effluent, soil erosion and slippage. Additionally in areas where the water table is seasonally high, groundwater seepage can occur decreasing the capacity for disposal while also creating an added concern for water quality.

Likely the most difficult limitation is within areas with shallow bedrock. It is required by Title 5 that at least 4 feet of naturally occurring pervious material be below the bottom of a soil absorption system when the percolation rate is 2 minutes per inch or less. In areas of the town where bedrock is located 4 feet or less from the bottom of a potential leaching field, a conventional Title 5 on-site wastewater disposal system is not feasible.

Soils alone, however, will not be a determining factor of whether or not a site will be able to support an on-site disposal system. As can be viewed in the Essex County Soil Survey Report by the USDA, some of the soils classified as "severe" may be acceptable for septic tank sewage disposal for rural homes or low density residential areas where homes are far apart.

In an area with soils that have slow or moderately slow permeability a larger leaching area will be required in treating effluent for a Title 5 system. For lot sizes that are insufficient in providing the necessary area for leaching, installing a system is not possible. For sites also having slopes greater than 15 percent complications will be greater. Excessive sloping on a potential site introduces the possibility of effluent seepage or breakout on the sloping areas. Additionally Title 5 has more rigorous requirements in such areas for the construction of leaching fields.

Much of the soils and underlying geology found in Manchester-by-the-Sea are not ideal for on-site wastewater disposal. Soil groups in town have been listed as having severe limitations for sewage effluent disposal from septic systems by the USDA Soil Conservation Service. These soils have the potential to create problems in disposal due to the fact that the majority of the town is covered by glacial till and bedrock, restricting the infiltration rate of water and wastewater. In other areas of town, exposed bedrock and steep slopes also limit the use of on-site systems.

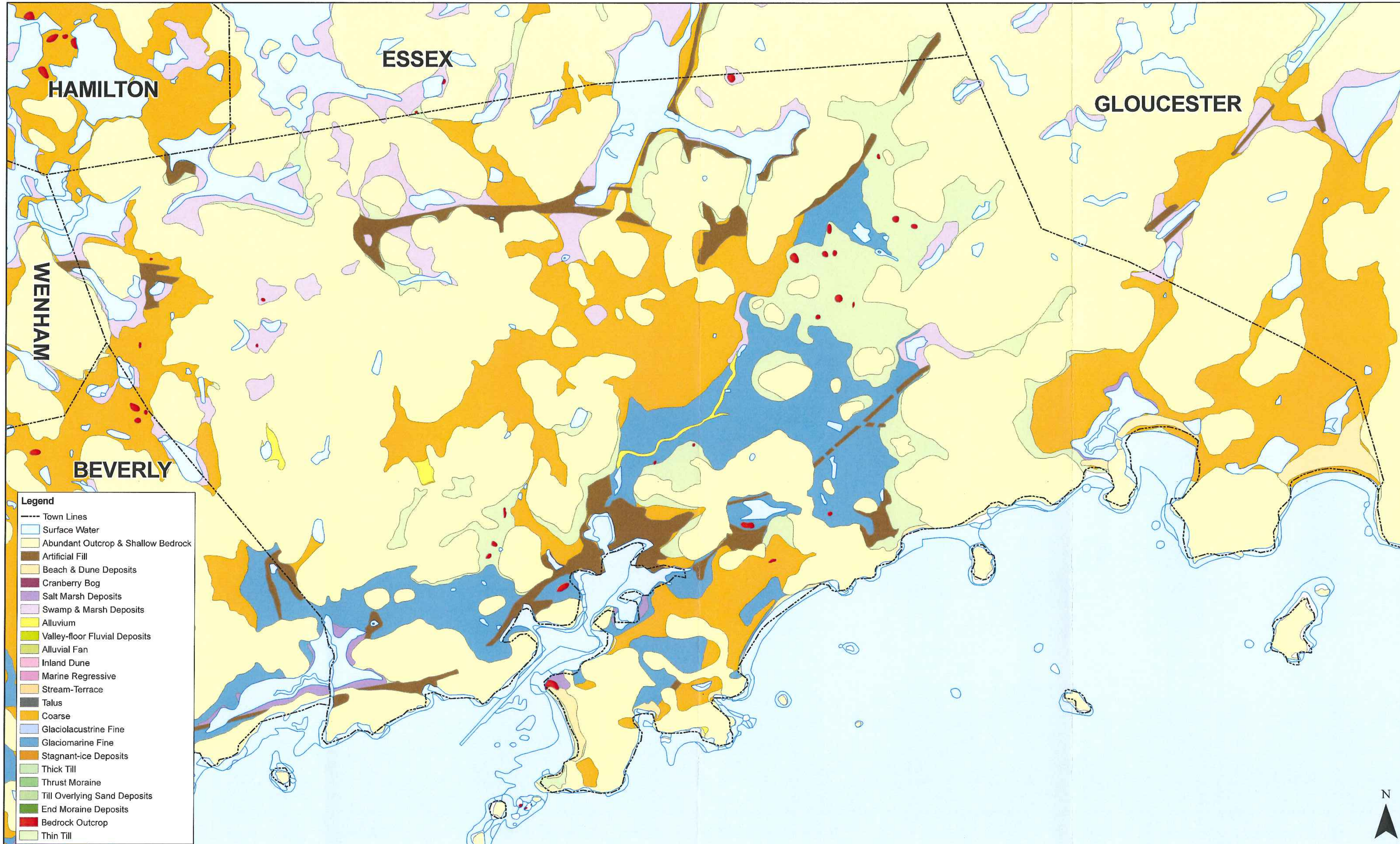
Soils that may create potential problems in installation and use of onsite disposal systems can be found in many areas throughout Manchester-by-the-Sea. The soils associated with slow percolation rates in town are classified as Ridgebury, Freetown, Annisquan, Whitman, Ipswich, and Swansea. Four soil groups in town are also associated with having a high water table (within 2 feet of ground surface): Ipswich, Freetown, Westbrook, and Swansea. Additionally up to 60 percent of the Chatfield-Hollis-Rock soils mapped throughout the town have slopes of greater than 15 percent.

In regions with poor soil conditions, especially areas with shallow depth to bedrock or high ground water, the cost for sewer construction would be increased. In areas where bedrock is present it often must be removed in order to lay out the sewer lines, increasing costs. Additionally if the sanitary line must be placed closer to the surface there will be a need for pump stations, also increasing costs.

Topography

The Town of Manchester-by-the-Sea has a variety of elevations, with the low points being around sea level (USGS) and high points reaching to almost 200 feet above sea level (USGS), creating geography that would be described as hilly. Steep slopes (in excess of 15%) occur in many locations throughout the town, but are common on the sides of valleys and on the south side of many hills. The geology of the region was defined by glaciations, with its direct effect on the hills and valleys and soils as the ice sheets moved and deposited by the glacial runoff.

Throughout the town there are landscapes such as marshes, beaches, rocky shores, salt marshes, and woodlands. In the northern region of the town 400 acres of wilderness can be found which includes areas such as Cedar Swamp, Cheever Commons, Milestone Hill, Woodland Park Trust, and Agassiz Rock Reservation. Refer to USGS Topographic Map in Figure IV-5.



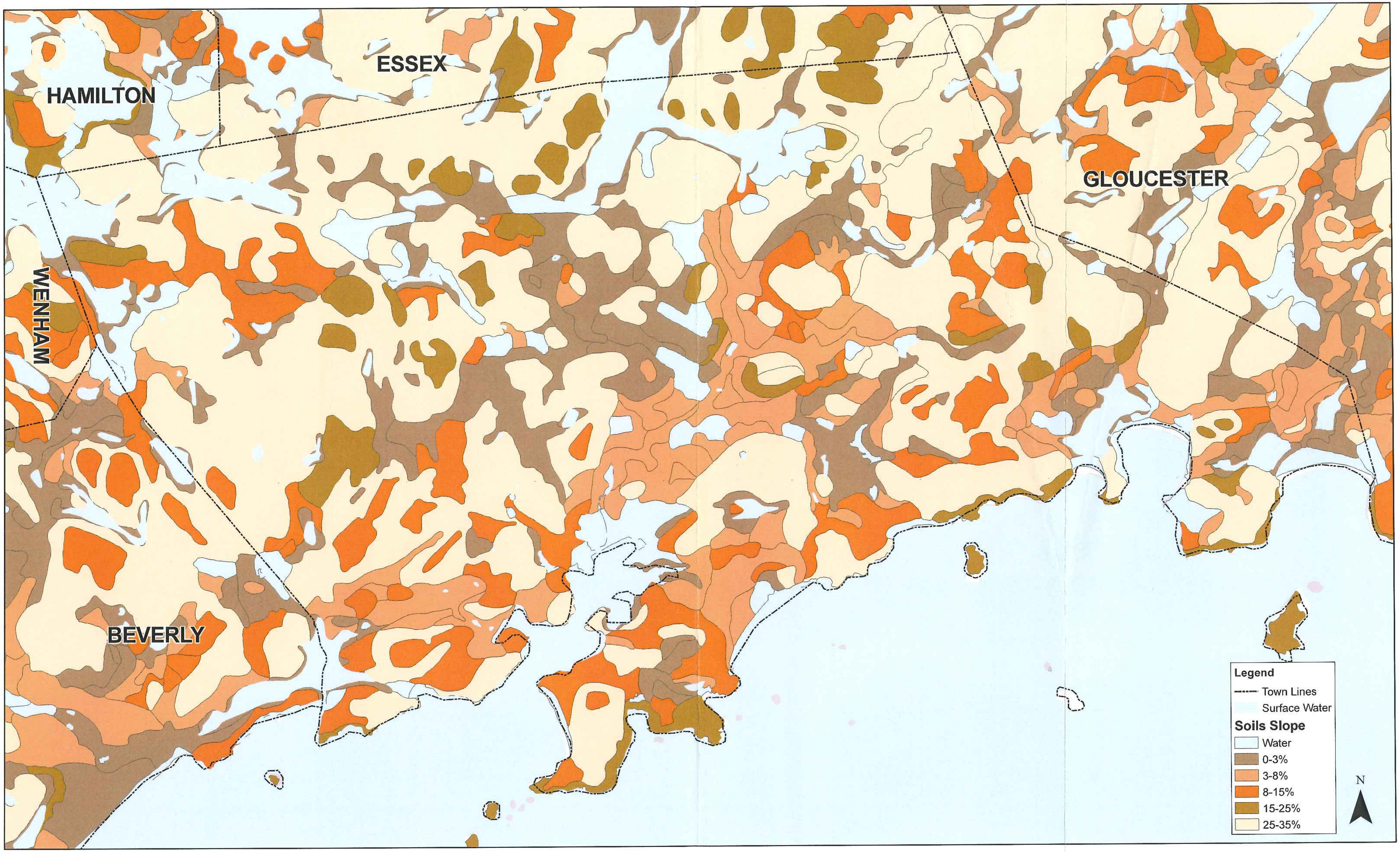
Manchester-by-the-Sea

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS

0 0.5 1 Miles

Surficial Geology

Figure IV-3



Manchester-by-the-Sea

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS, NRCS SSURGO

Soils

Figure IV-4

CDR MAGUIRE

Manchester-by-the-Sea

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS, USGS

0 0.5 1 Miles

Topographic Map

Figure IV-5

IV-3 WATER RESOURCES

Water resources in Manchester include a variety of surface and groundwater resources ranging from coastal resources to ponds and streams; aquifers and wells; and wetlands and vernal pools. Analysis of water resources within the CWMP is divided into: surface water, groundwater, and drinking water supply.

Surface Water

The Town of Manchester-by-the-Sea lies within the North Coastal Major Basin. Five river sub-basins are located either wholly or in part within the town limits including; the Danvers, Essex, Saugus, Pines, and Annisquann Rivers. Manchester-by-the-Sea is also part of five major surface watersheds: Gravelly Pond/Round Pond; Chubb Creek; Manchester Harbor; Kettle Cove and Magnolia Harbor.

The North Coastal Major Basin has a total drainage area of approximately 168 square miles and supports a population of approximately 500,000 people. The northern reaches of the North Coastal Watershed include the southern tier of Hampton and the Seabrook salt marsh complex, while further south, the most distinctive rocky coastline in all of Massachusetts can be found in the shores of Cape Ann. In this area you will find rocky peninsulas, mixed with embayments, salt marsh pockets and estuaries. Offshore of the irregular coastlines are numerous islands ranging in size from small rocky outcroppings to large multi-acre sanctuaries.

There are a variety of surface water bodies and features in the planning area. Open water areas within the Town of Manchester-by-the-Sea include streams, ponds, aquifers, wetlands, vernal pools and coastal resource. The Manchester-by-the-Sea Open Space and Recreation Plan lists the town's primary water resource areas as follows: Gravelly Pond/Round Pond, which includes portions of the Gravelly Pond and Round Pond watershed; Cedar Swamp and Aquifer, which is part of the Sawmill Brook watershed; Sawmill Brook/Lincoln Street Aquifer area, which includes Sawmill Brook watershed, Cat Brook and Causeway Brook, and the Lincoln Street well; Millet's Swamp and Brook, a tributary to Sawmill Brook and its watershed; Cat Brook, which is a tributary of Sawmill Brook; Eaglehead Swamps and Ponds, which enters into Causeway Brook and is also a tributary to Sawmill Brook; Bennett's Brook and its watershed; Chubb Creek and its watershed; Manchester Harbor; Kettle Cove and Clark pond, which includes Kettle Cove watershed and the Manchester-by-the-Sea Beaches.

Named streams and surface water bodies located within the Town of Manchester-by-the-Sea are depicted in Figure IV-6.

Groundwater

The town's groundwater supply is derived from a single active gravel-packed well located adjacent to the Manchester-Essex Regional Middle and High School on Lincoln Street.

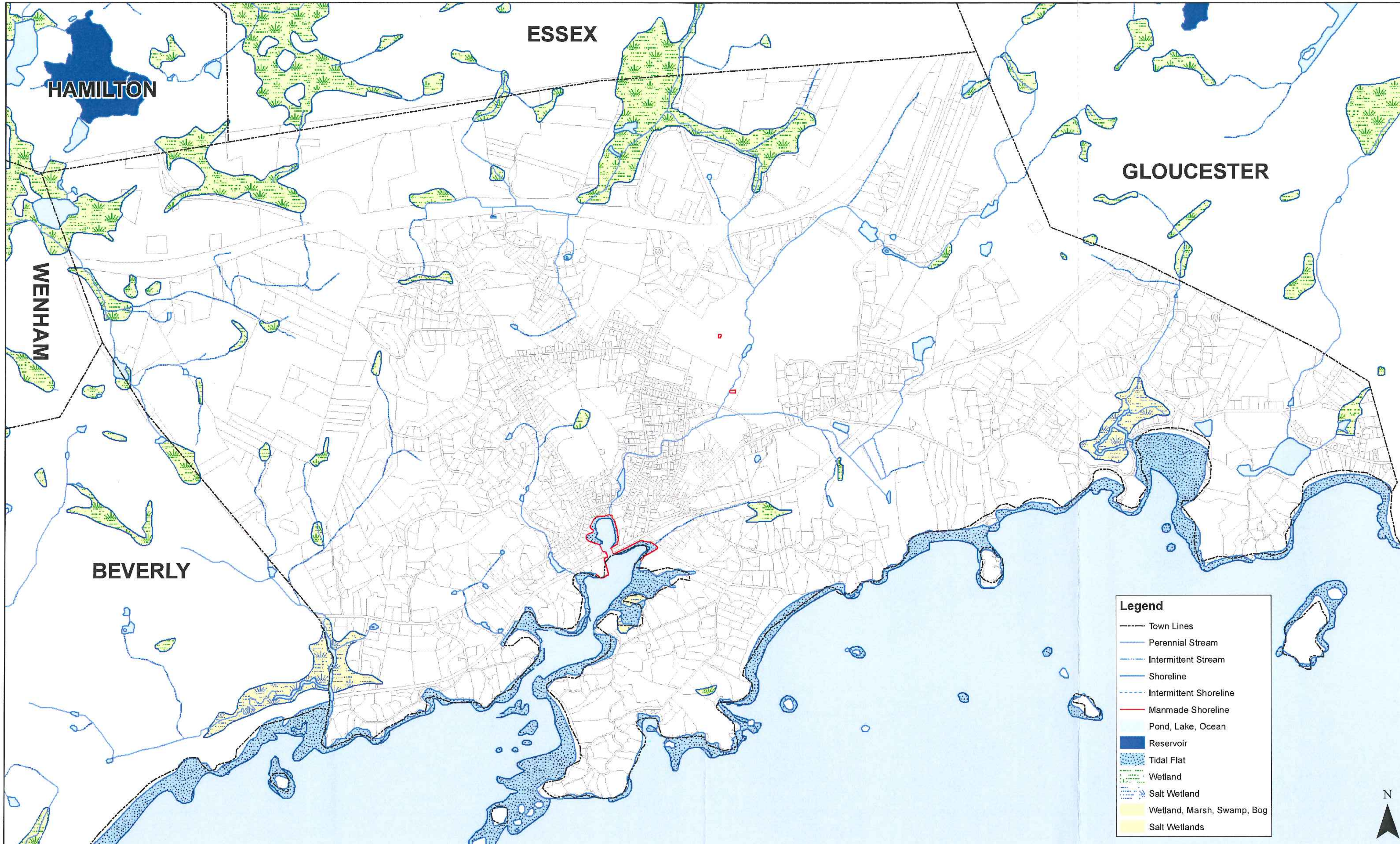
The town also has access to a reserve aquifer under Cedar Swamp that it shares with the Town of Essex. Ownership of the Cedar Swamp is a combination of town and privately funded conservation groups.

Drinking Water Supply

Manchester-by-the-Sea's public drinking water supply (MassDEP #3166000) comes from two primary sources both of which draw on the extensive North Coastal Drainage sub basin and watersheds within the neighboring community of Hamilton. The first source is from Gravelly Pond (3166000-01S), located north of the town border in Hamilton off Chebacco Road. This surface water reservoir provided approximately 65.4 percent of Manchester's drinking water in 2013 according to the town's Annual Drinking Water Quality Report. Gravelly Pond has a surface area of 49 acres and a capacity of more than 360 million gallons at capacity. The water from the reservoir is treated at a town owned facility and stored in a 500,000 gallon clearwell where it remains until adequate disinfection is achieved. The water is then pumped into the water distribution system. In addition, the town pumps water from the Round Pond Well (3166000-03G), also located along Chebacco Road in Hamilton, as a supplement to Gravelly Pond and its watershed recharge. In 2013 it was reported that a total of 67,564,500 gallons were transferred.

The second source of water supply is from the Lincoln Street Well (3166000-01G), which is located in the center of town next to the Manchester Essex Regional Middle and High School on Lincoln Street. Groundwater is pumped from a sand and gravel deposit which underlies the area. The Lincoln Street Well provided approximately 34.6 percent of the drinking water in the town according to the 2013 report. The water from the 58 foot deep, gravel packed well is treated by chlorination and chemical disinfection and then pumped directly into the distribution system. The well has a capacity of 600 gallons per minute.

Both Manchester groundwater sources, Lincoln Street Well and Round Pond, are within state defined protective areas. Zone I being the area closest to the well, usually a radius of 100 to 400 feet proportional to the well's pumping rate. MassDEP's water supply protection area characterizes the surrounding area as Zone II, which is the primary recharge area for a given aquifer. The surface water classification for the watershed area of Gravelly Pond is identified as Zone C having minimal protection. Figure IV-7 depicts the MBTS Water Supply system.



Manchester-by-the-Sea

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS

Surface Water

Figure IV-6

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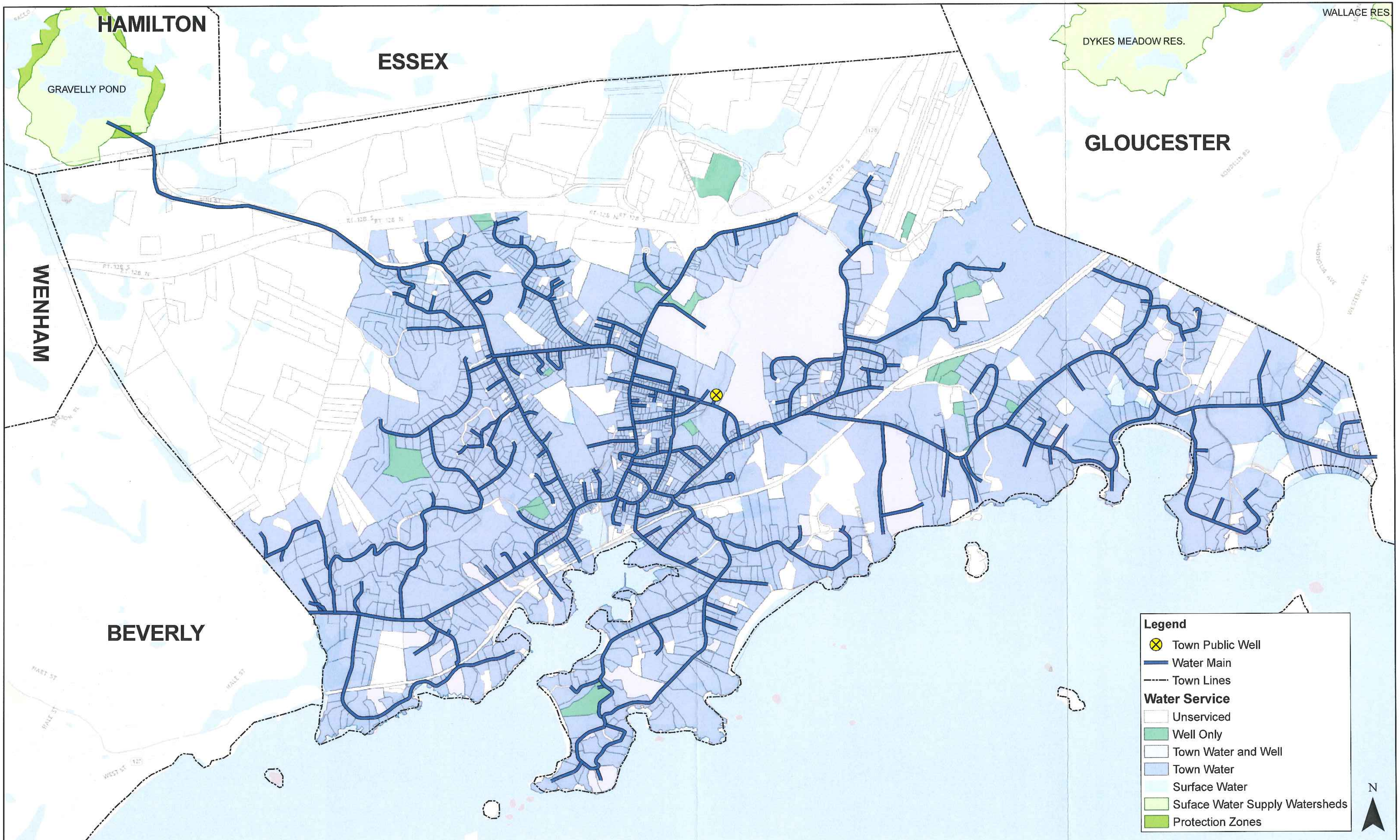


Manchester-by-the-Sea

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS

Water Supply

Figure IV-7

CDR MAGUIRE

IV-4 FLOOD PLAINS

Flood Plain Information

The Flood Disaster Protection Act of 1973 required all communities to subscribe to the flood insurance program after July 1, 1975 prior to receiving federal assistance for construction areas. Flood insurance studies have been prepared by the Federal Emergency Management Agency (FEMA) for communities across the country. These studies investigate the existence and severity of flood hazards and aid in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

Floodway data are presented in the Flood Insurance Studies for sections along the major tributaries. Corresponding elevations are reported in the studies for the 10, 50, 100, and 500 year floods. Land areas are designed by zones, each having specific flood potential or hazard. FEMA mapping identifies the presence of the following flood zones in town:

SFHA:	Special Flood Hazard Areas (SFHA) area where the National Flood Insurance Program (NFIP) floodplain management regulations must be enforced and the area where the mandatory purchase of flood insurance applies.
Zone A:	Areas subject to inundation by 1% Annual Chance Flooding, no Base Flood Elevation (BFE)
Zone AE:	Areas subject to inundation by 1% Annual Chance Flooding, Base Flood Elevations (BFE) determined.
Zone AO:	Area subject to inundation by 1% Annual Chance Flooding, 1-3 ft Sheet Flow flooding, with depth.
Zone VE:	Areas subject to inundation by 1% Annual Chance Flooding event with additional hazards due to storm-induced velocity wave action, Base Flood Elevations (BFE) determined. High Risk Coastal Area.
Zone X:	Areas subject to inundation by 0.2% Annual Chance of Flooding.

Figure IV-8 shows the Flood Zone boundary information for the town identified on the following National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM) 25009C0429F, 25009C0431G, 25009C0432G, 25009C0437G 25009C0441G, 25009C0442G, 25009C0433G, 25009C0434G, 25009C0453G, and 25009C0454G (all revised July 16, 2014).

In accordance with the Zoning By-Law of the Town of Manchester-by-the-Sea (revised April 2014), the town has designated an overlay Flood Control District (4.7). The purpose of the district is to "protect the public health and safety and property against the damages of flooding conditions caused by new development in areas with inadequate capacity of existing drainage systems, brook channels, and street culverts to accept storm runoff from the areas drained." Any land within the district shall be subject to the development and use regulations of the underlying district to the extent that it is not inconsistent with the regulations of the Flood Control District or that is expressly regulated under Section 4.7.3 of the Zoning By-Law.

IV-5 CULTURAL RESOURCES - HISTORIC LANDS OF SIGNIFICANCE

Manchester-by-the-Sea was once home to an Algonquin tribe and was part of the Massachusetts Bay Colony land grant by Charles I in 1629. It then became part of the Town of Salem, eventually becoming Manchester in 1645. Early residents of the town primarily participated in fishing and seafaring industries rooted along its 12.8 miles of tidal shore line. During the mid-1800s it became an elite summer resort area while today it is primarily a residential community. Despite the town having such a long standing history, none of its buildings are individually listed on the National Register of Historic Places. There is an area near the center of town which is designated on the National Historic Register and the town did establish the Manchester Historic District which encompasses most of the immediate village center along Central and Union streets.

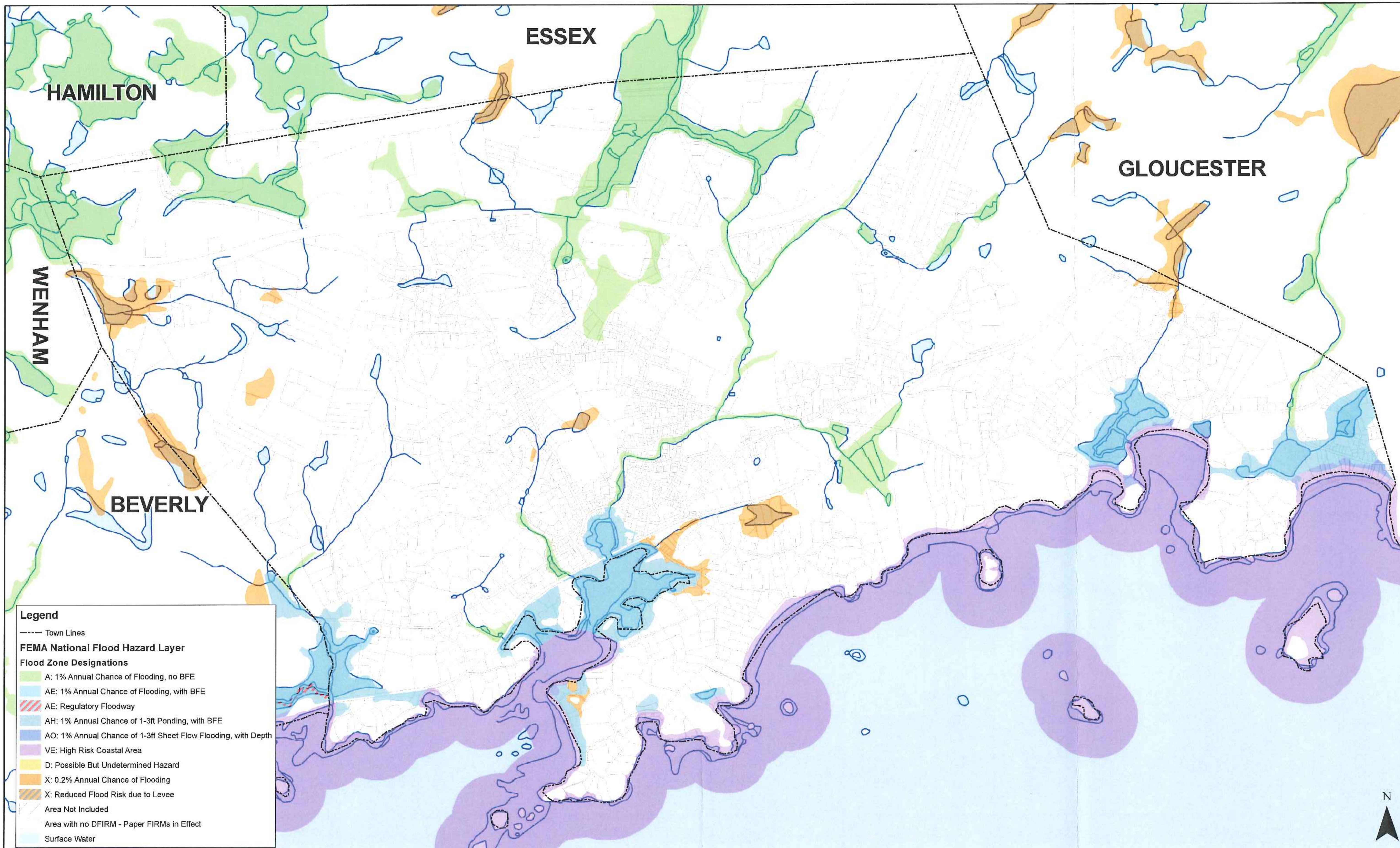
IV-6 BIOLOGICAL RESOURCES-VEGETATION AND NATURAL RESOURCES

Analysis of town geographic information systems (GIS) land cover mapping indicates the presence of extensive woodland areas intermixed with marsh areas particularly along areas north of Route 128. Many of these woodland areas are part of larger conservation land tracts which extend into neighboring communities. Other smaller woodland conservation, recreation, and town owned open space areas are inter-spersed throughout town along with wetland areas. Coastal areas host a combination of beaches and dunes; tidal flats, coastal bluffs; and rocky intertidal shore features.

State-Listed Species

The Massachusetts Endangered Species Act (MESA), enacted in December 1990 (M.G.L c. 131A) with revision and revised implementation in October 2010 (321 CMR 10.00) protects rare species and their habitats in the State of Massachusetts. MESA and its implementing regulations establish procedures for the listing and protection of rare plants and animals and outline project review filing requirements for Priority Habitat of Rare Species. The list of Endangered, Threatened, or Special Concern plants or animals is compiled by the MA Division of Fisheries and Wildlife (DFW). "Priority habitats are based on the known geographical extent of habitat for all state-listed rare species..." Estimated habitats are a sub-set of Priority Habitats, and are based on the geographical extent of habitat of state-listed rare wetlands wildlife. These are identified under the Wetlands Protection Act (WPA). Projects and activities proposed within such designated areas require review by the Natural Heritage and Endangered Species Program (NHESP).

Certified vernal pools are topographically small wetland depressions that are isolated from other surface water bodies. Their isolated status makes them inaccessible to predatory aquatic organisms which depend on streams. Like priority habitats, certified vernal pools are identified by NHESP and are awarded protection under WPA if they are within jurisdictional wetland resource areas, if not they are under the MA 401 Water Qualify regulations (314 CMR 9.00) as Outstanding Resource Water (ORWs) independent of other resource areas. Manchester Web



Manchester-by-the-Sea

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS, FEMA, NFIP

Flood Zone Designations

Figure IV-8

CDR MAGUIRE

GIS mapping identifies areas classified under the following MESA classifications: Estimated Habitats of Rare Wildlife; Priority Habitats of Rare Species; and Certified Vernal Pools.

Figure IV-9 depicts NHESP designated areas within the town. Review of the mapping indicates the presence of Priority and Estimated Habitats in the northwestern most corner of the town while Priority Habitat appears along the center region of the northern town border. Certified vernal pools are split half in designated jurisdictional areas and half scattered throughout a central section of the town. Mapping is intended to serve as a pre-screening tool to identify any potential impacts to state-listed species in the town and should be reexamined as projects come to fruition.

Wetlands

The Environmental Protection Agency (EPA) identifies wetlands as the transition zones where the flow of water, the cycling of nutrients, and the energy of the sun meet to produce a unique ecosystem characterized by hydrology, soils, and vegetation – making these areas very important features of a watershed. Manchester has a variety of wetland habitats scattered throughout town as depicted in Figure IV-10.

Within the coastal wetlands of Manchester there are three distinct wetland types including: tidal saltwater coastal wetlands, tidal freshwater coastal wetlands, and non-tidal freshwater coastal wetlands. MassGIS mapping of the wetland areas within the town further identified these areas as wooded swamp, shrub swamp, shallow marsh, deep marsh, coastal beach, barrier beach, barrier beach coastal dune, coastal bank buffer, rocky intertidal shore, and salt marsh.

As defined above, vernal pools are seasonal depressional wetlands, which appear throughout town. There are currently a total of 23 Certified Vernal Pools and another 22 Potential Vernal Pools within Manchester, with more than half of those certified as being within the Manchester-Essex Woods.

BioMap2

In an effort to protect the biodiversity and the functional effectiveness of wetlands within the Commonwealth, the Massachusetts Natural Heritage and Endangered Species Program and the Nature Conservancy's Massachusetts Program (NHESP/TNC) developed BioMap2 as a conservation plan. As shown in Figure IV-11, Manchester possesses BioMap2 Core Habitat (CH): Wetlands, Forested Core, and Species of Conservation Concern in wetland areas north of Route 128. There is also an area of BioMap2 Core Habitat Forest Core along the Manchester border with the Town of Gloucester and a BioMap2 Core Habitat Wetland along the Beverly border. Additionally, BioMap2 Core Habitat Aquatic Core designations occur along the Little Pine Island Creek and the Sawmill Brook. All of these core habitat areas are connected to BioMap2 Critical Natural Landscape (CNL) blocks and buffers. MassGIS BioMap2 designations also identify three Critical Natural Landscape Coastal Adaption Analysis areas along saltwater wetland areas. The presence of these designated areas throughout the town should be considered as this CWMP moves forward.

IV-7 COASTAL RESOURCES

Manchester is part of the North Shore Region of the Massachusetts Office of Coastal Zone Management (CZM).The mission of the agency is "to balance the impact of human activities with the protection of coastal and marine resources through planning, public involvement, education, research and sound resource management." The Manchester coastal zone extends north from the shore to Route 127 (Bridge and Summer Streets). The coastal features associated with the shore are a combination of: Beaches and Dunes; Tidal Flats; Sea Cliff and Coastal Bluff; and Rocky Intertidal Shore (Figure IV-12).

Publically accessible town marine beaches include West Manchester, Tuck's Point, Singing, White, Black and Magnolia Beaches. Manchester also has privately held marine beaches: Gray (Magnolia abuts), Graves (or Dana), and Long Beach. The Massachusetts Department of Public Health (MDPH) administers the "Beach Program" for all beaches in the Commonwealth. Beaches are tested by the Board of Health (BOH) with weekly monitoring during the summer of all public beaches. The program measures colonies of *Escherichia coliform* ("E. coli") and enterococci as indicator organisms for water quality, per state regulations listed in 214 CMR 4.00.

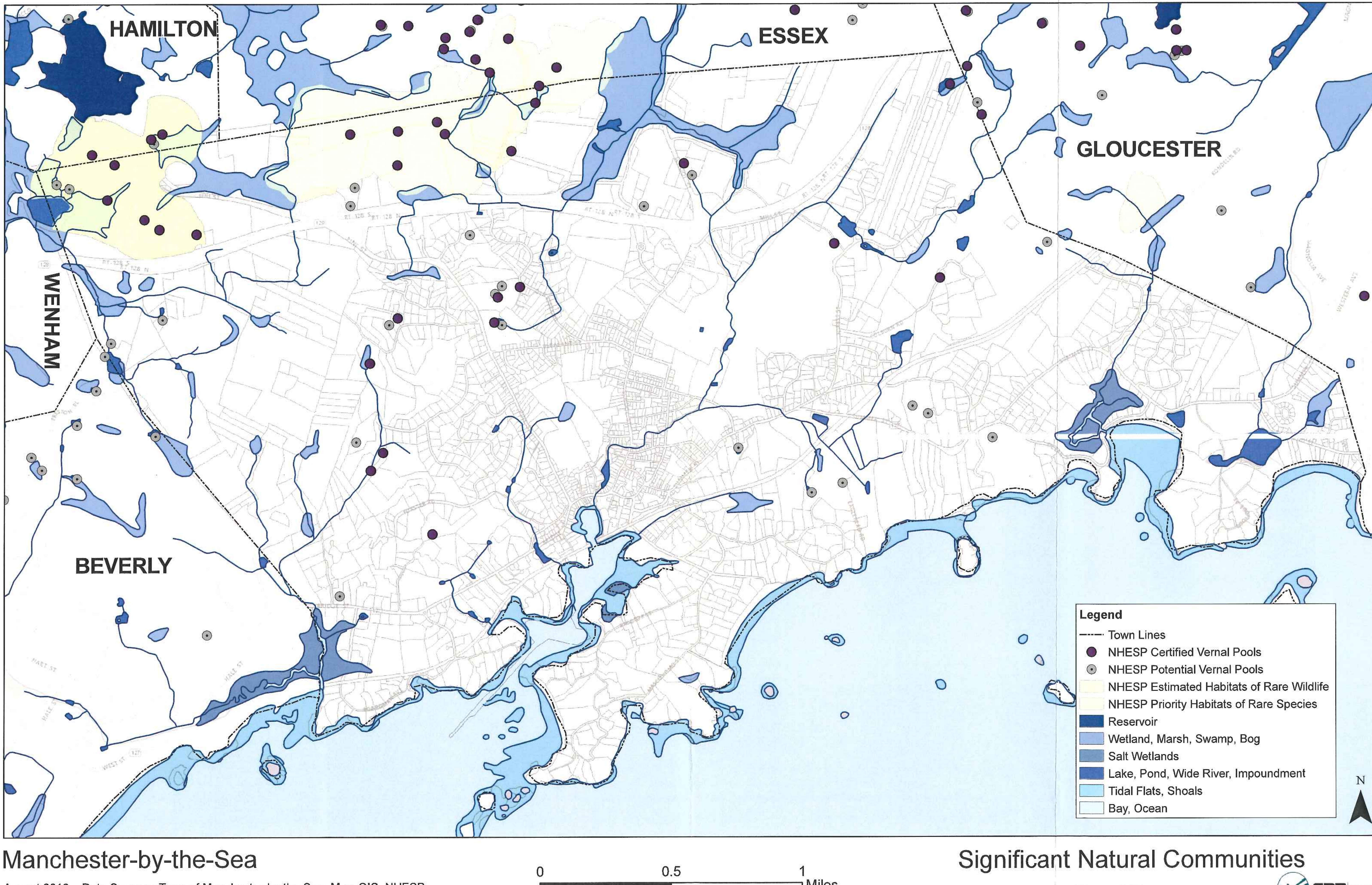
As a result of the sampling program findings, numerous closings of all public beaches with the exception of Singing Beach have occurred over the last decade. According to MDPH, Digital Health Department Records 2003-2014, closures by beach for Enterococci contamination are provided in the Table below and as depicted in Figure IV-12.

Table IV-3. Beach Sampling Results
2003-2014
Manchester-by-the-Sea

Public Marine Beaches	
Beach Name	**Total Number of Exceedances**
West Manchester	31
Tuck's Point	14
Singing	0
White	6
Black	14
Magnolia	13

Source: Massachusetts Department of Public Health Digital Health Department Records

Note: Closure events when maximum single-sample standard for marine waters is 104 colony forming units (cfu) of enterococci per 100 milliliters (100 mL), and the geometric mean of the five most recent bathing season samples cannot exceed 35 cfu/100 mL

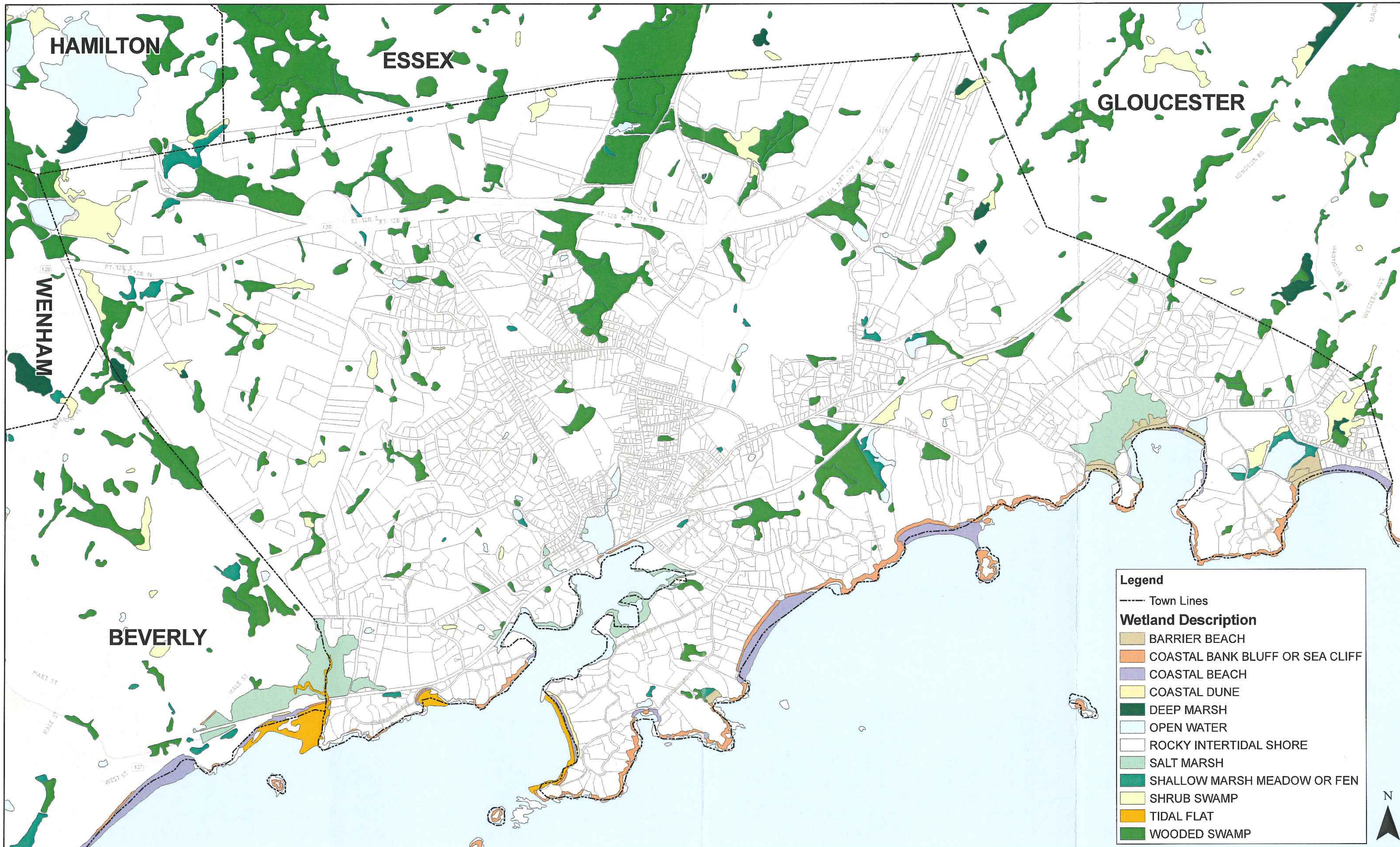


Manchester-by-the-Sea

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS, NHESP

Significant Natural Communities

Figure IV-9



Manchester-by-the-Sea

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS

0 0.5 1 Miles

Wetlands

Figure IV-10

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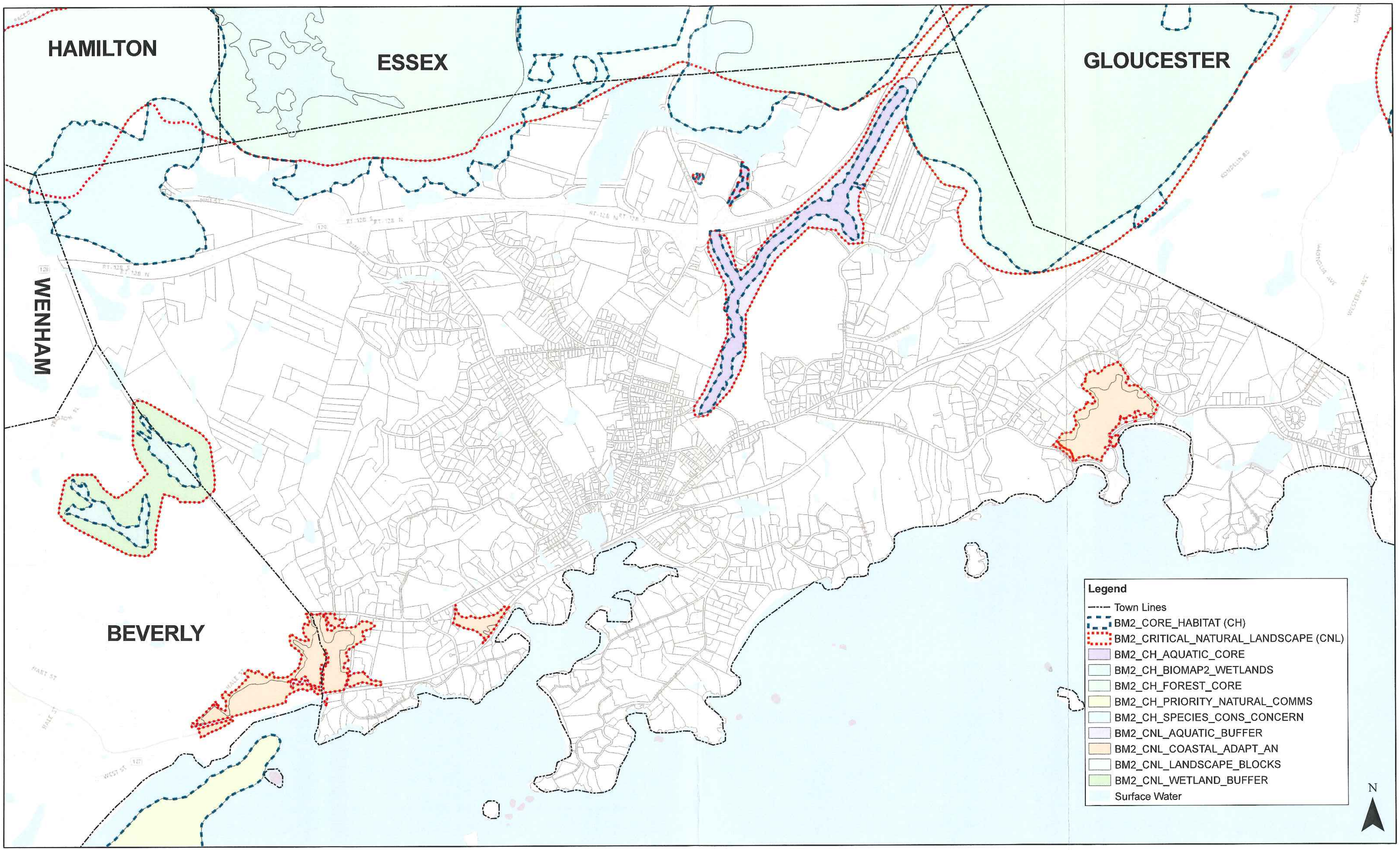

Manchester-by-the-Sea, BioMap2

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS, NHESP/TNC BioMap2

BioMap2

Figure IV-11

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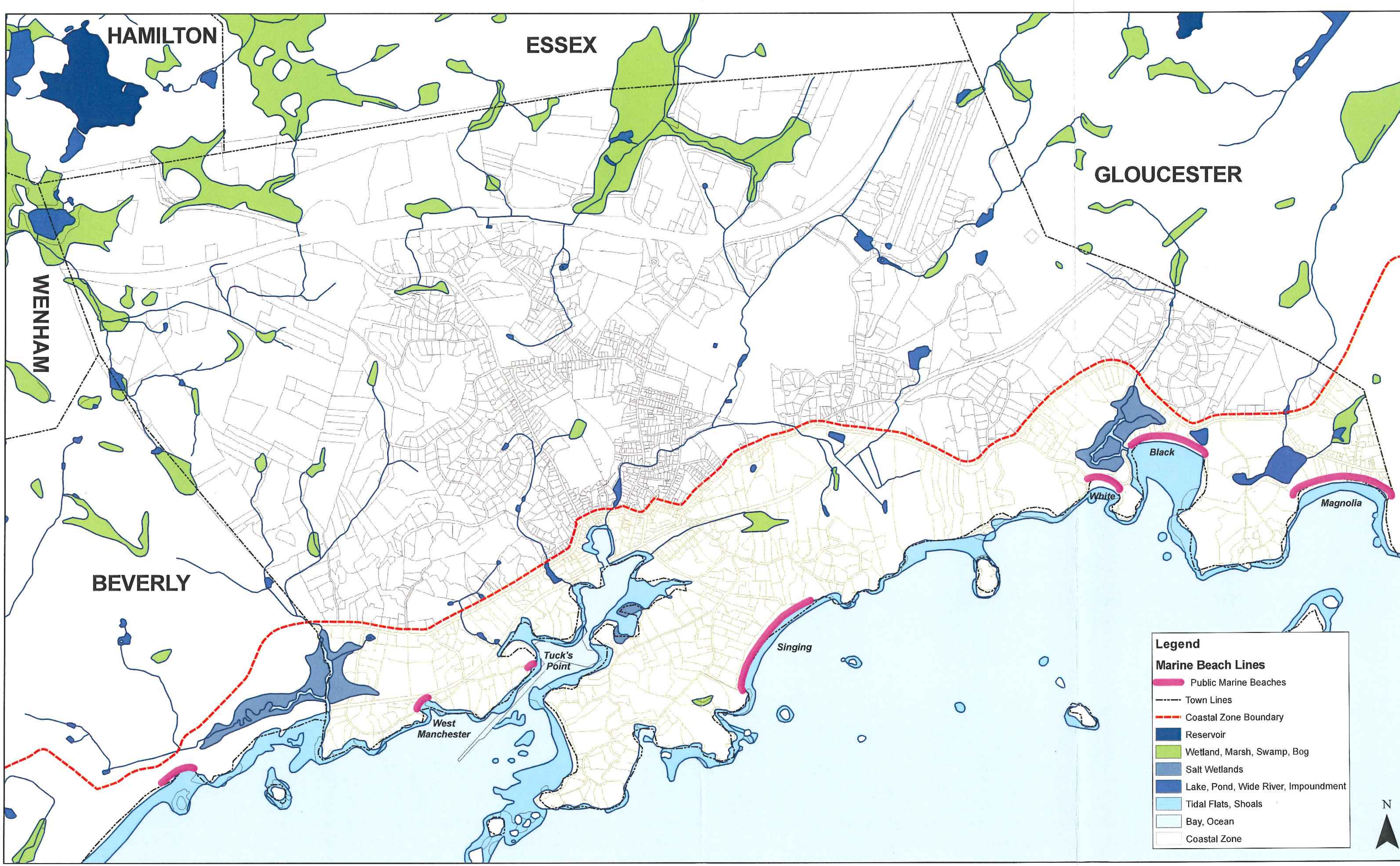


Manchester-by-the-Sea

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS, CZM

Coastal Boundary

Figure IV-12

CDR MAGUIRE

Manchester Harbor is located within Manchester Bay and is entered north of Bakers Island Light, between House Island and Great Misery Island. Two tributaries, Wolf Trap Brook and Cat Brook, flow into the harbor system.

IV-8 SOCIO-ECONOMIC ISSUES

Population

Manchester's population has remained predominately unchanged over the last forty years at a little over 5,100 residents according to U.S. Census Bureau statistics. The last major U.S. Census reports confirm this trend with the counts indicating a 1.76 percent decrease in the towns' population from between 5,228 in 2000 and 5,136 in 2010. Census data collected in 2010 lists the median age of a town resident as 47.6 years and a median household income of $117,063 confirming Manchester's status as a stable, aging, affluent community.

Data collected by the Town Clerk's office during 1990, 2000, and 2010 indicate a slightly higher population for the Town of Manchester-by-the-Sea than collected Census data (Table IV-4). The slight decrease in population numbers between 2000 and 2010 is consistent with Census data trends. It should be noted that the official town population of 5,696 residents on August 10, 2015 is not consistent with current trends and shows an increase in population from 2010 differing from the previous decreasing trend.

Table IV-4. Selected Population Trends
Manchester-by-the-Sea

Year	U.S. Census Population	Percent Increase (Decrease)	Town Clerk's Office Population	Percent Increase (Decrease)
1950	2,868	--		
1960	3,932	37.1%		
1970	5,151	31.0%		
1980	5,354	5.3%		
1990	5,286	(-2.5%)	5,389	
2000	5,228	(-1.1%)	5,636	4.6%
2010	5,136	(-1.76%)	5,571	(-1.15%)
2015			5,696	2.24%

Sources: U.S. Census Bureau – Manchester-by-the-Sea, Massachusetts
Town Clerk's Office – Manchester-by-the-Sea, Massachusetts

Demographics

Demographic statistics cited in this report have been gathered from the Massachusetts Department of Revenue Division of Local Services and the U.S. Census Bureau. The following discussion is provided for the purpose of presenting general demographic trends for the town.

According to Census documentation, the town population in 2012 was 5,216. The labor force identified for the same time period was a little more than half the population at 2,720 while the unemployment rate was listed at 5.6 percent. The total number of housing units in town as of 2010 was 2,147 of which 1,868 were serviced by municipal town water and 1,229 were serviced by municipal sewer.

IV-9 OTHER ISSUES

Air Quality

Air quality is defined on a regional scale and characterized based on National Ambient Air Quality Standards (NAAQS) set by the U.S. EPA, which requires the MassDEP to implement and adhere to in monitoring air quality and determining compliance with the Federal Clean Air Act. If air quality monitoring results do not meet NAAQS, the state must develop and implement pollution control strategies to attain that standard. If standards are met the state must develop a plan to maintain that standard while accounting for future economic and emissions growth. Plans devised under both scenarios are incorporated into the State Implementation Plan (SIP).

Under the NAAQS, primary and secondary standards have been established for six principal pollutants considered harmful to public health and the environment: carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter, and sulfur dioxide. Particulate matter is subdivided into "fine" particles that are 2.5 microns and smaller (e.g. smoke and haze) and "coarse" particles between 2.5 and 10 microns in size (e.g. wind-blown dust). Primary standards set limits to protect public health, including the health sensitive populations such as asthmatics, children and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to crops, vegetation and buildings.

The Commonwealth of Massachusetts has been designated as having attainment with respect to the NAAQS for carbon monoxide, lead is unclassifiable/attainment, Nitrogen Dioxide is unclassifiable/attainment, Sulfur Dioxide is shown to be below current standards. NAAQS for particulate coarse matter have attainment. Fine matter standards were classified as unclassifiable/attainment in 1997 and 2006. EPAs new standards developed in 2012 lower fine matter standards. As a result of this change, Massachusetts requested in 2013 that the State be designated as having reached attainment under 2012 regulations. EPA is expected to reach a decision on this matter at the end of 2014. Ozone results for the majority of the State including Essex County are classified as unclassifiable/attainment under current 2008 standards. Results identified in this report were taken from the *Massachusetts 2013 Air Quality Report* prepared by MassDEP, Bureau of Waste Prevention, Division of Air and Climate Programs Air Assessment Branch.

Climate

The climate within the study area exemplifies the often variable and unpredictable nature of the northern coastal region of Massachusetts's weather. According to the Soil Survey of Essex County, Massachusetts, Southern Part which uses weather readings recorded in Peabody, Massachusetts from 1967 to 1978, the average precipitation for the county is 49 inches per year, and the average snowfall is 57.6 inches. Annual 11-year average maximum, minimum and mean temperatures in Peabody, Massachusetts, were 58.2° F, 39.4°F and 48.8°F, respectively. The months of January (33.8°F) and July (82.1°F) were the coldest and hottest months, respectively.

The last freezing temperature in spring generally occurs in late April, while the first freezing temperature in the fall occurs around mid-October. The growing season, assuming a minimum temperature of 32°F, generally lasts for 148 days in Peabody, Massachusetts. Prevailing winds are from the southwest with an average wind speed of 14 miles per hour.

IV-10 DELINEATION OF STUDY AREAS

The Phase I Wastewater Facilities Plan (1994) and subsequent Wastewater Needs Assessment (2003) reviewed the wastewater needs of the entire town. Based on assessments completed in those reports, five areas were identified as potential needs areas for more in-depth analysis and assessment. The town utilized those same five study areas in subsequent studies, GIS mapping and data gathering, and wastewater planning efforts.

For the development of this Plan, a review of current existing conditions relative to those of the previous studies was completed to evaluate whether modifications or changes to the study areas were needed. It was determined that the five general study areas, with area refinements, should again be evaluated as potential wastewater needs areas in order to ensure consistency in CWMP planning and to best maximize data collected and developed by the town.

This CWMP added a sixth area identified as the LCD area for the town's Limited Commercial District zone. The LCD was incorporated into the study areas as a result of town official's input regarding the potential development opportunities in the area and the need to be able to identify to developers potential resources important for any such development options that may arise. Although there are no definite plans in place for future development in the LCD area, it is included for the consideration in the future town planning. The study areas are shown in Figure IV-13.

As in the previous planning efforts, it was again determined that any remaining land areas outside of these six study areas are not wastewater needs area. Existing conditions indicate that these areas, which are presently unsewered, can remain unsewered and continue to rely on individual on-lot disposal systems for their wastewater needs.

The following is a brief description of the delineated assessment areas:

Study Area 1 – West Manchester, located at the southwest corner of the town and borders the City of Beverly. Roads included within this area are Boardman Avenue, Bridge Street, Brookwood Road, Forster Road, Harbor Street, Highland Avenue, Jersey Lane, Norton's Point Road, Ox Pasture Road and Tuck's Point Road.

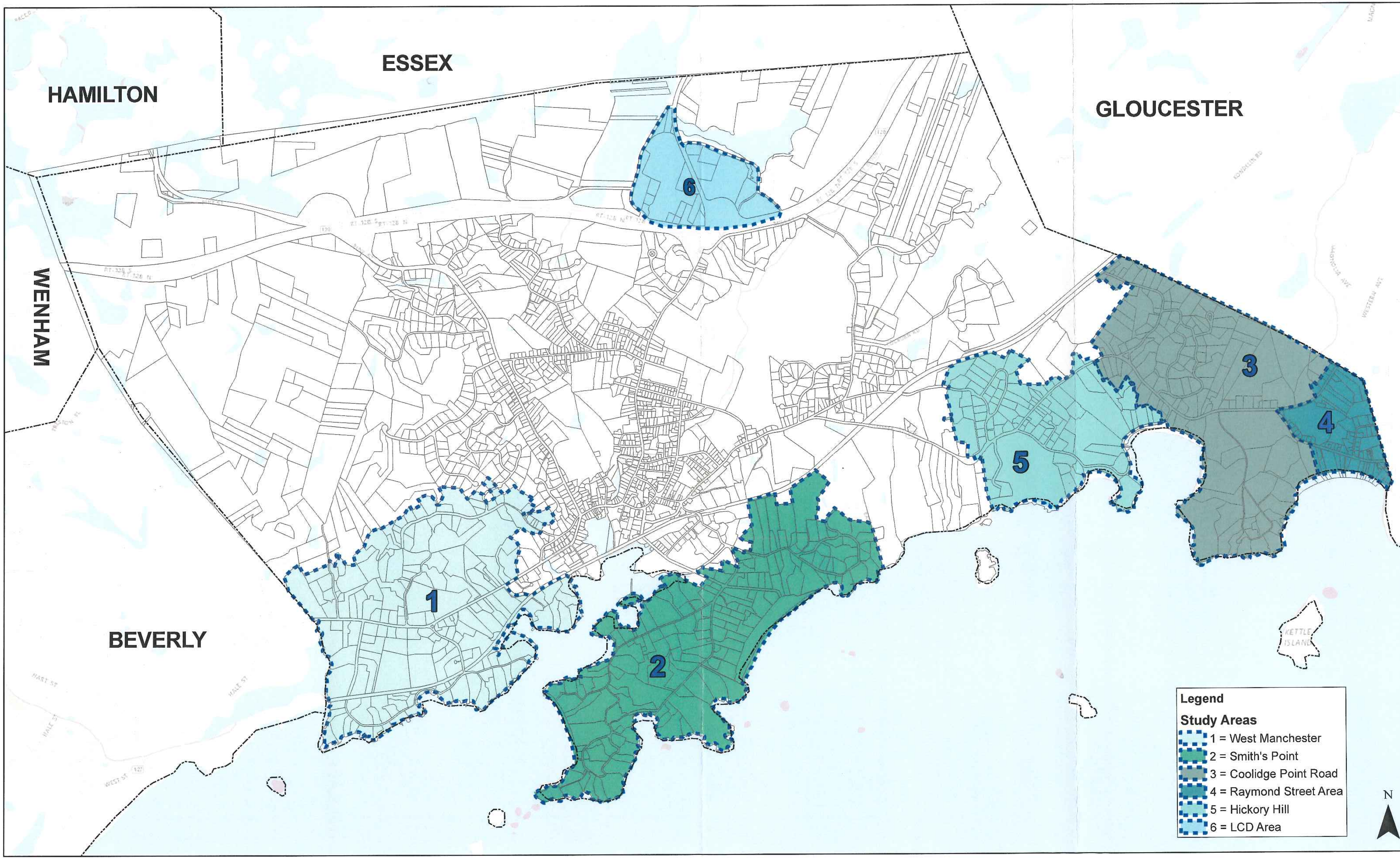
Study Area 2 – Smith's Point, located on the most southern point in the center of town. This study area is east of Manchester-by-the-Sea Harbor as well as West Manchester. Roads included within this area are Beach Street, Blossom Lane, Cobb Avenue, Eaglehead Road, Gales Point Road, Maconomo Street, Old Neck Road, Proctor Street, Sea Street, Smith's Point, and Tappan Street.

Study Area 3 – Coolidge Point Road, located in the eastern part of town which borders the City of Gloucester. Roads in this area are Big Rock Road, Crow Island, Magnolia Avenue, Overledge Road, Summer Street and University Lane.

Study Area 4 – Raymond Street Area, located to the south in the most eastern area of town, which abuts the City of Gloucester. Roads within this area include Butler Avenue, Raymond Street and Summer Street.

Study Area 5 – Hickory Hill, located in a south east area of town, west of Kettle Cove and Coolidge Point Road. Roads within this area include Ocean Street, Summer Street, and Hickory Hill Road.

Study Area 6 – LCD Area, located in the northeast part of town above Route 128. Roads within this area include School Street and Atwater Avenue.



Manchester-by-the-Sea, Study Areas

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS

Study Areas

Figure IV-13

CDR MAGUIRE

Section V. Existing Collection and Treatment Systems

V-1 INTRODUCTION

The Town of Manchester-by-the-Sea (MBTS) wastewater treatment and disposal needs are currently provided by a combination of on-site treatment Title 5 septic systems and sewer collection and treatment at the Manchester WWTF. By parcel count, the breakdown by wastewater treatment is 1099 sewered and 737 septic. There are also 526 additional land parcels that currently do not provide for wastewater management. Figure V-1 depicts the parcels within the sewer service area and those currently relying on on-site systems for their wastewater treatment and disposal needs.

V-2 UNSEWERED AREAS

The Town's Board of Health (BOH) works closely with their consultants Clean Water Industries and MassDEP, in the managing of permitting and inspecting on-site wastewater disposal systems and their subsequent septage. Much of the populated unsewered areas are characterized as having steep to very steep slopes with any of the following limiting factors:

- Flood zones
- Shallow bedrock
- Slow permeability
- Seasonal high water table
- Wetlands and hydric soils
- Proximity to municipal water supply wells

Areas that have historically exhibited the most chronic on-site wastewater disposal problems were documented and reviewed in previous studies resulting in the identification of 5 potential wastewater needs areas. These areas are:

- West Manchester
- Smith's Point
- Coolidge Point Road
- Raymond Street Area
- Hickory Hill

A 6th study area, the Limited Commercial District (LCD), north of the 128/School Street intersection was added to the list of study areas due to the potential for its future development.

<u>Title 5</u>

Title 5 of the Massachusetts State Environmental Code (310 CMR 15.000) is the governing regulation of the on-site sewage disposal systems. The purpose of Title 5 is to provide for the protection of public health, safety, welfare and the environment by requiring the proper siting, construction, upgrade, and maintenance of on-site sewage disposal systems and appropriate means for the transport and disposal of septage.

The term septic system commonly refers to conventional septic systems which include a septic tank, distribution box, and soil absorption system (SAS). Septic tanks are usually fabricated of reinforced concrete or fiberglass and serve as a watertight receptacle that receives sewage and provides primary treatment. Septic systems separate liquid and solid waste. The SAS provides additional treatment of the wastewater before it is distributed into the ground while the solid waste is periodically pumped from the tank. The SAS generally consists of an area of ground and a system of subsurface pipes or chambers into which the partially treated wastewater is discharged from the septic tank for final treatment and absorption by soil.

Modern day code requires a reserve area on-site for constructing a replacement disposal field if the original one should fail. This requirement cannot always be met due to insufficient lot sizes predating minimum zoning requirements and other limiting site conditions such as poorly drained soils, ledge and high groundwater. Variations of conventional on-site septic systems have been developed to counter limiting site conditions which include pumped systems with raised-bed SAS. Innovative/Alternative systems (I/A) which produce higher quality effluent are also increasingly used in place of conventional systems.

Manchester-by-the-Sea's unsewered area consists of approximately 700 septic systems, the vast majority of which (80%) are conventional septic systems.

The local BOH administers the program overseeing all on-site septic systems within the town. A complete review of the town's files including data gathering and interviews with the BOH was conducted to document the existing conditions within these study areas. This file review identified all septic systems that were inspected, any failed systems, and any repaired or replaced systems recorded by the BOH. Figure V-2 shows the results of those file reviews and illustrates potential problem areas within the town.

An inventory of BOH records indicates that there are 737 lots currently utilizing septic systems within MBTS; of these 342 systems have been inspected within the last 20 years. Parcels with repaired septic systems total 49, while 95 septic systems have been replaced outright according to town records.

<u>Lots of Title 5 Concern</u>

Throughout the town there are a number of parcels classified as "Lots of Title 5 Concern". Figure V-3 depicts the parcels of concern which occur primarily on small lots in densely developed areas with shallow depth-to-groundwater conditions. These parcels are of concern because existing conditions such as those listed above may limit the ability to design and construct Title 5 compliant septic system upgrades on these parcels.

Innovative/Alternative Systems

When sites with poor conditions and limitations make it difficult to meet standards when replacing a failing septic system with a conventional system, Innovative/Alternative systems (I/A) may be a viable alternative. In Manchester, about 20% of all on-site systems are I/A systems.

An I/A system is defined by MassDEP as any on-site wastewater disposal system or part of one that differs from the design or construction of a conventional, or standard on-site system. I/A systems are generally better than conventional septic systems at removing solids and other pollutants from wastewater before it goes to the SAS. The life of an SAS used with an I/A system is expected to be longer than one used with a conventional system. I/A systems can also be used to reduce wastewater nitrogen content when necessary.

There is currently a list of I/A technologies approved for use in Massachusetts as well as technologies under review. Several types of approved I/A systems are currently being used throughout Manchester-by-the-Sea including: Presby, Waterloo Biofilters, and Perc-Rite Drip Systems among others.

Due to the generally poor soils in town it may be difficult to site Title 5 compliant systems when homeowner's are seeking to replace their systems. As a result there has been an influx of I/A systems being installed. BOH records identify 132 on-site I/A systems currently in use with additional installations pending. Figure V-4 shows the locations of the I/A systems in the town. A review of DEP and BOH records indicate that I/A systems have been in use in MBTS dating back to 1996. The most recent inspections indicate that all systems are functioning properly with no reported violations. A summary of the I/A systems in town and the most recent inspection information is provided in Appendix E.

Lot-by-Lot Analysis

A detailed lot-by-lot analysis of non-sewered parcels was completed for the lots in each of the study areas. Table V-1 presents a summary of that analysis which has been updated from the 2009 Sewer Task Force Final Report.

Table V-1. Non-Sewer Parcels Estimates by Study Areas

Study Areas	Total Parcels	Lots of Concern	Repaired/Replaced
West Manchester	180	41	58
Smith's Point	172	37	44
Coolidge Point Road	151	40	36
Raymond Street Area	114	45	29
Hickory Hill	98	31	27
Total Study Areas	715	194	194

V-3 WASTEWATER COLLECTION AND TREATMENT

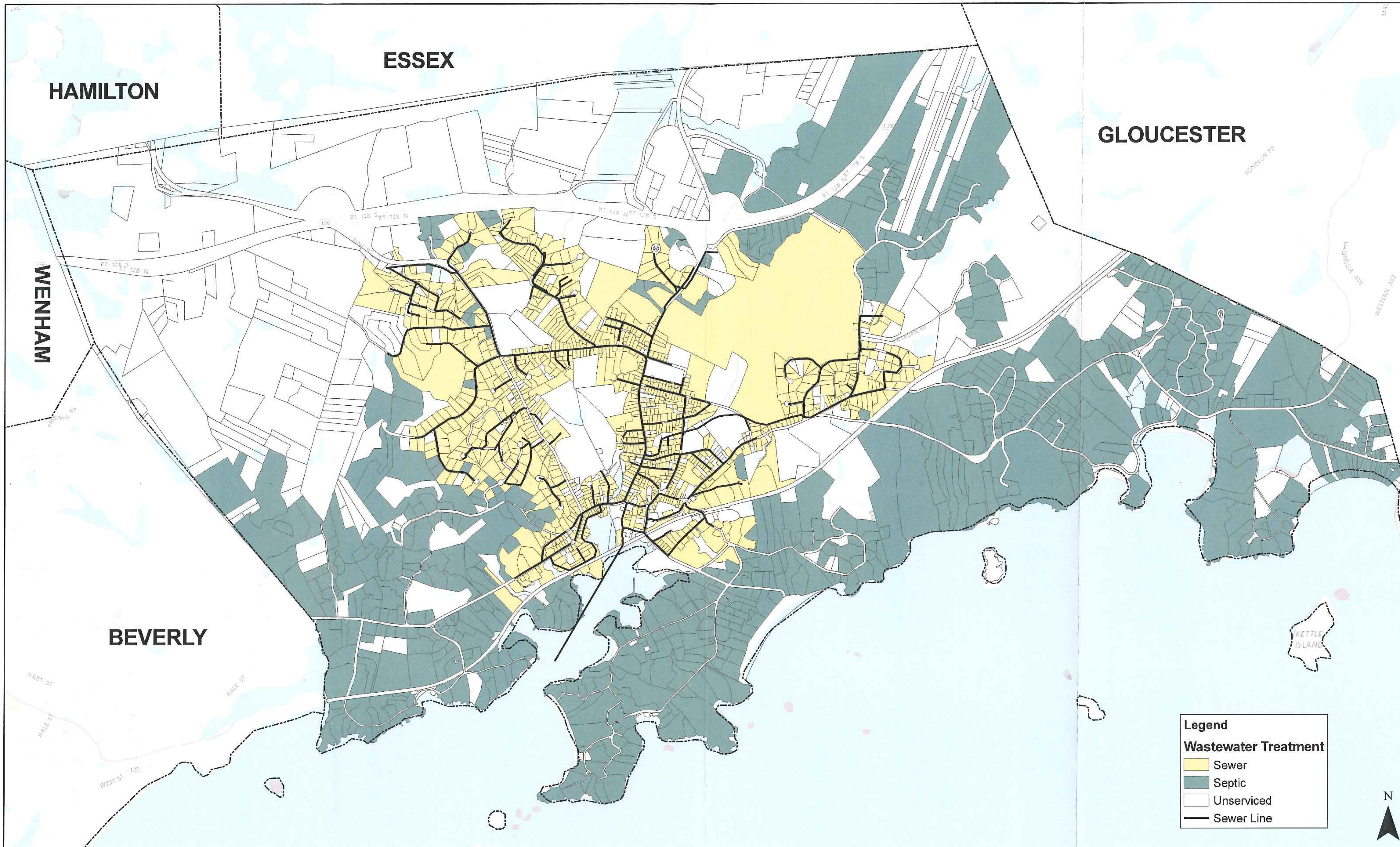
The extent of the existing wastewater collection system within the Town of Manchester-by-the-Sea is shown in Figure V-5. The sewer service area generally covers the downtown area surrounding the Manchester Harbor area with sewer lines extending out to Pine Street, School Street, and Summer Street. The collection system consists of over 23 miles of municipal sewer pipe ranging in size from 6 to 18 inches in diameter. The collection system dates back to the 1900's when it was first constructed and the varying pipe material (clay, asbestos-cement, iron, and PVC pipes) used in the system reflects the change in accepted sewer construction practice over time. The collection system also includes four wastewater pump stations and approximately two miles of force mains. The system currently services approximately 1,229 parcels according to town records.

Manchester-by-the-Sea Wastewater Treatment Facility

The Town of Manchester-by-the-Sea currently owns, operates and maintains one wastewater treatment facility (WWTF). The WWTF is located behind the Town Hall on town property. The property abuts the American Legion property on the west, the Masonic Hall and a church property on the north, and commercial property on the east. To the south, the Boston and Maine railroad tracks lie between the WWTF and the harbor. The facility was constructed in 1972 and last upgraded in 1999.

The 1999 upgrades to the WWTF were designed and permitted to treat an average daily flow of 1.2 mgd, a maximum daily flow of 3.0 mgd, and an instantaneous flow of 5 mgd. The wastewater is discharged to Manchester Harbor through a 9,000 foot long 20-inch outfall pipe that was installed in 1992. A section of this outfall pipe was recently repaired. Permitted flows from the WWTF are limited under the Ocean Sanctuaries Act (OSA).

The original facility was designed to treat wastewater to secondary treatment levels utilizing the extended aeration process. Figure V-6 through Figure V-9 shows process flow diagrams of the treatment plant. Wastewater enters the plant through the headworks building where grit (sand and rocks) are removed. The grit is transported to a concentrator where it is washed and removed for disposal. After grit removal the wastewater passes through screening equipment to remove other solids such as floatable objects and other items not removed in the grit chamber. This typically includes toilet paper, tampon applicators, and grease.



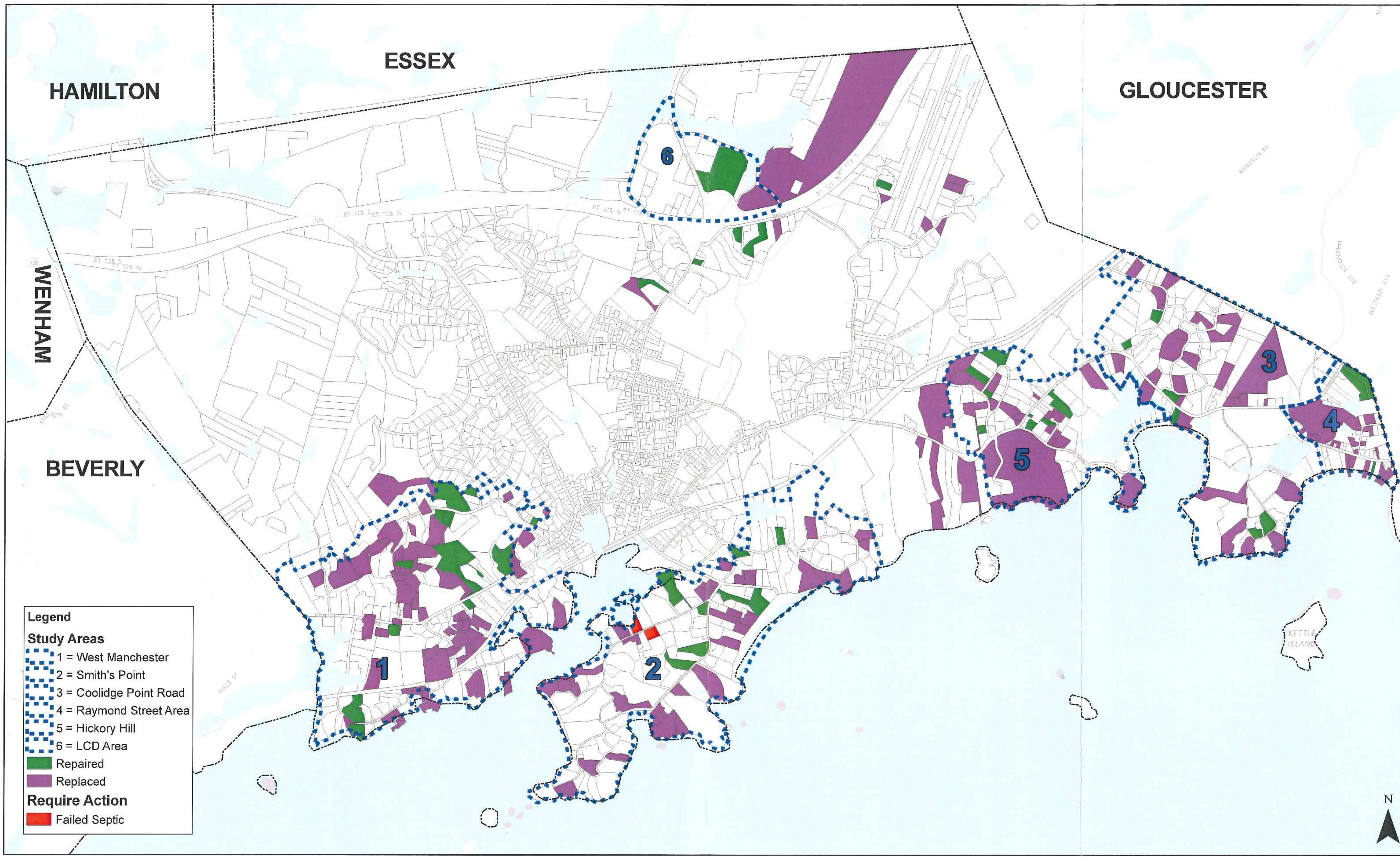
Manchester-by-the-Sea

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS

0 0.5 1 Miles

Existing Sewer & Unsewered Areas

Figure V-1



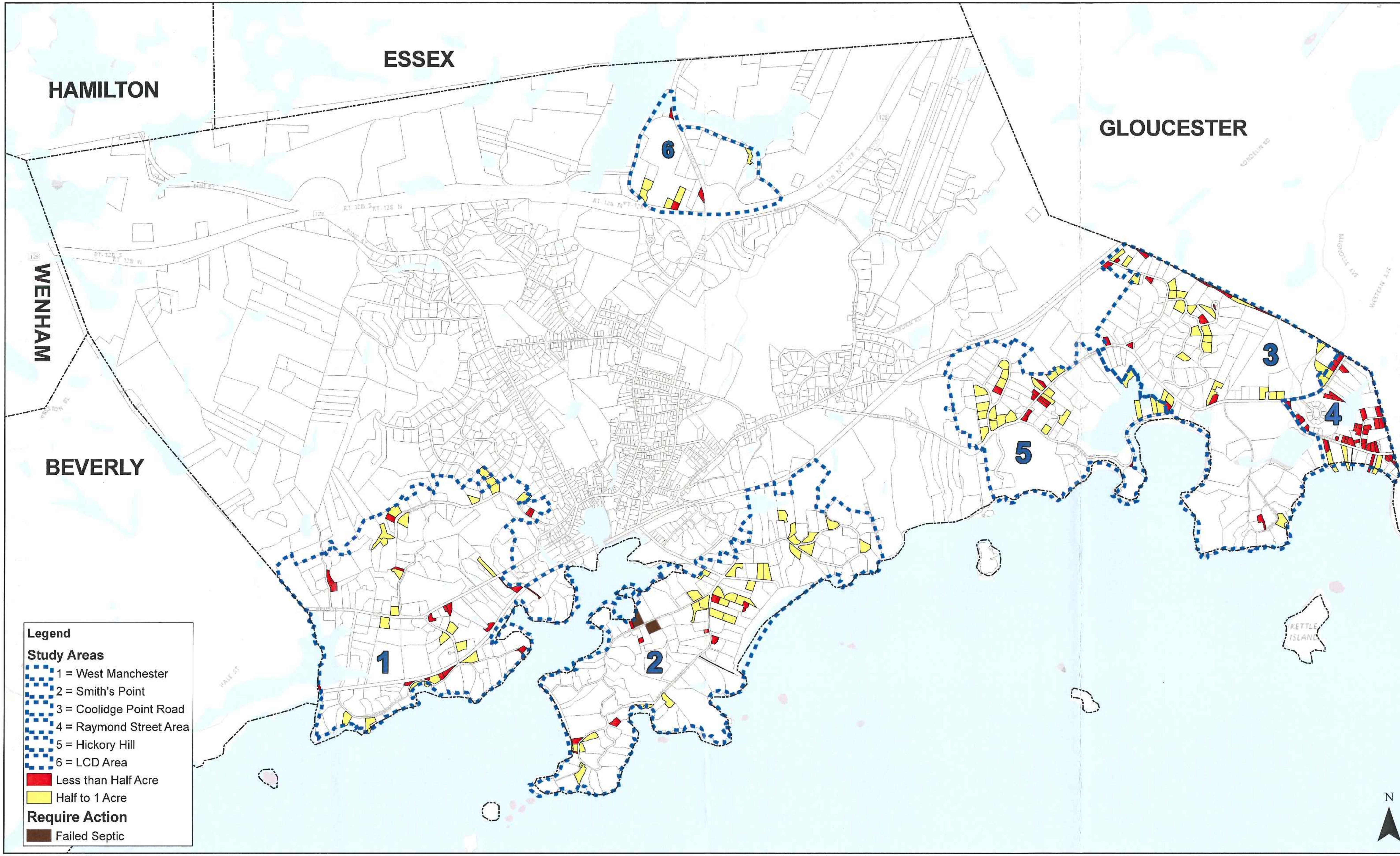
Manchester-by-the-Sea

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS, MBTS Board of Health

On-Site Systems

Figure V-2

CDR MAGUIRE



Manchester-by-the-Sea

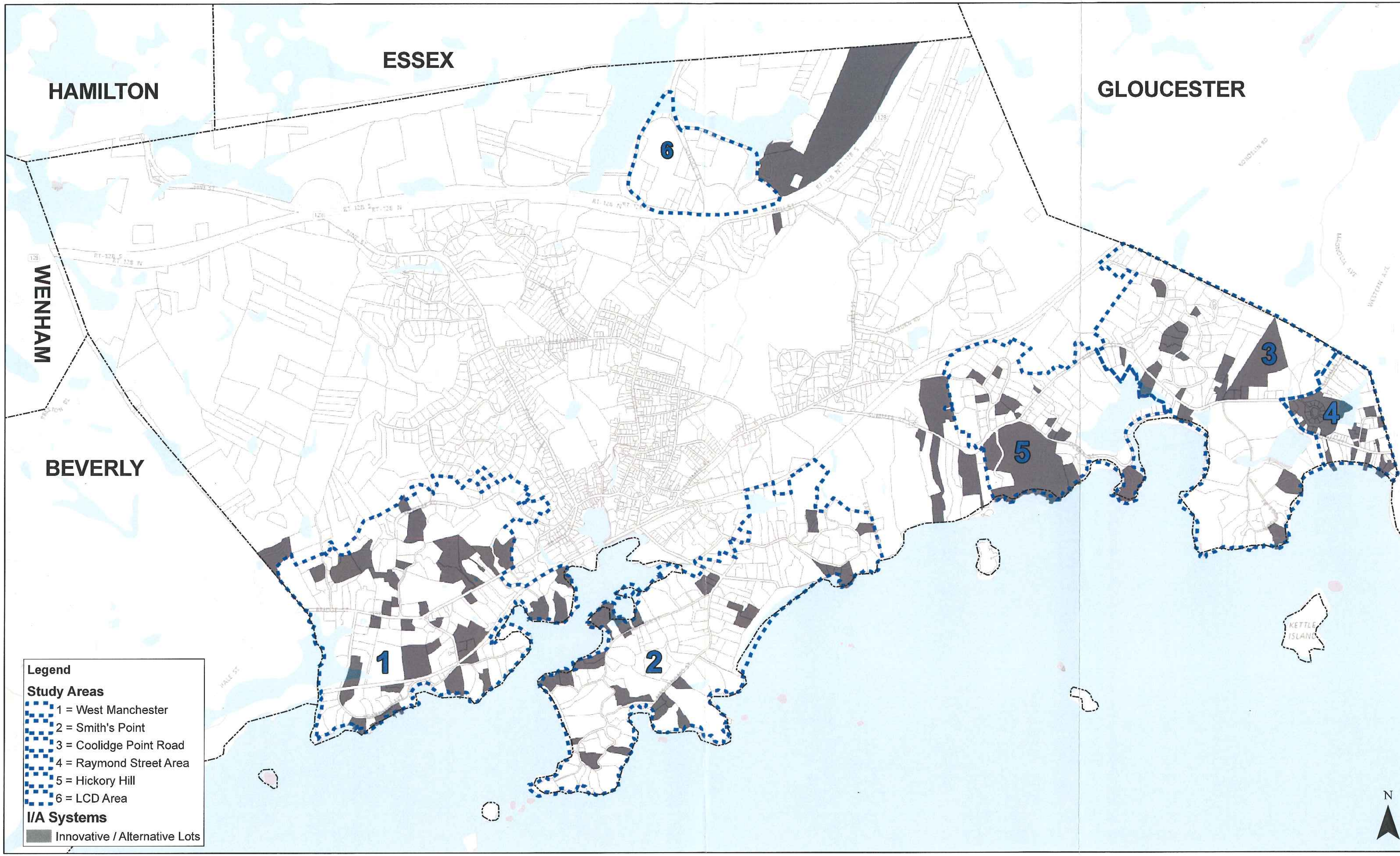
August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS, Board of Health

0 0.5 1 Miles

Lots of Title 5 Concern

Figure V-3

CDR MAGUIRE



Manchester-by-the-Sea

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS, Board of Health

0 0.5 1 Miles

I/A Systems

Figure V-4

CDR MAGUIRE

Manchester-by-the-Sea

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS

0 0.25 0.5 Miles

WWTF Collection System

Figure V-5

CDR MAGUIRE

Figure V-6. Process Flow Diagram

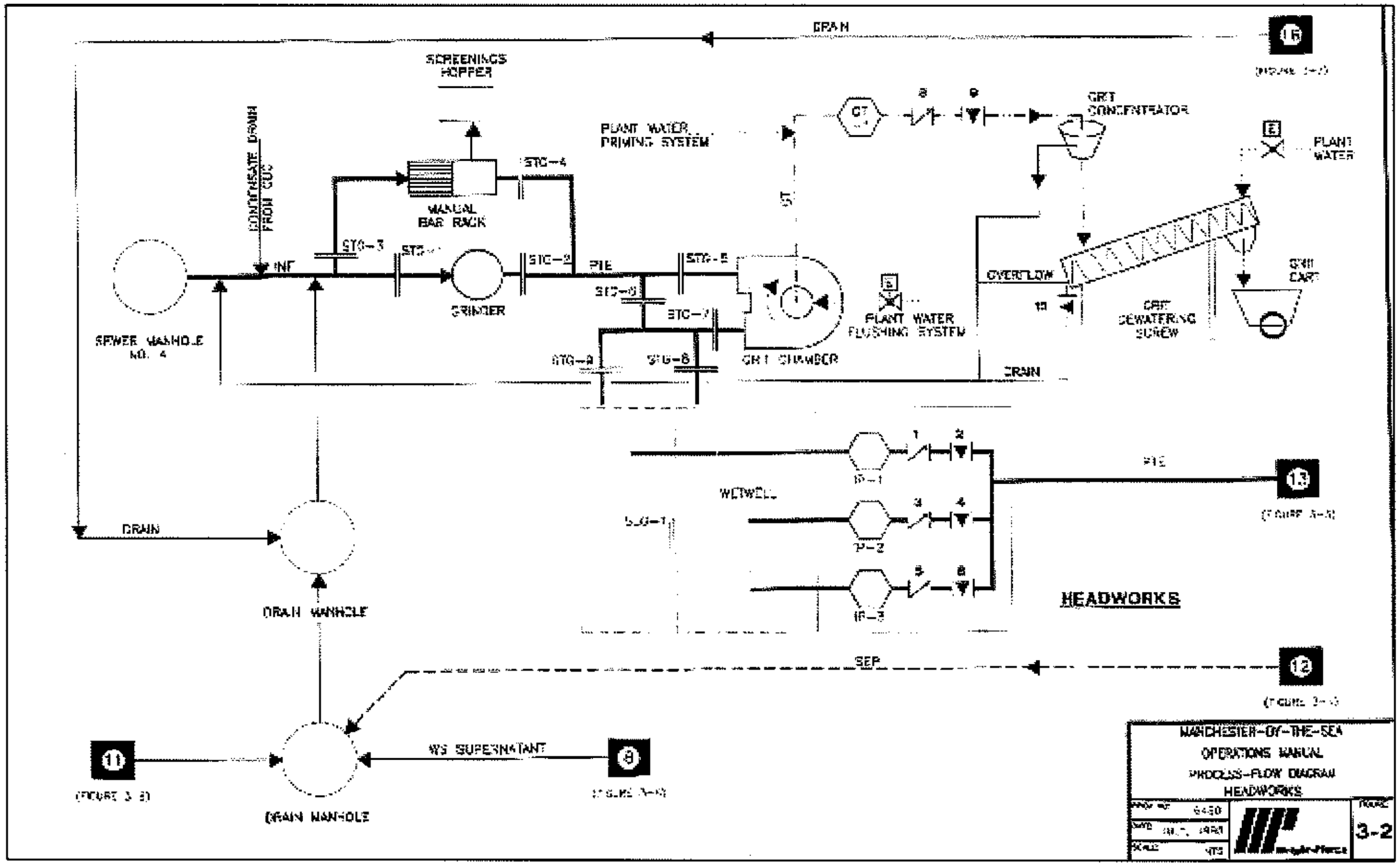


Figure V-7. Process Flow Diagram

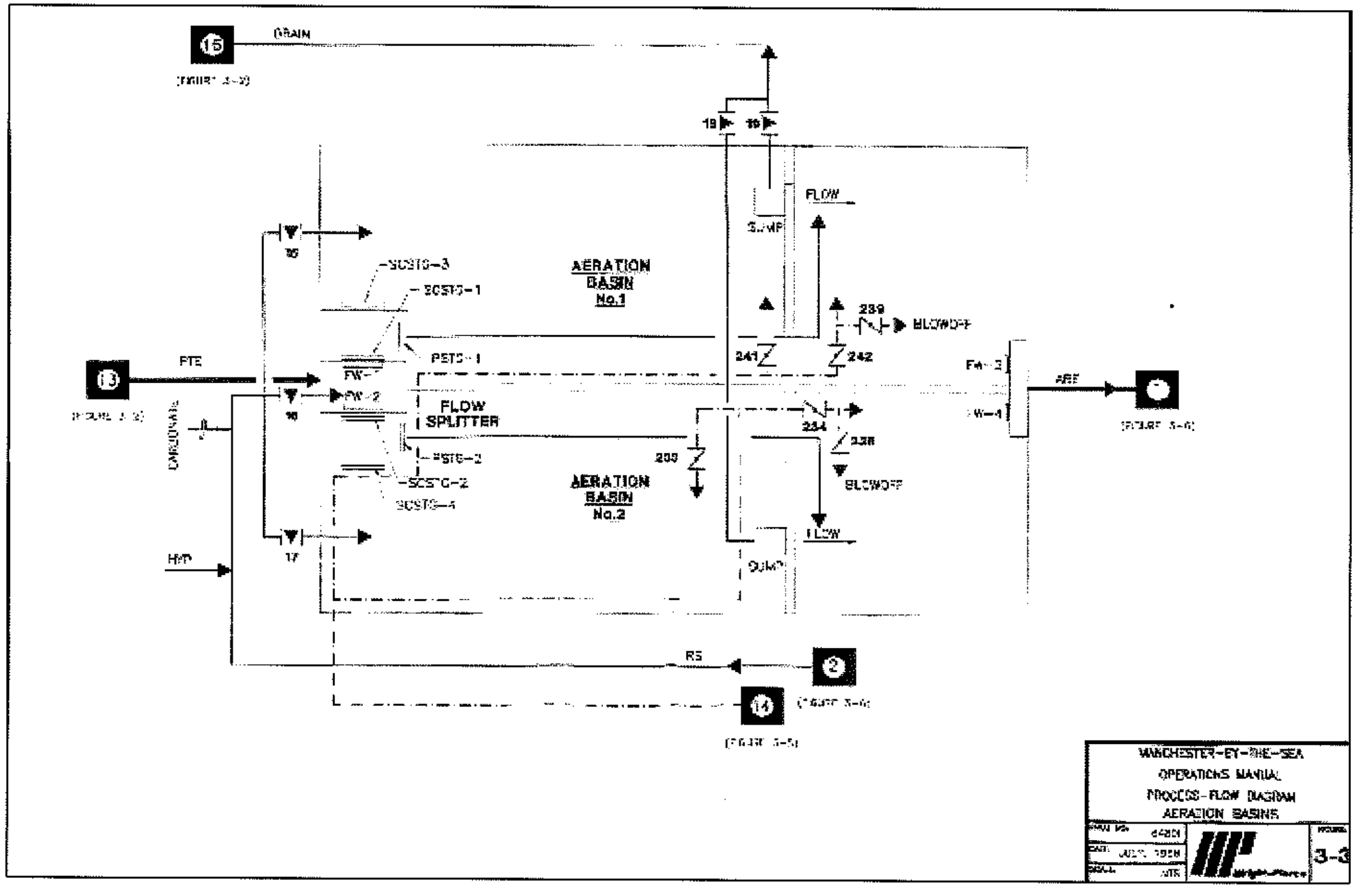


Figure V-8. Process Flow Diagram

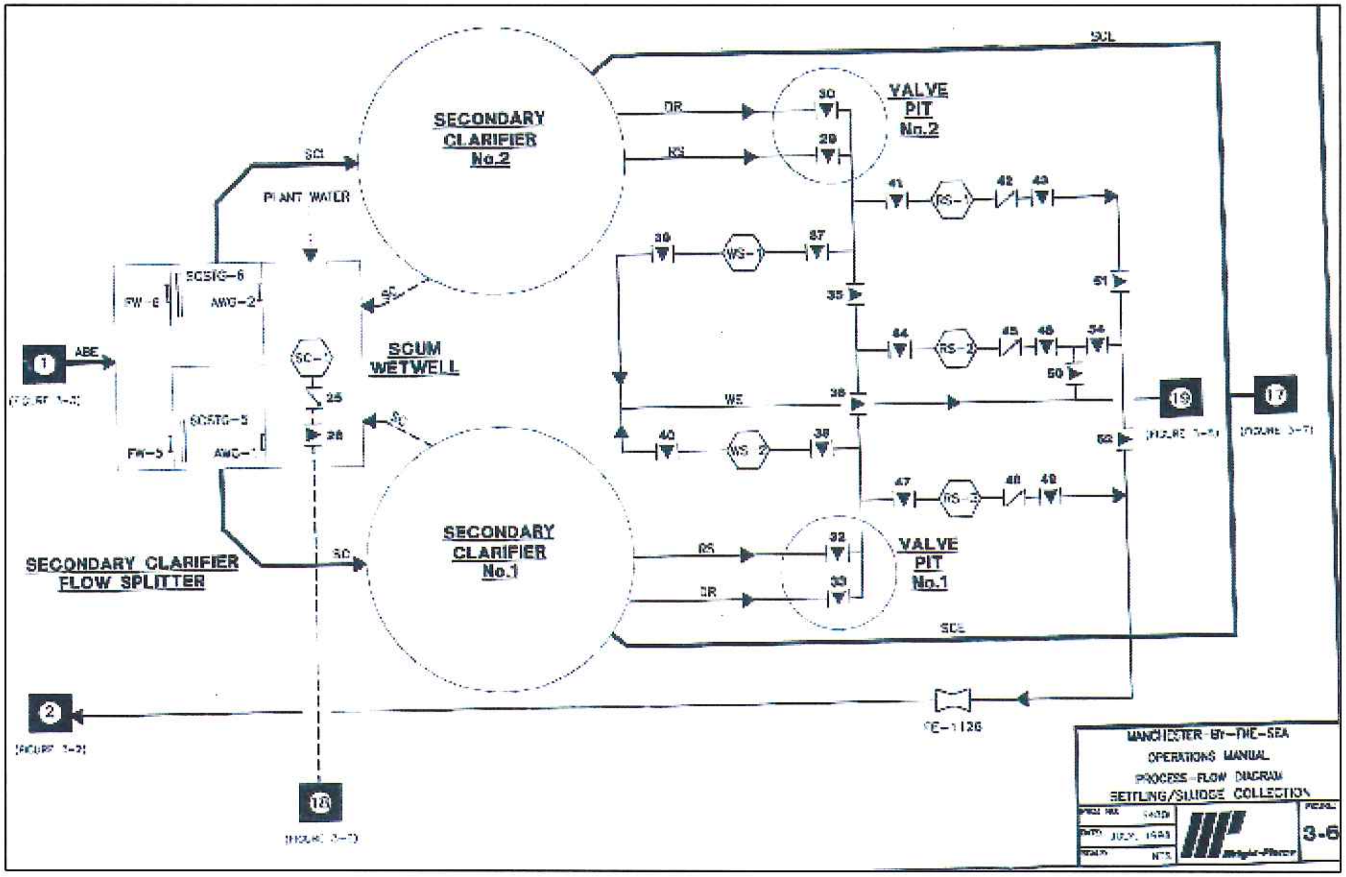
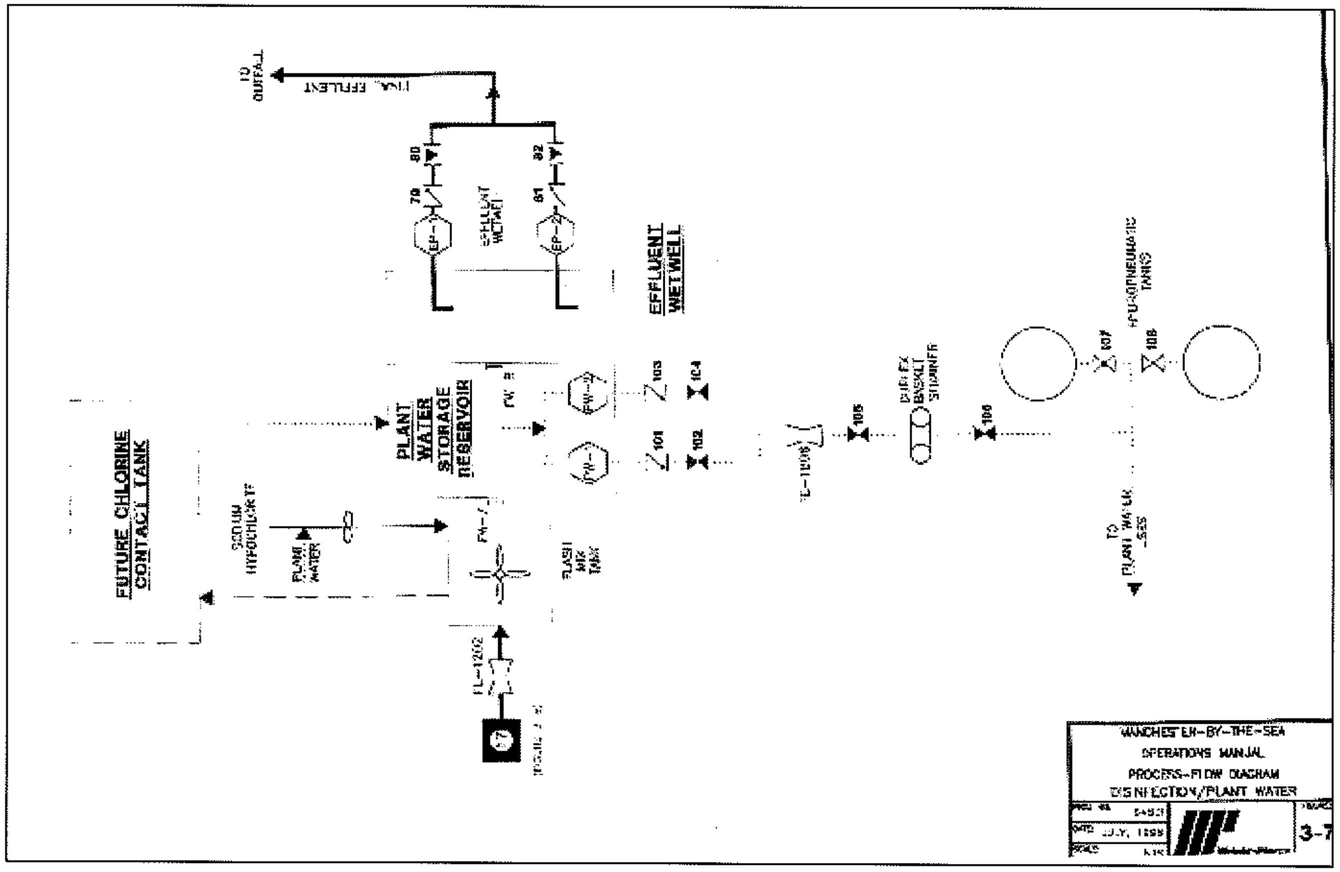


Figure V-9. Process Flow Diagram



After the grit and screenings are removed the flow is sent to aeration chambers. Air is diffused from the bottom of the tanks up through the flow. After this process the flow (now called mixed liquor) travels into the final clarifiers for settling of solids. After the final clarifier, the final effluent is disinfected with chlorine and discharged through the ocean outfall.

The plant's NPDES discharge permit requires the plant to treat the incoming wastewater to secondary treatment limits, what is commonly referred to as a 30/30 limit. The 30/30 limit is a measure of the quality of the effluent and is defined as 30 mg/l BOD (BOD is a measure of the Biological Oxygen Demand of the waste stream) and a 30 mg/l TSS (TSS is Total Suspended Solids and is a measure of the solids remaining in the treated effluent).

WWTF Design Flows

In 1994, the town prepared a report on the development of design flows as a basis for the design of the 1999 design upgrade to the wastewater treatment plant. The report incorporated potential growth and current usage into an estimate of future flows to the plant. Future flows were estimated for the year 2014.

The development of the estimated base domestic flow included the current flows (current sewered population and commercial flows), planned developments within the sewer service area, provisions for future growth (both domestic and commercial) within the sewer service area, and estimated flows from possible sewer extensions outside of the current sewered area. The 1994 Development of Design Flows report which provides details of how the plant design flows were developed can be found in Appendix F.

Table V-2 summarizes the development of the base domestic flow for the Manchester WWTF.

Table V-2. Base Domestic Flows	
Current Domestic Flow (1994)	298,000 gpd
Planned Development	30,000 gpd
Future Growth	20,000 gpd
Possible Extensions (1)	15,000 gpd
Estimated Base Domestic Flow (2014)	363,000 gpd
(1) Includes future flows from Raymond Street and Hickory Hill areas	

The final design flows for the plant also included a component for Infiltration/Inflow (I/I). The peak I/I was estimated at 818,000 gpd which was based on the peak 30-day sustained flow of record (1,316,000 gpd) less the current domestic flow (298,000 gpd), and less an estimate of I/I that would be removed from the system (200,000 gpd).

Table V-3 presents the Design Flows upon which the Manchester WWTF design and its NPDES discharge permit is based.

Table V-3. WWTF Design Flow Criteria (2014) (Flows in gpd unless noted)		
Component	**Dry Season**	**Wet Season**
Base Domestic Flow	382,000	382,000
Septage/Boat Wastes	1,440	430
I/I	164,000	818,000
TOTAL Average Daily Flow	**547,440** (1)	**1,200,430** (2)
Maximum Day (MGD)	**3.1**	**3.1**
Peak Instantaneous Flow (MGD)	**5.2**	**5.2**
(1) Permitted Dry Season and Annual Average Flow = 0.67 MGD (2) Permitted Wet Season Flow = 1.2 MGD		
Effluent Quality		
BOD (mg/l)	30	
TSS (mg/l)	30	

V-4 REVIEW OF WWTF FLOWS

Flows from the Manchester WWTF are governed by the United States Environmental Protection Agency (USEPA) through the National Pollutant Discharge Elimination System (NPDES) Permit # MA 0100871 (Permit). The current permit was enacted in June of 2011 and is included in Appendix B as previously stated. The permit has the following flow limits:

- Annual Average Daily Flow: 0.67 mgd (measured as a 12 month rolling average)
- Summer Monthly Average Flow: 0.67 mgd (June - November)
- Winter Monthly Average Flow: 1.20 mgd (December - May)

These limits were enacted largely due to the Ocean Sanctuaries Act (OSA) that limits discharges into the ocean. The Act is described in MGL Chapter 132 Section 12A. The town is allowed through a variance to discharge into the ocean, but must meet water quality and flow limits set by MassDEP.

A thorough review of Manchester WWTF plant flow data was completed. Figure V-10 shows the monthly average flows and 12 month rolling average annual flow between January 2004 and April 2015 time period in comparison with the permitted flows noted above. Except for the March-June 2005 time period, March 2010 is the only month in which flows exceeded the permitted flow. The March 2010 Monthly Average Flow was 1.45 mgd compared to the winter permit limit of 1.2 mgd. The plant has not exceeded the 12 month rolling annual average limit of 0.67 mgd except during the aforementioned March-June time frame.

In the last 5 year period between 2010 and 2014, the flow has averaged approximately 0.47 mgd, which is about 70% of the permitted annual average flow of 0.67 mgd. A summary of the WWTF flows during that period is shown in Table V-4.

Table V-4. MBTS WWTF Flows

MBTS WWTF FLOWS		AVERAGE ANNUAL	WINTER (Nov-May)	SUMMER (Jun-Oct)	WWTF DESIGN FLOWS (mgd)	
Ave Day (mgd)	2010	0.53	0.72	0.34		
	2011	0.55	0.65	0.45		
	2012	0.35	0.42	0.28		
	2013	0.42	0.51	0.33		
	2014	0.49	0.63	0.35		
Max Day (mgd)	2010	3.74	3.74	1.44		
	2011	1.85	1.85	1.52		
	2012	1.47	1.47	0.67		
	2013	2.25	2.25	1.43		
	2014	2.62	2.50	2.62		
Peak Hr (mgd)	2010	5.80	4.78	5.80		
	2011	5.90	2.80	5.90		
	2012	2.60	2.60	2.50		
	2013	3.70	3.70	2.70		
	2014	5.00	4.10	5.00		
WWTF FLOWS AVERAGE 2010-2014					**Winter**	**Summer**
AVG DAY		0.47	0.59	0.35	1.2	0.55
MAX DAY		2.39	2.36	1.54	3.3	
PEAK HR		4.60	3.60	4.38	5.2	
PEAK FLOW RATIOS AVERAGE 2010-2014						
PF MAX/AVG		5.10	4.03	4.39	2.75	
PF PEAK/AVG		9.84	6.14	12.51	4.33	

A review of the plant flow data indicates that while average flows are in line with design parameters and the permitted flows, maximum day and peak flows are outside what would normally be expected for a system of this size. According to TR-16 guidance documents, the peak flows ratios for Maximum Day to Average Daily Flow should be in the 2.4 to 2.6 range and the Peak to Average Daily Flow ratio should be in the 4.2 to 4.5 range. Plant flow data indicates that these flow ratios have averaged 5.1 and 9.8 for the Max/Avg and Peak/Avg respectively over the past 5 years. Even when considering just the winter flow period when the preponderance of peak flows occurs and the average daily flow is significantly higher, these ratios are still higher than expected at 4.0 and 6.1 respectively.

This can be seen graphically in Figure V-11 which shows the Total Daily Flow for the plant over this period. While the flows at the plant have exceeded the Maximum Design flow of 3.2 mgd on just three days in March 2010, the significant spikes in the flow pattern and the high maximum and peak flow ratios are indicative of higher than normal I/I in the system. For each of the highest total daily flow occurrences in each of the study years as presented in Table V-5, the maximum total daily flow occurred during or immediately after a rain event. Infiltration/Inflow issues are discussed further in Section V-5.

Table V-5. Summary of Maximum Total Daily Flows by Year			
Yea	Date	Total Flow (mgd)	Weekly Rainfall (in)
2010	March 15	3.74	7.39
2011	March 7	1.85	0.36
2012	December 27	1.47	2.07
2013	February 27	2.25	3.36
2014	October 23	2.62	7.49

Available WWTF Capacity Analysis

Despite the issue with excessive I/I in the system, it is apparent that there is some available capacity at the Manchester WWTF which may allow for extension of sewers beyond the current sewer collection service area or expansion of sewers to some of the study areas. Some noted items that support this conclusion include:

- The annual average flow over the past 5 years was 470,000 gpd compared to the permitted annual average flow of 670,000 gpd. The highest annual average flow over the past 5 years occurred in 2011 and was 550,000, still well below the permitted annual average flow amount.
- Based on 2.5 persons/household (1229 parcels), the current estimated service population is 3070. This population is less than not only the 2014 future residential service population of 4600 but also the 1994 residential service population of 3500 as documented in the 1994 Wastewater Treatment Facility Preliminary Design Documentation Report.
- The 2014 future design flows accounted for planned development and future growth that has not happened, particularly of note were possible future extensions into the Raymond Street and Hickory Hill areas.

Just looking at the 5 year average of the annual average flow to the plant compared to the permitted value would indicate that there is approximately 200,000 gpd of flow capacity available at the plant. However, the annual average flow to the plant is heavily influenced by the I/I entering the system and a significant stretch of storm and rainfall events could diminish the available capacity for additional domestic flows. Therefore, using the highest annual average flow over the past 5 years may be a better measure of the available flow capacity of the plant. By that analysis, there is approximately 120,000 gpd of flow capacity available.

A more detailed evaluation of the flows to the plant is presented in Table V-6. It presents the Average Monthly Flow, the Maximum Monthly Flow, and Minimum Monthly Flow on a month by month basis for the WWTF flow data between 2010 and April 2015. Of interest in determining available capacity are the flows in the summer months (in particular the months of July through September) as these are least influenced by I/I issues and provide a measure of the base domestic flow in the system. Depending upon whether all 3 months are used or just the month of September, comparing these flows to the 2014 Design Base Domestic Flow of 382,000 gpd indicates that there is 96,000 gpd to 117,000 gpd of capacity available for additional domestic flows to the plant.

Figure V-10. MBTS WWTF Flows

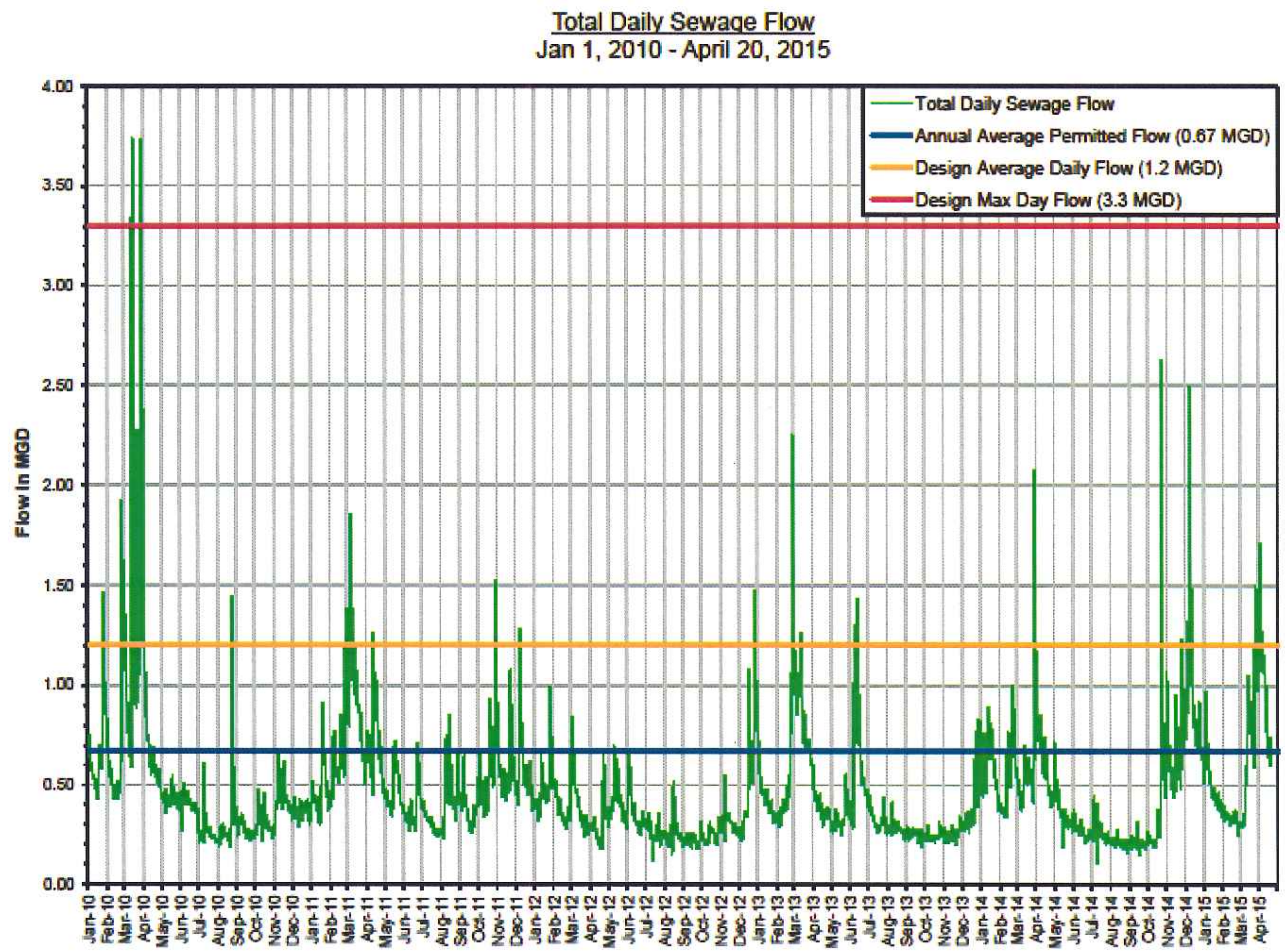


Figure V-11. MBTS WWTF Flows 2004-2015

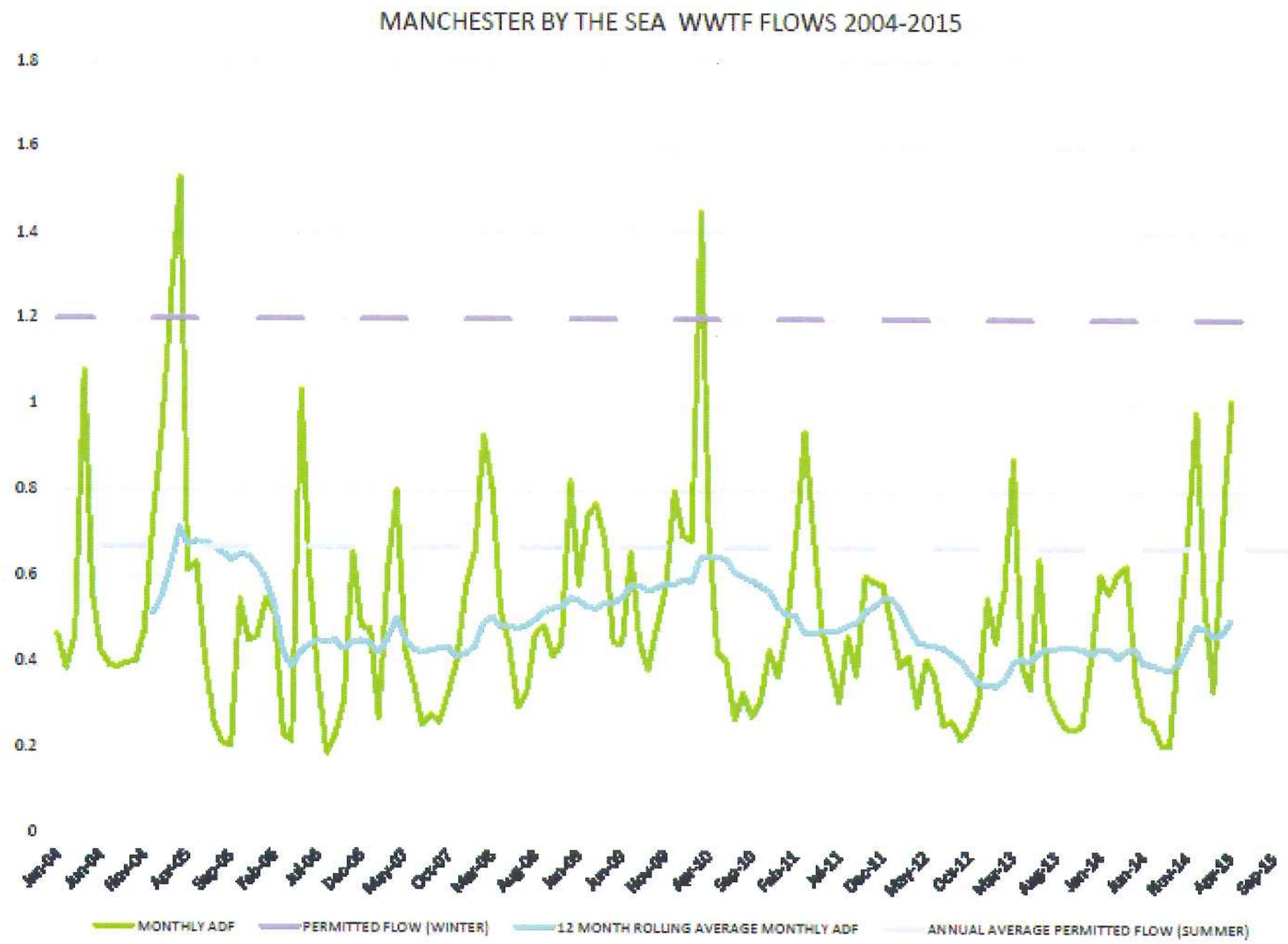


Table V-6. WWTF FLOW DATA 2010-2015 (mgd)													
MO.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**AVE**
AVG	0.541	0.538	0.706	0.625	0.405	0.416	0.285	0.309	0.265	0.371	0.454	0.579	**0.458**
MAX	0.996	1.247	**1.523**	1.187	0.644	0.738	0.462	0.698	0.384	1.053	0.772	1.303	**0.917**
MIN	0.348	0.331	0.402	0.391	0.291	0.260	0.186	0.192	0.202	0.234	0.309	0.352	**0.292**
			* March Data Adjusted only for 2011-2015										

	WET WEATHER			**DRY WEATHER**		**WET vs. DRY**			
	Feb-Mar	Dec-May		Jul-Sep	Jun-Nov	3 mo	6 mo		AVE
AVG	0.623	0.566	AVG	0.286	0.350	0.337	0.216	AVG	0.458
MAX	1.319	1.150	MAX	0.515	0.727	0.804	0.423	MAX	0.917
MIN	0.375	0.353	MIN	0.193	0.230	0.181	0.122	MIN	0.292

Table V-7 presents a summary of the various methodologies used in estimating the available capacity at the plant. The estimate ranges from a low of 96,000 gpd to a high of 200,000 gpd. It would be reasonable to conclude that additions to the sewer service area of the town that result in flows of that order of magnitude could be accommodated within the currently permitted flows.

Table V-7. Estimated Available Flow Capacity	
Basis of Estimate	Gpd
Permitted Annual Average Flow	670,000
2010-2014 Annual Average Flow	470,000
HIGH Estimate Available Flow Capacity	200,000
Permitted Annual Average Flow	670,000
2011 Annual Average Flow (high value last 5 years)	550,000
MODERATE Estimate Available Flow Capacity	120,000
2014 Design Base Domestic Flow	382,000
2010-2014 Average Flow September	265,000
MODERATE Estimate Available Flow Capacity	117,000
2014 Design Base Domestic Flow	382,000
2010-2014 Summer Average Flow (3 months, Jul-Sep)	286,000
LOW Estimate Available Flow Capacity	96,000

V-5 REVIEW OF INFILTRATION AND INFLOW (I/I) ISSUES

Extraneous water entering the collection system reduces the capacity and capability of sewer systems and treatment facilities to transport and treat wastewater. In addition, the extraneous water results in excessive energy costs for pumping and treatment. Ultimately, removal of "clean water" from the sewerage system would allow for additional sewer connections to the system without the need for future addition of unnecessary treatment capacity or modification of permit conditions.

Infiltration is defined as water other than wastewater that enters a sewer system through means such as leaky pipes, pipe joints, connections, or manholes. Infiltration is typically related to high groundwater conditions. Inflow is defined as water other than wastewater that enters a sewer system from sources such as roof gutters, cellar drains, basement sump pumps, yard drains, area drains, drains from springs and swampy areas, manhole covers and cross-connections between storm sewers and sanitary sewers, catch basins, surface runoff, street wash waters, or drainage. Inflow is typically associated with storm and rainfall events. The impact exerted by I/I on the collection and treatment systems produces different effects on flow rate. Infiltration typically occurs over a longer period of time, sometimes weeks or months, depending on the height of the groundwater table. The effects of inflow are shorter in duration and can be seen almost immediately in response to extreme wet weather events.

A typical I/I investigation and removal program consists of three phases. Phase I is the I/I Investigation and Analysis which typically consists of a flow metering program to:

- Determine whether excessive I/I exists (flow which is more economical to remove than to transport and to treat). Because eliminating all sources of I/I is not possible or cost-effective, the DEP has established a minimum threshold for excessive infiltration at 4,000 gpd/inch-mile. Infiltration sources above the minimum threshold are considered cost-effective to repair.
- Identify key subsystems exhibiting high I/I for further evaluation.
- Prepare a strategic plan, including costs and schedule, for prioritizing the sources of I/I in key subsystems to investigate further during the next phase of the I/I program.

The town completed the Phase I I/I Investigation and Analysis Report in December 2013. The report determined that there was a total of 273,000 gpd of peak infiltration entering the collection system. The report also estimated that 1,473,000 gallons of inflow would enter the system during a design storm event. The I/I Investigation and Analysis report targeted several sub-systems for completing Phase II investigations to identify sources of excessive I/I.

The second phase of an I/I program, Phase II Sanitary Sewer Evaluation Survey (SSES) includes a detailed site investigation utilizing various techniques (e.g., manhole inspections, CCTV, smoke testing, dye testing) to locate sources of clean water entering the sanitary system. An extensive comparison of the alternative repair technologies is performed to determine which locations are cost-effective for removal versus transportation and treatment. The town completed a portion of the first SSES study concurrent with the Phase I I/I report and the remainder in September 2014. The reports identified specific recommendations for sewer repair and rehabilitation to eliminate I/I sources. Additional SSES investigations into other sub-systems are continuing concurrently with this report.

The third phase of the I/I program is sewer rehabilitation. Based on the SSES work the town has already identified and removed one direct inflow source that was estimated to remove approximately 30,000 gpd of I/I from the system. Additionally, an initial sewer rehabilitation contract was issued for bid by the townin 2015. The work will provide for the rehabilitation of 8,300 linear feet of sewer and repair of 25 manholes. According to the SSES reports this work will remove over 50,000 gpd of I/I from the system although the actual work being completed is more extensive than that recommended in the SSES report.

It is recommended that the town continue to investigate I/I issues in the system and plan for completing a multi-year sewer rehabilitation program to continue removal of I/I in the system. As part of this effort it is also recommended that the town continues investigations into the ongoing concern of salt water intrusion into the collection system.

V-6 REVIEW OF EXISTING WASTEWATER TREATMENT FACILITIES

As part of the CWMP development, a review of the existing wastewater treatment facilities was conducted in order to assess what would be required to ensure that they would be fully functional to provide the required treatment over the twenty year planning period of the CWMP. These facilities include the Manchester WWTF and the wastewater pumping stations.

Manchester WWTF

A detailed review and assessment of the Manchester WWTF was completed. This included a site tour and interview with the Chief Operator. A technical memorandum of the review and assessment is included in Appendix G.

The Manchester WWTF currently meets its performance requirements and, barring changes in influent wastewater loads or permit conditions, modifications to plant processes are not necessary to continue to meet permit conditions. The plant is also in generally good condition. There were no noticeable structural or architectural issues identified that would require significant building or structural work.

It is recommended that the town plan for and implement a number of improvements to the WWTF over the planning period. These recommended improvements generally provide for either: 1) improving the operating range and efficiency of key pumps and equipment, 2) replacing aging equipment, or 3) improving operator control and/or reducing maintenance requirements.

The following is a brief summary of these recommendations:

OPERATIONAL PERFORMANCE and EFFICIENCY IMPROVEMENTS

The plant is designed for winter average daily flow of 1.2 mgd, a maximum day of 3.3 mgd, and a peak hourly flow of 5.2 mgd. While the plant can and sometimes does see flows of this magnitude, for the majority of time influent flows are much less than the plant is designed for. The major plant equipment that is sized to handle the full design flow has difficulties operating or operating efficiently under the lower flow conditions at which the plant normally operates.

- Influent Pumps – A new arrangement of size and number of influent pumps would help accommodate the wide variation in flows. Pumps need to be size accordingly for the variation of flows. Some structural modification may be needed to accommodate multiple pumps.
- Air Blowers – The aeration equipment is improperly sized and should be replaced. At low flow conditions, the blowers cannot be turned down sufficiently to be cost-efficient in providing the air requirements of the plant. Replacement with a more suitably-sized unit or the addition of smaller sized blowers would likely reduce operating costs (energy).
- Effluent pumps – As with other parts of the plant the extreme flow conditions are difficult to accommodate. During the low flows of the summer, the effluent pumps are too large and draw down the level of the effluent wet well too quickly and due to a lack of water, they can overheat. The addition of VFD's, replacement with more appropriately sized pumps, and/or the addition of smaller pumps should be considered.
- Diaphragm Sludge pumps – The pumps currently function, but more appropriate sizing would likely reduce energy costs. The pumps are approaching the end of their useful life.

REPLACE AGING EQUIPMENT

Some equipment is approaching the end of their useful life and may warrant replacement during the 20-year CWMP planning period. Replacement of aging equipment should be planned for in the plant's annual operational budget. Some of the more pertinent equipment needing replacement include:

- Waste Sludge Pump – The waste sludge pumps perform as expected, but are approaching the end of their useful life.
- SCADA Panels – Some of the existing SCADA panels have been replaced, but two additional panels should be replaced.

OPERATIONAL and MAINTENANCE IMPROVEMENTS

The plant has some minor items that require extra operator attention than should be necessary. Replacement of these items would free up operator time and effort for more important tasks, these include:

- Chlorine valves – The valves on the disinfection system (sodium hypochlorite) are problematic and require frequent (weekly) cleaning and maintenance to function properly. Replacement with a higher quality valve would reduce maintenance.
- Refrigerated Continuous samplers – The current samplers require the operators to obtain and provide ice to the samplers on a daily basis to ensure collected samplers are properly preserved. They are also reaching the end of their useful life and should be replaced with a refrigerated model.

Pumping Stations

The Manchester collection system has 3 wastewater pumping stations. These are all relatively small stations that consist of approximately 1500 gallon septic tank style wet wells with 5 hp @140 gallons per minute and run for approximately 50 minutes a day.

The town is currently undergoing a program to rehabilitate the pumping stations. This work is expected to include repairs/replacement of pumps and controls, and installation of emergency generators.

V-7 EXISTING TOWN REGULATIONS AND ORDINANCE

While the town does not currently have existing Septic System Regulations or a Sewer Use Ordinance it does address sewer and septic use in various town adopted regulations. The following text highlights some of the key references addressing the issues. The Zoning By-Law for the town addresses water and sewer connection requirements unless the Planning Board in consultation with the BOH determines that "other suitable provisions for water and sewer have been made." Section 6.11 Development Scheduling: Sewer Connection Limitation of the Zoning By-Law further documents development concerns and defined sewer connection limits. Article 40 of the regulations references a new Sewer Connection Limitation By-Law. Reference to septic and sewer requirements are also documented in Section 6.09 Review Procedures of the MBTS Subdivision Regulations document BOH review requirements for subdivision plans submitted to the Planning Board.

As stated by MassDEP, the local BOH is the primary regulatory authority for septic systems within the town under the direction of MassDEP. The board relies on the Septic Systems/Title 5 regulations on the MassDEP website for direction and guidance into all requirements, rules and regulations. MassDEP oversees innovative/alternative technology approvals, shared systems, large systems and variance requests.

Section VI. Future Conditions

VI-1 INTRODUCTION

A key element in facilities planning is forecasting conditions in the study area throughout the future planning period. For the purposes of this CWMP, the future planning period will begin in the year 2015 and end in the year 2035.

In order to properly evaluate future wastewater collection system needs, one must first define the conditions which are likely to occur in the future planning period. Since this process is not entirely analytical, it is necessary to draw upon historical and existing trends, accepted forecasting techniques and professional judgment.

Sections IV and V of this CWMP present information relative to the existing conditions within the planning study area and describe the existing wastewater collection and treatment systems. Wastewater characterization and system deficiencies are also discussed in Section V. This information provides the basis for projecting land development, population, and waste loadings which, in turn, determine the cost-effective facilities necessary to accommodate the conditions throughout the future planning period.

Growth of residential, commercial and industrial components within the Town of Manchester-by-the-Sea is highly dependent upon available land and intended land use, the availability of adequate water supply and wastewater disposal facilities, and a number of other factors including cost of land, economic climate, and the health of the local real estate market. Waste flows and loadings are also dependent upon water use trends and the condition of the wastewater collection system. The following subsections address these issues and describe how future development, population, flow and loading projections were determined for the planning study area (Figure VI-1).

VI-2 POPULATION PROJECTIONS

Various methodologies are available for projecting population. All rely to some degree on historic growth trends and extrapolation procedures. Regardless of the methodology, population projections should account for localized trends and specific study area conditions which may impact growth. Population projections provided by the Metropolitan Area Planning Council (MAPC) through 2030 during an anticipated *Status Quo Scenario* predict an insignificant decrease in the population of the town to just under 5,000 at 4,915 residents during next 15 years. MAPC projections for the same time frame under a *Stronger Region Scenario* indicate similar population trends with the number being slightly above 5,000 at 5,028. The projections take into account current birth, death and migration patterns. US Census Bureau statistics collected in 2010 confirm this minimal decreasing population trend. Table VI-1 lists the projections by the aforementioned sources for comparison, with extrapolated populations for each. For purposes of this Plan, the future population of the town in planning year 2030 is projected to be 5,028.

Table VI-1. Comparison of Population Projections
Manchester-by-the-Sea

Year	U.S. Census	% Change per Year	MAPC Projection Status Quo Scenario	% Change per Year	MAPC Projection Stronger Regional Scenario	% Change per Year	Town Clerks Office as of 8/10/15	% Change per Year
1990	5,286							
2000	5,228	-1.1%						
2010	5,136	-1.76%						
2015							5,696	
2020			*5,032*	*-2.02%*	*5,095*	*-0.8%*		
2030			*4,915*	*-2.33%*	*5,028*	*-1.32%*		

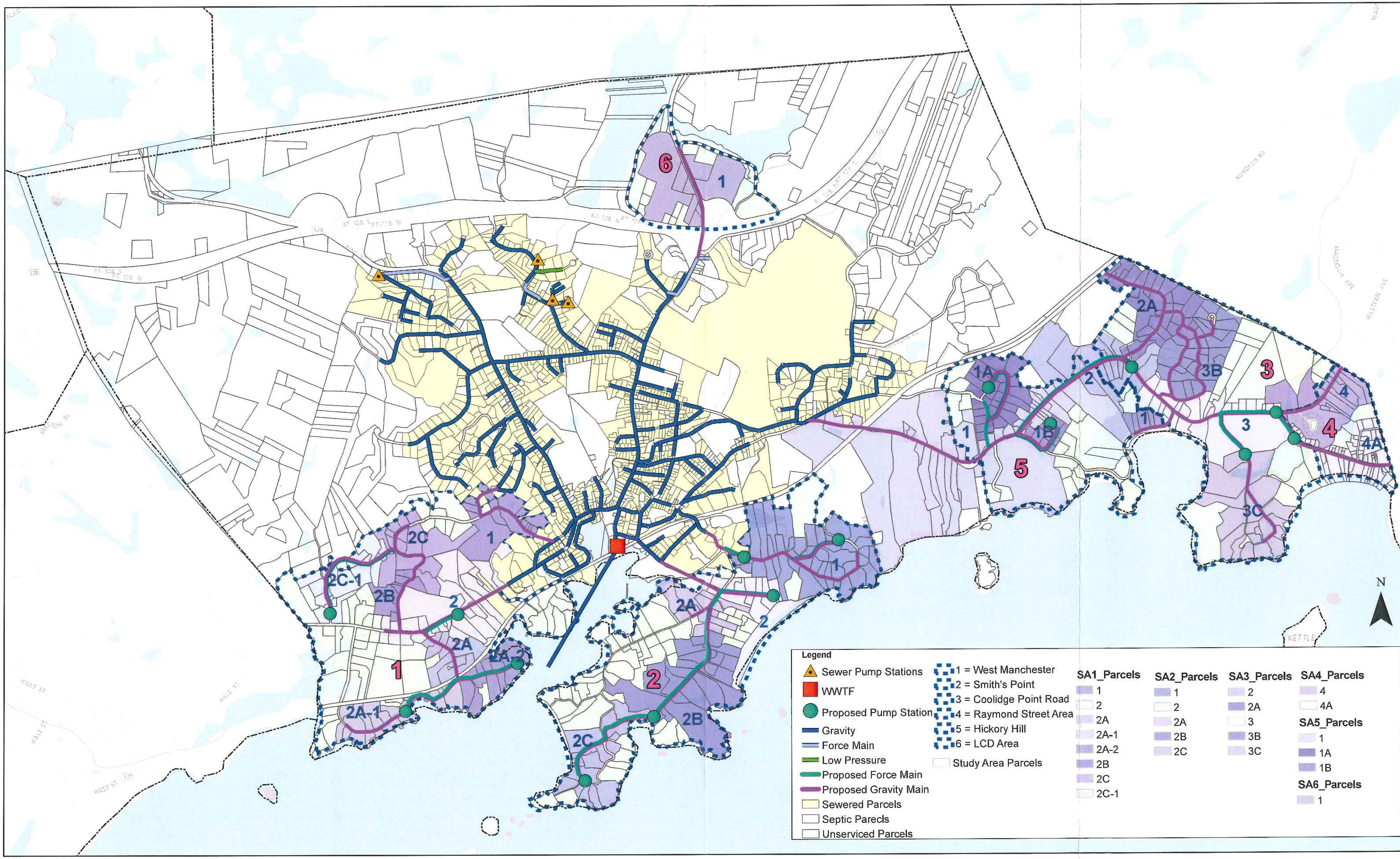
Notes:

- Projections indicated in italics

Sources:

- 1990, 2000 & 2010 U.S. Census
- Metro Boston 2030 Population and Housing Demand Projects Municipal Report – Manchester January 2014 edition (http://www.mapc.org/data-services/available-data/projection (2010 Census basis)
- Town Clerks Office 1/12/2015

Figure VI-2 is a graphical representation of the town's population at the 1990, 2000, and 2010 years along with extrapolated projections for the 2020 and 2030 year marks as published by MAPC in January of 2014.



Manchester-by-the-Sea

Augst 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS

Options for Future Sewer Service Areas

Figure VI-1

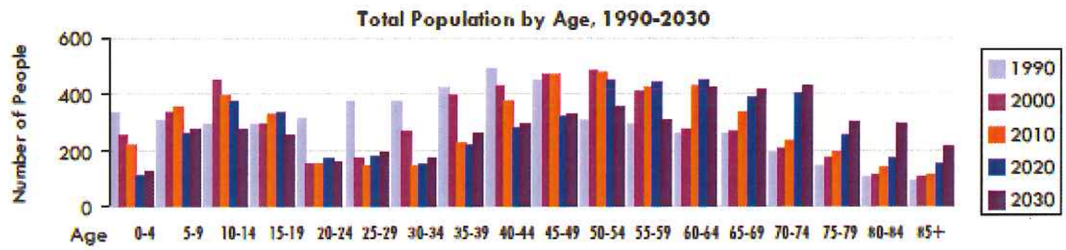
CDR MAGUIRE

Figure VI-2. Population History and Projections

Population Summary, 1990-2030

	1990	2000	2010	2020	2030
Total Population	5,286	5,228	5,136	5,095	5,028
Population under 15	932	1,038	970	744	663
Population over 65	782	859	1,009	1,361	1,644

MAPC's population projections are based on current patterns of births, deaths, and migration, as well as assumptions about how those trends might change in the coming decades. The projections are summarized in the table to the left. The chart immediately below shows population by five-year age groups. At the bottom of the page is a chart that compares the percent change for your municipality to average rates for other cities and towns in your Community Type, your Subregion, and the region overall.



Sources:

- Metro Boston 2030 Population and Housing Demand Projects Municipal Report – Manchester January 2014 edition (http://www.mapc.org/data-services/available-data/projection (2010 Census basis)

Of more relevance to this study is the slight projected increase in housing units during this same timeframe for both scenarios. The number of households is expected to increase from 2,147 in 2010 to 2,244 in 2020 and 2,298 in 2030, while the number of housing units is expected to increase to 2,476 and 2,533 during the same 2020 and 2030 projection intervals. This anticipated increase in the need even during a population decline is indicative of changing household preferences.

VI-3 FUTURE DEVELOPMENT

The Manchester-by-the-Sea Planning Board is currently in the process of a 2-year community planning initiative to develop a Comprehensive Master Plan for the town. The town currently has very limited plans for future growth and development. The main development area being discussed for potential expansion is within the Limited Commercial District (LCD). This planning area has been considered as a study area for purposes of this CWMP and considered for potential connection into the sewer collection system in anticipation of possible future development.

As far as the other study areas, no major development is presently planned. Review of community development plans, including "Manchester-by-the-Sea, MA Executive Order 418 Community Development Plan, June 2004", concludes that developable land in the study areas is minimal. Furthermore, due to the zoning within the town, most areas available for development throughout are limited by lot size requirements. Within the study areas, excluding the LCD area, the majority of vacant developable parcels have lot requirements that are generally over 2 or 1 acre in size. It is assumed that lots over an acre are large enough to support on-site septic systems for wastewater management.

VI-4 WATER USAGE

Under the operation of the Department of Public Works, Manchester-by-the-Sea's drinking water is supplied to the town from a combination of surface water and well water sources. About 99% of the town's population is served by public water supply according to town records. In 2014 approximately 285.77 mgy of drinking water was produced, on average, from the Manchester water treatment plant. The 2014 Annual Water Quality Report for MBTS states that the Gravely Pond reservoir at full capacity stores a total of 360 million gallons, providing approximately 65.4 percent of the drinking water in Manchester. In addition approximately 34.6% of the town's drinking water in 2014 was derived from the groundwater source at the Lincoln Street Well. In an effort to recharge the Gravelly Pond watershed and to supplement the pond supply, the town pumped gallons of water from the Round Pond Well into the Gravelly Pond.

VI-5 FLOW REDUCTION

Water conservation can be a viable means to reduce wastewater flows. Based on water usage information discussed above, however, it does not appear that significant water conservation efforts would have a significant impact on reducing flows discharged to the wastewater collection and treatment system. Current per capita water usage in MBTS is already within the range anticipated by water conservation programs.

Although flow reduction begins with water conservation, a rigorous program must also be considered on the wastewater end of the cycle, as there are additional measures, which can be taken to minimize wastewater flow. The most prominent means of flow reduction for the MBTS wastewater collection system is to vigorously address I/I issues. I/I removal and reduction is the best way to effectively increase available capacity of the wastewater system.

VI-6 WASTEWATER FLOW PROJECTIONS

This section provides an estimate of future wastewater flows that could potentially be added to the wastewater collection and treatment system based on the future development of the town. Estimates are developed for 3 separate areas:

- Infill within the existing sewer service area of those lots not currently connected to the wastewater collection system
- The five identified Study Areas
- The Limited Commercial District (Area 6)

<u>Basis of Wastewater Flow Estimates</u>

For the purposes of this analysis it is not anticipated that there will be significant future development in the 5 study areas or the remainder of town. First, the projected future population, discussed in Section IV-8, is not expected to increase considerably in the 20-year planning period, therefore new residential development is expected to be minimal. Secondly as discussed in Section II-1, the residential zoning of any remaining developable area within the study areas are such that they should be able to support an on-site system for their wastewater disposal needs. Therefore, wastewater flow projections are developed only for existing lots and households not currently connected to the sewer collection system.

In addition, the following assumptions were used in developing future wastewater flows that might be considered for possible connection to the sewer collection system.

- A per capita wastewater flow of 70 gallons per capita per day based on TR-16.
- An average of three occupants per lot/home (this is a conservative estimate; previous wastewater planning studies have used an estimate of 2.47 persons/household, while more recent planning studies indicate that MBTS is trending toward 2.13 persons/household).
- Study Area boundaries are shown in Figure IV-13.
- The gpcd and estimate of occupants were applied to all existing lots in the study areas.

<u>Infill Development</u>

The number of additional lots projected as infill development was calculated from the sum of vacant lots and septic user parcels within the current sewer service area that have the possibility for future tie-in. For large vacant lots, full build-out was calculated based on lot size and zoning regulations. Potential infill development and sewer tie-ins within the current sewer service area were estimated to potentially add approximately 68 additional lots/parcels to the collection system. Those new connections would add up to 15,000 gpd of possible future wastewater flow into the collection system. For the planning period it is assumed that 75% of the projected parcels would be connected to the system.

<u>Study Areas</u>

Maximum build-out of sewage flows are projected based on the number of lots in each study area. Lots currently undeveloped are included as single lots for contribution to account for any possible future development. The flows displayed in Table VI-2 below demonstrate the maximum amount of wastewater flow that would be contributed to the system if each study area was fully developed.

Table VI-2. Maximum Wastewater Flow Projections		
Study Area	**Approximate Number of Unsewered Parcels**	**Average Daily Flow (gpd)**
Study Area 1 West Manchester	180	37,800
Study Area 2 Smith's Point	172	36,120
Study Area 3 Coolidge Point	151	31,710
Study Area 4 Raymond Street	114	23,940
Study Area 5 Hickory Hill	98	20,580

In estimating future flows from the study area that may be connected to the system during the 20- year planning period a slightly different method was used to estimate the projected wastewater flows. For this scenario it was assumed that sewer extension would only be provided to those lots considered to be of concern. The lots of concern were defined as lots in each area that are less than 1 acre in size and have not been repaired or replaced in the last 15 years. It is assumed that these parcels would be the primary lots served if the sewer was expanded or extended in any given area. It was then anticipated that, on average, only 50% of the larger existing lots on streets with planned sewer extensions may choose to tie in. The projected wastewater flow was estimated as the flow from all existing lots of concern and 50% of any additional remaining existing lots.

Any large undeveloped lots, over 1 acre, are assumed to be sufficient to rely on on-site systems if developed in the future; thereby not adding any additional sewer flows to the initial projections. Additionally, any systems replaced or repaired in the last 15 years were assumed to be adequate for the planning period.

Table VI-3 presents the details of the wastewater flow projections for each of the study areas.

Table VI-3. Planning Period Wastewater Flow Projections							
	Total Parcels	Parcels Repaired or Replaced	Lots of Concern	Parcels Over 1 Acre-Not Repaired or Replaced	50% of Parcels Over 1 Acre-Not Repaired or Replaced	Total Parcels Considered	Estimated Flow (gpd)
Study Area 1 West Manchester	180	58	41	81	40.5	82	17,115
Study Area 2 Smith's Point	172	44	37	91	45.5	83	17,325
Study Area 3 Coolidge Point	151	36	40	75	37.5	78	16,275
Study Area 4 Raymond Street	114	29	45	40	20	65	13,650
Study Area 5 Hickory Hill	98	27	31	40	20	51	10,710

Summary of Wastewater Flow Projections

Table VI-4 presents a summary of the wastewater flow projections for both a Full-Build-out scenario and for the 20-year Planning Period.

Table VI-4. Summary of Wastewater Flow Projections		
Study Area	Full Build-out ADF (gpd)	Planning Period ADF (gpd)
Infill	15,000	11,250
Study Area 1 West Manchester	37,800	17,115
Study Area 2 Smith's Point	36,120	17,325
Study Area 3 Coolidge Point	31,710	16,275
Study Area 4 Raymond Street	23,940	13,650
Study Area 5 Hickory Hill	20,580	10,710
Study Area 6 LCD	62,000	31,000
TOTAL	227,150	117,325

As discussed in Section V, the wastewater treatment plant has 96,000 to 200,000 gpd of capacity available for additional domestic wastewater flows. It is not viable for all of the study areas to be connected to the wastewater collection and treatment system under the full build-out scenario and remains within currently permitted capacity of the plant. The reduced estimated projected flows that might be added during the CWMP planning period may be able to be accommodated at the plant without modification to the plant capacity or discharge permit. Possible sewer expansions and extension options are explored in further detail in Section VII.

Limited Commercial District
Projected flows for the LCD Area (Study Area 6) are based on the buildable acreage that exists in the area of potential future development. Buildable acreage was assumed to be 65% of the total acreage available. A flow value of 1000 gpd/buildable-acre was assumed for possible future commercial parcel development. Accordingly, projected wastewater flow from the LCD area would be 62,000 gpd. If the town chooses to to develop the area within the planning period it is assumed that only 50% of the LCD would be developed for a projected wastewater flow of 31,000 gpd.

VI-7 CLIMATE CHANGE

Climate Change
Whereas climate change is not directly a part of the scope of this CWMP and it is not expected to have an impact on the plant during the 20-year planning period of this CWMP, climate change and its impact on wastewater facilities is a growing concern. This is particularly important for facilities located in close proximity to the coast such as the Manchester WWTF where sea rise issues may impact the ability of the facilities to operate and perform as intended. While the majority of the plant's facilities are raised significantly above current grade level, there may be some significant impact to plant operations and performance should a large increase in sea levels become a reality in the future.

In an effort to evaluate the potential impacts of climate change and possible sea level rise issues on the plant's long-term viability and performance, Manchester-by-the-Sea took part in an EPA pilot study. The Massachusetts Climate Resilience Evaluation and Awareness Tool Exercise (CREAT) Report, dated July 6, 2015, is a risk assessment that considers the "impact of intense precipitation events and coastal storm surge in 2035 and sea level rise in 2060" on the Manchester WWTF. The assessment took into account both warm and wetter future condition risks.

Through the 2035 planning period of this CWMP, the CREAT model projected increases in average annual temperature, total annual precipitation, and the 100 year storm rainfall event. The report also projected a 7 inch sea level rise by 2035 and almost a 20 inch sea level rise at the WWTF by the year 2060.

The report concluded that if measures are implemented; the potential consequences that may be caused by future coastal storm surge events and intense precipitation events to the WWTF headworks building could be significantly reduced. Options presented to reduce the impact of climate change on the Manchester WWTF included constructing a sea wall on Manchester Harbor to protect the WWTF or relocating the WWTF to a higher elevated location to avoid damage from possible storm surge. The Massachusetts CREAT Exercise Report can be viewed in Appendix K.

The town should continue to evaluate, analyze, and implement preventative measures as necessary to minimize the impact of climate change on the town's wastewater facilities.

Section VII. Evaluation of Alternatives

VII-1 INTRODUCTION

This section contains an evaluation of alternatives for wastewater collection, treatment and disposal in the Town of Manchester-by-the-Sea. The assessment areas within the planning study area have varying, but similar physical characteristics, growth, and development potential. There is a wide range of potential solutions for managing wastewater in the assessment areas within the planning area dependent on individual area characteristics. The various alternatives considered are presented and screened to reduce the number of possibilities for detailed evaluation to develop the recommended plan discussed in the subsequent sections of this report.

VII-2 WASTEWATER NEEDS ASSESSMENT

Outside of the sewer service area in the center of town, the rest of Manchester-by-the-Sea is presently unsewered. These unsewered areas rely on both conventional and Innovative/Alternative (I/A) on-site systems for treating and disposing of wastewater.

The need for alternative methods of wastewater disposal for unsewered areas throughout the town was reviewed. Previous wastewater planning studies had identified 5 wastewater needs areas. The study areas, defined by previous documented studies, were refined to current conditions and evaluated. Based on the information gathered, none of the study areas exhibit failures to the extent that should warrant the need for extending public sewer due to environmental or public health concerns. A majority of the lots within the study areas are in excess of one acre with sufficient land area for constructing replacement systems to correct any existing problems. Additionally, a high percentage of existing systems in the study areas have been replaced or repaired in the past 10 years, therefore it is assumed to be sufficient for the 20 year planning period. A majority of replacements are innovative and alternative systems which also generally have a longer lifespan.

Although study areas 1 through 5 alone can be satisfied with on-site disposal systems, small extensions in proximity to the plant may be viable, cost comparable solutions for the lots surrounding the sewer collection system. All possible sewer extension combinations were examined and are discussed further in the upcoming subsections.

The Limited Commercial District (Study Area 6) may require a public sewer alternative for economic reasons. This was also further explored and will be discussed in upcoming subsections.

VII-3 IDENTIFICATION OF ALTERNATIVES

Preliminary alternatives were conceived to serve as a starting point for discussion and preliminary screening with town representatives. The following provides a general discussion of these alternatives as they may apply to the wastewater disposal needs of MBTS.

1. **On-site Systems -** This alternative would entail continued reliance on on-site system for wastewater disposal needs of each of the needs areas. This alternative would include both individual innovative alternative (I/A) or conventional Title 5 systems. The main concern with this alternative is the possibility of system failure with the resultant water quality issues that may arise from those failures. This is of particular concern for those areas with a higher percentage of smaller lots (less than ½ acre) and those areas that are in close proximity to sensitive resources such as beaches.

   If the town selects this alternative as a long-term solution for its wastewater disposal needs, they should consider completing a review and perhaps enhancement of the town's sewage management program for inspecting, maintaining, repairing and replacing onsite systems. Having a managed program will ensure effectiveness of the on-lot system alternative.

   The town has seen good success in recent years with installation of I/A systems as repairs or replacement of failed systems as an alternative to conventional systems. Use of on-site systems whether conventional or I/A has some environmental benefit as compared to collection and transport alternatives by recharging the groundwater in those areas.

   Finally, continued reliance on on-site systems in needs areas will impact the town's development and growth in those areas. Future development in those areas will be limited by the natural environment's ability to handle the wastewater rather than infrastructure to collect and transport the wastewater for treatment elsewhere. Limiting future growth is not a concern for most of the identified needs areas and in fact is consistent with town future development plans, the only exception being Study Area 6, the Limited Commercial District.

2. **Communal Treatment Systems -** Communal treatment systems involve the use of a conventional or alternative septic system that serve a group of properties. Communal systems can range from very small (serving a handful of homes), medium (serving a street or a neighborhood), to large (serving a large portion or all of an entire needs area).

   For the purpose of this CWMP, it is considered that small and medium systems are essentially the same alternative as the on-site system alternative whereas the homeowner, or group of homeowners, would be responsible for the system. This alternative then considers communal disposal systems in the context that the town would provide for the collection to a communal treatment system for a large portion of or entire needs area. It is further presumed that the communal treatment disposal system would necessarily be limited to subsurface disposal rather than discharge to a stream or other water course due to the permitting difficulties of that option and the likely significantly higher level of treatment required.

The communal system alternative has similar attributes as on-site systems do. They would similarly keep water recharge local and would limit future growth to that which can be supported by the natural environment. They would have some added environmental benefits, as it would be easier for the town to monitor and maintain the performance of a communal system than rely on homeowners to monitor and maintain proper operation of their individual systems.

By definition, it is also presumed that communal treatment systems would be sited in close proximity to the homes and parcels being serviced. Therefore the feasibility of this option is limited by the number of available potential sites that would be suitable for the subsurface wastewater disposal needs of the area. Community systems with subsurface disposal may be practical in the areas of town that have sufficient acreage with suitable physical soil characteristics for infiltrating wastewater effluent. But, as noted in Section IV, suitable soil types represent a relatively small percentage of the overall area in town. Taking into consideration extensive shallow depth to bedrock, shallow depth to the groundwater table in areas, and the limited amount of suitable land without other constraints such as private ownership, lot size and setback distances, and wetlands, the number of potential sites for this alternative is reduced to a very limited amount of sites.

A preliminary review of the potential sites for a communal treatment and subsurface disposal facility was completed in each of the needs areas. This preliminary review determined that there were only a handful of sites that might be possible to support a communal disposal system for an entire study area. The possible communal lots investigated are shown in Figure VII-1. Only Study Area 1 (West Manchester), Study Area 2 (Smith's Point), Study Area 4 (Raymond Street), and Study Area 6 (LCD) contained sites that had any possibility for the alternative to be a viable solution with further investigation. A summary of site review investigation documentation can be found in Appendix H.

3. **Connecting to Neighboring Systems -** This alternative entails conveying wastewater to the nearest town or other political subdivision for treatment and disposal. The nearby systems that may be able to accept flows from Manchester-by-the-Sea are the Cities of Beverly and Gloucester, as well as the Towns of Wenham, Hamilton and Essex. Each of these system connections would present its own different series of challenges and

have varying available capacities or which could be available with associated improvements to the receiving system.

The option of connecting to neighboring systems was investigated through an examination of town websites, MassDEP and NEPDES permit investigations, and email contact with neighboring officials. The following is a summary of those findings.

The Town of Hamilton does not have any municipal sewer and relies entirely on septic for its wastewater treatment needs. Wenham also does not have municipal wastewater treatment facilities, the town relies on on-site septic systems with the exception of at the Gordon College campus and the neighborhood known as Parsons Hill (located on the Beverly & Manchester border), both of which are serviced by the South Essex Sewer District (SESD). The Town of Essex developed a sewer system that collects wastewater from approximately 800 properties and conveys it to the City of Gloucester wastewater treatment plant per a June 6, 2000 agreement. It is important to note that Hamilton, Wenham, and Essex do not directly abut any of the study areas identified within this CWMP.

Study Area 1 abuts the Town of Beverly while Study Areas 3 and 4 abut Gloucester. Research into Beverly's wastewater management indicates that the town is already in a combined system, South Essex Sewer District (SESD) with Danvers, Marblehead, Middleton, Peabody and Salem. Response from the Commissioner of Public Services and Engineering indicated that connection would be highly unlikely and that it would require legislative approval. Gloucester's Water Pollution Control Facility currently treats wastewater from the nearby towns of Essex and Rockport. The Gloucester facility is currently operating under 2007 Administrative Consent Order, ACOP-NE-07-1N021, and 2010 "tentative denial" for reissuance of its NPDES permit (MA0100625). Examination of the proximity of the neighboring Gloucester sewer system to MBTS further indicates that the option of extending the system would not be cost effective even if it were feasible. Based upon these findings the option of connecting to neighboring systems does not appear at all viable.

4. **Sewer Expansion/Extensions to Manchester WWTF** – This alternative involves expanding the sewer collection system to the needs area to service existing parcels within the study areas for treatment at the Manchester WWTF.

   As discussed in Section V-4, the available capacity of the treatment plant is limited so this alternative may not be feasible for all of the needs areas as a whole but may be an option individually for some of the needs areas or even portions of some of the needs areas. The town continues to be under a sewer moratorium so any solution that involves expansion or extension of the sewer collection system would likely be subject to MassDEP concurrence for lifting the sewer moratorium. Regulatory requirements directly impact the implementation of this alternative as the ACO under which this CWMP is required also states that the town "shall not authorize or allow any new connections to or extensions of its sewer system, or increases in flow from existing sewer connections unless: ....MassDEP authorizes the connection in writing." Finally, increasing the capacity of the existing WWTF as a means to service the wastewater needs of the study areas is considered unlikely as it would require a variance from the currently permitted flows under the Ocean Sanctuaries Act (OSA). An application for a variance to the existing permitted flows would need to demonstrate that there are no other feasible alternatives for the study areas other than sewer expansion.

This alternative has the advantage of providing a long-term treatment option for wastewater in the needs area without the danger of on-site system failures resulting in water quality concerns. At the same time, it could impact existing water resources by transmitting water to the ocean instead of recharging the groundwater as currently occurs with the on-lot systems. This alternative also has the potential for undesirable indirect impacts as it may promote additional growth than planned by opening up parcels for future development along proposed sewer extensions.

5. **Sewer Extension to Other Facilities –** This alternative would involve the collection of wastewater in the study areas either individually or collectively and conveyance to a new treatment facility. As it is unlikely that another treatment facility would be permitted for an ocean discharge due to the OSA, the new treatment facility would need to be discharged to either subsurface disposal fields or to surface waters, the most likely being a subsurface discharge. This would involve permitting of groundwater discharge or surface water discharge.

   As was discussed previously under the communal system alternative there are limited sites in town that may fit the criteria needed for a subsurface disposal system, particularly one that involves flows from multiple needs areas. Further, given the potential costs of collection, conveyance, treatment and disposal, and operation and maintenance as compared to other options, this alternative has limited added benefit to justify the extra costs.

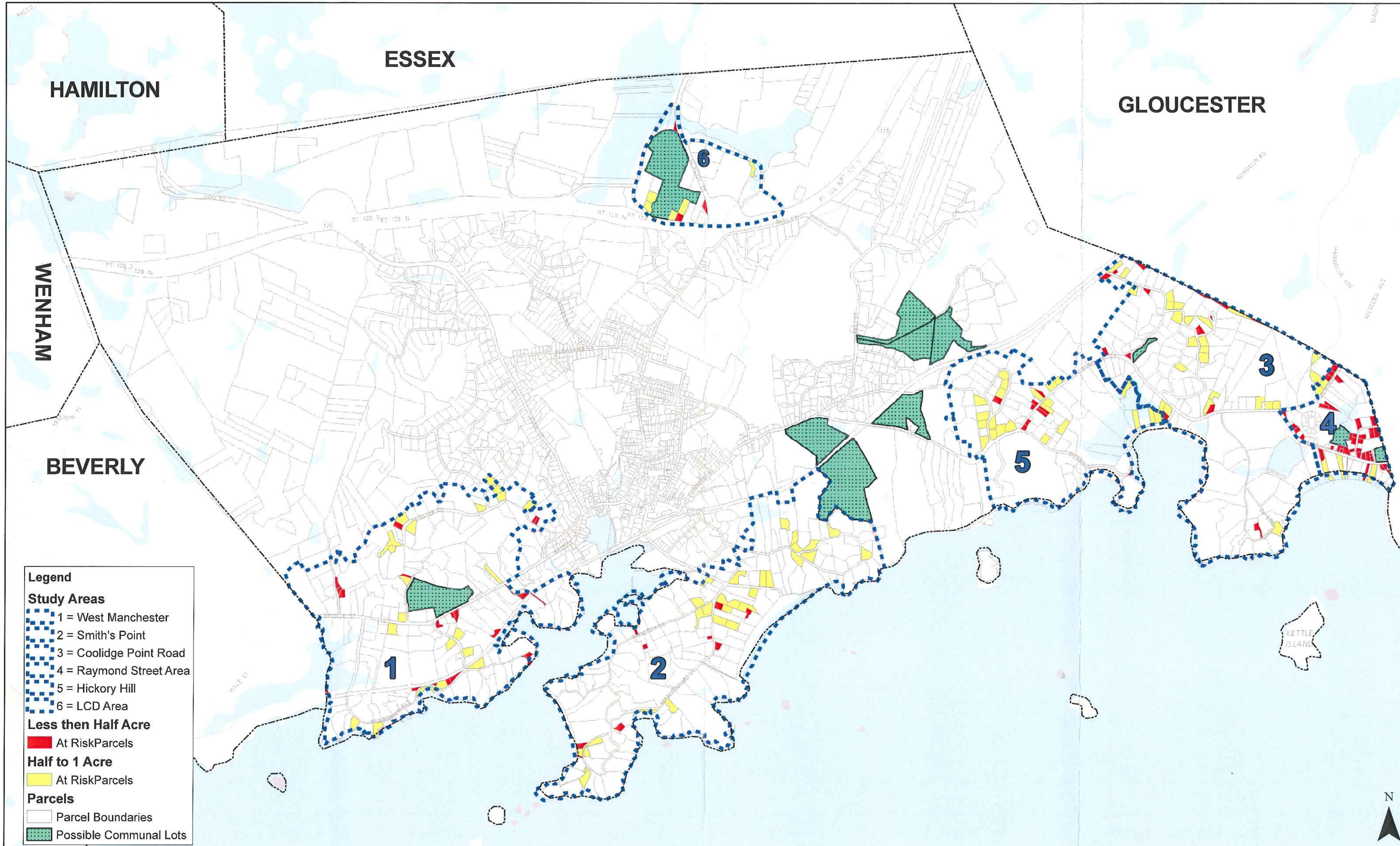
VII-4 PRELIMINARY SCREENING OF ALTERNATIVES

A preliminary screening of possible wastewater alternatives as listed above was conducted prior to completing a more comprehensive evaluation of feasible alternatives. A summary of the screening analysis is presented in Table VII-1. This initial screening considered the following criteria.

- Water Quality Issues – The potential impact on water quality issues including water resources.
- Capital Costs – The order of magnitude of cost/user or household for a given alternative.
- Land Requirements – The availability of land required to meet the needs of a given alternative.

- Town Planning Objectives – Whether a given alternative complies with town planning objectives, particularly with regards to development, growth, and protection of resources.
- Regulatory Requirements – The federal, state, and local regulatory need for permits, variances, and approvals of a given alternative.

Table VII-1. Screening of Preliminary Alternatives			
Alternative	**Pros**	**Cons**	**Assessment**
On-Site Systems	➢Reasonable Costs/Household ➢Limits Development & Growth in concurrence with town planning ➢Recharges groundwater locally	➢Possibility of failure and future water quality issues ➢Town Wastewater Management Program for monitoring & maintenance advised	Feasible for further consideration
Communal Treatment Systems	➢Reasonable Costs/Household ➢Limits Development & Growth in concurrence with town planning ➢Recharges groundwater locally	➢Generally "poor" soils limits possible sites ➢Limited available parcels of suitable size to service an entire needs area	Limited Feasibility May be an option for small neighborhoods or portions of a needs area
Connecting to Neighboring Systems		➢No adjacent municipal collection systems within reasonable distance ➢Requires long term agreement with neighboring community	Not Feasible
Sewer Expansion to Manchester WWTF	➢May be cost comparable to On-lot systems ➢Some WWTF capacity available ➢Improves long-term water quality	➢Sewer Extensions not currently permitted per Consent Order ➢Limited Available WWTF capacity ➢WWTF Capacity increase not permitted per Ocean Sanctuaries Act ➢May promote development growth along proposed sewers ➢Water "lost" in discharge to ocean	Feasible for further consideration
Sewer Expansion to New WWTF		➢Ocean Sanctuaries Act permit limits any new WWTF to a groundwater disposal system ➢Limited suitable sites available ➢Costs prohibitive as compared to other options ➢New facility would require extensive permitting	Not Feasible



Manchester-by-the-Sea

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS

Possible Communal Lots

Figure VII-1

CDR MAGUIRE

VII-5 DEVELOPMENT OF SOLUTIONS

Based on the preliminary screening completed above, a more detailed evaluation of alternatives was completed for each study area. The alternatives considered in the final evaluation included:

- On-site systems - this alternative considers that a study area would continue to rely on either conventional Title 5 systems or I/A on-site systems for future wastewater disposal needs. For cost comparison purposes, however, it is assumed that future on-site systems, whether new or replacement would be I/A systems.
- Communal systems – this alternative consists of developing a communal treatment and disposal facility to serve a study area or portion of an area. Potential lots/parcels that may be suitable for that purpose were identified and reviewed.
- Sewer Expansion – evaluation of this alternative included the development of a conceptual possible sewer expansion plan for each study area that would send wastewater flows to the Manchester WWTF for treatment.

As an initial step in the evaluation of alternatives, a conceptual sewer expansion plan for each area was developed. The conceptual sewer expansion plan was prepared as to extend sewer service to all lots of concern in a study area; lots of concern were all lots less than 1 acre in size that have not been repaired or replaced in the past 15 years. Estimated wastewater flows and an estimate of cost/lots served were then developed for each area. While Study Areas 1 and 2 were evaluated individually, Study Areas 3, 4 and 5 were combined when developing a possible conceptual sewer expansion plan.

Table VII-2 presents the results of the initial sewer expansion evaluation. The initial analysis indicated that cost per homeowner for sewer expansion to serve a given area was significantly greater than continuing to rely on on-site systems for wastewater disposal needs. The cost/lot of sewer expansion ranged from a low of $52,000 for Study Areas 3, 4, and 5 to over $101,000 for Study Area 1. Operation and maintenance costs have not been included at this time, although it is presumed that these costs would also favor on-site systems (annual cost of on-site system maintenance (inspections, pump-outs, etc) versus wastewater user fees).

Table VII-2. Cost Comparison of Sewer Expansion and On-Lot Systems			
	Study Area 1	**Study Area 2**	**Study Areas 3, 4, & 5**
Estimated Lots Serviced	58	64	155
Estimated Flow (gpd)	12,180	13,440	32,550
Alternatives	**Cost per Lot**	**Cost per Lot**	**Cost per Lot**
Conventional System	\$20,000-\$30,000	\$20,000-\$30,000	\$20,000-\$30,000
I/A system	\$35,000-\$45,000	\$35,000-\$45,000	\$35,000-\$45,000
Sewer Expansion	\$77,000-\$101,000	\$70,000-\$90,000	\$52,000-\$68,000

Note: Assumption is that all lots less than an acre and not fixed or replaced and 50% of remaining non-fixed lots would be serviced

Based on this initial sewer expansion analysis, a more detailed review of the sewer expansion alternative was completed. This review considered a multitude of sewer extension options of the sewer expansion plan to identify those sewer extensions that may be cost comparable to the on-site alternative on a per lot basis. As with the sewer expansion analysis, the number of lots served by the sewer extension options was determined by the sum of the lots of concern and approximately 50% of the additional non-fixed lots that may choose to tie-in. Preliminary analysis and planning for possible cost comparable extensions was performed. A detailed analysis of the extension options and cost comparison can be found in Appendix I. The cost comparable sewer extensions are discussed further in the upcoming subsections.

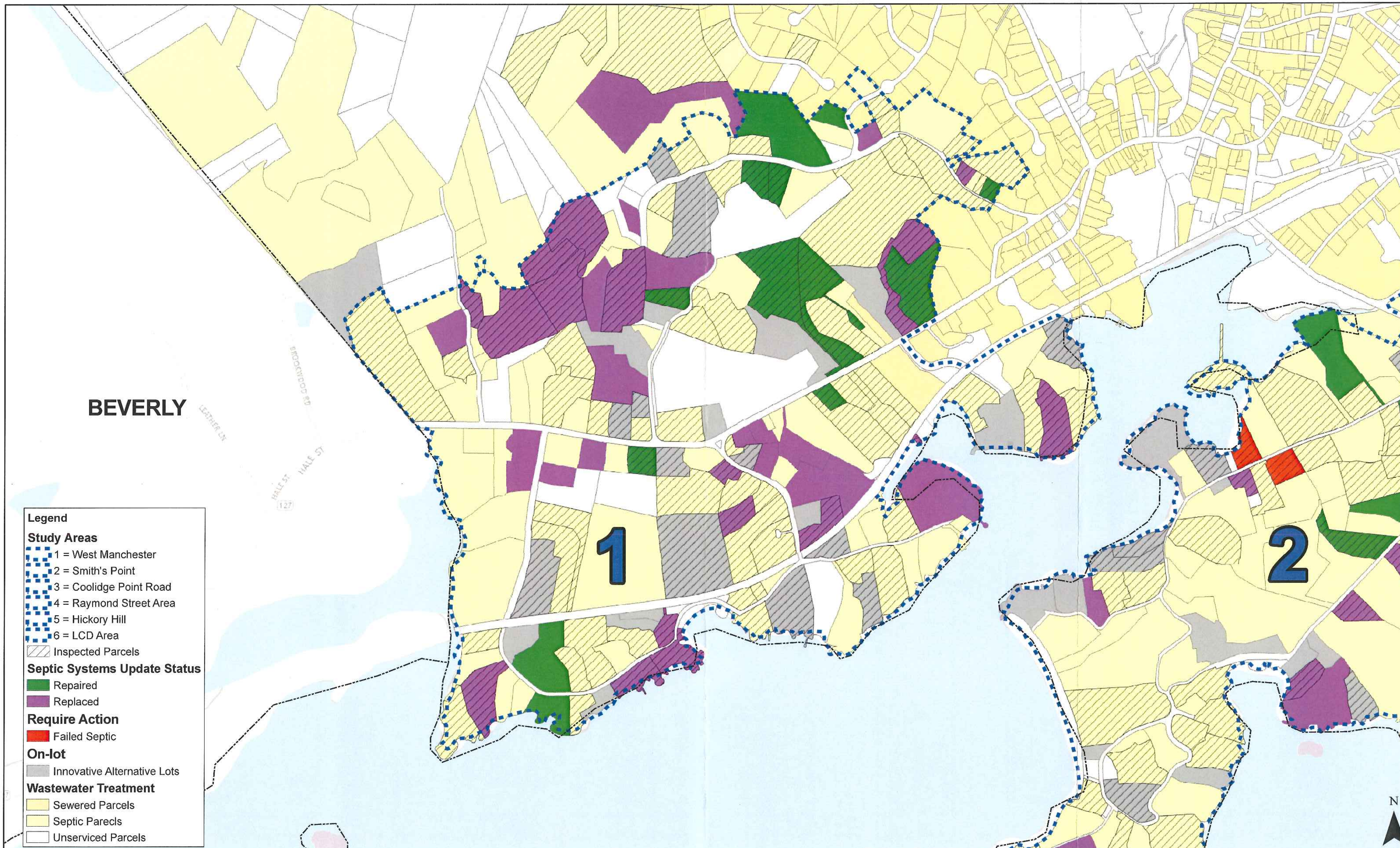
A summary review of the wastewater alternatives for each Study Area is discussed below.

<u>Study Area 1 - West Manchester</u>

On-Site Systems.

Figure VII-2 shows the locations of lots of concern in the West Manchester study area along with those lots that have recently been repaired or replaced. As can be seen a significant number of systems (approximately 20%) have been repaired or replaced in the area.

Table VII-3 presents a summary of the lots in the West Manchester study area. The majority of lots in the West Manchester's area are greater than 1 acre in size. When discounting those lots that have already been repaired or replaced, there are only 43 lots of concern, or 23% of all the lots in the area.



Manchester-by-the-Sea

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS, Board of Health

0 0.2 0.4 Miles

Study Area 1 Lots of Concern

Figure VII-2

CDR MAGUIRE

Table VII-3. Study Area 1 - West Manchester					
Total Lots	**Total Area Lots**	**Repaired Lots**	**Replaced Lots**	**Failed Lots**	**Remaining Lots of Concern**
< 1/4 Acre	9	0	0	0	9
1/4 to 1/2 Acre	13	1	2	0	10
1/2 to 1 Acre	33	2	6	0	24
Total	**55**	**3**	**8**	**0**	**43**
% of Total	**29.6%**	**20.0%**		**0.0%**	**78.2%**
Total Lots	**Total Area Lots**	**Repaired Lots**	**Replaced Lots**	**Failed Lots**	**Remaining Lots of Concern**
>1 acre	131	10	20	0	0
Total*	**186**	**13**	**28**	**0**	**43**
	% of Total	**22.0%**		**0.0%**	**23.1%**

*Total is representative of lots of all sizes in area

Communal Treatment Systems

A preliminary analysis of lots in the West Manchester study area identified one site of sufficient size for possible use to site a communal treatment and disposal system. The property is owned by the Town of Manchester-by-the-Sea and is identified below and shown previously on Figure VII-1. A review of the soil characteristics of the site indicates that it has poor soils and likely a great deal of ledge across the site but may have pockets of suitable soil.

Tax Parcel ID	Total Acres	Zoning
27 0 12	13.93	Single Residence C

A site inspection including site walkover and review with town personnel indicated that the site is not be favorable for use for siting a communal treatment and disposal system. The site, called Winthrop Field, has restricted use and it is very unlikely that installing a communal system in the area would be allowed. A summary of the site review is included in Appendix H as previously indentified.

Sewer Expansion

The conceptual sewer expansion plan for the West Manchester study area is shown in Figure VII-3.

This sewer expansion plan extends sewers to all lots of concern in the area. The overall sewer expansion plan would service approximately 58 lots and would send estimated 12,180 gpd to the WWTF. On a cost per lot basis, sewer expansion for the entire West Manchester area was found to be not cost comparable to remaining on on-site systems for the foreseeable future.

This is because of the number of lots potentially served by a collection system is a relatively low percentage of the total lots in the area.

A detailed analysis of various sewer extension options in the West Manchester study area was conducted. A complete matrix of those options is presented in Appendix I. Based on that analysis there was one sewer extension option that was considered to be cost comparable to relying on on-site systems. That sewer extension option is shown in Figure VII-4 and listed below. Extending sewers along to these streets is estimated to serve 10 to 15 lots and add approximately 1,995 to 3,360 gpd to the Manchester WWTF.

- Extension No. 1 – Forster Road

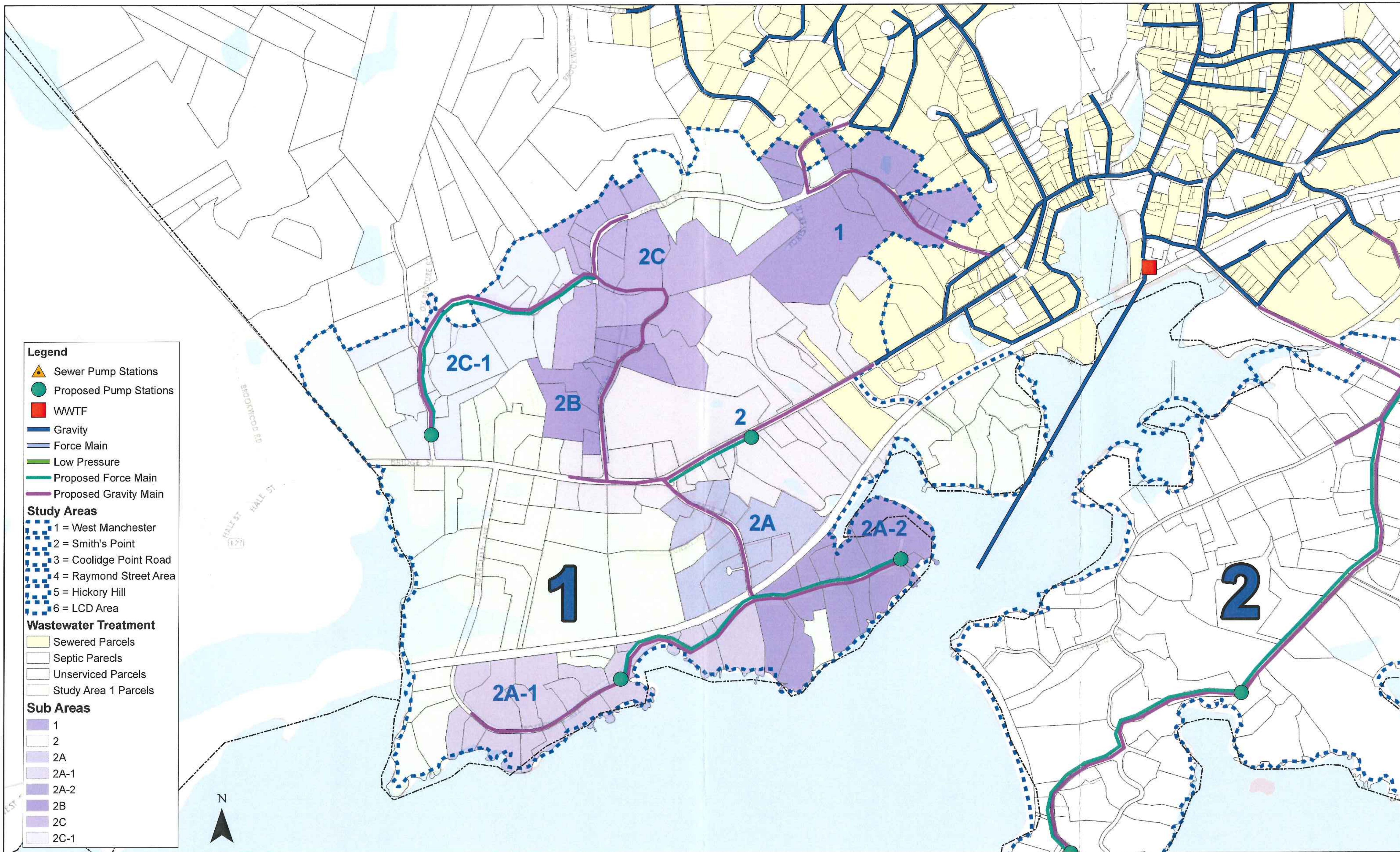
Table VII-4 presents a summary comparison of costs for the West Manchester area.

Table VII-4 Study Area 1 – Cost Comparisons

Alternative	Cost/Lot	Cost/Lot	# Lots				Estimated Flow*
	Low	High	<1/2 acre	1/2 - 1 acre	>1acre	Total	
On-Site Conventional	$20,000	$30,000	19	25	101	145	30,450
I/A	$35,000	$45,000					
Sewer Expansion[1] (Entire Area)	$77,000	$101,000	17	24	17	58	12,180
Sewer Extensions[2]							
Forster Rd. to Wood Crest Rd./ Wood Crest Rd.	$45,000	$59,000	2	5	3	10	2,100

(1) Sewer Expansion Plan based on Conceptual Sewer Maps

(2) Sewer Extensions based on Top Cost Comparable Extensions Figure VII-4



Manchester-by-the-Sea

Study Area 1 Sewer Expansions

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS

Figure VII-3

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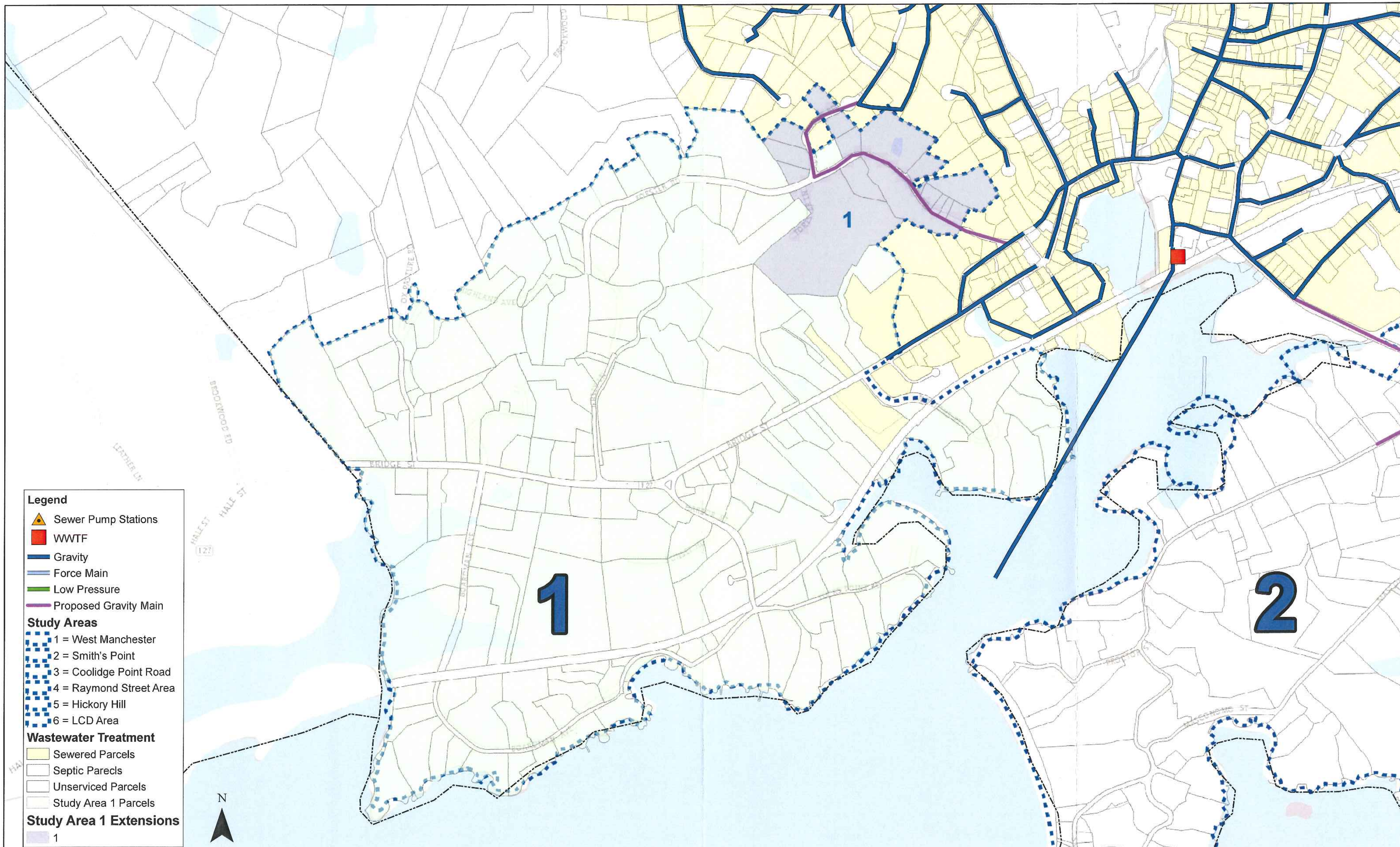


Manchester-by-the-Sea

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS

0 0.2 0.4 Miles

Study Area 1 Sewer Extensions

Figure VII-4

CDR MAGUIRE

Smith's Point

On-Site Systems

The state of on-site systems in the Smith's Point study area is shown in Figure VII-5. A small portion (13%) of on-site systems in the area have recently been repaired or replaced with most of those being lots greater than 1 acre in size. As in West Manchester area, most of the lots in the Smith's Point area are greater than 1 acre in size. When accounting for repaired or replaced lots, there are only 37 lots of concern in the area which is just 21% of all the lots in the study area. Table VII-5 presents a summary of the lots in the Smith's Point study area.

Table VII-5. Study Area 2 - Smith's Point

Total Lots	Total Area Lots	Repaired Lots	Replaced Lots	Failed Lots	Remaining Lots of Concern
< 1/4 Acre	6	0	0	0	6
1/4 to 1/2 Acre	5	0	0	0	5
1/2 to 1 Acre	30	1	3	0	26
Total	**41**	**1**	**3**	**0**	**37**
% of Total	**23.7%**	**9.8%**		**0.0%**	**90.2%**
Total Lots	**Total Area Lots**	**Repaired Lots**	**Replaced Lots**	**Failed Lots**	**Remaining Lots of Concern**
>1 acre	132	7	12	2	0
Total*	**173**	**8**	**15**	**2**	**37**
	% of Total	**13.3%**		**1.2%**	**21.4%**

*Total is representative of lots of all sizes in area

Communal Treatment Systems

A preliminary analysis identified two sites in the Smith's Point area with potential for siting a communal treatment and disposal system. The properties, as listed below and previously shown on Figure VII-1, are both owned by the Town of Manchester-by-the-Sea. They abut on either side of the train tracks and have a small river nearby with an impact area of 200 feet. They both are believed to have poor soils on site, ledge, and are somewhat wet. Past testing in the area has indicated that the conditions in the vicinity are not ideal for communal systems.

Tax Parcel ID	Total Acres	Zoning
11 0 19	27.6	Single Residence E
11 0 17	12.6	Single Residence A

A site inspection including site walkover and review with town personnel indicated that the site may not be favorable for use for siting a communal treatment and disposal system. A summary of the site review is included in Appendix I.

Sewer Expansion

The conceptual sewer expansion plan for the Smith's Point study area is shown in Figure VII-6. This sewer expansion plan extends sewers to all lots of concern in the area. The overall sewer expansion plan would service approximately 64 lots and would add 13,440 gpd to the WWTF. On a cost per lot basis, sewer expansion for the entire Smith's Point area was found to be not cost comparable to remaining on on-site systems. This is due to the relatively long lengths of sewer required to handle only a few lots of concern.

A detailed analysis of various sewer extension options for the Smith's Point study area was conducted. A complete matrix of those options is presented in Appendix I. Based on that analysis there was one sewer extension option that was considered to be cost comparable to relying on on-site systems. The sewer extension options would extend sewers along Beach Street and service 19-33 lots for an estimated flow of 3,990 to 6,930 gpd. The sewer extension is shown in Figure VII-7. Table VII-6 presents a summary comparison of costs for the Smith's Point area.

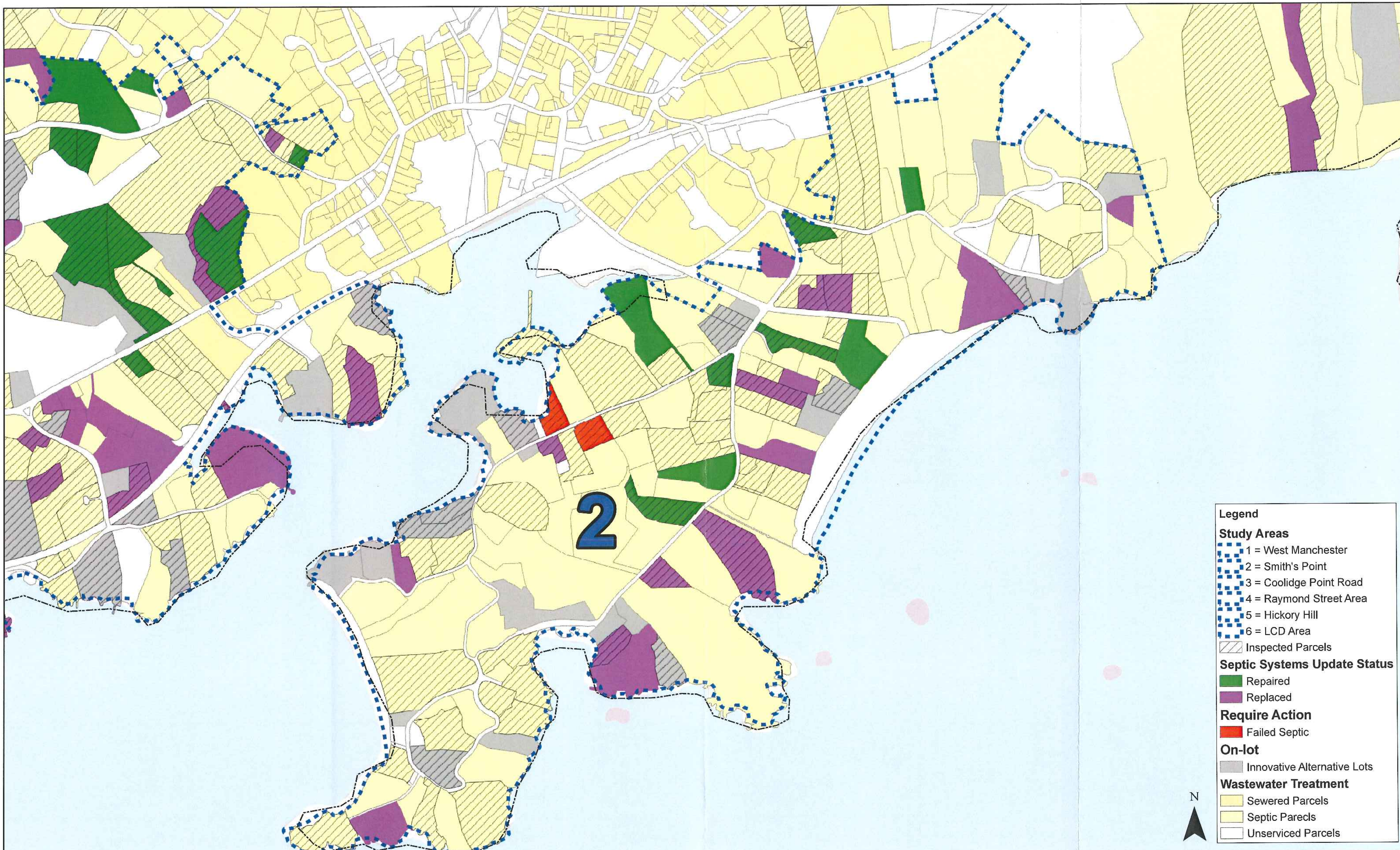
Table VII-6. Study Area – Cost Comparisons

Alternative	Cost/Lot	Cost/Lot	# Lots				Estimated Flow*
	Low	High	<1/2 acre	1/2 - 1 acre	>1acre	Total	
On-Site Conventional	$20,000	$30,000	11	26	113	150	31,500
I/A	$35,000	$45,000					
Sewer Expansion[1] (Entire Area)	$70,000	$90,000	7	26	31	64	13,440
Sewer Extensions[2]							
Beach St./Masconomo to Cobb Ave./Proctor St.(small ext)	$56,000	$73,000	1	7	11	19	3,990

(1) Sewer Expansion Plan based on Conceptual Sewer Maps

(2) Sewer Extensions based on Top Cost Comparable Extensions Figure VII-7

Study Areas 3 – Coolidge Point Road, 4 – Raymond Street and 5- Hickory Hill are all located east of the existing sewer collection area. Figure VII-8 shows the lots of concern and on-site systems that have recently have been repaired or replaced in those areas. Because of the location of these study areas in proximity to each other and the existing collection system, development of conceptual sewer expansion to those areas was done concurrently and will be discussed as a group rather than individually. That review follows the presentation of information specific to each of the individual study areas.



Manchester-by-the-Sea

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS, Board of Health

0 0.2 0.4 Miles

Study Area 2 Lots of Concern

Figure VII-5

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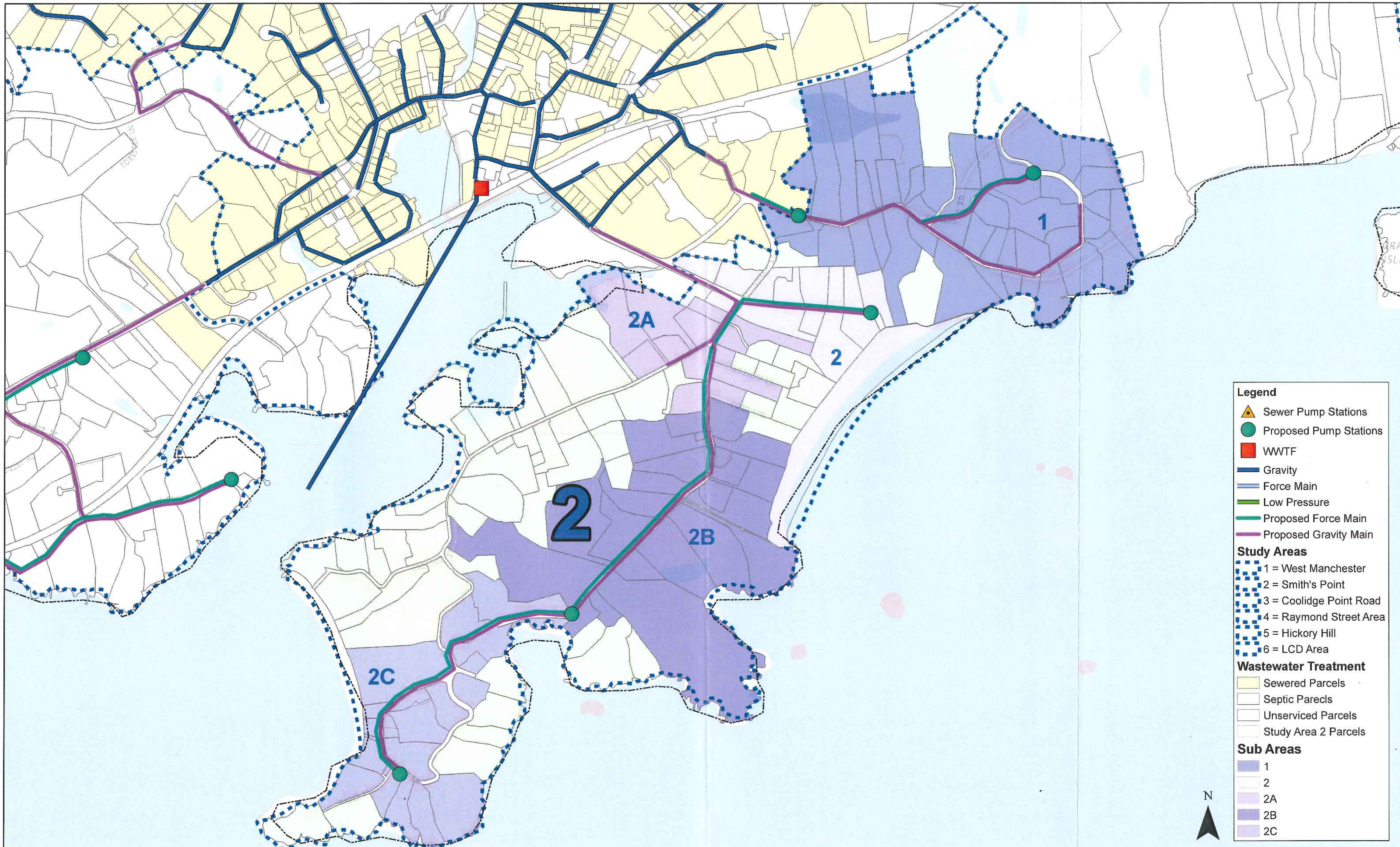


Manchester-by-the-Sea

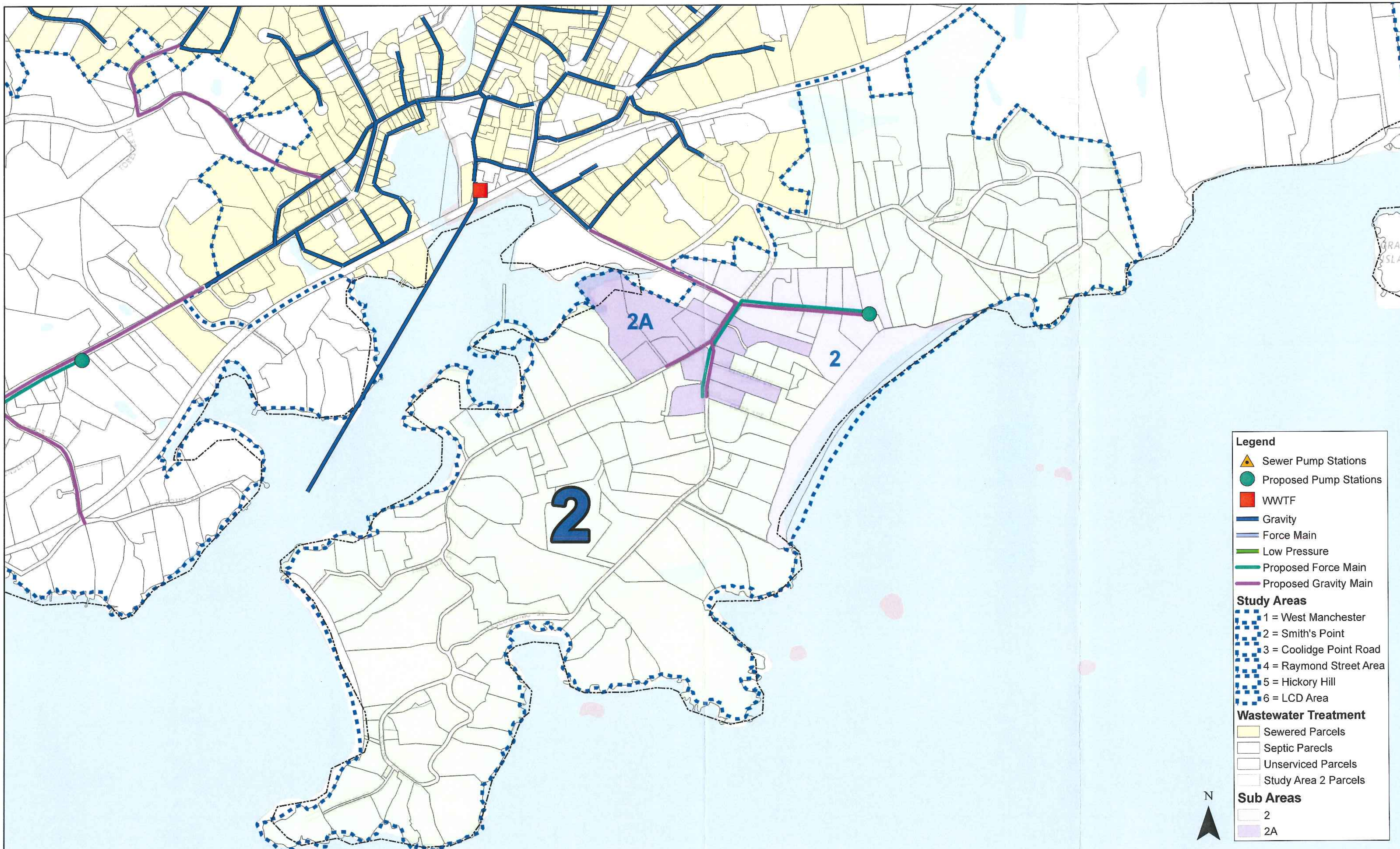
August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS

0 0.2 0.4 Miles

Study Area 2 Sewer Expansions

Figure VII-6

CDR MAGUIRE



Manchester-by-the-Sea

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS

0 0.2 0.4 Miles

Study Area 2 Sewer Extensions

Figure VII-7

CDR MAGUIRE

Coolidge Point Road

On-Site Systems

Table VII-7 presents a summary of the lots in the Coolidge Point study area. More than 2/3 of the lots in the Coolidge Point area are greater than 1 acre in size. The Coolidge Point area has had some recent repairs or replacements (14%) but the majority of those were on lots larger than 1 acre in size. When discounting those lots that have already been repaired or replaced, there are only 43 lots of concern, which is almost 30% of all the lots in the area.

Table VII-7. Study Area 3 - Coolidge Point Road					
Total Lots	**Total Area Lots**	**Repaired Lots**	**Replaced Lots**	**Failed Lots**	**Remaining Lots of Concern**
< 1/4 Acre	5	0	1	0	4
1/4 to 1/2 Acre	11	0	1	0	10
1/2 to 1 Acre	33	2	2	0	29
Total	**49**	**2**	**4**	**0**	**43**
% of Total	**32.5%**	**12.2%**		**0.0%**	**87.8%**
Total Lots	**Total Area Lots**	**Repaired Lots**	**Replaced Lots**	**Failed Lots**	**Remaining Lots of Concern**
>1 acre	102	4	11	0	0
Total*	**151**	**6**	**15**	**0**	**43**
	% of Total	**13.9%**		**0.0%**	**28.5%**

*Total is representative of lots of all sizes in area

Communal Treatment Systems with Subsurface Disposal

A preliminary review of the property in the Coolidge Point area did not identify any lots with the available land area with suitable soils and water table conditions to support a communal treatment and subsurface disposal system. For this reason, this alternative was eliminated for this area.

Raymond Street Area

On-Site Systems

Of all of the study areas, the Raymond Street area has the greatest percentage of lots of concern. Almost 80% of the area consists of lots less than 1 acre in size, with the majority of those being less than ¼ acre in size which makes repair or replacement of failed systems a difficult task, more than likely requiring an I/A system. In total there are 78 lots of concern still remaining in the Raymond Street area which represents almost 70% of all the lots in the area. Table VII-8 presents a summary of the lots in the Raymond Street study area.

Table VII-8. Study Area 4 - Raymond Street Area					
Total Lots	**Total Area Lots**	**Repaired Lots**	**Replaced Lots**	**Failed Lots**	**Remaining Lots of Concern**
< 1/4 Acre	55	0	6	0	49
1/4 to 1/2 Acre	22	1	0	0	21
1/2 to 1 Acre	11	0	3	0	8
Total	**88**	**1**	**9**	**0**	**78**
% of Total	**77.2%**	**11.4%**		**0.0%**	**88.6%**
Total Lots	**Total Area Lots**	**Repaired Lots**	**Replaced Lots**	**Failed Lots**	**Remaining Lots of Concern**
>1 acre	26	2	1	1	0
Total*	**114**	**3**	**10**	**1**	**78**
	% of Total	**11.4%**		**0.9%**	**68.4%**

*Total is representative of lots of all sizes in area

Communal Treatment Systems with Subsurface Disposal

A preliminary review identified two sites with potential for use for siting a communal treatment and disposal system. Those properties are listed below.

Tax Parcel ID	Total Acres	Zoning
1 0 38	2.183	Single Residence B
1 0 59	1.35	General District

The first property, privately owned, was found to be very wet with ponding on a majority of the land at the time of preliminary investigations. The second property, owned by the Town of Manchester-by-the-Sea is a community park which is known to have high groundwater and rocky soils. Neither property was considered viable for use of a communal treatment and disposal site.

Another option available in developing communal systems is to build decentralized neighborhood community systems. In this alternative the town would facilitate neighborhood communal systems in the Raymond Street area that they can monitor, operate and maintain. This would allow for higher wastewater treatment as well as better water quality because the town would be able to properly maintain the systems. It would also be necessary for the town to implement an organized program with intensive investigations of all areas to determine where such communal systems could be placed based on the size of area needed, soil and groundwater conditions, and the costs associated. The town would also be responsible in determining any easements, agreements, and all legal matters concerning the sharing of the communal system.

To pursue this option there must be enough property owners willing to have interest and come to an agreement on terms involved in the sharing of the system. Additionally, the soils and water table conditions found in Manchester may make neighborhood communal systems a challenging task if the town decides to go this route. However, it may be an environmentally beneficial approach to solving the wastewater needs of the area.

There have been on-going local community efforts to build a decentralized neighborhood scale septic system in the Raymond Street area, specifically on Raymond Street and Sandpiper Lane. A group of neighbors have funded a feasibility study and are currently pursuing the possibility of establishing the project. The communal system would be located on the private property of one of the neighbors involved and could serve approximately 17 to 36 bedrooms in the vicinity of the system, with the potential to be taken over by the town for operation and maintenance. The feasibility of the decentralized system for the most part has been established, however the project has many obstacles and a lack of funding inhibiting its progress. If the Raymond Street area remains with on-site wastewater management, the town should consider taking over the responsibilities of operating and maintaining the system for this local communal system to succeed.

Reports and documents of the proposed decentralized neighborhood wastewater treatment system are included in Appendix L.

A large scale solution to be considered for a communal system in the Raymond Street Area would entail treating the entire area of Magnolia Beach in conjunction with the City of Gloucester. After discussions with MassDEP it was determined that a joint system with Gloucester may not be feasible at this time as Gloucester is not currently pursuing wastewater management solutions in this area, however this option would prove beneficial and may be a viable solution in the future.

The Raymond Street portion of Manchester is bordering the Magnolia area in the City of Gloucester and the make-up of both areas is very comparable. The areas of concern are a significant distance from any sewer collection systems for both the Manchester and Gloucester portions. Connecting into sewer would not be the ideal solution for either and would be a considerable cost investment.

Within the Magnolia area, the Raymond Street Area (Study Area 4) consists of 114 lots (19%) versus the 489 (81%) lots estimated to be in Gloucester. The estimated areas of concern that make up the entire Magnolia Beach area can be viewed in Figure VII-9. After removing the lots that have recently been replaced or repaired, the Raymond Street area has approximately 85 parcels to be considered for a communal system. Addressing the issues of such a small portion of Manchester compared to the total problem area would prove to be much more costly than pursuing a joint cost effective solution with Gloucester. Additionally, there may be potential sites containing suitable soil with the ability to support a communal wastewater disposal system in Gloucester. As mentioned earlier there are very few possible communal sites in the Raymond Street area.

Initial cost calculations for a communal system with Gloucester, included in Appendix I, reveal the cost/lot for the Raymond Street area average from $29,390 to $35,268, which is significantly less than other options for the Magnolia Area. These calculations are very preliminary and do not take into account the actual costs that may be associated with the Gloucester side.

19% of the total cost for the transmission and treatment was considered for the Manchester portion, with transmission being assumed as 5 miles into Gloucester. The cost per lot was finally determined as the sum of the collection cost of Raymond Street and the associated transmission and treatment costs.

If there is not a need for alternative wastewater management solutions for the Raymond Street area in the near future, discussions should be further pursued to conclude if a joint communal system would be a feasible solution to serve the wastewater needs of the Magnolia Beach area in both Manchester and Gloucester.

Hickory Hill

On-Site Systems

The Hickory Hill area is another area where a significant portion of smaller lots. Approximately 50% of the lots in the area are less than 1 acre in size. The area is characterized by steep slopes further diminishing the ability of the lots to support conventional Title 5 systems. There are 37 remaining lots of concern in the Hickory Hill area, which is almost 40% of the total lots in the area, ranking second only to the Raymond Street area as the highest percentage of lots of concern. Table VII-9 presents a summary of the lots in the Hickory Hill study area.

Table VII-9. Study Area 5 - Hickory Hill					
Total Lots	Total Area Lots	Repaired Lots	Replaced Lots	Failed Lots	Remaining Lots of Concern
< 1/4 Acre	9	1	1	0	7
1/4 to 1/2 Acre	5	1	0	0	4
1/2 to 1 Acre	35	3	6	2	26
Total	**49**	**5**	**7**	**2**	**37**
% of Total	**50.0%**	**24.5%**		**4.1%**	**75.5%**
Total Lots	**Total Area Lots**	**Repaired Lots**	**Replaced Lots**	**Failed Lots**	**Remaining Lots of Concern**
>1 acre	49	3	5	0	0
Total*	**98**	**8**	**12**	**2**	**37**
	% of Total	**20.4%**		**2.0%**	**37.8%**

*Total is representative of lots of all sizes in area

Communal Treatment Systems with Subsurface Disposal

After investigating potential vacant lots, it was determined that there were no lots in the area with suitable conditions to support a communal system for the area present. All potential sites were found to be either conservation areas or to have inadequate area with suitable soils or water table conditions. For these reasons, this alternative was eliminated.

Sewer Expansion Study Areas 3, 4, and 5

As previously indicated, the development of a conceptual sewer expansion plan was done concurrently for the Study Areas 3, 4, and 5. This expansion plan is shown in Figure VII-10. The sewer expansion plan extends sewers to all lots of concern in the area.

Because of the large number of lots in the Raymond Street area that would be serviced by this sewer expansion plan, the costs per lot served, although slightly higher than on-site systems (I/A) are generally comparable. On an individual study area basis, the Raymond Street area has the lowest estimated cost per lot served and is considered to be cost comparable to I/A systems. This is particularly true when looking at just expanding sewers to the Raymond Street area in conjunction with picking up any other lots along the main sewer trunkline on Summer Street. The overall sewer expansion plan for servicing the entire 3, 4, and 5 study areas would service approximately 155 lots and would add 32,550 gpd to the WWTF. Table VII-10 presents a summary comparison of costs for the areas. A summary of the lots serviced by area, estimated flows and cost per lot served is summarized in Table VII-11.

Table VII-10. Study Areas 3, 4, & 5 – Cost Comparisons							
Alternative	Cost/Lot	Cost/Lot	# Lots				Estimated Flow*
	Low	High	<1/2 acre	1/2 - 1 acre	>1acre	Total	
On-Site Conventional	$20,000	$30,000	95	76	151	322	67,620
I/A	$35,000	$45,000					
Sewer Expansion[1] (Entire Area)	$54,000	$71,000	43	60	64	155	32,550
Sewer Extensions[2]							
Summer St./Raymond st./Butler Rd.	$49,000	$64,000	34	26	28	93	19,530

(1) Sewer Expansion Plan based on Conceptual Sewer Maps

(2) Sewer Extensions based on Top Cost Comparable Extensions Figure VII-11

Table VII-11. Sewer Expansion Summary Areas 3, 4, and 5			
Study Area	**Lots Served ***	**Estimated Flow (gpd)**	**Estimated Cost per Lot**
Study Areas 3, 4, & 5	155	32,550	$52,000 - $68,000
Study Area 3 (Coolidge Point)	82	17,220	$65,000 - $85,000
Study Area 4 (Raymond Street)	93	19,530	$47,000 - $61,000
Study Area 5 (Hickory Hill)	35	7,350	$72,000 - $94,000

* Lots Served are not additive as the lot count for an individual area includes lots that in other areas that are along sewer extension route.

A detailed analysis of various sewer extension options for the 3, 4, and 5 study area was conducted. A complete matrix of those options is presented in Appendix I. Based on the more detailed analysis, there were not any specific sewer extensions that had a lower cost per lot served than the Raymond Street sewer expansion plan or than the sewer expansion plan for the combined study area 3, 4, and 5. Should the town proceed with extending sewers to the Raymond Street area down Route 127 (Summer St.), one or more of the individual sewer extension options may become cost comparable in the future when considering only the cost to extend sewers from the main trunkline sewer to the area in question (See Figure VII-11).

<u>Limited Commercial District Area</u>

On-Lot Innovative Alternative/Conventional Title 5 Systems

This area consists mainly of adequate lot sizes to maintain on-site systems. Remaining with on-site systems however will inhibit growth and development in the area which has possible planned future development in the town.

Communal Treatment System

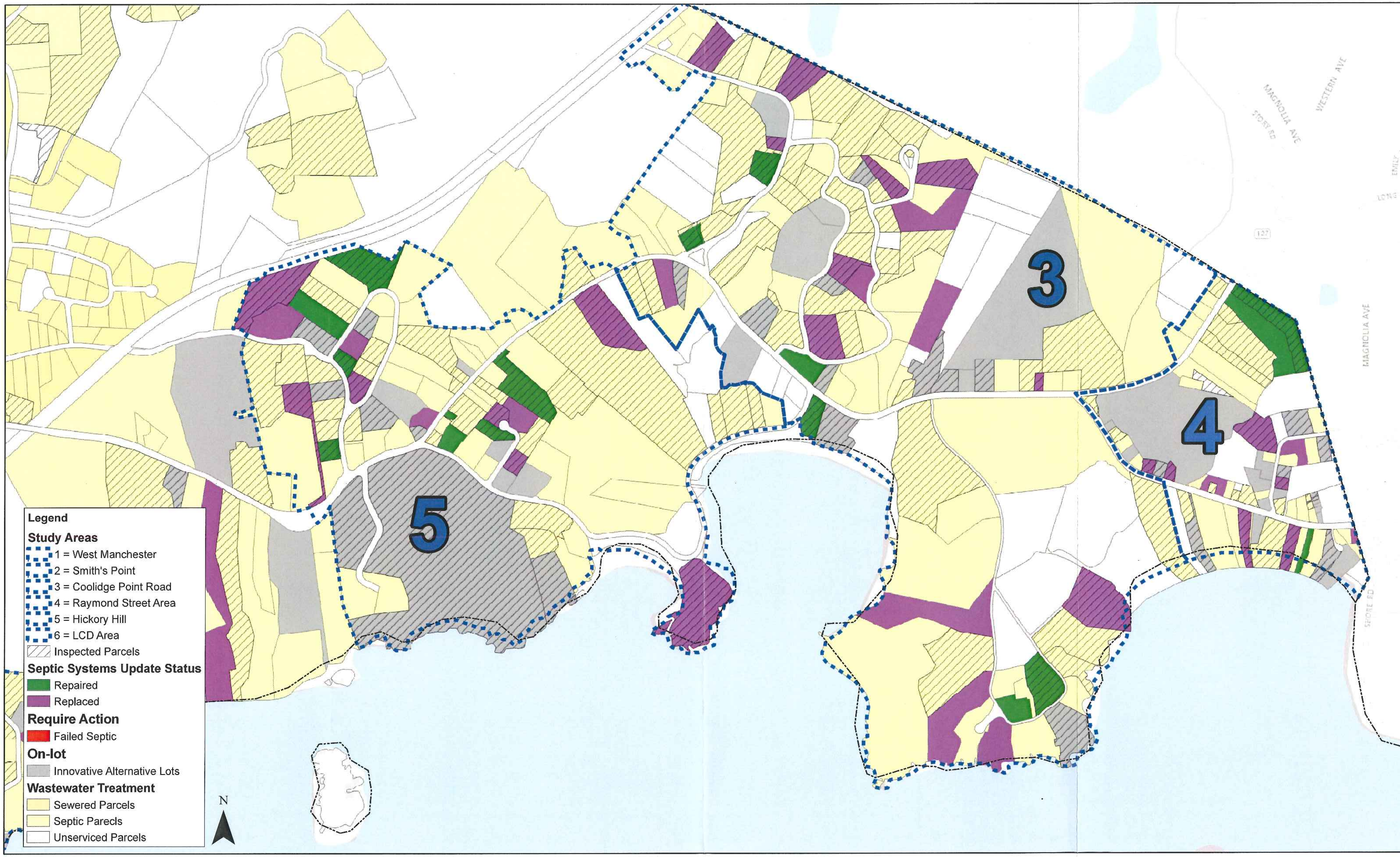
Wastewater would be conveyed to a community treatment and subsurface disposal facility located in the vicinity of the Limited Commercial District Area (LCD Area) and serving only the study area. Preliminary analysis shows one prospective site that may have a suitable area large enough for a communal system.

The property, privately owned, seemed to have potential from initial investigations. According to a Town Board of Health representative the soils in the area have revealed to be very poorly drained with ledge throughout, as much of the town is. Further investigation of the site would need to be completed to determine if the site has a large enough area of suitable soil to accommodate expected flows from the LCD Area.

Tax Parcel ID	Total Acres	Zoning
43 0 18	23.72	Limited Commercial District

Sewer Expansion

This alternative would require constructing sewers across route 128 to convey wastewater from the LCD to the Town of Manchester-by-the-Sea's collection system at the upper end of School Street. Connecting to public sewer would create opportunity for growth in the potential LCD development. The estimated maximum potential flow that may be expected from the entire LCD area based on available land acreage is approximately 62,000 gpd. For purpose of this study it is assumed that if town planning moves toward developing this area, only about 50% of the LCD Area would be developed during the 20-year planning period of the CWMP. Costs for extending sewers to the LCD Area are estimated to be $1.3 to $2.3 million.



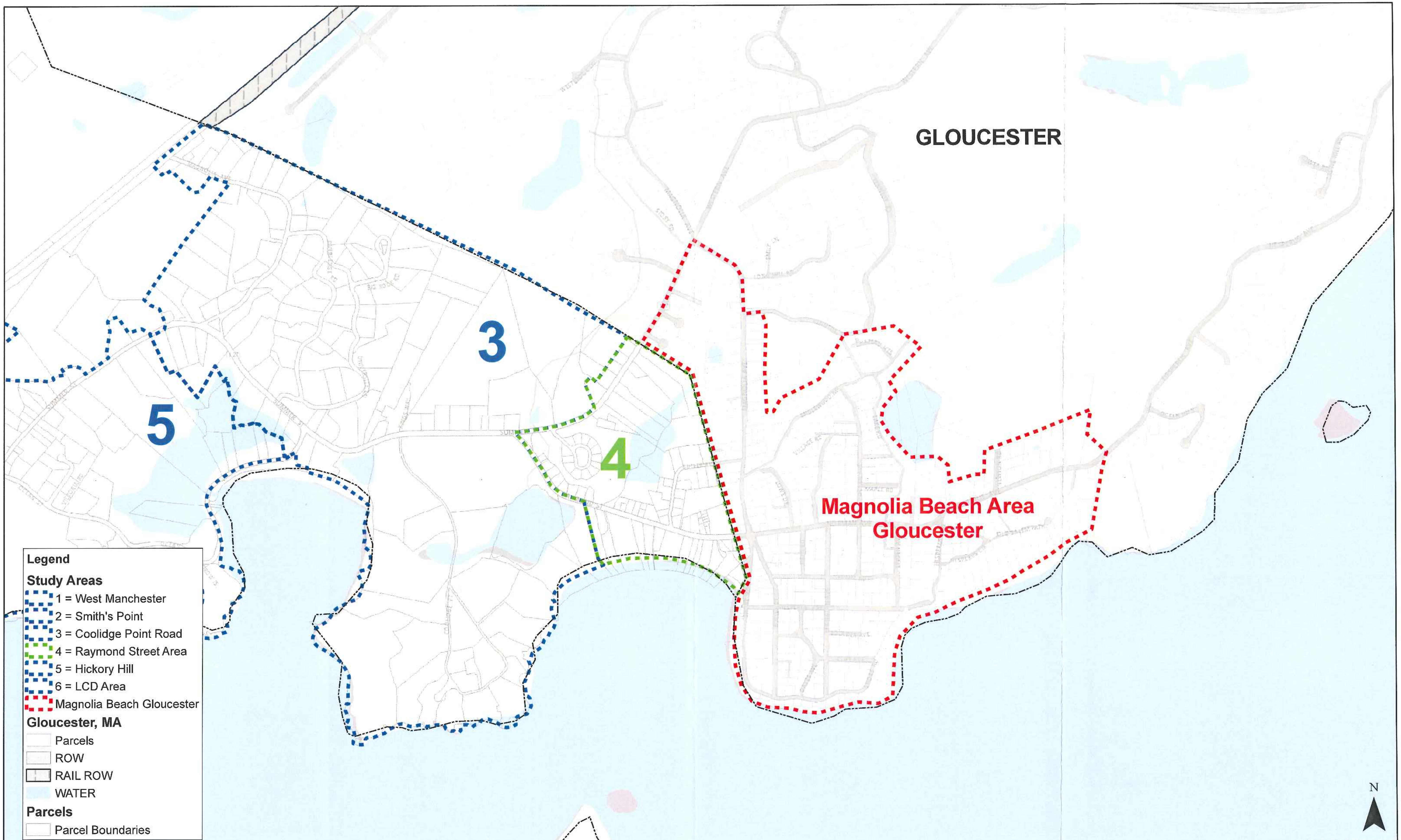
Manchester-by-the-Sea

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS, Board of Health

0 0.2 0.4 Miles

Study Areas 3, 4, & 5 Lots of Concern

Figure VII-8



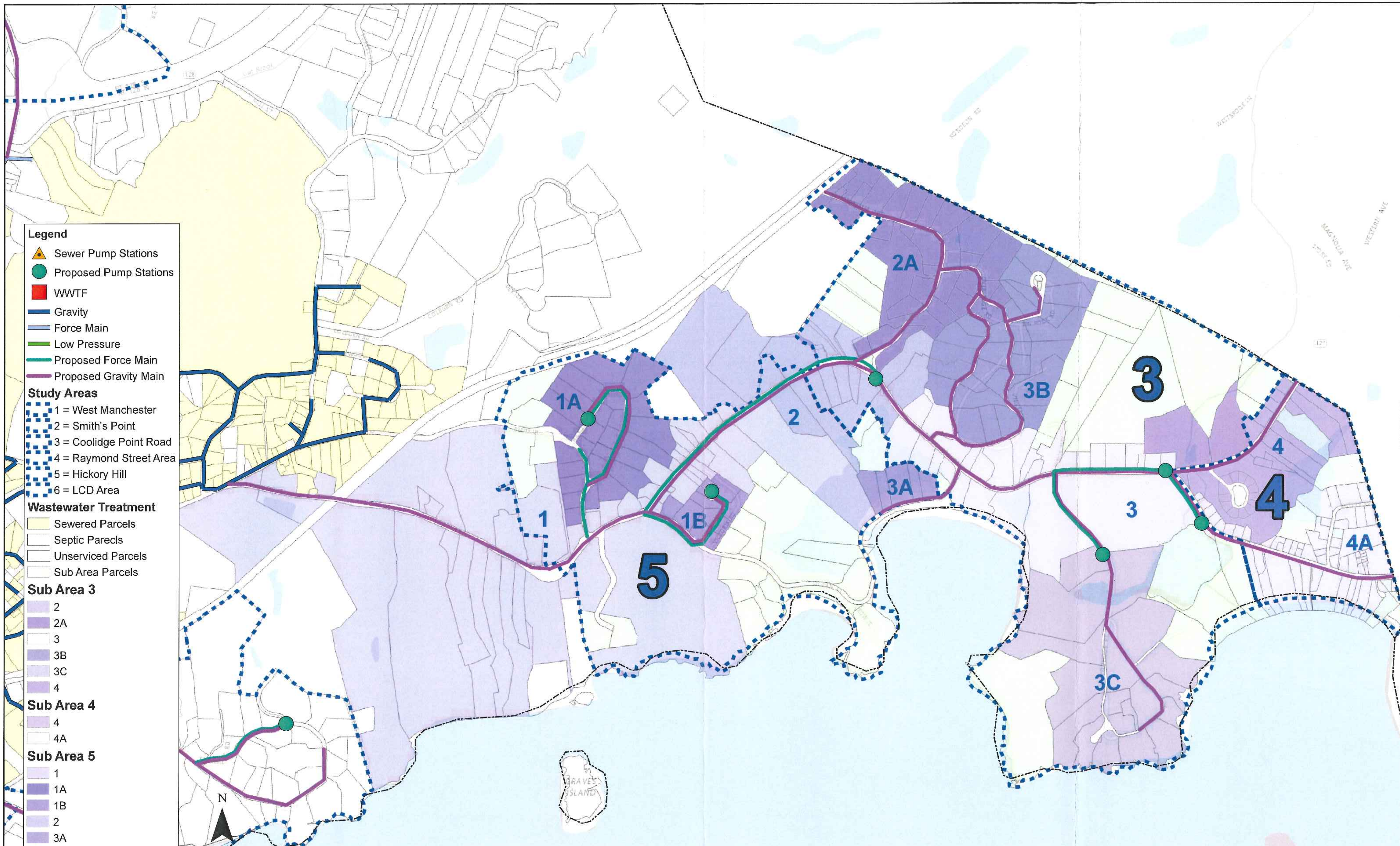
Manchester-by-the-Sea

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS

Magnolia Beach Area

Figure VII-9

CDR Maguire



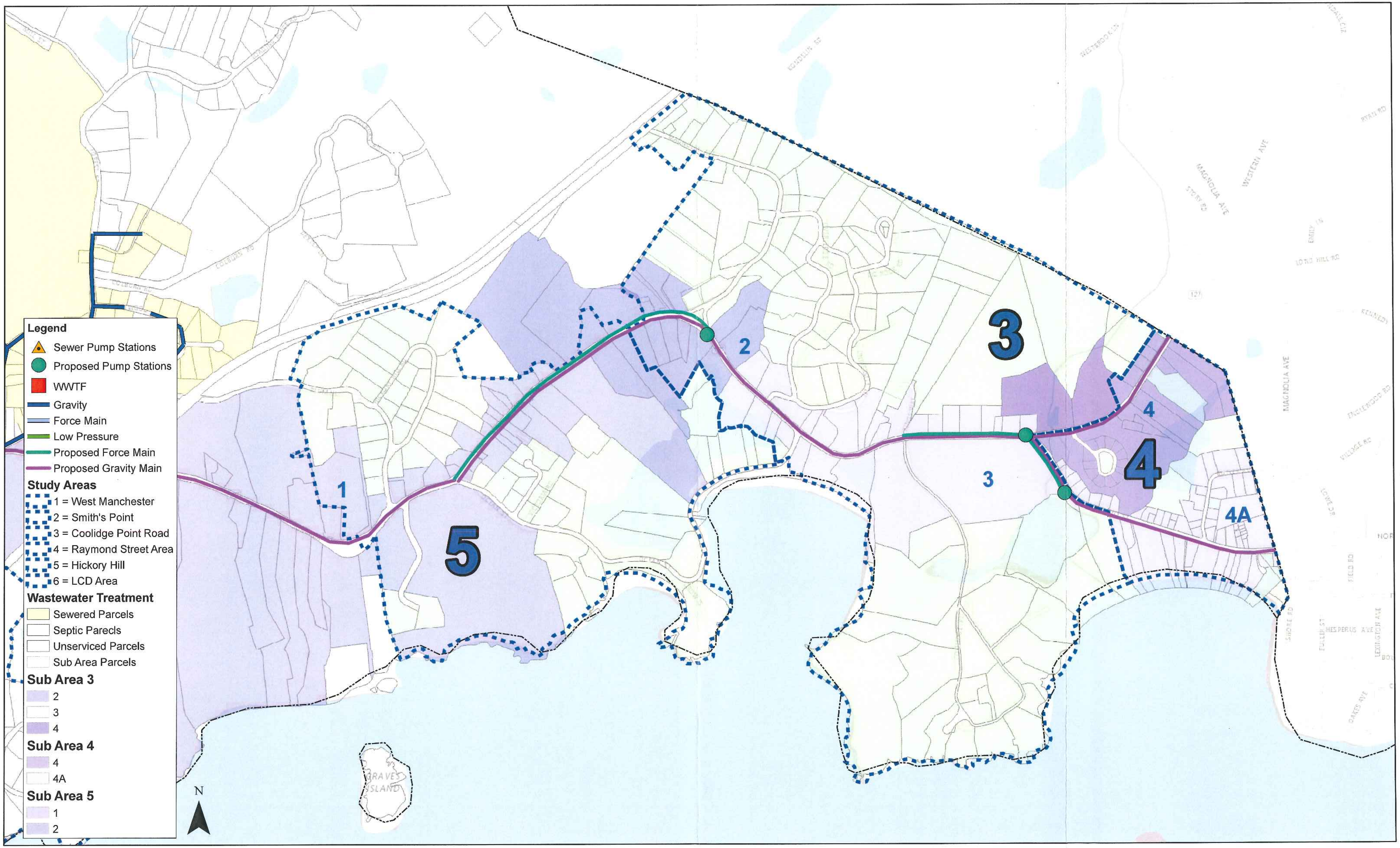
Manchester-by-the-Sea

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS

Study Areas 3, 4, & 5 Sewer Expansions

Figure VII-10

CDR Maguire



Manchester-by-the-Sea

August 2016 Data Sources: Town of Manchester-by-the-Sea, MassGIS

0 0.25 0.5 Miles

Study Areas 3, 4, & 5 Sewer Extensions

Figure VII-11

CDR MAGUIRE

VII-6 ENVIRONMENTAL ASSESSMENTS

An Environmental Assessment of the various elements of the recommended plan outlining the comparative environmental impacts of the proposed solutions is summarized in Table VII-12 and discussed in more detail below.

Table VII-12. Environmental Assessment of Alternatives			
Alternative	**Pros**	**Cons**	**Assessment**
On-Site Systems	➢Recharges groundwater locally	➢Possibility of failing systems and improper O&M could result in local water quality issues ➢Dependant on homeowner care ➢Town Wastewater Management Program for monitoring & maintenance advised	Can manage potential water quality impacts with stringent OSWMP implemented by the town.
Communal Treatment Systems	➢Recharges groundwater locally ➢Town has ability to monitor, maintain and operate	➢Possibility of failing systems and improper O&M could result in local water quality issues	Likely better managed systems and less potential for water quality issues than on-site systems.
Sewer Expansion/Extension to Manchester WWTF	➢Well monitored and maintained at treatment facility ➢High degree of treatment ➢Improves long-term water quality	➢Water "lost" in discharge to ocean. ➢Potential for unwanted growth that could have negative impacts on the community. ➢Temporary impacts due to construction activities (noise, traffic, etc.).	Least likely impact on water quality as all flows are treated. Negatively impacts quantity of water recharged to aquifer.

On-site and Communal Systems

An abundance of failing on-site systems can cause local water quality issues (i.e. beach closures etc.) in an area and negatively impact the quality of life. Properly maintained individual on-site systems should not negatively impact local water quality. Innovative/Alternative (I/A) on-site systems typically provide a higher level of treatment before discharged. I/A systems also require frequent monitoring and reporting which significantly reduces the potential for systems failing and resulting in water quality issues. An OSWMP can be made sufficiently stringent to ensure proper monitoring and maintenance of on-site system high water quality management.

Communal treatment systems generally provide a higher level of treatment versus individual on-site systems. The water quality is generally better due to the fact that the town has the ability to monitor, operate, and maintain the system rather than depending on homeowners to properly care for their systems.

One positive environmental benefit for both on-site and communal system alternatives is that these systems are not connected to a centralized wastewater treatment facility which in turn keeps the water in the town local. Discharge from on-site and communal systems is recharged to the ground and underlying groundwater aquifers. By using on-site systems, the groundwater stays within the community which is environmentally beneficial.

Sewer Expansion to Manchester WWTF

Extending sewers to needs areas will provide for the best treatment of the wastewater with minimal risk to water quality presuming that the additional flows do not exceed the treatment capacity of the plant and the plant operates in conformance with its NPDES discharge permit. Regulated wastewater treatment facilities are well monitored, maintained and operated and can provide the highest level of wastewater treatment. However, wastewater that is treated at a facility is ultimately pumped out of the town and not recharged back into the local water aquifers.

MEPA Thresholds

After an examination of MEPA review thresholds, there does not seem to be any aspects of the CWMP or its recommended alternatives that would require filing an ENF or EIR.

Section VIII. Recommended Plan

VIII-1 INTRODUCTION/OVERVIEW

This section presents a summary of the recommended long-term Comprehensive Wastewater Management Plan (CWMP) for the Town of Manchester-by-the-Sea (MBTS). Previous sections of this report present the existing and future conditions, wastewater management needs, and the alternative solutions that were developed and evaluated which form the basis of this Recommended Plan. A brief itemization of some of the more pertinent issues that were developed is repeated here.

EXISTING CONDITIONS and NEEDS

- The existing wastewater collection system area comprises approximately 50% of the lots in town currently serving approximately 1200 parcels. Approximately 700 lots utilize on-site systems for wastewater disposal, while the remaining parcels (approximately 500) are undeveloped at this time.
- The town is generally characterized by poor soil and environmental conditions for on-site systems. Several areas within the town have a history of on-site system failures.
- The town has a proven record of identifying and addressing water quality issues that may be attributable to on-site system failures.
- The town has proven record of successful installation, repair or replacement of on-site systems. I/A systems have been utilized when and where conventional systems would not be sufficient.
- The town is under a sewer moratorium preventing any additional sewer extensions until I/I issues in the system are addressed and peak flows are demonstrated to consistently meet permitted flow limits.
- The Ocean Sanctuaries Act (OSA) limits the viability of increasing the capacity of the existing wastewater treatment plant. A review of the plant flows over the past several years indicates that there is available capacity at the plant for expanding the sewer service area in town.

FUTURE CONDITIONS

- The town is not anticipated to grow significantly over the 20-year planning period. Population projections indicate that the town population will stay relatively stagnant through the year 2035.
- Undeveloped areas in town are zoned for large lots which should easily be support on-site systems for their wastewater needs.
- Town Planning has identified a possible area within the town for commercial development that is outside the current sewer service. It may be beneficial to extend sewer service to this area to support any possible commercial development if the town does in fact include this in their future plans. Capacity should be reserved at the wastewater treatment plant in the event that the development is pursued in the future.

ALTERNATIVE SOLUTIONS

- Given the town's history with on-site system repairs and replacement and installation of I/A systems where needed, continued reliance on on-site systems in unsewered areas is a viable long-term solution for most of the needs areas.
- Several of the needs areas have had a significant number of successful on-site repairs and replacement over the past 10-15 years, reducing the future wastewater management needs of the area and increasing the cost/lot served by a sewer expansion plan for the area. Sewer expansion that services an entire needs area is generally considered to have greater costs/lot served when compared to either conventional on-site or I/A wastewater management systems.
- The town has concerns that significant sewer expansion and/or extensions may encourage future growth greater than planned by increasing the number of lots that might be developable in the future and therefore has a preference to continue with reliance on on-site systems.
- The greatest wastewater management need is in the Raymond Street area due to the preponderance of smaller sized lots (less than ½ acre). This area is also the furthest from the existing sewer service area. The Raymond Street area is contiguous with the Magnolia area in the Town of Gloucester which is similar in make-up to the Raymond Street area with 4 to 5 times the number of lots.

VIII-2 PLAN OVERVIEW

In general, the town would prefer not to significantly expand the sewer collection system as concerns of significant expansion of the collection system could lead to growth that alters the character of the town. Further, the OSA will make it difficult to permit any increase in the discharge capacity of the wastewater treatment plant to accommodate a significant expansion of the existing wastewater collection system. Therefore, the long-term Recommended Plan for the town is for the most part to continue to rely on on-site systems in all areas of town that are currently outside of the existing sewer collection system for wastewater disposal.

The Town Board of Health currently does an excellent job of documenting and monitoring the on-site systems in town and aggressively investigating any water quality issues that might be attributable to poorly performing on-site systems. The town should consider development and adoption of enhancements to the current wastewater management plan which is currently in use by the Board of Health.

The town should consider some limited sewer extensions into currently unsewered areas of town. The Town should first put aside capacity for any possible necessary future extensions based on need in the town. With the remaining capacity available, sewer extensions should be considered where those extensions may be cost-beneficial on a lot-served basis, or serve other needs of the town, i.e. municipal facilities or for planned industrial/commercial growth. Sewer extensions can be considered as long as wastewater flows from the sewer extensions do not exceed available capacity of the wastewater treatment plant. As the town is currently operating under a sewer moratorium due to excessive I/I flows in the collection system, any extension of sewers within the town can only be considered with a demonstrated I/I removal program that will ensure that flows discharged from the treatment plant do not exceed current permit limits.

In determining capacity available for the addition of minor sewer extensions proposed, the town should first put aside capacity for the potential sewer expansion to the Raymond Street Area and extension to the LCD Area. The Raymond Street Area (Area 4) has the highest wastewater management need based on history of issues and size of lots. If all alternatives fail to solve the wastewater management issues in the Raymond Street Area, it will be necessary for the town to expand sewers to that area. Additionally, it is desirable to reserve capacity for the town to extend sewers to the LCD Area (Area 6) in the event that the area is developed for commercial purpose as part of the town's master planning.

An outline of the Recommended Plan by needs area is presented in Table VIII-1 below.

Table VIII-1. Recommended Plan		
Study Area	**Preferred/Primary**	**Alternative/Secondary**
Study Area 1 West Manchester	On-Site Wastewater Management with Limited Sewer Extensions	-
Study Area 2 Smith's Point	On-Site Wastewater Management with Limited Sewer Extensions	-
Study Area 3 Coolidge Point Road	On-Site Wastewater Management	-
Study Area 4 Raymond Street	On-Site Wastewater Management *	Sewer Expansion
Study Area 5 Hickory Hill	On-Site Wastewater Management	-
Study Area 6 LCD Area	Sewer Expansion	On-Site Wastewater Management

* The town should consider small neighborhood communal systems or a more expansive communal system with Gloucester should that opportunity arise.

The final element of the Recommended Plan proposes capital improvements to existing wastewater collection system needed to ensure that the wastewater system continues to provide proper treatment to collected wastewater over the 20-year planning period of the this CWMP. These improvements include:

- Sewer repair and rehabilitation necessary to reduce extraneous I/I flows in the system.
- Pump Station improvements including addition of emergency generators.
- Wastewater treatment plant improvements.

A more detailed discussion of the various elements of the Recommended Plan is provided in the following sections.

VIII-3 ON-SITE SEWAGE MANAGEMENT AREAS

The primary element of the Recommended Plan is for the town to continue the practice of using on-lot systems to meet the wastewater disposal needs of all of the areas in town outside of the current sewer collection area. These areas include West Manchester, Smith's Point, Coolidge Point Road, Raymond Street Area, and Hickory Hill.

Inspections, maintenance, repairs and replacement of these systems will be performed as required to comply with existing regulations. It is recommended that the town should formally adopt enhancements to the On-Site Wastewater Management Program (OSWMP) currently used for regulating the use, inspection, maintenance and rehabilitation of all on-lot wastewater systems relying on subsurface disposal to safeguard against system malfunctions that could result in groundwater pollution, water quality issues and public health hazards.

The OSWMP should include some or all of the following elements:

- Outline guidelines for the approval of site evaluators, system designers, installers, inspectors, and service providers
- Define specific design, performance, and treatment standards
- Establish schedules for routine system inspection and servicing based on system size and components
- Describe administrative protocols for design, construction, inspection, monitoring, and servicing of systems
- Establish and maintain a thorough database of records for systems throughout the town
- Describe actions to be taken by the town in the event of noncompliance
- Guide homeowners through the acquisition of financial assistance to fund critical system repairs, upgrades, or replacement

A draft sample of a suggested enhanced OSWMP is provided in Appendix J

VIII-4 COMMUNAL SYSTEMS

There is limited potential for the development of communal systems in any of the needs areas. The town as a whole has very poor soils, high groundwater, ledge, and minimal pockets of suitable material that could potentially be used for a large scale groundwater wastewater disposal site. If pursued, extensive investigation and testing would need to be performed to find suitable lots with large enough area to handle a communal wastewater disposal system. A preliminary screening of potential communal disposal sites did not identify any sites that would ideally meet the necessary conditions needed for this purpose. The greatest need for a communal system as a wastewater solution is in the Raymond Street area, but even in that location, sites for a possible communal treatment system are limited.

Although potential communal sites that could serve the entire Raymond Street area are limited, there are a couple of options that may make a communal treatment system viable for the Raymond Street area. The best solution for developing a communal wastewater disposal system for the Raymond Street area would be if the town could work in conjunction with the City of Gloucester to develop a communal wastewater disposal system for the entire Magnolia area. This solution is likely to be the most cost effective and environmentally beneficial solution for the entire area. However, Gloucester has no plans to develop wastewater solutions for the Magnolia area in the immediate or near future so this option is not considered to be feasible at this time.

A more likely communal system option for the Raymond Street area that could be implemented in the near term would be a series of small decentralized neighborhood systems connecting several homes at a time to a small treatment and disposal system. A series of small communal systems in the Raymond Street area would provide for higher quality treatment of wastewater in the area then the continued reliance on individual system even with a significant increase in the use of I/A systems. While this is a viable and cost comparable option, it may prove to be difficult to implement due to the lack of suitable sites needed to construct such systems as well as the willingness and commitments necessary for homeowners in sharing a joint system. This option would also require the town to take a lead role in developing an overall communal solution for the area including implementing a program with intensive investigations and analysis to determine locations for proposed communal treatment and disposal systems. The town would also need to address potential legal issues concerning the sharing of the communal systems including determining need for any easements, agreements, and all as well as take responsibility for monitoring, operating and maintaining the systems. All of these issues would need to be overcome before a communal system for the Raymond Street area becomes feasible.

Should wastewater issues in the Raymond Street area persist, that is the use of I/A systems fail to solve wastewater issues or the hurdles to implement small communal systems become too difficult to implement, then the town should further pursue a communal system solution for the entire Magnolia area with the City of Gloucester. If at that time, Gloucester still is not prepared to work with the town toward a joint solution, the town would then need to consider sewer expansion to the Raymond Street area. Until a satisfactory long-term solution is developed for the Raymond Street area, the town should continue to reserve capacity at the wastewater treatment plant for this possibility.

VIII-5 LIMITED SEWER EXTENSIONS

It is recommended that limited sewer extensions be considered for portions of West Manchester (Study Area 1), and Smith's Point (Study Area 2). The following sewer extensions have been identified as potentially being cost comparable with the installation of I/A on-lot systems and depending upon the actual number of lots that may be served by the extension, cost-beneficial when compared to I/A systems. Estimated flows that would be added to the system from these sewer extensions are well within available capacity of the existing wastewater plant.

The favorable extensions have been determined to be the following:

Study Area	Extension	Estimated Flow (gpd) (1)	Maximum Est Flow (gpd) (2)
West Manchester	Forster Rd & Wood Crest Rd	2,100	3,360
Smith's Point	Beach St, Masconomo St & Proctor St	3,990	6,930

(1) Estimated flow based on serving all lots less than ½ acre and 50% of lots greater than ½ acre.
(2) Maximum estimated flow based on serving all lots along the sewer extension.

It is the town's preference for the Raymond Street (Study Area 4) to remain on on-lot systems than to extend sewers to that area. However, the Raymond Street area has the greatest percentage of smaller sized lots (less than ½ acre) which makes a long-term wastewater management with on-site systems more of a challenge than other areas. Any repair or replacements of systems that fail in the future will likely require an I/A system rather than a convention system repair or replacement. As noted above, a communal system for the entire Magnolia Beach area in conjunction with the City of Gloucester may be the most desirable long-term and cost-effective wastewater solution for the Raymond Street area if it becomes possible in the future. It is recommended that the town pursue this as a possible alternative wastewater plan for this area if wastewater issues continue at that time.

However, if the waste management issues worsen and the option for a communal based system with Gloucester or local community based systems prove infeasible or too difficult to implement, extension of sewers to the Raymond Street area should be considered by the town. The maximum estimated flows from the Raymond Street area would be approximately 24,000 gpd. This capacity should be reserved at the wastewater treatment plant in the event that all other treatment options are exhausted and the extension is deemed necessary.

Study Area	Extension	Estimated Flow (gpd)	Maximum Est Flow (gpd)
Raymond Street Area	Summer St, Raymond St & Butler Ave	19,530	35,070

Finally, the Recommended Plan for the town's Limited Commercial District (Area 6), if the town decides to develop the area in the future, is to extend sewers to this area. Maximum estimated wastewater flow from this area is estimated at 60,000 gpd at full build-out. During the 20 year planning period of the CWMP, it is estimated that, if developed, 50% of the full build-out flows could potentially occur which would add approximately 31,000 gpd to the sewer collection system. This capacity should also be reserved by the town at the wastewater plant, to be available if development is pursued.

SEWER EXTENSIONS, SEWER MORATORIUM, and the OCEAN SANCTUARY ACT

The Town of Manchester-by-the-Sea (MBTS) is currently prohibited from extending sewers beyond those areas currently served by the collection system. Although the town was released from the 1992 ACO which prohibited sewer extensions, the release was conditional on addressing I/I issues within the system to ensure compliance with the town's NPDES permit. More recent correspondence from MADEP indicates that releasing the town from the sewer moratorium would be considered upon completion of this CWMP, presuming that the CWMP would demonstrate the need for the sewer extensions and the availability of plant capacity.

Further, the OSA limits any increase in the NPDES permitted flow from the town's wastewater plant. Therefore it must be demonstrated that any proposed sewer extensions will not cause an increase in flows discharged from the plant in violation of the permitted flow capacity. It is anticipated that MassDEP would expect that the town's I/I removal program has demonstrated that I/I issues have been or will be sufficiently addressed so that peak flows at the plant do not and will not exceed the NPDES permitted discharge flows even with the additional wastewater flows that would come from the proposed sewer extensions.

Table VIII-2. Wastewater Flow Projections for the Recommended Plan

Study Area	Full Build-out ADF (gpd)	Planning Period ADF (gpd)
Infill	15,000	11,250
Study Area 1 West Manchester (Forster & Wood Crest Sewer Ext)	3,360	2,100
Study Area 2 Smith's Point (Beach Street Sewer Extension)	6,930	3,990
Study Area 3 Coolidge Point	-	-
Study Area 4 Raymond Street Sewer Expansion	35,070	19,530*
Study Area 5 Hickory Hill	-	-
Study Area 6 LCD	62,000	31,000*
TOTAL	122,360	67,870

*Capacity for these flows should be reserved at the WWTF.

Table VIII-2 summarizes the estimated wastewater flows that would be added to the system from the recommended limited sewer extensions in West Manchester and Smith's Point area and expansion to the Raymond Street and LCD areas. The proposed sewer extensions listed are estimated to add a maximum of approximately 122,360 gpd to the plant's average daily flow at full build-out. It is noted that the design flows upon which the design capacity of the plant was based included some of the additional flows the proposed sewer extensions would add. For example, the 2014 design flows of the plant accounted for flows from 60 homes or 11,300 gpd in the Raymond Street area.

The existing wastewater treatment plant is designed for an annual average daily flow of 670,000 gpd. Average annual flows between 2010 and 2014 have averaged 460,000 gpd. The maximum 12 month rolling average annual flow during that period was 650,000 gpd; since 2011 the maximum 12 month rolling average was 550,000 gpd.

A detailed review of the current wastewater flows to the plant was presented in Section V. By all indications, there is between 96,000 and 200,000 gpd of available capacity at the plant for additional sanitary wastewater flows. With a programmed plan for sewer extensions in conjunction with the town's ongoing I/I removal program, the limited sewer extensions proposed in this CWMP will not cause the town to violate the current NPDES permit nor require a variance to the Ocean Sanctuary Act for an increase in the permitted discharge limit.

VIII-6 INFILTRATION and INFLOW REMOVAL PROGRAM

The town is committed to addressing I/I issues in the collection system to ensure that the town does not violate the plant's NPDES discharge permit. A metering program was completed in the spring of 2013 to measure flows in the system and determine I/I flows. Based on that metering program a total of 273,200 gpd of infiltration and 808,000 gallons of inflow was estimated. Subsequent follow-up investigation in the fall of 2013 and 2014 sought to identify specific sources of infiltration and inflow that could be removed with corrective actions. Based on those reports, the town issued a sewer rehabilitation construction contract that was completed in early 2016.

Further, the town continues to investigate I/I sources and it is expected that additional sewer rehabilitation work will take place in subsequent years to continue the program of I/I removal. Based on the continued presence of problematic I/I in the collection system, it is recommended that the town plan and budget for a systematic multi-year sewer rehabilitation program.

It is recommended that the town also continue investigations for the ongoing concerns present with saltwater intrusion into the collection system through salinity testing and inspection. Further assessment of potential tidal influence should also be evaluated based on the previously identified areas of concern.

The "Infiltration and Inflow (I/I) Removal Program 2015" report further details the ongoing sewer rehabilitation and I/I investigative work, including salt water intrusion issues, being pursued by the town. The report also includes further recommendations for continued efforts toward I/I removal.

VIII-7 MANCHESTER WWTF

The Manchester WWTF was upgraded in 1992 to treat an average daily flow of 1.2 mgd. The plant's NPDES discharge permit for wastewater discharges to surface waters was last issued in June 28, 2011 and expires on July 31, 2016. Under the permit, the town is allowed to discharge 670,000 gpd of treated wastewater on an annual average basis. Monthly average flows during dry weather months (Jun-Nov) are limited to the same 670,000 gpd basis, while monthly average flows during wet weather months (Dec-May) cannot exceed 1.2 mgd. In the five year period from 2010 to 2014, the monthly average flow limit was only exceeded once in March 2010 when the monthly average flow was 1.4 mgd.

As indicated above it is not expected that the Manchester WWTF would exceed its currently permitted annual average flow capacity of 670,000 gpd even if the town proceeds with any of the proposed sewer extensions. Therefore it is not proposed that the capacity of the plant be expanded.

The Manchester WWTF provides for secondary treatment of the wastewater. Treated effluent from the plant must meet a 30 mg/l BOD / 30 mgl/l TSS limit. The plant has routinely been in compliance with these permitted limits.

As noted above, the plant operates well and is meeting NPDES discharge permit limits and process changes or improvements are not required to continue to operate and meet those limits barring a change to those limits. However, the facility is in need of some upgrades at the plant to improve operational performance and efficiency of the plant as outlined in Section V. These repairs generally provide for either 1) improving the operating range and efficiency of key pumps and equipment, 2) replacing aging equipment, or 3) improving operator control and maintenance requirements.

Some of the more significant recommended improvements include:

- Replace and re-size Influent Pumps
- Replace and re-size Effluents Pumps
- Add VDF Controls for Influent & Effluent Pumps
- Replace and re-size Aeration Blowers
- Replace Sludge Pumps
- Upgrade and Replace SCADA Panels

Details of all of the recommended improvements to the Manchester WWTF are included in Section V.

Additionally, based on the results of the Climate Resilience Evaluation and Awareness Tool (CREAT) Exercise Report performed in conjunction with EPA, it is recommended that the town begin planning for climate change impacts particularly the potential seal level rise projected by 2060. The potential effects of climate change are not expected to have an impact on the plant for the 20-year planning period; however it should be taken into account for future planning purposes as the impact expected on the wastewater facilities is a growing concern.

Further investigation should be done to determine what measures should be implemented to prevent any consequences of future coastal storm surge or intense precipitation events expected with consideration to climate change for the future.

VIII-8 PLANNED IMPLEMENTATION TIMING

The implementation and timing of the recommended plan is a critical piece of the CWMP. As stated throughout this document, the recommended plan is a comprehensive strategy for wastewater management for MBTS for the next 20 years. The recommended plan is a combination of strategies including extension of existing sewer system, upgrades to WWTF, and implementing a stringent On-site Wastewater Management Program for maintaining on-site systems.

Implementation of any planned sewer extensions and connections to those sewer extensions needs to be carefully coordinated with the ongoing I/I removal program to ensure that flows to the treatment plant remain within design parameters of the plant and the town's NPDES permit.

VIII-9 FINANCIAL COMPONENT

Preliminary planning level project cost estimates for the various elements included in the Recommended Plan are presented in Table VIII- and Table VIII-4. Note that estimated costs are budgetary based on conceptual level concept plans. Further, it is not anticipated that all of the elements noted in the project cost summary will be implemented during the planning period by the town and therefore a total cost is not presented.

Table VIII-3 Project Cost Summary – Facilities Improvements

Study Area or Location	Description	Estimated Cost	Notes
Existing Collection Area	Sewer Rehabilitation	$1,500,000	$0.5M per year for 3 years (started in 2015)
WWTF	WWTF Improvements	$2,250,000	
Pump Stations	Generators and Improvements	$325,000	

The facilities improvements costs shown in Table VIII-3 should be implemented over the next 3-5 years. This will produce a cost of approximately 1 million per year in facilities improvements.

Table VIII-4. Project Cost Summary – Future Planning			
Study Area or Location	**Description**	**Estimated Cost**	**Notes**
West Manchester	Sewer Extension Forster Road and Wood Crest Road	$560,000	
Smith's Point	Sewer Extension Beach Street	$1,400,000	
Raymond Street Area	Sewer Expansion or Communal System w/Gloucester	$5,600,000 or $3,000,000	
LCD Area	Sewer Expansion	$2,400,000	Assume directional drilling required to cross RT 128

Table VIII-4 shows the possible future planning costs associated with any sewer expansion or extension the town may choose to implement as a wastewater management solution.

Using the cost estimates, the town should investigate and develop a structure to implement costs to users in order to provide funding as the work is completed.

Appendices

A. Administrative Consent Order (ACOP-NE-13-1N003)

DEP Response to Time Extension Request

MassDEP
Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection

Northeast Regional Office • 205B Lowell Street, Wilmington MA 01887 • 978-694-3200

DEVAL L. PATRICK
Governor

TIMOTHY P. MURRAY
Lieutenant Governor

RICHARD K. SULLIVAN JR.
Secretary

KENNETH L. KIMMELL
Commissioner

February 15, 2013

Mr. Wayne Melville
Town Administrator
Town Hall
10 Central Street
Manchester-by-the-Sea, MA 01944

Re: Administrative Consent Order (ACOP-NE-13-1N003) Executed Original

Dear Mr. Melville:

Please find enclosed a fully executed original of the Administrative Consent Order with Penalty, referenced above. MassDEP appreciates the time and effort you spent in working with the Department to reach agreement on this matter.

If you have any questions regarding the ACOP, feel free to contact Joseph E. Nerden of my staff at (978) 694 – 3239.

Sincerely,

Eric Worrall
Acting Regional Director

Enclosure

Cc: Steve Kenney via email w/encl.
John Sibbalds via email w/encl.

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION

In the matter of:	)	
	)	
	)	
Town of Manchester-by-the-Sea	)	File No.: ACOP-NE-13-1N003
	)	

ADMINISTRATIVE CONSENT ORDER WITH PENALTY
AND
NOTICE OF NONCOMPLIANCE

I. THE PARTIES

1. The Department of Environmental Protection ("Department" or "MassDEP") is a duly constituted agency of the Commonwealth of Massachusetts established pursuant to M.G.L. c. 21A, § 7. MassDEP maintains its principal office at One Winter Street, Boston, Massachusetts 02108, and its Northeast Regional Office at 205B Lowell Street, Wilmington, Massachusetts 01887.

2. The Town of Manchester-by-the-Sea ("Respondent") is a Municipality with Town offices at 10 Central Street, Manchester, Massachusetts 01944.

II. STATEMENT OF FACTS AND LAW

3. MassDEP is responsible for the implementation and enforcement of: M.G.L. c. 21, §§ 26-53, inclusive ("Clean Waters Act"); the Sewer System Extension and Connection Permit Regulations at 314 CMR 7.00 ("Sewer Permit Regulations"); the Surface Water Discharge Permit Regulations at 314 CMR 3.00 ("Surface Discharge Regulations"); and the Wastewater Operation, Maintenance and Pretreatment Regulations at 314 CMR 12.00 ("Wastewater Regulations"). MassDEP has authority under M.G.L. c. 21A, § 16 and the Administrative Penalty Regulations at 310 CMR 5.00 to assess civil administrative penalties to persons in noncompliance with the laws and regulations set forth above.

4. Respondent owns, operates and maintains a publicly owned wastewater treatment works consisting of a sewer system, from which it collects and transports pollutants from properties connected thereto, a wastewater treatment facility located at 12 Church Street, Manchester-by-the-Sea, MA 01944 ("WWTF"), and an ocean outfall, from which it discharges pollutants to

Manchester Harbor, a Class SB surface water of The Commonwealth. The WWTF, an extended aeration treatment plant, was completed in 1972 and upgraded in 1999.

5. MassDEP, acting pursuant to the Clean Waters Act, and the United States Environmental Protection Agency ("EPA"), acting pursuant to the Federal Water Pollution Control Act, 33 U.S.C. 1251 et seq., jointly administer a permit program within The Commonwealth requiring that all pollutant discharges to surface waters of The Commonwealth be in conformity with a jointly issued National Pollutant Discharge Elimination System ("NPDES") permit.

6. EPA and MassDEP jointly issued to Respondent a NPDES Permit, Federal Number MA0100871/State Number M-18 on March 30, 1984 (the "Permit").

7. On June 28, 2011, EPA and MassDEP jointly re-issued the Permit to Respondent ("2011 Permit"). The 2011 Permit, which expires on July 31, 2016, authorizes Respondent to discharge pollutants from the WWTF to Manchester Harbor, subject to effluent limits, monitoring requirements, and other conditions of the Permit.

8. One of the 2011 Permit conditions is Part I.A.1(f), which states:

> If the average annual flow in any calendar year exceeds 80% of the facility's design flow, the permittee shall submit a report to MassDEP by March 31 of the following calendar year describing its plans for further flow increases, and describing how it will maintain compliance with the flow limit and all other effluent limitations and conditions.

9. Section 42 of the Clean Waters Act states:

> Any person who, directly or indirectly, throws, drains, runs, discharges or allows the discharge of any pollutant into waters of the commonwealth, except in conformity with a permit issued under section forty-three; or who violates any provision of this chapter, any valid regulation, order or permit prescribed or issued by the director thereunder; or who knowingly makes any false representation in an application, record, report or plan, or falsifies, tampers with or renders inaccurate a monitoring device or method, required under this chapter, (a) shall be punished by a fine of not less than two thousand five hundred dollars nor more than $50,000 for each day such violation occurs or continues, or by imprisonment for not more than one year, or by both; or (b) shall be subject to a civil penalty not to exceed $50,000 per day of such violation, which may be assessed in an action brought on behalf of the commonwealth in any court of competent jurisdiction. This section shall not apply to sections thirty-four B and thirty-four C.

10. The Surface Discharge Regulations, specifically the provisions of 314 CMR 3.19(2), state:

> Duty to Comply. The permittee shall comply at all times with the terms and conditions of the permit, any conditions included in a related water quality certification issued by the Department, 314 CMR, the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26 through 53, and all other applicable state and federal statutes and regulations.

11. On December 2, 1992, MassDEP and Respondent entered into an Administrative Consent Order with Penalty, AP-BO-92-101, with an effective date of December 2, 1992 ("1992 ACOP"), in response to persistent violations of the Permit's effluent limits. Permit violations were documented for the following parameters: Total Suspended Solids ("TSS"), Biochemical Oxygen Demand ("BOD"), chlorine residual, and flow. The WWTF also failed to meet the Permit requirement of removal of at least 85% of the influent TSS and BOD.

12. The 1992 ACOP included a number of requirements for Respondent's return to compliance with Permit. The requirements included:

a. Restrictions on new connections to Respondent's sewer system;
b. Planning, design, and construction of substantial upgrades to the WWTF;
c. Transmittal of an Operation & Maintenance Plan and Staffing Plan; and
d. A plan to implement a program to identify and eliminate infiltration and inflow into the Town's sewer system.

13. In 1999, after Respondent completed construction of major upgrades to the WWTF, the upgraded WWTF went into full operation.

14. In December 2002, EarthTech, consultant to Respondent, completed a draft Wastewater Needs Assessment ("Draft Needs Assessment"). At that time, the Draft Needs Assessment indicated that the WWTF had 0.10 million gallons per day ("mgd") of remaining capacity under the Permit. It also identified six (6) areas within Respondent's community with severe adverse conditions that would not support on-site disposal systems. Recommendations included further study of these areas to identify long term wastewater management needs.

15. On September 26, 2008, a report entitled, "GIS Data Update to the 2003 Wastewater Needs Assessment Report" was completed by Woodard & Curran, consulting engineers for the Town ("2008 GIS Update Report"). The 2008 GIS Update Report identified 0.3 to 0.4 mgd of additional capacity needs for areas deemed "unsustainable" for on-site disposal systems. The 2008 GIS Update Report also included a draft scope of work for a comprehensive wastewater management plan.

16. The 2011 Permit includes the following flow limitations: (i) an average annual flow limitation of 0.67 million gallons per day (mgd); (ii) an average monthly flow limitation of 0.67

mgd for the months of June through November; and (iii) an average monthly flow limitation of 1.2 mgd for the months of December through May.

17. The December 2011 Discharge Monitoring Report ("DMR") reported average effluent flows for calendar year 2011 to be 0.550 mgd.

18. The 2011 calendar year average flow of 0.550 mgd exceeds 80% of the average annual flow limit (0.67 mgd, 80% = 0.536 mgd) established under the Permit.

19. In violation of Condition Part I.A.1(f) of the 2011 Permit, Respondent failed to submit, by March 31, 2012, a report describing: (i) plans for further flow increases; and (ii) any actions needed to sustain compliance with the terms and conditions of the 2011 Permit.

20. By failing to submit the required planning report, Respondent violated, and continues to violate, the conditions of the 2011 Permit, the Clean Waters Act and the Surface Water Discharge Regulations, specifically the provisions of 314 CMR 3.19(2).

III. DISPOSITION AND ORDER

For the reasons set forth above, MassDEP hereby issues, and Respondent hereby consents to, this Order:

21. The parties have agreed to enter into this Consent Order because they agree that it is in their own interests, and in the public interest, to proceed promptly with the actions called for herein rather than to expend additional time and resources litigating the matters set forth above. Respondent enters into this Consent Order without admitting or denying the facts or allegations set forth herein. However, Respondent agrees not to contest such facts and allegations for purposes of the issuance or enforcement of this Consent Order. This Consent Order supersedes the 1992 ACOP.

22. MassDEP's authority to issue this Consent Order is conferred by the Statutes and Regulations cited in Part II of this Consent Order.

23. For the reasons stated above, MassDEP hereby orders Respondent to perform the following actions within the times frames set forth herein.

a) On or before April 1, 2013, Respondent shall submit to MassDEP for review and approval a written Infiltration and Inflow Identification and Removal Plan ("I/I Plan") which details past actions undertaken by Respondent to address infiltration and inflow

("I/I") to the sewer system and plans for further work to identify and remove I/I sources. The I/I Plan shall include, at a minimum, the following elements:

i. A summary of all I/I work completed since calendar year 2000, including a summary of costs and the scope of work for all investigations, reports, and construction work done to address I/I in Respondent's sewer system;
ii. A Spring 2013 sewer metering program adequate to quantify I/I into Respondent's sewer system, including impacts of tidal inflow;
iii. A plan and schedule for further I/I work, including field investigations needed to identify I/I sources, and a private inflow removal program targeting sump pumps, roof leaders, private drains, and other sources of private inflow to Respondent's sewer system; and
iv. The I/I Plan shall be carried out in accordance with MassDEP's I/I Guidance document (available at http://www.mass.gov/dep/water/laws/iiguidln.pdf) and standard engineering practices.

Respondent shall implement the I/I Plan upon approval by MassDEP. Any failure by Respondent to implement the I/I Plan as approved by MassDEP shall be a violation of this Consent Order.

b) Respondent shall proceed to develop and complete a Comprehensive Wastewater Management Plan ("CWMP") in accordance with the following schedule:

i. On or before April 1, 2014, Respondent shall submit to MassDEP, for review and approval, a final scope of work for development of the CWMP. Said scope shall include a provision for public participation during the development of the CWMP. This final scope shall respond to MassDEP comments on the draft scope of work included in the 2008 GIS Update.

ii. On or before April 1, 2015, Respondent shall submit a Draft CWMP to MassDEP for review, which shall include a draft recommended plan. The Draft CWMP shall include a scope of work for developing a Final CWMP.

iii. On or before July 1, 2015, Respondent shall submit a Final CWMP to MassDEP for review and approval. The Final CWMP shall respond to comments transmitted by MassDEP and the public on the Draft CWMP, and include a final recommended plan.

Development and implementation of the CWMP shall comply with the requirements of the Massachusetts Environmental Policy Act, M.G.L. c. 30, §§ 61 – 62H, inclusive, and the regulations promulgated pursuant thereto at 301 CMR 11.00.

c) From the effective date of this Consent Order, and until such time as MassDEP approves the final CWMP, Respondent shall not authorize or allow any new

connections to or extensions of its sewer system, or increases in flow from existing sewer connections unless:

i. Respondent's Board of Health has found and certified to MassDEP in writing that such connection is necessary to abate an imminent hazard to public health or the environment caused by inadequate sewage disposal where there is no feasible alternative means of sewage disposal; or

ii. MassDEP authorizes the connection in writing.

d) On or before January 2 and July 1 of each successive calendar year, Respondent shall submit to MassDEP semi-annual status reports summarizing actions taken by Respondent in meeting the requirements of this Consent Order, including I/I actions and efforts to develop and finalize the CWMP. The first semi-annual report shall be due on or before January 2, 2014.

24. All engineering work performed pursuant to this Consent Order shall be under the general direction and supervision of a qualified professional engineer registered in Massachusetts experienced in wastewater collection and treatment. The I/I Report and the CWMP Reports shall each be stamped and signed by the professional engineer in responsible charge of the work. Any contractual relationship between Respondent and the engineer for work required hereunder shall require the engineer, as a condition of the contract, to implement work consistent with the provisions of this Consent Order.

25. From the effective date of this Consent Order and thereafter, Respondent shall, with regard to any and all future work in the Town, comply with the requirements of the Clean Waters Act, the Sewer Permit Regulations, the Surface Discharge Permit Regulations, the Wastewater Regulations, and all other applicable federal, state, and local laws, regulations and approvals.

26. Except as otherwise provided, all notices, submittals and other communications required by this Consent Order shall be directed to:

Kevin Brander, P.E., Section Chief
Wastewater Management Section
Massachusetts Department of Environmental Protection
Northeast Regional Office
205B Lowell Street
Wilmington, MA 01887

Such notices, submittals and other communications shall be considered delivered by Respondent upon receipt by MassDEP.

27. Actions required by this Consent Order shall be taken in accordance with all applicable federal, state, and local laws, regulations and approvals. This Consent Order shall

not be construed as, nor operate as, relieving Respondent or any other person of the necessity of complying with all applicable federal, state, and local laws, regulations and approvals.

28. For purposes of M.G.L. c. 21A, § 16 and 310 CMR 5.00, this Consent Order shall also serve as a Notice of Noncompliance for Respondent's noncompliance with the requirements cited in Part II above. MassDEP hereby determines, and Respondent hereby agrees, that any deadlines set forth in this Consent Order constitute reasonable periods of time for Respondent to take the actions described.

29. Respondent shall pay to the Commonwealth the sum of five thousand, seven hundred fifty dollars ($5,750) as a civil administrative penalty for the violations identified in Part II above. MassDEP hereby agrees to suspend payment of the entire penalty amount; provided, however, that if Respondent violates any provision of this Consent Order, or further violates any of the regulations cited in Part II above within two years of the effective date of this Consent Order, Respondent shall pay to the Commonwealth the full amount of five thousand seven hundred fifty dollars ($5,750) within thirty (30) days of the date MassDEP issues Respondent a written demand for payment. This paragraph shall not be construed or operate to bar, diminish, adjudicate, or in any way affect, any legal or equitable right of MassDEP to assess Respondent additional civil administrative penalties, or to seek any other relief, with respect to any future violation of any provision of this Consent Order or any law or regulation.

30. Respondent understands, and hereby waives, its right to an adjudicatory hearing before MassDEP on, and judicial review of, the issuance and terms of this Consent Order and to notice of any such rights of review. This waiver does not extend to any other order issued by the MassDEP.

31. This Consent Order may be modified only by written agreement of the parties hereto.

32. The provisions of this Consent Order are severable, and if any provision of this Consent Order or the application thereof is held invalid, such invalidity shall not affect the validity of other provisions of this Consent Order, or the application of such other provisions, which can be given effect without the invalid provision or application, provided however, that MassDEP shall have the discretion to void this Consent Order in the event of any such invalidity.

33. Nothing in this Consent Order shall be construed or operate as barring, diminishing, adjudicating or in any way affecting (i) any legal or equitable right of MassDEP to issue any additional order or to seek any other relief with respect to the subject matter covered by this Consent Order, or (ii) any legal or equitable right of MassDEP to pursue any other claim, action, suit, cause of action, or demand which MassDEP may have with respect to the subject matter covered by this Consent Order, including, without limitation, any action to enforce this Consent Order in an administrative or judicial proceeding.

34. This Consent Order shall not be construed or operate as barring, diminishing, adjudicating, or in any way affecting, any legal or equitable right of MassDEP or Respondent with respect to any subject matter not covered by this Consent Order.

35. This Consent Order shall be binding upon Respondent and upon Respondent's successors and assigns. Respondent shall not violate this Consent Order and shall not allow or suffer Respondent's employees, agents, contractors or consultants to violate this Consent Order. Until Respondent has fully complied with this Consent Order, Respondent shall provide a copy of this Consent Order to each successor or assignee at such time that any succession or assignment occurs.

36. In addition to the penalty set forth in this Consent Order (including any suspended penalty), if Respondent violates any provision of the Consent Order, Respondent shall pay stipulated civil administrative penalties to the Commonwealth in the amount of $1,000.00 per day for each day, or portion thereof, each such violation continues.

Stipulated civil administrative penalties shall begin to accrue on the day a violation occurs and shall continue to accrue until the day Respondent corrects the violation or completes performance, whichever is applicable. Stipulated civil administrative penalties shall accrue regardless of whether MassDEP has notified Respondent of a violation or act of noncompliance. All stipulated civil administrative penalties accruing under this Consent Order shall be paid within thirty (30) days of the date MassDEP issues Respondent a written demand for payment. If simultaneous violations occur, separate penalties shall accrue for separate violations of this Consent Order. The payment of stipulated civil administrative penalties shall not alter in any way Respondent's obligation to complete performance as required by this Consent Order. MassDEP reserves its right to elect to pursue alternative remedies and alternative civil and criminal penalties which may be available by reason of Respondent's failure to comply with the requirements of this Consent Order. In the event MassDEP collects alternative civil administrative penalties, Respondent shall not be required to pay stipulated civil administrative penalties pursuant to this Consent Order for the same violations.

Respondent reserves whatever rights it may have to contest MassDEP's determination that Respondent failed to comply with the Consent Order and/or to contest the accuracy of MassDEP's calculation of the amount of the stipulated civil administrative penalty. Upon exhaustion of such rights, if any, Respondent agrees to assent to the entry of a court judgment if such court judgment is necessary to execute a claim for stipulated penalties under this Consent Order.

37. Respondent shall pay all civil administrative penalties due under this Consent Order, including suspended and stipulated penalties, by certified check, cashier's check, or money order made payable to the Commonwealth of Massachusetts, or by electronic funds transfer. If payment is made by certified check, cashier's check, or money order, Respondent shall clearly print on the face of its payment Respondent's full name, the file number appearing on the first

page of this Consent Order, and the Respondent's Federal Employer Identification Number, and shall mail it to:

Commonwealth of Massachusetts
Department of Environmental Protection
Commonwealth Master Lockbox
P.O. Box 3982
Boston, Massachusetts 02241-3982

If payment is made by electronic funds transfer, Respondent must complete the attached form "Electronic Funds Transfer Request" and, within 10 days of the effective date of this Consent Order, submit it to Director, BAS Division of Fiscal Management via Facsimile at the MassDEP Revenue Fax Number 617-292-5824 or via mail to:

Department of Environmental Protection
Attn: Revenue Unit
1 Winter Street, 4th Floor
Boston, MA 02108

In the event Respondent fails to pay in full any civil administrative penalty as required by this Consent Order, then pursuant to M.G.L. c. 21A, § 16, Respondent shall be liable to the Commonwealth for up to three (3) times the amount of the civil administrative penalty, together with costs, plus interest on the balance due from the time such penalty became due and attorneys' fees, including all costs and attorneys' fees incurred in the collection thereof. The rate of interest shall be the rate set forth in M.G.L. c. 231, § 6C.

38. Failure on the part of MassDEP to complain of any action or inaction on the part of Respondent shall not constitute a waiver by MassDEP of any of its rights under this Consent Order. Further, no waiver by MassDEP of any provision of this Consent Order shall be construed as a waiver of any other provision of this Consent Order.

39. To the extent authorized by the current owner, Respondent agrees to provide MassDEP, and MassDEP's employees, representatives and contractors, access at all reasonable times to the Site for purposes of conducting any activity related to its oversight of this Consent Order. Notwithstanding any provision of this Consent Order, MassDEP retains all of its access authorities and rights under applicable state and federal law.

40. This Consent Order may be executed in one or more counterpart originals, all of which when executed shall constitute a single Consent Order.

41. The undersigned certify that they are fully authorized to enter into the terms and conditions of this Consent Order and to legally bind the party on whose behalf they are signing this Consent Order.

42. This Consent Order shall become effective on the date that it is executed by MassDEP.

Consented To By:
Town of Manchester-by-the-Sea

Wayne C Melville
Wayne Melville
Town Administrator
Manchester-by-the-Sea

Federal Employer Identification Number: 04-600-1208

Date: 2/12/2013

Issued By:
MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION

By: ____________________________

Eric Worrall
Acting Regional Director
Massachusetts Department of Environmental Protection/Northeast Regional Office
205B Lowell Street
Wilmington, MA 01887

Date: 2/14/13

MassDEP
Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection

Northeast Regional Office • 205B Lowell Street, Wilmington MA 01887 • 978-694-3200

Charles D. Baker
Governor

Karyn E. Polito
Lieutenant Governor

Matthew A. Beaton
Secretary

Martin Suuberg
Commissioner

March 20, 2015

Mr. Gregory T. Federspiel
Town Administrator
Town Hall
10 Central Street
Manchester-by-the-Sea, MA 01944

Re: Time Extension Request for submittal of CWMP Draft and Final Documents
Administrative Consent Order (ACOP-NE-13-1N003)

Dear Mr. Federspiel:

The Massachusetts Department of Environmental Protection, Northeast Regional Office (MassDEP), received your March 11, 2015 letter requesting an extension of time to complete and submit the draft and final documents of the Comprehensive Wastewater Management Plan (CWMP), in accordance with the ACOP noted above. MassDEP approves the revised submittal dates for the draft and final CWMP documents, now due on or before May 15, 2015, and August 1, 2015, respectively.

Please move as expeditiously as possible to execute the activities identified and comply with all provisions of the ACOP. The Town of Manchester-by-the-Sea remains under the terms and conditions of the ACOP. If you have any questions regarding these comments, please contact Joseph E. Nerden at (978) 694–3239.

Sincerely,

Rachel Freed

Rachel Freed
Acting Deputy Regional Director
Bureau of Water Resources

Cc: Carol A. Murray, Dir. DPW
George Harding, EPA Region 1

B. NPDES Permit (MA0100871)

AUTHORIZATION TO DISCHARGE UNDER THE
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Clean Water Act as amended, (33 U.S.C. §§1251 et seq.; the "CWA"), and the Massachusetts Clean Waters Act, as amended, (M.G.L. Chap. 21, §§26-53),

Town of Manchester-by-the-Sea

is authorized to discharge from the facility located at

Manchester-by--the-Sea Wastewater Treatment Plant
12 Church Street
Manchester-by-the-Sea, MA 01944

to receiving water named

Manchester Bay

in accordance with effluent limitations, monitoring requirements and other conditions set forth herein.

This permit shall become effective on the date of signature.

This permit and the authorization to discharge expire at midnight, five (5) years from the last day of the month preceding the effective date.

This permit supersedes the permit issued on December 9, 2004.

This permit consists of 13 pages in Part I including effluent limitations, monitoring requirements, Attachment A (Toxicity Protocol) and Attachment B (Summary of Reports to be Submitted) and Part II including General Conditions and Definitions.

Signed this 28th day of June, 2011

Director
Office of Ecosystem Protection
Environmental Protection Agency
Boston, MA

Director
MA Wastewater Management Program
Department of Environmental Protection
Commonwealth of Massachusetts
Boston, MA

A.1. During the period beginning on the effective date and lasting through expiration, the permittee is authorized to discharge treated effluent from outfall serial number **001** to Manchester Bay. Such discharges shall be limited and monitored as specified below.

	EFFLUENT LIMITATIONS			MONITORING REQUIREMENTS	
PARAMETER	**AVERAGE MONTHLY**	**AVERAGE WEEKLY**	**MAXIMUM DAILY**	**MEASUREMENT FREQUENCY**	**SAMPLE[3] TYPE**
Flow: Annual Ave. Monthly Ave. (June - November) Monthly Ave. (December - May)	0.67 MGD [1,2] 0.67 MGD 1.2 MGD	******** ******** ********	Report MGD Report MGD Report MGD	Continuous Continuous Continuous	Recorder Recorder Recorder
BOD_5 [4]	30 mg/l 165 lbs/Day	45 mg/l 252 lbs/Day	Report mg/l[1]	2/Week	24-Hour Composite[5]
TSS [4]	30 mg/l 165 lbs/Day	45 mg/l 252 lbs/Day	Report mg/l[1]	2/Week	24-Hour Composite[5]
pH Range[1]	6.5 - 8.5 SU SEE PERMIT PAGE 5 OF 13, PARAGRAPH I.A.1.b.			1/Day	Grab
Total Chlorine Residual[1,6,7]	Report mg/l	*********	1.0 mg/l	3/Day	Grab
Fecal Coliform[1,6]	88 cfu/100 ml	*********	260 cfu/100 ml	1/Week	Grab
Enterococci[6]	35 cfu/100 ml	*********	276 cfu/100 ml	1/Week	Grab
Total Kjeldahl Nitrogen (TKN)	*******	********	Report mg/l	1/Quarter	24-Hour Composite[5]
Total Nitrate + Nitrite	*******	********	Report mg/l	1/Quarter	24-Hour Composite[5]
Total Ammonia Nitrogen as N	*******	********	Report mg/l	1/Quarter	24-Hour Composite[5]
Whole Effluent Toxicity See Footnotes 8,9 and 10	Acute $LC_{50} \geq 50\%$			2/Year	24-Hour Composite[5]

Effluent samples for BOD and TSS shall be collected after the flow meter but before the chlorination chamber. Samples for TRC, pH, Fecal coliform, Enterococci, and Toxicity shall be collected at the effluent wet well after chlorination.

Footnotes:

1. Required for State Certification.

2. Report annual average, monthly average, and the maximum daily flow. The limit is an annual average, which shall be reported as a rolling average. The value will be calculated as the arithmetic mean of the monthly average flow for the reporting month and the monthly average flows of the previous eleven months.

3. All required effluent samples shall be collected at the point specified on page 2. A routine sampling program shall be developed in which samples are taken at the same location, same time and same days of the week each month. Occasional deviations from the routine sampling program are allowed, but the reason for the deviation shall be documented in correspondence appended to the applicable discharge monitoring report.

   All samples shall be tested using the analytical methods found in 40 CFR §136, or alternative methods approved by EPA in accordance with the procedures in 40 CFR §136.

4. Sampling required for influent and effluent.

5. A 24-hour composite sample will consist of at least twenty four (24) grab samples taken over a continuous 24 hour period, either collected at equal intervals and combined proportional to flow or continuously collected proportional to flow.

6. Fecal coliform discharges shall not exceed a monthly geometric mean of 88 colony forming units (cfu) per 100 ml, nor shall they exceed 260 cfu per 100 ml as a daily maximum and no more than 10 percent of the fecal coliform samples in any calendar month shall exceed 260 organisms per 100 ml. Enterococci discharges shall not exceed a monthly geometric mean of 35 cfu per 100 ml, nor shall they exceed 276 cfu per 100 ml as a daily maximum. Monitoring shall be conducted year round concurrently with a total residual chlorine sample. **See Part I.E** for the compliance schedule for attaining the enterococci limits.

7. The minimum level (ML) for total residual chlorine is defined as 20 ug/l. This value is the minimum level for chlorine using EPA approved methods found in the most currently approved version of <u>Standard Methods for the Examination of Water and Wastewater,</u> Method 4500 CL-E and G. One of these methods must be used to measure total residual chlorine. Sample results of 20 ug/l or less shall be reported as zero on the discharge monitoring report.

8. The permittee shall conduct definitive 48 hour acute toxicity tests two times per year. The permittee shall test the Inland Silverside (Menidia beryllina). Toxicity test samples

shall be collected during the months of June and September. The test results shall be submitted by the last day of the month following the completion of the test. The results are due July 31st and October 31st, respectively. The tests must be performed in accordance with test procedures and protocols specified in **Attachment A** of this permit

Test Dates Second Week in	**Submit Results By:**	**Test Species**	**Acute Limit LC_{50}**
June September	July 31st October 31st	Inland Silverside See Attachment A	$\geq$ 50%

After submitting **two years** and a **minimum** of **four** consecutive sets of WET test results, all of which demonstrate compliance with the WET permit limits, the permittee may request a reduction in the WET testing requirements. The permittee is required to continue testing at the frequency specified in the permit until notice is received by certified mail from the EPA that the WET testing requirement has been changed.

9. The LC_{50} is the concentration of effluent which causes mortality to 50% of the test organisms. Therefore, a 50% limit means that a sample of 50% effluent shall cause no more than a 50% mortality rate.

10. If toxicity test(s) using receiving water as diluent show the receiving water to be toxic or unreliable, the permittee shall either follow procedures outlined in **Attachment A (Toxicity Test Procedure and Protocol) Section IV., DILUTION WATER** in order to obtain an individual approval for use of an alternate dilution water, or the permittee shall follow the Self-Implementing Alternative Dilution Water Guidance which may be used to obtain automatic approval of an alternate dilution water, including the appropriate species for use with that water. This guidance is found on the EPA, Region I web site at http://www.epa.gov/region1/enforcementandassistance/dmr2005.pdf. If this guidance is revoked, the permittee shall revert to obtaining individual approval as outlined in **Attachment A**. Any modification or revocation to this guidance will be transmitted to the permittees. However, at any time, the permittee may choose to contact EPA-New England directly using the approach outlined in **Attachment A**.

Part I.A.1. (Continued)

a. The discharge shall not cause a violation of the water quality standards of the receiving water.

b. The pH of the effluent shall not be less than 6.5 nor greater than 8.5 at any time.

c. The discharge shall not cause objectionable discoloration of the receiving water.

d. The effluent shall contain neither a visible oil sheen, foam, nor floating solids at any time.

e. The permittee's treatment facility shall maintain a minimum of 85 percent removal of both total suspended solids and biochemical oxygen demand. The percent removal shall be based on monthly average values.

f. If the average annual flow in any calendar year exceeds 80 percent of the facility's design flow, the permittee shall submit a report to MassDEP by March 31 of the following calendar year describing its plans for further flow increases and describing how it will maintain compliance with the flow limit and all other effluent limitations and conditions.

g. The permittee shall minimize the use of chlorine while maintaining adequate bacterial control.

h. The results of sampling for any parameter done in accordance with EPA approved methods above its required frequency must also be reported.

2. All POTWs must provide adequate notice to the Director of the following:

a. Any new introduction of pollutants into the POTW from an indirect discharger which would be subject to section 301 or 306 of the Clean Water Act if it were directly discharging those pollutants; and

b. Any substantial change in the volume or character of pollutants being introduced into the POTW by a source introducing pollutants into the POTW at the time of issuance of the permit.

c. For purposes of this paragraph, adequate notice shall include information on:

(1) the quantity and quality of effluent introduced into the POTW; and

(2) any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW.

3. Prohibitions Concerning Interference and Pass Through:

   a. Pollutants introduced into POTW's by a non-domestic source (user) shall not pass through the POTW or interfere with the operation or performance of the works.

4. Toxics Control

   a. The permittee shall not discharge any pollutant or combination of pollutants in toxic amounts.

   b. Any toxic components of the effluent shall not result in any demonstrable harm to aquatic life or violate any state or federal water quality standard which has been or may be promulgated. Upon promulgation of any such standard, this permit may be revised or amended in accordance with such standards.

5. Numerical Effluent Limitations for Toxicants

   EPA or DEP may use the results of the toxicity tests and chemical analyses conducted pursuant to this permit, as well as national water quality criteria developed pursuant to Section 304(a)(1) of the Clean Water Act (CWA), state water quality criteria, and any other appropriate information or data, to develop numerical effluent limitations for any pollutants, including but not limited to those pollutants listed in Appendix D of 40 CFR Part 122.

B. UNAUTHORIZED DISCHARGES

The permittee is authorized to discharge only in accordance with the terms and conditions of this permit and only from the outfall listed in Part I A.1. of this permit. Discharges of wastewater from any other point sources, including sanitary sewer overflows (SSOs) are not authorized by this permit and shall be reported in accordance with Section D.1.e. (1) of the General Requirements of this permit (Twenty-four hour reporting).

C. OPERATION AND MAINTENANCE OF THE SEWER SYSTEM

Operation and maintenance of the sewer system shall be in compliance with the General Requirements of Part II and the following terms and conditions:

1. Maintenance Staff

The permittee shall provide an adequate staff to carry out the operation, maintenance, repair, and testing functions required to ensure compliance with the terms and conditions of this permit.

2. Preventative Maintenance Program

The permittee shall maintain an ongoing preventative maintenance program to prevent overflows and bypasses caused by malfunctions or failures of the sewer system infrastructure. The program shall include an inspection program designed to identify all potential and actual unauthorized discharges.

3. Infiltration/Inflow Control Plan:

The permittee shall continue to implement a plan to control infiltration and inflow (I/I) to the separate sewer system. An updated plan shall be submitted to EPA and MassDEP **within six months of the effective date of this permit** (see page 1 of this permit for the effective date) and shall describe the permittee's program for preventing infiltration/inflow related effluent limit violations, and all unauthorized discharges of wastewater, including overflows and by-passes due to excessive infiltration/inflow.

The plan shall include:

- An ongoing program to identify and remove sources of infiltration and inflow. The program shall include the necessary funding level and the source(s) of funding.

- An inflow identification and control program that focuses on the disconnection and redirection of illegal sump pumps and roof down spouts. Priority should be given to removal of public and private inflow sources that are upstream from, and potentially contribute to, known areas of sewer system backups and/or overflows.

- Identification and prioritization of areas that will provide increased aquifer recharge as the result of reduction/elimination of infiltration and inflow to the system.

- An educational public outreach program for all aspects of I/I control, particularly private inflow.

Reporting Requirements:

A summary report of all actions taken to minimize I/I during the previous calendar year shall be submitted to EPA and MassDEP annually, **by March 31**. The summary report shall, at a minimum, include:

- A map and a description of inspection and maintenance activities conducted and corrective actions taken during the previous year.
- Expenditures for any infiltration/inflow related maintenance activities and corrective actions taken during the previous year
- A map with areas identified for I/I-related investigation/action in the coming year.
- A calculation of the annual average I/I and the maximum month I/I for the reporting year.
- A report of any infiltration/inflow related corrective actions taken as a result of unauthorized discharges reported pursuant to 314 CMR 3.19(20) and reported pursuant to the Unauthorized Discharges section of this permit.

4.. Alternate Power Source

In order to maintain compliance with the terms and conditions of this permit, the permittee shall continue to provide an alternative power source with which to sufficiently operate its treatment works (as defined at 40 CFR §122.2).

D. SLUDGE CONDITIONS

1. The permittee shall comply with all existing federal and state laws and regulations that apply to sewage sludge use and disposal practices, including EPA regulations promulgated at 40 CFR Part 503, which prescribe "Standards for the Use or Disposal of Sewage Sludge" pursuant to § 405(d) of the CWA, 33 U.S.C. § 1345(d).
2. If both state and federal requirements apply to the permittee's sludge use and/or disposal practices, the permittee shall comply with the more stringent of the applicable requirements.
3. The requirements and technical standards of 40 CFR Part 503 apply to the following sludge use or disposal practices.

   a. Land application - the use of sewage sludge to condition or fertilize the soil

   b. Surface disposal - the placement of sewage sludge in a sludge only landfill

   c. Sewage sludge incineration in a sludge only incinerator

4. The requirements of 40 CFR Part 503 do not apply to facilities which dispose of sludge in a municipal solid waste landfill. 40 CFR Part 503.4. These requirements also do not apply to facilities which do not use or dispose of sewage sludge during the life of the permit but rather treat the sludge (e.g. lagoons, reed beds), or are otherwise excluded under 40 CFR Part 503.6.

5. The 40 CFR Part 503 requirements including the following elements:

   - General requirements
   - Pollutant limitations
   - Operational Standards (pathogen reduction requirements and vector attraction reduction requirements)
   - Management practices
   - Record keeping
   - Monitoring
   - Reporting

   Which of the 40 CFR Part 503 requirements apply to the permittee will depend upon the use or disposal practice followed and upon the quality of material produced by a facility. The EPA Region 1 Guidance document, "EPA Region 1 - NPDES Permit Sludge Compliance Guidance" (November 4, 1999), may be used by the permittee to assist it in determining the applicable requirements.[1]

6. The sludge shall be monitored for pollutant concentrations (all Part 503 methods), pathogen reduction and vector attraction reduction (land application and surface disposal) at the following frequency. This frequency is based upon the volume of sewage sludge generated at the facility in dry metric tons per year

less than 290	1/ year
290 to less than1500	1 /quarter
1500 to less than 15000	6 /year
15000 +	1 /month

   Sampling of the sewage sludge shall use the procedures detailed in 40 CFR Part 503.8.

7. Under 40 CFR Part 503.9(r), the permittee is a "person who prepares sewage sludge" because it "is … the person who generates sewage sludge during the treatment of domestic sewage in a treatment works …." If the permittee contracts with *another* "person who prepares sewage sludge" under 40 CFR Part 503.9(r) – i.e., with "a person

1 This guidance document is available upon request from EPA Region 1 and may also be found at: http://www.epa.gov/region1/npdes/permits/generic/sludgeguidance.pdf

who derives a material from sewage sludge" – for use or disposal of the sludge, then compliance with Part 503 requirements is the responsibility of the contractor engaged for that purpose. If the permittee does not engage a "person who prepares sewage sludge," as defined in 40 CFR Part 503.9(r), for use or disposal, then the permittee remains responsible to ensure that the applicable requirements in Part 503 are met (40 CFR Part 503.7). If the ultimate use or disposal method is land application, the permittee is responsible for providing the person receiving the sludge with notice and necessary information to comply with the requirements of 40 CFR Part 503 Subpart B.

8. The permittee shall submit an annual report containing the information specified in the 40 CFR Part 503 requirements ((Part 503.18 (land application)), Part 503.28 (surface disposal), or Part 503.48 (incineration)) by **February 19** (*see also* "EPA Region 1 - NPDES Permit Sludge Compliance Guidance"). Reports shall be submitted to the address contained in the reporting section of the permit. If the permittee engages a contractor or contractors for sludge preparation and ultimate use or disposal, the annual report need contain only the following information:

   - Name and address of contractor(s) responsible for sludge preparation, use or disposal
   - Quantity of sludge (in dry metric tons) from the POTW that is transferred to the sludge contractor(s), and the method(s) by which the contractor will prepare and use or dispose of the sewage sludge.

E. COMPLIANCE SCHEDULE

The permittee shall achieve compliance with the effluent limits for enterococci **within one year** of the effective date of the permit. During the interim period, the limits for enterococci will not be in effect, but sampling and reporting will be required at the frequency required in Part I.A.1.

F. MONITORING AND REPORTING

1. **For a period of one year from the effective date of the permit**, the permittee may either submit monitoring data and other reports to EPA in hard copy form, or report electronically using NetDMR, a web-based tool that allows permittees to electronically submit discharge monitoring reports (DMRs) and other required reports via a secure internet connection. **Beginning no later than one year after the effective date of the permit**, the permittee shall begin reporting using NetDMR, unless the facility is able to demonstrate a reasonable basis that precludes the use of NetDMR for submitting all DMRs and reports. Specific requirements regarding submittal of data and reports in hard copy form and for submittal using NetDMR are described below:

a. Submittal of Reports Using NetDMR

NetDMR is accessed from: http://www.epa.gov/netdmr. Within one year of the effective date of the Permit, the permittee shall begin submitting DMRs and reports required under this permit electronically to EPA using NetDMR, unless the facility is able to demonstrate a reasonable basis, such as technical or administrative infeasibility, that precludes the use of NetDMR for submitting DMRs and reports ("opt out request").

DMRs shall be submitted electronically to EPA no later than the 15th day of the month following the completed reporting period. All reports required under the permit shall be submitted to EPA, including the MassDEP Monthly Operations and Maintenance Report, as an electronic attachment to the DMR. Once a permittee begins submitting reports using NetDMR, it will no longer be required to submit hard copies of DMRs or other reports to EPA and will no longer be required to submit hard copies of DMRs to MassDEP. However, permittees shall continue to send hard copies of reports other than DMRs (including Monthly Operation and Maintenance Reports) to MassDEP until further notice from MassDEP.

b. Submittal of NetDMR Opt Out Requests

Opt out requests must be submitted in writing to EPA for written approval at least sixty (60) days prior to the date a facility would be required under the Permit to begin using NetDMR. This demonstration shall be valid for twelve (12) months from the date of EPA approval and shall thereupon expire. At such time, DMRs and reports shall be submitted electronically to EPA unless the permittee submits a renewed opt out request and such request is approved by EPA. All opt out requests should be sent to the following addresses:

Attn: NetDMR Coordinator
U.S. Environmental Protection Agency, Water Technical Unit
5 Post Office Square, Suite 100 (OES04-4)
Boston, MA 02109-3912

And

Massachusetts Department of Environmental Protection
Northeast Regional Office- Bureau of Resource Protection
205B Lowell Street
Wilmington, MA 01887

c. Submittal of Reports in Hard Copy Form

Hard copy DMR submittals shall be completed and postmarked no later than the 15th day of the month following the completed reporting period. MassDEP Monthly Operation and Maintenance Reports shall be submitted as an attachment to the DMRs. Signed and dated originals of the DMRs, and all other reports required herein, shall be submitted to the appropriate State addresses and to the EPA address listed below:

U.S. Environmental Protection Agency
Water Technical Unit
5 Post Office Square, Suite 100 (OES04-SMR)
Boston, MA 02109-3912

The State Agency addresses are:

Massachusetts Department of Environmental Protection
Northeast Regional Office- Bureau of Resource Protection
205B Lowell Street
Wilmington, MA 01887

And

Massachusetts Department of Environmental Protection
Surface Water Discharge Permit Program
627 Main Street, 2nd Floor
Worcester, Massachusetts 01608

G. STATE PERMIT CONDITIONS

1. This authorization to discharge includes two separate and independent permit authorizations. The two permit authorizations are (i) a federal National Pollutant Discharge Elimination System permit issued by the U.S. Environmental Protection Agency (EPA) pursuant to the Federal Clean Water Act, 33 U.S.C. §§1251 et seq.; and (ii) an identical state surface water discharge permit issued by the Commissioner of the Massachusetts Department of Environmental Protection (MassDEP) pursuant to the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53, and 314 C.M.R. 3.00. All of the requirements contained in this authorization, as well as the standard conditions contained in 314 CMR 3.19, are hereby incorporated by reference into this state surface water discharge permit.

2. This authorization also incorporates the state water quality certification issued by MassDEP under § 401(a) of the Federal Clean Water Act, 40 C.F.R. 124.53, M.G.L. c. 21, § 27 and 314 CMR 3.07. All of the requirements (if any) contained in MassDEP's water quality certification for the permit are hereby incorporated by reference into this state surface water discharge permit as special conditions pursuant to 314 CMR 3.11.

3. Each agency shall have the independent right to enforce the terms and conditions of this permit. Any modification, suspension or revocation of this permit shall be effective only with respect to the agency taking such action, and shall not affect the validity or status of this permit as issued by the other agency, unless and until each agency has concurred in writing with such modification, suspension or revocation. In the event any portion of this permit is declared invalid, illegal or otherwise issued in violation of state law such permit shall remain in full force and effect under federal law as a NPDES Permit issued by the U.S. Environmental Protection Agency. In the event this permit is declared invalid, illegal or otherwise issued in violation of federal law, this permit shall remain in full force and effect under state law as a permit issued by the Commonwealth of Massachusetts.

Attachment B

Summary of Required Report Submittals*

Required Report	Date Due	Submitted By:	Submitted To: (see bottom of page for key)
Discharge Monitoring Report (DMR)	Monthly, postmarked by the 15th of the month following the monitoring month (e.g. the March DMR is due by April 15th.	Town of Manchester	1, 2, 3
Whole Effluent Toxicity (WET)Test Report (Part I.A.1)	July 31 and October 31 of each year	Town of Manchester	1, 2, 3
I/I Control Plan (Part I.C.3)	Within 6 months of permit effective date	Town of Manchester	1,2
I/I Annual Report (Part I.C.3)	By March 31	Town of Manchester	1,2
Annual Sludge Report (Part I.D.8.)	February 19 each year	Town of Manchester	1,2

*This Table is a summary of reports required to be submitted under this NPDES permit as an aid to the permittee. If there are any discrepancies between the permit and this summary, the permittee shall follow the permit requirements.

**The addresses are for the submittal of hard copies. When the permittee begins reporting using NetDMR, submittal of hard copies of many of the required reports will not be necessary. See permit conditions for details.

1. Environmental Protection Agency
   Water Technical Unit (OES04-SMR)
   5 Post Office Square – Suite 100
   Boston, Massachusetts 02109 - 3912

2. Massachusetts Department of Environmental Protection
   Bureau of Resource Protection
   Northeast Regional Office
   205B Lowell Street
   Wilmington, MA 01887

3. Massachusetts Department of Environmental Protection
   Division of Watershed Management
   Surface Water Discharge Permit Program
   627 Main Street, 2nd Floor
   Worcester, Massachusetts 01608

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

FACT SHEET

DRAFT NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT TO DISCHARGE TO WATERS OF THE UNITED STATES.

NPDES PERMIT NO.: MA0100871

NAME AND ADDRESS OF APPLICANT:

Board of Selectman
Town Hall Building
10 Central Street
Manchester by-the-Sea, MA 01944

NAME AND ADDRESS OF FACILITY WHERE DISCHARGE OCCURS:

Manchester Wastewater Treatment Plant
12 Church Street
Manchester-by-the-Sea, Massachusetts 01944

RECEIVING WATER: Manchester Bay, North Coastal Basin - 93.

CLASSIFICATION: SB

I. Proposed Action, Type of Facility, and Discharge Location

The above named applicant has requested that the U.S. Environmental Protection Agency reissue its NPDES permit to discharge into the designated receiving water. The facility is engaged in collection and treatment of domestic wastewater. The discharge is from a secondary wastewater treatment plant. See **Attachments A and B** for facility location and treatment process diagrams respectively. Manchester's outfall is approximately 8,700 feet long and discharges through a 10 port diffuser into Manchester Bay, about 1000 feet northeast of Sauli's Rock, at a depth of about 40 feet.

A water quality designation for Manchester Bay is not included in the Tables in Part 4.06 of the Massachusetts Surface Water Quality Standards. EPA requested clarification from MassDEP, and was informed that Manchester Bay is classified in the Massachusetts Surface Water Quality Standards as a Class SB waterway. The designated uses for a

Class SB water are 1) the protection and propagation of fish, other aquatic life and wildlife, 2) for primary and secondary contact recreation and 3) Shell fish harvesting with depuration in designated areas. Manchester Bay is designated for shelfishing.

II. Description of Discharge

A quantitative description of the discharge in terms of significant effluent parameters based on recent DMRs from December 2008 to November 2010 is shown on **Attachment C.** A review of this data shows that the facility generally complies with its current NPDES permit for all parameters.

III. Limitations and Conditions

The effluent limitations and the monitoring requirements may be found in the draft NPDES permit.

IV. Permit Basis and Explanation of Effluent Limitation Derivation

The permittee owns and operates a 1.2 million gallon per day (MGD) secondary activated sludge wastewater treatment facility (WWTF), which was upgraded in 1999. Effluent is discharged to Manchester Bay through an extended outfall, as previously described. Sludge trucked off-site to the Upper Blackstone WWTF for incineration.

EPA is required to consider technology and water quality requirements when developing permit effluent limits. Technology based treatment requirements represent the minimum level of control that must be imposed under Sections 402 and 301(b) of the Act. Under Section 301(b)(1)(B) of the CWA, publicly owned treatment works (POTWs) must have achieved effluent limitations based upon secondary treatment by July 1, 1977. The secondary treatment requirements are set forth at 49 CFR Part 133.

EPA regulations require NPDES permits to contain effluent limits more stringent than technology-based limits where more stringent limits are necessary to maintain or achieve federal or state water quality standards.

Under Section 301(b)(1)(C) of the Clean Water Act (CWA), discharges are subject to effluent limitations based on Water Quality Standards. The Massachusetts Surface Water Quality Standards include the requirements for the regulation and control of toxic constituents and also establish that EPA criteria developed pursuant to Section 304(a) of the CWA shall be used as water quality criteria unless site specific criteria have been established.

Pursuant to 40 CFR 122.44(d)(1)(i), the permit must limit any pollutant or pollutant parameter (conventional, non-conventional, toxic, and whole effluent toxicity) that is or may be discharged at a level that caused, has reasonable potential to cause, or contributes to an excursion above any water quality criterion. An excursion occurs if the projected or actual instream concentrations exceed the applicable criterion. In determining reasonable potential, EPA considers existing controls on point and non-point sources of pollution, variability of the pollutant in the effluent, sensitivity of the species to toxicity and, where appropriate, the dilution of the effluent in the receiving water.

A permit may not be renewed, reissued, or modified with less stringent limitations or conditions than those contained in the previous permit unless in compliance with the anti-backsliding requirement of the CWA.

EPA's anti-backsliding provisions, found in Sections 402(o) and 303(d)(4) of the Clean Water Act and 40 CFR 122.44(l), restrict the relaxation of permits, standards, and conditions. Therefore, the effluent limits in the reissued permit must be at least as stringent as those of the previous permit, except under certain limited conditions.

The effluent monitoring requirements in the draft permit been specified in accordance with 40 CFR 122.41(j), 122.44(i) and 122.48 to yield data representative of the discharge.

A. Conventional Pollutants

Flow

The WWTF is designed for an average flow of 1.2 mgd with a maximum capacity of 3.0 mgd. However, as a condition for approval of the plant expansion under the Ocean Sanctuaries Act, an average annual flow limit of 0.67 MGD was imposed in the previous permit in order to ensure that the permittee limits expansion of the sewer system and continues its program to remove infiltration and inflow. This limit is included in the draft permit. The previous permit and the draft permit also include a monthly average limit of 0.67 MGD during the months of June through November and a monthly average limit of 1.2 MGD during the months of December through May.

The permit application shows that over the past two years the annual average flow has increased from 0.448 MGD to 0. 647 MGD. The maximum daily discharge has decreased from 3.986 MGD to 3.73 MGD over the same time period.

The draft permit requires the permittee to implement an I/I control program adequate to ensure that I/I does not cause overflows of the collection system or violations at the WWTF. These requirements are standard requirements of NPDES permits issued to publicly owned treatment works in Massachusetts. Since the permit has already developed an I/I removal program, the additional activities necessary to comply with the permit condition should be minimal.

BOD and TSS

The effluent limitations and monitoring requirements for BOD and TSS are the same as those found in the previous permit. These limits are in accordance with the secondary treatment requirements at 40 CFR 133.102.

Bacteria and pH

The numerical limitations for enterococci, fecal coliform, and pH are based on state certification requirements under Section 401(a)(1) of the CWA, as described in 40 CFR 124.53 and 124.55. These limitations are also in accordance with the Massachusetts Surface Water Quality Standards. .

Since the issuance of the current permit, MassDEP has revised the criteria for bacteria in the Massachusetts Surface Water Quality Standards for protecting recreational uses. The bacteria criteria for the protection of recreational uses in salt water were revised from fecal coliform bacteria to enterococci (fecal coliform remains the criteria for protecting shell-fishing use). The criteria for enterococci for Class SB waters are a monthly geometric mean of 35 cfu/100ml and single sample maximum (SSM) of 104 cfu/100ml. MassDEP views the use of the 90% upper confidence level of 276 cfu/100ml as appropriate for setting the maximum daily limit for enterococci in the draft permit. Accordingly, these limitations have been included in the draft permit. **See Part I.E** of the draft permit for the compliance schedule for attaining the enterococci limits.

The current permit has a fecal colifom monthly average limit of 200 cfu/100ml and a maximum daily limit of 400 cfu/100 ml. However, the criteria for SB waters designated for shellfishing are a geometric mean of 88 colony forming units (cfu) per 100 ml and that no more than 10 percent of the fecal coliform samples in any calendar month exceed 260 cfu/100 ml. Accordingly, the daft permit includes a monthly average geometric mean limit of 88 cfu/100 ml, a maximum day limit of 260 cfu/100 ml, and a requirement that no more than 10 percent of samples in a month shall exceed 260 cfu per 100 ml.

A review of the DMRs from 12/31/2008 through 12/1/2010 shows that the monthly average discharge of fecal coliform varies from 2 cfu/100ml to 45 cfu/100ml, and the maximum daily discharge varies from 4 cfu/100 ml to 228 cfu/100 ml. It does not appear that permittee should have difficulty complying with the new limits..

B. Toxic Pollutants

Under Section 301 (b) (1) (C) of the CWA, discharges are subject to effluent limitations based on water quality standards. The State Surface Water Quality Standards, include the following narrative statements and require that EPA criteria established pursuant to Section 304(a)(1) of the CWA be used as guidance for interpretation of the following narrative criteria:

> Waters shall be free from pollutants in concentrations or combinations that
>
> (a) Exceed the recommended limits on the most sensitive receiving water use;
>
> (b) Injure, are toxic to, or produce adverse physiological or behavioral responses in humans or aquatic life; or

(c) Exceed site-specific safe exposure levels determined by bioassay using sensitive species.

Whole Effluent Toxicity

National studies conducted by the Environmental Protection Agency (EPA) have demonstrated that domestic sources contribute toxic constituents to POTWs. These constituents include metals, chlorinated solvents, aromatic hydrocarbons and others.

Therefore, based on the potential for toxicity from domestic contributions, water quality standards and in accordance with EPA regional policy, the draft permit includes acute effluent toxicity limitations and monitoring requirements (LC50). (See, e.g., "Policy for the Development of Water Quality-Based Permit Limitations for Toxic Pollutants: 50 Fed. Reg. 30, 784 (July 24, 1985).

The principal advantages of biological techniques are: (1) the effects of complex discharges of many known and unknown constituents can be measured only by biological analyses; (2) bioavailability of pollutants after discharge is best measured by toxicity testing including any synergistic effects of pollutants; and (3) pollutants for which there are inadequate chemical analytical methods or criteria can be addressed. Therefore, toxicity testing is being used in conjunction with pollutant specific control procedures to control the discharge of toxic pollutants.

The frequency and the type of WET test depends on dilution ratio and risk factor. The dilution ratio of the effluent with the receiving water was modeled at 201:1 (i.e a dilution factor of 202) by EPA in 1994, during the development of a previous permit. Pursuant to EPA Region I policy and the Massachusetts Implementation Policy for the Control of Toxic Pollutants, dated February 23, 1990, discharges having dilution factors greater than 100 require acute toxicity testing two times per year with a LC - 50 limit of 50%.

The present permit requires that the permittee conduct acute WET testing for the Outfall 001 effluent two times per year and that each test include the use of Inland Silverside (Menidia beryllina). The draft permit requires the permittee to continue to test the Inland Silverside two times per year in accordance with 40 CFR Part 36 methods, and the EPA Region I protocol, included as permit Attachment A.

Chlorine

Chlorine and chlorine compounds produced by the chlorination of wastewater can be extremely toxic to aquatic life. The receiving water may not provide sufficient dilution of these compounds discharged by the WWTF to meet the EPA recommended in-stream criteria for acute and chronic toxicity levels specified in the water quality criteria document. The National Recommended Water Quality Criteria: 2002 states that the average total residual chlorine (TRC) in the receiving water should not exceed 7.5 ug/l and the maximum TRC should not exceed 13 ug/l to protect marine aquatic life.

The following is a calculation of the chlorine limits:

Acute Chlorine WQC = 13 ug/l
Chronic Chlorine WQC = 7.5 ug/l
Dilution Ratio = 201:1 [The data used to calculate the dilution was taken from the Salem Harbor Study done by U-Mass-Boston and the Manchester Outfall Study. During May of 1994, EPA model UMERGE was used to calculate the dilution ratio using a design flow of 1.2 mgd.]

Dilution Factor = (201 + 1) / 1 = 202
Daily Maximum Chlorine Limit = (202) x (13 ug/l) = 2625 ug/l = 2.625 mg/l
Average Monthly Chlorine Limit = (202) x (7.5 ug/l) = 1515 ug/l = 1.515 mg/l

The calculated limits are less stringent than the maximum chlorine effluent limitation of 1 mg/l allowed by the Massachusetts Implementation Policy for the Control of Toxic Pollutants. Therefore, the draft permit includes a maximum daily discharge limit of 1 mg/l, consistent with the Massachusetts policy.

Metals

Certain metals like copper, lead, cadmium and zinc can be toxic to aquatic life. EPA has evaluated (see below) the reasonable potential for toxicity in the receiving water from metals in the effluent. Based on this evaluation EPA has determined that there is no reasonable potential for adverse impacts on the aquatic life, and no need to monitor and limit these metals.

Calculation of reasonable potential for copper, lead, zinc and cadmium:

All effluent metals data are taken from the Toxicity Test Reports from the period June 2007 to September 2009. The applicable criteria are from National Recommended Water Quality Criteria: 2002:

Allowable Effluent Concentration, C = Criteria /CF x DF

Where, Criteria = the saltwater water quality criteria in ug/l
CF = conversion factor from dissolved to total recoverable metal
DF = Dilution Factor

Copper:	Chronic	C = 3.1/0.83 x 202 = 754 ug/l which is greater than the effluent concentration range of 15-28 ug/l. So there is no reasonable potential.
	Acute	C = 4.8/0.83 x 202 = 1168 ug/l which is greater than the maximum effluent concentration of 28 ug/l. So, there is no reasonable potential.

Lead	Chronic	C = 8.1/0.951 x 202 = 1720 ug/l which is greater than the effluent concentration range of 1-2 ug/l. So, there is no reasonable potential
	Acute	C = 210/0.951 x 202 = 44605 ug/l which is far greater than the maximum effluent concentration of 2 ug/l. So, there is no reasonable potential
Zinc	Chronic	C = 81/0.946 x 202 = 17296 ug/l which is far greater than the effluent concentration range of 123 - 231 ug/l. So, there is no reasonable potential.
	Acute	C = 90/0.946 x 202 = 19218 ug/l which is far greater than the maximum effluent concentration of 231 ug/l. So, there is no reasonable potential.
Cadmium	Chronic	C = 8.8/0.994 x 202 = 1788 ug/l which is greater than the average effluent concentration of 1 ug/l. So, there is no reasonable potential.
	Acute	C = 40/0.994 x 202 = 8128 ug/l which is far greater than the maximum effluent concentration of 1 ug/l. So, there is no reasonable potential.

C. Non Conventional Pollutants

Nitrogen

The current permit requires monitoring of nitrogen compounds (total kjeldahl nitrogen, total nitrate and nitrite and total ammonia as nitrogen). The draft permit continues those requirements.

V. Sludge

Sludge generated by the Manchester Wastewater Treatment Facility is digested and thickened by rotary drum. Stabilized thickened sludge is hauled off-site to Upper Blackstone Water Pollution Abatement District facility in Millbury, Massachusetts for incineration. Approximately 53.8 dry metric tons of sludge is generated per year.

Section 405(d) of the Clean Water Act requires that sludge conditions be included in all POTW permits. Technical sludge standards required by Section 405 of the Clean Water Act (CWA) were finalized on November 25, 1992 and were published on February 19, 1993. The regulations went into effect on March 21, 1993 (see 40 CFR part 503).

The draft permit has been conditioned to ensure that sewage sludge use and disposal practices meet the Act's Section 405(d) Technical Standards. In addition, EPA-New England prepared a 72-page document entitled "EPA Region I NPDES Permit Sludge Compliance Guidance" for use by the permittee in determining their appropriate sludge conditions for their chosen method of sewage sludge use or disposal practices. This guidance document is available upon request from EPA Region 1 and may also be found at: http://www.epa.gov/region1/npdes/permits/generic/sludgeguidance.pdf .

VI. Pretreatment

The permittee does not have any major industries contributing industrial wastewater to the WWTF. Pollutants introduced into POTWs by a non-domestic source shall not pass through the POTW or interfere with the operation or performance of the treatment works.

VII. Antidegradation

This draft permit is being reissued with an allowable wasteload identical to the current permit and no change in outfall location. The State of Massachusetts has indicated that there will be no lowering of water quality and no loss of existing water uses and that no additional anti-degradation review is warranted.

VIII. Essential Fish Habitat (EFH)

Under the 1996 Amendments (PL 104-267) to the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. § 1801 et seq.(1998)), EPA is required to consult with NMFS if EPA's action or proposed actions that it funds, permits, or undertakes, may adversely impact any essential fish habitat.16 U.S.C. § 1855(b). The Amendments broadly define essential fish habitat as: waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. 16 U.S.C. § 1802(10). Adversely impact means any impact which reduces the quality and/or quantity of EFH. 50CFR.§ 600.910(a). Adverse effects may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey, reduction in species' fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

Essential fish habitat is only designated for fish species for which federal Fisheries Management Plans exist. 16 U.S.C. § 1855(b)(1)(A). EFH designations for New England were approved by the U.S. Department of Commerce on March 3, 1999.

A review of the relevant essential fish habitat information provided by NMFS indicates that the wastewater outfall exists within designated EFH for 25 federally managed species. **(See Attachment D)**.

The outfall discharges at a depth of 40 feet of water, approximately 1,000 feet northeast of Sauli Rock in Manchester Bay. This area is subjected to currents associated with a semi-diurnal tidal exchange. The substrate in this area is predominantly hard, as depicted on nautical charts, indicative of an erosional environment. The effluent, which is discharged through a 10 port diffuser, mixes with a high volume of receiving water, with an EPA estimated dilution ratio of 201:1. The effluent discharged consists entirely of domestic, non-industrial wastewater, minimizing the likelihood of any toxic pollutants in the wastewater.

The limitations in the draft permit are not changed from the previous permit. There is no documented evidence of environmental degradation from the current discharge. An annual average flow limit of .67 MGD will continue in order to satisfy the requirements of the Ocean Sanctuaries Act.

Limits on total residual chlorine are more stringent than would be required to meet water quality standards, so there will be no effluent toxicity due to chlorine use. Monitoring requirements and limitations are also established on whole effluent toxicity. Such testing will detect any toxicity which occurs in the effluent. In addition, the permit also requires that the discharge shall not violate the state surface water quality standards.

EPA believes that the conditions and limitations contained within the draft permit adequately protect all aquatic life, including those species with EFH designation. Impacts associated with issuance of this permit to the EFH species, their habitat and forage, have been minimized to the extent that no significant adverse impacts are expected. Further mitigation is not warranted.

IX. Endangered Species

The Endangered Species Act of 1973, as amended (ESA), imposes requirements on Federal agencies related to the potential effects of their actions on endangered or threatened species of fish, wildlife, or plants (listed species) and their designated "critical habitat."

Section 7 of the ESA requires, in general, that Federal agencies insure that any actions they authorize, fund, or carry out, in the United States or upon the high seas, are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated "critical habitat" for those species. Federal agencies carry out their responsibilities under the ESA in consultation with, and assisted by, the Departments of Interior (DOI) and/or Commerce (DOC), depending on the species involved. The United States Fish & Wildlife Service (USFWS) of the DOI administers Section 7 consultations for freshwater species, while the National Oceanic and Atmospheric Administration (NOAA) of DOC does so for marine species and anadromous fish.

The federal action being considered in this case is EPA's proposed draft NPDES permit to the Manchester Wastewater Treatment Facility. The draft permit is intended to replace the existing NPDES permit in governing wastewater discharges from the Town's WWTF, as discussed above.

The permittee owns and operates a secondary activated sludge wastewater treatment facility (WWTF), which was upgraded in 1999. Effluent is discharged to Manchester Bay through an extended outfall. The WWTF is designed for an average flow of 1.2 mgd with a maximum capacity of 3.0 mgd. However, as a condition for approval of the plant expansion under the Ocean Sanctuaries Act, an average annual flow limit of 0.67 MGD was imposed in the previous permit in order to ensure that the permittee limits expansion of the sewer system and continues its program to remove infiltration and inflow. This limit is included in the draft permit. The previous permit and the draft permit also include a monthly average limit of 0.67 MGD during the months of June through November and a monthly average limit of 1.2 MGD during the months of December through May.

Manchester's outfall is approximately 8,700 feet long and discharges through a 10 port diffuser into Manchester Bay, about 1000 feet northeast of Sauli's Rock, at a depth of about 40 feet. The substrate in this area is predominantly hard, as depicted on nautical charts, indicative of an erosional environment. The effluent mixes with a high volume of receiving water, with an EPA estimated dilution ratio of 201:1. The effluent discharged consists entirely of domestic, non-industrial wastewater, minimizing the likelihood of any toxic pollutants in the wastewater

As the federal agency charged with authorizing the discharges from this facility, EPA has reviewed available information and determined that a number of federally listed species inhabit (seasonally) waters in the broad general area of the relevant discharges and further analysis is necessary with regard to these species.

The species in question are as follows: fish (shortnose sturgeon - endangered); mammals (whales: North Atlantic Right, Humpback, Fin, Sei, Sperm, Blue – all endangered); reptiles (sea turtles: Kemp's Ridley, Leatherback, Green – all endangered; Loggerhead – Threatened but proposed for listing as endangered). As discussed below, while some of these species are unlikely to be present in the areas affected by the discharges authorized by the permit, others may well occur in such areas on an intermittent basis during certain seasons. No designated critical habitat for any of these listed species lies within the areas impacted by WWTF.

NOAA administers the ESA for all of the above-listed species. Because certain of these species may be affected by the discharges authorized by the proposed permit, EPA must consult with NOAA under Section 7 of the ESA. EPA has evaluated the potential impacts of the permit action on these species. On the basis of this evaluation, which is discussed below, EPA's preliminary determination is that this action "is not likely to adversely

affect listed species or critical habitat."[1] 16 C.F.R. § 402.13(a). As a result, EPA will, in a separate letter, request NOAA's written concurrence with EPA's determination

[1] A project can be considered "unlikely to adversely affect" a listed species "when direct or indirect effects of the proposed project on listed species are expected to be discountable, insignificant or completely beneficial." August 20, 2009, Letter from Patricia A. Kurkul, Regional Administrator, NOAA, National

conclusion in order to complete the consultation with NOAA on an "informal" basis. *See* 16 C.F.R. § 402.13(a). If NOAA does not concur, then "formal consultation" will be necessary.

Discussion of ESA Listed Species in the Vicinity of the Outfall

Fish - The only listed species of fish that might conceivably be found in the general area of the discharges to be authorized by the Manchester WWTF NPDES permit is the shortnose sturgeon. An anadromous species of fish, the shortnose sturgeon is present in many large rivers in the Northeast (Dadswell , Et Al., 1984). The closest known population to the Manchester discharge, however, is in the Merrimack River (Kiefer and Kynard, 1989).

The only record of this species in Massachusetts Bay is recorded in Bigelow and Schroeder (1953) as having been taken at Rockport, Massachusetts. Therefore, shortnose sturgeons are unlikely to be present in the area of the WWTF[2]

After considering the relevant information, EPA's preliminary determination is that the proposed permitting action is unlikely to have an adverse effect on the shortnose sturgeon or its critical habitat. First, there is no designated critical habitat for shortnose sturgeon in the area of any of the discharges covered by the new permit. Second, as explained above, shortnose sturgeons are unlikely to occur in the areas affected by the discharge to be authorized by the proposed permit. Third, any shortnose sturgeon that did occur in the area of the discharge would be anomalous and would likely be only a short-term, transient visitor to the area. Fourth, the shortnose sturgeon is primarily a benthic species,

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Marine Fisheries Service, Northeast Region, to Melville P. Cote, EPA Region 1 ("NOAA's August 20, 2009, Rockport Consultation Letter") (addressing ESA issues concerning EPA's proposed NPDES permit for the Rockport, MA, POTW).

2 In its Biological Opinion concerning licensing of the Neptune offshore Liquefied Natural Gas import terminal, which lies approximately 16 miles east of Manchester-by-the-Sea, NOAA stated the following:

> In Massachusetts, the federally endangered shortnose sturgeon (*Acipenser brevirostrum*) is only known to occur in the Merrimack and Connecticut Rivers (NMFS 1998a), neither of which are in the vicinity of the buoy locations. As such, shortnose sturgeon are not likely to be present in the action area and will not be considered further in this BO.

National Marine Fisheries Service, Endangered Species Act Section 7 Consultation, Biological Opinion, Issuance of License to Neptune LNG by MARAD to construct, own, and operate an LNG deepwater port (Jan. 12, 2007) ("2007 NOAA BO for Neptune"), p. 21. In a letter regarding prior CSO abatement work by Gloucester, NOAA stated that "[w]hile several species of endangered and threatened whales and sea turtles are known to occur in the coastal waters of Massachusetts, no federally listed or proposed threatened or endangered species and/or critical habitat for listed species under the jurisdiction of the National Marine Fisheries Service (NOAA Fisheries) are known to exist in near-by Gloucester Harbor." December 9, 2004, letter from Mary A. Colligan, Assistant Regional Administrator for Protected Resources, National Marine Fisheries Service, Northeast Region, to Aaron Weieneth, Metcalf & Eddy ("NOAA's December 2004 Gloucester CSO Letter"). Furthermore, NOAA did not include the shortnose sturgeon as a species that might be present in its review of EPA's proposed NPDES permit for Rockport, MA. *See* NOAA's August 20, 2009, Rockport Consultation Letter.

whereas the WWTF discharge plume is positively buoyant and has limited, if any, direct contact with the bottom. Therefore, even if a sturgeon was in the area of the outfall, it would be especially unlikely to have any significant contact with the Town's pollutant discharges. Fifth, the WWTF's outfall discharges at a depth of 40 feet and uses a multi-port diffuser, achieving a high dilution factor of 201:1. All of these factors should contribute to precluding any marine organisms, including any shortnose sturgeon, from coming into contact with a concentrated discharge plume.

Finally, the draft permit proposes protective effluent limits based on secondary treatment. An annual average flow limit of .67 MGD will continue in order to satisfy the requirements of the Ocean Sanctuaries Act. Limits on total residual chlorine are more stringent than would be required to meet water quality standards, so there will be no effluent toxicity due to chlorine use. Monitoring requirements and limitations are also established on whole effluent toxicity. Such testing will detect any toxicity which occurs in the effluent. In addition, the permit also requires that the discharge shall not violate the state surface water quality standards.

Mammals – Whales - A number of whale species listed as endangered are or may be present in marine waters offshore of Manchester-by-the-Sea. *See* 2007 NOAA BO for Neptune at 20-21. *See also* Jeffreys Ledge Information Page (found at http://www.jeffreysledge.org) (c. Whale Center of New England) (Jeffreys Ledge Information Page). Indeed, the near-by City of Gloucester is home to an active commercial whale watch fleet. *See* 2007 NOAA BO for Neptune at 69.

Still, endangered whales would typically be expected to be found in waters relatively far offshore, such as in the areas of the Stellwagen Bank National Marine Sanctuary or Jeffreys Ledge,[3] or even farther offshore. *See* 2007 NOAA BO for Neptune at 84. Endangered species of whale that seasonally appear in some numbers in and around Stellwagen Bank and Jeffreys Ledge include the Humpback whale, the Fin whale, and the North Atlantic Right whale. *See* 2007 NOAA BO for Neptune at 25, 29-30, 32, 84. *See also* NOAA's August 20, 2009, Rockport Consultation Letter at 2. The waters around Stellwagen Bank and Jeffreys Ledge are important feeding grounds for these species because upwelling in these areas tends to produce abundant food supplies. Other endangered species of whale that could potentially be found in the waters of Stellwagen Bank and Jeffreys Ledge include the Sei, Blue and Sperm whales. These species, however, would be far less common because of their preference for either deeper water (Sperm and Sei whales) or more northern waters (Blue whales). *See* 2007 NOAA BO for Neptune at 34-41, 84. *See also* NOAA's August 20, 2009, Rockport Consultation Letter at 2; Jeffreys Ledge Information Page (separate pages on North Atlantic Right, Humpback, Fin, Sei, Blue and Sperm whales).

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[3] The Stellwagen Bank NMS encompasses a southeastern portion of Jeffrey's Ledge. *See Map of Gerry E. Studds Stellwagen Bank National Marine Sanctuary* (found at http://sanctuaries.noaa.gov/pgallery/atlasmaps/sb.html). *See also* Jeffreys Ledge Information Page.

Looking closer to shore, it is unlikely that any of the above-discussed whale species would be present in the vicinity of the Manchester WWTF outfall and, therefore, these species will be unaffected by the permit action. Furthermore, it is unlikely that Sei, Sperm, Blue or Fin whales would be present in the 40 foot waters in the vicinity of the WWTF diffuser because of their preference for deeper and/or more northerly waters. *See* 2007 NOAA BO for Neptune at 34-41, 84. *See also* NOAA's August 20, 2009, Rockport Consultation Letter at 2. Therefore, these species should also be unaffected by the WWTF discharge.

With regard to Humpback and North Atlantic Right whales, while these species are typically found farther offshore, such as around Stellwagen Bank, they are known to venture into nearer-shore waters on occasion. In such cases, the whales are most likely transient visitors on their way to another destination, such as an offshore feeding ground. *See* 2007 NOAA BO for Neptune at 84. *See also* NOAA's August 20, 2009, Rockport Consultation Letter at 2.

Having considered the relevant information, EPA's preliminary determination is that the proposed permit action is unlikely to adversely affect any of the endangered whale species at issue here because (a) none are likely to occur in the vicinity of the WWTF discharge, (b) individual North Atlantic Right and Humpback whales may come into the vicinity of the WWTF discharge, but these species are only present in Massachusetts Bay on a seasonal basis and would be unlikely to enter waters near the WWTF discharge on other than a temporary basis, most likely while transiting the area, and (c) the treatment and other controls required to meet the stringent limits of the proposed permit, coupled with the outfall's location, depth and use of a diffuser, should preclude any adverse effects upon whales, their prey or their habitat.

As discussed above, the draft permit proposes protective effluent limits based on secondary treatment. An annual average flow limit of .67 MGD will continue in order to satisfy the requirements of the Ocean Sanctuaries Act. Limits on total residual chlorine are more stringent than would be required to meet water quality standards, so there will be no effluent toxicity due to chlorine use. Monitoring requirements and limitations are also established on whole effluent toxicity. Such testing will detect any toxicity which occurs in the effluent. In addition, the permit also requires that the discharge shall not violate the state surface water quality standards. The WWTF's outfall discharges at a depth of 40 feet and uses a multi-port diffuser, achieving a high dilution factor of 201:1. All of these factors should contribute to precluding any marine organisms, including any marine mammal, from coming into contact with a concentrated discharge plume.

Reptiles – Turtles - The following listed species of sea turtle are known to occur in the waters of Massachusetts Bay: Kemp's Ridley, Green, Leatherback (all endangered), Loggerhead (listed as threatened but recently proposed for listing as endangered).[4] *See* NOAA Website at - http://www.nmfs.noaa.gov/pr/species/turtles/; and at

[4] Hawksbill sea turtles would not be expected to be present in the area of the discharges covered by the proposed NPDES permit. *See* 2007 NOAA BO for Neptune, at 21.

http://www.nmfs.noaa.gov/pr/pdfs/species/turtle_loggerhead proposed_dps.pdf." As explained below, however, EPA's preliminary determination is that the proposed permit action is unlikely to adversely affect any of these listed species of sea turtle. Each of these sea turtle species has a wide range and tends to occupy a different type of habitat during different stages of its life history. In connection with its review of EPA's proposed NPDES permit for the Town of Rockport, MA, POTW, NOAA explained that:

> Four species of federally threatened or endangered sea turtles under the jurisdiction of NMFS may be found seasonally in the coastal waters of Massachusetts, typically when water temperatures are higher than 15°C. The highest concentrations of sea turtles are normally present from June – October.
>
> The sea turtles in northeastern nearshore waters are typically small juveniles with the most abundant being the federally threatened loggerhead (*Caretta caretta*), followed by the federally endangered Kemp's ridley (*Lepidochelys kempi*). Federally endangered green sea turtles (*Chelonia mydas*) also occur in these waters. The three species of chelonid turtles found in the Northeast remain very briefly in open ocean waters, spending most of their time during the summer months in harbors and estuarine waters. The Federally endangered leatherback sea turtles (*Dermochelys coriacea*) may also be found in the waters of Massachusetts during the warmer months, however this species is unlikely to occur in the action area for this project as it is typically found in deeper, more offshore waters.

See also NOAA's August 20, 2009, Rockport Consultation Letter at 3. Thus, while all four species of sea turtle could potentially be present in the waters in the vicinity of the WWTF's discharge, the leatherback is particularly unlikely to be present because it favors deeper, more offshore waters. A more detailed discussion of each of these four species is presented below.

Loggerhead Sea Turtle
In the Atlantic Ocean, the loggerhead turtle's range extends from Newfoundland to as far south as Argentina. *See* NOAA Website at - http://www.nmfs.noaa.gov/pr/species/turtles/. More specifically, the loggerhead's range includes the area of the Atlantic in the vicinity of the discharges covered by the proposed NPDES permit. Although more common in waters south of this area, the northern reach of the loggerhead's foraging range extends into the Gulf of Maine during the summer (warmer water) months. *See* 2007 NOAA BO for Neptune at 44. Loggerheads can appear in the Gulf of Maine as early as June, with "the large majority leav[ing] the Gulf of Maine by mid-September," though some may remain into late fall. *Id.* Their presence or absence from an area is influenced by, among other things, water temperature. *Id.*

Some data suggests that loggerheads are most common in waters "from 22 to 49 meters deep" – which is deeper than the area where the Manchester WWTF outfall is located, at a depth of approximately 12 meters (40 feet) – but they can inhabit areas "from the beach to waters beyond the continental shelf." *Id.*[5] Somewhere between the ages of 7 and 12 years, oceanic juveniles are thought to migrate to nearshore coastal areas (neritic zone) where they continue maturing until adulthood. *See* NOAA Website at: http://www.nmfs.noaa.gov/pr/species/turtles/.

On its website, NOAA explains that:

> [i]n addition to providing critically important habitat for juveniles, the neritic zone also provides crucial foraging habitat, inter-nesting habitat, and migratory habitat for adult loggerheads in the western North Atlantic. To a large extent, these habitats overlap with the juvenile stage, the exception being most of the bays, sounds, and estuaries along the Atlantic and Gulf coasts of the U.S. from Massachusetts to Texas, which are infrequently used by adults. ...
> The predomina[nt] foraging areas for western North Atlantic adult loggerheads are found throughout the relatively shallow continental shelf waters of the U.S., Bahamas, Cuba, and the Yucatán Peninsula, Mexico.

Leatherback Sea Turtle
Leatherback sea turtles have a particularly wide range and can tolerate relatively low water temperatures. *See* 2007 NOAA BO for Neptune at 50. Leatherbacks inhabit waters as far north as Manchester and beyond. *See id.* at 52. After nesting, female leatherbacks migrate from tropical waters to more temperate latitudes which support high densities of their jellyfish prey in the summer. *Id.* While they "are predominantly a pelagic species ..., [l]eatherbacks may come into shallow waters if there is an abundance of jellyfish nearshore."

Id. at 53. *See also* http://www.nmfs.noaa.gov/pr/species/turtles/leatherback.htm. Thus, leatherbacks are unlikely to be found in the area of the discharge covered by the permit, because they would typically be expected to be found in waters well offshore of this area. *See* NOAA's August 20, 2009, Rockport Consultation Letter at 3.

Kemp's Ridley Sea Turtle
The range of the Kemp's Ridley sea turtle extends northward from the Gulf of Mexico to New England along the Atlantic seaboard of the United States. *See* http://www.nmfs.noaa.gov/pr/species/turtles/kempsridley.htm. Adult Kemp's Ridley turtles "primarily occupy 'neritic' habitats," *id.*, and "[t]heir diet consists mainly of swimming crabs, but may also include fish, jellyfish, and an array of mollusks." *Id.* Thus, Kemp's Ridley turtles could be present in the vicinity of the discharge covered by the proposed permit.

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[5] NOAA has also noted that "Loggerhead sea turtles are a cosmopolitan species, found in temperate and subtropical waters and inhabiting pelagic waters, continental shelves, bays, estuaries and lagoons." 2007 NOAA BO for Neptune at 43,

Green Sea Turtle
The range of Green sea turtles in the western Atlantic Ocean extends (from as far south as Argentina) to the waters of Massachusetts. *See* 2007 NOAA BO for Neptune at 59. Juvenile Green sea turtles occupy pelagic habitat, but when they reach a certain length the juveniles leave these habitats and "enter benthic foraging areas, shifting to a chiefly herbivorous diet but may also consume jellyfish, salps, and sponges." *Id.* at 58. Thus, Green turtles could occur in the vicinity of the discharge covered by the proposed permit.

Having considered the relevant information, EPA's preliminary determination is that the proposed permit action is unlikely to adversely affect any of the listed species of sea turtle, and will not affect any of their designated critical habitats.

To begin with, no critical habitat will be affected because none has been designated in the vicinity of the areas affected by the WWTF discharge. In addition, EPA has three additional important reasons for concluding that the species are not likely to be adversely affected by the proposed permit action.

First, the permit contains environmentally protective conditions that should preclude adverse effects on sea turtles. More specifically, there are protective effluent limits based on secondary treatment. An annual average flow limit of .67 MGD will continue in order to satisfy the requirements of the Ocean Sanctuaries Act. Limits on total residual chlorine are more stringent than would be required to meet water quality standards, so there will be no effluent toxicity due to chlorine use. Monitoring requirements and limitations are also established on whole effluent toxicity. Such testing will detect any toxicity which occurs in the effluent. In addition, the permit also requires that the discharge shall not violate the state surface water quality standards.

Second, given that the WWTF's outfall discharges at a depth of 40 feet and uses a multi-port diffuser, achieving a high dilution factor of 201:1, neither sea turtles nor their food sources would come into contact with a concentrated discharge plume.[6] Indeed, except for leatherbacks, which are unlikely to be in the area, the turtles in question here are primarily benthic feeders. The discharge is positively buoyant and has little or no contact with the bottom.

Third, while individuals of the various species could be seasonally present in the areas around the WWTF discharge, they would not be expected to be present in large numbers or for lengthy periods of time. They would, instead, be more likely to be occasional, solitary, transient visitors. *See* NOAA's December 2004 Gloucester CSO Letter ("no

[6] While EPA is proposing that the new permit contain environmentally protective conditions, the Agency also notes that in its 2007 NOAA BO for Neptune, at 126, NOAA explained that:

> [t]urtles are relatively hardy species and are not easily affected by changes in water quality or increased suspension of sediments in the water column. However, if these changes persist, they can cause habitat degradation or destruction, eventually leading to foraging difficulties, which may in turn lead to long term avoidance or complete abandonment of the polluted area by the affected species (Ruben and Morreale 1999).

federally listed or proposed threatened or endangered species and/or critical habitat for listed species under the jurisdiction of the National Marine Fisheries Service (NOAA Fisheries) are known to exist in near-by Gloucester Harbor."). Leatherback turtles primarily inhabit offshore pelagic environments. *See* NOAA's August 20, 2009, Rockport Consultation Letter at 3.

The other listed species discussed here might visit the affected near-shore waters, but still would only be expected to venture into this area on a temporary basis during the warmer months. It seems unlikely that this area represents particularly good turtle habitat given the relatively cold water temperatures along the coast of Manchester. Again, however, even if sea turtles do occasionally forage in proximity to the outfall, it is EPA's preliminary determination that they are not likely to be adversely affected by the discharges.

X. State Certification Requirements

EPA may not issue a permit unless the Massachusetts Department of Environmental Protection with jurisdiction over the receiving waters certifies that the effluent limitations contained in the permit are stringent enough to assure that the discharge will not cause the receiving water to violate State Water Quality Standards. The staff of the Massachusetts Department of Environmental Protection has reviewed the draft permit. EPA has requested permit certification by the state pursuant to 40 CFR 124.53 and expects that the draft permit will be certified.

XI. Public Comment Period, Public Hearing, And Procedures For Final Decision

All persons, including applicants, who believe any condition of the draft permit is inappropriate must raise all issues and submit all available arguments and a supporting material for their arguments in full by the close of the public comment period, to Suprokash Sarker, U.S. EPA, MA Office of Ecosystem Protection, 5 Post Office Square, Suite 100 , Boston, Massachusetts 02109-3912. Any person, prior to such date, may submit a request in writing to EPA and MassDEP for a public hearing to consider the draft permit. Such requests shall state the nature of the issues proposed to be raised in the hearing. A public hearing may be held after at least thirty days public notice whenever the Regional Administrator finds that response to this notice indicates significant public interest. In reaching a final decision on the draft permit, the Regional Administrator will respond to all significant comments and make these responses available to the public at EPA's Boston Office. Following the close of the comment period, and after a public hearing, if such hearing is held, the Regional Administrator will issue a final permit decision and forward a copy of the final decision to the applicant and each person who has submitted written comments or requested notice.

XII. EPA Contact

Additional information concerning the draft permit may be obtained between the hours of 9:00 a.m. and 5:00 p.m., Monday through Friday, excluding holidays from:

Suprokash Sarker, P.E.
Municipal Permits Branch
U.S. Environmental Protection Agency
5 Post Office Square, Suite 100 (OEP 6-1)
Boston, MA 02109-3912
Telephone: (617) 918-1693
E-Mail: sarker.soupy@epa.gov

Kathleen Keohane
Department of Environmental Protection
Division of Watershed Management
627 Main Street, Floor # 2
Worcester, MA 01608
508-767-2856
kathleen.keohane@state.ma.us

____
Date

Stephen Perkins, Director
Office of Ecosystem Protection
U.S. Environmental Protection Agency
Boston, MA

List of Attachments:

A - Facility Location
B - Treatment Process Diagram
C - DMR Data
D - EFH

C. Town of Manchester-by-the-Sea Infiltration/Inflow Analysis

Prepared by Woodard & Curran in December 2013

WOODARD
&CURRAN

Town of Manchester-By-The-Sea

Infiltration/ Inflow Analysis

Town of Manchester-by-the-Sea
10 Central Street
Manchester By-The-Sea, MA 01944

226624
Town of Manchester-by-the-Sea
December 2013

woodardcurran.com
COMMITMENT & INTEGRITY DRIVE RESULTS

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDICES

1. INTRODUCTION

This report presents an Infiltration and Inflow (I/I) Identification and Removal Plan ("I/I Plan") for the Town of Manchester-by-the-Sea (Town). This I/I Plan was developed as required by the Administrative Consent Order with Penalty and Notice of Noncompliance (ACOP/NON), File No. ACOP-NE-13-1N003, issued to the Town by the Massachusetts Department of Environmental Protection (MassDEP), and was implemented in accordance with the MassDEP's *Guidelines for Performing Infiltration/Inflow Analysis and Sewer System Evaluation Survey* revised January 1993. A copy of the ACOP/NON is included in Appendix A.

1.1 BACKGROUND

The Town owns and operates a wastewater treatment works consisting of a separate sewer system and a wastewater treatment facility. According to the GIS data from the Town, the collection system includes approximately 15.2 miles of gravity sewer pipe up to 24 inches in diameter, four small pumping stations, and a secondary activated sludge wastewater treatment plant (WWTP) that discharges through an ocean outfall to Manchester Bay.

Discharges from the WWTP are regulated by the United States Environmental Protection Agency (EPA) and MassDEP through the National Pollutant Discharge Elimination System (NPDES) permitting program. The NPDES discharge permit issued in 2011 includes a requirement stating "if the average annual flow in any calendar year exceeds 80 percent of the facility's design flow, the permittee shall submit a report to MassDEP by March 31 of the following year describing its plans for further flow increases, and describing how it will maintain compliance with the flow limit and all other effluent limitations and conditions." According to the ACOP/NON, in 2011, the treatment plant's flow of 0.550 MGD exceeded 80% of the average annual flow limit established under the NPDES Permit. Because the Town did not comply with this Permit requirement, and therefore violated provisions of the permit, the Clean Water Act and the Surface Water Discharge Regulations, MassDEP issued the ACOP/NON.

As a result of the above and in accordance with the ACOP, the Town was required to develop and submit a written I/I Plan to MassDEP no later than April 1, 2013, which must include:

- A summary of all I/I work completed since calendar year 2000, including a summary of costs and scope of work for all investigations, reports, and construction completed to address I/I in the Town's system;
- A Spring 2013 metering program to quantify I/I into the Town's sewer system, including tidal inflow impacts; and
- A plan and schedule for further I/I work, including field investigations needed to identify I/I sources and a private inflow removal program targeting sump pumps, roof leaders, private drains, and other sources of private inflow into the Town's sewer system.

In a letter to MassDEP dated April 1, 2013, on behalf of the Town, Woodard & Curran submitted a summary of previous I/I work completed since calendar year 2000 as required by Item 1 above. The letter recommended that a sewer system metering program be conducted in the Spring of 2013 as a first step in addressing I/I in the system in accordance with Item 2 above. Item 3 above is addressed in this report and in subsequent reports prepared by the Town. A copy of the April 1, 2013 letter to MassDEP is included in Appendix A.

As further discussed in Section 2 of this report, a total of six (6) flow meters were installed and maintained between March 29 and June 21, 2013 (approximately 12 weeks) along with groundwater and rainfall gauges for this program. Metering data was analyzed to identify base flows, infiltration from seasonal high groundwater, rainfall induced I/I from precipitation events, and tidal inflow. The main purpose of this report is to provide a quantification of extraneous flows and an identification of their general locations in the respective sewer subareas of the collection system. This is the initial step towards targeting areas for more detailed future investigation and eventual rehabilitation. To meet the ACOP/NON requirements, this report includes an analysis of the Spring 2013 flow metering program results, as well as prioritization of the sub-areas for additional I/I or Sewer System Evaluation Survey (SSES) activities and recommendations for a phased program for additional I/I investigations. The locations of the proposed flow meters are identified on the figure reproduced in Appendix A.

1.2 PREVIOUS REPORTS

The Town has engaged the services of various consulting firms over recent years to investigate I/I issues in the sewer system, as well as perform construction and repair work. Woodard & Curran reviewed the Town's records to identify I/I work completed since calendar year 2000. The results of the records review are presented in Appendix A and include a summary of costs and the scope of work for investigations, reports, and construction work previously done to address I/I in the Town's sewer system.

In December 2012 and January 2013, in order to follow up on investigations completed in 2011, the Town conducted a study to investigate salt water intrusion into the collection system and WWTP. The study included sampling and flow rate testing along the shoreline and inland areas, and concluded that there exists a major saltwater intrusion source located 30 feet downstream of MH 155A on Beach Street. In the Summer of 2013, the Town pursued identification and elimination of the source. Tidal inflow is discussed in Section 3 of this report. A copy of the tidal inflow report prepared by Wright-Pierce dated February 4, 2013 is included in Appendix A.

1.3 INFILTRATION AND INFLOW

Throughout this report, excess sewer flow from groundwater, stormwater, and ocean water will be referred to as Infiltration and Inflow (I/I). Infiltration is generally defined as groundwater which enters the collection system through leaking pipes or manholes. Infiltration occurs when existing sewer lines experience material and/or joint degradation and deterioration. Infiltration also can occur when sewer lines are poorly designed and constructed.

Inflow is generally defined as stormwater or ocean water which enters the collection system directly through open manholes, manhole covers, frame seals or indirect connections with storm sewers. Inflow also includes direct piped connections to the collection system such as sump pumps and roof drains.

The identification of subareas with high levels of I/I is essential to protect the considerable investment the Town has made in its collection system and wastewater treatment facility. This report provides identification of priority subareas within the collection system for additional I/I investigation and/or future rehabilitation with the end goal of minimizing wastewater flows and the associated costs for transport and treatment. Extraneous "clean water" flows which enter collection system consume capacity that could be allocated for true wastewater treatment, leading to undue operational and maintenance costs. Peak flow periods with I/I contributions occur most significantly during wet weather events and are relatively infrequent, so they do not relate directly to average daily flows. The main reason for consideration of I/I flows in this report is to target areas for future I/I removal. The analysis and data presented in this report can be used to project how removal of extraneous flows could impact the WWTP's 12-month rolling average flow through seasonal average daily flow reduction.

2. DEVELOPMENT OF METERING PROGRAM

Woodard & Curran worked with the Town and MassDEP to develop a Town-wide metering program that is consistent with the MassDEP I/I Guidelines. The sewer system was divided into subareas in order to isolate and evaluate flow patterns. The overall metering program was further defined by determining the most effective locations for flow meters, reviewing meter manhole locations on the mapping, selecting acceptable meter types, and preparing for field verification of meter locations. The proposed metering locations were validated by a site visit and reviewed with MassDEP prior to installation. In total, six (6) open channel flow meters, one (1) rain gauge, and two (2) groundwater gauges were installed town-wide on March 29, 2013 and maintained throughout the metering period until removal on June 21, 2013. Metering was conducted by EST Associates, Inc. (EST Associates) of Needham, MA. A map showing the location of the flow meters, the rain gauge, and groundwater gauges is included in Appendix B. A full copy of the EST Associates report is included in Appendix C.

2.1 METER SITES

Metering sites including location and upstream pipe network length are listed below in Table 2-1. Woodard & Curran calculated upstream pipe footage and inch-miles using information from the Town's GIS database. Where record information for pipe length was not available in the Town's GIS database, Woodard & Curran used GIS shape lengths. Where pipe diameter was not available in the Town's GIS database, Woodard & Curran assigned a diameter to the segment based on upstream and/or downstream pipes and best engineering practices.

Table 2-1: 2013 Spring Metering Sites

Meter/Subarea	Manhole No.	Location	Pipe (linear feet)	Pipe (inch-miles)
1	3	Manchester Lodge Lot	13,189	21.24
2	12	School Street	16,112	24.48
3	20	School Street & Rosedale Avenue	13,700	20.78
4	34	Pleasant Street	12,001	19.31
5	151	Beach Street	5,280	7.26
6	93	Central Street	18,718	25.29

2.2 RAIN DATA

A tipping bucket type rain gauge was installed at the WWTP located at 12 Church Street and was maintained for the duration of the metering program. Rain data was collected in 15 minute intervals. Storm events were determined by identifying the greatest peak hour rainfall events over the entire metering period. A summary of rainfall event dates, size, and duration are included in Table 2-2. The data from each metering site and the rain gauge were used to create plots of wastewater flow and rainfall for each subarea. These plots are included in the EST Associates report in Appendix C. As shown in Table 2-2, Storm Event 3 on June 7, 2013 exhibited the highest peak hour intensity. The plots show that Storm Event 3 also caused the largest flow increase in all subareas in the collection system during the study period; therefore, the inflow analysis focused on flows during Storm Event 3. This storm event approached the MassDEP I/I Guidelines design storm of 0.87 inches as shown in Table 2-2.

Table 2-2: Study Period Rainfall Events

Storm Event	Event Start Date	Time	Day of Week	Total Rainfall (Inches)	Rain Duration (hours)	Peak Hour Rainfall Intensity (inches/hr.)
1	May 9, 2013	12:15 AM	Thursday	0.66	2	0.49
2	May 9, 2013	12:45 PM	Thursday	0.28	1.75	0.25
3	June 7, 2013	8:45 AM	Friday	2.49	18.25	0.68
4	June 10, 2013	7:30 PM	Tuesday	1.31	13	0.28
MassDEP Design Storm						0.87

2.3 GROUNDWATER DATA

EST Associates also installed piezometers in two sewer manholes, MH 34 on Pleasant Street in Subarea 4 and MH 151 on Beach Street in Subarea 5, to monitor groundwater elevations. Groundwater elevations have a direct impact on infiltration. Figure 1 below presents a plot of groundwater elevations over the metering period. Elevation readings are relative to the manhole inverts. Groundwater elevations declined steadily from March to May then increased in June. As shown, groundwater levels remained above pipe inverts at the gauge locations during the entire study. Accordingly, potential infiltration into pipelines would be maintained during the study as a result. The groundwater data is included in the EST Associates report in Appendix C.

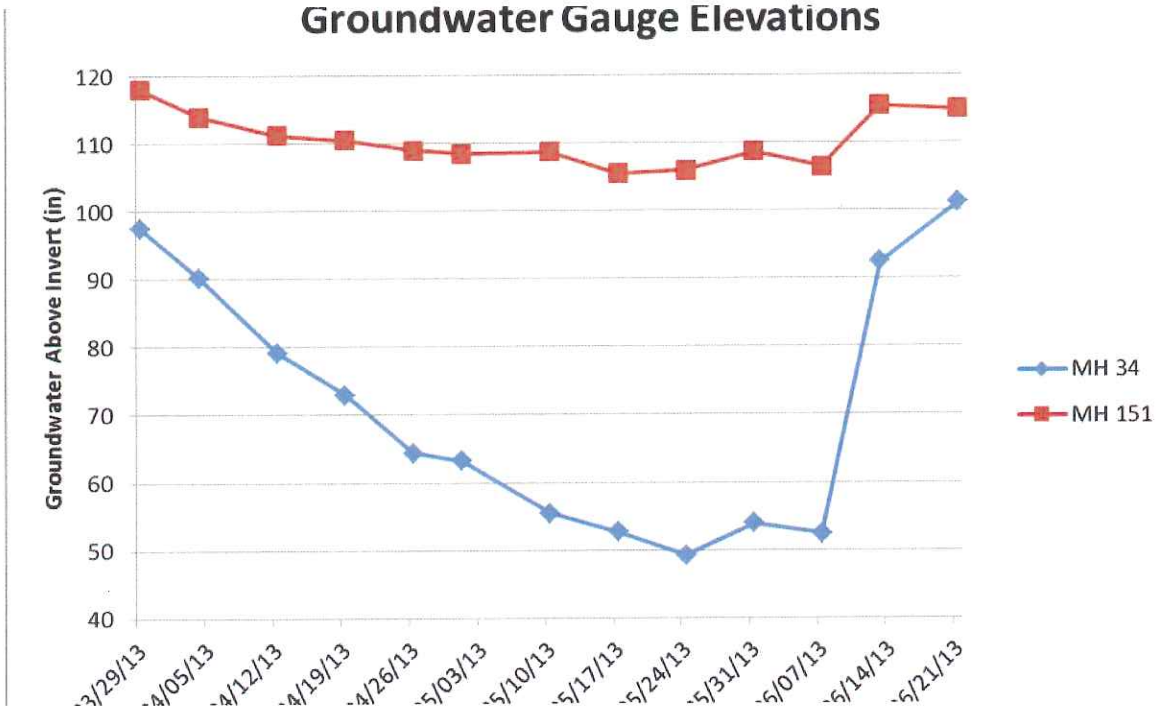


Figure 1 - Groundwater Gauge Elevations

2.4 WWTP FLOWS

The WWTP staff provided daily total flow readings from the effluent flow meter at the plant. Study meter readings from Meters 1 and 5 were then totaled to approximate influent flow to the plant and compared to the metered plant flow in order to check study results to actual plant flow. The estimated influent and metered effluent WWTP flows were graphed as shown in Figure 2.

Figure 2 shows that the combined flows from Meters 1 and 5 generally mirror the effluent flows measured at the wastewater treatment plant, generally validating the study results. Although the combined meter flows are slightly higher than the treatment plant flows, this could be due to several factors, including study meter accuracy or calibration; effluent meter accuracy or calibration; or a combination of both.

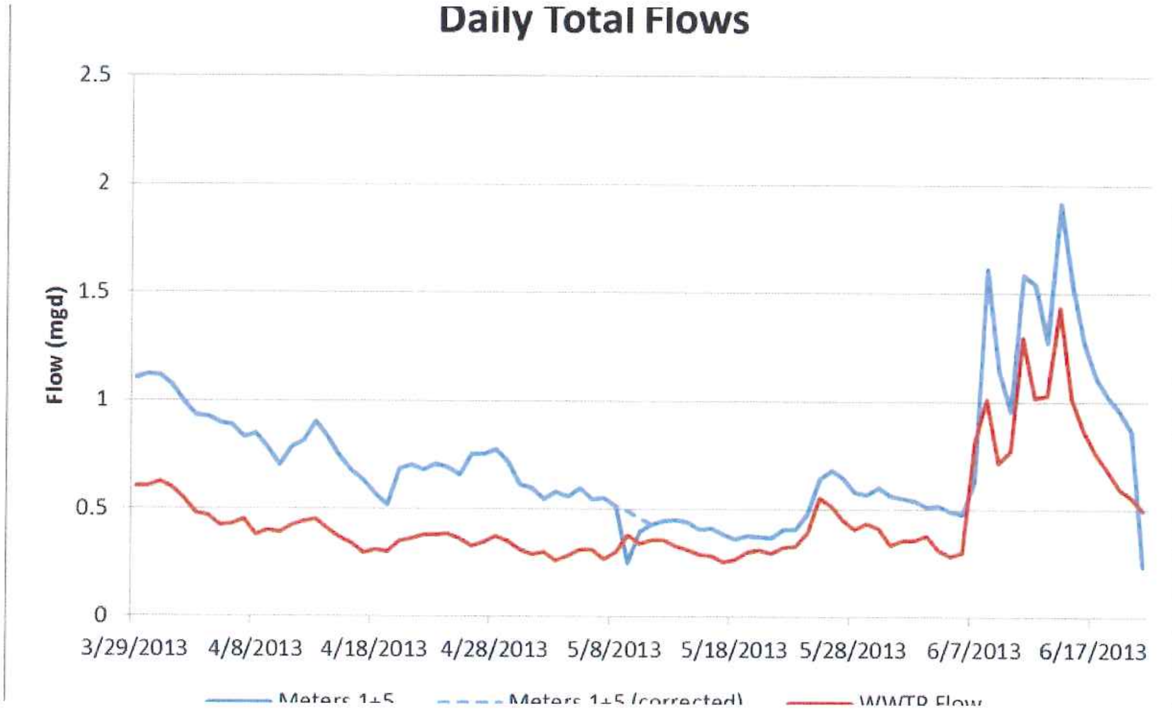


Figure 2 - WWTP Flows

2.5 DATA ANALYSIS METHODOLOGY

2.5.1 Initial Review and QA/QC

Flow metering was conducted for 12 weeks during the high groundwater season to measure seasonal infiltration and inflow. Six (6) fixed flow meters were installed. The flow meters used were continuous-read electronic recording flow meters. Total flow, depth and velocity was recorded at each site. Gross flows and net flows were reported for all areas. Total flow recorded during nighttime dry weather was used to evaluate infiltration potential for each subarea. Total flow during rain events was compared to data collected from rain gauges to evaluate inflow potential.

Data was reviewed and checked for inconsistencies (e.g., negative flow values, etc.). Because of the length of the program, small gaps in data were within acceptable guidelines and did not affect results. The results of the program were flow measurements for each subarea that were used to assist with the determination of sanitary flow, infiltration and inflow.

Flow data for subareas were normalized by converting net flow to gallons per day-inch-mile (gpdim). Normalized data compares the quantity of increased flow caused by groundwater infiltration to the length and size of the sewer system upstream of the flow measurement point. In general, normalized values of more than 4,000 gpdim are considered "excessive" and warrant additional investigation per MassDEP Guidelines. This metric was used to determine which subareas should be scheduled for additional infiltration investigations.

Peak inflow rates are not normalized but are adjusted based on the MassDEP defined design storm intensity of 0.87 inches per hour.

During the twelve week metering program, rainfall data was collected using a rainfall gauge. This information was used to determine the time of peak rainfall events and to quantify total rainfall during this period. Once all of the data was collected and reviewed for accuracy, it was evaluated on a variety of parameters, including dry day flows, wet day flows, storm stages and duration, base infiltration, tidal inflow/infiltration, gross meter flow, net meter flows, average daily flows, and total flow versus rainfall intensity flows.

2.5.2 Infiltration Evaluation

The infiltration evaluation was performed in accordance with MassDEP Guidelines. Dry day minimum flows were evaluated between the hours of midnight and 6 AM over the metering period to determine baseline infiltration in gallons per day. GIS data was used to calculate the inch-diameter-miles (im) of pipe in each subarea. Baseline infiltration for each subarea was divided by the total inch-diameter-miles to calculate the estimated peak infiltration for the subarea in gpdim. This provides a more equitable comparison of subareas, taking larger pipe sizes into account. Graphs of infiltration rates for each meter are included in Appendix D.

2.5.3 Inflow Evaluation

The inflow evaluation was also performed in accordance with MassDEP Guidelines. MassDEP considers "peak" inflow as the inflow occurring during the 1 year, 6 hour storm. This storm results in a peak hour rainfall intensity of 0.87 inches per hour. Several storm events were identified during the metering period and the peak hour of intensity determined. The peak flow rate during each storm event was compared to the flow 24 hours prior to the storm event. The difference between the wet weather flow and the corresponding dry day flow was determined to be the inflow rate. Total inflow volume was found by calculating the area between the wet weather flow curve and the corresponding dry weather flow curve. The net inflow volume for each subarea was determined from the total inflow volumes for each meter.

Inflow rates and inflow volumes for study storm 3 at 0.68 inches per hour intensity were then scaled by a factor to the MassDEP design storm with peak hour rainfall intensity of 0.87 inches per hour. Inflow hydrographs of each storm event for each meter are included in Appendix D.

2.5.4 Basis of Recommendations

MassDEP Guidelines were used for the evaluation and prioritization of infiltration. Subareas where total infiltration is more than 4,000 gpdim are considered "excessive" and warrant additional investigation. This additional investigation is generally flow isolation and CCTV inspection of the pipes to locate the defects that are leaking. Section 3 discusses the subareas where excessive infiltration was found.

MassDEP Guidelines were also used for the evaluation and prioritization of inflow. MassDEP defines the priority inflow subareas as the subareas contributing the top 80% of all system inflow. Direct inflow in a subarea warrants smoke testing to identify direct sources such as roof drains and catch basins. Delayed inflow warrants private property inspections to identify sources such as area drains and sump pumps. In addition, MassDEP recommends an evaluation for capacity issues in areas that experience high inflow rates. Section 3 discusses the subareas where high inflow and capacity issues were identified.

3. RESULTS OF METERING ANALYSIS

The following sections discuss the results of the metering analyses for the continuous flow meters within the Town. Woodard & Curran performed an analysis to estimate infiltration and inflow, and where appropriate, tidal inflow, into the subareas for each meter. Graphical output from the data analysis is included in Appendix D. General observations are made in this Section and more specific recommendations are provided in Section 4.

3.1 METER 1

Meter Subarea 1 is downstream of Subareas 2, 3, and 6, and flows directly into the wastewater treatment facility. Heavy ragging occurred on May 8, 2013 and was removed on May 10, 2013, which resulted in inconsistent flow readings during that period. Flows exhibited typical responses to Storm Events 3 and 4, with a larger amount of inflow occurring during Storm 3.

This subarea contains 21.24 inch-miles of pipe, and the normalized estimated net infiltration was 5,500 gpdim. This is greater than MassDEP's guideline for excessive infiltration of 4,000 gpdim, and therefore is indicative of excessive infiltration. The calculated inflow rate for this subarea was 2.02 MGD and the net inflow volume was 736,000 gallons. Subarea 1 has the greatest estimated inflow out of all the subareas, and should be investigated further.

There was a possibility of tidal influence on Meter 1 flows due to the subarea's proximity to the harbor; however, after analyzing dry weather nighttime flows that occurred during high tide, there was no observed correlation between tide and flow. A tidal chart of Meter 1 depicting flows and tidal height during dry weather on May 15, 2013 can be seen in Appendix D.

3.2 METER 2

Meter Subarea 2 flows directly into Subarea 1. Due to a meter malfunction in March, metering data was unavailable for a brief period of time between March 29, 2013 and April 4, 2013. Subarea 2 includes Manchester Essex Regional Middle High School and Manchester Memorial Elementary School. Storms 1 and 2 resulted in an immediate large peak flow with negligible delayed inflow. Flows exhibited typical responses to Storm Events 3 and 4.

A large flow spike of 0.189 MGD occurred on May 16, 2013. This flow spike appears to be unrelated to any specific rainfall events and may have been the result of a meter error or a significant sanitary discharge from the nearby schools or light industry.

This subarea contains 24.48 inch-miles of piping, and the normalized estimated net infiltration was 116 gpdim. This is the lowest infiltration rate out of all the subareas. The calculated inflow rate for this subarea was 0.15 MGD, and the net inflow volume was 95,000 gallons, which is less than 80% of the total system inflow volume. This is not indicative of excessive inflow.

3.3 METER 3

Meter Subarea 3 is downstream of Subarea 4 and flows directly into Subarea 1. There were negligible flow responses to Storm Events 1 and 2. A large flow spike of 0.34 MGD occurred on May 9, 2013 at 10 AM. This flow spike appears to be unrelated to any storm events and may have been the result of a meter error or a significant sanitary discharge from light industry. The meter exhibited typical flow responses to Storm Events 3 and 4.

Subarea 3 contains 20.78 inch-miles of pipe and the normalized estimated net infiltration for this subarea was approximately 1,900 gpdim. This does not indicate any significant infiltration in this subarea. Calculated inflow for this subarea is 0.31 MGD. The net inflow volume was 108,000 gallons, which is not indicative of excessive inflow.

3.4 METER 4

Meter Subarea 4 flows directly in Subarea 3. Storm Events 1 and 2 resulted in negligible inflow. The meter exhibited typical flow responses to Storm Events 3 and 4.

This subarea contains 19.31 inch-miles of pipe and the normalized estimated net infiltration for this subarea was approximately 1,600 gpdim, which is not indicative of infiltration. The calculated inflow rate for this subarea was 0.20 MGD and the net inflow volume was 144,000 gallons, the third highest estimated inflow volume out of all the subareas. This subarea should be considered for inflow investigations.

3.5 METER 5

Meter 5 is directly upstream of the wastewater treatment plant. There was no noticeable flow response to Storms 1 and 2. The meter exhibited typical flow responses to Storms 3 and 4, with large flow spikes attributed to high tide events.

This subarea contains 7.26 inch-miles of pipe. The normalized estimated net infiltration for this subarea was 3,400 gpdim, which does not indicate excessive infiltration. The calculated inflow rate for this subarea was 0.08 MGD and the net inflow volume was 72,000 gallons. This volume of inflow is not considered excessive.

However, there is a significant tidal influence on Meter 5 flows, confirmed by analyzing dry weather nighttime flows that occurred during high tide on May 1, 14, 15, 16, 28, 29, and 30, 2013. There is a positive correlation between flows and tidal height during dry weather. Appendix D includes a chart showing the May 15, 2013 nighttime high tide and the increase in flow due to the tide. The average of tidal inflow during the seven events analyzed was approximately 14,500 gallons during a 2 hour period at high tide, totaling 29,000 gpd for the two daily high tide events. Peak flows during the seven dry weather high tide events analyzed ranged from 0.11 MGD to 0.22 MGD. The dry weather high tide peak flow of 0.173 MGD at Manhole 152, measured during the 2012 Wright-Pierce salinity study, is within the same range. Since the Spring 2013 metering program verified previous reports of a saltwater intrusion source in Subarea 5, the Town proceeded to identify and rehabilitate the source. Accordingly, in September 2013, the Town located and confirmed the defect by CCTV and a leaking service line was repaired to reduce the salt water intrusion from the sewer system. Further salt water intrusion investigations downstream of Meters 1 and 5 were completed by the Town in October 2013 and the results are reported in Section 4 herein.

3.6 METER 6

Meter Subarea 6 flows directly into Subarea 1. There were issues of silt deposit around the sensor during metering weeks 3-6, from April 12, 2013 to May 3, 2013. On May 1, 2013, EST Associates noticed large sedimentary debris in front of the sensor and cleared the debris. On May 17, 2013, EST Associates observed that an existing groundwater gauge tube was washed into the flow and blocked a large portion of the pipe. These metering issues resulted in inconsistent flow readings during those time periods. Storms 1 and 2 resulted in relatively small flow responses, while Storms 3 and 4 exhibited typical flow responses.

This subarea contains 25.29 inch-miles of pipe. The normalized estimated net infiltration for this subarea was 2,300 gpdim, which does not indicate excessive infiltration. The calculated inflow rate for this subarea was 0.42 MGD and the net inflow volume was 317,000 gallons. This inflow volume is the second largest inflow out of all the subareas.

Prior to completing the metering program, Woodard & Curran considered the possibility of tidal influence on Subarea 6 due to the proximity of this area to the harbor; however, the results of the metering program show there was no correlation between tide and flow. A chart of Meter 6 depicting flows and tidal height on May 29, 2013, a dry weather period, is included in Appendix D.

3.7 SUMMARY OF INFILTRATION ANALYSIS

Dry weather flow during the high groundwater season was reviewed to estimate the rate of infiltration in the Town. The results of this analysis, based on the gpdim, indicate that infiltration is a significant component of flow in Subareas 1 and 5. Table 3-1 summarizes the results of the metering program dry weather nighttime flow measurements. Subarea 1 had a normalized infiltration rate significantly greater than MassDEP's guideline of 4,000 gpdim. Subarea 5 on average did not exhibit excessive infiltration; however, with the addition of tidal inflow/infiltration due to the saltwater intrusion source in the area, Subarea 5 contributes significantly to infiltration flow. Elimination of the saltwater intrusion source was recommended and completed in Subarea 5. Therefore, investigation for infiltration is recommended in Subarea 1 only. A flow schematic summarizing the infiltration analysis can be found in Appendix D.

Table 3-1: Estimated Infiltration

Meter Subarea	Pipe per Subarea (linear feet)	Pipe per Subarea (inch-miles)	Total Estimated Peak Infiltration (gpd)	Net Estimated Peak Infiltration (gpd)		Estimated Peak Infiltration (gpdim)
1	13,189	21.24	248,000	116,700		***5,500***
2	16,112	24.48	2,900	2,900		119
3	13,700	20.78	71,300	39,600		1,900
4	12,001	19.31	31,700	31,800		1,600
5	5,280	7.26	25,000	25,000	±29,000 Tidal I/I	3,400
6	18,718	25.29	57,200	57,200		2,300

Note: Italicized values represent infiltration greater than 4,000 gpdim.

3.8 SUMMARY OF INFLOW ANALYSIS

The design inflow of each subarea was estimated by comparing the wet weather flow during Storm 3 (June 7, 2013) to the previous day's flow which was preceded by dry weather for four days. The difference between the wet and dry day flows are used to estimate an inflow rate for that storm event. Both inflow rate and inflow volume were scaled by a factor of 1.29 to the MassDEP design storm with peak hour rainfall intensity of 0.87 inches/hour. The net inflow volume for each subarea was estimated from the total inflow volumes for each meter.

Total system inflow volume was the combined net inflow from Subareas 1 and 5, and was approximately 1,473,000 gallons. Subareas with the most inflow were prioritized by comparing each subarea's net inflow volume to the MassDEP defined 80% of the total system inflow, or 1,178,000 gallons. A summary of the inflow calculations is provided in Table 3-2.

As shown in Table 3-2, Subareas 1, 4, and 6 were the top three areas for predicted inflow and should have both smoke testing and building inspections conducted. Inflow investigations should initially be focused in these areas. When combined, these subareas also fall within the top 80% of system inflow and a private property inflow investigation should be considered for these three areas.

A flow schematic summarizing the inflow analysis can be found in Appendix D.

Table 3-2: Estimated Inflow

Meter Subarea	Pipe per Subarea (linear feet)	Pipe per Subarea (inch-mi)	Peak Inflow Rate (mgd)	Total Inflow Volume (gallons)	Net Inflow Volume (gallons)
1	13,189	21.24	2.02	1,400,000	***736,000***
2	16,112	24.48	0.15	95,000	95,000
3	13,700	20.78	0.31	252,000	108,000
4	12,001	19.31	0.20	144,000	***144,000***
5	5,280	7.26	0.08	72,000	72,000
6	18,718	25.29	0.42	317,000	***317,000***

Note: Italicized values represent the top 80% of inflow.
** The top 3 inflow areas account for 1,197,000 gallons (81%) of inflow predicted. These areas are recommended for smoke testing.*

3.9 SUMMARY

The recommendations resulting from the above analysis are focused on three areas: infiltration, inflow, and operational issues. Table 3-3 summarizes the results. Specific recommendations for additional investigation are made in Section 4.

Table 3-3: Recommendations for Additional Investigation

Infiltration (>4,000 gpdim)	Inflow (Top 80%)	Other Issues
Subarea 1	Subareas 1, 4 and 6	Subarea 5 – Saltwater Intrusion

4. RECOMMENDED PLAN

4.1 RECOMMENDED APPROACH

Woodard & Curran recommends the Town pursue a practical and targeted approach for collection system investigation and rehabilitation. Woodard & Curran recommends a coordinated phasing of all rehabilitation and investigation efforts be conducted based on the priority rankings, which are identified in the tables in this section. Investigations and repairs should begin in high priority areas and then progress towards those areas that are a lower priority for the Town. This should be accomplished by implementation of a phased plan.

An I/I reduction program is an iterative process. The results of the metering program identify the areas in Town that have the most significant I/I problems. The next step in a logical I/I reduction program is to focus additional investigation efforts on these areas in order to narrow down specific locations or sources of I/I. Once specific locations are identified, investigation to quantify the volume of I/I and a plan to remove each source will need to be implemented. For example, metering results identify the areas where flow isolation for infiltration should be conducted. Flow isolation results will identify specific manhole-to-manhole segments that have high infiltration. Follow-up CCTV inspection will further identify the type of defect and the volume of infiltration per defect. This information is finally used to design rehabilitation and to evaluate whether the recommended repair is cost effective.

4.2 RECOMMENDED INVESTIGATION METHODS

An I/I investigation and rehabilitation program is typically conducted in two steps starting with an I/I Analysis. This report is the I/I Analysis. The second step is the SSES which typically includes three phases to further locate and eliminate I/I sources. Phases I and II are additional investigative steps and Phase III is the actual rehabilitation and/or removal of the sources. The following describes the next steps in the I/I investigation and rehabilitation program as recommended in this report.

4.2.1 Sewer System Evaluation Survey – Phases I and II

Infiltration

1. Flow isolation is relatively affordable and several thousand feet a night can be completed. Flow isolation should be conducted on dry days, during high groundwater season, between the hours of midnight and 6 AM. The result of the flow isolation can be used to develop a focused CCTV inspection program.
2. Manhole inspections can be conducted in conjunction with flow isolation activities at minimal additional cost.
3. After flow isolation and manhole inspections have identified specific pipe segments and manholes with excessive I/I, CCTV on those segments is recommended to obtain specific information required to design the rehabilitation. CCTV inspection should also be conducted during high groundwater season.

Inflow

1. Private property inspections are recommended in areas where high rates of inflow were found. Specifically, sump pumps are a concern, but roof drains, driveway drains, etc. may also be identified during inspections. As required by the ACOP, the Town is developing a private inflow investigation program concurrently with this report and will be addressed separately.
2. Smoke testing is also recommended in subareas where high rates of inflow were found. Smoke testing will identify roof leaders, area drains and leaking manhole covers in low wet areas, providing manholes are not submerged. Smoke testing should be conducted during low groundwater season.

3. Based on inspections and smoke testing, dyed water testing (and potentially dyed water flooding) are recommended. Dyed water flooding is usually performed in conjunction with CCTV inspections. Dye water flooding aides in the location and quantification of specific defects. The procedure consists of forcing non-toxic dye into defects located during smoke testing and manhole inspection. The path of the dye is then documented, and leaks in the sewer lines are located. Manholes with evidence of inflow/infiltration, mainline defects, cross-connections, roof drains and area drains can all be investigated using the dye flooding procedure.
4. Implement a sump pump removal program. This could be concentrated in areas where high inflow rates were found or town-wide. This task can be conducted by Town staff, with a specific department responsible for inspection and documentation of sump pump removals.

4.2.2 Sewer System Evaluation Survey – Phase III

Infiltration

1. Sewer pipe may be rehabilitated by grouting of sewer joints and laterals, short-lining of specific defects, manhole to manhole Cured in Place Lining (CIPP) of deteriorated pipe sections, open cut repairs to broken or collapsed pipe, and complete pipe replacement.
2. Manholes may be rehabilitated by grouting, full monolithic lining, or by replacement of the complete manhole structure.
3. Before rehabilitation is performed, a cost effectiveness evaluation should be conducted to demonstrate the repairs will be cost-effective over the long term.

Inflow

1. Elimination of inflow from the system (public inflow) and sump pumps, roof drains, etc. (private inflow) is accomplished by disconnecting the source from the sewer system. Redirection of these sources to an acceptable discharge location is a key component of this program.
2. Leaking manhole frames and covers can be rehabilitated by installing a new waterproof frame and cover or dish insert below the cover.
3. In some locations, inflow may occur only during large storm events, high groundwater season, or, for structures adjacent to the harbor, during high tides. Manholes in easements that may flood should be raised so that the covers are above the high water elevation and watertight covers should be installed.

Sewer system maintenance and operational issues observed will also be noted during the SSES and that information provided to Town crews. Likewise, blockages, collapsed pipes, or other emergency situations will be reported to the Town immediately for necessary action.

4.3 I/I PROGRAM RECOMMENDATIONS

The following table presents a summary of recommended I/I investigations based on the 2013 flow metering program.

Table 4-1: Recommended I/I Program

Type of Investigation	Subarea (s)	Comments	Estimated Quantity
Infiltration			
Flow Isolation	1	In conjunction with manhole inspections.	13,200 LF
CCTV	1	Based on results of flow isolation.	TBD
Inflow			
Smoke Testing	1, 4, 6	Direct inflow, in order of priority.	44,000 LF
Dyed Water Testing and Dyed Water Flooding	1, 4, 6	Based on results of smoke testing.	TBD
Private Inflow Removal Program	1, 4, 6	Delayed inflow, in order of priority. Required by ACOP. Separate Submittal.	TBD

4.4 I/I PROGRAM WORK ACCOMPLISHED BY THE TOWN IN 2013

4.4.1 Smoke Testing

Based on the recommendations from the flow metering program, a smoke testing program was developed and implemented to address inflow sources within the sewer system. Three subareas were recommended for smoke testing based on the MassDEP Guidelines as contributing over 80% of the peak design-storm inflow to the sewer system.

The smoke testing program included the testing of approximately 44,000 linear feet of pipe. The field program was completed by Flow Assessment Services, LLC of Goffstown, NH (Flow Assessment) during the month of October 2013. Smoke testing is conducted on sewer pipes during dry weather and low groundwater to identify points in the system that allow inflow to enter the sewer. These point sources can be cracked manhole covers, broken cleanouts, storm drains incorrectly connected to the sewer system, roof leaders, and yard drains. A comprehensive public notification program was developed in conjunction with DPW, fire and police officials. Areas to be tested were scheduled with public safety officials and residents in advance to maximize awareness of the program. Residents were notified one week and 24-hours in advance of the work.

Smoke testing involved the introduction of a non-toxic smoke into the sewer system using a container of smoke-producing liquid and a blower. The smoke travels through the pipe and service connections, typically exiting through building vent stacks and from non-waterproof manhole covers. Where service cleanouts are broken; manholes have cover or corbel cracks; drains are directly connected to the sewer, etc., smoke will be observed exiting from them and these sources are easily identified as being potential contributors of inflow to the sewer system. In cases where smoke is emanating from drain structures, dye water flooding of the suspect drain system is used to verify the presence of an inflow-contributing source. Results of the smoke testing task are summarized below.

Subarea 1

Smoke testing was conducted on 12,684 feet of pipe. Smoke was observed from seven (7) potential sources including one roof leader. As a result, one potential source was recommended for dyed water flooding in this subarea based on the smoke testing program.

Subarea 4

Smoke testing was conducted on 13,247 feet of pipe. Smoke was observed from 15 potential sources including three (3) roof leaders, three (3) manholes, several cleanouts and two (2) catch basins. As a result, two (2) potential inflow sources were recommended for dyed water flooding in this subarea based on the smoke testing program.

Subarea 6

Smoke testing was conducted on 18,892 feet of pipe. Smoke was observed from 12 potential sources including two (2) roof leaders and five (5) catch basins. As a result, eight (8) potential inflow sources were recommended for dyed water flooding in this subarea based on the smoke testing program. In addition, a 25-foot section of sewer was found to be exposed near 17 Woodcrest Road and should be addressed by the Town as soon as possible.

Table 4-2 presents a summary of the Smoke Testing Program showing the subareas smoke tested, the length of sewers tested and the number of locations where smoke was observed. Table 4-3 presents a detailed summary of the smoke testing program showing the locations, sources and potential inflow from the defects identified during the program. The Flow Assessment Smoke Testing Report is attached hereto in Appendix E. Photographs and sketches of potential sources are included in the attached Smoke Testing Report.

Peak Inflow Determination – Direct Sources

As peak inflow was calculated for the flow metering program using the MassDEP Design Storm of 0.87 inches of rain per hour for the peak hour of the storm, this approach using the Rational Method is also used to calculate the peak inflow quantity at each location identified as a direct potential inflow source during the smoke testing task. Peak inflow from indirect sources that were dye water flooded is discussed below and shown in Table 4-2. The Rational Method used to calculate peak inflow at each location in cubic feet per second (cf/sec), uses the following formula:

$$Q = CiA$$

The values of C (runoff co-efficient) and A (in acres) were estimated in the field by Flow Assessment and are included in the attached Smoke Testing Report. The rainfall intensity (i) is the design storm intensity used to evaluate the metering results: 0.87 inches /hour for the storm's peak hour. Q (flow) is in cf/sec and is converted to gallons per day (gpd) and presented in Table 4-3. Almost 29,000 gpd of peak inflow is estimated from the direct sources listed in Table 4-3.

Peak Inflow Determination – Indirect Sources

Peak inflow for the Design Storm for indirect sources that were dye water flooded with positive results is assumed to be 50% of the dye transfer rate measured during the dye water flooding task. This approach takes into account that the drain structures most likely will not be completely filled during the Design Storm as they were during the dye water flooding task, resulting in the transfer of less storm water than dye water to the sewer system.

Table 4-2: Summary of Smoke Testing Program – Observed Smoke Sources

Area	Roof Leaders	Cleanouts	Catch Basins	Sewer Manholes	Drain Manholes	Ground/ Other	Total	Linear Feet
1	1		1			5	**7**	**12,684**
4	3	5	2	3		2	**15**	**13,247**
6	2	1	5	1	1	3	**13**	**18,892**
Total	**6**	**6**	**8**	**4**	**1**	**10**	**35**	**44,823**

4.4.2 Dyed Water Flooding

Dyed water flooding was also conducted by Flow Assessment in October 2013. In this test, an upstream catch basin is filled with dyed water and the downstream catch basin plugged, allowing the drain line between them to fill with the dyed water. The level of dyed water in the catch basin is maintained for a period of time while the flow at the downstream sewer manhole is monitored. Dyed water observed in the downstream sewer manhole is an indication that the drain line or catch basin is indirectly connected to the sewer contributing an amount of inflow to the sewer system.

A total of eight (8) potential sources at seven (7) locations were dye water flooded, with transfer of dyed water observed at five (5) of the potential sources. As a result, over 25,000 gpd of peak inflow may be entering the sewer system at these locations during the Design Storm. Results of dyed water flooding are summarized in Table 4-4.

The Flow Assessment Dyed Water Flood Report is attached hereto in Appendix F.

4.4.3 Summary of Smoke Testing and Dyed Water Flooding

The metering program indicated excessive inflow from the three (3) subareas that were recommended for smoke testing and the results of the smoke testing program indicate that a fair number of direct inflow sources such as drainage structures, roof drains, broken cleanouts, and leaking manholes are present. However, the contributory drainage area for most of the sources is quite small, resulting in minimal amounts of peak hourly inflow during the MassDEP Design Storm. As a result, the data presented in Tables 4-3 and 4-4 indicate that only about 54,000 gpd of peak inflow may be entering the sewer system during the Design Storm from the defects identified in the smoke testing and dyed water flooding tasks.

Table 4-3: Summary of Smoke Testing Program – Potential Inflow Sources

Area	Location	Source	Type	Drainage Area (SF)	Runoff Coefficient	Inflow (GPD)
1	54 School Street	Roof Leader	Direct	180	0.9	2,091
1	12 Brook Street	Catch Basin	Indirect			Dye Water Flood
Subtotal Area 1						**2,091**
4	Pine Street	MH 210 Corbel	Direct	90	0.9	1,046
4	Pine Street	MH 232 Below Grade	Direct	9 24	0.9 0.3	198
4	1 Anthony Avenue	Cleanout Below Grade	Direct	9	0.3	35
4	6 Highwood Road	Broken Cleanout	Direct	15	0.3	58
4	13 Moses Hill Road	Roof Leader	Direct	320	0.9	3,717
4	159 Pine Street	Catch Basin	Indirect			Dye Water Flood
4	165 Pine Street	2 Roof Leaders	Direct	1050	0.9	12,198
4	6 Rockwood Heights Road	Cleanout Below Grade	Direct	9 6	0.3 0.9	105
4	15 Walker Road	Cleanout Below Grade	Direct	4 1	0.3 0.9	27
4	40 Walker Road	Catch Basin	Indirect			Dye Water Flood
Subtotal Area 4						**17,384**
6	17 Bridge Street	Roof Leader	Direct	576	0.9	6,691
6	65 Bridge Street	Open Cleanout	Direct	0	0	0
6	48 Central Street	Roof Leader	Direct	216	0.9	2,510
6	9 Morse Court	Catch Basin	Indirect			Dye Water Flood
6	2 & 7 Tanglewood Road	Catch Basins	Indirect			Dye Water Flood
6	9 Woodcrest Road	Catch Basin	Indirect			Dye Water Flood
6	13 Woodcrest Road	MH Corbel	Direct	9	0.3	35
6	17 Woodcrest Road	Exposed Sewer Line and Service	None			Repair
6	4 Woodholm Road	Catch Basin	Indirect			Dye Water Flood
6	27 Woodholm Road	Catch Basin	Indirect			Dye Water Flood
Subtotal Area 6						**9,236**
Total Peak Inflow from Direct Sources						**28,711**

Table 4-4: Summary of Dyed Water Flooding – Indirect Inflow

Area	Location	From MH	To MH	Transfer (GPM)	Transfer (GPD)	Estimated Inflow (GPD)	Description
1	Brook Street	68	67	25	36,000		Increased flow at MH 67
Subtotal Area 1					36,000	**18,000**	
4	Pine Street	233.2	233.1	-	-		Not Flooded. Hydrant 800' Away
4	Walker Road	220A	220	0	0		No Observed Dye Transfer
Subtotal Area 4				0	0	**0**	
6	Woodholm Road	3-27	3-28	-	-		Not Flooded. Drain Lower than Sewer
6	Woodholm Road	3-32	108C	1.0	1,440		Increased flow at MH 108C. MH 33 not located
6	Woodholm Road	3-32		0.25	360		Leaking MH invert at MH 3-32
6	Woodcrest Road	3-17		0.5	720		Leaking MH invert at MH 3-17
6	Tanglewood Road	3-2	3-3	0	0		No Observed Dye Transfer
6	Tanglewood Road	3-6	3-7	0	0		No Observed Dye Transfer
6	Bennet Street	134	133.1	-	-		Not Flooded. Drain Outfall in Poor Condition.
6	Morse Court	118A		8	11,520		Increased Flow in 4"VCP at MH 118
6	Woodcrest Road	3-23	3-25	-	-		Exposed Sewer Line and Service
Subtotal Area 6					14,040	**7,020**	
Total Peak Inflow from Indirect Sources					50,040	**25,020**	

4.5 ADDITIONAL SALINITY TESTING FOR SALT WATER INTRUSION

Additional salinity testing to address continued salt water intrusion into the sewer system was conducted by New England Civil Engineering Corp. (NECEC) of Salem, MA, sub consultant to Woodard & Curran, in October 2013. The work was performed downstream of Meters 1 and 5 within and adjacent to the WWTP, and on Beach Street downstream of the repair that was made by the Town to address the major salt water intrusion source found by previous salinity testing. NECEC testing was conducted after the Beach Street repair was made in order to re-test that line after the repair and to concentrate on areas not previously tested in and around the WWTP.

Results of the testing show that salinity readings of the WWTP effluent increased from 0.8 parts per thousand (ppt) at low tide to 4.1 ppt at high tide. During the same time period, salinity in the main sewer to the WWTP serving Areas 1, 2, 3, 4 and 6 increased from 0.6 ppt to 3.9 ppt while the main sewer serving Area 5 increased from 3.0 ppt to 14.0 ppt. From this data it is clear that salt water intrusion from Area 5 is evident at both low and high tide, with the high tide reading at 14.0 ppt indicating that the flow in that sewer was almost 50% salt water, which registers at about 29.0 ppt in the harbor.

The results of the October 2013 salinity testing confirm that significant salt water intrusion persists from the WWTP upstream into Drainage Area 5. The salinity readings for this area are double that for all the remaining areas tributary to the plant. Accordingly, it is recommended that flow isolation of selected sewer lines be conducted during the spring high groundwater period, at both low and high tides, in order to capture both non-tidal and tidal infiltration into the system from this area. It is estimated that approximately 3,000 feet of sewer near the waterfront should be investigated. In addition, significant infiltration into the sewer system was documented in Manholes 1, 3 and 4 as described in the NECEC report. During initial field work, significant infiltration was observed by Town, Woodard & Curran and NECEC personnel at the table of Manhole 1 as reported by NECEC. Accordingly, it is recommended that these three (3) manholes be grouted to eliminate the infiltration sources.

The NECEC Report is included as Appendix G.

4.6 RECOMMENDED I/I INVESTIGATION AND REHABILITATION PROGRAM

As a result of the work described in the previous sections of this report, additional I/I investigations are necessary to identify infiltration sources and to complete the inflow source documentation initiated in the Fall of 2013. In addition, rehabilitation of inflow and infiltration sources identified in this report should be addressed as soon as possible to reduce unnecessary extraneous flow to the WWTP. Accordingly, Table 4-5 presents the Recommended I/I Investigation and Rehabilitation Program based on the work done to date. As shown in Table 4-5 over 53,700 gpd of peak removable I/I flow has been identified so far. This will result in lower overall average flows at the WWTP. Together with the 29,000 gpd of salt water intrusion already removed from the system, a decrease in overall average WWTP flows can be expected. In total, almost 83,000 gpd of extraneous flow could be removed from the system after a successful rehabilitation program. This total does not include grouting of the 3 manholes at the WWTP, results of dyed water flooding at the 2 additional sites, and potential sources identified during the flow isolation and CCTV program for infiltration and salinity testing scheduled for Spring 2014. Identifying and removing these additional sources could add to a reduction in overall average flow to the WWTP.

4.6.1 Private Inflow Removal Program

As required by the ACOP, the Town has developed a Private Inflow Removal Program that targets sump pumps, roof leaders, private drains, and other sources of private inflow to the sewer system. The Program includes a sump pump inspection at time of property sale and rehabilitation of the inflow sources identified herein. The smoke testing task has already identified existing and potential inflow sources on private property in the three (3) areas that were tested. The sources found to be contributing inflow to the sewer system and scheduled for repair are included in Table 4-5 and include six (6) roof leaders and 5 cleanouts. Follow-up dyed water testing has also identified several existing and potential sources to be investigated and/or repaired. In addition, the sewer connection source allowing a significant quantity of salt water to enter the system was repaired by the Town in 2013 as described in Section 3.5 of this report.

After reviewing the results of property inspections conducted by the Town over a several year period, analyzing the metering results for the 3 areas studied for inflow, and considering the results of the smoke testing task, it is concluded that sump pumps are not a significant issue in the Town and do not contribute significant flow to the sewer system. As a result, implementing a formal sump pump inspection program in the 3 areas is not considered to be cost-effective. Therefore, the Town will continue inspecting properties for sump pumps at the time of sale and monitor flows to the plant for the next few years as the I/I rehabilitation program is implemented and note if sump pump flow appears to be an issue to address. In the meantime, the Town is mounting an aggressive approach to reducing private sources of inflow to the sewer system by implementing rehabilitation of identified sources in 2014.

Table 4-5: Recommended I/I Investigation and Rehabilitation Program

Area	Location	Source	Type	Rehabilitation Description	Estimated Cost ($)	I/I Flow (GPD)
1	54 School Street	Roof Leader	Direct	Disconnect	1,000	2,091
1	Brook Street MH 68 to MH 67	Catch Basin	Indirect	CCTV Inspect and Test & Seal ~250 LF 10" Sewer	5,000	18,000
Subtotal Area 1					**6,000**	**20,091**
4	Pine Street	MH 210 Corbel	Direct	Repair	1,000	1,046
4	Pine Street	MH 232 Below Grade	Direct	Raise MH	1,000	198
4	1 Anthony Avenue	Cleanout Below Grade	Direct	Raise Cleanout	1,000	35
4	6 Highwood Road	Broken Cleanout	Direct	Repair/Replace Cleanout	2,000	58
4	13 Moses Hill Road	Roof Leader	Direct	Disconnect	1,000	3,717
4	Pine Street MH 233.2 to MH 233.1	Catch Basin	Indirect	Provide Water by Vactor and Dye Water Flood	1,000	N/A
4	165 Pine Street	2 Roof Leaders	Direct	Disconnect	2,000	12,198
4	6 Rockwood Heights Road	Cleanout Below Grade	Direct	Raise Cleanout	1,000	105
4	15 Walker Road	Cleanout Below Grade	Direct	Raise Cleanout	1,000	27
Subtotal Area 4					**11,000**	**17,384**
-	**WWTP Area**	MH Infiltration	Direct	Chemical Grout 3 Manholes	3,000	N/A
Subtotal WWTP Area					**3,000**	**N/A**
6	17 Bridge Street	Roof Leader	Direct	Disconnect	1,000	6,691
6	65 Bridge Street	Open Cleanout	Direct	Replace Cover	500	0
6	48 Central Street	Roof Leader	Direct	Disconnect	1,000	2,510
6	Morse Court MH 118A	Catch Basin	Indirect	CCTV Inspect and Test & Seal 100'+/- of 4" VCP Sewer	2,000	5,760
6	Bennet Street MH 134 to MH 133.1	Catch Basins	Indirect	Repair Drain Outfall and Dye Water Flood	10,000	N/A
6	Woodcrest Road MH 3-17	Catch Basin	Indirect	Chemical Grout MH Invert	1,000	360
6	13 Woodcrest Road	MH Corbel	Direct	Repair	1,000	35

Table 4-5: Recommended I/I Investigation and Rehabilitation Program (Cont.)

Area	Location	Source	Type	Rehabilitation Description	Estimated Cost ($)	I/I Flow (GPD)
6	17 Woodcrest Road MH 3-23 to MH 3-25	Exposed Sewer Line and Service	N/A	Repair/Backfill Exposed Sewer Line and Service	10,000	0
6	Woodholm Road MH 3-32 to MH 33	Catch Basin	Indirect	Locate MH 3-33. CCTV Inspect and Test & Seal 200 LF 8" Sewer	3,000	720
6	Woodholm Road MH 3-32	Catch Basin	Indirect	Chemical Grout MH Invert	1,000	180
Subtotal Area 6					**30,500**	**16,256**
Total					**50,500**	**53,731**
Engineering and Contingency					**50,000**	
Total Program Cost					**$100,500**	

4.7 SUMMARY OF RECOMMENDED PROGRAM

A summary of the implementation schedule and estimated costs for the recommended I/I Program is presented in Table 4-6. The total program cost so far is $157,200, with additional funds required for Phase III infiltration rehabilitation and any additional private inflow source removal.

The Phase I and II SSES for both infiltration and salt water intrusion is planned for Spring 2014, including manhole inspections and CCTV inspection. From this work, infiltration sources can be identified for Phase III rehabilitation in 2015 and beyond. Funds would need to be allocated for this work at the 2015 Annual Town Meeting or before. Since smoke testing and dyed water tracing/flooding was completed in Fall 2013, rehabilitation of inflow sources is planned for Summer 2014 with funding from the 2014 Annual Town Meeting.

The Private Inflow Removal Program is scheduled to be initiated in Summer 2014 with funding from the 2014 Annual Town Meeting and will include rehabilitation of private property inflow sources. A Sump Pump Identification and Re-Direction Program consisting of property inspections at time of sale is being developed by the Town and will be launched in 2014.

Table 4-6: Summary of Recommended I/I Program

Phase	Unit	Quantity	Cost	Schedule
Phase I SSES - Inflow				
Smoke Testing[1]	LF	44,000	Completed	Fall 2013
Private Inflow Removal Program[4]			TBD	Summer 2014
Subtotal:			*TBD*	
Phase I SSES - Infiltration				
Flow Isolation (subareas)	LF	13,200	$9,500	Spring 2014
Flow Isolation for Salinity	LF	3,000	$2,200	Spring 2014
Manhole Inspections[2]				
A) Extensive	EA	24	$2,500	Spring 2014
B) Surface	EA	48	$3,000	Spring 2014
Subtotal:			$17,200	
SUBTOTAL Phase I			***$17,200***	
Phase II SSES - Inflow				
Additional Investigations & Rehabilitation[5]			Included Below in Phase III Investigation and Rehabilitation	Summer 2014
Phase II SSES - Infiltration				
CCTV Inspection and Cleaning[3]	LF	6,600	$40,000	Spring 2014
SUBTOTAL Phase II			***$40,000***	
TOTAL PHASE I AND II PROGRAM			**$57,200**	
Phase III Inflow Investigation and Rehabilitation[5]			**$100,500**	Summer 2014
Phase III Infiltration Rehabilitation[6]			TBD	2015-2017
I/I Program Status Reporting			Included in Phase 1	Bi-Annually

Notes:

1. *Includes dyed water flooding. Completed Fall 2013.*
2. *A total of 72 manholes are in Subarea 1. Assumes 1/3 need extensive and 2/3 need surface.*
3. *Assumes 50% of flow isolation footage requires CCTV.*
4. *Program required by ACOP. Known source rehabilitation cost is included in Phase III Inflow Investigation and Rehabilitation line item*
5. *From Table 4-5.*
6. *From Phase 1 and 2 Infiltration Investigations.*

4.8 LONG-TERM RECOMMENDATIONS

The long-term recommendation for the Town is to rehabilitate the priority defective areas of the collection system which contribute the highest levels of I/I in order to optimize the use of the WWTF capacity, while minimizing the potential for sanitary sewer overflow (SSO) events and avoiding process operations problems. The system should be investigated regularly and the Town should consider appropriating a sum of money at the Town Meeting annually for sewer system investigation and rehabilitation.

Woodard & Curran recommends a phased program, using Town crews for some tasks to manage costs, and contracting other tasks where town crews are not available or trained. The investigation results should be evaluated annually and a detailed program for rehabilitation of specific pipe segments and manholes can be designed and bid by the Town. Implementation of an annual program that systematically removes the most significant I/I sources from the system has been shown to be highly effective in other communities and is an approach recommended for Manchester-by-the-Sea.

Sources of funding to conduct I/I investigation, rehabilitation design, and construction for the Town of Manchester-by-the-Sea include the MassDEP's State Revolving Fund (SRF) loan program and local funds. Use of funds from either of these sources requires a Town Meeting vote. Application to the MassDEP SRF program requires a Project Evaluation Form (PEF) be submitted with a specific scope of work and a budget, generally in August for consideration of funding in the following year.

The Town is committed to reducing I/I and overall average flow to the WWTP during the next 5 years with $3 million dollars planned for sewer system improvements, of which $500,000 is planned for FY2015.

Program status reporting to MassDEP will be submitted bi-annually in accordance with the Town's ACOP.

D. Public Outreach Materials

Presentations

Public Comments/ Meeting Minutes

Frequently Asked Questions

Manchester-By-The-Sea, Massachusetts

Comprehensive Wastewater Management Plan

Overview

- Purpose
- Existing Conditions
- Future Growth
- Needs Summary

Purpose

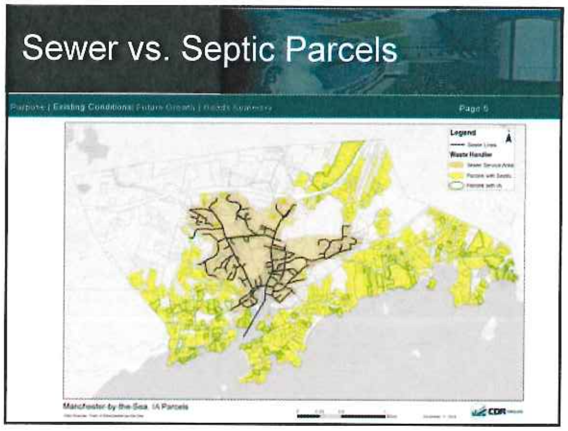
- Comprehensive Wastewater Management Plan (CWMP)
- Required under Mass DEP Administrative Consent Order (ACO) to prepare a CWMP
  - Draft by April 1, 2015
  - Final by July 1, 2015
- Purpose: Evaluate current and future wastewater management needs and develop wastewater management alternatives to meet needs.
- Public input is a necessary part of the CWMP process
  - December 15, 2014 Existing Conditions and Needs
  - February 17, 2015 Review of Alternatives
  - April 27, 2015 Draft Plan

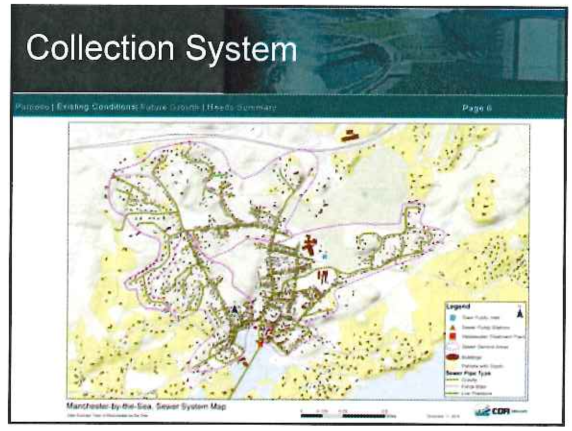
Background

- 1994 Wastewater Facilities Plan
- 1994 WWTF Preliminary Design Documentation
- 2003 Wastewater Needs Assessment
- 2008 GIS Data Update to the 2003 Needs Assessment Report
- 2009 Sewer Task Force Final Report

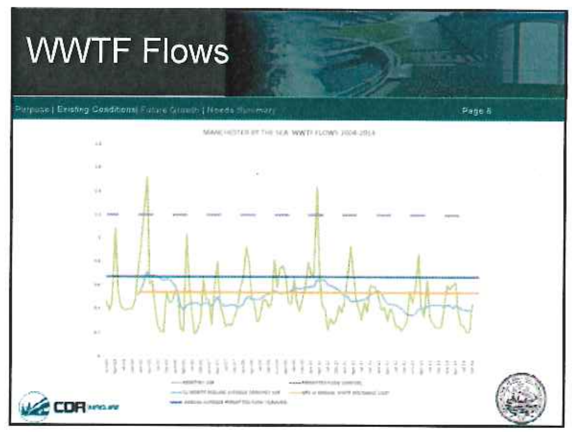
Existing Conditions

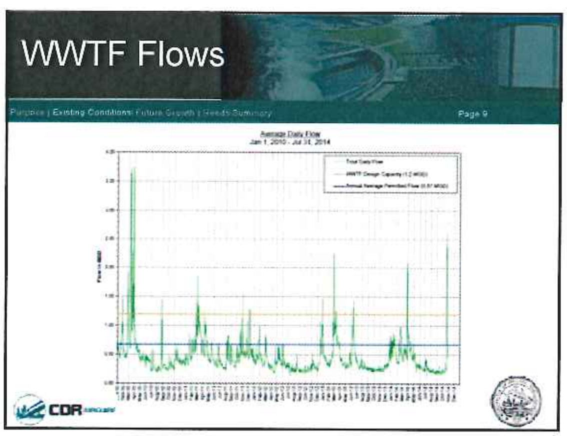
- Overview of Sewer Collection and Septic System
- Collection System and Wastewater Treatment Facility Assessment
- Septic System Assessment
- Water Quality Issues

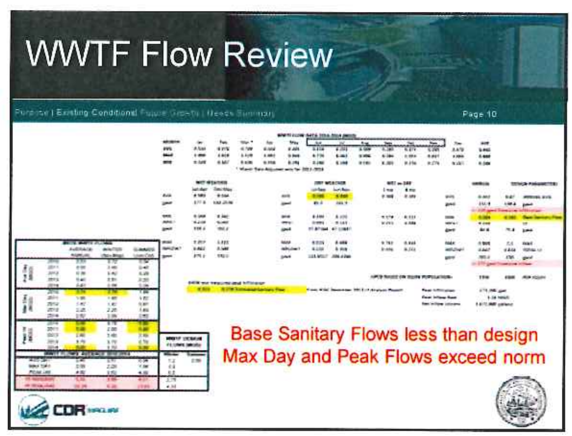

Sewer vs. Septic Parcels
Purpose | Existing Conditions| Future Growth | Needs Summary
Page 5
Legend
Manchester-by-the-Sea IA Parcels


Collection System
Purpose | Existing Conditions| Future Growth | Needs Summary
Page 6
Legend
Manchester-by-the-Sea Sewer System Map


Wastewater Treatment Facility
Purpose | Existing Conditions| Future Growth | Needs Summary
Page 7
CDM Smith


WWTF Flows
Purpose | Existing Conditions| Future Growth | Needs Summary
Page 8
CDM Smith


WWTF Flows
Purpose | Existing Conditions| Future Growth | Needs Summary
Page 9
Average Daily Flow
CDM Smith


WWTF Flow Review
Purpose | Existing Conditions| Future Growth | Needs Summary
Page 10
Base Sanitary Flows less than design
Max Day and Peak Flows exceed norm
CDM Smith

WWTF Issues

Purpose | Existing Conditions | Future Growth | Needs Summary — Page 11

- ❑ Inability to turn down influent pumps and aeration blowers to match flows.
- ❑ Process disruption due to increased salinity during high tide events.
- ❑ No Plant Water (Use Town Water)
- ❑ Effluent Pumps drives problems during high flows, need for spare pump?
- ❑ SCADA/Control Panel upgrades

CDM Smith

Collection System Issues

Purpose | Existing Conditions | Future Growth | Needs Summary — Page 12

- ❑ Infiltration/Inflow
  - ❑ Est. Peak Infiltration: 273,000 gpd
  - ❑ Est. Peak Inflow Rate: 3.18 MGD
  - ❑ Est. Peak Inflow Volume: 1,472,000 gallons
- ❑ Tidal Influence
  - ❑ 29,000 gpd added flow during high tide events
  - ❑ Salinity impacts plant operation
- ❑ Pump Stations
  - ❑ Repairs needed at all stations, Emergency Generators
- ❑ Collection System
  - ❑ System surcharging and backups
  - ❑ Pipe age and material contribute to infiltration

CDM Smith

Septic System Evaluation

Purpose | Existing Conditions | Future Growth | Needs Summary — Page 13

- ❑ Lot Size Distribution
- ❑ Failures/Repairs/Replacements
  - BOH Data Base Summary
- ❑ Water Quality

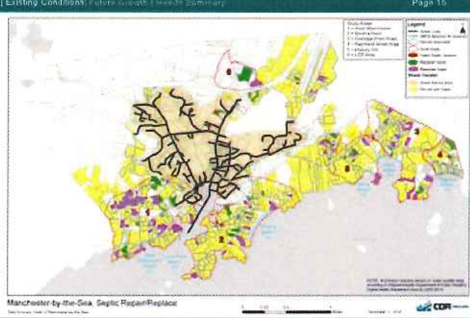
CDM Smith

Lot Size Distribution Map

Purpose | Existing Conditions | Future Growth | Needs Summary — Page 14

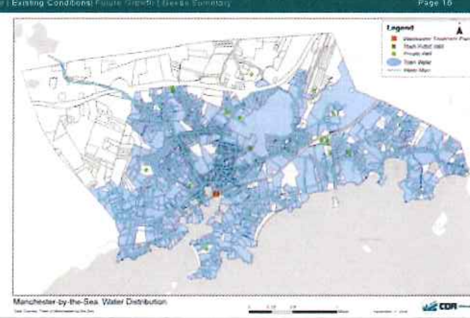
File Review Summary

Purpose | Existing Conditions | Future Growth | Needs Summary — Page 15



Town Water and Wells

Purpose | Existing Conditions | Future Growth | Needs Summary — Page 16



Water Quality

Purpose | Existing Conditions | Future Growth | Needs Summary   Page 17

Beach Closures (2003-2014)

Beach	Number of Closures
West Manchester	31
Tuck's Point	14
Singing	0
White	6
Black	14
Magnolia's	13

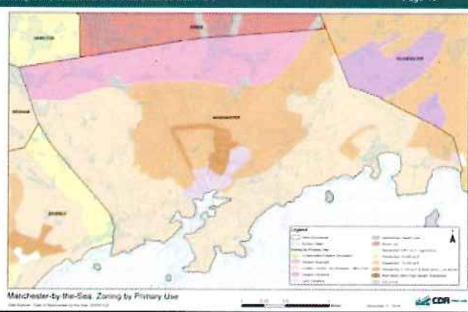
Future Growth

Purpose | Existing Conditions | Future Growth | Needs Summary   Page 18

- Population trend decreasing
  - Future development expected to be minor
- Town Planning for Future Development
  - Limited Commercial District Area

Zoning Map

Purpose | Existing Conditions | Future Growth | Needs Summary   Page 19



Future Growth

Purpose | Existing Conditions | Future Growth | Needs Summary   Page 20

Exiting Population Data and Projections

Year	Reported/Estimated Population
1990	5,286
2000	5,228
2010	5,136
2020	5,032
2030	4,915

MAPC Population and Housing Demand Projections for Metro Boston, Jan 2014

Years	% Growth Rate
1990 - 2000	-1.10%
2000-2010	-1.76%
2010-2020	-2.02%
2020-2030	-2.33%

Future Growth

Purpose | Existing Conditions | Future Growth | Needs Summary   Page 21

Historic and Predicted Age Distribution

MAPC Population and Housing Demand Projections for Metro Boston, Jan 2014

Needs Summary

Purpose | Existing Conditions | Future Growth | Needs Summary   Page 22

- I/I Removal and Collection System Improvements
- Treatment Plant Upgrades
- Septic System Wastewater Management

Infiltration and Inflow

I/I Removal is TOP PRIORITY for wastewater management needs.

- Excessive Infiltration impacts plant capacity that could be used for possible sewer expansion.
  2013 Report: 273,000 gpd peak infiltration
- Excessive Inflow causes peak flow extremes in collection system (surcharging) and at wwtf plant (exceed permitted discharge)
  2013 Report: 3.18 MGD peak inflow rate

EXPANSION OF SEWER SERVICE CANNOT BE CONSIDERED WITHOUT COLLECTION SYSTEM IMPROVEMENTS THAT REDUCE AND CONTROL EXCESSIVE I/I.

CDR

Treatment Plant Upgrades

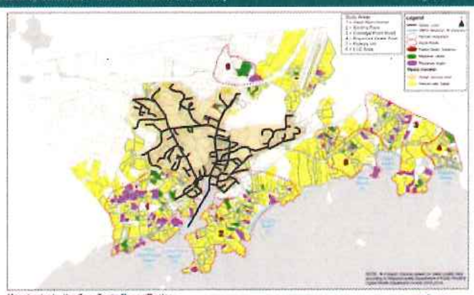
CWMP must identify needs of WTTF to provide proper treatment for planning period.

- Major Equipment Upgrades
- Improvements in process operations to ensure permit compliance

Influent Pumps (Low Flow Conditions)
Aeration Blowers (turn down, possible opportunity for energy savings)
SCADA/Control Panel Upgrades
Effluent Pumps (spare pump to support high flow conditions)

CDR

Septic Management Needs



Lot by Lot Summary

		Number of Parcels				Total Replaced Systems	%Total Replaced Systems
	Total Parcels	Quarter acre or less	Quarter to half acre	Half to one acre	Greater than 1 acre		
Study Area 1 West Manchester	205	3.4%	6.8%	17.1%	72.7%	29	14.1%
Study Area 2 Smith's Point	183	2.2%	3.8%	20.2%	73.8%	12	6.6%
Study Area 3 Coolidge Point	141	5.0%	7.1%	27.7%	60.3%	14	9.9%
Study Area 4 Raymond Street	100	37.0%	20.0%	11.0%	32.0%	7	7.0%
Study Area 5 Hickory Hill	91	11.0%	5.5%	38.5%	45.1%	7	7.7%
Study Area 6 LCD Area	25	4.0%	8.0%	20.0%	68.0%	1	4.0%

CDR

Estimated Flows

Maximum Study Area Septic Flows

	Study Area 1 West Manchester	Study Area 2 Smith's Point	Study Area 3 Coolidge Point	Study Area 4 Raymond Street	Study Area 5 Hickory Hill	Study Area 6 LCD Area	Total
Parcels Total Area Parcels	205	183	141	100	91	25	745
Estimated Flow *gpd	43,050	38,430	29,610	21,000	19,110	61,945**	213,145

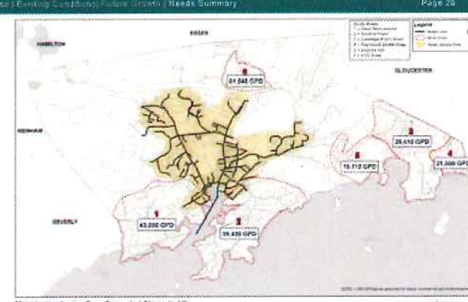
Septic Flows based on Need (Lot Size/Replaced Systems)

	Study Area 1 West Manchester	Study Area 2 Smith's Point	Study Area 3 Coolidge Point	Study Area 4 Raymond Street	Study Area 5 Hickory Hill	Study Area 6 LCD Area	Total
Parcels Needs Parcels	76	68	42	59	43	25	313
Estimated Flow *gpd	15,960	14,280	8,820	12,390	9,030	61,945**	122,425

*Sewage Flows were calculated using tr-16 as reference.
Average daily sewage flow = # of lots * 3 occupants * 70 GPD
**1000 gpd/acre was assumed for future commerical parcel development, estimated 65% developable

CDR

Estimated Flows Map



Next Steps

TASKS	Public Meeting Date
Review of Alternatives	February 17, 2015
Review Draft Plan	April 27, 2015

Closing

Thank You

Questions ?

Manchester-By-The-Sea, Massachusetts

Comprehensive Wastewater Management Plan Public Forum II

Public Forum II

- Project Overview - Public Participation Program
- Project Recap
- Alternatives Screening
- Review of Needs Areas
- Comparison of Alternatives
- Draft Outline of Suggested Plan

Project Overview

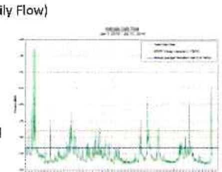
- Comprehensive Wastewater Management Plan (CWMP)
- Purpose: Evaluate current and future wastewater management needs and develop wastewater management alternatives to meet needs.
- Required under Mass DEP Administrative Consent Order (ACO) to prepare a CWMP
  - Draft by May 15, 2015
  - Final by August 1, 2015

Public Participation Program

- Public input is a necessary part of the CWMP process
- Schedule of Public Meetings
  - December 15, 2014 Existing Conditions and Needs
  - March 30, 2015 Review of Alternatives
  - TBD: June 15, 2015 Recommended Plan
- Formal Public Comment Period
  - May 15, 2015 to June 30, 2015
- Project Website www.CWMPManchester.info
  - Available April 15, 2015
  - Link from Town website
  - Public Comments

Project Recap

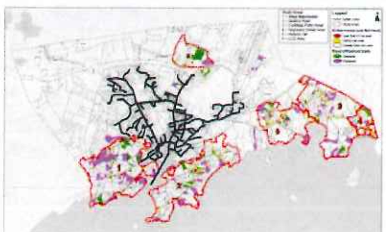
WASTEWATER TREATMENT
- Expansion limited by Ocean Sanctuary Act
- Some available capacity for additional flow (~50,000 to 100,000 gpd Annual Average Daily Flow)
- Maximum Day and Peak Hour flows exceed norm
- Need for plant and equipment upgrades



COLLECTION SYSTEM
- Issues with Infiltration/Inflow
- Ongoing Program for I/I identification and removal
- Sewer Rehabilitation Contract this year
- Pump Station improvements ongoing

Project Recap

NEEDS AREAS
- Area 1
  West Manchester
- Area 2
  Smith's Point
- Area 3
  Coolidge Point Road
- Area 4
  Raymond Street Area
- Area 5
  Hickory Hill
- Area 6
  Limited Commercial District



Screening of Alternatives

- **On-lot Innovative Alternative / Conventional Title 5 Systems** – individual I/A or conventional Title 5 on-lot disposal systems
- **Communal Treatment Systems** – new conventional or alternative treatment and disposal systems that service several properties
- **Connecting to Neighboring Systems** – conveying wastewater to neighboring town's for treatment and disposal
- **Sewer Expansion to Manchester WWTF** – expansion of the current sewer system to study areas
- **Sewer Expansion to a New WWTF** – wastewater collected and conveyed to a new treatment facility

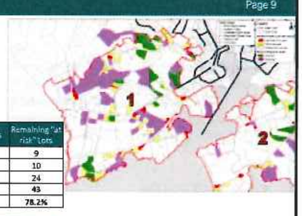
Screening of Alternatives

- On-lot Innovative Alternative / Conventional Title 5 Systems
  - Pros -
    - Cost can be reasonable ($20-$50k/lot served)
  - Cons -
    - Possibility of failure/ future water quality issues
    - Need for monitoring & maintenance
    - Town Wastewater Management Program
  - Other-
    - Limits Development and Growth
- Communal Treatment Systems
  - Pros -
    - Cost can be reasonable
    - May be feasible alternative for small development/neighborhoods
  - Cons -
    - Lack of "good" soils for suitable site
    - Limited locations of suitable size
  - LIMITED FEASIBILITY

Screening of Alternatives

- Connecting to Neighboring Systems
  - No adjacent municipal collection systems within reasonable distance
  - Requires long term agreement with neighboring community
  - NOT A FEASIBLE ALTERNATIVE
- Sewer Expansion To Manchester WWTF
  - Pros -
    - May be cost comparable to On-site Systems in some areas
    - Some limited WWTF capacity available
  - Cons –
    - Sewer Extensions not currently permitted per Consent Order
    - WWTF Capacity Increase not permitted per Ocean Sanctuaries Act
  - Other –
    - May promote development growth along sewer
- Sewer Expansion to New WWTF
  - OSA permit limits any new WWTF to a groundwater disposal system
  - Limited suitable sites available
  - Costs would be prohibitive as compared to other options
  - New facility would require extensive permitting
  - NOT A FEASIBLE ALTERNATIVE

West Manchester – Lot Analysis

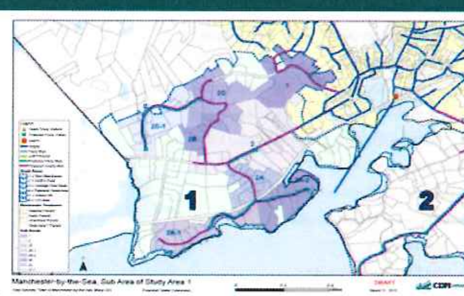


Total Lots	Total Area Lots	Repaired Lots	Replaced Lots	Failed Lots	Remaining "at risk" Lots
< 1/4 Acre	9	0	0	0	9
1/4 to 1/2 Acre	13	1	2	0	10
1/2 to 1 Acre	33	2	6	0	24
Total	55	3	8	0	43
	% of Total	20.0%		0.0%	78.2%

Total Lots	Total Area Lots	Repaired Lots	Replaced Lots	Failed Lots	Remaining "at risk" Lots
>1 acre	131	10	20	0	0
Total*	186	13	28	0	43
	% of Total	22.0%		0.0%	23.1%

*Total is representative of lots of all sizes in area

West Manchester – Sewer Plan



West Manchester - Costs

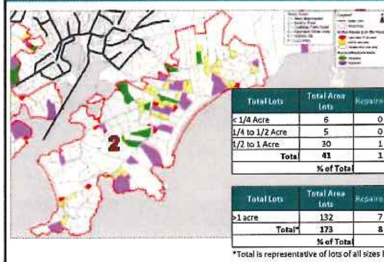
Estimated Lots Serviced	Estimated Flow (GPD)
71	14,910

*Sewage Flows were calculated using tr-16 as reference.
Average daily sewage flow = # of lots * 3 occupants* 70 GPD

Alternatives	Cost per Lot
Conventional System	$20,000-$30,000
I/A system	$35,000-$45,000
Sewer Expansion	$63,000-$82,000
Sewer Extension	$45,000-$62,000

Note: Assumption is that all lots less than an acre and not fixed or replaced and 50% of remaining non-fixed lots would be serviced

Smith's Point – Lot Analysis



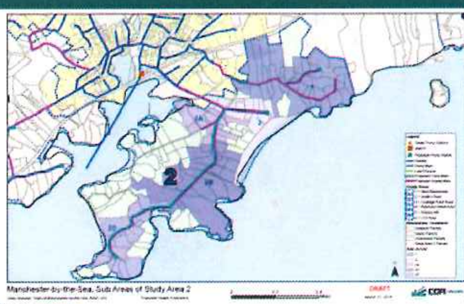
Total Lots	Total Area Lots	Repaired Lots	Replaced Lots	Failed Lots	Remaining "at risk" Lots
< 1/4 Acre	6	0	0	0	6
1/4 to 1/2 Acre	5	0	0	0	5
1/2 to 1 Acre	30	1	3	0	26
Total	41	1	3	0	37
% of Total		9.8%		0.0%	90.2%

Total Lots	Total Area Lots	Repaired Lots	Replaced Lots	Failed Lots	Remaining "at risk" Lots
>1 acre	132	7	12	2	0
Total*	173	8	15	2	37
% of Total		13.3%		1.2%	21.4%

*Total is representative of lots of all sizes in area

CDR

Smith's Point – Sewer Plan



CDR

Smith's Point - Costs

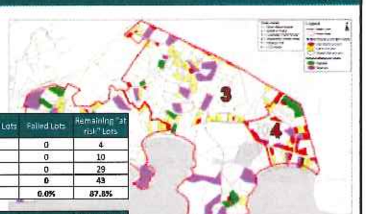
Estimated Lots Serviced	Estimated Flow (GPD)
73	15,330

*Sewage Flows were calculated using tr-16 as reference.
Average daily sewage flow = # of lots * 3 occupants* 70 GPD

Alternatives	Cost per Lot
Conventional System	$20,000-$30,000
I/A system	$35,000-$45,000
Sewer Expansion	$61,000-$79,000
Sewer Extension	$50,000-$64,000

Note: Assumption is that all lots less than an acre and not fixed or replaced and 50% of remaining non-fixed lots would be serviced

Coolidge Point Road – Lot Analysis



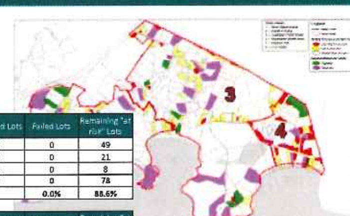
Total Lots	Total Area Lots	Repaired Lots	Replaced Lots	Failed Lots	Remaining "at risk" Lots
< 1/4 Acre	5	0	1	0	4
1/4 to 1/2 Acre	11	0	1	0	10
1/2 to 1 Acre	33	2	2	0	29
Total	49	2	4	0	43
% of Total		12.2%		0.0%	87.8%

Total Lots	Total Area Lots	Repaired Lots	Replaced Lots	Failed Lots	Remaining "at risk" Lots
>1 acre	102	4	11	0	0
Total*	151	6	15	0	43
% of Total		13.9%		0.0%	28.5%

*Total is representative of lots of all sizes in area

CDR

Raymond Street – Lot Analysis



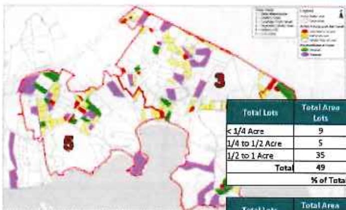
Total Lots	Total Area Lots	Repaired Lots	Replaced Lots	Failed Lots	Remaining "at risk" Lots
< 1/4 Acre	55	0	6	0	49
1/4 to 1/2 Acre	22	1	0	0	21
1/2 to 1 Acre	11	0	3	0	8
Total	88	1	9	0	78
% of Total		11.4%		0.0%	88.6%

Total Lots	Total Area Lots	Repaired Lots	Replaced Lots	Failed Lots	Remaining "at risk" Lots
>1 acre	26	2	1	1	0
Total*	114	3	10	1	78
% of Total		11.4%		0.9%	68.4%

*Total is representative of lots of all sizes in area

CDR

Hickory Hill – Lot Analysis



Total Lots	Total Area Lots	Repaired Lots	Replaced Lots	Failed Lots	Remaining "at risk" Lots
< 1/4 Acre	9	1	1	0	7
1/4 to 1/2 Acre	5	1	0	0	4
1/2 to 1 Acre	35	3	6	2	26
Total	49	5	7	2	37
% of Total		24.5%		4.1%	75.5%

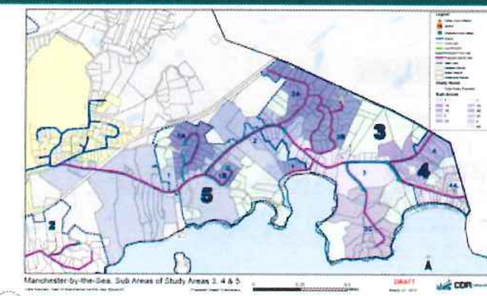
Total Lots	Total Area Lots	Repaired Lots	Replaced Lots	Failed Lots	Remaining "at risk" Lots
>1 acre	49	3	5	0	0
Total*	98	8	12	2	37
% of Total		20.4%		2.0%	37.8%

*Total is representative of lots of all sizes in area

CDR

3,4,& 5 - Sewer Plan

Coolidge Point, Raymond St, Hickory Hill



CDR

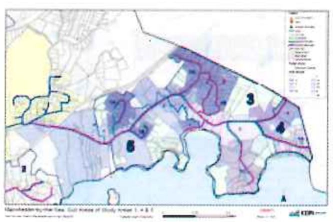
3,4,& 5 - Costs

Coolidge Point, Raymond St, Hickory Hill

Estimated Lots Serviced	Estimated Flow (GPD)
187	39,270

*Sewage Flows were calculated using tr-16 as reference.
Average daily sewage flow = # of lots * 3 occupants* 70 GPD

Alternatives	Cost per Lot
Conventional System	$20,000-$30,000
I/A system	$35,000-$45,000
Sewer Expansion	$43,000-$56,000
Sewer Extension	$37,000-$56,000



Note: Assumption is that all lots less than an acre and not fixed or replaced and 50% of remaining non-fixed lots would be serviced

LCD Area

CDR

LCD – Sewer Plan

CDR

LCD - Costs

- Area 6 – LCD Area

Maximum (with directional drilling)

Sewer Main (FT)	Force Main	Pump Station	Directional Drilling	Cost
1500	[illegible]	[illegible]	1,200	$ 1,250,000

Description	Unit Cost
Sewer Main: 8-inch (LF)	$150
Force Main (LF)	$100
Pump Station (Ea)	$250,000
Directional Drilling (LF)	$1,000

		Minimum		Maximum
Cost for service	Permits, Studies & Engineering (25%)	Subtotal	Contingency (40%)	Total
$1,250,000	$312,500	$1,562,500	$375,000	$2,062,500

Note: directional drilling was estimated for 1200 ft.

Hanging Pipe estimate

Sewer Main (FT)	Force Main	Pump Station	Directional Drilling	Cost
1500	1100	2	0	$ 750,000

Description	Unit Cost
Sewer Main: 8-inch (LF)	$150
Force Main (LF)	$100 (hanging)
Pump Station (Ea)	$250,000

		Minimum		Maximum
Cost for service	Permits, Studies & Engineering (25%)	Subtotal	Contingency (40%)	Total
$750,000	$187,500	$937,500	$375,000	$1,312,500

Note: The cost used for directional drilling is an estimate, not including rock excavation or geotechnical investigation directional drilling was estimated for 1200 ft

Estimated Flow
61,945**

**1000 gpd/acre was assumed for future commercial parcel development, estimated 65% developable

Suggested Plan

ON-SITE WASTEWATER MANAGEMENT PROGRAM with LIMITED SEWER EXTENSIONS

CONSIDER WORKING WITH GLOUCESTER for POSSIBLE COMBINED COMMUNITY WASTEWATER SOLUTION for RAYMOND STREET/MAGNOLIA AREA

Suggested Plan

Wastewater Management Program Elements to Consider

- Options being considered by BOH
- Range from minimal involvement to comprehensive management plan
- Elements can include: Public Education
  BOH inventory and maintenance of records
  Town Review/Approval/Issuance of Permits
  Town Inspections
  Required Pump Out and Inspection Schedules

Limited Sewer Extensions to Consider

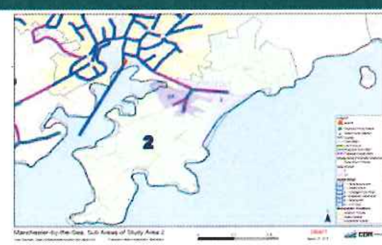
- Prioritize based on Need, Available flow capacity
- Raymond Street, Limited Commercial District, other areas

West Manchester – Sewer Extensions

Favorable Extensions

Entire Area	2		Lots Serviced	Estimated Potential Flow (GPD)
	Min	Max		
1	$45,500	$59,000	10	1,995
1+2+2A+2B	$48,000	$62,000	36	7,560

Smith's Point – Sewer Extensions

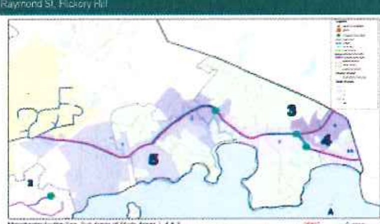


Favorable Extensions

Entire Area	2		Lots Serviced	Estimated Potential Flow (GPD)
	Min	Max		
2+2A	$49,500	$64,000	22	4,515

3,4,& 5 – Sewer Extensions

Coolidge Point, Raymond St, Hickory Hill



Favorable Extensions

Entire Area	2		Lots Serviced	Estimated Potential Flow (GPD)	
	Min	Max			
1+2+3+4+4A	$37,000	$48,000	116	24,360	Area 4 (Entire Area)
1+1A+1B+2+2A+3+3A+3B+3C+4+4A	$43,000	$56,000	187	39,270	All Area 3,4, and 5

Public Input

Draft Report Available: May 15,2015

Public Hearing: June 15,2015

Public Comment Period: May 15, 2015 to June 30, 2015

Project Website: Online April 15, 2015
www.CWMPManchester.info
Link from Town Website
Portal to provide written comment

Fact Sheet

The Town of Manchester-by-the-Sea Comprehensive Wastewater Management Plan

What is Manchester's Comprehensive Wastewater Management Plan (CWMP)?

Manchester's CWMP evaluates the sewage collection, treatment, and disposal needs of the Town of Manchester-by-the-Sea over the 20-year planning period. The plan will document the current and future wastewater needs throughout the town, identifies possible alternatives to accommodate those needs, evaluate the cost-effectiveness, feasibility and environmental impact of the alternatives, and demonstrate that the final plan is achievable from legal, institutional, financial, and management perspectives.

Why does Manchester need a CWMP?

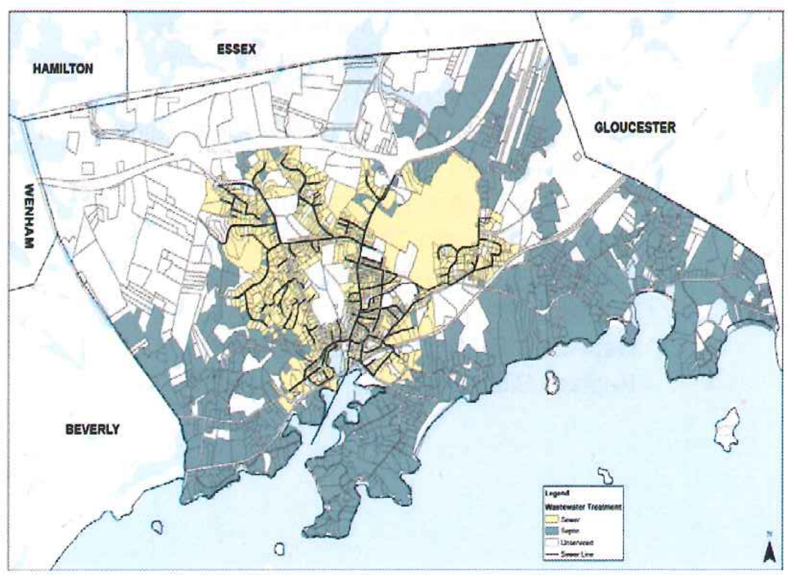
The CWMP is being developed for the Town of Manchester-by-the-Sea (MBTS) in response to a Massachusetts Department of Environmental Protection (MassDEP) Administrative Consent Order (ACOP-NE-13-1N003) to prepare a CWMP for the study and evaluation of current and future wastewater needs within the town and implementation of recommended solutions.

What are the main issues that the town is faced with from a wastewater prospective?

Approximately 40% of the developed lots in the town rely on on-site systems for wastewater disposal. A number of these are in danger of septic system failures due to unfavorable lot development conditions, (i.e. small lot size, poor soils, high groundwater). Alternative long-term solutions other than continued reliance on on-site systems need to be considered. However, the ACO requiring the town to prepare this CWMP also prohibits any sewer extensions to the system until the CWMP is completed and it is demonstrated that there is available capacity in the system to handle any additional flows from those sewer extensions. Further, the Ocean Sanctuaries Act (OSA) prohibits any increases to the permitted discharge from the town's WWTF without state approval. Current flow discharges from the Manchester WWTF have exceeded regulated limits during peak times. Peak flow exceedances at the WWTF are attributable to excess infiltration and inflow (I/I) that plague the collection system.

What is infiltration/inflow (I/I) and what is being done to address it?

Infiltration/inflow (I/I) occurs when excess water flows into sewer pipes from groundwater and stormwater. Groundwater seeps into sewer pipes through holes, cracks, joint failures, and faulty connections causing infiltration. Stormwater flows into sewers via roof drain downspouts, foundation drains, storm drain cross-connections, and through holes in manhole covers resulting in inflow. The resulting effect of extraneous water from I/I sources entering the system is reduced capacity and capability of the sewer system and treatment facilities. The town is committed to removing excess I/I from the collection system and has appropriated funds to make a complete investigation of the system to identify I/I sources and to make repairs to the collection system.



What is the recommended plan of the CWMP?

- Continued reliance on on-site systems in all areas town outside existing sewer collection system including Study Areas 1, 2, 3, 4 & 5.
- Enhancement of town approved wastewater management program.
  The purpose of the program is to **Educate, Regulate, Track** and **Ensure** proper functioning of the many on-site wastewater treatment programs in town through proper, **siting, Design, Installation, Operation** and **Compliance Monitoring.**
- Possible combined community wastewater solution with GLOUCESTER for RAYMOND STREET/MAGNOLIA AREA
- The Town may consider extending sewers into other areas in Town based on available WWTF capacity, Town planning needs, resident/neighborhood desires and costs.
  - Limited Sewer Extensions in Study Areas 1 & 2 may be cost comparable to on-site I/A system replacements.
  - Sewer Expansion to LCD Area 6 may help foster desirable commercial development.

Wastewater Treatment Facility Improvements
The Town should plan for capital upgrades and improvements for the WWTF in addition to current collection system improvements (sewer rehabilitation and pumping stations.)

- Replace & Re-size Influent Pumps
- Replace & Re-size Effluent Pumps
- Add VDF Controls for Influent & Effluent Pumps
- Replace & Re-size Aeration Blowers
- Replace Sludge Pumps

For More Information
About **Manchester's CWMP**

Read the draft CWMP report.
Copies are available at the following:

- http://cwmpmanchester.info/
- The Town Hall (10 Central St.)
- The Public Library (15 Union St.)

Questions?

Greg Federspiel , Town Administrator
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federspielg@manchester.ma.us

Sue Brown, Town Planner
(978) 526-4397
browns@manchester.ma.us

Allison Cunha, Engineer/Analyst
(617) 778-1468
allison.cunha@cdrmaguire.com

Town of Manchester-by-the-Sea

PUBLIC HEARING on the
Comprehensive Wastewater Management Plan

Are you a resident of Manchester-by-the-Sea?

Want to find out about the Town's Comprehensive Wastewater Management Plan and how it may affect you?

Come to the Public Hearing and listen to a presentation on the draft 20-year management plan.

Share your comments during the Public Hearing!

Or

Read the draft plan
and
Submit your comments on the CWMP Website http://cwwmpmanchester.info/

DATE:	**June 15, 2015**	
TIME:	**Selectmen's Meeting: 6:00 p.m.**	
		Public Hearing: 7:00 p.m.
LOCATION:	**Manchester Town Hall** **Room 5** **10 Central Street** **Manchester-by-the-Sea, MA**	

For More Information, Contact:

Greg Federspiel , Town Administrator
(978) 526-2000
federspielg@manchester.ma.us

Sue Brown, Town Planner
(978) 526-4397
browns@manchester.ma.us

Allison Cunha, Engineer/Analyst
(617) 778-1468
allison.cunha@cdrmaguire.com

Manchester-By-The-Sea, Massachusetts

Comprehensive Wastewater Management Plan Public Hearing (Forum III)

Board of Selectmen & CWMP Steering Committee
June 15, 2015

CWMP

Acknowledgements

Steering Committee

Eli Boling – Board of Selectmen
Gary Russell – Conservation Commission
Gerry McDonald – Board of Health
Rebecca Jaques – Planning Board
Ronald Mastrogiacomo – Planning Board
Alida Bryant – Citizen At Large
Brian Balukonis – Citizen At Large

Board of Selectmen
Paul Barclay, Susan Beckmann, Eli Boling, Margaret Driscoll, & Tom Kehoe

Town Administer
Gregory Federspiel

Town Planner
Sue Brown

Public Works Director
Carol A. Murray

Board of Health
Ellen Lufkin

Chief Wastewater Plant Operator
John Sibbalds

Purpose

Comprehensive Wastewater Management Plan

Purpose: Evaluate current and future wastewater management needs and develop wastewater management alternatives to meet future needs.

Required: MBTS is required under Mass DEP Administrative Consent Order (ACO) to prepare a CWMP by August 1, 2015.

Objectives

Manchester-by-the-Sea
Wastewater Needs Planning Objectives

- **Protect the Environment**
- **Protect Drinking Water**
- **Protect Quality of Life**
- **Maintain Character of Town**

Existing Conditions

1,099 Sewered Parcels

737 Septic Parcels

Our Approach

- Evaluate and demonstrate that On-site Systems are a viable means for providing wastewater management for non-sewered areas in Town.
- Evaluate and demonstrate that the existing WWTF has available capacity to accommodate additional flows if needed or desired.
- Evaluate and compare alternative wastewater management methodologies.

Potential Needs Areas

NEEDS STUDY AREAS
- Area 1
  West Manchester
- Area 2
  Smith's Point
- Area 3
  Coolidge Point Road
- Area 4
  Raymond Street Area
- Area 5
  Hickory Hill
- Area 6
  Limited Commercial District (LCD)

Table V-1. Non-Sewer Parcels Estimates by Study Areas

Study Areas	Total Parcels	Lots of Concern	Repaired/Replaced
West Manchester	180	41	58
Smith's Point	172	37	44
Coolidge Point Road	151	40	36
Raymond Street Area	114	45	29
Hickory Hill	98	31	27
Total Study Areas 1-5	715	194	194
LCD	25	-	-

Potential Needs Areas

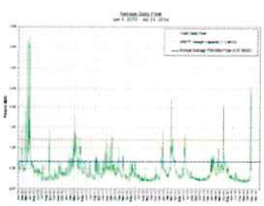
Table VI-1. Summary of Wastewater Flow Projections

Study Area	Full Build-out ADF (gpd)	Planning Period ADF (gpd)
Infill Parcels	15,000	11,250
Study Area 1 West Manchester	37,800	17,115
Study Area 2 Smith's Point	36,120	17,325
Study Area 3 Coolidge Point	31,710	16,275
Study Area 4 Raymond Street	23,940	13,650
Study Area 5 Hickory Hill	20,580	10,710
Study Area 6 LCD	62,000	31,000
TOTAL	227,150	117,325

Existing Wastewater Facilities

WASTEWATER TREATMENT
- Expansion limited by Ocean Sanctuary Act
- Design Capacity: 1.2 MGD
- Permitted Capacity: 0.67 MGD
- Maximum Day and Peak Hour flows exceed norm
- Need for plant and equipment upgrades

COLLECTION SYSTEM
- Issues with Infiltration/Inflow
- Ongoing Program for I/I identification and removal
- Sewer Rehabilitation Contract this year
- Pump Station improvements ongoing



WWTF has available flow capacity to treat an additional 90,000 – 200,000 gpd (~400 - 950 parcels).

Alternatives Analysis

Table VII-1. Screening of Preliminary Alternatives

Alternative	Pros	Cons	Assessment
On-lot Systems	➢ Reasonable Costs/Household ➢ Limits Development & Growth in concurrence with town planning ➢ Recharges groundwater locally	➢ Possibility of failure and future water quality issues ➢ Town Wastewater Management Program for monitoring & maintenance advised	Feasible for further consideration
Communal Systems	➢ Reasonable Costs/Household ➢ Limits Development & Growth in concurrence with town planning ➢ Recharges groundwater locally	➢ Generally "poor" soils limits possible sites ➢ Limited available parcels of suitable size to service an entire needs area	Limited Feasibility May be an option for small neighborhoods or portions of a needs area
Connecting to Neighboring Systems		➢ No adjacent municipal collection systems within reasonable distance ➢ Requires long term agreement with neighboring community	Not Feasible
Sewer Expansion to Manchester WWTF	➢ May be cost comparable to On-lot systems ➢ Some WWTF capacity available ➢ Improves long-term water quality	➢ Sewer Extensions not currently permitted per Consent Order ➢ Limited Available WWTF capacity ➢ WWTF Capacity increase not permitted per Ocean Sanctuaries Act ➢ May promote development growth along proposed sewers ➢ Water "lost" in discharge to ocean	Feasible for further consideration
Sewer Expansion to New WWTF		➢ Ocean Sanctuaries Act permit limits any new WWTF to a groundwater disposal system ➢ Limited suitable sites available ➢ Costs prohibitive as compared to other options ➢ New facility would require extensive permitting	Not Feasible

What we found out

ON-SITE WASTEWATER MANAGEMENT
- The Town has an effective septic system monitoring program that demonstrates the long-term viability of on-site systems for wastewater management.
- Use of I/A systems in recent years has reduced the need (number of lots of concern) in most areas of town.
- The Raymond Street area has the greatest need (volume and concentration of lots of concern).

What we found out

WASTEWATER TREATMENT FACILITY
- There is insufficient available capacity for the WWTF to serve all needs areas.
- Expansion of WWTF capacity is limited by the Ocean Sanctuaries Act.
- The WWTF has some available capacity for some sewer extension/expansion if desired.
- The Town needs to continue its on-going I/I removal program to ensure that WWTF treatment capacity is available.

What we found out

ALTERNATIVES ANALYSIS

- Sewer expansion (serving an entire needs area) generally has a higher cost/lot served when compared to repair/replacement of on-site systems.
- There are some sewer extensions within needs areas that are cost comparable to on-site systems.
- Communal systems are generally not a viable option for most needs areas due to a lack of potential sites.
- A communal system for the Raymond Street area may be a viable option in conjunction with the Magnolia area of Gloucester.

CDR

Recommended Plan

PREFERRED/PRIMARY ALTERNATIVE
•ON-SITE WASTEWATER MANAGEMENT PROGRAM (ALL AREAS EXCEPT AREA 6)

AREA 6 LCD: If future Town Planning determined that it is desirable to develop Area 6 for Limited Commercial Development it should consider expanding sewer collection to this area to help foster the proposed development.

SECONDARY/BACKUP ALTERNATIVES
•COMMUNAL SYSTEM: It may be feasible to develop a combined communal wastewater solution for the Raymond Street/Magnolia area in conjunction with Gloucester.
•SEWER EXPANSION to Raymond Street. Less desirable because of potential undesirable growth issues along Summer Street sewer extension.
•LIMITED SEWER EXTENSIONS: The Town can consider some limited sewer extension into other needs areas within available WWTF capacity.

CDR

Recommended Plan

ON-SITE WASTEWATER MANAGEMENT PROGRAM
Continued reliance on on-site systems in all areas town outside existing sewer collection system including Study Areas 1, 2, 3, 4 & 5.

ENHANCEMENT of TOWN APPROVED WASTEWATER MANAGEMENT PROGRAM
The purpose of the program is to **Educate, Regulate, Track** and **Ensure** proper functioning of the many on-site wastewater treatment programs in town through proper, **Siting, Design, Installation, Operation** and **Compliance Monitoring.**

CDR

Recommended Plan

COMMUNAL SYSTEM

- Possible combined community wastewater solution with GLOUCESTER for RAYMOND STREET/MAGNOLIA AREA

CDR

Recommended Plan

SEWER EXTENSIONS & EXPANSIONS
The Town may want to consider extending sewers into other areas in Town based on available WWTF capacity, Town planning needs, resident/neighborhood desires and costs.

- Limited Sewer Extensions in Study Areas 1 & 2 may be cost comparable to on-site I/A system replacements.
- Sewer Expansion to LCD Area 6 may help foster desirable commercial development.



CDR

Recommended Plan

WASTEWATER TREATMENT FACILITY IMPROVEMENTS
The Town should plan for capital upgrades and improvements for the WWTF in addition to current collection system improvements (sewer rehabilitation and pumping stations.)

- Replace & Re-size Influent Pumps
- Replace & Re-size Effluent Pumps
- Add VDF Controls for Influent & Effluent Pumps
- Replace & Re-size Aeration Blowers
- Replace Sludge Pumps




CDR

Summary

- Wastewater management is a complex planning issue that needs to continue beyond the planning period.
- The CWMP is a road map for the Town's use in implementing wastewater management solutions, it is intended to be a living document that will adapt depending on results of earlier implementation phases.
- Most properties in town contribute to the issue, so everyone needs to be involved in the process.
- All benefit from improved water quality and protection of water resources.

CDR

Public Input

Draft Report Available:	Online, at Town Hall & the Library
Public Hearing:	June 15,2015
Public Comment Period:	May 15, 2015 to June 30, 2015

Project Website:

www.CWMPManchester.info

Link from Town Website

Portal to provide written comment

CDR

CDR MAGUIRE

Report of Meeting

WINNER OF TWO PRESIDENTIAL AWARDS FOR DESIGN EXCELLENCE

Date of Meeting: **October 2, 2014**

Project: **Town of Manchester-by-the-Sea CWMP Plan**

Project No.: **19549**

Report By: **Allison Cunha**

Purpose: **Steering Committee Meeting Minutes**

Attendees:
Greg Federspiel, MBS Town Administrator
Eli Boling, Board of Selectmen
Gerry McDonald, BOH Representative
Becky Jaques, Planning Board
Garry Russell, Conservation Commission
Sue Brown, Town Planner
Alida Bryant, Citizen at Large
Matthew Amorello, CDR Maguire
Steve Landry, CDR Maguire
Allison Cunha, CDR Maguire

Copies To: **Attendees, File, FTP File Share**

General discussions of the meeting are as follows:

1. Contact list will be updated and sent around to the group.

2. Project FTP/File Sharing Site for information – Filr: There will be a file share set up on an FTP site by CDR Maguire to store any project information that may be helpful to the committee. Past reports, memos, meeting minutes, and working report documents, etc will be accessible through the site. An email will be sent to each member providing an individual user name and password providing access to the shared folder. This is expected to be set up and shared during the next week.

3. Project Schedule review: The committee has agreed to meet on the first Thursday of every month with a tentative time of 5:30 pm. This is subject to change if necessary.

The first public forum is expected to be held on Thursday Dec. 11, 2014. Notices/handouts will be prepared by CDR Maguire. There will be a sign made by CDR Maguire to display on Election Day, November 4th, providing information on the CWMP public forum asking for public input. Handouts will also be made to give to voters asking for public participation on the CWMP forum as well as the option for written comment to be sent in for consideration.

There is also a possibility of including a notice of the public forums within the Town water bills sent out to residents. If this is completed it would be for future public forum dates as the billing is done quarterly.

4. Conditions Overview and Needs Assessment Discussions:

<u>Existing Conditions:</u>
The Town is starting process of updating the Master Plan, the CWMP will need to coordinate with this update with regards to impacts on wastewater and wastewater needs.

One area in Town that is being considered for future development is the limited commercial district (LCD) area. This is the northeast area of town, north of Route 128 in the surrounding area of School St. This area of town is known to have septic problems. There are also several wetlands around the area.

Other development possibilities are developers buying large lots and building additional houses. These may be in areas where there could be a requirement to use on-site systems. There is also pressure within the Town to provide more affordable housing.

System Updates/Upgrades/Problems Noted

- Pine St. Sewer district contamination
- Boardman area – inspected, many upgrades in the area
- Crooked lane – Sewer extension
- Raymond St. (Area 4) – Most systems upgraded
- Beach near Raymond Street has had water quality problems in the past
- Existing Sewer Problem Concern – Old Essex Rd. between Pine and School St. Sewer backups about 3 times in 6 years. Could be a maintenance problem, crack in pipe, collapse, rooting, etc. May require investigation (CCTV) to identify problem

Current Water Quality issues are relative minor, there have been some beach closures. The Board of Health has procedures in place to address water quality issues, including investigations of septic systems in the area. These procedures may need to formalized and documented in the CWMP.

<u>Needs Areas and Possible Solutions:</u>
The final CWMP will likely recommend individual on lot I/A systems for most study areas, some small sewer extensions, and community systems where

needed. A plan that relies on continued use of on-site and I/A systems may require additional or modifications to existing Town bylaws, such a development of wastewater management districts and a wastewater management plan.

West Manchester and Smith's Point are two areas where tie-ins to existing service area has most merit. The WWTF design plant capacity accounted for servicing some additional areas beyond the current service area. DEP acceptance of expanding the sewer service area will be contingent on demonstrating resolution of I/I issues that have caused high flows at the WWTF are resolved.

Community systems will be considered or some areas. Raymond Street area has history of being very difficult to maintain septic systems is the most likely candidate for a community system given its distance from the existing service area.

5. OTHER

<u>Infiltration/Inflow (I/I)</u>

I/I in the system continues to be a concern for DEP. Studies/reports are currently being done. DEP looking for corrective action to be taken on those issues that have been identified through the sewer investigations. Inflow into the system during high tides still seems to be an issue even though one problems that was identified has been corrected.

<u>Ocean Sanctuary Act (OSA)</u>

The Ocean Sanctuary Act limits flow discharge from the WWTF. The WWTF has a design capacity of 1.2 mgd but annual flow is limited to 0.67 mgd on a rolling average basis and summer months (June-November). Modification to permitted WWTF flow requires approval through the OSA and would require demonstration that no other feasible alternatives are available to the Town.

NEXT MEETING – November 4, 2014
TENTATIVE ITEMS for DISCUSSION

- Review and Update of Existing Conditions
    - Lot by Lot database review, system failures/problems, repairs (I/A) Systems
- Public Notification/Public Forum Planning
    - Election Day handouts

CDR | MAGUIRE

Report of Meeting

WINNER OF TWO PRESIDENTIAL AWARDS FOR DESIGN EXCELLENCE

Date of Meeting:	**November 6, 2014**
Project:	**Town of Manchester-by-the-Sea CWMP Plan**
Project No.:	**19549**
Report By:	**Allison Cunha**
Purpose:	**Steering Committee Meeting Minutes**
Attendees:	Greg Federspiel, MBS Town Administrator Eli Boling, Board of Selectmen Gerry McDonald, BOH Representative Becky Jaques, Planning Board Gary Russell, Conservation Commission Sue Brown, Town Planner Alida Bryant, Citizen at Large Brian Balukonis, Citizen at Large Matthew Amorello, CDR Maguire Steve Landry, CDR Maguire Allison Cunha, CDR Maguire
Copies To:	**Attendees, File, FTP File Share**

General discussions of the meeting are as follows:

1. Conditions Overview and Needs Assessment Discussions:

   Existing Conditions:

   Beaches are tested regularly by BOH. There is a system in place any time there is a concern and testing is necessary. Recently testing has been focused on systems in the areas of both Black and White Beach. A few systems failed inspections and were upgraded.

   The procedure that the BOH uses in these events and the results from it should be documented and included in the CWMP to show how that there is a management system in place for these events in the Town.

<u>Maps</u>
A preliminary set of plans produced by CDR Maguire were presented and explained. The maps are available on the Filr ftp website. The following maps were presented:

Town Map
Sewer Service Area Map
Sewer System Map
Surficial Materials
Zoning Map
Town Owned Lots Map
Open Space Map
Town Owned/Open Space Overlay Map
Lot Size Map
Study Areas (2003)
Study Areas 2003 vs 1994

2. Needs Areas

<u>Estimated Sewer Flows</u>
Preliminary Sewage flows for each of the 2008 GIS updated sewer areas were calculated and organized into 2 tables, one using tr-16 methods and the other using Title 5 flow calculations. The tr-16 calculations are generally used for design flows that are being added into an existing system. Title 5 flow calculations are used when considering flow for designing onsite septic systems.

Each table displays sewage flows broken up by study area as well as size of parcels. The parcels were divided into categories: quarter acre or less, quarter to a half acre, half to one acre and greater than 1 acre. The smaller parcels, specifically lots that are half acre or less, are expected to have more sewage need due to limiting space for an onsite system.

As the study areas are refined based on data collected by CDR, the sewage flows will be updated. The flows will be examined further and calculated on a lot by lot basis.

<u>Possible Solutions:</u>
The final CWMP will likely recommend individual on lot I/A systems for most study areas, some small sewer extensions, and community systems where

Community systems will be considered or some areas. Raymond Street area has history of being very difficult to maintain septic systems and is the most likely candidate for a community system given its distance from the existing service area.

3. WWTF Discussion

A figure of the WWTF capacity and flows was produced by CDR displaying the permitted capacity compared to the month rolling average, 80% of the annual discharge limit, and the monthly average daily flow.

The Ocean Sanctuary Act limits flow discharge from the WWTF. The WWTF has a design capacity of 1.2 MGD but annual flow is limited to 0.67 MGD on a rolling average basis and summer months (June-November).

The WWTF design flows include peak I/I in design (818,000).

Some of the areas included in the treatment plant design flow that were not connected to the sewer system are Raymond Street area (study area 4) and Hickory Hill neighborhood (study area 5).

The available capacity at the plant will be determined to estimate how much flow can be potentially sewered from needs areas.

When calculating the available capacity at the treatment plant the following will be considered: design capacity, how much capacity is currently being used, the build-out study and how much additional capacity will be needed for the system in 20 years.

The needs area flows shown for all study areas in the 2008 update has a total of 150,000 GPD. There is enough capacity at the plant but it is not allowable due to the OSA limits. Modification to permitted WWTF flow requires approval through the OSA and would require demonstration that no other feasible alternatives for the problem areas are available to the Town.

CDR will continue analysis of data for WWTF using past 3 to 4 years of data really looking at plant flows as well as taking a deeper look into the sanitary flows vs. I/I.

Rainfall data will be overlaid with the flows. Storm events can affect the treatment process – exceed treatment limits. Events also cause quality issues. It is what DEP is concerned with when issuing these consent orders.

Water Quality

The water quality permit was estimated to be about a 30/30. This is 30 mil/liter BOD and 30 mil/liter suspended solids. This is a somewhat generous permit for water quality so there shouldn't be any water quality issues.
A 7" storm in Manchester still passed on the limits for water quality in the past.
There are no Nitrogen/Phosphorus limits currently in Manchester.

The problem in Manchester is not a water quality issue but rather the problem lies with getting the water into the ground with the soils present within the Town.

One concern in the wastewater treatment of the Town is the salinity of the water getting into the system during high tides. The salt in the water eats away at the bugs in treatment and can affect the treatment process, ultimately making the quality of the water coming out of the system a concern.

4. Public Forum

The public forum date is being changed from Thursday 12/11 to Monday 12/15. It will be held at 7pm, after the board of selectmen hearing.

For the public forum the existing conditions will be presented along with the problem areas that will be identified. The public will be asked if there are any other problem areas we may be missing that they have knowledge of. Are there any sewer problem, septic and I/A system problems etc.

Should be sure to include the sensitive areas such as the limited commercial districts as it will be something sure to be brought up.

Some ways to get the word out to the public:

-Boy Scouts
-Mass Mailing
-Water Bills

NEXT MEETING – December 11, 2014 @ 5:30
TENTATIVE ITEMS for DISCUSSION

- Study Area delineation
    - More in depth analysis - Lot by Lot database review, system failures/problems, repairs (I/A) Systems
    - Refining sewage flows
- WWTF
    - Assessment of Treatment Plant
        - List of recommendations
        - Capability for 20 yrs of service
        - Pump station inspection
    - Analysis of flows into the system
        - Available capacity at the plant
        - Needs flows vs. capacity
        - Build-out for flows in a 20 yr period

- Public Forum
    - Presentation
    - Handouts

CDR MAGUIRE

Report of Meeting

WINNER OF TWO PRESIDENTIAL AWARDS FOR DESIGN EXCELLENCE

Date of Meeting:	**January 15, 2015**
Project:	**Town of Manchester-by-the-Sea CWMP Plan**
Project No.:	**19549**
Report By:	**Allison Cunha**
Purpose:	**Steering Committee Meeting Minutes**
Attendees:	Greg Federspiel, MBS Town Administrator Eli Boling, Board of Selectmen Gerry McDonald, BOH Representative Garry Russell, Conservation Commission Sue Brown, Town Planner Alida Bryant, Citizen at Large Matthew Amorello, CDR Maguire Steve Landry, CDR Maguire Allison Cunha, CDR Maguire Christine O'Grady, CDR Maguire
Copies To:	**Attendees, File, FTP File Share**

General discussions of the meeting are as follows:

1. Draft Report to be uploaded to Filr project website for committee to view and comment as desired. This draft is a very rough draft with holes and information to be added.

   A project website will be developed for all information and reports to be made available to public. The site will be set up in the next few weeks.

   The second public forum is expected to be held on Monday March 2, 2015 as part of the agenda for the Board of Selectmen Meeting. Notices/handouts will be prepared by CDR Maguire.

2. Study Areas Alternatives/Potential Properties at risk Discussions:

   At risk parcels were mapped to show where the need was in each study area. The at risk parcels are defined as being less than 1 Acre in size and on a septic lot that is not on record as being repaired or replaced.

   There will be updated maps to also show the less than a half acre "at risk" parcels as the more crucial properties in need.

   The data must be updated as to whether the parcels "at risk" are truly in need. (i.e. part of another parcel, etc.)

   Initial Alternatives and Screening

   On-lot – this alternative suggests continuing use of innovative alternative systems and Conventional Title V on-lot disposal systems for wastewater management.

   It is expected that it would be recommended to use I/A systems, and continue the pattern that seems to already be in effect in the study areas. The study areas show that many systems have been replaced or repaired in the last 10 to 15 years and that many of these system replacements have been I/A systems.

   Communal Systems – a new conventional or alternative septic system that would service several properties. For this option a site large enough to service the treatment of the community based on sewage flows must be available in the vicinity of the properties being serviced.

   Calculations will be performed to determine how large of a parcel is needed to treat each area. After running the numbers, the lot feasibility in the study areas, for acreage of lot discharge, will be determined.

   An Acre/gal disposal analysis will be presented for next meeting as all alternatives will be expanded on a more cost basis.

   Examples from other towns and communities that have used communal systems will be provided in the future if communal systems are presented as an alternative option/recommendation.

   If a communal system is recommended, there will be a need for a groundwater discharge permit as well.

   Connecting to Neighboring Systems – Connecting to neighboring systems does not seem to be an option initially. After discussing, there does not seem to be a viable Town or City with a wastewater treatment facility in close proximity or with capacity.

In order to rule out all possibilities, discussions with Towns and cities will be conducted.

Sewer Option – There are concerns on inviting development due to sewer extensions.

Possibility of extending some sewer lines a small amount to incorporate the "at risk" parcels around the sewered area.

Zoning by-law would dictate what would be allowed in each area.

Other discussion

- Possibility of having a town-wide system management program for inspecting and maintaining on-site systems.

  Typical Title V inspection cost is $500. Maybe have it required every 5 or 10 years.

- The areas with most wastewater concern are the areas of Raymond Street and Coolidge Point Road.

- A rank of the needs areas should be done in order to see which locations are of higher priority than others. This can be done using a matrix with checklist items of factors to consider for defining a wastewater need.

- Once alternatives are screened, the potential solutions will be evaluated for feasibility and cost effectiveness.

- Sewer costs will also be calculated including areas that may need pump stations to convey the waste for treatment.

Preliminary Alternative Matrix – Desirability

A table was presented showing feasibility of initial alternatives for each study area as well as a column showing desirability. Feasibility is more of a concern for the engineer - "will this alternative work". Desirability is based more on a cost, location, political opinion.

Feedback for this table is requested by the committee to help get a better understanding of what alternatives would be best physically, environmentally, politically, etc.

NEXT MEETING – February 12, 2014
TENTATIVE ITEMS for DISCUSSION

- Review and Update of Alternatives Screening and draft report
- Public Forum Planning – Review of Alternatives
  - March 2, 2015

CDR | MAGUIRE

Report of Meeting

WINNER OF TWO PRESIDENTIAL AWARDS FOR DESIGN EXCELLENCE

Date of Meeting:	**February 12, 2015**
Project:	**Town of Manchester-by-the-Sea CWMP Plan**
Project No.:	**19549**
Report By:	**Allison Cunha**
Purpose:	**Steering Committee Meeting Minutes**
Attendees:	Greg Federspiel, MBS Town Administrator Eli Boling, Board of Selectmen Garry Russell, Conservation Commission Sue Brown, Town Planner Brian Balukonis, Citizen at Large Ron Mastrogiacomo, Planning Board Matthew Amorello, CDR Maguire Steve Landry, CDR Maguire Allison Cunha, CDR Maguire Christine O'Grady, CDR Maguire
Copies To:	**Attendees, File, FTP File Share**

General discussions of the meeting are as follows:

1. Draft Report to be uploaded to Filr project website for committee to view and comment as desired.

   A project website is in the beginning stages of starting development. This page will be used for all information and reports to be made available to public.

   The second public forum is expected to be held on Monday March 2, 2015 as part of the agenda for the Board of Selectmen Meeting.

   A ranking system was created in which "incident factors" were calculated per area. The data and results were presented in tables. The results showed no real outstanding need in any particular study area. Some of the numbers still must be tweaked and reviewed however the results should not change significantly. Going forward CDR will find a ranking system that may show the need of certain areas over others. Possibly by risk lot % per area.

2. Study Areas Alternatives Discussions:

   At risk parcels were mapped to show where the need was in each study area. The "at risk" parcels are defined as being less than 1 Acre in size and on a septic lot that is not on record as being repaired or replaced.

   The data must be updated as to whether the parcels "at risk" are truly in need. (i.e. part of another parcel, etc.)

Alternatives Screening

On-lot – this alternative suggests continuing use of innovative alternative systems and Conventional Title V on-lot disposal systems for wastewater management.

It is expected that it would be recommended to use I/A systems, and continue the pattern that seems to already be in effect in the study areas. The study areas show that many systems have been replaced or repaired in the last 10 to 15 years and that many of these system replacements have been I/A systems.

With the exception of minor areas that could be treated by communal systems and small sewer extensions, it is expected that on-lot management will be the primary recommendation.

Communal Systems – a new conventional or alternative septic system that would service several properties. For this option a site large enough to service the treatment of the community based on sewage flows must be available in the vicinity of the properties being serviced.

Calculations were done to determine the acreage for a lot needed for a communal system to service the "remaining lots" flow in each area. This was calculated for good, fair, and poor soils.

Specific acreage calculations for each study area were performed based on the soils present in each area (taking in account additional acreage necessary for divider berms, access roads, hillside grading, etc.). The desired lot sizes for disposal area were provided.

Possible vacant/large/town-owned lots were then selected and investigated to determine feasibility for a community system in each study area.

The lots were presented in numbered map along with a corresponding table describing the soil makeup, size, owner, hydraulic conductivity, etc. The sites that seem initially feasible and met the lot size guidelines calculated were marked for further investigation.

Connecting to Neighboring Systems – Connecting to neighboring systems does not seem to be an option initially. After discussing, there does not seem to be a viable Town or City with a wastewater treatment facility in close proximity or with capacity.

The surrounding Towns and Cities have been contacted. Only a couple of them have responded.

The Towns of Wenham and Hamilton do not have sewer within their Towns therefore should not be examined further.

There will be additional attempts to begin discussion with Essex, Beverly, and Gloucester. It is not expected that it is possible to tie in to any existing systems.

The City of Gloucester's sewer system and treatment is significantly far from the areas of need, however with Gloucester there is a potential area where a communal system between towns may be a viable solution.

Additional contacts for Gloucester will be pursued to begin discussions on whether a community disposal area between Gloucester and Manchester-By-The-Sea is possible.

Sewer Option –

Preliminary sewer layouts for each study area were made to show the length of sewer needed to reach all of the "risk lots" in that area. The maps presented show the maximum amount of sewering needed as well as the estimated number of pump stations necessary to send the sewage flow to the wastewater treatment facility. They are meant to show the possible routes each area would use if it were to sewer, not taking into account plant capacity or cost.

An initial cost per lot serviced was calculated based upon only those lots that were considered "at risk" (under 1 acre and not fixed). These costs could likely change and decrease depending on other non-risk lots in the proximity of the proposed sewer line that may be added on to be serviced.

The more likely possibility is to extend some sewer lines for a smaller amount of "at risk" parcels around the immediate sewered area. The cost per lot for these smaller loops will be calculated to determine if they are cost effective.

It was brought to the attention that discussion in planning found that a sewer extension to the Bath House at Singing Beach may be desirable. The possibility of extensions where desirable for the Town, such as for the bath house, will be considered per request.

Having smaller extensions where they make sense will also eliminate possible future development concerns with sewering.

Other discussion

- The cost per lot for each option will be calculated to compare each alternative based on feasibility and cost effectiveness. For the sewer alternative individual extensions will be priced out. The LCD area sewer will be priced out separately based on the specific situation.

- Town-wide system management program options for inspecting and maintaining on-site systems will be presented at the next Steering Committee meeting.

NEXT MEETING – March 19, 2015
TENTATIVE ITEMS for DISCUSSION

- Review and Update of Alternatives Screening, recommendations, and draft report.
- Overview of on-site management plan options.

CDR | MAGUIRE

Report of Meeting

WINNER OF TWO PRESIDENTIAL AWARDS FOR DESIGN EXCELLENCE

Date of Meeting:	**April 16, 2015**
Project:	**Town of Manchester-by-the-Sea CWMP Plan**
Project No.:	**19549**
Report By:	**Allison Cunha**
Purpose:	**Steering Committee Meeting Minutes**
Attendees:	Greg Federspiel, MBS Town Administrator Eli Boling, Board of Selectmen Garry Russell, Conservation Commission Sue Brown, Town Planner Gerry McDonald, Board of Health Matthew Amorello, CDR Maguire Steve Landry, CDR Maguire Allison Cunha, CDR Maguire
Copies To:	**Attendees, File, FTP File Share**

General discussions of the meeting are as follows:

1. The remaining project schedule till project completion was reviewed. An updated revised schedule is available to view on the Steering Committee file sharing website.

   The next Steering Committee meeting is scheduled for Thursday May 21st at 5:30. There will be one additional Steering Committee meeting before the public hearing, date to be determined at next meeting.

2. The Public Hearing is scheduled to be held on June 15th at 7:00pm at the end of the Selectmen's meeting.

   A poster and handouts will be made to advertise the public hearing at the Manchester Sawmill Watershed meeting on Wednesday April 22nd.

There will also be a notice to the public in the Cricket news paper by mid May. Beth Heisey (Manchester) will work with CDR to come up with wording to submit for the article.

3. The Draft Report will be submitted to DEP and available to public for comment on May 15th.

   The recommended plan will be submitted by CDR for review by Town at the end of April before draft is submitted.

4. The draft of the project website was sent to the town for comment. The website has been established and is set to go Live by April 27th. There is a public comment section that will allow the public to submit their comments through an online form. The comments will then be sent to Sue Brown, Eli Boling, and CDR Maguire for record keeping purposes. CDR will formulate responses when necessary.

   There is concern that the FAQ section is too technically worded for the general public. CDR will review and update with simpler language as necessary.

5. Alternatives Analysis – Updated

   The Cost estimates have been slightly adjusted and refined. The results however show the same conclusions. The tables and comparisons are available on the Steering Committee website.

   In looking at the flow coming to the plant and possible future flows to be added, we must include the infill of the current sewer system area. Any additional undeveloped lots, possible additions, septic lots, etc. to account for build-out of existing sewer area.

   A quick estimate of cost/lot to have a shared communal system with Gloucester in the Magnolia area was performed. It has to be refined a bit for a more accurate number; however, it does show a significant reduction in price per home.

   In the upcoming week, there will be site visits to possible communal lots within Manchester that have been identified previously. Gerry McDonald (BOH), Gary Russell (ConCom) and Allison Cunha (CDR) will rule out any sites that are visibly infeasible.

6. Suggested/Recommended Plan

   The suggested plan will likely be to, for the most part, remain on on-site systems throughout the town with possibilities for small extensions that are cost comparable. The small extensions with minor flows may be added to the plant as capacity at the plant should be available. Adding capacity to the plant is dependent on I/I removal and DEP lifting the sewer extension ban.

The possibility for communal on-site systems will be recommended as a possible solution where feasible sites are available.

For Area 4 (Raymond Street) it will be recommended to stay with on-site systems as well but to look more into working with Gloucester on a communal system in the future and to continue to pursue discussion with Gloucester on their current wastewater management situation in the Magnolia area to see if it is feasible. It will be suggested that if problems worsen in that area, there is potential to connect to sewer if needed.

All solutions presented will have to be in the capacity of the plant.

Plant upgrades will be included in the recommendations. The overall plan will include costs of the upgrades needed as well. (Pumps, etc.)

The final recommended on-site management plan will also be included in the recommended plan.

7. On-site Management Plan Options
   There was a meeting held with the Board of Health to discuss the suggested On-site management plan that will be included in the recommended plan.

   The BOH feels that there is already a good program in place now and that the plan should document the current plan.

   The BOH also feels that they already push the envelope with their standards. They do a good job and have aggressive standards, etc. already. If they were to be any more aggressive there may not be good reception.

   In the recommended plan, the system currently in place will be documented and shown how well it is working and the effectiveness of the program. Then it will add additional things that they should include to comply with title 5 standards if necessary.

   Between turnovers, new systems, beach closures, complaints, etc. Many of the homes are getting inspected. Out of the approx. 800 systems about 60-65% have good updated data. Around 30% of data has to be updated. The plan should include how to systematically inspect the remaining systems to make data current. With a goal that within 5 years there will be 100% updated data on all systems. Then after this is reached, every 7(?) years an inspection should be required.

The write up of the On-site Management Program will be submitted to Ellen (BOH) for comment and review. CDR will work with Manchester to refine the program before submitting as a final recommendation.

NEXT MEETING – May 21st, 2015
TENTATIVE ITEMS for DISCUSSION

- Recommended Plan
- Public Hearing Review

CDR MAGUIRE

Report of Meeting

Winner of Two Presidential Awards for Design Excellence

Date of Meeting: **June 2, 2015**

Project: **Town of Manchester-by-the-Sea CWMP Plan**

Project No.: **19549**

Report By: **Allison Cunha**

Purpose: **Steering Committee Meeting Minutes**

Attendees:
Greg Federspiel, MBS Town Administrator
Eli Boling, Board of Selectmen
Gary Russell, Conservation Commission
Sue Brown, Town Planner
Alida Bryant, Citizen at Large
Ron Mastrogiacomo, Citizen at Large
Matthew Amorello, CDR Maguire
Steve Landry, CDR Maguire
Allison Cunha, CDR Maguire
Christine O'Grady, CDR Maguire

Copies To: **Attendees, File, FTP File Share**

Discussions of the meeting are as follows:

1. DEP is currently reviewing the Draft CWMP. Any comments by the Steering Committee should be submitted to CDR.

   Final Report is due to DEP by August 1, 2015.

2. Public Hearing
   The Public Hearing is scheduled to be held on June 15th at 7:00pm at the end of the Selectmen's meeting.

   The hearing will be a bit more formal than the previous forums were. There should be a small formal introduction of the presentation and speakers. This should be done by someone other than CDR explaining briefly what the presentation will be about. There will need to be audio and video of the hearing, stenographer etc. There should also be a sign in sheet for anybody who attends and especially a sign in sheet for commenters to provide names and addresses for documentation purposes.

Notices
A poster will be made to advertise the public hearing at the Manchester Town Hall.

A newspaper article will be published to notify of the hearing. The article should inform the public as to where the reports are available to view.

Consider making the CWMP website more noticeable on the town webpage. Maybe use flashing red for notice or something to that affect to stand out.

On the actual CWMP website the date for the hearing should be more noticeable. Maybe highlight it and put it at the top. It was difficult to find a date for the hearing at all when attempted by a committee member.

Consider putting Public Hearing announcements on some of the town Facebook pages to notify public.

Presentation
Draft presentation will be sent for Committee to review.

It will be a shorter version of the presentations and will highlight the recommendations of the CWMP.

Three Themes that should be stated to outline the objective of the CWMP are the following:

1. For the majority, the town should continue to rely on on-site systems. They are not only good for the environment but also keep the character of the town.

2. There is capacity at the plant that can accommodate some expansion of sewers if needed.

3. There is ongoing I/I work being done currently to correct the system and maintain capacity at the plant. I/I work has been awarded for work in the summer.

It is important to explain to the public the benefits of an on-site system opposed to connecting to sewer. Also to explain that on-site systems are beneficial if properly maintained and give recommendations for keeping systems well maintained and operated.

3. Recommended Plan Review
   LCD Area – Make sure it is a preserved option to have if they are considering developing commercial land in the future. Write is to not necessarily encourage development.

   Available capacity at the plant. Some room for expansion to certain areas.

   Cost not necessarily totaled. It is not intended to be because the different recommendations are intended to give all the options that can be done. It is made to give the ability to take pieces of the plan that the town would like to address at a given time.

4. Draft Report Comments
   Beach Closure Protocol will be added to the appendices for the final submittal.

   The intentions of the CWMP should be clearer for the public to read. Give the audience an idea of what the recommendations are for. Use words more like "Future Considerations" and "Possible".

   Figure numbering should be made clearer on the figure map inserts.

   On VI-1 "Future Sewer Service Areas", it should read as "Optional Future Sewer Service Areas". Having just future in the title may lead the public to believe that this is the intended plan going forward.

   I/I progress needs to be explained further so that the public is aware that it is currently on-going etc. Need to be sure the public is aware that this is getting done.

5. General
   On-site system management
   For on-site system users there should be notices given for users that may be due for inspections to remind for upkeep. This can probably be done through the BOH database. It can be searched to determine which systems may be due.

   Educational pamphlets would be very helpful to give to septic users. They could explain the positive aspects of having an on-site system since many have negative views.

   The final CWMP document may be slightly different than the draft, per DEP comment. If for some reason it is significantly changed, which is not anticipated, the public portion of the process will have to be redone with a new Public Hearing.

Final CWMP document will be made available the same as the draft was, on the website and placing copies at the Manchester Town Hall and the public library.

The Manchester WWTF is a secondary treatment plant. It probably wouldn't need an upgrade to a 4 stage plant. It likely wouldn't need to be a more stringent process because the outfall is so far out.

Having the wastewater treated to a higher level could, however, be a possible argument for having additional loading.

NEXT MEETING – June 30th, 2015

- Final Meeting for Final Report discussion – at close of comment period.
- DEP Comment discussion.

CDR | MAGUIRE

Report of Meeting

WINNER OF TWO PRESIDENTIAL AWARDS FOR DESIGN EXCELLENCE

Date of Meeting:	**June 15, 2015**
Project:	**Town of Manchester-by-the-Sea CWMP Plan**
Project No.:	**19549**
Report By:	**Allison Cunha**
Purpose:	**Public Hearing for CWMP**
Attendees:	Greg Federspiel, MBS Town Administrator Paul Barclay, Board of Selectman Eli Boling, Board of Selectmen Margaret Driscoll, Board of Selectman Tom Kehoe, Board of Selectman Steve Landry, CDR Maguire Allison Cunha, CDR Maguire Christine O'Grady, CDR Maguire Citizens of the Town of Manchester-by-the-Sea
Copies To:	**Attendees, File, Website, and Local Cable Access**

Discussions of the meeting are as follows:

1. Public Hearing General Presentation
   The Public Hearing was held on June 15^{th} at 7:00pm at the end of the Selectmen's meeting.

   Presentation highlighted the recommendations of the CWMP.

   Three Themes stated to outline the objective of the CWMP are the following:

   1. For the majority, the town should continue to rely on on-site systems. They are not only good for the environment but also keep the character of the town.

   2. There is capacity at the plant that can accommodate some expansion of sewers if needed.

   3. There is ongoing I/I work being done currently to correct the system and maintain capacity at the plant. I/I work has been awarded for work in the summer.

It is important to explain to the public the benefits of an on-site system opposed to connecting to sewer. Also to explain that on-site systems are beneficial if properly maintained and give recommendations for keeping systems well maintained and operated.

2. Recommended Plan Review

LCD Area – Make sure it is a preserved option to have if they are considering developing commercial land in the future. Write is to not necessarily encourage development.

Available capacity at the plant. Some room for expansion to certain areas.

Cost not necessarily totaled. It is not intended to be because the different recommendations are intended to give all the options that can be done. It is made to give the ability to take pieces of the plan that the town would like to address at a given time.

3. General

On-site system management

For on-site system users there should be notices given for users that may be due for inspections to remind for upkeep. This can probably be done through the BOH database. It can be searched to determine which systems may be due.

Educational pamphlets would be very helpful to give to septic users. They could explain the positive aspects of having an on-site system since many have negative views.

The final CWMP document may be slightly different than the draft, per DEP comment. If for some reason it is significantly changed, which is not anticipated, the public portion of the process will have to be redone with a new Public Hearing.

Final CWMP document will be made available the same as the draft was, on the website and placing copies at the Manchester Town Hall and the public library.

The Manchester WWTF is a secondary treatment plant. It probably wouldn't need an upgrade to a 4 stage plant. It likely wouldn't need to be a more stringent process because the outfall is so far out.

Having the wastewater treated to a higher level could, however, be a possible argument for having additional loading.

4. Public Comments/Questions

Wendi Goldsmith, 34 Raymond Street – Presented with CDR Maguire with a copy of the Feasibility Study contracted by residents of the Raymond Street

Area. She voiced concern regarding the buyer/seller agreements during real estate transactions being collected by the Department of Health.

Sarah Creighton – Wanted clarification on what needs to be submitted to the Department of Environmental Protection. Terms of the Consent Agreement were discussed as it relates to the CWMP.

Gary Gilbert – Wanted to know how the town will address sewer management in the capitol budget. The $2.5 million investment being undertaken over the next five years for sewer upgrades. Discussed the scientific evidence in favor of I/A systems as the best option for treatment in the majority of town. Cost estimates developed as part of the report were explained.

Regina Villa – Wanted to know if the plan has statistics documenting the priority for I/I removals.

Alex Magnason – Suggested that the town consider expanding Board of Health involvement and compliance enforcement.

Wendi Goldsmith – Commented that she liked the idea of a communal wastewater management system in the Raymond Street Area. She would like more information about successful examples being used in Massachusetts. Also wants a municipal management maintenance system because the area in question is existing development. She is part of a group of homeowners in the Raymond Street area that joined together to organize and fund feasibility studies in the area to explore the possibility of a neighborhood joint communal system. The area they are looking into as a possible location is in her backyard. It is an ongoing effort and in depth analysis and reports were made to support the efforts. She submitted report information and documents to CDR.

Alex Magnason - He has three concerns, the first being the need for sewer expansion in Area 6. The panel responded that this is a recommendation to consider if the area is developed as envisioned by the town. Could potentially be a development issue otherwise. Such measures are also suggested due to the areas proximity to the watershed.

Gary Gilbert – Questioned the I/I removal goal desired by the town efforts. It was explained that a 50% reduction over the next 2-3 years at a cost of $3 million is anticipated.

Sarah Creighton – Wanted clarification on what the I/I factors would be if the extension were developed.

Alex Magnason – Wanted to know if floodplain and climate change as it relates to the location of the wastewater plant were discussed in the report. A discussion of the Massachusetts Pilot Program that MBTS is participating in ensued. While climate change and floodplains were documented in the report, a mention of the pilot project will need to be added in the final report. IT was also noted that MBTS is challenging current FEMA maps and is awaiting a decision.

Sarah Mellish – Questioned whether or not the maintenance costs associated with I/A systems was accounted for in cost analysis. The town stated that water and sewer rates are currently being examined and that user rates will be rising thereby leveling costs associated with both types of management.

NEXT MEETING – June 30th, 2015

- Final Meeting for Final Report discussion – at close of comment period.
- DEP Comment discussion.

CDR | MAGUIRE

Report of Meeting

WINNER OF TWO PRESIDENTIAL AWARDS FOR DESIGN EXCELLENCE

Date of Meeting: **June 30, 2015**

Project: **Town of Manchester-by-the-Sea CWMP Plan**

Project No.: **19549**

Report By: **Allison Cunha**

Purpose: **Steering Committee Meeting Minutes**

Attendees:
Greg Federspiel, MBS Town Administrator
Eli Boling, Board of Selectmen
Gary Russell, Conservation Commission
Sue Brown, Town Planner
Gerry McDonald, Board of Health
Alida Bryant, Citizen at Large
Wendy Goldsmith, Citizen
Steve Landry, CDR Maguire
Allison Cunha, CDR Maguire

Copies To: **Attendees, File, FTP File Share**

Discussions of the meeting are as follows:

1. DEP is currently reviewing the Draft CWMP. Comments from DEP are expected by June 30, so they should be in soon.

   Final Report is due to DEP by August 1, 2015.

2. Communal Option Review
   - Communal systems can be beneficial for water quality because it allows for monitoring, maintenance, and operation. The same can also be argued for on-site systems if the town makes a program sufficient enough to be monitored properly for water quality management.
   - Local neighborhood communal alternative should be included in the report as a possible solution, especially for Raymond Street.
   - There are many hurdles associated with this option on the town side, DEP, owners and local community. There are also regulatory hurdles.

- If a local system was to be implemented, the town would have to take over at some point as the pipes for the system would be located in the street.
- The report should include the possibility for local neighborhood systems so that it leaves the door open for this as a possible option in the future. It must also make clear that a public hearing, Board of Selectmen's hearing and approval etc. would be necessary to proceed any further with this option.

3. General Discussion

It was asked if a mention of an order of intent for neighborhood community systems could be included in the report, however it does not fit into the scope of work. An order of intent would be the next step after the CWMP.

The CWMP serves as a plan for the town in the 20 year planning period for wastewater management. It also serves as a fulfillment of the consent order for the town and will allow for possible future connections etc.

Raymond Street area is probably the main area of concern in the town. The alternatives for this area will be outlined in the report as a communal system, possible sewer connection, and local community communal systems. A communal system would be the ideal solution but if necessary in the future it will be possible to tie into the existing system.

A draft of the CWMP will be submitted about a week before the Final submittal, after DEP comments are received and implemented. Additionally major sections that have been altered or added, such as the communal system section, executive summary and environmental impacts will be submitted to the town for review upon completion.

MANCHESTER-BY-THE-SEA

BOARD OF SELECTMEN • TOWN HALL
Manchester-by-the-Sea, Massachusetts 01944-1399
Telephone (978) 526-2000 FAX (978) 526-2001

MINUTES OF THE BOARD OF SELECTMEN

June 15, 2015 6:00 p.m. Town Hall

MEMBERS PRESENT: Chairman Kehoe, Vice-Chair Driscoll, Mr. Barclay and Mr. Boling
MEMBERS ABSENT: Mrs. Beckmann
STAFF PRESENT: Town Administrator Federspiel, Mrs. Thorne
PRESS: CATV

At 6:00 p.m., Chairman Kehoe called the meeting to order and noted that the meeting was being video-taped by Cape Ann T.V. Access Corporation volunteers and audio-taped by Mrs. Thorne for accuracy in the minutes and requested any audience members taping the meeting to inform the Board.

Citizen's Open Forum
No items were brought forth for discussion.

Conservation Administrator Mary Reilly – Retirement Recognition
The Board recognized and thanked Mary Reilly for her more than 4 years of service as the Conservation Administrator. In addition to her diligent administrative work, she has been instrumental in bringing the Open Space and Recreation Plan up to date and will continue to work part-time until the completion of several grant funded projects she has initiated.

Contract Award for Sewer I/I Work
Vice Chair Driscoll moved to award the Basin 1 Sewer System Rehabilitation bid to Insituform Technologies of Chesterfield, MO for a total of $460,001 and to award to CDR Maguire the bid to provide engineering and construction services for the Basin 1 Sewer rehabilitation in the amount of $29,500. Mr. Barclay seconded the motion and it passed unanimously.

The work includes relining the sewer main along Pine Street and I/I work elsewhere in town upgrading manholes and pipes. The unspent funds from the Pine Street Burn Dump account that the voters approved for this project will be used along with sewer capital funds.

Meeting Minutes: June 1, 2015 and June 1, 2015 Executive Session Minutes
Vice Chair Driscoll moved to approve the June 1st regular and executive session meeting minutes as submitted with one minor name spelling correction on the ES minutes. Mr. Barclay seconded the motion and it passed unanimously.

Water/Sewer Abatement Requests

- 52 Pine Street – MacNally: Chairman Kehoe moved to grant a 25% abatement of the entire bill. This is a one-time only abatement; future requests will be denied. Mr. Boling seconded the motion and it passed unanimously.
- 1 Woodholm Road – Richards: Chairman Kehoe moved to deny the abatement request submitted. Mr. Barclay seconded the motion and it passed unanimously.
- 6 Bennett Street – Murray: Chairman Kehoe moved to grant an abatement of $912 from the sewer portion of the bill; the water portion is due in full. Mr. Barclay seconded the request and it passed unanimously.

Public Hearing – FY2016 Water and Sewer Rates

At 6:15 p.m., Vice Chair Driscoll moved to open the Public Hearing to review the policy for establishing sewer and water rates and to establish sewer and water rates for FY 2016. Mr. Barclay seconded the motion and it passed unanimously. The Board reviewed the policy for establishing sewer and water rates and the proposed rates for FY2016. The proposed rates represent a 4% rate increase over last year. Mr. Alfred Rossi, 89 Bridge St. felt that the Title 5 Flow Ratings (1 bedroom at 110 gpd) pertaining to the sewer capacity fee were high; TA Federspiel responded that the Town has costs to cover for added sewer flow; if the 110 gpd rating were to be reduced then the rate per gallon would be increased to arrive at the necessary cost for the town. At 6:24 p.m., Vice Chair Driscoll moved to close the Public Hearing. Mr. Barclay seconded the motion and it passed unanimously.

Mr. Barclay moved to accept the water and sewer rate policy for FY2016, as presented, summarized below:

Operational Cost

- Sewer 100% of the operational cost is paid by the users.
- Water 100% of the operational cost is paid by the users.

Capital Cost

- Sewer 75% of the bonded capital cost is paid by the users.
  25% of the bonded capital cost is paid by all taxpayers.
- Water 100% of the bonded capital cost is paid by all taxpayers.

Vice Chair Driscoll seconded the motion and it passed unanimously.

Mr. Barclay moved to accept the water and sewer rates for FY2016, as presented below:

Sewer

- $12.65 per 100 cubic feet (prior year $12.16) 4% increase

Water

- $5.43 per 100 cubic feet, for first 3,000 cubic feet used (prior year $5.22)
- $5.53 per 100 cubic feet for next 3,000 cubic feet used (prior year $5.32)
- $5.65 per cubic feet for any usage over 6,000 cubic feet (prior year $5.43)

This represents a 4% increase for each.

Sewer Capacity Fee

- $15.00 per gallon (total gallons per day determined by Title 5 Flow Ratings) (e.g.: 1 bedroom rated at 110 gpd – 110 gpd x $15.00 = $1,650

Vice Chair Driscoll seconded the motion and it passed unanimously.

Massachusetts Clean Water Trust Interim Bond Loans

Vice Chair Driscoll moved to approve the Massachusetts Water Trust Interim Bond Loans, referencing the page submitted for the Vote to the Board of Selectmen, which reads as follows:

(1) That the Town shall issue a bond or bonds in an aggregate principal amount not to exceed $250,000 (the "Bonds") pursuant to Chapters 29C and 44 of the General Laws and votes of the Town passed April 7, 2014 (Article 6) and May 20, 2014 (Question 4) which authorized a total borrowing of $250,000 for the construction of sewers and other water pollution control facilities identified in such votes (the "Project).

(2) That in anticipation of the issuance of the Bonds the Treasurer is authorized to issue an interim loan note or notes (the "Notes") from time to time in an aggregate principal amount not to exceed $250,000;

(3) That each Bond or Note shall be issued as a single registered security, and sold to the Massachusetts Clean Water Trust (the "Trust") at a price determined pursuant to the Financing Agreement;

(4) That the Treasurer is authorized to determine the date, the form, the maximum interest rate and the principal maturities of each Bond and Note, and to execute a Financing Agreement (or Agreements) with the Trust with respect to the sale of the Bonds and Notes, such date, form and maturities and the specific interest rate or rates of the Bonds and Notes to be approved by a majority of the Board of Selectmen and the Treasurer and evidenced by their execution of the Bonds or Notes;

(5) That all action taken to date by the Town and its officers and agents to carry out the project and its financing, including the execution of any loan commitment or agreement by the Treasurer, are hereby ratified, approved and confirmed; and

(6) That the Treasurer and the other appropriate Town officials are each hereby authorized to take any and all actions necessary or convenient to carry out the provisions of this vote, including execution and delivery of the Financing Agreement(s) and the Project Regulatory Agreement(s) relating to the project.

Mr. Boling seconded the motion and it passed unanimously.

Winthrop Field Committee Update

Mike Chapman, Chair of the Winthrop Field Committee, as well as committee members George Nickless, Ben Rossi and Sue Thorne, presented an update of the committee's work over the past year which included:

- Restoration work on the stone wall, which will be partially paid for with a Community Preservation grant. The survey work done to support the Bridge St. wall restoration allowed the Committee to re-establish the northern boundary of the field.
- Repair of the broken manhole cover and supporting structure in the center of the field by Ben Rossi which will aid in drainage during heavy rains.

- Recommendation that the Selectmen approve an increase in the number of members of the committee from 5 to 7 with 2 new members ready to volunteer in 2015.
- Haying and baling, although the second rotary cut could not be done because of field conditions. The hay is not food grade and, in the past, has only been sold for silt fencing. New technology in that field no longer utilizes hay so the committee needs to find another use for the hay.
- Giving permission to groups to use the field. One group mowed a patch of the field without permission. Going forward, the "no mowing" policy will be stated in advance to groups using the field.

The committee presented the Board with a donation of $3,200 from members of the committee for the Winthrop Field account. Vice Chair Driscoll moved to accept the donation of $3,200. Mr. Barclay seconded the motion and it passed unanimously. Chair Kehoe thanked the members for their donation and for their continued dedication to the upkeep of this town treasure.

Mr. Rossi spoke further of the desire of the committee to clean the drainage ditch which runs through neighbors properties via an easement. Mr. Rossi is gathering further information regarding the ditch and will submit it once completed.

John Creedon – Temporary Liquor License for Boston Lobster's Event
John Creedon, Jr., of Creedon & Co., appeared before the Board to apply for a temporary liquor license for the Boston Lobster home tennis matches to be held at the Manchester Athletic Club on the following dates: July 12, 13, 15, 23, 25 and 27 between the hours of 5-11pm. The license would be valid only for the outdoor concession and seating area. Alcohol servers are "Servesafe" certified. The Board discussed how to contain the area where alcohol is allowed and wants Creedon & Co. to work with security on-site to keep alcohol away from the parking lots. Mr. Barclay moved to approve the temporary liquor license as presented, with alcohol to be limited to the immediate area around the event. Vice Chair Driscoll seconded the motion and passed unanimously.

Board and Committee Appointments and Resignations
Bruce MacDonald submitted his resignation from the Manchester Housing Authority, effective June 30, 2015. The Board will need to appoint a replacement to fill his seat until the next election. The Board accepted the resignation of Rebecca Jaques from The Planning Board and all other boards and committees she is a member of, effective May 19, 2015.

ADA Committee: Vice Chair Driscoll moved to reappoint Lisa Bonneville and Gretchen Wood to the ADA Committee for a term ending June 30, 2018. Mr. Barclay seconded the motion and it passed unanimously.
Animal Control Board: Vice Chair Driscoll moved to reappoint Roxanna Leone to the Animal Control Board for a term ending June 30, 2018. Mr. Barclay seconded the motion and it passed unanimously.
Board of Appeals: Mr. Barclay moved to re-appoint Gary Gilbert to the Zoning Board of Appeals and move him from the 1st Alternate Position to regular member for the term ending June 30, 2018. Vice Chair Driscoll seconded the motion and it passed unanimously.

Board of Assessors: Vice Chair Driscoll moved to reappoint Jeffrey McAvoy to the Board of Assessors for a term ending June 30, 2018. Mr. Barclay seconded the motion and it passed unanimously.
Bike/Pedestrian Committee: Vice Chair Driscoll moved to reappoint Amy Coleman and Terry Cowman to the Bike/Pedestrian Committee for a term ending June 30, 2018. Mr. Barclay seconded the motion and it passed unanimously.
Cape Ann Regional Planning Committee Emergency Response Director: Mr. Barclay moved to reappoint Thomas P. Kehoe as the Cape Ann Regional Planning Committee Emergency Response Director for the term ending June 30, 2018. Mr. Boling seconded the motion and it passed 3-0, with Mr. Kehoe recusing himself.
Community Preservation Committee: Vice Chair Driscoll moved to reappoint John F. Burke and Rebecca G. Campbell to the Community Preservation Committee for a term ending June 30, 2018. Mr. Barclay seconded the motion and it passed unanimously.
Conservation Commission: Vice Chair Driscoll moved to reappoint Steve Gang and Gary Russell to the Conservation Commission for a term ending June 30, 2018. Mr. Barclay seconded the motion and it passed unanimously.
Council on Aging: Vice Chair Driscoll moved to reappoint Steven Gillespie to the Council on Aging for a term ending June 30, 2018. Mr. Barclay seconded the motion and it passed unanimously.
Cultural Council: Vice Chair Driscoll moved to reappoint Evonne Blanchard to the Cultural Council for a term ending June 30, 2018. Mr. Barclay seconded the motion and it passed unanimously. Vice Chair Driscoll moved to appoint Winifred Diedrich as an ex-officio (non-voting) member to the Cultural Council. Mr. Barclay seconded the motion and it passed unanimously.
Downtown Improvements Project Committee: Vice Chair Driscoll moved to reappoint Carroll Cabot, Fred Gibson, Ed Halsted, Gar Morse, Alfred Rossi and Chris Shea to the Downtown Improvements Project Committee for a term ending June 30, 2016. Mr. Barclay seconded the motion and it passed unanimously.
Emergency Management Director: Mr. Boling moved to reappoint Captain Tod Biggar as Emergency Management Director and Thomas P. Kehoe as Assistant Emergency Management Director for a term ending June 30, 2016. Mr. Barclay seconded the motion and it passed 3-0, with Chairman Kehoe recusing himself from the vote.
Finance Committee: Vice Chair Driscoll moved to reappoint Albert M. Creighton, III and John Croft to the Finance Committee for a term ending June 30, 2018. Mr. Barclay seconded the motion and it passed unanimously.
Harbor Advisory Committee: Vice Chair Driscoll moved to reappoint Greg Bialy and Mike MacEachern to the Harbor Advisory Committee for a term ending June 30, 2018. Mr. Barclay seconded the motion and it passed unanimously. Chairman Kehoe also requested that the Harbormaster review and draft an updated Charge for the HAC to be reviewed by the Board at an upcoming meeting.
Board of Health: Chairman Kehoe moved to reappoint Paula Polo-Filias to the Board of Health for a term ending June 30, 2018. Mr. Barclay seconded the motion and it passed unanimously. New applicant Deborah Bradley will be invited to appear at the next meeting.
Historic District/Historical Commission: Vice Chair Driscoll moved to appoint Tracey Gothie to the Historic District/Historical Commission to complete the vacant "Realtor position" term which will expire on June 30, 2017. Mr. Barclay seconded the motion and it passed unanimously.

July 4th Committee: Vice Chair Driscoll moved to appoint Donna Brewster to the July 4th Committee for a term ending July 31, 2016. Mr. Boling seconded the motion and it passed unanimously.
Manchester Coastal Stream Team: Vice Chair Driscoll moved to reappoint Francie Caudill to the Manchester Coastal Stream Team for a term ending June 30, 2018. Mr. Barclay seconded the motion and it passed unanimously. The Board also reviewed Eric Thomsin's meeting attendance and his lack of response as to whether he would like to stay on the committee and asked that one last letter be sent asking about his intentions.
Manchester Energy Efficiency Advisory Board (MEEP): Vice Chair Driscoll moved to reappoint Stephen Carr, Dennis Dixon, Eric Majors, Sean Stallings, David Walls, William Vachon and Davis Keniston to MEEP for a term ending June 30, 2016. Mr. Barclay seconded the motion and it passed unanimously.
Memorial Day Observance: Vice Chair Driscoll moved to reappoint the American Legion and the Legion Auxiliary as Memorial Day Observance Administrators for a term ending June 30, 2016. Mr. Boling seconded the motion and it passed unanimously.
North Shore HOME Representative: Vice Chair Driscoll moved to reappoint Irene Frontiero as Manchester's North Shore HOME Representative for a term ending June 30, 2016. Mr. Boling seconded the motion and it passed unanimously.
Parks and Recreation Committee: Vice Chair Driscoll moved to reappoint Kelly Blagden to the Parks and Recreation Committee for a term ending June 30, 2018. Mr. Boling seconded the motion and it passed unanimously.
Board of Registrars: Vice Chair Driscoll moved to reappoint Bruce Warren to the Board of Registrars for a term ending June 30, 2018. Mr. Boling seconded the motion and it passed unanimously.
Seaside One Committee: Vice Chair Driscoll moved to reappoint Merritt Miller to the Seaside One Committee for a term ending June 30, 2018. Mr. Barclay seconded the motion and it passed unanimously.
Shade Tree Management and Pest Control: Vice Chair Driscoll moved to reappoint Mark Hammond as the Shade Tree Management and Pest Control Agent for the Town of Manchester for a term ending June 30, 2016. Mr. Barclay seconded the motion and it passed unanimously.
Winthrop Field Committee: Vice Chair Driscoll moved to reappoint Sue Thorne to the Winthrop Field Committee for a term ending June 30, 2018. Mr. Barclay seconded the motion and it passed unanimously. Vice Chair Driscoll moved to appoint Matthew Brzezinski and Jay Panetta to the Winthrop Field Committee for a term ending June 30, 2018. Mr. Barclay seconded the motion and it passed unanimously

Public Hearing - Comprehensive Wastewater Management Plan
At 7:00 pm, Mr. Boling moved to open the Public Hearing on the Comprehensive Wastewater Management Plan. Vice Chair Driscoll seconded the motion and it passed unanimously. Steve Landry of CDR Maguire, the Town's consultant presented a summary of the Draft Comprehensive Wastewater Management Plan. The main recommendations were to:

- Work to stabilize the Infiltration/Inflow peaks which occur during high rainfall events. Replace and resize pumps at the plant. Once stabilized, the treatment plant is adequate to meet the town's needs over the next 20 years with room for growth and some expansion to the service area.
- Enhance monitoring of on-site septic systems by the Board of Health, update regulations and promote newer, more effective septic system installations. Some

recent studies have concluded that newer septic systems can actually be better for the overall environment than large wastewater treatment systems.

- Consider limited expansion of the sewer system in Areas 1, 2 and the Limited Commercial District. The current plant capacity will not cover the entire needs of the town and expansion is limited by the Ocean Sanctuaries Act.
- Raymond St. area is a high need area for an upgraded system – consider installation of a communal system.

The Draft report can be viewed on-line on the Town's website. The Public comment period runs from May 15, 2015 to June 30, 2015. Several members of the public were at the Hearing. Comments included:

- Wendy Goldsmith, Raymond St.., commented that residents of the Raymond St. area researched and pursued a communal septic plan in 2009 and they have a lot of information to share if requested.
- Sara Hammond Creighton asked what is required by the DEP in the Consent Decree issued to the Town. TA Federspiel responded that the DEP is requiring a plan to address the I/I peaks at the plant as well as submission of a comprehensive wastewater management plan.
- Gary Gilbert asked what the plan is for the I/I work that is needed. TA Federspiel responded that the Town has planned for $2.5 Million in capital expenditures over the next 5 years to replace piping and fix leaks.

At 8:05 pm, Vice Chair Driscoll moved to close the Public Hearing. Mr. Boling seconded the motion and it passed unanimously.

Town Administrators Report

Vehicle Night is scheduled for June 30th at 5pm behind Town Hall.

DPW Update: 2 long time employees are retiring within a few weeks; the DPW is recruiting for 3 positions: Operations Manager, 2 Skilled Laborers (1 for Highway, 1 for Sewer Plant). Mark Hammond has been moved to the Building and Grounds Foreman position and Shawn Johnson has been promoted to Interim Highway Foreman.

Mason Building: Efforts continue to consummate a deal with the Masons. A general membership meeting is scheduled for June 15th which could move the negotiations along.

Water Plant: The Dept. of Revenue is requiring that voters approve expending the insurance money to rebuild the water plant roof. State law says that any insurance claim expenditure over $25,000 must be approved by the voters. The Board discussed possible dates for a Special Town Meeting on August 31 or September 1st.

NOAA: Mr. Boling discussed the possible new requirements for observers on lobster boats and has drafted a letter to NOAA opposing this plan. Vice Chair Driscoll moved to send a letter to NOAA opposing this program. Chair Kehoe seconded the motion and it passed unanimously.

At 8:50 pm, Chairman Kehoe moved to adjourn to executive session for the purpose of discussing strategy sessions to discuss strategy with respect to collective bargaining or litigation of an open meeting may have a detrimental effect on the bargaining or litigating position of the public body and not to return to open session. Mr. Barclay seconded the motion and it passed unanimously on a roll call vote.

Respectfully submitted,

Pamela B. Thorne

Pamela B. Thorne
Administrative Assistant

APPROVED: June 20, 2015

Documents used:

- Request for Temporary Liquor License for Boston Lobsters
- Public Hearing Notice FY2016 Water and Sewer Rates and Letter dated June 11, 2015 with proposed Policy and Rates.
- Proposal dated June 10, 2015 submitted by CDR Maguire for Sewer Rehabilitation Bid recommendation.
- Draft Minutes dated June 1, 2015 Regular and Executive Session
- Winthrop Field Committee Update dated June 15, 2015
- Water/Sewer Abatement Request letters: 6 Bennett St., 52 Pine St., 1 Woodholm Rd.
- Letter dated June 10, 2015 from Locke/Lord Re: Interim Loan
- Board/Committee Appointments List
- Public Hearing Notice – CWMP
- Draft Letter(s) to NOAA Re: Proposed Lobster Observer Program

(Documents used by the Selectmen during this meeting are filed with the original minutes)

Comprehensive Wastewater Management Plan

Frequently Asked Questions

Manchester-by-the-Sea

1. What is the Comprehensive Wastewater Management Plan (CWMP)?

The CWMP is being developed for the Town of Manchester-by-the-Sea (MBTS) in response to a Massachusetts Department of Environmental Protection (MassDEP) Administrative Consent Order (ACOP-NE-13-1N003) to prepare a CWMP for the study and evaluation of current and future wastewater needs within the town and implementation of recommended solutions.

2. What is the purpose of the CWMP project?

The CWMP, as administered by the MassDEP, is a long-term wastewater management document for MBTS. The goal of the CWMP is to develop alternatives for managing the wastewater collection, treatment and disposal needs projected over a 20-year planning period. The plan will document the current and future wastewater needs throughout the town, identifies possible alternatives to accommodate those needs, evaluate the cost-effectiveness, feasibility and environmental impact of the alternatives, and demonstrate that the final plan is achievable from legal, institutional, financial, and management perspectives.

3. What does the project involve?

The project is a comprehensive review of MBTS's wastewater management practices in order to provide a planning tool for handling wastewater needs in the town over the next 20-years. Using available information and planning projections, the future needs of the town were assessed, and alternatives to address those needs fully evaluated for effectiveness, implementation, and cost.

4. Why is this being done now?

This CWMP is being done in response to a MassDEP Administrative Consent Order (ACOP-NE-13-1N003) to prepare a CWMP for the study and evaluation of current and future wastewater needs within the town and implementation of recommended solutions for addressing those needs. Analysis of the town's existing wastewater program indicates areas of need within the town where potential Title 5 issues have become a concern due to poor developable soils and small lot sizes. Strict restrictions limiting the Wastewater Treatment Facility (WWTF) capacity require that the town examine other viable methods of meeting the needs of the town and state regulations.

5. What are the main issues that the town is faced with from a wastewater prospective?

Approximately 40% of the developed lots in the town rely on on-site systems for wastewater disposal. A number of these are in danger of septic system failures due to unfavorable lot development conditions, (i.e. small lot size, poor soils, high groundwater). Alternative long-term solutions other than continued reliance on on-site systems need to be considered. However, the ACO requiring the town to prepare this CWMP also prohibits any sewer extensions to the system until the CWMP is completed and it is demonstrated that there is available capacity in the system to handle any additional flows from those sewer extensions. Further, the Ocean Sanctuaries Act (OSA) prohibits any increases to the permitted discharge from the town's WWTF without state approval. Current flow discharges from the Manchester WWTF have exceeded regulated limits during peak times. Peak flow exceedances at the WWTF are attributable to excess infiltration and inflow (I/I) that plague the collection system.

6. What is infiltration/inflow (I/I)?

Infiltration/inflow (I/I) occurs when excess water flows into sewer pipes from groundwater and stormwater. Groundwater seeps into sewer pipes through holes, cracks, joint failures, and faulty connections causing infiltration. Stormwater flows into sewers via roof drain downspouts, foundation drains, storm drain cross-connections, and through holes in manhole covers resulting in inflow. The resulting effect of extraneous water from I/I sources entering the system is reduced capacity and capability of the sewer system and treatment facilities.

7. What is being done to address I/I?

The town is committed to removing excess I/I from the collection system and has appropriated funds to make a complete investigation of the system to identify I/I sources and to make repairs to the collection system.

8. What various wastewater treatment alternatives are being examined?

The CWMP examines five alternatives for addressing wastewater management needs within the town over the next twenty years. They include:

- Conventional Title 5/ On-lot Innovative Alternative systems (Septic)
- Communal Treatment systems
- Connecting to Neighboring systems
- Sewer Expansion to the Manchester WWTF
- Sewer Expansion to Other Facilities

The Recommended Plan presented in the CWMP is a combination of some of these wastewater treatment alternatives.

9. Will this project lead to growth and development within the town?

The CWMP will address both existing needs and future desired needs from a wastewater standpoint. Existing land use controls will be evaluated and revised accordingly to ensure only town planned growth occurs.

10. What is the timeline for the project?

Development of this CWMP began August of 2014 through a contract with CDR Maguire. The Draft CWMP is being submitted in May of 2015 with the final submission planned for August 2015. Public forums were held December 15, 2014 and March 30, 2015. The final Public Hearing is scheduled for June 15, 2015.

11. Who is involved in the project?

Several groups are involved in this process at both the local and state level. Locally the CWMP Steering Committee is coordinating the CWMP process on behalf of the Board of Selectmen and the town. The committee is comprised of representatives from the Board of Selectmen; town staff including the Board of Health, the Town Administrator and the Town Planner; members of the Planning Board and Conservation Commission and Citizens at Large. The Public Works Director and the Chief Wastewater Plant Operator have also been consulted with during this process. The town has also contracted with consultant CDR Maguire for technical guidance during the process. At the state level the MassDEP is overseeing the process and ultimately reviewing the CWMP.

12. For more information, who do I contact?

Public outreach is an important aspect of this project and Town Employees are available to answer your questions at the Town Administrator's office at 978-526-2000. Ongoing public presentations are being made to at Board of Selectmen and Steering committee meetings to keep the public informed about the progress. Key presentation materials, public notices and meeting agendas are available on the Town's website at www.manchester.ma.us

13. How do I provide input/comment on the CWMP?

Public input and comment is an essential component of the CWMP process. Public notification and solicitation of comments regarding the project has occurred through public forums and open steering committee meetings throughout the process. A public hearing for the project is scheduled for **June 15, 2015** with a draft version of the CWMP scheduled to be released on the town website on **May 15th**, which will commence the MassDEP required 30 day comment period. The comment period will be extended two weeks past the public hearing in order to ensure that the entire community has had an opportunity to attend the public hearing, questions and review the document. In accordance with town procedures the public hearing will be broadcast on PEG Access Comcast Cable channels 10, 20 and 67.

Comments and input may also be provided to the Steering Committee via the town website under Quick Links - Comprehensive Wastewater Management Project. The project homepage has a "Share your thoughts" tab which will disturb comments to representatives within the process team. Additionally, comments may also be mailed to the CWMP Steering Committee at Town Hall or questions may be asked of Planning Director at 978-526-4397.

E. I/A Systems Summary

Innovative/Alternative System Records – Manchester-by-the-Sea Board of Health

Innovative/Alternative System Inspection Information – Review Records

Innovative/Alternative System Records - Manchester-by-the-Sea - Board of Health

Map	Lot	Study Area	House No	Street	Year System Built	Lot Size (sf)	Soil Type	GWL	Date of Inspection	Title V Inspection	Failure Type	System Type	Repair Type	Variance Requested	Permit Date	System Installer	First Pump Date	Second Pump Date	Third Pump Date	Fourth Pump Date	System Engineer	Title V Inspector	Notes
17	13	SMITH'S PT	4	Blossom Lane	2002	.895 AC	sandy	56"	NA	no	upgrade	I/A FAST	FULL	LOCAL	12/3/02	P. Drinkwater					v. Talacko	NA	I/A
17	14	Smith's Point	8	Blossom Lane	2012	1.47 Ac.	FSL,LS	53"	6/15/09	Y	Pass	I/A PROSTEP		Yes	12/7/12	Stoneworks					J. Bennett	J. Scanlon	I/A System Requires O&M
24	10	WEST	6	Boardman Avenue	2008	1.1.Ac.	LS	48"				I/A Singulair	I/A	Yes	09/22/08	R. Hobbs					J. Judd	A. Filias	I/A System Singulair & Infiltrators
24	31	West	1	Boardman Avenue	2010	.59 Ac.	clay/loam	28"				I/A		Yes	9/9/10	Kellet					D. Ottenheimer		I/A System Waterloo,Cultec Shared with #3
23	25	WEST	19	Boardman Avenue	2007	3.2 Ac.	SL,LS	126"	00/00/00	Y	Pass	TANK/FIELD		NO	02/01/07	M.F. Roberts					P. Thompson	G. Norris	3 bedroom limit – BASEMENT UNHEATED!
24	11	West	3	Boardman Avenue	2010	.79 Ac.	LS	28"				I/A	I/A system	Yes	9/9/10	Kellet					D. Ottenheimer		I/A System Waterloo, Cultec Shared w/#1
24	7	West	10	Boardman Avenue	2009	1.593 Ac.	SL	48"			I/A	I/A biofilter,	I/A	Yes	3/18/09	GH Ricker	6/19/01				D.Ottenheimer		I/A System biofilter, pump, hydraulic
24	15	WEST	4	BOARDMAN AVENUE	1998	1.39 AC	FSL,S	29.1-	8/22/97	Y	UNDERSIZE	I/A FAST	REPLACE	yes	12/22/98	B. WOGAN					V. TALACKO	W. WHALEN	I/A System
24	4	WEST	17	Boardman Avenue	2001	1.41 AC	sandy	82"	NA	no		I/A FAST x3		yes	5/3/2001	Wogan	4/1/2002				V. Talacko	NA	I/A FAST x 3 Well on Site
23	3	WEST	144	Bridge Street	2014	.957 Ac.	SL	48"			voluntary	I/A PRESBY		Yes	08/10/14	P Ricker					J. Bennett		I/A System
26	33	WEST	151	Bridge Street	2007	1.03 Ac.	LS,SL,si	24"	12/21/10	Yes		I/A PRESBY		YES	12/10/07	R. Roberts					J. Judd	A. Filias	I/A System Presby
27	3	WEST	79	Bridge Street	2013	1.05 ac	SL,CS,C	82"				I/A PRESBY		No	3/21/13	MacEachern					Rossi		I/A system presby
23	5	WEST	138	BRIDGE STREET	2003	1.26 AC	SL		12/23/00	y		I/A		YES	8/14/03	DF Clark, INC	11/27/01				V,Talacko	P Mirandi	I/A Waterloo, Deed Restriction
28	33	WEST	73	BRIDGE STREET		3.8 Ac.	silt	30"	12/18/97	Y 1998		TANK/FIELD	voluntary	yes	7/30/99	B. McGrath					V. Talacko	J. BENNETT	1998 NEW PIPE/D-BOX, G.W. WELLS, I & A
28	33	WEST	71	Bridge Street	1999	3.12 AC	SL,LS,FSL	34"	12/18/97	yes	fail	I/A FAST	new system		7/30/99	B.McGrath					J. Serwatka	J. Bennett	I/A FAST, PRESSURE DOSED FIELD
27	13	WEST	89	BRIDGE STREET	2007	3.62 AC	LS,SL,S,C	28"		N		I/A PRESBY		yes	5/8/07	A. Rossi					A.Rossi	NA	I/A System PRESBY
27	02	WEST	87	BRIDGE STREET	2007	5.5 AC	SL,LS,C,S,	28-40"	10/24/05	Yes	Fail			Yes	6/9/07	A. Rossi					A. Rossi	G. Norris	I/A System PRESBY
21	2	WEST	100	Bridge Street	2003	30,000 sq ft	fsl,sl,sil,gr,l s	12-48"	09/04/07	Yes	Breakout	I/A FAST		yes, 15.404, 15.405, 15.405	10/07/03	P. Ricker	5/29/02	5/10/02			P. Ogren	M Godwin	I/A FAST
27	3	WEST	81	BRIDGE STREET	2014	3 AC.	F.SAND	25.5"	7/7/12	yes	reinspect	I/A PRESBY	new sds for	yes	01/01/13	M.MacEachern					A. Rossi	J. Gallant	I/A PRESBY, WELL ON SITE
27	9	WEST	131	BRIDGE STREET	2007	.896 AC	LS,CS,GR	103"				I/A PRESBY		yes	07/23/07	B. Reed					A. Rossi		I/A PRESBY
25	1	WEST	1	BROOKWOOD ROAD	1996	5.5 AC	CL,SL,GR					I/A FAST			08/09/96	R.FRAZER					T. Neve		I/A FAST-2014 RELOCATE PORTION OF LEACH
1	34	RAYMOND	6	Butler Ave	1990	.458 AC	cs	2'	NA	no		tank/d-box/field		Yes	1/18/90	MF Roberts					Bennett, CAPE	NA	approved I/A Plan on File, deed restriction on file
1	53	RAYMOND	3	Butler Avenue	2003	.22 AC	SL,silt	23-40"	06/03/11	Yes	Title V	I/A Sand Filter	full	Yes	07/09/03	M.F. Roberts	12/13/2001	12/28/2001			B.Perkins	G. Norris	I/A Sand Filter, Deed Restriction on File
1	52	RAYMOND	5-7	Butler Avenue	2004	9,583 sq ft	fs,s,clay,gr,	20-48"	09/04/12	yes		I/A		Yes	07/19/04	A Fillias	07/19/04				D. Ottenheimer	G Norris	I/A Waterloo, Deed Restriction
1	42	RAYMOND	16	Butler Avenue	2010	19,463 sq ft	SL,LS,sil	14-36"	06/26/14	Yes		I/A PRESBY		Yes	07/01/10	A. Filias					J. BENNETT	J. Bennett	I/A PRESBY, DEED RESTRICTION ON FILE
1	44	RAYMOND	17	Butler Avenue	2000	18,646 SF	sl,ls,silt	27"				tank/field			04/17/00	T. Willey					J. Judd		no living space above garage – access from garage
1	33	RAYMOND	4	Butler Avenue	2012	.45 AC	cs,fill,SL	25"				I/A Singulair		Yes	12/29/12	A Fillias					J. Judd		I/A Singulair, infiltrator
1	54	RAYMOND	1	Butler Avenue	2002	.177 AC	fs,cl	12"				I/A WATERLOO		yes, 15.240 (1) 15.211	2/27/02	DF Clark	8/24/2001	11/1/2001	7/12/2001		C. Johnson		I/A WATERLOO, DEED RESTRICTION ON FILE
3	20	COOLIDGE	33	Coolidge Point	2006	2.6 AC	Sand,SL	43.6	10/17/14	yes		I/A		Yes	04/24/06	B. Wogan					V. Talacko	Hobbs	I/A WATERLOO
3	5	COOLIDGE	45-47	Coolidge Point	1995	3.4 Ac.	s, GRAVEL	>60"	05/31/05	Yes – 2 systems/2	new main house	I/A WATERLOO	full	Yes	10/26/06	Nexco					D. Ottenheimer	na	I/A Waterloo, Well Abandoned 2006
8	1	HICKORY	1	Crow Island	2000	5 AC	LS,SL	48" +	5/26/98	Yes	HYDRAULIC	I/A	REPLACE	Yes	11/14/99	CURRIER					J. Sullivan	W. WHALEN	I/A System house & carriage house
13	37	SMITH'S PT.	3	Eaglehead Road		.59 Ac.	SL,LS	>108"				I/A PRESBY		YES							J. Bennett		I/A System PRESBY
13	38	SMITH'S PT.	5	Eaglehead Road	2010	.54 AC	SL,FSL,	24"				I/A		yes	5/27/10	A Fillias					I. Rowe		I/A SYSEM PRESBY & PERC RITE
13	18	SMITH'S PT.	19	Eaglehead Road	2010	1.6AC	FSL,SL,VF	30"	12/20/96			I/A Waterloo		Yes	8/6/10	Mark Marlowe					Dan MacRitchie	Randy Carter	I/A SYSTEM WATERLOO & INFILTRATORS
13	36	SMITH'S PT.	1	Eaglehead Road	2008	.953AC	LS,SL	60"	4/30/01	yes		I/A PRESBY		Yes							John Bennett	E.Cullen	I/A System PRESBY
13	15	SMITH'S PT.	25	Eaglehead Road	2010	28,851sq ft	SL,Ls,CR	75"				I/A		Yes	09/25/10	James					D. Ottenheimer		I/A Waterloo, Deed Restriction
13	39	SMITH'S PT.	7	Eaglehead Road	2007	90,431 sq ft	FSL,SL	38"				I/A		Yes	3/8/07	Infirriti					Meridian		I/A System Waterloo
29	23	WEST	48	Forster Road	2009	44,066 sq.ft.	SL,LS	42"	12/04/08	Yes		I/A FAST		Yes	08/31/09	P. Ricker					D. Johnson	D. Johnson	I/A System FAST
29	17	WEST	47	Forster Road	2007	5.09 AC	SL,LS,Bw,	27-48"	05/16/14	Yes		I/A		Yes	06/12/07	J. Filias					D. Ottenheimer	G. Norris	I/A WATERLOO/PERC RITE
22	11	WEST	22	Harbor Street	2002	4.3 AC	SL,SiL	18"			new sds--	I/A	voluntary	Yes	6/18/02	DF Clark	6/14/2001				G. McDonald		I/A waterloo
23	12/13	WEST	27	Harbor Street	2001	1.1 AC	SL	>73"	06/08/11	Yes	Title V	I/A	full	YES	04/16/01	DF Clark	1/19/02				J. Bennett CAPE	D. Clark	I/A WATERLOO, P.D. field
22	13	WEST	44	Harbor Street	2003	1.42 AC	SL	5-7'	09/24/13	Yes		I/A ISF	full	Yes	05/12/03	M.F. Roberts					W. Perkins	J. Roberts	I/A ISF, well on site
22	12	WEST	40	Harbor Street	2002	.833 AC	SL,SiClay	9-30"		no		I/A			5/7/02	DF Clark	10/16/2000				J. Bennett		I/A WATERLOO
23	7/8	WEST	1	Harbor Street	2002	.639 AC	fill,SL,LS,g		09/11/07	Yes		I/A ISF	full	Yes	05/15/02	Rossi					B. Perkins	A. Filias	I/A ISF
22	7	WEST	16	Harbor Street	2006	30,190 sq.ft.	SL,LS,AB	45"	08/04/14	Yes		TANK/BIOFILT		Yes	12/12/06	B.Reed					D. Ottenheimer	P Ricker	I/A BIOFILTER
22	27/28	WEST	50	Harbor Street	1996	3.3 AC	Sandy	80"	2012	Yes		I/A ISF		Yes	6/19/96	Wogan	11/12/2001				J. Scanlon	G Norris	I/A ISF, Well On Site, Shared with #65
34	6	HICKORY	7	Hickory Hill	1997	1.03 AC		>9'	09/28/04	yes		I/A FAST			09/25/97	J Doucette	1993	10/1997	11/1997	11/27/2001	J. Bennett	J. Bennett	Orenco filter, tank 15 Polyethylene
34	17	HICKORY	9	Hickory Hill	2012	1.6 AC	SL,LS	12"		no		I/A PRESBY			10/23/12	A. Filias					j. Judd	A.Filias	I/A Presby
34	35	HICKORY	20	Hickory Hill	2013	.652 AC	SL,LS	80'	05/11/04	yes		I/A presby		Yes	12/11/12	Simard					J. Judd	G. Norris	I/A Presby
10	5	HICKORY	33	Hickory Hill Road	2010	.926 AC	SL,fsl,LS	28-36"		yes, '96		I/A Singulair		Yes	10/07/10	A. Filias	1990	1996	12/12/2001		j. judd	Rossi	I/A singulair/ Deed Restriction on File
26	19	WEST	15	Highland Ave	1995	4.7 AC	sand,silt	>84"	4/7/99	Yes		TANK/FIELD	full	Yes	3/28/95	D.F. Clark	1995	4/99			H.L. Graham	Wm. Whalen	I/A System
25	6	WEST	6	Highland Ave	1951	72,900 sq.ft.	fsl,ls,sl	42'				I/A Perc-Rite		Yes	pending						I Rowe		I/A Perc-Rite installation pending
26	17	WEST	17		1983	3.5 AC	sandy	>6'	11/15/14	Yes		I/A	full	Yes							H.L. Graham	C. Shea	I/A System
26	27	WEST	8	Jersey Lane	2009	2.42 AC	FSL,LS,Si	47-60"				I/A		Yes	08/03/09	T. Willey					R. Burlely		I/A WATERLOO BIOFILTER
26	15	WEST	12	Jersey Lane	2010	1.03 AC	fsl,SL,LS	54"		no		I/A Perc-Rite			09/30/10	J. Filias					I Rowe	NA	I/A PERC-RITE
7	8	COOLIDGE	4	King's Way	pending	2.6 AC	LS,SL	55"				I/A PRESBY		Yes	pending						J. Bennett		I/A PRESBY installation pending
33	14/15	COOLIDGE	16	Magnolia Avenue	2000	1.617 AC	fsl,gsl	52"	NA	no		I/A FAST		Yes	3/2/00						D.Johnson	NA	I/A FAST
18	23	SMITH'S PT	52 A&B	Masconomo Street	2009	1.12 AC	SL,LS	48"		Yes		I/A	full	Yes	08/14/09	D.F. Clark					C. Johnson	NA	I/A WATERLOO/BSF
18	15	SMITH'S PT	40	Masconomo Street	1995	1,1 AC	vfs,clay	30"	04/07/06	Yes		I/A FAST	full	Yes	3/23/95	B. Wogan					V. Talacko	G. Norris	I/A FAST
18	17	SMITH'S PT	44	Masconomo Street	2001	33,750 sq ft	coarse	52"				TANK/FIELD		Yes	9/25/01	Linskey					M. Halleran		I/A FAST
18	24	SMITH'S PT	56	Masconomo Street	2012	35,000 sq ft	SL,LS	34"				I/A		yes	04/02/12	D.Clark	4/3/2002				I Rowe		I/A WATERLOO/PERC RITE
18	17	SMITH'S PT	44	Masconomo Street	2001	.775 AC	coarse,	>47"	NA	no		I/A FAST			9/25/01	Linskey					Atlantic	NA	I/A FAST
16	4	SMITH'S PT	9	Masconomo Street	2007	.70 AC	SL,LS,Cl,fs	58"	08/19/05	Yes		I/A PRESBY		Yes	12/21/06	P. Ricker	5/4/2001				D. Johnson	D. Johnson	I/A MICROFAST/PRESBY
16	7	SMITH'S PT	11	Masconomo Street	2014	1.36 AC	fsl,ls,l	26"	01/17/11	yes		I/A		Yes	04/22/14	D.F. Clark	11/2/2001	1/31/2002			I Rowe	G. Norris	I/A WATERLOO
38	4	VILLAGE	21	Mill Street	2012	1.25 AC	FSL,SL,LS	24-50"		no		I/A ProStep		unk	06/23/11	T&W Exc.	12/12/2001				I Rowe	NA	I/A PROStep
21	24	WEST	5	Norton's Point	2002	72,120 sq ft	sandy	62"			NA, new				6/25/02	P. Titus					Meridian		I/A ISF
21	31	WEST	3	Norton's Point	1998	2.9 AC	SL,SG	26-32'	NA	no		I/A ISF		yes	11/2/98	Rossi	9/8/2000	11/5/2001			W. Perkins		I & A
21	42	WEST	8	NORTON'S POINT	1999		SL,LS	44'	03/13/00	yes		I/A FAST		Yes	12/01/99	T Finn	9/26/98				L. Graham	D. Finn	I/A FAST, Shared System 8,9,10 Norton's Point
8	2	HICKORY	17	Ocean Street	2004	2.7 AC	SL,FSL	32-61"	07/15/01	Yes		I/A System ISF		Yes	12/06/04	A. Rossi					W. Perkins	A. Rossi	I/A System ISF
6	23	HICKORY	16	Ocean Street	2013	1.2 AC	SL,gravel,c	69'				I/A PRESBY		Yes	06/20/13	B.McGrath					A. Rossi		I/A Presby
6	22	HICKORY	14	Ocean Street	2014	.523AC	FSL,LS,L	53"				I/A PRESBY		Yes	11/06/14	J. Filias					J.Bennett		currently being installed
5	26	COOLIDGE	8	Overledge Road	2009	22,536 sq ft	fLS	42"	12/11/07	yes		I/A		Yes	10/29/09	P.Ricker					D.Johnson	G.Fuller	I/A EnviroSeptic

Innovative/Alternative System Records - Manchester-by-the-Sea - Board of Health

Map	Lot	Study Area	House No	Street	Year System Built	Lot Size (sf)	Soil Type	GWL	Date of Inspection	Title V Inspection	Failure Type	System Type	Repair Type	Variance Requested	Permit Date	System Installer	First Pump Date	Second Pump Date	Third Pump Date	Fourth Pump Date	System Engineer	Title V Inspector	Notes
19	24	SMITH'S PT	31	Proctor Street	1968	1.056 AC	FSL,L	38"	10/21/05	yes		TANK/FIELD											I/A WATERLOO plans currently in review
16	18	SMITHS PT	19	Proctor Street	1995	1 AC	CS,fsl,cos	43"	06/26/12	Yes Fail		I/A Perc-Rite		YES	1/5/95	Drinkwater	5/22/2001				I. Rowe	G Norris	approved plan on file pending – deed restriction
19	1	SMITHS PT	43	Proctor Street	2006	2.16 AC	Sand,SL,,L	24"				I/A		Yes	11/22/06	M Nunes					D. Ottenheimer		I/A WATERLOO,
19	2	SMITHS PT	41/43	Proctor Street	2006	1.52 AC	SiLO,grLS,	24"				I/A		Yes	06/19/06	M. Nunes					D. Ottenheimer		IA WATERLOO, cottage has tank-dbox-field
16	20/23	SMITHS PT	21	Proctor Street	2012	1.5 AC	fill,mcs,SL	>10'	06/17/10	yes		I/A PRESBY		yes	04/10/12	M. MacEachern					J Judd	NA	I/A PRESBY
19	5	SMITHS PT	33	Proctor Street	2009	1.853 AC	Fsl,grLS,L	27"	10/21/05	yes		I/A		YES	10/29/09	K. Hamilton					D. Ottenheimer	A. McBrearty	I/A WATERLOO
16	22	SMITHS PT	27	PROCTOR STREET	2000	4.01 AC	LS,si,S,SL	27-67"		N		I/A ISF		Yes	11/18/99	P.DRINKWATER					V. TALACKO		I/A ISF, Well on Site
1	81	RAYMOND	43	Raymond St.	2012	.44 Ac.	fill/sand	48"		no		I/A Effluent		Yes	11/29/12	Araneo	11/93				J. Judd	NA	IA Effluent Filters & Infiltrators
1	10	RAYMOND	4	Raymond St.	2013	.099 AC	Fill,SL	9.8El				I/A		Yes	09/29/12	Clark					C. Johnson		I/A Waterloo Biofilter & Bottomless Sand Filter
1	16	RAYMOND	16	Raymond St.	2011	.2238 AC	SL,LS	4'		Yes 6/25/07		I/A Singulair		Yes		A Fillias	8/98				J. Judd	D. Luscomb	I/A Singulair Pump Deed Restriction
1	31	RAYMOND	40	Raymond Street	2007	.17 Ac.	SL,LS	36-48"		No		I/A Presby			09/11/07	Cooper	7/10/02	12/7/01	10/7/00		J. Judd		I/A Presby
1	15	RAYMOND	14	RAYMOND STREET	2000	.231 AC	fsl	42-76"	NA	Y	HYDRAULIC	I/A FAST	REPLACE	yes	11/02/00	T. Roberts					J.MORIN	CURRIER/C.A.	I/A FAST Deed Restriction on File
1	28	RAYMOND	32	Raymond Street	2010	.108 AC	fine sand	26"		Yes 9/22/06		I/A Drip		Yes	12/11/09	MacEachern					A. Rossi	J. Carota	
1	89	RAYMOND	65	Raymond Street	2005	.48 AC	LS,S	27"	NA	Yes 5/30/08		I/A			09/22/05	A. Rossi	4/3/01				B. Perkins	B. Perkins	I/A
1	93	RAYMOND	69	Raymond Street	2000	8356 sq.ft.	Sand	67"		No		I/A Singulair		Yes	09/11/03	R. Cooper					D. Ottenheimer		I/A Singulair
1	75	RAYMOND	25	Raymond Street	1996	.5 AC	fsl,sand	70"	NA	Yes 6/21/95		I/A FAST pd		Yes	1/28/96	DF Clark					C. Johnson	NA	I/A FAST System
1	84	RAYMOND	53	Raymond Street	2002	.398 Ac.	fsl,Sand	62"	11/26/01	Yes 11/26/01	Title V	I/A FAST	full	yes, 15.211, local	6/18/02	Grammas					Hancock	Filias	I/A FAST with Pressure Dosed Field
1	89	RAYMOND	63	RAYMOND STREET	PENDING	.47 Ac.	SL,LS,MS	20-29"		No		I/A PRESBY		Yes		TBD					A. Rossi	NA	I/A Presby
1	90	RAYMOND	67R	RAYMOND STREET	2010	.637 Ac	FS,SL,Ssi	>72'				I/A PRESBY		YES	10/18/10	M. MacEachern					A. Rossi		I/A PRESBY
1	13	RAYMOND	10	Raymond Street	2009	.231 AC	fsl,silt loam	29-55"		No		I/A Presby		Yes	06/22/09	P. Ricker	9/18/2000				D Johnson		I/A Presby
1	64	RAYMOND	0	Sandpiper Lane	2012	.086 AC	LS,SL,fill	36"				I/A	FULL	Yes	12/18/12	R.Amor	12/24/01				C.Johnson		I/A waterloo,bottomless sand filter
1	65/66	RAYMOND	2-6	Sandpiper Lane	1974	.033 AC	sandy	24-39	5/4/01	Yes 5/4/01		I/A Waterloo		Yes	08/13/94	Rezza	2/20/02				Gallagher	Mirandi	I/A System in Planning
19	13	SMITH'S PT	4	Smith's Point Rd.	2013	3.2 AC	fill,LS,ledg	68"		no		IA		yes	09/04/13	D. Clark					I Rowe	NA	I/A WATERLOO,PERCRITE
20	14	SMITH'S PT	12	Smith's Point Rd.	in	2.2 AC	sand,fill	90"	06/05/12	yes		I/A		NO	11/01/14	B Wogan	12/12/2000				C. Wear	J. Clark	I/A WATERLOO,two systems (one for tower)
20	4	SMITH'S PT	13	Smith's Point Rd.	2003	2.2 AC	sand,fill	74"				I/A FAST		yes	04/01/03	R. Strong					V,Talacko		I/A FAST
20	28	SMITH'S PT	25	Smith's Point Rd.	2013	1.3 AC	SL,S,gr,Si	45"				I/A		YES	08/14/12	B. Wogan					V,Talacko		IA WATERLOO,PERC-RITE
7	9	COOLIDGE	502	Summer Street	2003	1.7 AC	SL,LS	17-20'	04/07/07	yes		I/A FAST		no	05/12/03	M. MacEachern					D.Johnson	G.Norris	I/A FAST
6	45	HICKORY	395	Summer Street	2012	7.6 AC	fsl,LS,ms	28"				I/A		YES	07/24/12	M. Hamilton					I Rowe		I/A WATERLOO,PERC-RITE
12	3	HICKORY	229	Summer Street	2004	5.9 AC	fsl,sl,grls	66"	NA	no	voluntary/pro	I/A Sand Filter		yes	11/11/04	R. Simard	6/26/2001				P Ogren		I/A Sand Filter
1	8	RAYMOND	601	Summer Street	2013	12.2 AC	LS,C,	123>	NA	no		I/A		NO	11/27/13	B. Wogan	11/6/2000				C. Wear	NA	I/A Shared System Wells on Site
9	3	HICKORY	305	Summer Street	2011	39 AC	SL,LS	80"				I/A PRESBY		yes	11/21/11	A Fillias					J. Judd		I/A PRESBY
7	1	COOLIDGE	468	Summer Street	2014	1.2 AC	fsl,LS,cl,Si	22-34"	10/17/11	yes		I/A		YES	11/07/13	M. Hamilton	10/11/2001				D. Johnson	J. Granz	I/A System WATERLOO in installation
2	3	COOLIDGE	506	Summer Street	2011	.501 AC	FSL,LS,SL	46-56"				I/A	P. Wright	yes	12/03/11	P. Wright					I Rowe		I/A WATERLOO
2	1	COOLIDGE	504	Summer Street	2013	.67 AC	FSL,SL,LS	24-38"		yes		I/A perc-		yes	07/08/13	D. Clark	8/17/2000				I.Rowe		I/A WATERLOO,PERC-RITE
34	8	HICKORY	314	Summer Street	pending	.228 AC	fsl,sl,ls,Cd,	72'		yes		I/A		YES							I. Rowe		I/A system installation pending-WATERLOO
9	7	HICKORY	281	Summer Streeet	2012	6.5 AC	gravelly	55"				I/A ProStep		yes	10/06/11	T. Webster					C. Johnson		I/A PROSTEP
10	14	HICKORY	225	Summer Street	2013	45,090 sq ft	SL,fsl	36"	06/18/13	yes		I/A		yes	10/10/13	D. Clark	3/3/97				I Rowe	M. Graham	I/A WATERLOO
34	11	HICKORY	340	Summer Street	2014	.221 AC	fill,C1,C2	64"				I/A		yes	4/31/14	M. MacEachern					S. Cameron		no plan on file
2	4	RAYMOND	596&598	Summer Street	2010	6.42 AC	FSL,SL,vv	64"				IA		yes	09/07/10	G. Thornton					I Rowe		I/A WATERLOO, PERCRITE
2	12	RAYMOND	602	Summer Streeet	2005	16.04 AC	LS	45-62"				TANK/FIELD		yes	10/11/05	M. Nunes					J. Judd		deed restriction on file
22	24	WEST	2	Tuck's Point Road	2002	.85 AC	SL,sL	72"	3/22/95	yes		I/A		YES	07/09/02	B. McGrath	6/14/2001				D. Johnson	D. Johnson	I/A FAST
22	22	WEST	7	Tuck's Point Road	2013	1.44 AC	LS,fsl	32"	04/21/10	yes		I/A		YES	06/11/13	A. Filias	10/96	10/10/2000	11/6/2001		I Rowe	D. Johnson	I/A WATERLOO
5	57	COOLIDGE	25	University Lane	2001	.61 AC	fill, silty	34"	12/18/09	yes	pass	I/A		YES	04/17/01	DF Clark					D. Ottenheimer	I.Rowe	I/A Waterloo
6	16	HICKORY	7	Victoria Road	2006	.54 AC	SL,Ls, sand	60"				tank,pump,a-box, presby			12/19/06	A Fillias	8/29/98	5/21/2001			J.Bennett		I/A system presby
37	8	VILLAGE		Beaver Dam Road								I/A FAST		NO							C. Field		I/A FAST
6	39	HICKORY	389	Summer Streeet	2009	.68 AC	SL,fls	44"	08/24/09	yes		I/A PRESBY		YES	11/05/09	A. Filias					J. Judd	A. Filias	I/A PRESBY
17	16	SMITH'S PT	6	Cobb Avenue	2009	1.39 AC	FSL,LS,SL	92"				I/A system tank,pump,perr		no	3/24/09	P. Wright	1/16/02	1/18/02			I. Rowe		field dug up- error needs reinstalled
27	7	WEST	28	Forster Road	2012	.62AC	SL	38"		NA		I/A Presby		Yes							J. Judd		no reserve, 455 vs. required 600 sq ft. minimum
23	16	WEST	25	Harbor Street	2013	7.303 AC	SL,LS,ledge	el81	2012	Yes		I/A PRESBY		Yes	05/16/13	B. Wogan					S. Cameron	Windriver	I/A PRESBY,
34	32	HICKORY	29	Hickory Hill	2004	1.09 AC	SL,LS,Silt loam	4'	07/06/09	Yes		I/A FAST		No	11/18/04	P. Ricker	2001				D. johnson	G.H. Ricker	
26	31	WEST	4	Jersey Lane	2009	25,481 sq ft	SL,Clay,silt	18'	09/28/10	YES		I/A PRESBY		No	07/02/07	T. Roberts					D. Johnson	G Norris	
18	20	SMITH'S PT	48	Masconomo Street	2007	1.403 AC	LS	46"	04/14/97	yes		I/A WATERLOO			12/16/07	P. Drinkwater					V. Talacko	T.Oconnor	Well on Site
16	3	SMITH'S PT	7	Masconomo Street	2011	.5 AC	SL,LS,SiL	34"		no		I/A PRESBY		yes	11/15/11	M. MacEachern					J Judd	NA	
13	12	SMITH'S PT	19	Old Neck Road	2008	87,000 sq ft	grS	36-53"	NA	Yes		I/A WATERLOO, CULTEC		unk	9/8/2008						B. Reed		I/A WATERLOO, CULTEC, Well on Site
7	25	COOLIDGE	505	Summer Street	2005	1.79 AC	LS,SiL	40-48"	06/15/12	yes		I/A ISF		YES	09/04/03	P. Drinkwater	09/04/03				B. Buia	D. Clark	I/A ISF
10	2	HICKORY	216	Summer Street	2003	12 AC	SL	40"	NA	no		I/A WATERLOO		YES	07/08/03	A. Filias					J. Bennett	NA	plans for workshop septic only
	59	COOLIDGE	24	University Lane	2013		BW	72"				Enviro Septic		no	04/06/12	A. Filias					I Rowe		
4	43	COOLIDGE	30	University Lane	2013	1.03 AC	fsl,SL,LS	>120"	8/8/2005	Yes		I/A tank,field		no	09/19/13	J. Duncan	9/26/2000				I Rowe	T. Chigas	deed restriction on file
7	16	COOLIDGE	5	University Lane	2008	.64 AC	SL,cs,Bw,C	34"	08/01/13	yes		I/A WATERLOO		YES	01/25/08	M. MacEachern	5/23/2001				D. Ottenheimer	G.Norris	
5	60	COOLIDGE	28	University Lane	2014	69,375 sq.ft.	fsl,LS	56"				I/A Perc-Rite		no	01/16/14	B.Wogan					I Rowe		Well on Site

Innovative/Alternative System Inspection Information - Review Records					
Address	**Lot Number**	**Owner**	**Inspection Years**	**Year Installed**	**Comments/Problems**
1 Butler Avenue	1 0 54	Keating Philip B.	2014	2002	Basket covers rotting out/cloudy with little odor
			2013 (April, Oct)		Cloudy with little odor/ replaced off float and low alarm float
1 Crow Island - Caretaker House	8 0 1	Von Metzch Ernst H	2014		Good
			2013		Good
			2012		Good
1 Crow Island - Main House	8 0 1	Von Metzch Ernst H	2014		Cloudy with little odor/ installed new alarm
			2013		Good
			2012		Good
3 Butler Avenue	1 0 53	Tosi Jr Jon S	2014	2008	Good
			2013		Good
			2012		Good
4 Boardman Lane	24 0 15	Skates Mary A	2014	2000	Good, Replaced Alarm
4 Raymond Street	1 0 10	Batchelder Jacqueline Q	2014	2013	Good
4 Smiths Point Road	19 0 13	Putnam George III	2014	2013	Little Cloudy, no odor
5-7 Butler Avenue	1 0 52 A, 1 0 52 B	Delisle Heidi H, Kang Lawler	2014	2005	Pumping recommended, alarms replacement recommended, cloudy little odor
			2012		Good, little cloudly little odor
7 Mascononomo Street	16 0 3	Bane Joseph M	2014		Good
8 Jersey Lane	26 0 27	Apple Trees Invest Prop LLC	2014	2010	Good
			2013		Good
10 Eagle Head Road	13 0 22	Mann Lane H	2014		pumped on 7/1/14
			2013		Recommended pumping
16 Harbor Street	22 0 7	16 Harbor St LLC	2014	2006	Good, installed new float
			2013(Feb, Aug)		Good
16 Raymond Street	1 0 16	Cellucci Jerry A	2014	2008	Pumping recommended - sludge build up
			2013 (Dec, June)		Good
			2012		Good
19 Eaglehead Road	13 0 18	Feeley Edmund J	2014	2010	Good
			2013		Good
			2012		Good, little odor
19 Old Neck Road	13 0 12	Attenborough T Neale	2014	2008	Good
			2013(April, Nov)		Good
25 Smiths Point Road	20 0 28	Leno Sam R.	2014	2012	Good
26 Loading Plan Road	37 0 53	Gustafson Joey M	2014		Good

Innovative/Alternative System Inspection Information - Review Records					
Address	Lot Number	Owner	Inspection Years	Year Installed	Comments/Problems
			2013		Good
27 Proctor Street	16 0 22	(25 Hall Robert T)	2014		Good
			2013		Good
33 Hickory Hill Road	10 0 5	Vytopil Michal	2014	2010	Good
40 Harbor Street	22 0 12	Johnson Florence	2014	2002	Pumping Recommended
			2013		Good
40 Masconomo Street	18 0 15	Strachan Margaret A	2014		Good
			2013		Good, Little Cloudy
			2012		Good, Little Cloudy
41 Proctor Street	19 0 2	Davis Andrew O	2014	2006	Good
			2013		Good
43 Proctor Street	19 0 1	Davis Andrew O	2014	2006	Good
			2013		Good
47 Coolidge Point Road	3 0 5	Von Metzch Ernst H (caretakers house)	2014	2006	Good
			2013(Jan, Aug)		Good
50 Harbor Street	22 0 27	Bousquet Dawna M	2014		Good
			2012		Good
52 Masconomo Street	18 0 23 A	Magnuson Richard Axel	2014	2009	Good
			2013(April, Nov)		Good
56 Masconomo Street	18 0 24	Gudonis Paul R	2014	2013	Good, Little cloudy
			2013		Good
71 Bridge Street	28 0 75	Burbott Amy C	2014	1999	Good
			2013		Pumping Recommended-solids buildup
216 Summer Street	10 0 2	Jonathans Pond LLC	2014	2002	Pumping Recommended - tank scum buildup, pump chamber sludge buildup
			2013		Good
504 Summer Street	2 0 1	Alvarez De Toledo Fabrizio	2014	2013	Good
506 Summer Street	2 0 3	Doue John C & Susan H	2014	2011	Good, Little cloudy
			2013(Jan, July)		Good, Little cloudy
596 & 598 Summer Street	2 0 11	Porter Jonathan D	2014	2010	Good
			2013		Good
Zero Sandpiper Lane	1 0 64	Shea Marcia J	2014	2012	Good
			2013		Good

Innovative/Alternative System Inspection Information - Review Records					
Address	Lot Number	Owner	Inspection Years	Year Installed	Comments/Problems
1 & 3 Boardman Avenue	24 0 31 & 24 0 11	Genta Matthew, Gartner Hane Dieter	2013 (June, Dec)	2010	Good
4 Butler Avenue	1 0 33	Doherty Gary	2013 (April, Oct)	2012	Good
5 Eaglehead Road	13 0 38	Komishane Harris G	2013 (June, Dec)	2010	Pumping Recommended-sludge buildup (Dec)
			2012		Good
5 University Lane	7 0 16	Franco Greg A	2013 (May, Dec)	2007	Pumping Recommended - solids buildup (May), pumped on 6/21/13
6 Cobb Ave	17 0 16	Spindrift Realty Trust	2013		Good
7 Eaglehead Road	13 0 39	Carter Christine	2013 (March, Sept)	2008	Good
10 Boardman Avenue	24 0 7	Plunge II LLC	2013 (July, Dec)	2007	Good
			2012		Good
12 Jersey Lane	26 0 15	Greenough Malcolm W Jr	2013 (Feb, Dec)	2010	(Pumped on 9/6/12)
13 Smiths Point Road	20 0 4	Besser Donald E	2013		Good (tank pumped 11/9/12)
15 Highland Avenue	26 0 19	Harrington George	2013	1995	Good
17 Boardman Lane	24 0 4	Skates Mary A	2013(April, Nov)	2001	Good
22 Harbor Street	22 0 11	Brox Stephen M	2013(June, Dec)	2002	Good
25 Eaglehead Road	13 0 15	Prinn Stephen J	2013	2011	Good (tank pumped 7/25/13)
25 Raymond Street	1 0 75	McDonough Mark	2013(March, Oct)	1996	Good
25 University Lane	5 0 57	Lockwood Robert A	2013(April, Nov)	2001	Good
32 Raymond Street	1 0 28	Proia Thomas	2013		Good
33 Coolidge Point Road	3 0 20	Burrage Walter S Jr	2013(Jan, Aug)	2007	Good
33 Proctor Street	19 0 5	Bullen Philip L	2013(May, Dec)	2008	Good
47 Forster Road	29 0 17	Mclaughlin Amanda L	2013(April, Nov)	2007	Good
48 Masconomo Street	18 0 20	Waud, Cornelius Byron Trustee	2013(June, Dec)	2008	Good
138 Bridge Street	23 0 5	Norton Robert G	2013(Feb, Oct)	2003	Good
395 Summer Street	6 0 45	Pope Trust Charles T Geoffrey J	2013(Feb, Aug)	2012	Good

F. 1994 Development of Design Flows Report

Development of Design Flows

Population Equivalent Contributions

Design Flows and Loads

DEVELOPMENT OF DESIGN FLOWS

(From Orginal Facility Plan)

ESTIMATE OF BASE DOMESTIC FLOWS (BASED ON MAPC POPULATION PROJECTIONS)

Current		
Current sewered population	3,500	
Equivalent population for commerical flows	400	
Total equivalent population	3,900	
Per capita flows, gpcd	76.4	
Estimate of domestic flow, gpd	298,000	298,000
Planned development		
McNiff, 86 units, @ 2.47 persons/unit, 76.4 gpcd	16,200	
Affordable housing, 123 bedrooms, @ 110 gpd/br	13,500	
Pygmalion, 6 units, @ 2.47 persons/unit, 76.4 gpcd	1,100	
Subtotal, gpd	30,800	30,800
Future growth		
MAPC projected population	5,359	
Current population, 1990 Census	5,286	
Residential growth	73	
Residential flows, gpd, @ 76.4 gpcd	5,600	
Commercial flows, proposed book warehouse, gpd	14,000	
Subtotal, gpd	19,600	19,600
Possible future sewer extension needs		
Raymond Street, 60 homes, @ 2.47 persons/home, 76.4 gpcd	11,300	
Hickory Hill, 20 homes, @ 2.47 persons/home, 76.4 gpcd	3,800	
Subtotal, gpd	15,100	15,100
Total Base Domestic Flow, gpd		363,500

TOTAL PEAK I/I FLOW

Peak 30-day sustained flow of record, gpd	1,316,000	
Domestic flow, gpd	298,000	
I/I removed from system, gpd	200,000	
Remaining peak 30-day sustained I/I, gpd	818,000	818,000
TOTAL SUSTAINED MONTHLY FLOW,gpd		1,181,500
TOTAL SUSTAINED MONTHLY FLOW,gpd, rounded		1,200,000

DEVELOPMENT OF DESIGN FLOWS

(From Orginal Facility Plan)

PROPOSED DESIGN FLOWS AND LOADS

Maximum month flow, mgd				
Domestic flow			0.382	
I/I			0.818	
Maximum month			1.200	1.200
Maximum day flow, mgd				
Maximum day of record			3.274	
Removed I/I			0.200	
Current maximum day			3.074	
Additional domestic flow			0.084	
Peak additional domestic flow, with PF=3.0			0.252	
Maximum day, (sum of current and additional)			3.326	3.3
Peak Instantaneous flow,mgd				
Maximum peak of record			3.900 3.5	
Additional domestic flow			0.084	
Peak additional domestic flow, with PF=5.0			0.420	
Sum of current and additional			4.320	
Peak instantaneous with 20% contingency 10%			5.184	5.2 4.3
BOD and SS loadings				
Domestic flow, gpd			382,000	
Population equivalents			5,000	
BOD loading, lbs/day				
Average	Based on	0.20 lbs/capita/day	1,000	
Peak	Based on	0.36 lbs/capita/day	1,800	
SS loading, lbs/day				
Average	Based on	0.18 lbs/capita/day	900	
Peak	Based on	0.28 lbs/capita/day	1,400	

POPULATION EQUIVALENT CONTRIBUTIONS

PROCESS PARAMETER	CURRENT	DESIGN
Populations		
Residential	3500	4600
Commercial Population Equivalents	400	400
Total	3900	5000
Population Equivalent (PE) Contributions		
Flow, gal/PE/day	76.4	76.4
BOD, #/PE/day		
Average	0.20	0.20
Peak	0.36	0.36
TSS, #/PE/day		
Average	0.18	0.18
Peak	0.28	0.28
Ammonia Nitrogen, #/PE/day		
Average	0.016	0.016
Peak	0.019	0.019
Organic Nitrogen, #/PE/day		
Average	0.010	0.010
Peak	0.013	0.013

DESIGN FLOWS AND LOADS

PROCESS PARAMETER	CURRENT	FUTURE
Plant Influent - Without Recycle Flows (1)		
Flows		
Dry Season (summer) - Average Monthly Flow, gpd		
Residential/Commercial	298,000	382,000
Septage/Boat Wastes	1,440	1,440
I/I Component	164,000	164,000
Total	463,440	547,440
Wet Season (winter) - Average Monthly Flow, gpd		
Residential/Commercial	298,000	382,000
Septage/Boat Wastes	430	430
Inflow/Infiltration	818,000	818,000
Total	1,116,430	1,200,430
Maximum Day Flow Components, mgd	3.1	3.3
Peak Instantaneous Flow, mgd	4.7	5.2
Loads		
Dry Season (summer) - Peak Organic Month		
BOD, #/day		1850
TSS #/day		1480
Ammonia Nitrogen, #/day		97
Organic Nitrogen, #/day		66
Dry Season (summer) - Average Organic Month, gpd		
BOD, #/day		1050
TSS #/day		980
Ammonia Nitrogen, #/day		81
Organic Nitrogen, #/day		50
Wet Season (winter) -- Average Organic Month, gpd		
BOD, #/day		860
TSS #/day		820
Ammonia Nitrogen, #/day		80
Organic Nitrogen, #/day		48
Plant Design Values - With Recycle Flows (1) - Includes Septage and Boat Wastes		
Dry Season (summer) - Peak Organic Month		
Design Average Daily Flow, gpd		588,070
BOD, #/day		1915
TSS #/day		1753
Ammonia Nitrogen, #/day		207

DESIGN FLOWS AND LOADS

PROCESS PARAMETER	CURRENT	FUTURE
Nitrate Nitrogen, #/day		1
Organic Nitrogen, #/day		93
Dry Season (summer) - Average Organic Month, gpd		
Design Average Daily Flow, gpd		577,120
BOD, #/day		1084
TSS #/day		1138
Ammonia Nitrogen, #/day		191
Nitrate Nitrogen, #/day		1
Organic Nitrogen, #/day		66
Wet Season (winter) -- Average Organic Month, gpd		
Design Average Daily Flow, gpd		1,225,780
BOD, #/day		884
TSS #/day		934
Ammonia Nitrogen, #/day		189
Nitrate Nitrogen, #/day		0
Organic Nitrogen, #/day		60
Permitted Effluent Quality		
BOD, mg/l		30
TSS, mg/l		30

Notes

(1). Recycle flows are those flows produced from process operations that are discharged back to the headworks and contribute to the organic and hydraulic loadings on the facility.

G. WWTF Review and Assessment Technical Memorandum

CDR | MAGUIRE

Memorandum

Date: May 20, 2015

To: File

From: Robert Sims/Steve Landry

Subject: Manchester-by-the-Sea Plant tour

BACKGROUND

On November 20, 2014 a plant tour was conducted at the Manchester-by-the-Sea wastewater treatment facility. Mr. Steve Landry and Robert Sims were accompanied by John Sibbards, Chief Operator

The tour of the plant proceeded through the process:

Headworks – This process includes grinder, bar rack and screening equipment. Equipment is in reasonable condition and no major improvements are warranted. The byproduct of the headworks is grit and screenings that are washed and transported to a dumpster for disposal.

Influent Pumps – The influent pumps are included in the headworks building. Due to the high variability of the flow (low in summer and high in spring), the influent pumps operate a large portion of the year at low flow or high flow. It would be helpful to the overall operation of the plant if the influent pumps could be redesigned to provide the ability to function properly with low and high flows.

<u>Aeration Tanks</u> – After leaving the headworks, the flow passes through the aerated tanks. This process utilizes air bubbled through the flow to accelerate biological activity. This facilitates the removal of organics. This process is hampered by blowers that are poorly sized for the application. A redesign of the size and configuration should be completed. The operator did mention the need to replace the sludge transfer pumps that move sludge collected off of the bottom of the aerated tanks to the sludge holding tank.

Final Clarifier – After the aerated tank the water is allowed to settle in large tanks. This allows the biological activity to stop and allow sludge to settle to the bottom of the tank. As with the aerated tanks, the sludge is collected and pumped to the sludge holding tank. The operator mentioned that these sludge transfer pumps are also in need of replacing.

Effluent Pumps – Once the entire process is complete, the treated water is disinfected with the injection of chlorine and pumped out the underwater outfall for ultimate disposal. As with the influent pumps, the effluent pumps were designed for certain flow conditions and the plant exhibits large variations in the flow. A redesign of the effluent pumps should be performed to properly size them for the varying flow conditions that the plant is subject to.

Electrical Controls – Many of the electrical controls at the plant have been upgraded over the years. However, some of them have not. The influent and effluent control panels should be replaced to augment the newly designed influent and effluent pumps. In addition, the Supervisory Control and Data Acquisition (SCADA) have not all been replaced and upgrade/replacement is warranted.

Sludge Pumps – As discussed above the sludge from the Aeration tank and Final clarifiers are in need of replacement. The capacity of the pumps seems adequate, the equipment is simply beyond its useful life.

Sludge Handling – The sludge that is collected is processed by removing excess water through a centrifuge. The water that is removed is sent back to the influent at the plant while the dewatered sludge is placed in a holding tank for removal by an outside contractor.

Chemical Feed – The operator identified a problematic operation of the chlorine feed system. It is a maintenance problem. We suggest utilizing a different pumping system that is less prone to maintenance.

The table below summarizes the proposed upgrades and a budgetary cost. Costs include engineering, design and construction. For the purpose of this being a planning document we have also included 50% contingency and 30% for engineering and construction services.

Description	Estimated Cost	Reason for Improvement
Influent Pumps	$337,500	Does not meet current design conditions
Effluent Pumps	$337,500	Does not meet current design conditions
Pump Controls	$300,000	Needed for new pumps
Sludge Pump	$90,000	Beyond useful life
Waste Sludge Pump	$240,000	Beyond useful life
Blowers	$100,000	Difficult to meet current conditions
Disinfection System	$30,000	High maintenance
SCADA	$150,000	Incomplete upgrades
Sampler	$15,000	Equipment replacement
Subtotal	$1,720,000	
Engineering (30%)	$516,000	
Total	$2,236,000	

H. Summary of Site Review Investigation Documentation

Technical Memo

Date: April 24, 2015

To: File

Subject: Manchester-By-The-Sea CWMP

Potential Communal Lot Site Review

An engineer from CDR Maguire, a member of Conservation Commission, and a Town representative from the Board of Health department performed a potential communal sites review on April 24th, 2015. The review included a site visit and visual examination of each potential parcel. The summary of the findings are included.

Enclosure : Site review and photos.

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Site 1

Study Area 1 – West Manchester

Address: Bridge Street, 13.93 acres

Description: The area is wet, but has some potential. BOH rep has done testing in the vicinity, noting soil is poor and clay like and likely ledge throughout. There may be pockets of sand or good material but it would be very difficult to locate and may not be a big enough area to accommodate a communal system.

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<u>Site 2</u>

Study Area 2 – Smith's Point

Address: Summer Street, 27.6 acres

Description: This site is located behind the rail tracks and hard to view or gain access. There is a small river in back of the site located on the abutting property which has an impact area of 200 feet. There is some potential but past testing was not shown to have ideal conditions for a communal system.

(Unable to get picture due to location)

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Site 3

Study Area 2 – Smith's Point

Address: 113 Summer Street, 12.62 acres

Description: This site consists of recreational fields. There is a small river on/near site that has a 200ft impact area. This impact zone leaves a smaller area available for potential use. Past testing has shown soils to be fairly poor. A smaller system was put in nearby, however a significantly larger communal system will be much more difficult to accommodate. In depth investigation would be necessary to determine if the site contains a large enough area containing suitable soils.

Site 4

Study Area 3 – Coolidge Point Road

Address: Magnolia Avenue, 1.34 acres

Description: Lot is too small to accommodate the size communal system necessary for the area flows. The site also includes a historic burial ground area which would decrease the usable space even further. Furthermore, the site is adjacent to Wolf Trap Brook, which has had high fecal counts in the past. For these reasons, the site is not a possible location.

Site 5

Study Area 4 – Raymond Street Area

Address: Raymond Street, 2.183 acres

Description: The site is Located behind a new development area. The development is on a high point and the site location is much below this elevation in the back area. As seen in the photo, the area is very wet, ponding on a majority of the land. From this initial review, it looks as though there would not be a significant amount of suitable land to accommodate a communal system.

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Site 6

Study Area 4 – Raymond Street Area

Address: 56 Raymond Street, 2.183 acres

Description: The location of this parcel is known as Surf Park. The area has a high ground water level. Past testing in the area has revealed very rocky soils as well. While there is slight potential, a significant amount of further investigation must be performed to determine if there is an area containing suitable soil, large enough to accommodate the communal system necessary on site.

Site 7

Study Area 5 – Hickory Hill

Address: 216 Summer Street, 11.3 acres

Desciption: This site was found to be in an extremely wet area. As pictured, there were large areas of ponding throughout. The conditions of this site make it a less than ideal location to install a communal system.

Site 8, 9, and 10

Study Area 5 – Hickory Hill

Address: Colburn Road

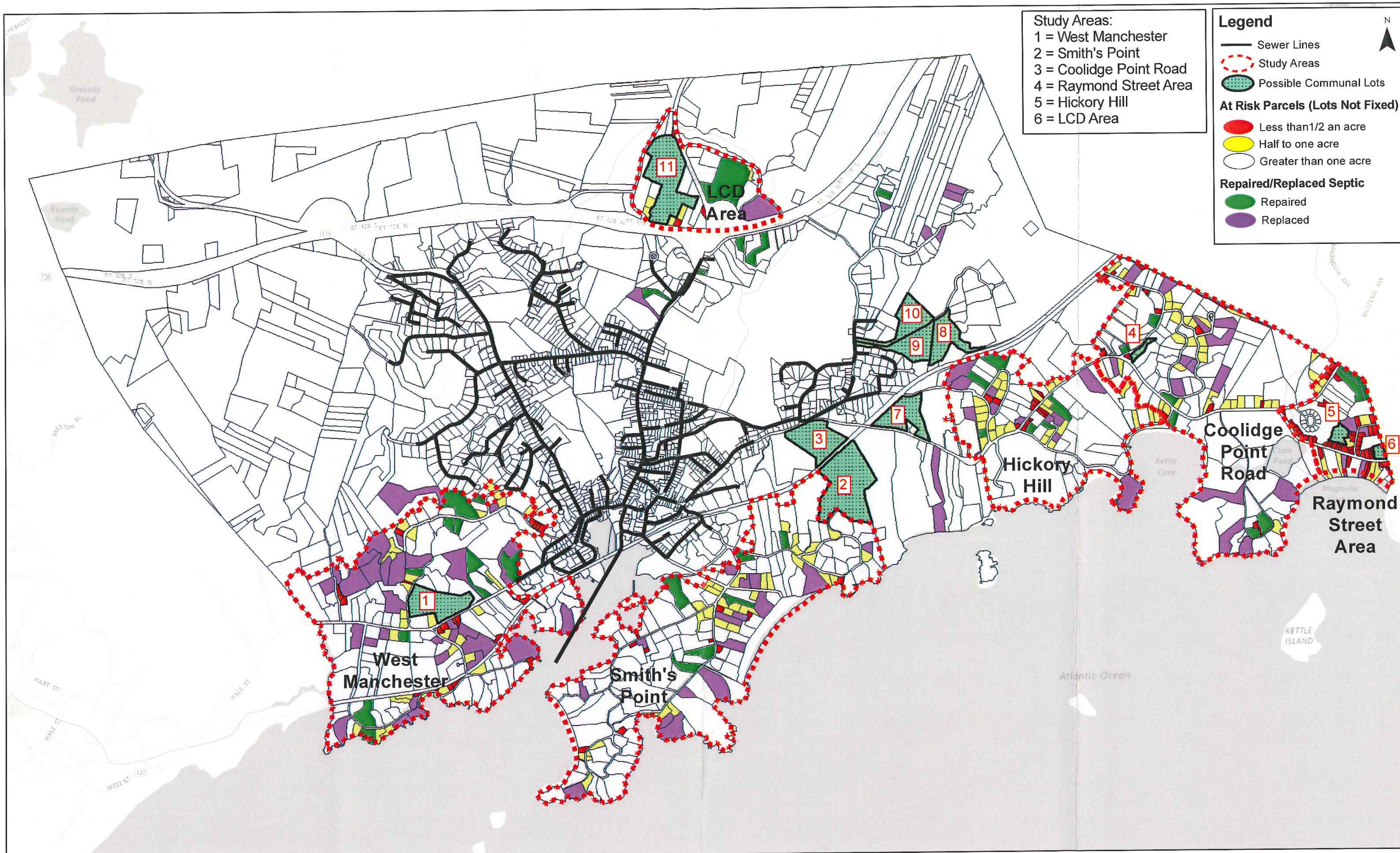
Description: The areas of this site, known as Long Hill, are politically controversial conservation areas. A small area nearby was recently gifted as an extension to the conservation area. Site 9 includes Dexter's Pond. Not likely that this would pass as a potential location. All three sites have no possibility of being considered for communal systems.

Site 11

Study Area 6 – LCD

Address: School Street, 23.72

Description: The site is very large and difficult to view in entirety. Past testing in the area has exhibited very poorly drained soils as well as an extensive amount of ledge in the area. Further, intensive investigations would be necessary to determine if the area has potential for a communal system with the ability to handle the LCD area flows.



Manchester-by-the-Sea, At Risk Parcels

Data Sources: Town of Manchester-by-the-Sea

0 0.5 1 Miles

DRAFT

February 27, 2015

CDR MAGUIRE

Study Area 1 - West Manchester

	Parcel ID	Location/address	Owner	Acres	Note	Soil ID	Soil Descrip	Slope	Ksat (cm/hr)	Perc Rate (min/in)	Disposal Rate (gpd/sq. ft)	Suitable Soils approx acreage	Potential Estimated Disposal Capacity
1	27 0 12	Bridge Street	Town of Manchester	13.9301		14B	Scitico silt loam	0 to 5 percent	0 to .1524	>60	0.15	13.9301	91019.2734

Study Area 2 - Smith's Point

	Parcel ID	Location/address	Owner	Acres	Note	Soil ID	Soil Descrip	Slope	Ksat (cm/hr)	Perc Rate (min/in)	Disposal Rate (gpd/sq. ft)	Suitable Soils approx acreage	Potential Estimated Disposal Capacity
2	11 0 19	Summer St	Town of Manchester	27.5931		12A(16%), 14B(30%), 102E (45%), 102C(9%)	Maybid silt loam, Scitico silt loam, Chatfield-Hollis-Rock outcrop complex	0 to 3 percent, 0 to 5 percent, 15 to 35 percent, 3 to 15 percent	0 to .508 (maybid), 0 to 0.1524(Scitico),0 to 0.06	35 (maybid), >60 (Scitico), >60 (chatfield)	0.27 (maybid), 0.15(Scitico), 0.15 (Chatfield)	12.692826	106012.4695
3	11 0 17	113 Summer St	Town of Manchester	12.6231	recreation fields	14B(26%), 651(23%), 12A(32%), 102E(19%)	Scitico silt loam, Udorthents, Maybid silt loam, Chatfield-Hollis-Rock outcrop	0 to 5 percent, smoothed, 0 to 3 percent, 15 to 35 percent	0 to 0.1524(Scitico),0 to .508 (maybid),0 to 0.06 (Chatfield)	>60 (Scitico),35 (maybid),>60 (chatfield)	0.15(Scitico), 0.27 (maybid),0.15 (Chatfield)	7.321398	68952.72439

Study Area 3 - Coolidge Point Road

	Parcel ID	Location/address	Owner	Acres	Note	Soil ID	Soil Descrip	Slope	Ksat (cm/hr)	Perc Rate (min/in)	Disposal Rate (gpd/sq. ft)	Suitable Soils approx acreage	Potential Estimated Disposal Capacity
4	5 0 46	Magnolia Av	Town of Manchester	1.34306	excessively	242D	Hinckley gravelly fine sandy loam	15 to 25 percent	6 to 20	<5	0.6	1.34306	35102.21616

Study Area 4 - Raymond Street Area

	Parcel ID	Location/address	Owner	Acres	Note	Soil ID	Soil Descrip	Slope	Ksat (cm/hr)	Perc Rate (min/in)	Disposal Rate (gpd/sq. ft)	Suitable Soils approx acreage	Potential Estimated Disposal Capacity
5	1 0 38	Raymond St	Bain Richard A	2.183	poorly drained	12A	Maybid silt loam	0 to 3 percent	0 to .508	35	0.27	2.183	25674.6996
6	1 0 59	56 Raymond St	Town of Manchester	1.34943	Conservation Restriction, Park	(15%) 102E, (85%) 602	Chatfield-Hollis-Rock outcrop complex, Urban Land	15 to 35 percent	-	-	-	X (needs further review)	-

Study Area 5 - Hickory Hill

	Parcel ID	Location/address	Owner	Acres	Note	Soil ID	Soil Descrip	Slope	Ksat (cm/hr)	Perc Rate (min/in)	Disposal Rate (gpd/sq. ft)	Suitable Soils approx acreage	Potential Estimated Disposal Capacity (GPD)
7	10 0 1	216 Summer St	Karas Summer ST TR	11.273		12A(25%), 220B(20%), 102E(40%), 102C(10%), 722E(5%)	Maybid silt loam, Boxford silt loam, Chatfield-Hollis-Rock outcrop, Annisquam fine sandy loam	0 to 3 percent, 3 to 8 percent, 15 to 35 percent, 3 to 15 percent, 15 to 35 percent	0 to .508 (maybid),0 to .508(boxford), 0 to 0.06 (Chatfield), .508 to 1.524(Annisquam)	35(maybid), 35 (boxford),>60 (chatfield), 10 to 35 (Annisquam)	0.27(maybid), 0.27(boxford), 0.15 (chatfield), .6 to .33(Annisquam)	5.6365	71079.75963
8	36 0 49	Colburn Rd	Town of Manchester	10.0571		102E(60%), 12A(30%), 1(15%), 14B(15%)	Chatfield-Hollis-Rock outcrop complex, Maybid silt loam, water, Scitico silt loam	15 to 35 percent, 0 to 3 percent, 0 to 5 percent	0 to 0.06 (Chatfield), 0 to .508 (maybid),0 to .1524(Scitico)	>60(chatfield), 35(maybid),>60(Scitico)	0.15 (chatfield), 0.27(maybid),0.15(Scitico)	4.525695	45342.03307
9	36 0 8	Colburn Rd	Town of Manchester	9.38306		1(50%), 14B(50%),	Water, Scitico silt loam	0 to 5 percent	0 to .1524(Scitico)	>60(Scitico)	0.15(Scitico)	4.69153	30654.45702
10	36 0 13	Colburn Rd	Town of Manchester	10.0031		14B(10%), 220B(90%)	Scitico silt loam, Boxford silt loam	0 to 5 percent, 3 to 8 percent	0 to .1524(Scitico) ,0 to .508(boxford)	>60(Scitico), 35 (boxford)	0.15(Scitico), 0.27(boxford)	10	112419.6393

Area 6 - LCD Area

	Parcel ID	Location/address	Owner	Acres	Note	Soil ID	Soil Descrip	Slope	Ksat (cm/hr)	Perc Rate (min/in)	Disposal Rate (gpd/sq. ft)	Suitable Soils approx acreage	Potential Estimated Disposal Capacity (GPD)
11	43 0 18	School Street	Brown George A	23.72	very poorly drained	51A(6.7%), 102E(73.6%, 651(19.7%)	Swansea muck, Chatfield-Hollis-Rock outcrop complex, Udorthents	0 to 1%, 15 to 35%, smoothed	0.3556 to 36(Swansea), 0 to 0.06 (Chatfield)	5 to 55 (Swansea),>60 (chatfield)	-	-	-

usda soil survey

Ksat from soil survey
perc rate conversion from nrcs
disposal rate from 310 CMR

Town owned parcel

I. Cost Comparisons and Matrix

STUDY AREA 1
Broken into Sub Areas

# of lots per Sub Area	Lots Served: "Risk" Lots Serviced	Lots Served: All additional potential lots(w/o repairs/replacements) 50%	Lots Served: All additional potential lots(w/o repairs/replacements) 100%	Lots Served: Max Lots Served
1	7	10	12	16
2	4	10	15	31
2A	3	4	5	11
2A-1	2	5	8	13
2A-2	11	14	17	22
2B	3	4	4	8
2C	3	6	8	13
2C-1	5	7	9	17

Cost for Pipe	Sewer Main	Force Main	Pump Station	Cost
1	2400	0	0	$360,000
2	2670	1220	1	$722,500
2A	1215	0	0	$182,250
2A-1	1200	1200	1	$500,000
2A-2	2750	1500	1	$762,500
2B	1100	0	0	$165,000
2C	1870	0	0	$280,500
2C-1	2270	2270	1	$767,500

Description	Unit Cost
Sewer Main: 8-inch (LF)	$ 150
Force Main (LF)	$ 100
Pump Station (Ea)	$ 200,000

Entire Area	Cost for service	Permits, Studies & Engineering (20%)	Minimum Subtotal	Contingency (30%)	Maximum Total
1	$360,000.00	$72,000.00	$432,000.00	$129,600.00	$561,600.00
1+2+2A+2B	$1,429,750.00	$285,950.00	$1,715,700.00	$514,710.00	$2,230,410.00
1+2+2B	$1,247,500.00	$249,500.00	$1,497,000.00	$449,100.00	$1,946,100.00
1+2+2B+2C+2A	$1,710,250.00	$342,050.00	$2,052,300.00	$615,690.00	$2,667,990.00
1+2+2A+2A-2+2B+2C	$2,472,750.00	$494,550.00	$2,967,300.00	$890,190.00	$3,857,490.00
1+2+2A	$1,264,750.00	$252,950.00	$1,517,700.00	$455,310.00	$1,973,010.00
1+2	$1,082,500.00	$216,500.00	$1,299,000.00	$389,700.00	$1,688,700.00
1+2+2A+2A-1+2A-2	$2,527,250.00	$505,450.00	$3,032,700.00	$909,810.00	$3,942,510.00
1+2+2A+2A-1	$1,764,750.00	$352,950.00	$2,117,700.00	$635,310.00	$2,753,010.00
1+2+2A+2A-1+2A-2+2B+2C+2C-1	$3,740,250.00	$748,050.00	$4,488,300.00	$1,346,490.00	$5,834,790.00
1+2+2B+2C+2C-1	$2,295,500.00	$459,100.00	$2,754,600.00	$826,380.00	$3,580,980.00
1+2+2B+2C	$1,528,000.00	$305,600.00	$1,833,600.00	$550,080.00	$2,383,680.00

		Minimum	Maximum								
	Entire Area	Cost for service (w/ 20% Engineering)	Total Cost (Including Contigency (30%))	1		2		3		4	
				Min	Max	Min	Max	Min	Max	Min	Max
	1	$432,000	$561,600	$61,714	$80,229	$45,474	$59,116	$36,000	$46,800	$27,000	$35,100
	1+2+2B+2C+2A	$2,052,300	$2,667,990	$102,615	$133,400	$64,134	$83,375	$46,643	$60,636	$25,978	$33,772
	1+2+2A+2B	$1,715,700	$2,230,410	$100,924	$131,201	$64,743	$84,166	$47,658	$61,956	$25,995	$33,794
	1+2+2A+2A-2+2B+2C	$2,967,300	$3,857,490	$95,719	$124,435	$64,507	$83,858	$48,644	$63,238	$29,379	$38,193
	1+2+2B+2C	$1,833,600	$2,383,680	$107,859	$140,216	$65,486	$85,131	$47,015	$61,120	$26,965	$35,054
	1+2+2A	$1,517,700	$1,973,010	$108,407	$140,929	$65,987	$85,783	$47,428	$61,657	$26,167	$34,017
	1+2+2B	$1,497,000	$1,946,100	$106,929	$139,007	$66,533	$86,493	$48,290	$62,777	$27,218	$35,384
	1+2	$1,299,000	$1,688,700	$118,091	$153,518	$68,368	$88,879	$48,111	$62,544	$27,638	$35,930
	1+2+2A+2A-1+2A-2	$3,032,700	$3,942,510	$112,322	$146,019	$72,207	$93,869	$53,205	$69,167	$32,610	$42,393
	1+2+2A+2A-1	$2,117,700	$2,753,010	$132,356	$172,063	$75,632	$98,322	$52,943	$68,825	$29,827	$38,775
Area 1 (Entire Area)	**1+2+2A+2A-1+2A-2+2B+2C+2C-1**	$4,488,300	$5,834,790	$118,113	$153,547	$77,384	$100,600	$57,542	$74,805	$34,262	$44,540
	1+2+2B+2C+2C-1	$2,754,600	$3,580,980	$125,209	$162,772	$78,703	$102,314	$57,388	$74,604	$32,407	$42,129

1	Cost per lot servicing only lots that are less than an acre and have not been fixed or replaced
2	Cost per lot servicing lots that are less than an acre and have not been fixed or replaced as well as 50% of the remaining lots that have not been fixed or replaced
3	Cost per lot servicing all lots in the area that have not been fixed or replaced
4	Cost per lot servicing all lots in the area (maximum amount of lots serviced)

Entire Area Counts

Estimated Lots Served	Cost per Lot	Cost per Lot Min
	Min	Max
58	$77,384	$100,600

Note: Assumption is that all lots less than an acre and not fixed or replaced and 50% of remaining non-fixed lots would be served

Estimated Lots Served	Estimated Flow (GPD)
58	12,180

*Sewage Flows were calculated using tr-16 as reference.
Average daily sewage flow = # of lots * 3 occupants* 70 GPD

STUDY AREA 2
Broken into Sub Areas

# of lots per Sub Area	"Risk" Lots Serviced	All additional potential lots(w/o repairs/replacements)		Max Lots Served
	Lots Served			
		50%	100%	
1	8	21	33	43
2	5	8	11	15
2A	10	11	12	18
2B	3	9	15	23
2C	10	15	20	22
	36			

#

Cost for Pipe	Sewer Main	Force Main	Pump Station	Cost
1	4975	1750	2	$1,321,250
2	2275	1300	1	$671,250
2A	1017	637	0	$216,250
2B	2343	2343	1	$785,750
2C	2300	1400	1	$685,000

Description	Unit Cost
Sewer Main: 8-inch (LF)	$ 150
Force Main (LF)	$ 100
Pump Station (Ea)	$ 200,000

Entire Area	Cost for service	Permits, Studies & Engineering (20%)	Minimum Subtotal	Contingency (30%)	Maximum Total
2+2A	$887,500	$177,500	$1,065,000	$319,500	$1,384,500
2+2A+2B+2C	$2,358,250	$471,650	$2,829,900	$848,970	$3,678,870
1+2+2A	$2,208,750	$441,750	$2,650,500	$795,150	$3,445,650
2+2A+2B	$1,673,250	$334,650	$2,007,900	$602,370	$2,610,270
1+2+2A+2B+2C	$3,679,500	$735,900	$4,415,400	$1,324,620	$5,740,020
1+2+2A+2B	$2,994,500	$598,900	$3,593,400	$1,078,020	$4,671,420
2	$671,250	$134,250	$805,500	$241,650	$1,047,150
1+2	$1,992,500	$398,500	$2,391,000	$717,300	$3,108,300
1	$1,321,250	$264,250	$1,585,500	$475,650	$2,061,150

Entire Area		Minimum Cost for service (w/ 20% Engineering)	Maximum Total Cost (Including Contigency (30%))	1 Min	1 Max	2 Min	2 Max	3 Min	3 Max	4 Min	4 Max
	2+2A	$1,065,000	$1,384,500	$71,000	$92,300	$56,053	$72,868	$71,008	$92,308	$32,273	$41,955
	2+2A+2B+2C	$2,829,900	$3,678,870	$101,068	$131,388	$65,812	$85,555	$48,791	$63,429	$36,281	$47,165
	1+2+2A	$2,650,500	$3,445,650	$115,239	$149,811	$67,101	$87,232	$47,330	$61,529	$34,875	$45,338
Area 2 (Entire Area)	**1+2+2A+2B+2C**	$4,415,400	$5,740,020	$122,650	$159,445	$69,534	$90,394	$48,521	$63,077	$36,491	$47,438
	2+2A+2B	$2,007,900	$2,610,270	$111,550	$145,015	$71,711	$93,224	$52,839	$68,691	$35,855	$46,612
	1+2+2A+2B	$3,593,400	$4,671,420	$138,208	$179,670	$74,091	$96,318	$50,611	$65,795	$36,297	$47,186
	1	$1,585,500	$2,061,150	$198,188	$257,644	$77,341	$100,544	$48,045	$62,459	$36,872	$47,934
	1+2	$2,391,000	$3,108,300	$183,923	$239,100	$83,895	$109,063	$54,341	$70,643	$41,224	$53,591
	2	$805,500	$1,047,150	$161,100	$209,430	$100,688	$130,894	$73,227	$95,195	$53,700	$69,810

1	Cost per lot servicing only lots that are less than an acre and have not been fixed or replaced
2	Cost per lot servicing lots that are less than an acre and have not been fixed or replaced as well as 50% of the remaining lots that have not been fixed or replaced
3	Cost per lot servicing all lots in the area that have not been fixed or replaced
4	Cost per lot servicing all lots in the area (maximum amount of lots serviced)

Entire Area Counts

Estimated Lots Serviced	Cost per Lot Min	Cost per Lot Min Max
64	$69,534	$90,394

Note: Assumption is that all lots less than an acre and not fixed or replaced and 50% of remaining non-fixed lots would be serviced

Estimated Lots Serviced	Estimated Flow (GPD)
64	13,440

*Sewage Flows were calculated using tr-16 as reference.
Average daily sewage flow = # of lots * 3 occupants* 70 GPD

STUDY AREAS 3,4,5
Broken into Sub Areas

# of lots per Sub Area	Lots Served			
	"Risk" Lots Serviced	All additional potential lots(w/o repairs/replacements)		Max Lots Served
		50%	100%	
1	14	19	23	30
1A	10	13	16	26
1B	3	4	4	10
2	1	5	9	12
2A	11	19	27	34
3	7	12	17	27
3A	4	5	5	5
3B	8	14	20	29
3C	2	9	15	19
4	8	13	17	29
4A	36	45	53	69

Cost for Pipe	Sewer Main (LF)	Force Main (LF)	Pump Station	Cost
1	5740	1220	0	$983,000
1A	2100	1400	1	$655,000
1B	1050	1050	1	$462,500
2	1900	1900	1	$675,000
2A	3865	0	0	$579,750
3	2920	1140	1	$752,000
3A	900	0	0	$135,000
3B	3875	0	0	$581,250
3C	2995	925	1	$741,750
4	1600	0	0	$440,000
4A	3330	480	1	$747,500

Description	Unit Cost
Sewer Main: 8-inch (LF)	$ 150
Force Main (LF)	$ 100
Pump Station (Ea)	$ 200,000

Entire Area	Cost for service	Permits, Studies & Engineering (20%)	Minimum Subtotal	Contingency (30%)	Maximum Total
1+2+3+4+4A	$3,597,500	$719,500	$4,317,000	$1,295,100	$5,612,100
1+1A+1B+2+2A+3+3A+3B+3C+4+4A	$6,752,750	$1,350,550	$8,103,300	$2,430,990	$10,534,290
1+1A	$1,638,000	$327,600	$1,965,600	$589,680	$2,555,280
1	$983,000	$196,600	$1,179,600	$353,880	$1,533,480
1+1A+1B	$2,100,500	$420,100	$2,520,600	$756,180	$3,276,780
1+1A+1B+2+2A+3+3A+3B	$4,823,500	$964,700	$5,788,200	$1,736,460	$7,524,660
1+1A+1B+2+2A+3	$4,107,250	$821,450	$4,928,700	$1,478,610	$6,407,310
1+1A+1B+2+2A	$3,355,250	$671,050	$4,026,300	$1,207,890	$5,234,190
1+1A+1B+2+2A+3+3A+3B+3C+4	$6,005,250	$1,201,050	$7,206,300	$2,161,890	$9,368,190
1+1A+1B+2+2A+3+3A+3B+3C	$5,565,250	$1,113,050	$6,678,300	$2,003,490	$8,681,790
1+2+2A+3+3A3B+3C	$4,447,750	$889,550	$5,337,300	$1,601,190	$6,938,490
1+1A+1B+2	$2,775,500	$555,100	$3,330,600	$999,180	$4,329,780

	Entire Area	Minimum Cost for service (w/ 20% Engineering)	Maximum Total Cost (Including Contigency (30%))	1		2		3		4	
				Min	Max	Min	Max	Min	Max	Min	Max
Area 4 (Entire Area)	**1+2+3+4+4A**	$4,317,000	$5,612,100	$65,409	$85,032	$46,670	$60,671	$36,277	$47,161	$25,850	$33,605
All Area 3,4, and 5	**1+1A+1B+2+2A+3+3A+3B+3C+4+4A**	$8,103,300	$10,534,290	$77,916	$101,291	$52,279	$67,963	$39,336	$51,137	$27,942	$36,325
	1+1A	$1,965,600	$2,555,280	$81,900	$106,470	$62,400	$81,120	$50,400	$65,520	$35,100	$45,630
	1	$1,179,600	$1,533,480	$84,257	$109,534	$63,762	$82,891	$51,287	$66,673	$39,320	$51,116
	1+1A+1B+2+2A+3+3A+3B	$5,788,200	$7,524,660	$99,797	$129,736	$64,673	$84,074	$47,836	$62,187	$33,458	$43,495
	1+1A+1B+2+2A+3+3A+3B+3C+4	$7,206,300	$9,368,190	$105,975	$137,768	$65,215	$84,780	$47,100	$61,230	$32,608	$42,390
Area 3 (Entire Area)	**1+2+2A+3+3A+3B+3C**	$5,337,300	$6,938,490	$113,560	$147,627	$65,488	$85,135	$46,011	$59,815	$34,213	$44,478
	1+1A+1B+2+2A+3+3A+3B+3C	$6,678,300	$8,681,790	$111,305	$144,697	$68,146	$88,590	$49,105	$63,837	$34,783	$45,218
	1+1A+1B+2+2A	$4,026,300	$5,234,190	$103,238	$134,210	$68,242	$88,715	$50,966	$66,256	$35,949	$46,734
	1+1A+1B+2+2A+3	$4,928,700	$6,407,310	$107,146	$139,289	$69,418	$90,244	$51,341	$66,743	$35,458	$46,096
Area 5 (Entire Area)	**1+1A+1B**	$2,520,600	$3,276,780	$93,356	$121,362	$72,017	$93,622	$58,619	$76,204	$38,191	$49,648
	1+1A+1B+2	$3,330,600	$4,329,780	$118,950	$154,635	$83,265	$108,245	$64,050	$83,265	$42,700	$35,583

1	Cost per lot servicing only lots that are less than an acre and have not been fixed or replaced
2	Cost per lot servicing lots that are less than an acre and have not been fixed or replaced as well as 50% of the remaining lots that have not been fixed or replaced
3	Cost per lot servicing all lots in the area that have not been fixed or replaced
4	Cost per lot servicing all lots in the area (maximum amount of lots serviced)

Entire Area Counts

Area 3

Estimated Lots Serviced	Cost per Lot Min	Cost per Lot Min Max
82	$65,488	$85,135

Note: Assumption is that all lots less than an acre and not fixed or replaced and 50% of remaining non-fixed lots would be serviced

Estimated Lots Serviced	Estimated Flow (GPD)
82	17,220

Area 4

Estimated Lots Serviced	Cost per Lot Min	Cost per Lot Min Max
93	$46,670	$60,671

Note: Assumption is that all lots less than an acre and not fixed or replaced and 50% of remaining non-fixed lots would be serviced

Estimated Lots Serviced	Estimated Flow (GPD)
93	19,530

Area 5

Estimated Lots Serviced	Cost per Lot Min	Cost per Lot Min Max
35	$72,017	$93,622

Note: Assumption is that all lots less than an acre and not fixed or replaced and 50% of remaining non-fixed lots would be serviced

Estimated Lots Serviced	Estimated Flow (GPD)
35	7,350

Areas 3,4,5

Estimated Lots Serviced	Cost per Lot Min	Cost per Lot Min Max
155	$52,279	$67,963

Note: Assumption is that all lots less than an acre and not fixed or replaced and 50% of remaining non-fixed lots would be serviced

Estimated Lots Serviced	Estimated Flow (GPD)
155	32,550

*Sewage Flows were calculated using tr-16 as reference.
Average daily sewage flow = # of lots * 3 occupants* 70 GPD

Ranking of Top Cost Comparable Extensions

Area 1 - West Manchester

Entire Area	2		Lots Serviced	Estimated Potential Flow (GPD)	Max Lots Serviced	Estimated Max Flow (GPD)
	Min	Max				
1	$45,474	$59,116	10	1,995	16	3,360

Area 2 - Smith's Point

Entire Area	2		Lots Serviced	Estimated Potential Flow (GPD)	Max Lots Serviced	Estimated Max Flow (GPD)
	Min	Max				
2+2A	$56,053	$72,868	19	3,990	33	6,930

Area 3 - Coolidge Point Road
Area 4 - Raymond Street Area
Area 5 - Hickory Hill

	Entire Area	2		Lots Serviced	Estimated Potential Flow (GPD)	Max Lots Serviced	Estimated Max Flow (GPD)
		Min	Max				
Area 4 (Entire Area)	**1+2+3+4+4A**	$46,670	$60,671	93	19,425	167	35,070
All Area 3,4, and 5	**1+1A+1B+2+2A+3+3A+3B+3C+4+4A**	$52,279	$67,963	155	32,550	290	60,900

Ranking for all top extensions

	Entire Area	1		2		3		4	
		Min	Max	Min	Max	Min	Max	Min	Max
Area 1	**1**	$61,714	$80,229	$45,474	$59,116	$36,000	$46,800	$27,000	$35,100
Area 3,4,5 (Entire Area 4)	**1+2+3+4+4A**	$69,629	$90,518	$49,057	$63,774	$37,868	$49,229	$25,850	$33,605
Area 3,4, and 5 (All)	**1+1A+1B+2+2A+3+3A+3B+3C+4+4A**	$81,852	$106,407	$54,385	$70,700	$40,720	$52,936	$27,942	$36,325
Area 2	**2+2A**	$71,000	$92,300	$56,053	$72,868	$71,008	$92,308	$32,273	$41,955

1	Cost per lot servicing only lots that are less than an acre and have not been fixed or replaced
2	Cost per lot servicing lots that are less than an acre and have not been fixed or replaced as well as 50% of the remaining lots that have not been fixed or replaced
3	Cost per lot servicing all lots in the area that have not been fixed or replaced
4	Cost per lot servicing all lots in the area (maximum amount of lots serviced)

Study Area 6 Cost Comparisons

Maximum (with directional drilling)

Sewer Main (FT)	Force Main	Pump Station	Directional Drilling	Cost
1000	0	0	1,200	$1,350,000

Description	Unit Cost
Sewer Main: 8-inch (LF)	$150
Force Main (LF)	$100
Pump Station (Ea)	$200,000
Directional Drilling (LF)	$1,000

		Minimum		Maximum
Cost for service	Permits, Studies & Engineering (25%)	Subtotal	Contingency (40%)	Total
$1,350,000	$337,500	$1,687,500	$675,000	$2,362,500

Note: directional drilling was estimated for 1200 ft

Hanging Pipe estimate

Sewer Main (FT)	Force Main	Pump Station	Directional Drilling	Cost
1000	1200	0	0	$750,000

Description	Unit Cost	
Sewer Main: 8-inch (LF)	$150	
Force Main (LF)	$500	**(hanging)**
Pump Station (Ea)	$200,000	

		Minimum		Maximum
Cost for service	Permits, Studies & Engineering (25%)	Subtotal	Contingency (40%)	Total
$750,000	$187,500	$937,500	$375,000	$1,312,500

Note: The cost used for directional drilling is an estimate, not including rock excavation or geotechnical investigation directional drilling was estimated for 1200 ft

Estimated Flow
61,945**

**1000 gpd/acre was assumed for future commercial parcel development, estimated 65% developable

Treatment Cost

Area	Lots Served	Flow (Gal)	Unit Price	Total Cost
Manchester	85	17850	$20	$357,000
Gloucester	489	102690	$20	$2,053,800
			Total	**$2,410,800**

Table VII-X Raymond Street Joint Communal System Estimate					
Item	**Description**	**Unit**	**Quantity**	**Unit Cost**	**Item Cost**
1	Sewer Main	LF	5,080	$150	$762,000
2	Pump Station	EA	1	$200,000	$200,000
	Subtotal				$962,000
3	Permits, Studies & Engineering	%		20%	$192,400
	Subtotal				*$1,154,400*
4	Force Main	LF	26,400	$100	$2,640,000
5	*Treatment System/Leaching Field (sand)*	GAL	120,540	$20	$2,410,800
	Subtotal				$5,050,800
6	Permits, Studies & Engineering	%		20%	$1,010,160
	Subtotal				$6,060,960
	Raymond Street Portion	%		19%	*$1,151,582*
	Subtotal				$2,305,982
	Contingency	%		30%	$691,795
	TOTAL				**$2,997,777.1**

Lots Served	Total Cost		Avg. Cost Per Lot	
	Min.	Max.	Min.	Max.
85	$2,498,148	$2,997,777	**$29,390**	**$35,268**

Note: Mininum Cost was calculated considering only 30% contingency,
Force Main was assumed to be 5 miles to Communal Site

J. On-Site Wastewater Management Program

Policies, Procedures and Local Addenda to Title 5

MANCHESTER-BY-THE-SEA BOARD OF HEALTH

ON-SITE WASTEWATER MANAGEMENT PROGRAM

POLICIES, PROCEDURES AND
LOCAL ADDENDA TO TITLE 5

Table of Contents

APPENDICES

SECTION 1 – ADMINISTRATION

1.1 MANAGEMENT AND PUBLIC EDUCATION

A. Regulatory Authority

The Board of Health (BOH) in the Town of Manchester-by-the-Sea is the local regulatory authority for On-Site Wastewater Treatment Systems (OWTS). As such, the BOH is responsible for the review and approval of all designs for repair, replacement or new OWTS. They maintain records on all of the systems within the town. The BOH officials regulate OWTS within the town under the guidance of Commonwealth of Massachusetts Department of Environmental Protection (MassDEP) Title 5 regulations.

The MassDEP is the State regulatory authority. They oversee local implementation of the program as well as providing technical support and training of local officials along with some regulatory approvals. OWTS which require review and approval by MassDEP continue to require submission of all permit applications, test results, installation information, etc. to the BOH.

B. Public Education

The local BOH will have available for public use, information about the Town's On-Site Wastewater Management Program (OSWMP) and any proposed changes to the program or the regulations. An Advisory Committee shall be formed which may include members of the local Regulatory Authority, Service Providers and System Owners. This committee shall review and recommend changes when necessary to the BOH for approval. Questions on the interpretation of the requirements shall be directed to the BOH or the Advisory Committee.

The Advisory Committee in conjunction with the BOH shall provide biennial Public Informational Sessions to explain the requirements of the OSWMP to Owners/Users and the Service Providers.

When an Owner/User receives the Certificate of Compliance for new construction or the final approval on repairs or changes to a system, they shall also receive information from the BOH on the care and use of On-Site systems.

1.2 LICENSES AND PERMITS

A. Renewable/Revocable Permits When a new system is constructed or an existing system is repaired or replaced in accordance with Section III of this document, the BOH shall issue a renewable/revocable operation permit to the Owners/User with the Certificate of Compliance. The permit stipulates the performance criteria, compliance monitoring, and reporting of the system. The terms shall indicate the required maintenance and pumping schedule. Proof of compliance in accordance with the permit shall be submitted to the BOH. This does not alter or reduce the owner's responsibility to submit any required information to the MassDEP per their original approval.

B. Disposal System Construction Permit ["DSCP"] No DSCP shall be issued until a septic plan has been approved. The permit shall be issued only to an installer with a valid Manchester license. The permit shall be signed by the installer thereby creating a contractual obligation between the installer and the Town. Said contract is the property of the Town and cannot be transferred, assigned or the conditions as set forth, extended or modified without the written consent of the Board of Health and the installer. All DSCPs shall be valid for two [2] years upon payment of any fee.

A completed application shall consist of the DSCP properly filled out, including the signature, fee paid, and the submittal of the required number of plan copies.

Attached as Appendix 1.1 is the form for Application for a DSCP.

C. Septic Hauler Permit The applicant for such permit shall, at all times comply with the requirements of 310 C.M.R. 15.000 (herein after referred to as "Title 5") sections 15.502 through 15.505 of Title 5 when transporting, hauling or disposing of any septic contaminated soils, water, solids or compost. All vehicles engaged in the applicant's operation may be required to be made available to the Board of Health for inspection. The application shall be filled out completely and the appropriate fee paid prior to the scheduling of any vehicle inspection.

Attached as Appendix 1.2 is the form for Application for a Septic hauler Permit.

D. Septic Installers Permit. No septic system shall be installed, modified or repaired within the Town of Manchester-by-the-Sea unless the contractor is in possession of a valid septic installer's permit. Permits shall be valid for a twelve [12] month period. Installers who hold a valid permit in the Town may elect to renew their permit by providing the Board of Health with a current Department of Public Safety hoisting license, a copy of liability and workers compensation insurance, a completed contract, a signed workmen's compensation affidavit, and the required fee. The signed contract is an obligation by the installer to provide service in compliance with Title 5 and the Manchester Addenda to Title 5 to a third party through the licensing agent, the Board of Health. Those contractors who do not have a hoisting license, but subcontract this work, must provide a copy of the operators hoisting license and state who the operator is and any substitutes. All subcontractors must provide proof of insurance, even if provided by the General Contractor.

Applicants requesting a septic installers permit shall pass an exam which is comprised of questions concerning Title 5 and practical engineering. The passing score is 85%. Failure to meet the minimum passing grade shall result in retesting.

Failure to pass the exam on a second attempt will result in the applicant having to wait six months before being able to retest.

The Board may restrict the right of a licensed installer to obtain a permit to install a septic system if, in the opinion of the Board, the scope of work exceeds the capability or experience of the licensed installer. .
The installer shall provide to the Board a completed "System Certification" within thirty [30] days of completion of any installation prior to receiving a Certificate of Compliance. Failure to provide system certification shall affect licensure.

Septic System Abandonment forms must be completed and provided to the Board upon completion of work.

Septic contaminated material excavated from a job site may be reused on site, provided a plan for its reuse is approved. Stockpiling of contaminated soil off site within the confines of a "contractors" yard requires written permission from the Board. Transfer of liquefied septage contaminated soil and materials shall be within a vehicle designed to provide containment of all liquid. Transfer shall be a by a licensed hauler who shall provide to the Board the end destination of said septage.

Attached as Appendix 1.3 is the form for Application for a Septic Installers Permit.

E. O&M Service Providers Operation and Maintenance (O&M) service providers, shall have a licensed septic inspector on staff or be working in conjunction with a licensed inspector. O&M service providers licensed by both the Commonwealth of Massachusetts and the Town of Manchester-by-the-Sea, shall perform necessary maintenance of the system. Inspections shall be performed during the maintenance appointment. The service provider shall submit all information required by the permit to the BOH within fourteen (14) days of conducting the associated maintenance activity. The submission shall include water usage information.

1.3 RECORDKEEPING AND REPORTING

The Town of Manchester-by-the-Sea Board of Health will maintain a comprehensive inventory of all systems within the Town. For each individual system the BOH will have records which include copies of the following;

- Site/Soil Evaluations
- The system design
- Approval record
- Installation inspection reports and photos
- System As-Built
- Certificate of Compliance
- Maintenance/Inspection record
- O&M Agreement (for I/A systems)

- Pump Out record
- Non-Compliance/Violation notifications
- Repair record
- Water usage

Although the BOH will have copies of all files for each system, it is recommended that the Owner/User, the O&M Service Provider and the Designer also maintain their own set of files. The Owner/User should have, at a minimum, copies of the System As-Built, Maintenance/Inspection, O&M Agreement (if applicable), Pump Out and water usage records. All information sent to the MassDEP must also be sent to the BOH. The home owner's records will be useful in assisting the Service Provider when performing the maintenance and inspection of the system.

O&M Service Providers shall maintain record of all inspections and maintenance performed during the time they have been contracted to service the system and must submit a copy of the O&M agreement with the homeowner to the BOH for their records. The service provider is asked to maintain their maintenance and inspection records for a minimum of five (5) years. The service provider shall notify the BOH if the Owner/User discontinues or cancels their service contract within seven (7) days of termination of the contract.

The designer is asked to maintain a record of the system design and construction inspection for no less than a period of five (5) years in the event that Town records are lost, misplaced, or otherwise not properly accounted for. Should the system fail within that time period, the designer may be asked to bring forth the inspection reports demonstrating that the system was installed correctly.

The combination of records from the BOH, Owner/User and the Designer will be utilized to determine possible causes for the failure and a means to correct the issue.

On an annual basis the BOH must provide a program summary to the state and/or EPA, as appropriate. This report shall include:

- Name and address of the primary contact person within the BOH
- Number and type of on-site systems installed that year
- Number of outstanding permits for on-site systems
- Cumulative total number of on-site systems installed since inception of the management program
- Total number of inspections and pumpouts completed that year
- Total number of failures reported that year
- Current number of on-site systems malfunctioning as of the date of the report

- Percentage of program-mandated system monitoring inspections that have actually been performed that year
- A summary of any resource impact monitoring results
- A brief written assessment of overall performance of the management program

SECTION 2 – REGULATIONS AND POLICIES

2.1 SOIL TESTING

Soil tests shall be scheduled with the Board's Health Agent and shall comply with the provisions below.

Applications To Schedule Soil Testing shall be completed and submitted to the Board of Health Office. The required soil test witnessing application fee, shall be submitted at the time the application is filed. The application fee is to be paid for each lot or parcel to be tested and allows the applicant up to four [4] hours, or one half day, morning or afternoon, of testing or monitoring. The BOH shall have fourteen (14) days to approve or reject this application. If no decision is made, the application shall be deemed approved.

The application for soil testing may only be made by a professional engineer or registered sanitarian. The application must include a plot plan, survey or subdivision plan. The soil evaluator for this testing must be a DEP Certified Soil Evaluator.

All percolation tests and deep observation holes shall be performed in accordance with strict adherence to the Commonwealth's State Environmental Code Title 5 and the Manchester Addendum Title 5.

The soil evaluator shall submit a report of his/her test results to the Board within sixty [60] days of the date of the test, along with a drawing or sketch showing the test hole locations established from physical features and landmarks such as control survey stakes, trees or other natural permanent features on the property. Where applicable, the drawing or sketch should show test hole locations relative to major rock outcroppings, wetlands, salt or freshwater marsh, streams, ditches, pipes, drains, wells, drives, roads, structures and the like.

Without exception, no test holes shall be left open overnight. Should there be equipment failure, weather or any delays, the applicant shall take full responsibility to see that the test holes are properly backfilled that day.

All utilities shall be located in the field prior to digging.

Attached as Appendix 2.1 is the form for Application To Schedule Soil Testing.

2.2 TWO COMPARTMENT SEPTIC TANKS & EFFLUENT FILTERS

All septic tanks shall be constructed of two compartments with a concrete baffle. The larger capacity area is to provide detention and storage, while the second is to act as a clarifier. A MA/DEP approved septic tank filter shall be installed on the outlet side of the second compartment. Filtering capacity of these filters should not exceed 3/16ths of an inch. Both manholes should be either at grade or buried no deeper than six [6] inches. Manhole risers may be constructed of high-density polyethylene or concrete.

Information on the filter and the maintenance shall be presented to the owner by the installer.

2.3 INNOVATIVE AND ALTERNATIVE TECHNOLOGY (I/A)

The Board of Health will allow the use of alternative septic systems approved by the Massachusetts Department of Environmental Protection under Title 5.

Innovative and Alternative On-Site Systems shall be required for all new and replacement systems within Areas of Critical Concern. Any areas which meet one or more of the following criteria are deemed Areas of Critical Concern.

- Within five-hundred (500) feet of environmentally sensitive area, drinking water supply or recreational waters
- In areas where the percolation rate is greater than 30 minutes per inch
- In areas where the restrictive layer is within five (5) feet of the existing ground surface
- In areas where the seasonal high groundwater table is within three (3) feet of the existing ground surface.

The BOH may also require upgrades to existing systems within these areas should degradation of a water supply or an ecological resource becomes imminent. This requirement must be communicated to Owners/Users in the community prior to the time a decision is made to initiate the management program.

Title 5, Section 15.004 Availability (3) indicates that no system shall be installed or repaired in areas where a sanitary sewer system is available. In some areas within the Town, public sanitary sewers may be present within the right of way. However, it may be infeasible for a connection to be made. The capacity of the Wastewater Treatment Facility is not sufficient to handle the flow from all parcels within the Town. The Comprehensive Wastewater Management Plan indicates the areas that may be serviced by the sanitary sewer.

2.4 PLAN SUBMISSION AND REVIEW

In order for a septic plan to be placed on the agenda of the next regularly scheduled meeting of the Board of Health, the applicant must comply with the provisions herein.

A complete plan application must be submitted to the Board office no later than 12:00 noon, fourteen [14] calendar days prior to the Board meeting at which an agenda entry is requested.

A copy of the Board's septic system plan review checklist should be completed and attached to the plans submitted to the Board.

Incomplete submittals will not be placed on the Board's meeting agenda, rather the designer/applicant will be requested to make and submit any necessary revisions.

Plan submittals that include variance requests may require the Board to advertise a Public Hearing and may also require the applicant to notify abutters by certified return receipt mail. Said advertising and notification will require additional up front time to satisfy these requirements.

Pursuant to M.G.L. Chapter I I L §3 1 E the Board of Health has forty-five [45] days from receipt of a complete submittal in which to act on a septic design plan.

Attached as Appendix 2.2 is the form for Plan Review Checklist.

2.5 SEPTIC "AS BUILT" PLANS

All septic installations shall require "as built" plans submitted by the design engineer in accordance with Title 5 15.021(3). Said plan shall conform to the minimums as outlined in 310 C.M.R. 15.220. Should the soil absorption system be located less than the [10] feet from a property line, the "as built" plan shall bear the seal of a registered land surveyor. The "as built" plan shall also note any deviations or changes in the actual construction layout which differ from the approved drawings.

The design engineer shall be responsible for monitoring the system installation. System modifications which require moving the system and/or the proposed building structure by 25% outside of their approved footprint shall be noted during inspection and shall trigger a redesign submittal. The 25% criteria is cumulative with the system and the building structure (ex. If the system is moved by 10% and the house by 16%, the 25% criteria is triggered). After verifying that the modifications deviate from the approved plans in such a manner, the engineer must resubmit the design and an approval must be received from the BOH prior to continuing. Minor field modifications, such as relocation of a septic tank, D-box, system or structure within 25% of the approved footprint and within 0.1 feet of approved elevations, can be noted and approved by the engineer. If the design invert of the system is at the minimum for proper separation to the seasonal high groundwater table or the impervious layer (bedrock, ledge), no allowance shall be made for inverts lowered from the design. If encountered, the system will be adjusted to meet the design elevation.

The "As-Built" survey plan will be used to demonstrate that proper inverts, slopes, grading and perimeter slopes are met. The plan shall include a minimum of three (3) swing ties each to the septic tank, distribution box, any I/A components, and corners of the disbursal field. Invert elevations and final ground surface elevations shall be shown sufficient to demonstrate that the system has been constructed as designed.

"As built" plans of pumped and dosed systems shall be required to verify the float heights and pumping time to ascertain compliance with the approved design. All systems which require a proprietary subcontract will require a letter from the subcontractor indicating that the portion of the system installed or sold by the company was in compliance with the manufacturers standards when installed. Said "as built" plan shall be submitted prior to the issuance of a Certificate of Compliance.

2.6 INSTALLER'S CERTIFICATE OF SYSTEM CONSTRUCTION

All septic installers currently licensed by the Board of Health shall submit, upon completion of the construction, repair or alteration of a septic system; a written certification in accordance with Title 5 15.021(3). Said certification shall be completed on a form supplied by the Board. Any changes or modifications made in the actual field location of any component must be listed and accounted for on the certification. No Certificate of Compliance shall be released until the Board is in receipt of this certification. Failure to provide certification or falsification of the certification shall be grounds for a license suspension.

Attached as Appendix 2.3 is the form for System Certification.

2.7 SEPTIC SYSTEM ABANDONMENT

In fulfilling the requirements of 310 C.M.R. 15.354, the Board of Health shall require all currently licensed septic installers to provide a completed copy of a "Septic System Abandonment Form". Any septic system consisting of a septic tank, leaching pit, cesspool, drywell, galley or chamber shall be emptied of its content prior to backfilling with sand or stone. Evidence of pumping and filling shall accompany the abandonment form. No Certificate of Compliance shall be issued for a repair or new components to an existing septic system unless and until there is an abandonment form filed with this department. The contents of any septic component including, but not limited to, effluent, soil, pipes, concrete, stone and fill shall be disposed of in accordance with the provisions of this document.

Attached as Appendix 2.4 is the form for Septic System Abandonment.

SECTION 3 – LOCAL ADDENDA TO TITLE V

3.1 DEED RESTRICTION.

In the case of an existing, non-conforming property that is having a septic system upgrade, the Board of Health may choose to impose a deed restriction on the property, limiting the number of bedrooms to the number noted on the septic system design plan.

3.2 DEFINITION OF EXISTING APPROVED CAPACITY.

The design flow of a system in use and as authorized by the Certificate of Compliance issued by the Board or the Massachusetts Department of Environmental Protection.

3.3 BUILDING PERMITS

The Board reserves the right to request an applicant for a building permit to submit to the Board the location and components of the existing septic system serving the dwelling to review for conformity to Title 5 and the Manchester Addenda to Title 5. In the event an applicant for a building permit seeks to expand an existing structure in such a way as to increase the demands upon any on site sewage disposal system and the applicant is unable to satisfy the Board of Health that the existing septic system serving the structure as expanded complies with the provisions of Title 5 and the addenda thereto adopted by the Town of Manchester, such applicant must request a variance in writing from the terms of Title 5 and the addenda. Such request must specify the provisions from which relief is being sought and state all grounds for the granting of the relief.

3.4 INSPECTIONS

A. **Construction Inspections:** During construction, the design engineer and a representative of the BOH shall inspect the stone below the tanks, the bottom of the system excavation, the system prior to it being covered, and the final cover over the system. The installer shall contact the engineer and BOH a minimum of forty-eight (48) hours prior to the start of construction and a minimum of twenty-four (24) hours prior to a required inspection to arrange for their presence on-site. The BOH shall provide a two (2) hour window for their inspections. The engineer shall perform their inspection no later than the end of the two (2) hour window provided by the BOH. An additional inspection may occur when pumps or Innovative and Alternative technology is used, or alarms are part of a critical component. Photos shall be taken by the design engineer at each inspection to document the work.

   For the bottom of the excavation shall be dry and scarified prior to the installation of septic gravel. Septic gravel/sand shall be tested for compliance with Title 5 and the design specifications. A copy of the sieve analysis performed by an authorized testing facility shall be submitted to the BOH prior to the authorization to cover the system. If the tank or disbursal field is covered without authorization from the engineer and BOH, the contractor shall uncover the system to allow inspection.

All septic tanks and distribution boxes shall be certified as water tight. Septic tanks shall have three openings, over the inlet, outlet and compartment divider. Risers with covers shall be installed on the septic tank and D-box and brought to finished grade. Covers shall be secured to limit access. No structures are permitted over any component of the system.

The engineer must prepare a notice of completion and submit the following items within three (3) business days of the completion of construction and prior to the issuance of the Certificate of Compliance by the BOH.

- Statement indicating compliance with the approved design
- Sieve Analysis
- Inspection notes and photos
- As-Built Survey Plan

If the submittal package is deemed incomplete, the BOH shall contact the designer requesting the missing information. The designer will have two (2) business days to submit the required information. If it is not received during that time period, the submittal will be returned to the designer. No Certificate of Compliance shall be issued until such time that a complete submission package is provided.

B. Maintenance Inspections: All conventional systems shall be inspected at a minimum of every three (3) years. Septic tanks shall be pumped every three (3) years or when upon inspection the sludge level is noted to be within twelve (12) inches of the bottom of the outlet tee or the scum layer is within two (2) inches of the top of the outlet tee. If the system receives waste from a garbage grinder, the system shall be pumped yearly.

All I/A on-site systems shall be inspected yearly in accordance with the MassDEP regulations. An Operation and Maintenance agreement is required for all I/A systems between the Owner/User and a Commonwealth of Massachusetts licensed Service Provider. Quarterly sampling and testing of influent and effluent is required for all I/A systems. The effluent from the I/A system shall meet or exceed secondary treatment standards which include the following.

- BOD_5 & TSS $\leq$ 30mg/L
- pH in the range of 6.0 to 9.0
- Total nitrogen $\leq$ 25 mg/L

3.5 DEFINITION OF SEPTIC SYSTEM ABANDONMENT

A system serving commercial, industrial or residential buildings is considered abandoned when occupation or use is terminated for a consecutive period of two (2) years. The septic system serving any building deemed abandoned shall be upgraded to the new construction guidelines as set forth in Title 5.

SECTION 4 – SEPTIC SYSTEM DESIGN & PLAN REQUIREMENTS

4.1 GENERAL REQUIREMENTS

Location and installation of each individual sewage disposal system or other means of disposal, newly constructed or repaired, shall be such that with reasonable maintenance it will function in a satisfactory manner and will not create a nuisance or discharge into any wetland resource areas of the Town of Manchester as listed in Section 2.1 of the Town of Manchester General Wetland by-law.

In determining a suitable location for the system, consideration shall be given to the size and shape of the lot, water supplies, depth to groundwater, presence of impervious material, soil classification and reserve area. No disposal system construction permit ("DSCP") as described in 310 C.M.R. §15.020 shall be issued until a representative of the approving authority has:

[a] performed a site examination;

[b] witnessed deep observation holes;

[c] witnessed percolation tests;

[d] obtained an approved disposal system plan; and

[e] received evidence that all other Town approvals necessary have been obtained.

4.2 APPLICATIONS

Application for all new construction and any alterations and major repairs, which in the opinion of the Board of Health are extensive, shall address the following in addition to § 15.203 and § 15.220 of 310 C.M.R.

Septic facilities and potable or agricultural wells within 100 feet of the septic system or any part thereof on immediately adjacent lots shall be indicated on the plan.

If a plan has been considered by the Board of Health meeting in a regular session, and a change in the plan is required, such a change or modification shall be made in such a way as to be easily distinguishable from the original proposal. Revisions shall be made distinguishable by including a revision date and an explanation of the change. This information shall be placed in the Title Block whenever possible.

All easements shall be clearly indicated on the plan and ownership of record of such shall be marked therein.

The plan shall include a statement which clearly reads:

> "NO CHANGES ARE TO BE MADE IN THE FIELD WITHOUT THE APPROVAL OF THE BOARD OF HEALTH OR ITS DESIGNEE AND THE DESIGN ENGINEER."

Applications shall be considered complete when a completed DSCP application is completed, signed and dated and the application is accompanied by three (3) sets of plans, and the appropriate fee is rendered.

4.3 BENCHMARKS

Two permanent benchmarks referenced to U.S.G.S. shall be placed on or near the property and placed on plans submitted to the Board. All elevations, water table levels and other topographical features shall be U.S.G.S. elevations. In "VE" or "A" zones, the highest spring tide shall be shown on the plan using the Army Corps of Engineers Tide Charts or the spring high water rack line. One benchmark reference within fifty feet more or less of the septic system shall be indicated on the plan. A variance must be requested if the designer is unable to fulfill this requirement.

4.4 STRUCTURES

The plan shall include the location and elevations on the lot of any in-ground and above ground structure(s), including any swimming pools and storage tanks within 50 feet of the proposed or existing dwelling on the locus lot.

4.5 DISTANCES

No septic tank or leaching facility shall be constructed within 100 feet of wetland resource areas of the Town of Manchester, as listed in Section 2.1 of the Town of Manchester General Wetlands By-Law or as defined in Title 5. An applicant who provides for the use of a State approved wastewater pretreatment system may request a variance from the Board of Health to decrease this 100 foot setback to a distance of no less than 50 feet.

4.6 PUMPS

Force main pipes shall be installed to guard against freezing.

Pressure dosed systems shall follow the DEP methodology as set forth in the DEP guidance letter. All electrical work shall be performed by a licensed electrician and shall require inspection from the electrical inspector with a sign-off provided prior to the issuance of a Certificate of Compliance.

The minimum combined liquid capacity of pump chambers (in systems which utilize pumps) shall be 1,500 gallons. Pump chamber design must accommodate one day of storage volume above the high water alarm. Individual dose volumes shall not exceed one eighth (1/8) of the daily design flow.

4.7 VARIANCES

In the event an applicant for a DSCP submits a plan for a subsurface sewage disposal system, and such plan is inconsistent with the terms of Title 5 and/or any addenda thereto adopted by the Town of Manchester, such applicant shall request a variance in writing. Such request must specify the provision from which relief is being sought and state all grounds for the granting of such a variance.

4.8 NOTIFICATION

The applicant for a variance from the Town of Manchester's Addenda to Title 5 must notify all abutters by certified mail, return receipt requested at least ten (10) days before the Board of Health hearing/meeting at which the variance request will be on the agenda. Failure of the applicant to prove that such notice was given may be grounds for the denial of the request for a variance. No such notice is required if the applicant only seeks to repair an existing system and meets the required well and property line setback distances.

4.9 SEVERABILITY

The invalidity of any section or provision of this addenda shall not invalidate any other section or provision, nor shall it invalidate any permit or determination previously issued.

4.10 GARBAGE GRINDERS

Garbage grinders shall be prohibited in nitrogen-sensitive areas and areas of critical concern. Outside of these areas, garbage grinders are discouraged. If a garbage grinder is to be installed, the size of the septic tank shall be increased to 200% of the design flow and the design of the disbursal field shall be 1.5 times the standard requirement.

SECTION 5 – CORRECTIVE ACTIONS AND ENFORCEMENT

5.1 PENALTIES FOR FAILURE TO SUBMIT A REPORT:

Failure to submit a mandated report for on-site system inspection, operation & maintenance, or pumping & hauling in a timely fashion will result in a punitive fine of not more than twenty-five (25) dollars per day for each day the report is not submitted beyond the deadline.

5.2 SYSTEM FAILURE:

In the event of a system failure, the owner/user of the system shall, within fourteen (14) days after the submission of the Inspector's report to the Board of Heath, submit an action plan which outlines what steps are going to be taken, when they will be taken and by whom. Should the Owner/User fail to submit an action plan or contact the BOH for guidance on the issue within the allotted time, the BOH shall revoke the permit and issue a fine of not more than twenty-five (25) dollars per day for every day the permit has been revoked. The BOH shall inspect the system during completion of the repairs or system replacement. Upon completion of the work, a Certificate of Compliance will be issued to the Owner/User and the permit updated to reflect the changes.

5.3 PERMIT NON-COMPLIANCE:

In the event of non-compliance with the permit from the BOH, the owner shall receive written notification of the non-compliance. The Owner/User shall provide a written acknowledgement of the non-compliance notification and present their intent to correct the situation within seven (7) days of receipt of the notification. They will have twenty-one (21) days thereafter to rectify the issue and to bring the permit back into compliance or submit an action plan as noted above. Should this not occur, the BOH shall have the right to revoke the permit and issue a fine of not more than twenty-five (25) dollars per day for every day the permit has been revoked.

5.4 PERMIT EXPIRATION:

All permits must be renewed no later than sixty (60) months after the issuance of the current permit. The BOH shall send out a reminder thirty (30) days prior to the expiration of the permit. A list of required submission material will be included in the renewal reminder. At the time of renewal, the Owner/User must submit all required documentation. If they have been submitting the required information as required in the current permit, they will likely need only to submit the application and fee. The fee for permit renewal shall be listed in the Fee Schedule on the Manchester-by-the-Sea, Health Department portion of the town website. In the event that the Owner/User chooses not to renew the permit, they will need to submit proof that the system is no longer in use. If no correspondence is received, the BOH will send out notification no more than seven (7) days after the expiration of the permit informing the Owner/User that their system is non-compliant. If seven (7) days after the issuance of the non-compliance notice, the Owner/User does not contact the BOH or if the Owner/User refuses to renew the permit for an active system, the BOH shall have the right to issue a fine of not more than twenty-five (25) dollars per day for every day the permit has been expired, until such time that the Owner/User submits an application for renewal.

SECTION 6 – FINANCIAL ASSISTANCE

6.1 GENERAL

The Owner/User can apply for long term low interest financing, such as a Betterment Loan to repair, replace or upgrade a failing septic system. Betterment loans are provided through the Town, which finances them through a Loan Agreement with the Massachusetts Water Abatement Trust (MWAT). Another option is to obtain a low interest loan from the Massachusetts Housing Finance Agency (www.masshousing.com) or the Farmers Home Administration (Multi-Family homes 202-708-2495, Single-Family homes 202-708-3175). The USDA Rural Development Program (www.urudev.usda.gov/MAHome.html) has loans for individuals with very-low-incomes.

In addition to the above loan programs, a tax credit is available to property owners whose principal residence is the subject property. This tax credit is provided to offset some of the cost for repair or replacement of a failed cesspool or septic system. The Department of Revenue has more information on the specifics of this credit. They can be reached at 617-887-6367 or at www.mass.gov/dor/individuals/filing-and-payment-information/guide-to-personal-income-tax/credits/table-of-credits.html.

6.2 BETTERMENT LOANS

The Clean Water State Revolving Fund

The Town may elect to enter a Loan Agreement with the Massachusetts Water Abatement Trust (MWAT) to help homeowners finance the repairs or upgrades required to bring failed or noncompliant systems into compliance with code. The decision to borrow monies must be certified through a Town Council vote requiring a 2/3 majority to proceed.

Once the decision to borrow monies has been authorized, the Town must submit its On-Site Wastewater Management Plan (this document) to the MassDEP for approval, and revise as the Department requires. Once the MassDEP has approved of the plan, the Town may enter a Loan Agreement with the MWAT, in which funds are allocated to the Town from the State Revolving Fund (SRF).

The SRF loan is offered at an effective 0% rate of interest (50% Grant Equivalency) from the Commonwealth to the Town. These funds are then disbursed to homeowners through the brokering of Betterment Loan Agreements with the BOH, pursuant to Massachusetts General Laws (M.G.L.) Chapter 111 §127B ½ (the "Betterment Law"). Betterment Loans are typically offered to qualifying homeowners at a 2-5% rate of interest. Up to 2.5% of the proceeds of the Trust loan may also be used to finance local administrative efforts or other costs of issuance related to the OSWMP. A grant in the amount of $20,000 is also available to help communities entering a CSMP for the first time cover administrative costs.

The Loan Agreement will provide a Final Disbursement Date by which all SRF loan funds must be expended, either through the financing of homeowner septic repairs or through administrative costs. The Town assumes full responsibility for repayment of borrowed monies to the Trust; however, the repayment obligation is secured through the Betterment Agreements with individual homeowners. For this reason, the Town's participation in this program should not result in the creation or increase of any municipal taxes.

No special provision authored by the Town is required to accept the "Betterment Law"; the majority vote mentioned above is required only to proceed with the decision to borrow SRF funds through a Loan Agreement with the MWAT.

Eligible Project Costs

Homeowners may use Betterment Loan funding to cover all costs associated with the repair or replacement of a failed system, either through renovations to an existing system, connection to an existing municipal sewer, or the upgrade of a conventional septic system to an alternative system pursuant to Title 5. Costs eligible for funding under this program include:

- Performing soil and percolation tests, and other necessary site analyses
- Specification of the failed system components to be repaired, replaced, and/or upgraded
- Design of the system or components to be repaired, replaced, and/or upgraded
- Obtaining all applicable federal, state, and local permits and approvals required to complete the work
- Seeking bids and awarding contracts for assessment, design, consulting, and construction work and materials in accordance with applicable laws, regulations, and requirements
- Minimizing any disruption of utility service, and reasonably restoring the property to as near its original condition as is practicable
- Engaging such other services and procuring such other materials as, within the reasonable discretion of the BOH, shall be necessary to complete the project in a good and workmanlike manner
- Professional services for project oversight and management

Other costs directly or indirectly related to the project may also be eligible. Before the commencement of the project, the owner/user and the BOH should define a scope of work. The BOH may choose to increase the loan sum provided in the event of unforeseen circumstances that arise during construction (such as the discovery of a boulder or ledge), provided that the additional work is reasonably related to the successful completion of the project.

Project Planning and Priority Lists

The BOH is responsible for informing homeowners of the availability of financial assistance to carry out required projects, and should begin doing so well in advance of the loan application period.

To begin the application process, the Town should first distribute preliminary loan applications in order to identify and prioritize owners/users requiring assistance. Note that due to funding limitations, only systems in higher priority areas within the Town are likely to receive initial funding. The BOH should estimate the number of septic systems that can be repaired with available program funds, and rank applications based on estimated threat to the public health or the environment. The criteria for ranking properties for assistance must be clearly communicated to homeowners well in advance of awarding of loans in order to avoid the appearance of arbitrariness. Lower ranked properties which cannot be offered betterment assistance due to budget limitations may be put on a waitlist which prioritizes them for future funding as it becomes available.

Loan applications should then be screened based on location relative to critical areas outlined in Section II-2. Properties known to pose an immediate threat to public health or the environment may also be afforded a higher priority. Failing systems posing equal risk to public health and the environment may be ranked on the basis of income and funding needs. Note that DEP approval is required prior to awarding of betterment loans to any individual or family with a gross taxable income in excess of $150,000. If not enough applications for properties within priority areas are received, the BOH may choose to extend the application deadline or award loans based on date of filing.

Once the application deadline has passed, the BOH can establish a Priority List based on the criteria above. The Priority List should include, at a minimum, the following information about each applicant:

- Name of applicant
- Address of applicant
- Presence within a Critical Area (Y/N). If yes, identify area ranking
- Type of project – repair/replacement of septic system, sewer hookup, etc.
- Estimated project cost/betterment amount

The remaining pool of lower-ranking projects beyond the available funding cutoff may be similarly ranked to create a waitlist which prioritizes them for funding as it becomes available.

The BOH must develop and maintain a timeline for the distribution of materials, submission and review of applications for betterment agreements, and distribution of betterment loan funding. Steps toward creating a group of projects to receive betterment loans can be as follows:

- Establish deadline for application
- Rank projects according to environmental/public health impact to create a priority list
- Apply level of funding to the list of projects to establish a cutoff on the priority list
- Reserve 10% for contingency
- Certify compliance with Title 5
- Create a waitlist from the remaining pool of applicants
- If a project or projects need be bypassed, use the waiting list to choose the next highest priority project

Establishment of Betterment Agreement

Once the Priority List is finalized, the BOH may begin to notify qualified homeowners that they have been approved for financial assistance, and offer to enter into Betterment Agreements with these owners. The offer should contain a strict deadline for a response, and also explain that, as a waiting list for assistance exists, the BOH should be notified immediately if the homeowner is no longer interested in obtaining a Betterment Loan. A "grace period" for responses may be included with the deadline such that otherwise qualified applicants are not denied funding due to unforeseen circumstances, such as illness or vacations.

If the response deadline expires without a Betterment Agreement being created, the homeowner must be notified in writing advising them that they have been moved from the priority list to the waiting list. After this notice, the priority list may be adjusted to advance one or more homeowners from the waiting list.

If the Betterment Agreement is accepted, copies of any relevant Betterment Documents must be provided to the homeowner. The BOH should be prepared to answer any and all questions the homeowner may have regarding what costs are available for funding, when and how money will be made available, and what documentation must be provided by the homeowner to satisfy program legal requirements. Prior to project commencement, the homeowner and the BOH must define a scope of work. The homeowner and BOH must also agree to abide by a timetable in order to ensure that Betterment Agreements are promptly executed, and that the betterment projects are completed in a timely fashion. Throughout the process, the BOH should review each form carefully to ensure that all pertinent information is provided by the homeowner pursuant to MassDEP requirements.

Elderly Deferrals

The BOH may also choose to enter into Deferral and Recovery Agreements (DRAs) with elderly homeowners who may require additional assistance to repay monies lent to complete a betterment project through a Betterment Loan Agreement. DRAs are made available through M.G.L. Chapter 80 §813B and allow eligible homeowners to postpone payment of the Betterment Loan provided that other provisions of the statute are complied with. Eligible homeowners include those qualified for a real estate tax exemption under M.G.L. Chapter 59 §5 clause 41A. Qualifications include:

Age and status

- Owner is single or, if married, the owner's spouse is not an owner. Owner must be 65 years or older by July 1 in the year in which application for the DRA is made, or;
- Owner and spouse are joint owners. Either spouse must be 65 years or older by July 1 in the year in which application for the DRA is made

Ownership and Occupancy

- Applicant must have owned and occupied as a domicile any real property in Massachusetts (including the present property) for a minimum of five (5) years. Massachusetts must have been the applicant's domicile for the preceding ten (10 years)

Gross Income

- Gross income from all sources in the calendar year proceeding the year in which the DRA application is made may not exceed \$20,000. The town may choose to adopt a higher maximum qualifying gross income amount, but such amount may not exceed \$40,000
- A surviving spouse inheriting the property must have occupied it or other real property in Massachusetts for five (5) years
- The surviving spouse who otherwise qualifies may continue to defer payment of the betterment, however the total apportioned and deferred betterment payments (and taxes if applicable), together with accrued interest, may not exceed fifty (50%) of the owner's interest in the assessed value of the property
- Anyone having a legal or beneficial interest in the property (including a lender holding a mortgage) must approve of the DRA. The DRA form contains a section for such a person or entity to sign off
- Payment of a deceased spouse's deferred betterment charges shall not be required during the life of a surviving spouse who inherits the property and who enters a DRA

Homeowner Repayment

In order to facilitate homeowner repayment of the betterment loans, the BOH must work together with the Town's municipal treasurer and/or accountant to set up an account for each betterment project. After all betterment loan funds have been disbursed to the homeowner, a final accounting of disbursed funds must be made. The BOH shall certify the total amount funded for the project to the municipal assessor; the assessor, in turn commits towards tax collection the total project amount.

Betterment payments may be spread over a period of up to 20 years and are assumable by the buyer of a property. To protect its ability to honor the Loan Agreement with the MWAT, the Town can require Betterment Loans to be repaid by the homeowner sooner than it is obligated to repay SRF monies. For example, if the Town takes its SRF loan for 20 years, it may choose to make Betterment Loans with homeowners over 10 years.

If a participating homeowner defaults on the payment of the betterment loan, the Town has a municipal lien on the property. Homeowner defaults will be charged an accrued interest rate of 14%, rising to 16% if a "taking" is required per state law for "delinquent" municipal charges.

Repayment of SRF Loan

The Town shall commence repayment of borrowed monies to the Trust approximately two years after the loan agreement is made. This enables the Town to accumulate at least one year of payments, together with interest, to cover unexpected defaults. The Town is only obligated to repay monies actually utilized to fund betterment projects. Interest accrued on the betterment loans used to finance these projects may be credited to a "receipt reserved" account to commit monies towards future project or administrative costs, provided that the management plan is reauthorized by the Town on an annual basis. Monies repaid to the Town as part of this program shall not be credited to the Town's General Fund account. The Town treasurer and accountant must prepare a quarterly report detailing current betterment loan activity as well as the anticipated funding of any additional projects in the next quarter.

APPENDICES

APPENDIX 1.1 – APPLICATION FOR DSCP

APPENDIX 1.2 – APPLICATION FOR SEPTIC HAULER PERMIT

APPENDIX 1.3 – APPLICATION FOR SEPTIC INSTALLER'S PERMIT

APPENDIX 2.1 – APPLICATION TO SCHEDULE SOIL TESTING

Manchester Board of Health
Application to Schedule Soil Testing

Please complete the soil test application below and return to the Board of Health along with a site map and the application fee. After receipt by the Board of Health it will be forwarded to our consulting engineers who will contact you directly to schedule an appointment.

Applicant Information

Name:
Address:
Phone Number:

Property Owner

Name:
Address:
Phone Number:

Engineer

Name:
Address:
Phone Number:

Property Data

Assessor's Map & Lot #:
Street Address:
Estimated Time to Complete Test:
Has Parcel Been Previously Tested?
Date of Prior Testing:

Utilities

Please provide the current dig safe number for this job:
Please initial here that you have contacted the Manchester Water Department at (978 526 4450)for a mark out:

Required Plans

All applications are to be accompanied by a subdivision, survey, or plot plan of the property to be tested.

Fee ***(as of January 2006)***
This fee is to be paid for each lot or parcel to be tested and allows the applicant up to 4 hours (one half day) morning or afternoon of test monitoring. The fee must be paid at the time the application is filed. *No telephone reservations will be accepted*.

New Construction: $385.00
Repair/Upgrade: $385.00

All applications are to be submitted (along with the applicable fee) to the Manchester Board of Health, Town Hall 10 Central Street, Manchester, MA 01944. Applicants will be contacted directly by our consultant, H.L. Graham Associates to schedule an appointment time.

Statement of Applicant
The above information is true and correct to the best of my knowledge. I accept full responsibility for the location of all testing and for access to the test sites over all lands, pubic or private. I further hold the Town and its employees and consultants harmless for any damage to public or private property and/or utilities that might occur as a result of the testing operation. I and/or my engineer shall comply with the State Title V and the Manchester Addenda to Title V and their procedures for soil testing.

______________________________ ______________

Signature of Applicant Date

APPENDIX 2.2 – SEPTIC SYSTEM CERITIFICATION FORM

APPENDIX 2.3 – PLAN REVIEW CHECKLIST

APPENDIX 2.4 – SEPTIC SYSTEM ABANDONMENT FORM

K. Manchester-by-the-Sea, Massachusetts CREAT Exercise Report

MANCHESTER-BY-THE-SEA, MASSACHUSETTS

July 6, 2015

EXECUTIVE SUMMARY

Manchester-by-the-Sea, Massachusetts provides drinking water and wastewater services to residents, tourists, and local businesses. The wastewater treatment plant (WWTP) is permitted to discharge up to 0.67 million gallons per day (MGD) as a monthly daily average for coastal resources protection, and is designed for 5 MGD of capacity for wet weather flow.

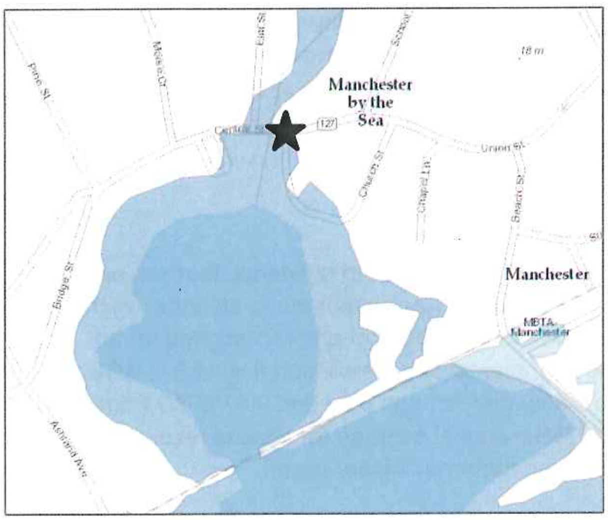


Figure 1. FEMA 100- and 500-year floodplain for area near Manchester-by-the-Sea

From November 2014 to June 2015, Manchester-by-the-Sea engaged in a series of webinars and an in-person meeting to conduct a climate risk assessment using the U.S. Environmental Protection Agency's (EPA) Climate Resilience Evaluation and Awareness Tool (CREAT). The risk assessment considered the impact of intense precipitation events and coastal storm surge in 2035 and sea level rise in 2060 on their WWTP. Manchester-by-the-Sea assessed their threats with warmer and wetter future conditions. With the implementation of potential adaptive measures, including constructing sea walls and asset relocation, Manchester-by-the-Sea found they could reduce all potential consequences of future coastal storm surge events and intense precipitation events to their headworks building from 'Very High' to 'Low', while the consequences from sea level rise itself in the 2060 time period were 'Low.' See **Table 1** for a summary of climate data that was used in the CREAT assessment.

Table 1: CREAT-Provided Data for Manchester-by-the-Sea

CLIMATE VARIABLE	HISTORICAL VALUES	CREAT PROJECTED VALUES (WARM AND WET MODEL PROJECTION	TIME PERIOD
Average Annual Temperature	48.92 degrees Fahrenheit	51.12 degrees Fahrenheit	2035
Total Annual Precipitation	47.05 inches	50.05 inches	2035
100-Year Storm	6.54 inches	6.91 inches	2035
Sea Level Rise	N/A	19.78 inches	2060

Manchester-by-the-Sea will continue to evaluate and compare the costs and benefits of constructing a sea wall on Manchester Harbor and implementing other adaptive measures to protect the WWTP, including relocating the WWTP to a new location on higher ground to avoid damage from coastal storm surge. While continuing to identify and reduce inflow and infiltration (I&I), the City has identified additional potential measures to control wet weather flows and bolster operations that reduce the risks associated with more frequent and intense rainfall events.

BACKGROUND

Manchester-by-the-Sea, Massachusetts provides drinking water and wastewater services to residents, tourists, and local businesses. This exercise focused on wastewater operations. The utility has three wastewater pump stations which are not expected to be threatened by storm surge. The WWTP is located at Manchester Harbor and is designed for an average daily flow of 1.2 MGD, a maximum daily flow of 3.0 MGD and an instantaneous maximum flow of 5.0 MGD. The WWTP is permitted to discharge a monthly average of 1.2 MGD from December through May and 0.67 MGD from June through November. It also has an Ocean Sanctuaries Act Limit of 0.67 MGD annual average for coastal resources protection. The WWTP has an 8,900 foot outfall that discharges outside the harbor at Misery Island.

The sanitary collection system serves about half of the community, but has a high rate of I&I during heavy precipitation events, therefore the WWTP was designed for a 5 MGD wet weather capacity. The WWTP is not permitted to bypass wastewater treatment, even during heavy flows. This capacity can become an issue in dry weather when the utility has difficulty pumping low flows through the treatment processes.

Increased influent flow and I&I issues during extreme precipitation events and facility inundation due to coastal storm surge/sea level rise are of concern. The utility has experienced a number of intense precipitation events in the past; during 2014, the area saw 7 inches of rain fall in a 24-hour period. The City is currently performing condition assessments to identify and eliminate

Figure 2. *Manchester-by-the-Sea WWTP*

I&I, although budget constraints have restricted the amount of work which may be completed. The City is planning on spending $1M on I&I reduction over the next two years. The work will continue for a number of years to eventually reduce I&I with an affordable schedule.

Most of the WWTP is located within the 100- and 500-year FEMA floodplains. The headworks building is at a high risk of flooding because it is entirely in the floodplain, with entrances at grade. The headworks building houses non-submersible influent and effluent pumps below grade that would be inoperable if flood waters entered the structure. There are no sump pumps in the headworks building and the utility currently experiences seepage problems in the structure. Chemicals are also stored in the headworks building at grade, which is at risk of flooding. The parking lot adjacent to the WWTP has flooded during king tides and storm surges in the past and damaged meters and electrical conduits in service manholes. During extreme flooding events, the headworks building is at a primary risk of being flooded, which would leave the WWTP inoperable for some time. The WWTP has a backup generator that could provide power to the facility for about 10 days at 40% capacity.

Climate resiliency planning is being conducted for Manchester-by-the-Sea by Tighe & Bond, who have started to evaluate the potential impacts of storm surge and sea level rise on their infrastructure. Thus far, they have only completed coastal mapping using GIS showing what areas would be inundated with higher sea levels.

ASSESSMENT

Exercise Process

From November 2014 to June 2015, Manchester-by-the-Sea participated in a series of calls, webinars and one in-person event to guide them through a climate change risk assessment process. To better understand the vulnerability of their wastewater infrastructure and operations, Manchester-by-the-Sea assessed potential climate change impacts using the U.S. Environmental Protection Agency's (EPA) Climate Resilience Evaluation and Awareness Tool (CREAT)[1]. The assessment brought together individuals from various departments within Manchester-by-the-Sea, state agencies, local environmental organizations, and EPA Region 1 staff to think critically about potential climate impacts, priority assets and possible adaptation measures **(Appendix A)**. At the time of the assessment, Manchester-by-the-Sea was developing a Comprehensive Wastewater Management Plan, which would capture activities and plans for the next 20 years. Manchester-by-the-Sea is interested in using the results of the CREAT analysis to inform the development of the plan, as well as support grant or loan applications in the future to reduce the risk of flooding.

CREAT Analysis and Results

CREAT provides climate data within a risk assessment framework to help utilities understand climate change, assess risks, and evaluate adaptation measures. Leveraging the available information, several potential impacts of a changing climate were discussed including: higher wet weather flows at the WWTP due to increased precipitation, and WWTP flooding due to coastal storm surge and sea level rise. For assessment purposes, Manchester-by-the-Sea elected to focus on their critical asset at the WWTP, the headworks building. If the headworks building were to be inundated, the entire WWTP would be taken offline for an extended period of time.

Within CREAT, users can consider scenarios of projected changes in climate to assess consequences to their assets from climate-related threats. The three projected climate scenarios available in CREAT capture the range in potential future conditions at any given location within the US, based on Global Climate Model (GCM) calculations. While all models project warming, the anticipated changes in precipitation vary, with some forecasting wetter conditions and others

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[1] EPA Climate Resilience Evaluation and Awareness Tool, available at: http://water.epa.gov/infrastructure/watersecurity/climate/creat.cfm

projecting drier conditions. Manchester-by-the-Sea used the CREAT-provided 'warm and wet' climate scenarios in their assessment (**Table 2**), focusing on the 2035 time period for the precipitation and flooding threats, and 2060 for the sea level rise threat. In the warm and wet scenario, total annual precipitation is projected to be 50.05 inches (6.39% increase) for 2035, and the 100-year storm is 6.91 inches of rain in a 24-hour period (5.77% increase) for 2035. A 'high' sea level rise curve was selected (1.5 meters of sea level rise by 2100), resulting in 19.78 inches of sea level rise in 2060. For more information on Manchester-by-the-Sea climate data, see **Appendix B**.

Table 2: Manchester-by-the-Sea Data Sources

CLIMATE PROJECTION	DATA
Warm/Wet Projected Climate Scenario	Warm/wet scenario in CREAT (Meteorological Institute Coupled Ocean-Atmosphere General Circulation Model, Meteorological Research Institute (Japan))
Sea Level Rise	High sea level rise curve (1.5 meters by 2100) 2035: 6.43 inches 2060: 19.78 inches

Manchester-by-the-Sea also reviewed data available in EPA's Storm Surge Inundation and Hurricane Frequency Map[2] to understand flooding threats and potential storm surge concerns. Selected threats were defined based on the available climate data, as shown in **Table 3**.

Table 3: Manchester-by-the-Sea Threat Definitions

THREAT NAME	THREAT DEFINITION	TIME PERIOD
Coastal Storm Surge	WWTP is inundated (king tides can reach 13.5 feet), additional 7 inches of sea level rise	2035
High Flow Events	Conditions similar to 2014 rain event of 7 inches of rain in a 24-hour period, occurring with increased frequency	2035
Sea Level Rise	20 inches of sea level rise, no storm surge considerations	2060

In general, risk assessments facilitate an evaluation of potential threats or hazards in terms of the likelihood of their occurrence and the consequences should they occur. Based on the likelihood that the rainfall, flooding and sea level rise threats will be realized during the selected time periods, Manchester-by-the-Sea elected to use the conditional likelihood setting within their CREAT analysis. This setting enabled them to consider the threat as occurring and to focus on how effective potential adaptation options would be at reducing consequences. The risk assessment framework in CREAT guides users through baseline and resilience analyses to gauge the potential future vulnerabilities of utility assets with and

[2] EPA Storm Surge Inundation and Hurricane Strike Frequency Map available at http://water.epa.gov/infrastructure/watersecurity/climate/stormsurge.cfm

without adaptation options. The baseline analysis includes current or existing actions only, while the resilience analysis includes additional potential adaptive actions.

To assess the level of consequence, CREAT provides a consequence matrix of five categories that capture the range of impacts a utility may experience. These include utility business impacts, utility equipment impacts, source and receiving water impacts, environmental impacts and community/public health impacts (**Appendix C**). Within each of these categories, Manchester-by-the-Sea assessed the impacts on a four-point qualitative scale from Low to Very High. CREAT combines these assessments to calculate an overall consequence risk level for each analysis.

Within their risk analysis, Manchester-by-the-Sea first performed a baseline assessment of the potential consequences of flooding from heavy precipitation events, flooding from coastal storm surges, and sea level rise to their infrastructure and operations given the adaptive measures currently employed. For the assessment of each of these potential threats, Manchester-by-the-Sea considered how the potential adaptive measures would help to lower consequence risks in a resilience analysis.

For coastal storm surge in 2035, Manchester-by-the-Sea compared the amount of consequence reduction and cost effectiveness of building a sea wall and several other potential measures as opposed to relocating the WWTP. Given the capabilities of the selected potential adaptive measures, Manchester-by-the-Sea was able to lower all potential consequences from 'Very High' to 'Low' for the flooding assessments. The sea wall and WWTP relocation would provide the same amount of consequence reduction, but cost and other external factors differ. See **Table 4** for the baseline and resilience assessment results. Baseline results illustrate the consequences the utility would expect to experience if the threat occurred, considering the utility's current capabilities. Resilience results reflect new levels of consequences if the same threat occurred, but considering additional capabilities of potential adaptation options that could reduce consequences. Details on level definitions are provided in **Appendix C.**

Table 4. Manchester-by-the-Sea Baseline and Resilience Analysis Results for the Headworks Building/Coastal Storm Surge Assessment, Considering Either a Sea Wall or WWTP Relocation (2035 time period)

ANALYSIS	Utility Business Impacts	Utility Equipment Damages	Source/ Receiving Water Impacts	Environmental Impacts	Community/ Public Health Impacts
Baseline – Warm and wet model projection	LOW	VERY HIGH	VERY HIGH	VERY HIGH	VERY HIGH
Resilience – Warm and wet model projection	LOW	LOW	MEDIUM	MEDIUM	MEDIUM

For high flow events in 2035, current condition assessment work is being performed to identify and reduce I&I, but that alone will not entirely address the potential threat to the WWTP equipment, operations, permit compliance, and surface waters uses should influent flows exceed the WWTP capacity. Potential adaptive measures were added to better control runoff, reduce I&I and protect the WWTP assets, which reduced the consequence level to 'Low'. See **Table 5** for the baseline and resilience assessment results.

Table 5. Manchester-by-the-Sea Baseline and Resilience Analysis Results for the Headworks building/High flow events assessment (2035 time period)

ANALYSIS	Utility Business Impacts	Utility Equipment Damages	Source/ Receiving Water Impacts	Environmental Impacts	Community/ Public Health Impacts
Baseline – Warm and wet model projection	LOW	VERY HIGH	HIGH	HIGH	HIGH
Resilience – Warm and wet model projection	LOW	LOW	LOW	LOW	LOW

Even considering the high rate of sea level rise, the utility expected to experience a 'Low' level of consequences when considering current capabilities with the impacts of sea level rise and related wave action. Higher high tides and king tides would occur more frequently and flood the parking lot adjacent to the WWTP. With the anticipated wave action and projected sea level rise, sea water may flood service manholes and enter the headworks building, resulting in some short-term damage to pumps and electrical controls. Several potential adaptation measures are expected to reduce consequences from this impact. See **Table 6** for the baseline and resilience assessment results.

Table 6. Manchester-by-the-Sea Baseline and Resilience Analysis Results for the Headworks building/Sea level rise assessment (2060 time period)

ANALYSIS	Utility Business Impacts	Utility Equipment Damages	Source/ Receiving Water Impacts	Environmental Impacts	Community/ Public Health Impacts
Baseline – Warm and wet model projection	LOW	MEDIUM	LOW	LOW	LOW
Resilience – Warm and wet model projection	LOW	LOW	LOW	LOW	LOW

NEXT STEPS

Based on the results of the analysis of the storm surge threat, Manchester-by-the-Sea is comparing the costs and benefits of constructing a sea wall on Manchester Harbor to protect the WWTP, or relocating the WWTP to a new location on higher ground to avoid damage from coastal storm surge. More data is needed to determine the height of the sea wall needed to protect the WWTP, but the utility was encouraged to use the 100-year flood level plus 2 feet of freeboard, with an additional safety factor incorporated to account for projected sea level rise.

Manchester-by-the-Sea will also expand current I&I reduction measures, increase community outreach, and join the mutual aid network, Massachusetts Water/Wastewater Agency Response Network (MAWARN)[3].

[3] More information on MAWARN available at http://www.mawarn.org/.

APPENDIX A: EXERCISE PARTICIPANTS

NAME	CONTACT INFORMATION	AFFILIATION
Greg Federspiel	federspielg@manchester.ma.us	Manchester-by-the-Sea, MA
Carol Murray	murrayc@manchester.ma.us	Manchester-by-the-Sea, MA
Mary Reilly	reillym@manchester.ma.us	Manchester-by-the-Sea, MA
John Sibbalds	sibbaldsj@manchester.ma.us	Manchester-by-the-Sea, MA
Barbara Warren	barbara.warren@salemsound.org	Salem Sound Mass bays Program
Kristin Divris	kristin.divris@state.ma.us	Massachusetts Department of Environmental Protection
Curt Baranowski	Baranowski.curt@epa.gov	EPA Headquarters
Jane Downing	Downing.Jane@epa.gov	EPA Region 1
Lynn Gilleland	Gilleland.Lynn@epa.gov	EPA Region 1
Regina Lyons	Lyons.Regina@epa.gov	EPA Region 1
Gina Snyder	Snyder.Gina@epa.gov	EPA Region 1
Ivy Milsna	Milsna.Ivy@epa.gov	EPA Region 1 Fellow
Laura Dubin	Dubin.laura@epa.gov	EPA ORISE
Mike Maier	Maier.michael@epa.gov	EPA ORISE
Bill McMillin	McMillin.William@CH2M.com	CH2M
Susan Butler	Butler.Susan@CH2M.com	CH2M
Steve Fries	jfries3@csc.com	CSC
Amy Posner	aposner@csc.com	CSC
Ashley Stevenson	abrosius@csc.com	CSC
Elise Tao	jtao2@csc.com	CSC

APPENDIX B: CLIMATE DATA

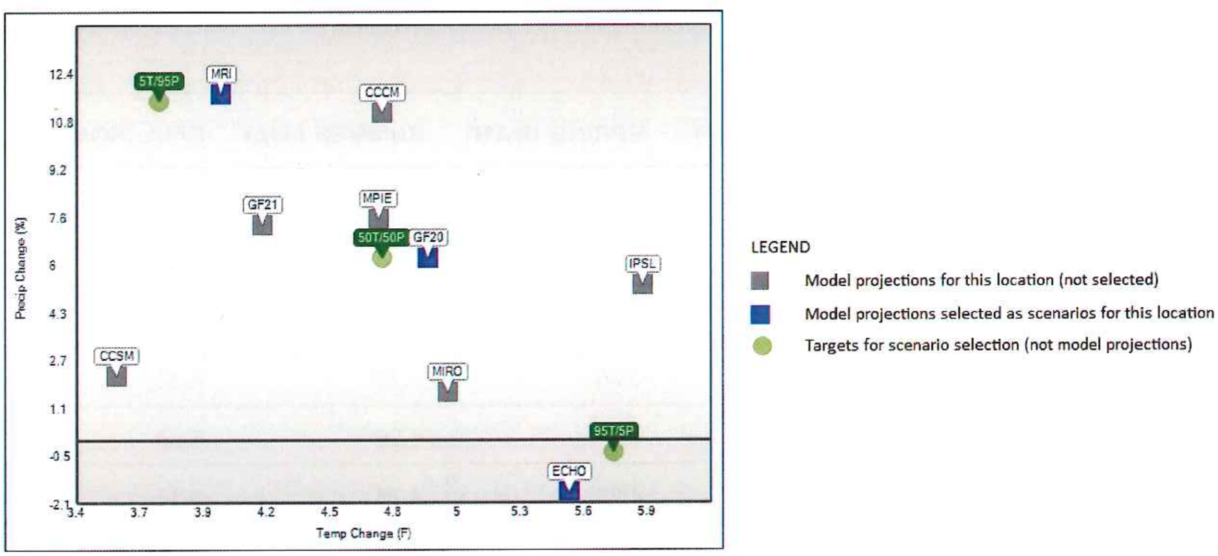
Climate Model Selection for Manchester-by-the-Sea

The scatter plot of model run results below provides a visual of how the CREAT-provided scenarios were selected. Each point represents the projected changes in average annual temperature and total annual precipitation in 2060 for the ½ degree cell containing Manchester-by-the-Sea, Massachusetts. For each scenario, the selected model was used to generate monthly changes in average conditions as well as the changes in intense precipitation event magnitudes on annual and seasonal bases.

Model projections for changes in average annual conditions for the 2060 time period were considered to evaluate the distribution of possible future conditions and to select three models that best describe the range of projections. This selection was based on finding the specific model that projected a change in conditions nearest to three statistical targets, each indicative of certain projected changes. The three scenarios provided in CREAT are called:

- **Hot and dry model projection** – model nearest the 5th percentile of precipitation and 95th percentile of temperature projections (larger increase in temperature with lower total precipitation)
- **Central model projection** – model nearest the 50th percentile of both precipitation and temperature projections (central condition, among models, for temperature and total precipitation)
- **Warm and wet model projection** – model nearest the 95th percentile of precipitation and 5th percentile of temperature projections (smaller increase in temperature with larger total precipitation)

The terms dry and wet are used here relative to the range of total precipitation projected for this location in 2060 time period. For example, dry does not always indicate a reduction in total precipitation relative to today; dry simply indicates projected total precipitation on the lower end of distribution of projected precipitation. A horizontal line on the plot indicates no projected change in precipitation (i.e., 0%) to help distinguish those models projecting increases in annual total precipitation from those projecting decreases.



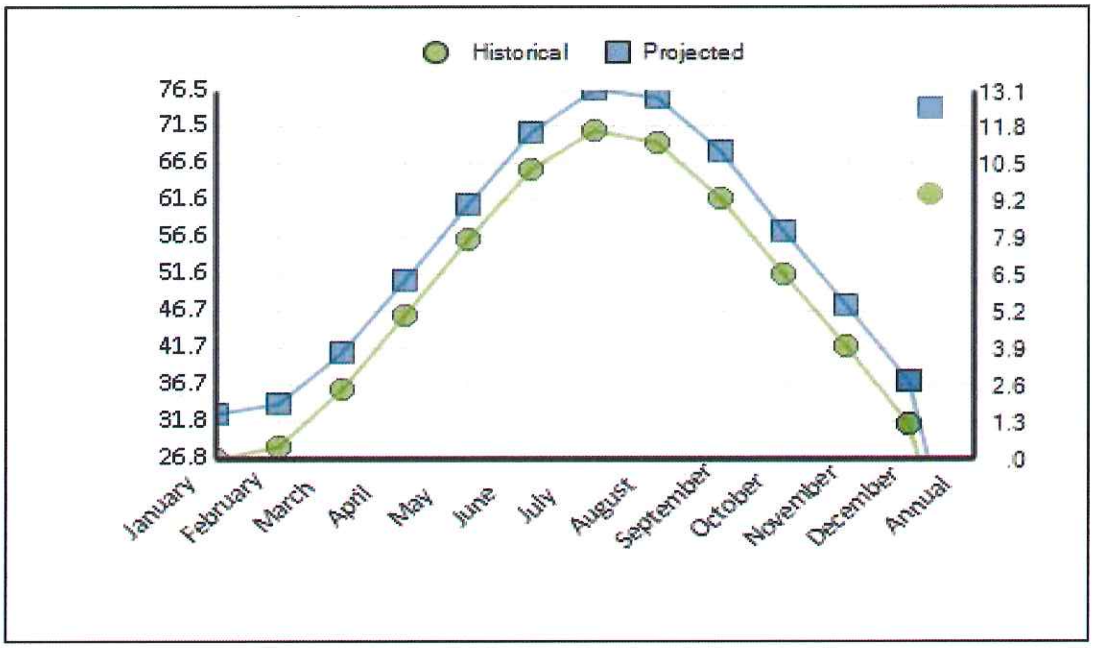
Warm and Wet Model Projection: Projected Climate Conditions for the Year 2035 in Manchester-by-the-Sea, Massachusetts

AVERAGE TEMPERATURE DATA (°F)		TOTAL PRECIPITATION DATA (INCHES)	
ANNUAL	51.12	ANNUAL	50.05
JAN	29.88	JAN	4.97
FEB	30.78	FEB	3.76
MAR	38.26	MAR	4.46
APR	47.97	APR	4.45
MAY	58.73	MAY	3.66
JUN	68.00	JUN	3.49
JUL	72.90	JUL	3.47
AUG	71.60	AUG	3.45
SEP	63.82	SEP	4.34
OCT	53.65	OCT	4.34
NOV	44.08	NOV	5.23
DEC	33.62	DEC	4.42

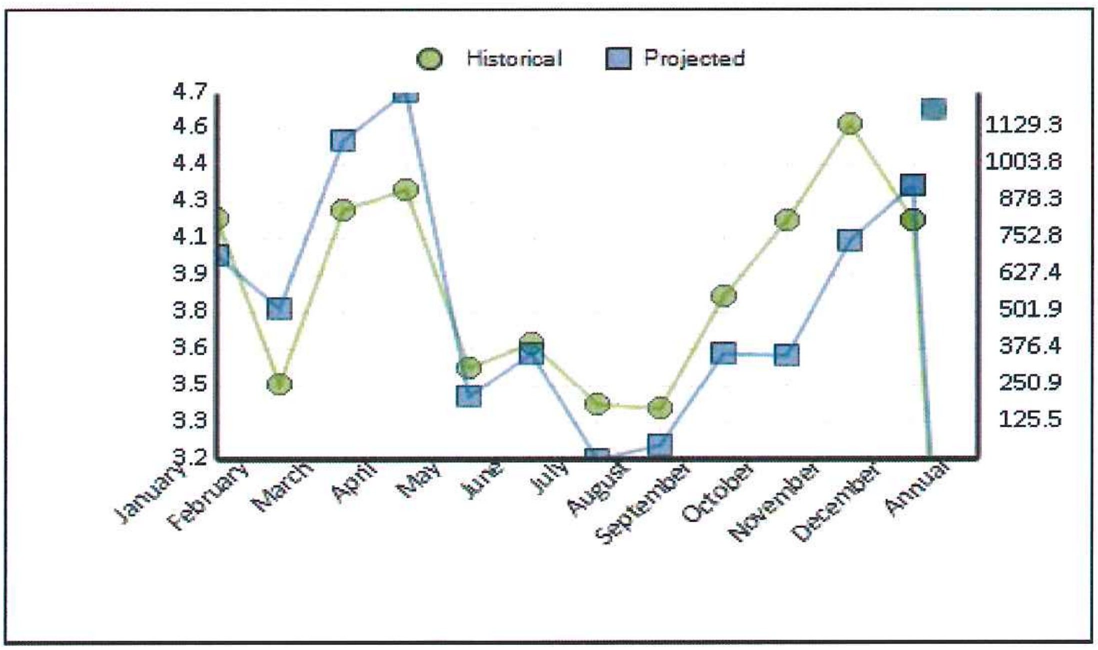
Total Precipitation (inches) During 24-Hour Event

RETURN INTERVAL	ANNUAL	WINTER (DJF)	SPRING (MAM)	SUMMER (JJA)	FALL (SON)
5-YEAR	3.71	2.50	2.50	2.46	3.13
10-YEAR	4.37	2.91	3.04	2.95	3.74
15-YEAR	4.78	3.16	3.33	3.24	4.11
30-YEAR	5.49	3.53	3.86	3.78	4.82
50-YEAR	6.07	3.83	4.24	4.20	5.36
100-YEAR	6.91	4.21	4.83	4.75	6.16

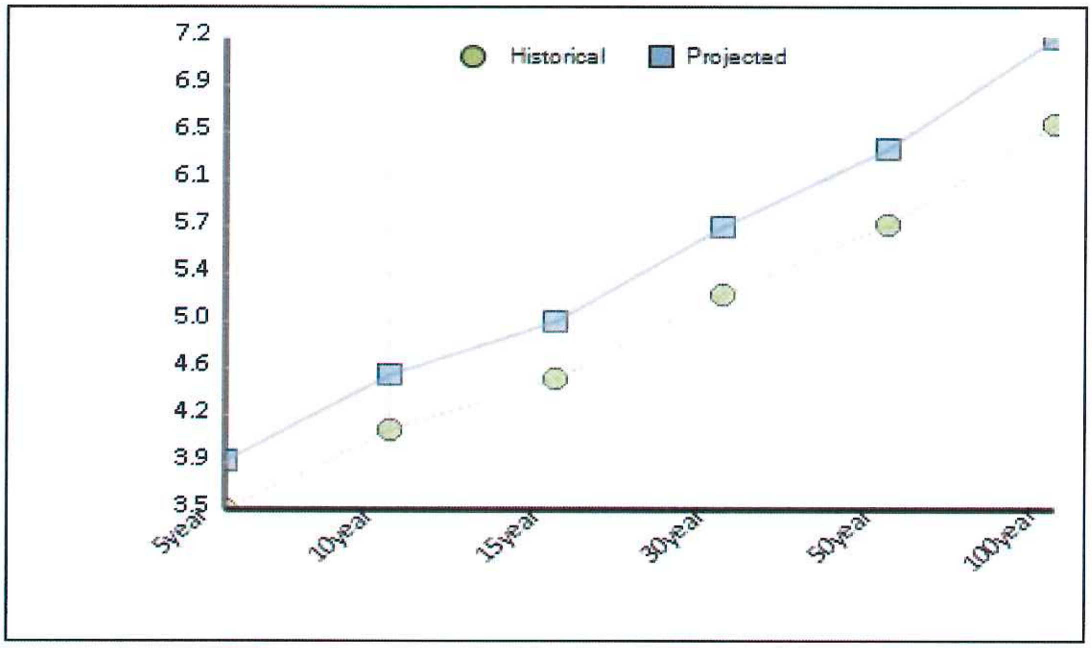
Average Temperature



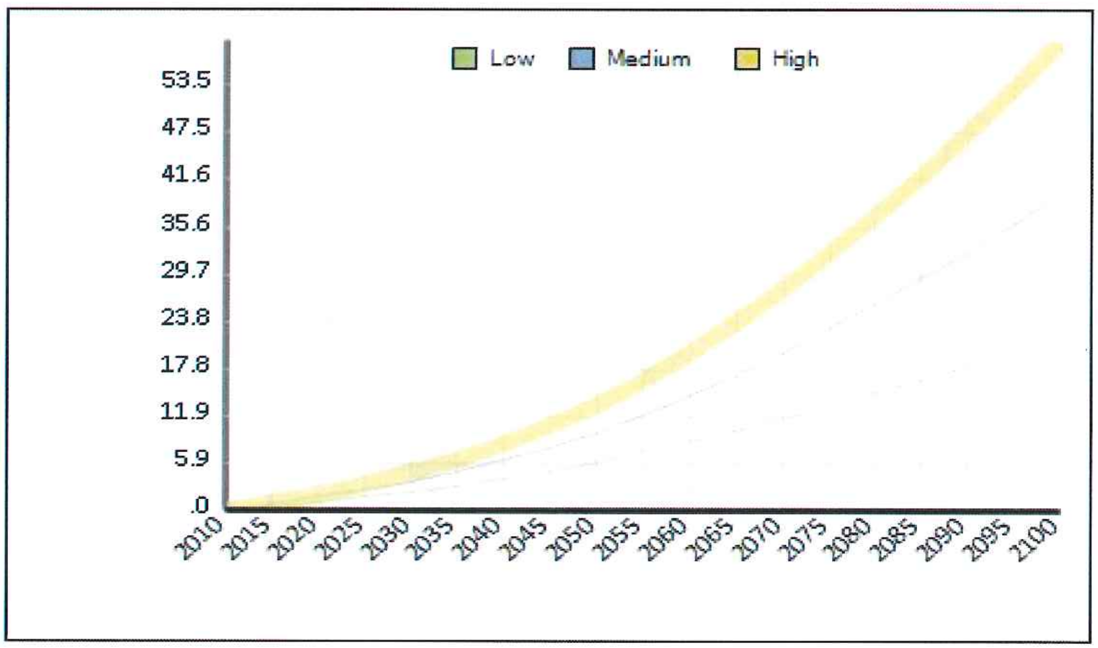
Total Precipitation



24-h Event Precipitation for 2060



Sea Level Rise



APPENDIX C: CONSEQUENCE CATEGORIES AND LEVEL DESCRIPTIONS

Title	Utility Business Impacts	Utility Equipment Damage	Source/ Receiving Water Impacts	Environmental Impacts	Community Public Health Impacts
Description	Revenue or operating income loss evaluated in terms of magnitude and recurrence of service interruptions	Costs of replacing the service equivalent provided by a utility or piece of equipment evaluated in terms of magnitude of damage (minimal, minor, significant, complete loss) and financial impacts (flexible cost scale, "$x," can be customized by each user)	Degradation or loss of source water or receiving water quality and/or quantity, evaluated in terms of recurrence (minimal, temporary, seasonal or episodic, long-term)	Evaluated in terms of environmental damage or loss (aside from source water or other assets) and compliance with environmental regulations (minimal, short term, persistent/permit violations significant impact and/or regulatory enforcement and actions)	Evaluated in terms of duration (short- or long-term) and extent (minimal, minor, localized, or widespread)
Very High	Long-term and/or significant loss of expected revenue or operating income	Complete loss of asset; replacement costs of $x++	Long-term compromise of source water quality and/or quantity	Significant environmental damage — may incur regulatory action	Long-term and/or widespread public health impacts
High	Seasonal or episodic — but minor — compromise of expected revenue or operating income	Significant damage to equipment; costs estimated at <$x+	Seasonal or episodic compromise of source water quality and/or quantity	Persistent environmental damage — may incur regulatory action	Short-term and localized public health impacts
Medium	Minor and short-term reductions in expected revenue or operating income	Minor damage to equipment; costs estimated at <$x	Temporary impact on source water quality and/or quantity	Short-term environmental damage, compliance can be quickly restored	Minor public health impacts
Low	Minimal potential for any attributable loss of revenue or operating income	Minimal damage to equipment	No more than minimal changes to source water quality and/or quantity	No impact or environmental damage	No impact on public health
Weight	20	20	20	20	20

L. Decentralized Neighborhood Wastewater Treatment

APPLICATION COVER SHEET AND STATEMENT OF OTHER FUNDING SOURCES

Please fill out the following cover sheet and attach it as the first page of the Application. Please do not leave any sections blank. Indicate "N/A" where applicable.

Title of Project	Decentralized Neighborhood Wastewater Treatment System in Manchester-by-the-Sea, MA
Lead Organization Name (as shown on your income tax return) Center for Urban Watershed Renewal	
Lead Organization Business Name, if different than above	
Lead Organization Address (number, street, apt. or suite no., city, state and ZIP) 18 Commercial Street, Salem, MA 01970	
Lead Organization Main Contact/s for the purpose of this Application (name, title, phone and email. Include address if different than above) Wendi Goldsmith, CPG, CPSSc, 978-224-3107	
Application Team (Please indicate each member of the Application Team and include a contact name & address):	
Brief statement of project, partners, grant request, cost share and goals for use by CEC communications staff for Program publicity (no more than three sentences). This project, if funded, will provide a unique opportunity for collaboration between CUWR, subcontractors, residents of Manchester-By-the-Sea, and the State of Massachusetts. While the technology proposed for this site has already been proven effective, it has never been implemented at this scale and in such a way as to alleviate the effect of failing individual septic systems on a coastal marine environment and help homeowners reduce their septic costs.	
Statement of other funding sources (fill in tables below or indicate if not applicable)	

Statement of Other Funding Sources

The goal of requesting a statement of other funding sources is to understand the funding either already committed or sought for the proposed project. For the purposes of the Application, please note only funding that is for related work on the same technology or concept; that is, work that is a subtask of the proposed project, or work to which the proposed project contributes.

Please indicate below as part of this cover sheet whether the Lead applicant or any other member of the Applicant Team has:

Decentralized Neighborhood Wastewater Treatment System in Manchester-by-the-Sea, MA

MassCEC Demonstration Project Pilot Program Concept Paper Application

11/20/2014

Table of Contents

INTRODUCTION

Wastewater and drinking water systems add over 45 million tons of greenhouse gases to the atmosphere every year. In the U.S., these systems account for of 3-4 percent of total national energy use. In municipalities, over one third of total energy is consumed by wastewater and drinking water treatment facilities.[1]
While individual residential septic systems require almost no operating energy, they require appropriate ground conditions, substantial acreage and have the following energy and environmental drawbacks:

- EPA recommends yearly septic inspections of residential septic systems for sludge build up[1]. A schedule of pumping every 1 to 3 years is also recommended to prevent system degradation. Homeowners often do not follow this pumping schedule resulting in excessive build of solids in the tank. This can cause partial or complete septic system failure, resulting in surface-level pollution and costly repair action.
- Pumped sludge must be processed in cesspools or municipal sewage systems.
- Conventional septic systems, even when in perfect functioning condition, are not designed to treat for or reduce nutrients from residential wastewater, including nitrogen and phosphorus, which are primary pollutants in both freshwater and marine environments.
- Failed septic systems or inadequate site conditions often contaminate groundwater and/or surface water.

The proposed neighborhood cluster system has the following general benefits:

- The system can handle 5000 gpd and similar cluster systems can accommodate flows ranging from 200 gpd to 100,000 gpd, making it a widely replicable pilot project.
- The system requires no management from homeowners.
- System requires very low life cycle and operation and maintenance costs.
- Effluent will be used for drip irrigation and the treated wastewater will be returned to the water table.
- One neighborhood system is much more energy efficient than individual systems.

Many of the residences on Raymond Street and Sandpiper Lane in Manchester-by-the-Sea, MA have failing septic systems. Leakage is causing high levels of bacteria in the surface and groundwater and contributing to beach closings at the nearby shorefront. The replacement of these systems has been costing upwards of $50,000 for nearby individual households in recent years. Treatment of the wastewater at the centralized treatment facility in town is not an option because it is too costly to build the infrastructure necessary to pump the water from the homes. Additionally, the centralized system in Manchester-by-the-Sea is already operating at the 0.67 million gallons per day capacity enforced by the Ocean Sanctuaries Act.[2]

Cluster systems present a middle ground between private individual septic systems and town-wide centralized sewer collection and treatment. The Center for Urban Watershed Renewal (CUWR) and its subcontractor Mill River Consulting propose an on-site cluster wastewater treatment system at the neighborhood scale. It is the perfect alternative to the high costs of installing new or repairing individual septic systems and the high operational energy costs of a sewer line to the neighborhood. While the cluster wastewater treatment system suggested will cost more to design and build than an individual septic system, it will have low O&M and will be able to treat many homes, thus sharing the expenses, reducing per-home cost substantially, and saving energy. The proposed system also faces the extra costs of education and documentation as it is unfamiliar to the community and local regulatory boards who are receptive, but not yet ready to embrace a new technology without a tangible demonstration. Unlike the option to treat sewage at the existing central facility, the neighborhood system will return the cleaned water to the local water table, which has positive climate cooling implications as well as helps to prevent conditions in which seawater is known to intrude into fresh groundwater. This can represent both a climate mitigation and adaptation strategy for coastal communities.

Support from MassCEC will be invaluable in establishing a pilot and marketing this innovative solution. While the technologies employed by the project are not novel, to the best of our knowledge they have never been used

[1]http://water.epa.gov/infrastructure/sustain/energyefficiency.cfm
[2]http://www.manchester.ma.us/pages/manchesterma_sewer/Index

as a retrofit solution in Massachusetts. As this is the first demonstration of a retrofit solution, there are perceived risks such as permitting, as well as homeowner and Town reluctance. A solid pilot with well-publicized results should lower the permitting confusion and homeowner and Town reluctance risks substantially. With the help of organizations such as Clean Water Fund, the project will receive the publicity it needs to become widely known as an example of an established, energy-efficient neighborhood wastewater treatment system. As seen in Attachment D, several organizations are supportive of the project and its goals. In-kind services have been offered in the form of equipment, technology support, and public outreach.

Coastal communities like Manchester-by-the-Sea and others especially on the Cape are in need of energy-efficient alternatives to individual septic systems and centralized waste treatment facilities. The residences on Raymond Street and Sandpiper Lane have small lot sizes, high water tables, and shallow underlying bedrock, which all pose a challenge to the traditional septic system design and installation.Mill River Consulting has completed a feasibility study of the neighborhood and found that the lot at 34 Raymond Street is large enough for a 36 bedroom capacity system that will collect wastewater from individual houses, treat it using state-of-the-art technologies, and remove more nutrients, pathogens and pollutants than is possible with a traditional individual system. The treated water will be reused for subsurface drip irrigation, contributing to the overall sustainability of the project.

The system at 34 Raymond Street will be a model for sustainable, small-scale wastewater treatment systems in Massachusetts. While the scope of this project is novel and innovative, there is little risk; the Town of Manchester-by-the-Sea has been supportive of the project and included in all aspects of the feasibility study. Additionally, the local Board of Health, Conservation Commission, Department of Public Works, Town Manager and the Massachusetts Department of Environmental Protection have been consulted, and all are in favor of the project. Once complete, this private, neighborhood scale system could be turned over to the Town of Manchester-by-the-Sea for management, as an option. The system could then be replicated in other areas of the Town with failing septic systems. Elsewhere in the state, especially on Cape Cod where water quality violations and litigation are forcing large scale corrective action, the project can serve as a model that balances environmental benefits with energy and water conservation.

INSTALLATION PLAN

The neighborhood wastewater treatment system proposed will have a capacity of 36 bedrooms. It will be located at 34 Raymond Street, Manchester-by-the-Sea, MA 01944. The lot has an area of 0.406 acres. The Flow Equalizer Tank (FET) and the Bioclere unit are underground elements that will be located in the front left portion of the lot. These elements will occupy a combined area of approximately 186 SF and will maintain the final grade at the existing surface elevation of 12.0 ft (NGVD). The proposed drip dispersal field will extend within an area of approximately 3,000 SF which will be located within the existing backyard at an elevation that varies from 11.0 ft to 12.0 ft (NGVD). Potential exists to expand the capacity of the system to address up to 50 bedrooms at a future phase by increasing the dispersal field and adding homes and collection system elements.

As shown in the following schedule, the feasibility phase of the project has already been completed, with initial engineering and community coordination complete. Once grant funding is secured, the project can begin immediately upon notice to proceed in June 2015. Final design can be completed and permits secured during the 3rd quarter 2015. Construction should last two to four months, in early winter 2015, and will be fully completed prior to the end of Quarter 1 2016.

Schedule for Design & Construction of Neighborhood Septic System at 34 Raymond Street, Manchester-by-the-Sea, MA

FINAL DESIGN PHASE	Quarter 2 2015
Collection System	
Treatment System	
Dispersal Field System	
Board of Health and Department of Environmental Protection Permit Application	
Notice of Intent Application	
Board of Health Hearing	
Conservation Commission Hearing	
BIDDING PHASE	Quarter 3 2015
Prepare Bid Documents	
Select Contractor	
CONSTRUCTION PHASE	
Installation Permits	
Dispersal Field System	
Treatment Unit	
Collection Pipe	
Operations Manual	Quarter 4 2015
Decommission at Each Dwelling	Quarter 1 2016
Compile As-Built Plans	
Oversee System Start-Up	

TECHNOLOGY DESCRIPTION

The wastewater treatment system proposed will employ the Bioclere system by AquaPoint, a Massachusetts based firm headquartered in New Bedford. The Bioclere is a modified trickling filter over a clarifier. It is designed to handle irregular flows with changeable organic and nutrient concentrations. The Bioclere treatment system at 34 Raymond Street will follow STEP (Septic Tank Effluent Pumped) collection. Wastewater influent flows into a primary tank located at each dwelling. After the solids are settled and partially digested, effluent from the septic tank streams into a Flow Equalizer Tank (FET) located on the 34 Raymond Street lot. The effluent from the FET is forced by gravity to the Bioclere filtering unit. The filter consists of plastic media which promote the growth of a microorganism film around each particle. The microorganisms feed on the organic materials and nutrients present in the wastewater. The system employs a recycle line to pump recycled solids from the filter back to the primary tank. A dosing pump circulates the treated water back to the top of the filter to ensure it is thoroughly cleansed. A fan is positioned at the top of the Bioclere unit and supplies oxygen to the system.

Once water is treated by the Bioclere it flows through the Perc-Rite Drip System. The Perc-Rite System is ideal for the Raymond Street lot because it can accommodate sites with less than 2 feet of naturally occurring soil. Pumps will push the water from the Bioclere unit into the Perc-Rite drip irrigation system. Then the clean, treated effluent will infiltrate and replenish the water table.

These systems have been chosen because they have been proven to be sustainable, efficient alternatives to more traditional technologies. The Bioclere system is the best system for this job due to its combination of simplicity and proven performance. Bioclere utilizes a very stable fixed film process, and it is resistant to shock loads. The system is easy to operate and requires among the lowest energy requirements in the industry. AquaPoint products are factory direct with single vendor responsibility, and the Bioclere system is built as a complete module under strict QA/QC in New Bedford, MA. The Bioclere module is easy and economical to install with no site assembly, which minimizes the potential for contractor error. The installation process is assisted with factory trained representatives. The quiet, no odor system is perfect for a neighborhood setting such as the one in Manchester-by-the-Sea. Oakson, the manufacturer of the Perc-Rite Drip irrigation system is based in Gloucester, MA. The Perc-Rite Drip Dispersal is known for its ease of installation as well as its minimal impact. The dispersal tubing follows natural contours in the land, preserving the appearance of the site after installation.

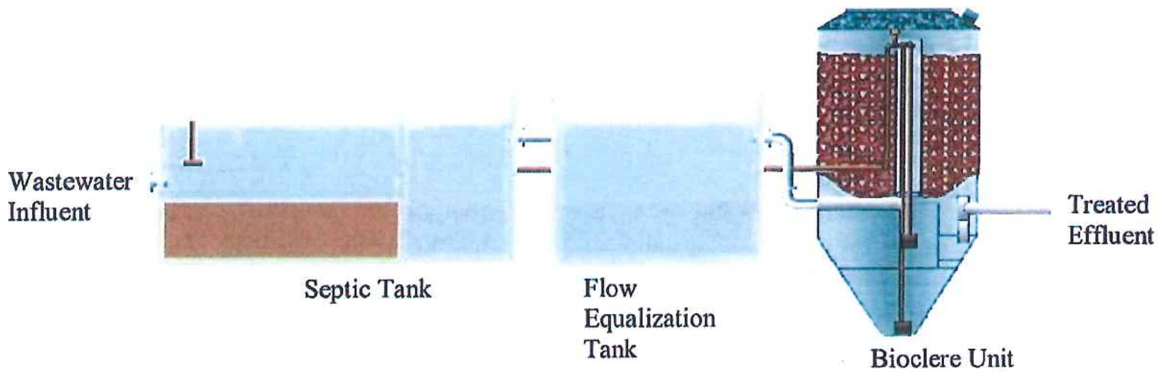


Figure 1: Diagram of flow of wastewater from septic tank (one located at each dwelling) to the flow equalization tank and Bioclere unit located on the 34 Raymond Street lot.

Figure 2: Perc-Rite Drip Irrigation System

PROJECT TEAM

The project team will be Center for Urban Watershed Renewal (CUWR), and Mill River Consulting. Amery Burnham, Director and Treasurer of CUWR will be the Lead Applicant, responsible for administration of subcontracts, as well as outreach and promotion of the findings of the pilot project to wider audience. The members from Mill River Consulting will be Isaac Rowe and Dan Ottenheimer for engineering and permitting services, as well as technical oversight of system installation. Mill River Consulting of Gloucester has the strongest reputation in MA for alternative wastewater handling based on high-performance small scale systems. CUWR has utilized Rubin and Rudman Attorneys for legal support early on in the development of this project to establish an escrow agreement for neighborhood participants who contributed funds. Moving forward, the project team may choose an alternate legal firm to address operating agreements for the proposed cluster system and possible asset transfer to the Town, as attorney Peter Feuerbach passed away unexpectedly in spring 2013.

PROJECT BENEFITS

A modest amount of energy and money will be saved for homeowners if a cluster system is installed at 34 Raymond Street. One cluster system will use little more energy than each individual system would require, thus achieving efficiency of scale for higher treatment, operating at only 10% of the expected energy use of central sewage treatment. The proposed system would be the first shared retrofit in MA for failing septic systems at the neighborhood scale. In addition to benefiting individual homeowners, the project in Manchester-by-the-Sea can be replicated throughout Massachusetts and specifically, Cape Cod. The installation of similar systems in coastal neighborhoods in Massachusetts would have a significant impact on hundreds of communities. Manchester-by-the-Sea and Cape Cod are ideal examples where the neighborhood cluster system can be established to help reduce homeowner cost, save water and energy, and decrease impacts on local water bodies, with an estimated 96% Nitrogen removal efficiency estimated at double the current levels. The replacement of septic systems with the cluster system will greatly decrease waste and inefficiency.

Market

The market for the cluster wastewater system is any neighborhood or municipality facing costly septic repairs/replacements, or expensive and energy intensive sewer line installation. The cluster system may cost more upfront but is a sound investment for homeowners and requires far less maintenance than a septic system. The system is ideal for coastal neighborhoods due to low impact on fragile ecosystems such as on Cape Cod, now studying solutions in the multi-billion dollar range that municipalities can't afford. The combined Massachusetts based firms can expect to play significant roles related to the design and material sales of similar systems, keeping roughly 25 jobs in state, with the potential to export products and services throughout New England and the US. Based on the synergy of the Oakson drip irrigation system, combined with the Bioclere unit, the system has many advantages not currently available in the market, many of which have been developed jointly with Israeli technology researchers. Various innovations exist related to fuel cells capable of generating electricity from sewage, though none are commercialized yet. We intend to identify and enlist the best-available partner to allow the system to demonstrate the capacity to generate adequate power to operate pumps and motors for treatment and dispersal operations. Hence the project targets a net-zero waste, energy, and water solution suitable for residential neighborhoods which has large potential for future disaster resilience and sustainability goals now being established by many progressive communities. NATO currently estimates the market for such infrastructure solutions at $50 billion by 2020 and the project team aspires to command 10% worldwide, or $5 billion.

BUDGET NARRATIVE

We expect that the design and permitting processes, including application fees and legal document preparation, will cost approximately $157,000 in the form of, $145,000 of services from Mill River Consulting, $40,000 from host, $5,000 for legal services, and $7,000 for biogas-to-electricity consulting services. CUWR will provide $7,000 in administrative and program management services. For the construction of collection system we assume a cost of $100 per foot of pipe at 2,300 linear feet of pipe is $230,000. For the treatment system, the construction of the full system is 388,000, including tanks and pumps at $8,000 per unit at 10 dwellings. Homeowners have already contributed to the funding of the feasibility study for the project and will be expected to pay for collection tanks. This brings the total project cost to $723,750,. In addition, support from the project will come in the form of in-kind services: $2,500 from Clean Water Fund; $5,000 of in-kind outreach services and $15,000 in equipment discounts from AquaPoint, and $5,000 of in-kind services and $5,000 in equipment discounts from Oakson, Inc. Wendi Goldsmith will provide another $5000 in outreach through technical publications and lectures. The detailed cost estimate is included in Attachment C. A future expansion phase would result in lower unit costs for up to 50 bedrooms, thus addressing the full area targeted by the Town as deficient.

ATTACHMENT A: AUTHORIZED LEAD APPLICANT'S SIGNATURE AND ACCEPTANCE FORM

MassCEC InnovateMass Program
RFP FY2014-DEMO-01

The undersigned is a duly authorized representative and Lead of the Application Team listed below. The Lead has read and understands the RFP requirements and acknowledges that the Application Team has read and understands the RFP Requirements. The undersigned acknowledges that all of the terms and conditions of the RFP are mandatory.

The Lead and Application Team understands that all materials submitted as part of the application are subject to disclosure under the Massachusetts Public Records Law, as explained in the RFP, and acknowledges and agrees that MassCEC has no obligation, and retains the sole discretion to fund or choose not to fund the application set forth herein, and that MassCEC's receipt of the application does not imply any promise of funding at any time.

The Lead applicant understands that, if the Application is selected by MassCEC pursuant to this RFP, the Lead applicant will detail and execute a contract that outlines the respective roles and responsibilities of the Application Team and MassCEC.

I certify that the statements made in this Application, including all attachments and exhibits, are true and correct to the best of my knowledge.

Lead Applicant: Amery Burnham

(Printed Name of Applicant)

By: Amery A Burnham

(Signature of Applicant or Authorized Representative)

Title: CUWR Director and Treasurer

Date: 11/20/14

ATTACHMENT B - PROJECT WORKPLAN TEMPLATE

Timeline	Key Tasks and Milestones	Responsible Party(ies)
Q2 2015	Meetings and final design	CUWR/Mill River
Q32015	Construction	CUWR/Mill River
Q4 2015	Operations and Maintenance manual	Mill River
Q1 2016	Compile as-built plans, decommission at each dwelling, oversee system start-up	Mill River
Post Demonstration Period	Next Steps	Turn over management of the system to Manchester

Attachment C

CUWR MassCEC Proposal

Note this information was formatted in order to better capture and clarify project cost categories during the interview process of 2013 when the project did not receive funding.

Supporting Information

Cost Share: In-Kind unless identified as cash					
Potentially $80000 from homes			Not calculated here		
Potentially roadwork from Town			Not calculated here		
Clean Water Action	$	2,500			
CUWR--Program Mgt+Outreach	$	10,000	$50/hr for Director Amery Burnham		
Oakson--Product discount+outreach	$	10,000			
AquaPoint--product discount+outreach	$	20,000			
Goldsmith--Real Estate Easement	$	91,250	$	91,250	25% of assessed value for land
Goldsmith--Outreach	$	5,000			
Goldsmith--cash contribution	$	40,000			
	$	**178,750**	Not counting potential additional $$		
Subcontractors: Engineering and Construction					
Mill River Consulting--eng'ng/permits	$	145,000			
Attorney, Emerging Tech expert	$	12,000	**$**	**157,000**	subotal services
Collection System in street	$	230,000			
Treatment tanks and shoring	$	17,000			
Dispersal system	$	15,000			
Septic sand, topsoil, boulderwall	$	30,000			
Bioclere Unit	$	16,000			
8 home tanks replaced w pump-tanks	$	80,000	**$**	**388,000**	subtotal installation
MassCEC Grant Request	**$**	**150,000**			
TOTAL PROJECT COST	**$**	**723,750**			
Cost Share as %		**25%**			
MassCEC Grant Request as % Cost		**21%**			
Outreach (already budgeted as in-kind)					
Clean Water Action	$	2,500			
CUWR	$	3,000			
Oakson	$	5,000			
Aquapoint	$	20,000			
Wendi Goldsmith, PG	$	5,000	**$**	**35,500**	subtotal outreach
EPA funded non-salary items					
Collection system	$	230,000	requested information from 2013		

Attachment D – Letters of intent

CUWR
Center for Urban Watershed Renewal

18 Commercial Street | Salem, MA 01970
P. 617.901.2306 | F. 978.740.0097 www.cuwr.org

25 November 2014

Massachusetts Clean Energy Center
55 Summer Street, 9th Floor
Boston, MA 02110

Dear Ms. Izzo:

Since first becoming familiar with the intent and scope of the proposed decentralized wastewater treatment system in Manchester, MA, the Center for Urban Watershed Renewal (CUWR) has been supportive. CUWR personnel have been kept informed of the series of hurdles and questions that the project has faced which appear to stem from its novel nature, and its efforts to accomplish something for which there is no precedent in Massachusetts. CUWR has been highly supportive of methods including decentralized wastewater systems to address Massachusetts' water quality issues on a cost effective basis. We are resubmitting despite a losing grant application in 2013. Having received debrief information, we strongly believe the basis for rejecting the project was not founded on current information about obstacles facing Massachusetts communities, homeowners, and watersheds. Retrofits of decentralized sewage treatment within existing built-out neighborhoods are unheard of due to regulatory hurdles and the lack of suitable role models. In a handful of outstanding cases, legal battles have resulted in shared systems being installed as retrofits, but this is hardly an attractive example to follow. The technology is not new (though the combination is), but the administrative approach and the resulting level of treatment for residential neighborhoods is unprecedented in Massachusetts.

CUWR is a charitable, non-profit organization that works as an advocate and agent for the transformation of stigmatized and degraded sites into ecologically, economically, and socially viable amenities. The Center for Urban Watershed Renewal believes that environmental quality, community vitality, and socioeconomic opportunity are deeply connected. The Center seeks to devise solutions that integrate natural resource management, commercial and residential development, and urban infrastructure. CUWR was established in 1999, is headquartered in Massachusetts, and has conducted over $10 million in contract and grant funded project work in its history. Having received funding through MA DEP, US EPA, US Army, and others, CUWR is entirely capable of administering performance of this project including fulfilling reporting, audit, and other functions as may be required under various grants, in addition to coordination of technically qualified subcontractors. CUWR currently maintains federally audited overhead rates, and is aware that the MassCEC grant only covers direct costs, and not OH allocations. CUWR currently holds cash reserves from which it commits $10,000 of direct labor and project expense to contribute as a match to the project in order to conduct administration and coordination (estimated at $7000) and outreach (estimated at $3000).

CUWR areas of expertise include site repair, open space utilization, stormwater management, and decentralized wastewater treatment and reuse. CUWR is one of several NGOs working to help decentralized sewer systems receive an equal level of review and consideration as we work on increasing enforcement of nutrient loading into sensitive waterways in urban areas or less densely developed areas that can serve as prototypes on Cape Cod and elsewhere. Many alternative technologies exist, but are simply less familiar to the engineering community and municipal officials, and we have observed resistance, or simply lack of knowledge. Although decentralized systems are becoming common for new developments which connect to a neighborhood scale shared system, it has never been done to our knowledge for existing homes with failing or questionable septic systems. It would be highly beneficial to have a successful case study of a retrofit project that accomplishes this, and for this reason CUWR wishes to step in to assist in the advancement of the project.

The chief obstacles include lack of understanding of the legal and administrative procedures and options, as well as lack of data about cost and performance. In essence, without a precedent that can be followed or cited, no one to date has coordinated an effort to carry out such a project. Hence the Manchester proposed pilot project could fill a known gap. The Town's newly established committee has expressed interest in supporting the project, and future wider examples, as a way to overcome the Town's non-compliant sewage plant discharges. Throughout Massachusetts there are many sites and regions that could benefit from this example. Some are so sensitive and politicized that though the need is high, the chance of success for a rapid and successful pilot may be low, such as Cape Cod. In contrast the Manchester pilot would offer a less sensitized situation that nevertheless has sufficient similarities to serve as a meaningful precedent.

Identified benefits include:

1. Demonstration of first MA neighborhood scale shared septic system as a retrofit (examples exist for new development, but not for existing homes)
2. Demonstration of technology that delivers high quality water treatment with lowest feasible energy inputs, highlighting a balanced solution addressing the energy-water nexus (some estimates of energy consumption for WWT on the Cape using conventional technology indicate an increase of 20% in regional energy use which would create new problems)
3. Treatment of known health impacts (beach closings and shellfish prohibitions) of beachfront older neighborhood with shallow groundwater and failing or poorly functioning systems
4. Treatment of area not feasible to add to existing municipal system (due to bedrock/distance costs for collection system and inability to add to existing centralized WWT system due to current permit limitations)
5. Documentation of a technical approach that would add to appraised value of homes and create local jobs, adding economic value to the owners, the town, and the region
6. Documentation of administrative and legal process that homeowners and communities could follow or adapt in the future

For these reasons, we at CUWR are highly supportive of the project, and others like it that may arise, and we commit to participating in the broader work of sharing the findings as part of our ongoing outreach and advocacy process. We hope you will find merit in our grant application for what we believe is a worthy and much needed pilot project addressing the energy-water nexus here in Massachusetts. I would be happy to answer any questions and can be contacted at (617) 602-5900.

Sincerely

Center for Urban Watershed Renewal, Inc.

Amery A Burnham

Amery Burnham
Director and Treasurer

34 Raymond St
Manchester-by-the-Sea, MA 01944

November 25, 2014

Ms. Emily Izzo
Massachusetts Clean Energy Center
55 Summer Street, 9th Floor
Boston, MA 02110

Dear Ms. Izzo:

I offer this Letter of Intent to host a decentralized neighborhood scale septic system project at my home located at the above address. This project can achieve exemplary levels of energy savings, while address a neglected water quality and public health issue. Having founded, then recently sold Bioengineering Group, an innovative science and engineering firm active in sustainable planning and design, especially for Department of Defense projects, I brought more awareness and insight to bear on my residential property than most people would be inclined or able to do. I understood when I purchased the property in 2007 that the septic system on my lot was in marginal condition, and that many neighbors who had lower lying and smaller lots were in worse shape, and with fewer options to remedy the situation. Some of the homes in the neighborhood are little more than seasonal bungalows, though many now serve as year round residences. No sooner had I moved in, than I began to ask neighbors some questions about the condition of their septic systems. What I learned was at times shocking. Many neighbors were aware that their own systems, or those belonging to abutters, had been cited by the Town for being nonfunctional and that surface release of untreated sewage was visible, especially after heavy rains, including directly onto adjacent Magnolia Beach. However no system existed to either compel people to correct the problem, nor to assist and guide them in identifying and carrying out viable solutions, despite frequent beach closings due to high bacteria counts.

Being deeply connected to state-of-the-art discussions hosted by organizations including Water Environment Federation, Johnson Foundation, Center for Urban Watershed Renewal, and others I knew that technical solutions existed, but the missing link in this case was a shining example of what a project would look like, how much it would cost to build and to operate, and what its benefits would be, not only in terms of energy and water conservation and reduced environmental impacts, but also to homeowners and municipalities. I decided I was willing to "walk my talk" and initiate a pilot project on my own property, starting with bringing up the taboo subject of sewage with a wider group of neighbors. I did not want to live in a neighborhood known for ignoring its sewage contamination issues, and I saw myself able to trigger some positive change.

I began to host "sewer parties" on my back deck to cultivate awareness and knowledge about the problem and its possible solutions. I learned that many neighbors wanted to address the problem but did not know how, and were afraid to seek public help lest they trigger compliance penalties. Some had already consulted engineers who told them their lots were so small they had no options that were compliant with state health codes. Others including two widows and one cancer patient could not afford doing it alone. Before long a core group of neighbors not only agreed to participate in a shared system, they also contributed money to complete a feasibility study for 36-bedroom cluster system, with pro-rated contributions of $2000 per bedroom to develop site surveys, inspection of existing septic systems, preliminary engineering of a collection and treatment system, coordination meetings with public officials, and development of a project budget. That study is now complete, and we have defined all the work needed to proceed, including a generous allowance for documentation and outreach activities.

Along the way some other neighbors handled their own septic system upgrades that became necessary due to sale or expansion of the home, and the cost of those systems ranged from $50,000 to $95,000, with intensive ongoing energy consumption, and less-than-ideal water treatment effectiveness. These high individual costs with low overall function further drove home to the neighborhood, and the town, the need to identify and demonstrate better options. However along the way municipal officials also made it clear that they were seeking more detailed studies, reports, and meeting time in order to receive an education on the subject. This exposed the need to produce detailed educational type materials above and beyond the normal scope of engineering studies.

The current group of neighbors stands ready to contribute to the cost of final design and permitting, as well as constructing the system. A formal legal agreement was developed by Rubin and Rudman Attorneys to bind the neighbors with financial and operating terms. Homeowners stand ready to cover the cost of final engineering and construction. What we now seek is supplemental financial support that CEC can bring to help the project move to the next phase, and also garner the level of documentation and public outreach that can help it catalyze other similar projects. Completing the project will solve problems in one neighborhood; completing it in a well documented and generalized format will allow it to be replicated elsewhere.

I am willing to encumber my personal property by siting a shared neighborhood system in my back yard. The proposed layout of the equalization and treatment tanks in my front yard allows ease of access and also the option of potentially transferring the system and responsibility for future operations to the Town. In that case I stand ready to deed over title to a subdivided parcel of land, and/or an easement for access and/or operations. I personally pledge to contribute $40,000 of cash towards the construction of the project, not counting the in-kind value of land, which will change depending on whether any public easement or transfer is negotiated. My neighbors are prepared to contribute over $400,000 collectively to the construction costs, as reflected in agreements already executed, and building upon the individual payments made to fund the feasibility study and preliminary engineering to date. The recently established committee to guide Manchester to become compliant with state and federal water quality rules and standards has expressed great interest in the project, and so have the various departments in the Town, each of who may play a large or small role should the Town eventually take over project ownership. The project is able to proceed with or without transfer to the Town, but such a transfer would facilitate the Town's future enforcement actions resulting in failing systems connecting to future phases of the system.

I hope you will favor our project by offering funding support for this important energy-water nexus pilot project. If you have any questions please contact me at 617-901-2306.

Sincerely,

Wendi Goldsmith

Wendi Goldsmith

CLEAN WATER
FUND

November 25, 2014

Massachusetts Clean Energy Center
Attn: Amery Burnham
63 Franklin Street, 3rd Floor
Boston, MA 02110

Dear Ms. Burnham,

I write today in support of The Center for Urban Watershed Renewal's proposed project for MassCEC's Demonstration Project Pilot Program. While I recognize that this is the preliminary Concept Paper submission, we would like to encourage MassCEC to invite the project back for a full proposal and consideration for funding.

Clean Water Fund's mission is to develop strong grassroots environmental leadership and to bring together diverse constituencies to work cooperatively for changes that improve their lives, focused on health, consumer, environmental and community problems. Clean Water Fund's programs build on and complement those of Clean Water Action, a nearly one million member national organization which has helped develop, pass, strengthen and defend the nation's major water and toxics laws such as the Clean Water Act, Safe Drinking Water Act, Superfund and others, including their state-level counterparts.

In Massachusetts, CWF has approximately 30,000 members, and our staff has recently spent significant time developing an understanding of emerging opportunities and the evolving technical, economic, and societal strategies available to address clean water needs beyond conventionally engineered wastewater approaches.

We recognize that the *Decentralized Neighborhood Wastewater Treatment System (Neighborhood WWT System)* proposed in Manchester, MA represents such a project, with science, engineering, and community involvement services provided by the Center for Urban Watershed Renewal and collaborators including Wendi Goldsmith. As such, we strongly urge you to favor the project based on its technical merit, and also due to its critical significance in modeling smart, scalable and replicable decentralized waste water treatment solutions throughout the Commonwealth.

1010 Vermont Avenue NW, Suite 400 | Washington, DC 20005
Phone: 202.895.0420 | Fax: 202.895.0438

88 Broad Street, Lower Level | Boston, MA 02110
Phone: 617.338-8131 | Fax: 617.338.6449

www.cleanwateraction.org/ma

While decentralized wastewater systems are routinely adopted in states across the U.S. and abroad in recognition that large, centralized wastewater systems are too expensive, use too much energy, can lack the dexterity to adapt to emerging contaminants of concern and, in turn, technical advances for treating these, and drain far too much freshwater from local systems, MA has lagged in permitting these types of proven systems. Decentralized wastewater treatment methods can help to reduce treatment costs, decrease energy consumption, increase property values and reduce tax/fee burdens, achieve higher levels of treatment than conventional systems in some cases, and keep water local – which allows for beneficial reuse of clean effluent for irrigation and groundwater recharge. Again, despite these benefits, they remain uncommon in Massachusetts for new development and, to date, no community has acted to install a system like this as a retrofit.

Many towns and cities in Massachusetts face serious problems with failing septic systems, perfectly functional septic systems whose design simply does not treat for their local water pollution problems (nutrients, largely), ailing central wastewater treatment plants, or simply no wastewater treatment capacity in existence. Simultaneously, many communities use more electricity to pump and treat sewage than for any other purpose. Projects like the one proposed would provide a critical, tailored demonstration of how alternative approaches can be successfully applied right here in the Commonwealth, using local firms and local labor. It can be a true win for Governor Patrick's focus on strengthening our clean-tech economy and shoring up jobs for skilled laborers in the emerging green economy.

The *Neighborhood WWT System* project would provide valuable data on the cost of engineering, construction, and operation, and would also offer an excellent and highly teachable case study to help home owners, health department staff and volunteers, and other town officials and the broader state and federal regulatory agencies. Before communities on the Cape and other contentious wastewater management regions can succeed with adopting decentralized wastewater technology solutions, it would be very helpful to show how it can be done, on a retrofit basis, in less controversial and agitated settings which the opportunity in Manchester presents.

Clean Water Fund has called upon Wendi Goldsmith in the past as a speaker for meetings and events, and regularly helps promote broader understanding of the type of innovative projects the Center for Urban Watershed Renewal frequently undertakes. We know this project has been well planned, has included input from many community members and other stakeholders, and reflects state-of-the-art practices within the US. Hence, we want to support the project on its technical merit, as well as the science and engineering team, based upon their proven leadership abilities. Mill River Consulting is the right firm to provide professional services to a project of this type. CWF will continue to call upon them as a model for technical leadership, and we hope to be able to point to the proposed project as a concrete example of how a project comes together technically, with community involvement, state and local permitting processes worked through, and with great system performance.

With some funding support, this project can succeed on a timely basis to pave the way for an effective and beneficial consideration of similar technologies which we feel are broadly applicable on Cape Cod, and many other locales in MA. We stand ready to assist with outreach and education efforts and can offer a pledge to provide at least $2500 of in-kind services over the life of the project by promoting the project and providing outreach and education with our web, print, and events for outreach. CWF would contribute staff time, facilities, and related expenses. It would be our pleasure, entirely compatible with our mission, to assist in spreading the word of this project and its story throughout and beyond the Commonwealth to targeted audiences who are all hungry for truly smart, clean, and green water project design.

Please feel free to reach out with any questions about our support for the proposed project. While we have always admired and supported the work of MassCEC, we are especially pleased to participate in this expansion of your clean energy work to help build awareness and practice in the critical nexus of clean energy and clean water.

Very best,

Becky Smith

Becky Smith
Water and Clean Energy Campaign Coordinator
Clean Water Action & Clean Water Fund
www.cleanwateraction.org/ma/
www.cleanwaterfund.org/ma

88 Broad St, Lower Level
Boston, MA 02110
617.338.8131 x210
617.338.6449 fax

AQUAPOINT
AN OBEH COMPANY

25 November 2014

Amery Burnham
Center for Urban Watershed Renewal, Inc.
18 Commercial Street
Salem, MA 01970

Dear Amery:

Since the initial brainstorming about the proposed decentralized sewage treatment system in Manchester, MA, I have been an avid supporter and proponent of the project. The Bioclere technology is not new. Nevertheless, it requires constant support, in both financial and policy forms in order to demonstrate its efficacy as a technology and the social, economic, and ecological benefits that it has to offer. By far the biggest market opportunity lies in using it for retrofitting existing neighborhoods where aging septic systems perform poorly, but sewers and large treatment plants are costly and merely discharge nutrients to ailing waterways.

Aquapoint was involved in furnishing technical advice and language to the state legislature earlier this year, leading to the passage of the Act Improving Drinking Water and Wastewater Infrastructure which among other things, funds the grant program of interest to CUWR. It is no accident that the first definition of Green Infrastructure under the Act is for decentralized wastewater systems such as CUWR is proposing to implement. Throughout Massachusetts, but notably near coastal waters on Cape Cod and elsewhere, the need and opportunity for decentralized wastewater infrastructure modernization is vast…yet remains undeveloped. I have attended literally dozens of formal conferences, informal meetings, and training sessions hosted by Environmental Business Council of New England, US EPA, Cape Cod Commission, and other during which the technical merits of decentralized systems are touted. Yet they remain rare in practice, especially in the areas where they could benefit water quality the most, namely older neighborhoods with small lots and failing septics.

Our company licenses technology originally developed in Israel, and our manufacturing occurs in New Bedford. When this technology thrives, it will bring added jobs to Massachusetts. Right now the vast majority of our sales occur outside of this state, for projects at Guantanamo Bay, in Alabama, and elsewhere to address recognized need for conserving water through re-use of treated effluent. We hope to see a resurgence of interest and action here in our home state, as well. We have observed and analyzed how community owned decentralized systems immediately generate a bona fide increase in appraised home values when compared with homes using individual septics. This increase in value is a boon to the homeowner (especially if they have need or interest to sell and conform to Title V regulations) and also to the communities that benefit from the improved tax base. This benefit comes at a significantly lower capital cost than conventional sewerage, though it also can be combined and integrated with central sewer systems.

The most important form of support needed today is through pilot projects that demonstrate how technologies like Bioclere can be successfully applied in a retrofit scenario to achieve decentralized sewage treatment. In Massachusetts and elsewhere, homeowners, town officials, and also state regulators tend to balk at the unfamiliar. Many projects including the one proposed in Manchester have come under not merely scrutiny, but essentially puzzlement leading to regulatory limbo. The multitude of complex regulations and permits is arduous enough for new multi-home developments to navigate (with many successful examples complete), and has thus far been unattainable on a retrofit bases with a system shared between multiple homeowners.

39 Tarkiln Place • New Bedford, Massachusetts 02745
Phone: 508.985.9050 • Fax: 508.985.9072

We foresee that successful advancement of the Manchester project can show municipal officials, homeowners, and engineers how community-scale wastewater treatment can become a favorable option to extending sewer lines, expanding centralized treatment plants, implementing costly individual system upgrades, or doing nothing (which sadly remains the most common practice).

Not only does this project promise to address key issues related to water quality management, with benefits to public health and ecological productivity, it can also contribute substantially to energy savings by eliminating the need to pump significant volumes of effluent many miles to a centralized plant, which in turn operates a high energy consuming treatment process. The benefits accrue to the town, the homeowners, and the region at large.

Some of the key benefits anticipated from this project will be:

1. Energy savings on water treatment
2. Improved water treatment and potential for irrigation re-use of treated effluent
3. Improved home values potentially rectifying "upside-down" mortgage levels
4. Reduced municipal infrastructure cost burden combined with increased tax base
5. Successful pilot project featuring innovative products and services from multiple MA based companies

AquaPoint offers to perform an independent review of your project design at no cost in order to become familiar with the site-specific elements and to allow us to better serve as an advocate for the project through its final design and permitting process. Please schedule this at your convenience. Moreover, AquaPoint offers its remedial use permit as the state approved permit as a supplement to the piloting program should it be required.

I submit this letter to document our general technical support for the project, and also to memorialize out intent to contribute $20,000 of in-kind value to the project, as outlined below.

1. $31,000 standard price for AquaPoint model #24/24/950 as normally quoted with typical features.
2. $16,000 will be the price charged for this project, reflecting our intent to contribute $15,000 of in-kind product value.
3. $5,000 of anticipated outreach effort will be provided, in the form of presentations at regional and national conferences and meetings about the project, including developing powerpoint presentations, and delivering 3-5 presentations including registration fees, time, and travel.

Please contact me should you require any clarification or assistance. We wish you all the best success with your grant application, your project, and your ongoing mission to support and conduct innovative and sustainable project planning and design.

Sincerely,

Craig Lindell
EVP

39 Tarkiln Place • New Bedford, Massachusetts 02745
Phone: 508.985.9050 • Fax: 508.985.9072

OAKSON, INC.

Innovative Drip Dispersal, Water Re-Use, & Wastewater Products

November 24, 2014

Amery Burnham, Director
Center for Urban Watershed Renewal
18 Commercial St
Salem, MA 01970

RE: Decentralized Wastewater Project, Manchester, Massachusetts

The ability to use creative solutions to community problems is the hallmark of a healthy community and a healthy society. In this instance, a number of houses in the Raymond Street and Sandpiper lane neighborhood of Manchester, Massachusetts are dealing with the need to upgrade their substandard onsite wastewater systems. Proposing a single, joint, solution for a number of houses achieves great benefits for the owners, reduces energy consumption needs, improves the environmental health of the neighborhood, and creates considerable efficiencies on many accounts.

Using drip dispersal as part of the solution would be an effective tool to assist in achieving many of the benefits desired. From the initial design layout until now it is clear that Perc-Rite Drip Dispersal can provide many benefits to this project. I am delighted to be associated with this ground-breaking effort and am offering both in-kind and direct financial support to the project.

Oakson's contributions will include:

- A $5,000 price reduction for this system. Acquisition costs are typically about $20,000 for a system of the size needed and we would provide a $5,000 discount as part of this effort
- In-kind donation of $5,000 in terms of supporting the publicity associated with this project such as presenting papers at conferences and being present at demonstration tours

Oakson is the New England distributor of the Perc-Rite drip dispersal system. This innovative solution uses a combination of American pumps and engineering together with Israeli filters and irrigation tubing to make a complete water dispersal system for effective disposal and re-use.

Thank you very much for the opportunity to work with you on this exciting project.

Sincerely,

Daniel Ottenheimer
President

ATTACHMENT E - NOTICE OF CONFIDENTIAL INFORMATION COVER LETTER

Omitted, not applicable.

ATTACHMENT F - PRESS RELEASE

Bioengineering
GROUP
Building Sustainable Communities
on an Ecological Foundation

For Immediate Release
August 26, 2010

FIRST PRIVATE COMMUNITY-SCALE DECENTRALIZED SEPTIC SYSTEM IN STATE BEING PLANNED IN MANCHESTER-BY-THE-SEA, MA

Salem, MA – August 26, 2010 -- Bioengineering Group, a woman-owned consulting and design firm headquartered in Salem, MA, is leading the design effort for a unique and cost-effective solution to handling wastewater at the neighborhood scale. The science and engineering team is coordinating with the MA Department of Environmental Protection, the Manchester Conservation Commission, Board of Health, and Town Engineer, and local residents for the installation of a community septic system that can be utilized by numerous homeowners, to be located in the Raymond Street neighborhood in Manchester-By-The-Sea. The feasibility study has been completed and included, among other tasks, soil and percolation testing, inspection of existing septic systems, topographic and utility survey, wetland delineation, preliminary engineering and cost estimation. The results of the study indicate that the selected Raymond Street residential lot can handle wastewater flow from as many as 36 bedrooms. The proposal involves collecting wastewater from multiple homes which have serious constraints such as small lot size, shallow bedrock, and high water tables that limit their ability to accommodate modern septic systems, and treating many homes wastewater in a shared system located on the lot with the most space and best access. In addition, EPA grant money is being pursued to help offset the cost of the project and cover a detailed documentation and outreach effort to help other towns understand the methods and benefits of this type of system. The system is currently in the design phase with installation expected to begin in the spring of 2011.

Inadequate wastewater treatment in the region leads to high surface and groundwater bacteria levels and increased frequency of beach closings. Individual septic systems are standard solutions, but are expensive to build and often are not regularly maintained. Shared or decentralized wastewater treatment systems collect wastewater from multiple homes; treat it using state-of-the-art technology; and remove more nutrients, pollutants, and pathogens than is possible with an individual system. Additionally, due to economy of scale, the cost is far lower when considered on a per bedroom basis. Highly cleansed water can be beneficially reused for subsurface drip irrigation as well, making the approach truly sustainable.

ATTACHMENT F - PRESS RELEASE

Bioengineering Group identified opportunities and methods to integrate design, landscape, and permitting needs. The wastewater system proposed on Raymond Street will help neighbors with questionable or failing septic systems who would otherwise face high costs and greatly altered landscapes in attempting to repair or construct their own new septic systems. The effort is currently being funded privately under a cooperative agreement between participants, and will be built on private property, using the Town road for siting the sewer pipe that collects wastewater. When complete, the potential exists to turn over the entire system to the municipality, or to continue operating it under private control. With today's Title 5 requirements for septic system performance, homes become less saleable and property values decrease when they have problem septic systems. However communities often lack the ability to create or extend conventional sewage systems. Community-scale shared septic systems offer a promising middle ground that is technically proven elsewhere in the country but relatively new in this region. Both the MA DEP and the US EPA are very supportive of this technical approach. Dr. Erin Bennett of Bioengineering Group, who is leading the planning phase of this project, is currently compiling contact information for interested neighbors who wish to join in the project, or obtain more information as limited opportunity remains to connect to this system. For more information, contact Dr. Bennett at ebennett@bioengineering.com or at (978) 224-3129.

About Bioengineering Group

Bioengineering GROUP

Founded in 1992, Bioengineering Group has been a pioneer in the field of ecological restoration and the application of sustainability principles to site planning, development, and water management. The firm provides a full range of science, engineering, landscape architecture, and construction management services with a mission of "Building sustainable communities on an ecological foundation." Distinguished by their interdisciplinary staff of ecologists, scientists, engineers, and landscape design professionals, Bioengineering Group is uniquely positioned to guide large-scale site planning, development, and ecosystem restoration projects toward sustainable outcomes. The firm has worked with many municipalities, states, and government agencies to provide innovative site engineering and landscape architectural design; parks and greenways planning and design; integrated water management assessment and design; stream and shoreline restoration; as well as plan review, environmental permitting and remediation.

For more information about Bioengineering Group, visit *www.bioengineering.com*.

34 RAYMOND STREET
DECENTRALIZED WASTEWATER SYSTEM
NOI DRAWINGS
DECEMBER 16, 2010

DRAWING INDEX

SHEET NO.	SHEET TITLE
G-001	COVER SHEET
G-002	GENERAL NOTES AND LEGEND
[illegible]	EXISTING CONDITIONS PLAN
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

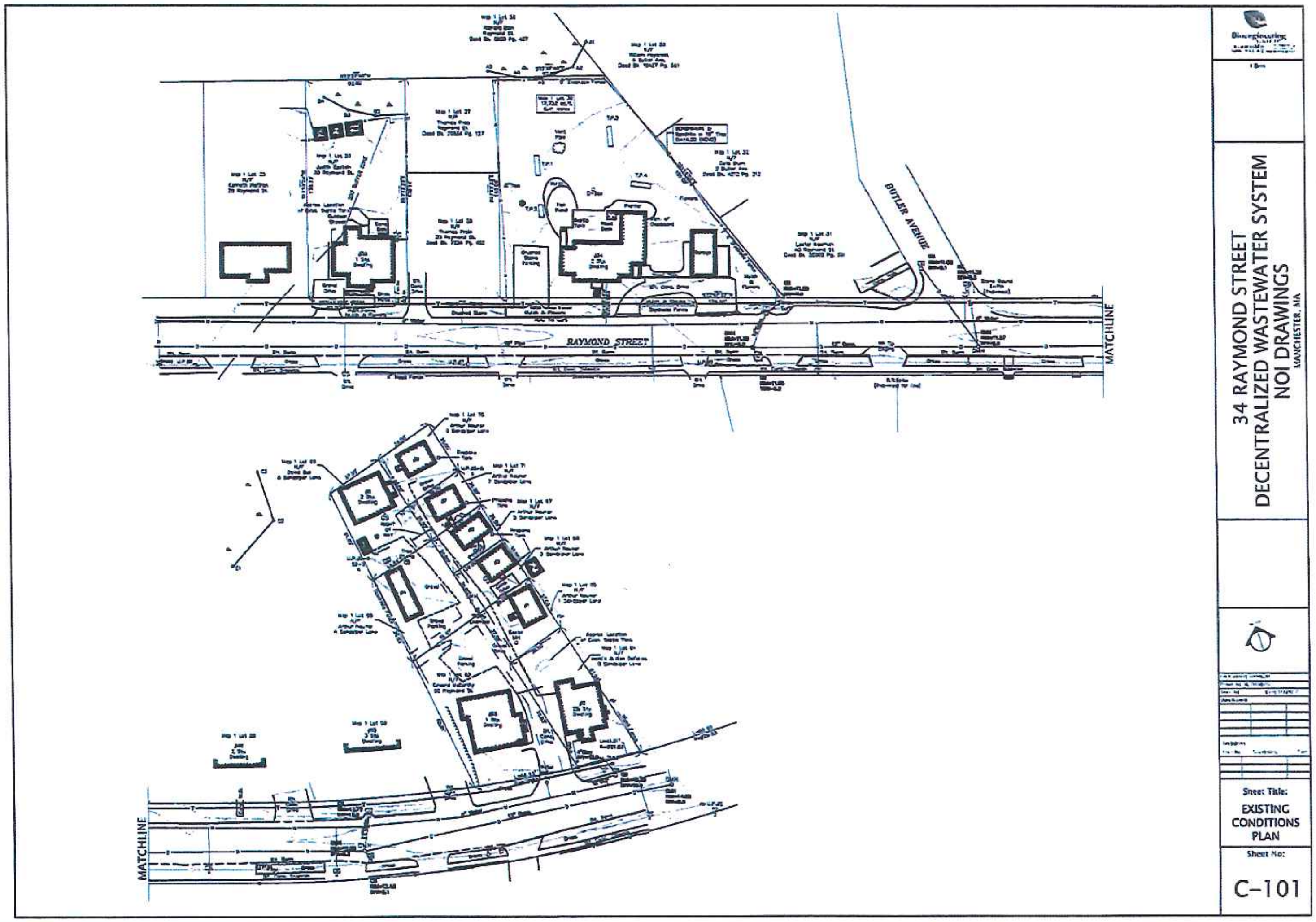
PROJECT LOCATION MAP

34 RAYMOND STREET
DECENTRALIZED WASTEWATER SYSTEM
NOI DRAWINGS
MANCHESTER, MA

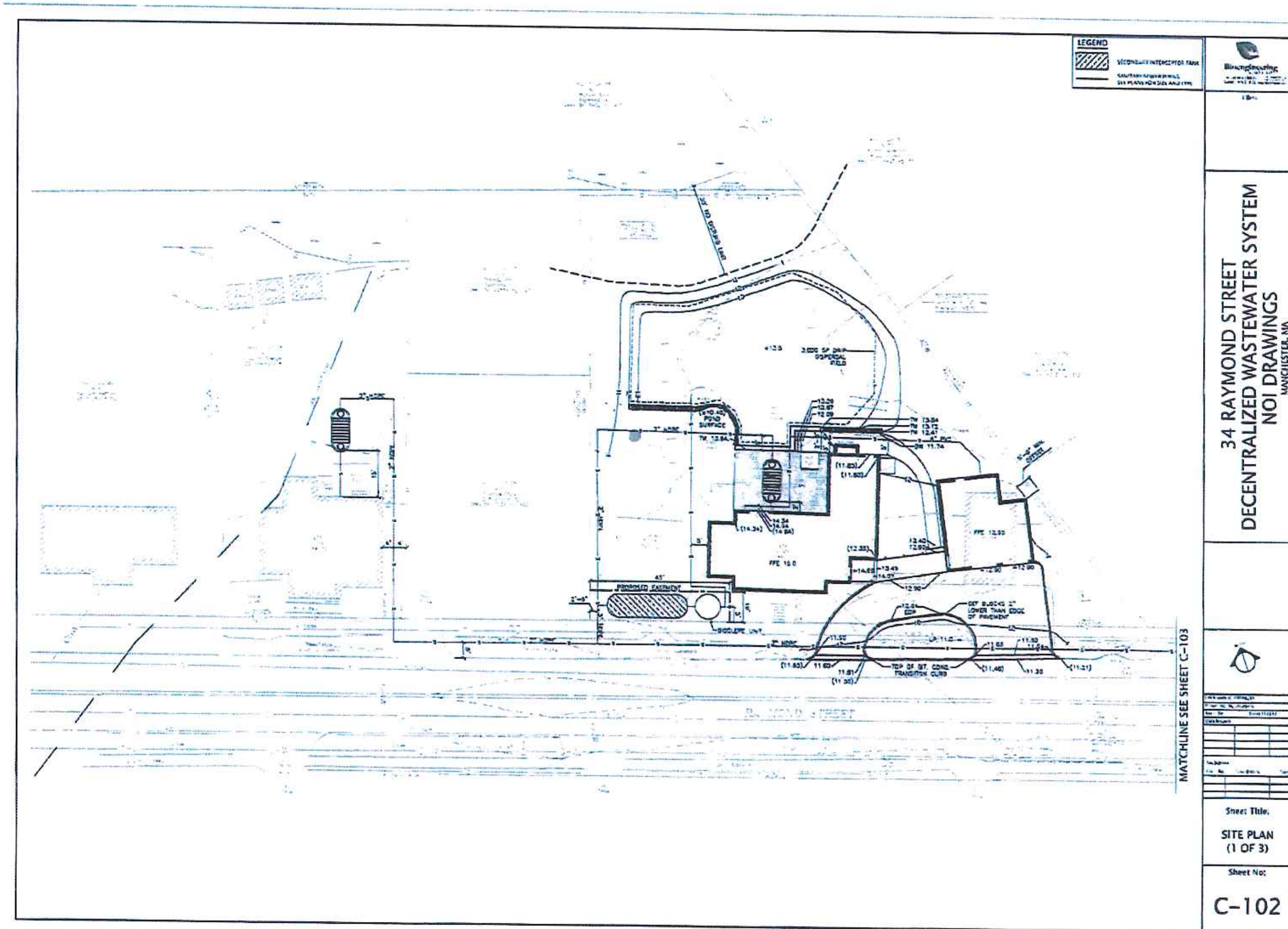
Sheet Title:
COVER SHEET

Sheet No:
G-001

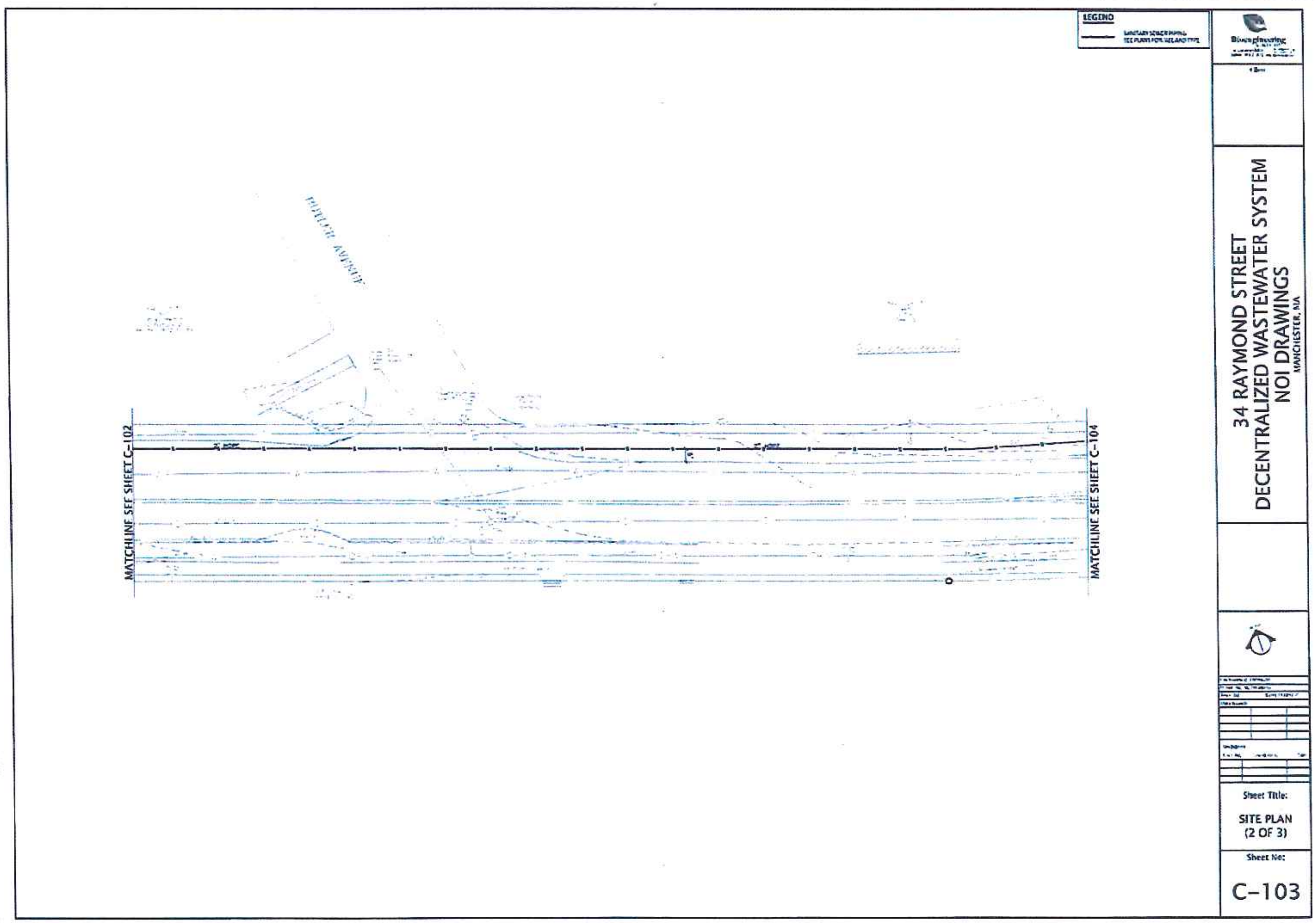
ATTACHMENT G - NOI DRAWINGS



ATTACHMENT G - NOI DRAWINGS



ATTACHMENT G - NOI DRAWINGS



ATTACHMENT G - NOI DRAWINGS


Robert Garner PE
Wendi Goldsmith
Vladimir Novotny PhD
Retrofit existing homes and septics with privately held cluster system at no muni cost, affordable homeowner cost and high N removal
BUTLER AVENUE
PROJECT LOCATION
RAYMOND STREET
MAGNOLIA PARK
MANCHESTER BATH AND TENNIS CLUB
Decentralized Neighborhood
Wastewater Treatment System
Manchester, MA

PROBLEM:

Individual septic systems do not remove much N, loading causes eutrophication

Standard approaches of central wastewater treatment plant and sewerage OR upgraded individual systems cost a lot to build and operate

No known examples of cluster system retrofits exist in MA today to serve as an inspirational and practical role model

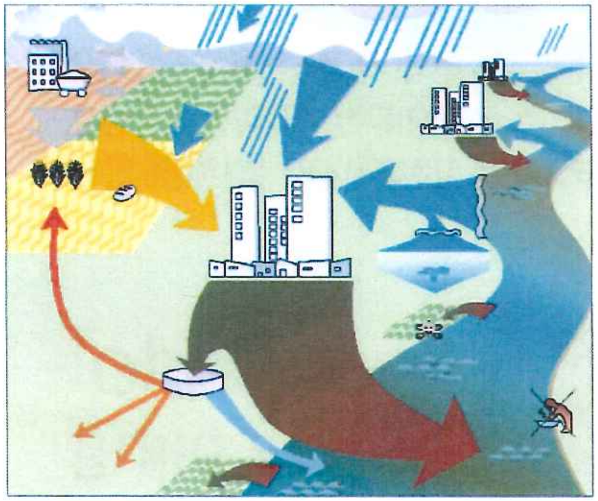
NEED STATEMENT:

What holds back adoption of this cost effective and proven method? Lack of knowledge, information and trust

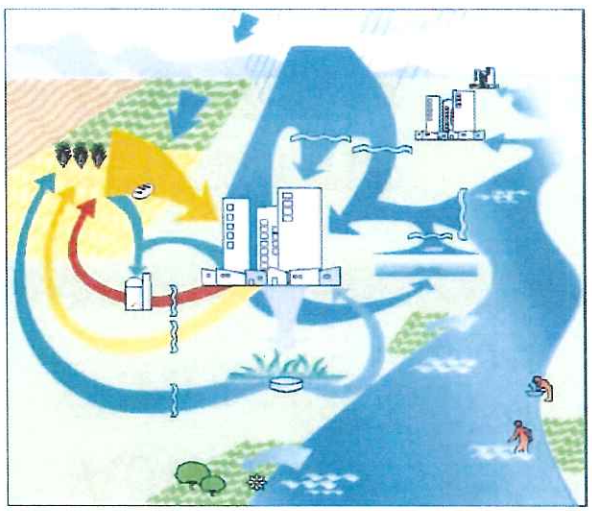
Develop case study and cost data as planning template

Overcome administrative hurdles to create sample documents and provide outreach

APPLY A NEW PARADIGM:

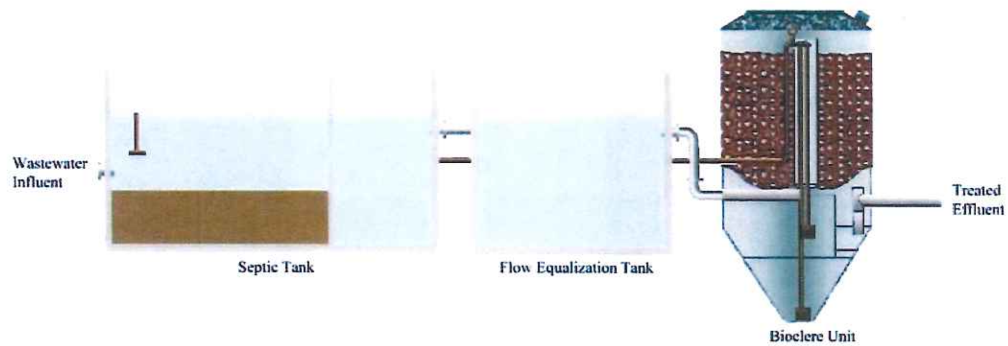


Open linear system: waste management

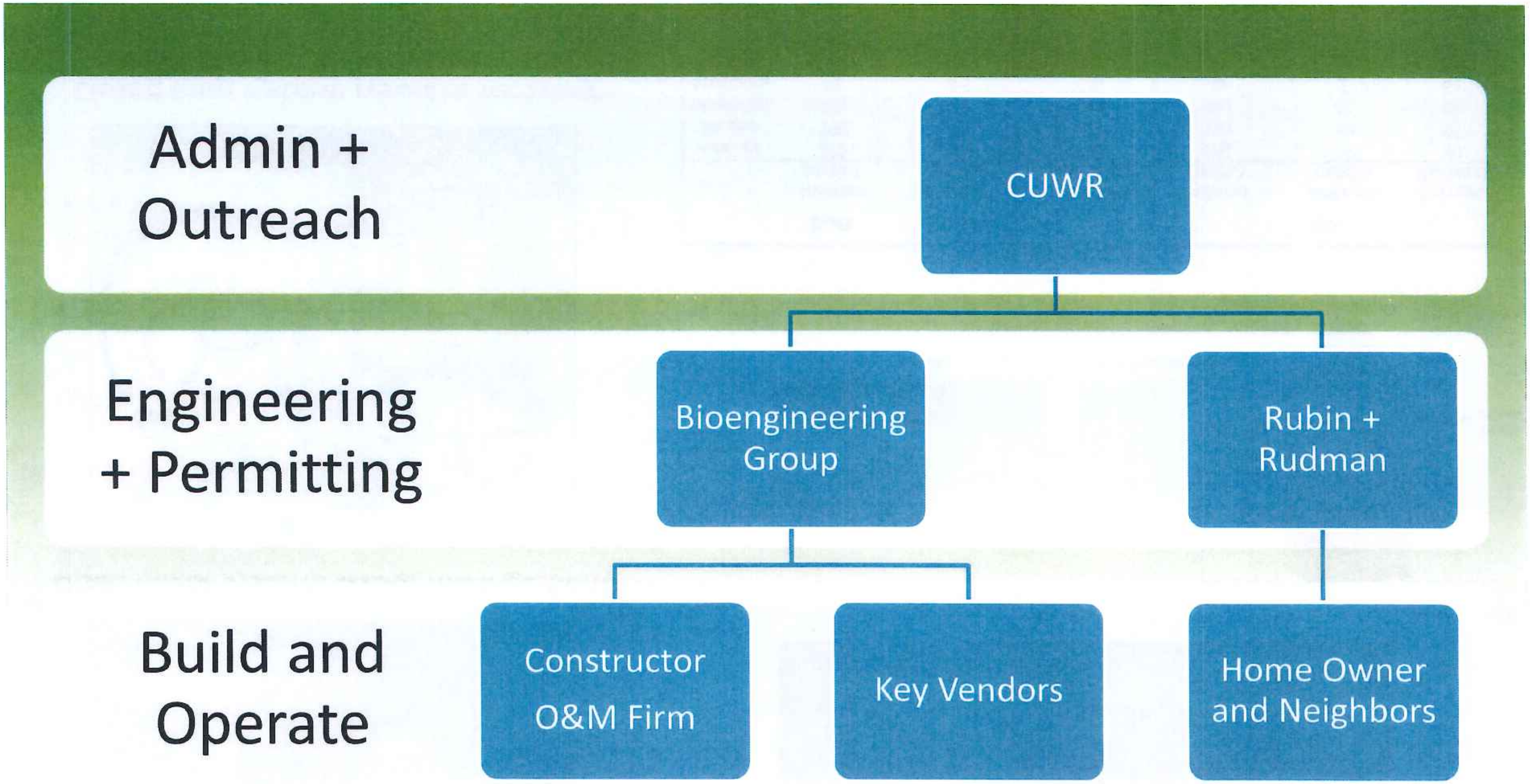


Closed loop system: resource recovery
(Modified from Dr. Nicholas Ashbolt, EPA)

SOLUTION:



	BOD_5	$CBOD_5$		TSS		
	Influent (mg/L)	Effluent (mg/L)	Percent Removal	Influent (mg/L)	Effluent (mg/L)	Percent Removal
Average	210	14	93	160	16	90
Median	200	10	95	140	10	93
Maximum	380	60	98	410	62	98
Minimum	72	3.5	78	40	2	63
Std. Dev.	70	11	5.0	71	16	7.0



Additional outreach will be provided by above named entities as well as Clean Water Action, Water Alliance, Cities of the Future, and more in support of CUWR's documentation and outreach program

Major Milestones

FINAL DESIGN PHASE	Quarter 3 2013
Collection System	
Treatment System	
Dispersal Field System	
Board of Health and Department of Environmental Protection Permit Application	
Notice of Intent Application	
Board of Health Hearing	
Conservation Commission Hearing	
BIDDING PHASE	Quarter 4 2013
Prepare Bid Documents	
Select Contractor	
CONSTRUCTION PHASE	
Installation Permits	
Dispersal Field System	
Treatment Unit	
Collection Pipe	
Operations Manual	Quarter 1 2014
Decommission at Each Dwelling	Quarter 2 2014
Compile As-Built Plans	
Oversee System Start-Up	

Risks & Management

- Established team of NGO, neighborhood association and professionals
- Initial neighbor escrow agreement funded and signed
- Feasibility study completed successfully
- Use of proven technology balances risk of novel systems approach
- Informal and formal meetings with town officials
- Unique assemblage of retrofit system vetted with town and vendors
- Pricing verified
- Experienced engineering and construction management staff

RESULTS:

- 5,000 GPD System built
- 17-36 Bedrooms of homes serviced
- Failed or compromised systems eliminated
- Improved watershed health
- Energy savings with potential for 80% reduction
- Municipality informed and experienced
- Data collected on construction and O&M cost
- Data collected on system performance
- Sample documents created
    - Feasibility study escrow agreement
    - Easement and ROW filings
    - Homeowner operating agreement
    - System O&M contractor agreement
    - Case study: Written and powerpoint
    - Lessons learned and future recommendations
- Thought leader NGOs engaged
- Extensive local and national outreach

Replication of this approach throughout Massachusetts, especially Cape Cod where opportunity exists to save billions and keep water local

Quarter Beginning:	6/1/2013	10/1/2013	1/1/2014	4/1/2014	7/1/2014	10/1/2014	Total 2013	Total 2014	Total
PROJECT COST SECTION									
Direct Labor									
Awardee							0	0	0
Sub-Contractors									
Bioengineering Group	100000	20000	20000	25000			120000	45000	165000
Attorneys and Emerging Tech Support	12000						12000	0	12000
Collection System			230000				230000	230000	460000
							0	0	0
							0	0	0
Sub Contractor Sub Total	112000	20000	250000	25000	0	0	132000	275000	407000
Direct Labor Total	112000	20000	250000	25000	0	0	132000	275000	407000
Capital Expense (Items > $10,000)									
Bioclere (aquapoint)		30000					30000	0	30000
Dispersal (Oakson)		20000					20000	0	20000
Treatement Tanks and Shoring		17000					17000	0	17000
Septic sand, topsoil, boulderwall		30000					30000	0	30000
8 home septic tanks replacement				80000			0	80000	80000
Add more if necesssary							0	0	0
Total Capital Expense	0	97000	0	80000	0	0	97000	80000	177000
Expensed Items (<$10,000):							0	0	0
Total Gross Project Cost	112000	117000	250000	105000	0	0	229000	355000	584000

TGPC

	Quarter Beginning:	6/1/2013	10/1/2013	1/1/2014	4/1/2014	7/1/2014	10/1/2014	Total 2013	Total 2014	Total
	Cost Sharing									
	In-Kind & Discounted Contributions									
	Direct Labor									
	Awardee							0	0	0
	Sub-Contractors									
	Bioengineering Group							0	0	0
	Wendi Goldsmith			40000				40000	40000	80000
	Sub 3							0	0	0
	Sub 4							0	0	0
	Homeowners		50000	75000	75000	75000	75000	50000	300000	350000
	Sub Contractor Sub Total	0	50000	115000	75000	75000	75000	50000	340000	390000
	Direct Labor Total	0	50000	115000	75000	75000	75000	50000	340000	390000
	Capital Expense Items									
	Bioclere (aquapoint)		21200					21200	0	21200
	Oakson (dispersal)		10000					10000	0	10000
	Item 3							0	0	0
	Item 4							0	0	0
	Item 5							0	0	0
	Add more if necesssary							0	0	0
	Total Capital Expense	0	31200	0	0	0	0	31200	0	31200
	Expensed Items (<$10,000):							0	0	0
TCS	**Total Cost Share**	0	81200	115000	75000	75000	75000	81200	340000	421200
	% of TGPC							0.35458515	0.95774648	0.72123288
	Grant Request (TGPC-TPS)	112000	35800	135000	30000	-75000	-75000	147800	15000	162800
	% of TGPC							0.64541485	0.04225352	0.27876712


PROJECT
LOCATION
RAYMOND STREET
BUTLER AVENUE
MAGNOLIA
PARK
MANCHESTER
BATH AND
TENNIS CLUB
Thank You!

CDR MAGUIRE INC.
2 Granite Avenue
Milton, MA 02186
www.CDRMaguire.com