1

2.3.1 Existing Customer Base and Town-wide Water Use Patterns

The BWD serves approximately 23,368 customers (2013 ASR) through 7023 service connections. 100% BWD customers, including all public buildings, including connections to Bridgewater State University, are metered. Residential use accounts for approximately 89 % of demand (2013 ASR). The following sections discuss the nature of the customer classes and outlines information available about other water development and use within the Town.

2.3.2 Current Water Use

The Bridgewater Water Department obtains water from 8 groundwater sources, which are summarized in Table 2-7: Water Supply Sources Permitted Production and Yield. Annual metered consumption has ranged from 520 to 580 Million Gallons. Residential service is provided through 6,681 metered connections comprising 95 % of all connections. Commercial connections and industrial uses comprise 4.7% and 4.0% of metered use in 2013. Peak monthly demand is typically July or August with a summer to winter demand ratio ranging from 1.15 to 1.25 based on DEP methodology. This ratio may reflect demand of Bridgewater State University with its resident student population which is higher in the months of September through May.

Table 2-7. Water Supply Sources Permitted Production and Yield

Town of Bridgewater Water Supply Sources, Permitted Use and Yield			WMA Permit 2007 WMA Registration 2008				
	Source	Type	Number	Registration only Volume MGD	Registration + WMA Volume MGD	Yield	Year Built
Registered # 42504201	Carver's Pond #1 (GP Well # 1)	GW	4042000-03G	0.1		0.43	1960
	Carver's Pond #5a (GP Well 5A)	GW	4042000-13G	0.244		0.24	2008
Registered # 42504201 and WMA Permit # 9P-4-25-042.01	High Street #3 (GP well #3)	GW	4042000-02G	*	*	0.5	1965
	Carver's Pond #2 (GP Well # 2)	GW	4042000-04G		0.58	0.58	1971
	High Street #6 (GP Well #6)	GW	4042000-05G	*	*	0.25	1950
	Carver's Pond #4 (GP Well #4)	GW	4042000-06G		0.43	0.43	1971
WMA Permit # 9P-4-25-042.01	Well #7 (GP Well #7)	GW	4042000-08G		0.14	0.14	1989
	Well #8 (GP Well #8)	GW	4042000-09G		*	0.43	1995
	Well #9 GP Well #9)	GW	4042000-10G		*	0.43	1995
	Well #10A (GP Well 10A)	GW	4042000-11G		0.23	0.23	2005
	Well #10B (GP Well 10B)	GW	4042000-12G		0.31	0.31	2005

Notes: * Wells #3. #6, #8, #9 combined 1.62 MGD maximum daily rate

Total Registration # 42504201 (2008) 605.9 MGY
1.66 MGD

Well 4042000-13G not listed in 2007 WMA Permit

Well #7 was taken off line in 1999

Yield reported in 2010 CIP

Water production has ranged from 575 to 605 Million Gallons from 2008 to 2013, as shown in Table 2-8: Historical Water Production (in Gallons), Bridgewater Water Department System, below. Baseline use (2005) is 633 million gallons according to DEP methodology. Between 2004 and 2013 BWD production ranged from 575 to 643 million gallons per year and maximum daily production has ranged from 1.81 to 2.49 million gallons.

Table 2-8. Historical Water Production (in Gallons), Bridgewater Water Department System

Year	Annual Finished Water Production	Max Monthly Production	Max Day Production
2013	586,361,000	56,203,000	1,813,000
2012	578,267,000	58,404,000	1,884,000
2011	587,998,000	57,785,000	1,864,032
2010	605,000,000	65,063,000	2,098,806
2009	575,077,000	55,100,000	1,777,419
2008	585,286,000	61,133,768	2,487,314

2007	642,895,000	65,568,000	2,115,097
2006	601,460,000	59,560,000	1,921,290
2005	633,330,000	65,430,000	2,110,645
2004	623,980,000	61,632,000	1,988,129

2.3.3 *Water Customers*

Residential customers are the largest category of metered connections (95%) and the largest consumers of water (89%) in 2013. Table 2-9: Total and Residential Metered Use shows number of residential connections and annual residential water use from 2008 to 2013. The MCI Bridgewater facility has a separate water source and is therefore not included in data pertaining to BWD system.

Table 2-9. Total and Residential Metered Water Use

Year	2008	2009	2010	2011	2012	2013
Total Metered Connections	6705	7071	7120	6868	6925	7023
Residential Connections	6497	6749	6795	6546	6600	6681
Percent Residential Connections	96.90%	95.45%	95.44%	95.31%	95.31%	95.13%

Year	2008	2009	2010	2011	2012	2013
Total Metered Consumption	566.787	545.610	569.728	558.358	520.651	580.572
Residential Consumption	526.742	470.500	493.229	463.595	437.519	519.111
Percent Residential Consumption	92.93%	86.23%	86.57%	83.03%	84.03%	89.41%

2.3.4 *Other Private & Public Water Supplies*

Approximately 10% of the residential population of Bridgewater is not served by the BWD. These residents are served by individual wells and their annual water use is estimated to be 65 MGY. Several large water users are not served by the BWD. They include the Olde Scotland Links (Golf Course), two agricultural users, and industrial user and a residential development. In addition, the facilities at MCI Bridgewater are supplied by the City of Taunton. Total estimated water use within the Town that is not provided by the BWD is 106 MGY.

2.3.5 *Bridgewater Water Supply Infrastructure*

The Town of Bridgewater relies solely on groundwater for its water supply. The Town operates a public water supply and outside of its service area, individual privately operated wells comprise the supply. This section describes the water supply infrastructure including source wells, treatment, and storage and distribution facilities

2.3.5.1 *Bridgewater Water Supply Wells*

The BWD develops water from 10 wells in two general locations (refer to Figure 1-4 Water Resources). The wells are less than 100 feet in depth and develop alluvial deposits along the Matfield River and glacial deposits near Carver's Pond. Available records indicate the wells are screened and filter packed within each water-producing interval. As discussed in a previous section, Zone I and II protection has been established either through Town ownership of overlying property or establishment of an aquifer protection district.

2.3.5.2 *Bridgewater Zone I and Zone II Areas*

In order to assure water quality of public drinking water sources, Massachusetts establishes zones around source wells and well fields that define land uses and reduce potential for contamination. For most public water supply wells with approved yields of 100,000 gpd or greater, the protective radius is 400 feet and is measured from the wellhead. The Town of Bridgewater owns the property within 400 feet of each well.

The Zone II aquifer is determined by hydrologic study as the area of groundwater contribution to each well field based on 180 days of pumping with no charge. Potential pollution sources within Zones I and II are identified and reported annually.

A Source Water Protection Report was prepared in 2005 and delineates Zones I and II for current production wells and summarized land uses within each zone.

2.3.6 *Bridgewater Water Treatment and Distribution*

Location, type and capacity of drinking water treatment systems

Water introduced into the Bridgewater distribution system is chlorinated for disinfection purposes. Further treatment is provided to water from the Carver's Pond area wells for removal of iron and manganese at the Carver's Pond Treatment Plant. The High Street wells along the Matfield River were formerly treated for nitrates, but the plant has been closed since nitrate levels dropped following changes in upstream land uses, particularly altered dairy farm operations. A summary of existing water treatment facilities and their capacities is shown in Table 2-10: Water Treatment Facilities.

Table 2-10. Water Treatment Facilities

Facility Name	Number	Treatment Type	Capacity (MGD)
PUMPING STATION (WELLS 10A AND 10B)	4042000-06T	IRON REMOVAL DISINFECTION	0.54
WELL HOUSE 3 (Well 3)	4042000-01T	IRON REMOVAL	0.5
WELL HOUSE 6 (Well 6)	4042000-02T	IRON REMOVAL	0.22
NITRATE PLANT (Wells 3 and 6)	4042000-03T	DISINFECTION	0.72
PUMPHOUSE 8/9 (Wells 8 and 9)	4042000-05T	IRON REMOVAL DISINFECTION	0.72
CARVER'S POND TREATMENT PLANT (Wells 1, 2, 4 and 5A)	4042000-07T	IRON REMOVAL DISINFECTION	1.8

Source ASR 2013

Size, nature and age of distribution system

The BWD distribution system comprises 130 miles of water main and two storage tanks. The system currently has 7,015 connections all of which are metered. The water mains range in size from 2 inches to 16 inches in diameter with most of the system 6 inch and 8 inch in size.

Table 2-11. Water Main Materials and Size.

Total Pipe in System		Pipe diameter		
Materials	Total Length	< 6 inch	8-12 inch	15-42 Inch
PVC	19.7	0.4	19.3	0
Ductile Iron	6.8	4	2.8	0
Cast Iron	23.8	13.2	10.6	0
AC	47.1	15.5	31.6	0
Other	1		1	0

Source 2010 CIP

Storage Facilities

In order to control pressure and provide high rates of flow for emergency response, water is stored in two tanks, one on Great Hill holding 900,000 gallons and one on Sprague's Hill to the north holding 4,700,000 gallons. Together these provide 2 days of storage based on the recent maximum day's consumption of 2.2 MGD and 2.9 days of storage based on 2007 average consumption of 1.73 MGD.

Table 2-12. Water Storage Facilities

Facility Name	Material Type	Capacity	Built	Spill Elevation
GREAT HILL STANDPIPE	Steel	0.9 MG	1925	
SPRAGUE HILL STANDPIPE	Steel	4.7 MG	1973	

Source of information 2011 ASR

2.3.7 Bridgewater Water Operations

Data monitoring and control systems

The BWD relies on a SCADA system to monitor its supply, treatment and distribution system. Data is collected and stored by the District as a basis for developing the Annual Statistical Report to the Department of Environmental Protection. In addition, water use data are used as a basis for billing customers.

Leak detection and Emergency Procedures

The Town conducted a water audit using fiscal years 2005 – 2008 to balance the volume of drinking water produced with the volume billed and account for the remaining water (loss) using the AWWA standard and the MassDEP guidance then available through the Water Management Act Program, *Water Management Act Program Guidance Document for a Water Audit and Leak Detection Survey.*

The water audit and subsequent water loss survey were conducted under grant from the DEP. In its report on the audit and subsequent actions, the town reported a 5% unaccounted for water loss. This is below the10% target recommended by the Water Management Act. It was calculated that the average water usage is 620 million gallons per year and it costs approximately $4.00 per 1000 gallons to deliver potable water to the Town for the various uses.

The grant included funding for a leak detection survey that consisted of a comprehensive leak detection survey of the entire water distribution system including 130 miles of main, including hydrants, gate valves and service connections. The leak detection survey included use of GIS compatible equipment which accurately measured the relative location of water mains and nearby roadways and provided the Water Department with updates and corrections to its reporting database. The Water Department uses the GIS to minimize response time and water loss in main break incidents.

Maintenance and Replacement Programs

Pursuant to its Master Plan and CIP filed with the DEP in 2010, BWD maintains, upgrades and expands its facilities to meet the needs of existing and future customers; these projects are proposed and funded through the Town of Bridgewater annual budget process. As discussed below, the BWD includes capital projects for supply, distribution and storage in its ongoing maintenance and replacement programs.

Water Supply- The BWD is evaluating additional well supply sites to increase operational flexible and reliability. It recently acquired land and developed two new wells at Wyman Meadow. These went into service in 2006 and are producing 500,000 gallons/day (.5MGD). These wells are included in the WMA permit. (Table 2-7:Water Supply Sources Permitted Production and Yield)

The department has also purchased land at Beech Street next to the Titicut Conservation Parkland for a possible added well. Evaluation of well potential at Beech Street/Titicut Camp site for production capacity and water quality is ongoing.

Water Distribution- The BWD has three types of upgrades of their distribution system that are included in their CIP: 1) increasing the size/capacity of under-sized sections, 2) looping (adding additional water main interconnections) certain sections to improve reliability and circulation and 3) replacement of Asbestos/Concrete (A/C) main nearing the end of its service life. Continued growth has increased flow to near capacity along certain mains. Looping is needed in certain areas to improve operational flexibility as well as increase reliability during service related water main shutoffs. Finally, the BWD has approximately 47 miles of AC water main in service put into service in the 1950 and 1960s. A/C water main has proven to become more failure prone at the end of its service life. For this reason, BWD replaces A/C sections of its system as funding allows.

BWD is in the process of replacing its customer water meters: replacing residential meters with magnetic radio read meters. BWD expects new meters to have extended service life and improve data accuracy. In addition, the new meters will reduce the level of effort needed to collect readings. In addition, larger meters are being replaced with newer and properly sized meters to improve accuracy of reading.

Storage- The BWD has evaluated the benefits of additional water storage in the Beecher Street portion of their service area. An additional stand pipe is included in the BWD long term plans.

Water audits and Water Conservation Programs

The Water Department summarizes water use and water losses as part of its annual statistical report (ASR) to the Department of Environmental Protection. In addition, the BWD has a comprehensive water conservation program summarized in Table 2-13: Water Conservation Programs.

Table 2-13
Water Conservation Programs

Summary of BWD Water Conservation Program
Standards
1. Comprehensive Planning and Drought Management Planning
1. Develop a drought management plan
2. Develop an emergency management plan
3. Develop a written program to comply with Conservation Standards
4. Make documents available
2. System Water Audits and Leak Detection
1. Conduct the ASR water audit annually
2. Conduct system-wide leak detection survey every two year
3. Meet or demonstrate progress towards 10% UAW
4. Conduct field surveys for leaks and repair programs
5. Repair leaks as expediously as posslble
3. Metering
Ensure 100% metering for water users
Increase billing frequncy
Implement a water meter repair/replacement progra
Seal water account metering systems against tampering
Calibrate
Properly size lines and meters
4. Pricing
Use Full Cost Pricing
Prohibit dereased block rates
5. Residential
Install water-efficient plubming fixtures
Use Residential Water Efficiently
Implement a residential water conservation program
6. Public Sector
Municipal and state buildings
Conduct indoor and outdoor audits
Analyze existing water-use data
Identify measures with greatest efficiences
Build new buildings with equipment that reduces water use
Replace/retrofit
Good & efficient lawn and landscape water-use
7. Industrial, Commerical, and Institutional (IC)
Water Audit
Install separate meters for process water
Develop and implement a water saving strategy
Use best avaiable technologies for water conservation
Practice good lawn and landscae water use technolgoies
8. Agricultural
9. Lawn and Landscape
Minimize watering lawns or landscapes
Develop and implement seasonal demand managemetn
Adopt and implement water restripction byla
Abide by water restrictions
Fully enforce water restrictions
10. Public Education and Outreach
Develop and implement and education plan

2.4 Existing Stormwater Management Practices

2.4.1 Background

Stormwater runoff is rainwater or snowmelt that flows into rivers, streams, lakes, and other receiving waters, either directly through point source discharges from formal drainage networks or indirectly through non-point sources from overland flow. Pollution is a concern because stormwater runoff may wash pollutants from the ground surface and transport them into receiving waters. Stormwater pollution is of greatest concern where there are industrial, commercial, or agricultural activities; and in developed areas where impervious area can increase the accumulation of pollutants from common sources such as the atmosphere, motor vehicles, and litter. Some of the most common pollutants that may be present in stormwater include:

- Bacteria: from animal wastes, or human wastes via failing/ineffective septic systems
- Chlorides: from winter deicing operations
- Hydrocarbons: from motor vehicle oil, gas, and other petroleum products
- Metals: from industrial activities
- Nutrients: from fertilizing and other lawn and garden activities, and animal waste
- Pesticides: from agricultural and household insecticide/herbicide application
- Suspended Solids: from sand and other sediments in roadways and construction sites
- Large Solids: trash and debris

According to inventories of Massachusetts's rivers and streams compiled by the DEP in their 2000 Summary of Water Quality Report (305(b)), nearly half of the water quality problems in streams are attributable to stormwater. In addition, development has notably reduced the amount of pervious area and consequently also reduced the amount of stormwater infiltrating into the ground. This infiltration is necessary to recharge groundwater and aquifers that support vital base flow to rivers during dry weather and to drinking water wells.

A great deal of information regarding the effects of stormwater on the environment and ways to minimize these effects is provided in the two-volume Stormwater Management Handbook prepared by the DEP and the Massachusetts Coastal Zone Management.

2.4.2 Federal and State Permitting for Stormwater Discharges

Over the years, many new regulations have been introduced to minimize stormwater contamination and to help protect water resources from the effects of stormwater that has been polluted. The first regulation enacted was the Federal Water Pollution Control Act (WPCA). Initially enacted in 1948, this regulation utilized ambient water quality standards to specify acceptable levels of pollution in lieu of preventing the causes of water pollution. The 1972 amendments to the WPCA, referred to as the Clean Water Act (CWA), later implemented measures which were focused on establishing effluent limitations on point sources, or "any discernable, confined, and discrete conveyance… from which pollutants are or may be discharged."

The 1972 CWA introduced the National Pollutant Discharge Elimination System (NPDES). The NPDES program was established as the fundamental regulatory mechanism of the CWA requiring direct dischargers of pollutants into waters of the United States to obtain a NPDES permit. Between 1972 and 1987, the NPDES permit program focused on improving surface water quality by reducing pollutants of industrial process wastewater and municipal sewage. During this period, several nationwide studies on water quality, most notably the United States Environmental Protection Agency (USEPA) National Urban Runoff Program (NURP) identified storm water discharges as a significant source of water pollution.

The results of the NURP and similar studies, along with pressure from environmental groups, resulted in the reauthorization of the CWA in 1987 with the passage of the Water Quality Act (WQA). The WQA established a legal framework for and required USEPA to develop a comprehensive phased program for regulating municipal and industrial stormwater discharges under the NPDES permit program.

The NPDES Phase I rule, which was issued in November 1990, addressed stormwater discharges from medium to large municipal separate storm sewer systems (MS4s), which were communities serving a population of at least 100,000 people, as well as stormwater discharges from 11 categories of industrial activity. One such industrial activity was construction activities disturbing five or more acres of land.

The NPDES Phase II rule, which was promulgated in December 1999, addressed small MS4s serving a population of less than 100,000 people in urbanized areas. The Phase II rule requires that all MS4s located within "urbanized areas" as defined by the Bureau of the Census latest decennial Census automatically comply with the Phase II Stormwater regulations. Since Bridgewater is located within an urbanized area (see map in Appendix H: 2016 & 2003 Permits for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4)), the EPA designated the town as a Phase II community, which must comply with the NPDES regulations. In May 2003, the EPA and the Massachusetts Department of Environmental Protection (MADEP) jointly issued the NPDES General Permit for Discharges from Small MS4s and Bridgewater submitted the required Notice of Intent (NOI) for inclusion under this General Permit. Copies of the 2003 MS4 General Permit and NOI are included as Appendix H: 2016 & 2003 Permits for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4) of this Plan, respectively.

The 2003 NPDES Phase II MS4 General Permit required Bridgewater to develop, implement, and enforce a Stormwater Management Plan (SWMP). The objectives of the SWMP are to reduce the discharge of pollutants from the MS4 to the maximum extent practicable, to protect water quality, and to satisfy the appropriate water quality requirements of the CWA. These objectives are accomplished through the implementation of Best Management Practices (BMPs) for each of the following minimum control measures required by the Phase II regulations:

- Public Education and Outreach
- Public Involvement/Participation
- Illicit Discharge Detection and Elimination
- Construction Site Stormwater Runoff Control
- Post-Construction Stormwater Management in New Development and Redevelopment
- Pollution Prevention/Good Housekeeping for Municipal Operations

The 2003 NPDES Phase II General Permit expired in 2008. However, the Town remains covered under this permit until the new permit becomes effective. The new permit was re-issued by USEPA and DEP on April 4, 2016, and becomes effective on July 1, 2017.

2.4.3 Stormwater System Description

In Bridgewater, a storm drain piping network serves selected portions of the town. Figure 2-8: Town of Bridgewater Mapped Stormwater Inlets is under development by Town staff to better document the extents and physical components of the stormwater/drainage system. The town's stormwater drainage system has been pieced together over the years. Portions of the drainage system were constructed as the town has developed, and new components have been added and older components have been upgraded.

The Town is in the process of developing a comprehensive GIS map of their drainage system. Bridgewater has an estimated 490 stormwater outfalls. The precise amount of miles of pipe currently making up the Bridgewater drainage system is unknown. There are formal stormwater collection facilities within the more "urban" areas of town. There are also a great number of subdivisions throughout town with their own collection and conveyance and outfall systems. Little to no formal collection system facilities exist on the more rural roadways in town, over the past several years, the Town's Highway Department has focused on making drainage improvements to the Walnut Street-Cherry Street-Short Street Area, where stormwater systems generally flow to the Taunton River. Aging and corroded corrugated metal drainage piping has been replaced with HDPE piping to eliminate silt and other solids from entering the drainage system and flowing to the Taunton River. The lengths and locations of drainage facilities replaced (and to be replaced) in this area are summarized in Table 2-14: Summary of Lengths and Locations of Drainage Facilities Replaced (to be Replaced), below.

Table 2-14. Summary of Lengths and Locations of Drainage Facilities Replaced (to be Replaced)

Year	Location	Pipe Length (ft)
2014	Short Street	1500
2015	Walnut Street	2500
2016*	Cherry Street	2400

* Indicates work to be completed

In all of the above locations improvements included replacing catch basins, drain manholes, and drainage piping, as well as replacement of existing outlets outfalls with flared end pipes and rip rap. In some cases, additional catch basins were installed, where needed, to collect street drainage. While available town funds are limited for needed storm drain improvement, the town has typically used Chapter 90 funding for the above-noted improvements. Since the Walnut Street-Cherry Street-Short Street area is also the site of a proposed large scale family development, the above noted work will be coordinated with required stormwater systems to be installed as part of the Childs Bridge subdivision drainage including a stormwater treatment system prior to surface drainage. Those improvements will be made using private (and not public) funds.

One other noteworthy stormwater improvement involved the installation of vegetative swales and associated piping, flowing to the Bridge Street outfalls to the Satucket River. Heavy flooding in the area and resulting washouts of roadways and soils into the river preceded the drainage improvements to that section of town near the East Bridgewater municipal boundry.

2.4.4 Public Education and Outreach

The 2003 MS4 Permit requires that each Phase II community "implement a public education program to distribute educational materials to the community or conduct an equivalent outreach activity about the impacts of stormwater discharges on water bodies and the steps the public can take to reduce pollutants in storm water runoff."

There are educational stormwater materials that are maintained in town offices, schools, the Town library, and in other municipal buildings. In addition, the Town had a Stormwater Committee comprised of municipal staff that had been working to implement the requirements of the 2003 MS4 Permit.

2.4.5 Public Involvement and Participation

The 2003 MS4 Permit requires that each Phase II community, "at a minimum, comply with state, tribal, and local public notice requirements when implementing a public involvement/participation program. The EPA recommends that the public be included in developing, implementing, and reviewing a storm water management program and that the public participation process should make efforts to reach out and engage all economic and ethnic groups."

The Town encourages public involvement within the community and residents participate in a number of different ways. Some public participation opportunities have included Town Earth Day park clean-ups, Town catch basin leaf clean-ups, Lion Club Recyclemania and the DPW booth at Autumnfest.

2.4.6 Illicit Discharge Detection and Elimination

The 2003 MS4 Permit requires that each Phase II community "develop, implement, and enforce a program to detect and eliminate illicit discharges into their small MS4." They must "develop a storm sewer system map, showing the location of all outfalls and the names and locations of all waters of the United States that receive discharges from those outfalls. To the extent allowable under state, tribal or local law, they must effectively prohibit, through ordinance, or other regulatory mechanism, non-stormwater discharges into their storm sewer system and implement appropriate enforcement procedures and actions." They must "develop and implement a plan to detect and address non-stormwater discharges including illegal dumping to their stormwater system. They must "inform public employees, businesses, and the general public of hazards associated with illegal discharges and improper disposal of waste." The categories listed in 40 CFR 122.34(b)(3)(D)(iii) must also be addressed if it is determined that they are significant contributors of pollutants to the MS4.

The Town has a Drainage GIS that includes mapping of 100% of the Town's roadways, water bodies, and sub-watersheds. An estimated 1,375 catch basins and 277 outfalls have been located, mapped, and inspected to date. Additional outfall mapping is shown on available as-built plans, and the Town continues to work to update their GIS and map known outfalls within urbanized areas. The Town estimates that they have approximately 490 outfalls. The GIS mapping is intended to facilitate the identification of key infrastructure and factors influencing proper system operation, and potential for illicit sanitary sewer discharges. The Town adopted an IDDE bylaw on November 14, 2002. This bylaw is enforced and fines are assessed as appropriate.

2.4.7 Construction Site Stormwater Runoff Control

The 2003 MS4 Permit requires that each Phase II community "develop, implement and enforce a program to reduce pollutants in any stormwater runoff to their small MS4 from construction activities that result in a land disturbance of greater than or equal to one acre. The program must include: the development and implementation of (at a minimum) an ordinance or other regulatory mechanism to require erosion and sediment controls, as well as sanctions to ensure compliance, requirements for construction site operators to implement appropriate erosion and sediment control BMPs, requirements for construction site operators to control waste at the construction site; procedures for site plan review which incorporate consideration of potential water quality impacts; and procedures for receipt and consideration of information submitted by the public."

The Town has a Construction Site Runoff Control Bylaw in place, which was adopted on November 13, 2006. All Town Departments and Boards adhere to the requirements of this bylaw when performing subdivision and site plan reviews and inspections. Both the Building Inspector and the Conservation Commission enforce the bylaw requirements by performing regular site inspections and taking corrective action as needed.

2.4.8 Post-Construction Stormwater Management in New Development/Redevelopment

The 2003 MS4 Permit requires that each Phase II community "develop, implement and enforce a program to address stormwater runoff from new development and redevelopment projects that disturb greater than or equal to one acre, including projects that are less than one acre that are part of a larger common plan of development or sale, that discharge into the small MS4. The Phase II community must "develop and implement strategies, which include a combination of structural and/or non-structural BMPs appropriate for the community; use an ordinance or other regulatory mechanism to address post-construction runoff; and ensure adequate long-term operation and maintenance of BMPs."

The objective of this control measure is to reduce the discharge of pollutants found in stormwater through the retention or treatment of stormwater after construction on new or redeveloped sites. The Town adopted new regulations in 2004 to comply with the permit requirements. This bylaw was further amended in 2007 and 2012 to require compliance with the MADEP Stormwater Management Standards. The regulations require developers to operate and maintain BMPs that are installed for a 5-year period before operation and maintenance responsibilities are transferred to the Town. The Town requires that all newly installed storm drains are televised prior to acceptance by the Town to ensure they have been installed properly and that they are functioning properly. The Town's Building Inspector provides assistance with bylaw enforcement.

2.4.9 Pollution Prevention/Good Housekeeping for Municipal Operations

The 2003 MS4 Permit requires that each Phase II community "develop and implement an operation and maintenance program that includes a training component and has the ultimate goal of preventing or reducing pollutant runoff from municipal operations."

The town employs a number of "good housekeeping" practices. Catch basins are cleaned on a regular basis, and catch basins may be cleaned more frequently depending on sediment accumulation. If a catch basin needs frequent cleaning, the cause is investigated and addressed. Streets in low-lying areas are swept regularly to reduce accumulation of leaves and debris. All other streets are swept as resources permit with the goal of sweeping these streets once per year. The Highway Department employs the use of erosion and sediment controls when completing roadway repairs. Emergency spill kits are kept at the DPW facility to protect catch basins should any spills occur. The Town has reviewed their winter good housekeeping operations and implemented some changes. They have limited the use of sand to reduce the amount of sediment generated. All salt storage areas are covered to prevent runoff. Calibrated spreaders are used to minimize salt usage. Stored magnesium chloride has secondary containment and is mixed at the spinner, and not at the salt shed, to prevent the discharge of pollutants. Vehicle washing is also performed indoors with discharge to an oil/water separator prior to discharge to the Town's sewer system.

2.4.10 Total Maximum Daily Loads

Under Massachusetts General Law (MGL) Chapter 21, the MADEP is responsible for monitoring the waters of the Commonwealth, identifying those waters that are impaired, and developing a plan to bring them back into compliance with the Massachusetts Surface Water Quality Standards. The list of impaired waters, better known as the "303d list," identifies waters bodies that are impaired and the reasons for impairment.

Once a water body is identified as impaired, the MADEP is required by the Federal CWA to develop a strategy for restoring the health of the impaired water body. The process of developing this strategy, which is generally referred to as a Total Maximum Daily Load (TMDL) includes identifying the type of pollutant, and the potential sources of the pollutant, in addition to determining the maximum amount of pollutant that can be discharged to a specific surface water body in order to meet surface water quality standards. Part of the TMDL also includes the development of a plan to help in meeting the TMDL limits once they have been established.

As part of their SWMP, Phase II communities are required to develop BMPs for surface water bodies within their jurisdiction for which a TMDL has already been developed. These impaired waters are listed under Category 4A in Part II of the Massachusetts Integrated List of Waters. Based on the 2014 Final Integrated List of Waters for Massachusetts, the Matfield River (MA62-32) is impaired for bacteria and is included under the Final Pathogen TMDL for the Taunton River watershed. In order to limit bacterial contamination in the watershed, the Town is required to reduce bacteria in discharges to the Matfield River by implementing BMPs to meet the TMDL.

2.4.11 Discharges to Water Quality Impaired Waters

In addition to identifying water bodies for which a TMDL has already been developed, the 303d List also identifies Impaired Waters under Category 5 – Waters Requiring a TMDL. Category 5 includes those water bodies that are impaired or threatened for one or more designated uses. The MS4 permit requires that all permitees determine whether discharges from any part of the MS4 contribute, either directly or indirectly, to a Category 5 listed water body.

Based on the Massachusetts 2014 Final Integrated List of Waters, Bridgewater currently has the following water bodies within its boundaries or is tributary to the following water bodies, which are listed under Category 5 and require the development of a TMDL (which has not yet been completed):

- Matfield River: Aquatic macroinvertebrate bioassessments, excess algal growth, dissolved oxygen, total phosphorus, and taste and odor.

- Taunton River: Dissolved oxygen and fishes bioassessments.

- Mount Hope Bay: Chlorophyll-a, fishes bioassessments, total nitrogen, dissolved oxygen and water temperature.

Under the 2003 MS4 Permit, the Town was required to identify in their Stormwater Management Plan measures that will be taken to control the discharge of pollutants of concern and to ensure that the discharge will not cause an in-stream exceedance of the water quality standards. The Town also had to identify what control measures and BMPs were to be used to control the discharge of the pollutants of concern from its MS4.

3.0 ASSESSMENT OF FUTURE CONDITIONS

Information in this report section will document the projections and assumptions for future conditions in Bridgewater used in the development of the needs analysis.

3.1 CWMP Planning Period

The planning period for this CWMP is 20 years.

3.2 Land Use Projections

3.2.1 Plan Goals

The Town's 2012 Housing Production Plan suggested possible revisions to the Town's Zoning Ordinance in order to increase density downtown. In September, 2013, the Bridgewater Town Council approved a Mixed Use Zoning Bylaw for the Central Business District that allows mixed commercial and residential development by special permit. The zoning bylaw allows for a maximum of five residential units or a maximum of eight residential units per acre if 25% of the total units are deemed affordable. The bylaw further requires that commercial uses be located on the first floor. The previous Central Business District in this area required a minimum lot size of 10,000 square feet or 4.4 units per acre. The new zoning allows for increased density in the Downtown from what was previously permitted. Because of this increase in allowed density in the new zoning, the Town Planner has expressed that Bridgewater has the potential to see an additional 200 units of housing in its downtown.

3.2.2 40B and Other Initiatives

According to DHCD, as of April 30, 2013, 2.7% of the Town's housing stock was considered affordable. DHCD shows that the Town has a total of 8,288 total housing units, of which 224 are listed on the Subsidized Housing Inventory (SHI). Because the Town has not yet met the Commonwealth's requirement of 10% of its housing stock be affordable, the Town has seen a high number of Comprehensive or 40B permits proposed within the Town. According to the Town's Planning Department, over the past 10 years, a total of 522 units have been approved through the 40B process. Of those approved units, 119 have already been built. That leaves approximately 403 additional units still to be constructed, of which approximately 314 will be affordable units. In addition to those permits already approved, the Town currently has two 40B projects undergoing the permitting process. Those projects together total 37 single family lots (21 lots at Jasmine Way and 16 lots on Laurel Street). If and when all of the lots either undergoing permitting or already approved are built, the Town will add 322 (314 affordable units permitted but not yet constructed plus 20% for the two projects undergoing permitting) affordable units to its housing stock. In order for the Town to meet its 10% affordability requirement, they would still need 283 additional units of affordable housing. Thus, there remains a potential for a significant number of additional 40B projects in the Town because even with the previously discussed projects, the Town will still be under the 10% threshold.

3.2.3 Current Potential Development Information From Planning Department

Since 2002, the Town of Bridgewater has seen the approval of 28 new developments consisting of 382 new dwelling units and 8 industrial lots on approximately 522 acres of land. All of these new developments are/will be connected to the public water system, while only 2 of these new developments, consisting of a total of 27 units, will be connected to the public sewer system. The remaining 355 units will be serviced through individual private septic systems. Based on information provided by the Planning Department, approximately 215 units have been constructed, while 167 units are permitted but have not yet been constructed.

By including both the 40B permits and conventional subdivisions that have been approved but not yet constructed, the Town will see the construction of a total of approximately 570 additional housing units in the Town in the coming years.

The Town has expressed that there are several possibilities for future development. There has been discussion of a casino to be permitted in the Town. A 104 room hotel, approximately 100,000 square feet of retail space, and 2 office buildings could be included as part of the proposed casino project. There is also approximately 11 acres located at the Perkins Ironworks site. The site is currently utilized as an iron works facility, but there have been discussions with the Town that it could be redeveloped into a big box retail facility. Finally, the Town contains a 40R Smart Growth Overlay District which is located in the Waterford Village area and comprises approximately 128 acres. The Town anticipates that if developers were to build at the density permitted in the 40R Overlay District it could account for an additional 500 - 600 units of housing. None of the above mentioned projects have begun a permitting process, thus they may never come to fruition

3.3 Demographic & Economic Projections

In 2000, there were two buildout analyses that were completed for the Town. The first was completed by the State's Executive Office of Environmental Affairs (EOEA) and the second by the Old Colony Planning Council. EOEA's buildout analysis set out to determine how much growth the Town could experience, given the current land use patterns and zoning regulations. The analysis found 8,382 potentially developable acres accommodating 7,610 new housing units and 19,538 new residents. The analysis also determined that there was the potential for an additional 31,165,899 square feet of new commercial/industrial space.

The Old Colony Planning Council (OCPC) revised the buildout analysis completed by EOEA in 2000 and projected a population growth of roughly 15% between 2000-2030, with a projected population of 29,000 in 2030. This projection indicates an increase of approximately 2,438 new Bridgewater residents from 2010-2030. The projections further indicate a leveling off of growth as compared with prior decades with a 7% increase forecast between 2010-2020 and a 2% increase between 2020 and 2030.

Both of these buildout analysis' are simply projections based on land use, not taking into account other factors that could occur in the future which can limit or change growth patterns. Although, even with such issues, these buildout projections can be helpful when looking at population projections. According to the draft Master Plan, based on the trends in population growth which Bridgewater has seen over the last 40 years, it shows that the population has already begun to level off, particularly from what we can see in the last 20 years (18.5% from 1990 to 2000 and 5% from 2000 to 2010). Because of this, it can be projected that that the Town's growth could potentially continue to level off in the next 20 years, as predicted by the OCPC buildout analysis.

Predicting an average annual growth in population of 5% in Bridgewater is in keeping with the growth seen in the surrounding communities. The Housing Production Plan performed an analysis of growth trends for 11 regional municipalities including Bridgewater in the past decade. The analysis shows an average annual growth of 5.5%, with a range of -0.5% population loss (Brockton) to 15.9% population gain (Middleborough).

There have been three studies developed in the past several years which have projected the population growth for the Town of Bridgewater over the next fifteen years. The studies and their findings are as follows:

- The Old Colony Planning Council developed a Comprehensive Economic Development Strategy (CEDS) in June of 2011. The study determined that by 2030, the population of Bridgewater would increase by 2,111 persons by the year 2030 (26,563 in 2010 and 28,674 in 2030). These population forecasts were developed by the Massachusetts Department of Transportation for OCPC.

- The Metropolitan Area Planning Council developed Population and Housing Demand Projections for Metro Boston, including regional projections and municipal forecasts in January, 2014. The study included population projections for the Town of Bridgewater. The study developed two scenarios to determine future population, household, and housing unit growth. The first scenario is the "status quo" scenario which is based on the continuation of existing rates of births, deaths, migration and housing occupancy. The second scenario is the "stronger region" scenario. This scenario explores how changing trends could result in higher population growth, greater housing demand, and substantially larger workforce. The population projections for Bridgewater under the status quo scenario forecast the population in 2020 to be 26,596 and by 2030 to be 26,777. The population projections under the stronger region scenario forecast the population in 2020 to be 27,055 and by 2030 to be 27,619.

- UMass conducted a population projections study in November, 2013, titled "Long Term Population Projections for Massachusetts Regions and Municipalities". The study forecasted a population of 26,688 in 2020 and a population of 25,741 by 2030. This study is the only study to determine a loss in population by 2030.

The following Table 3-1: Population Projections illustrates the three different population projections that have been completed for the Town of Bridgewater in the last several years:

Table 3-1: Population Projections

	EOEA (2000) (19,538 new residents until buildout)	OCPC Buildout Analysis (2000)	OCPC CEDS (2011)	MAPC Population Projection Study – Status Quo Scenerio (2014)	MAPC Population Projection Study – Stronger Region Scenerio (2014)	UMass Population Projections (2013)
2020		28,422	27,997	26,596	27,055	26,688
2030		29,000	28,674	26,777	27,619	25,741

The MAPC Population Projection Study, which takes into account the Stronger Region Scenario seems to be the most in-depth projection and the most realistic. The Town of Bridgewater has shown with the amount of construction it has seen in the past several years and the high number of Chapter 40B permits that it has and will see in the coming years, that it is a strong region that expects to see economic growth in the future.

Based on the 4 different projections that were completed, it is expected that the population of the Town of Bridgewater will reach approximately 28,000 persons by 2030, an increase of approximately 1,500 people from its current population.

3.4 Bridgewater Correctional Complex (MCI Bridgewater)

Based on a telephone conversation with a representative from the Bridgewater Correctional Complex, there are no plans at this time for expansion of the facility in the future.

3.5 Bridgewater State University

As discussed in Section 1, Bridgewater State University (BSU) has been updating their master planning efforts. The most recent formalized planning effort was completed in a 2012 update, the details of which are summarized in Appendix A: BW State University Planning Information & Correspondence. More recent discussions with BSU representatives in January 2016, as part of this CWMP process, however, have refined the future projections for development and associated impacts related to the university.

Through the master planning process, DCAM set 12,500 students as the target future enrollment at BSU. However, based on the January 21, 2016 meeting with BSU representatives, future student population is likely closer to 12,000 students (or less). It is anticipated that BSU will need to hire 40- 50 faculty to meet the increased academic needs associated with these students. A BSU representative stated that the policy of the University is that students living on campus will never be higher than 36% of the students enrolled at the University. In addition, within the next 5 -20 years, the University has discussed the possible construction of the following on campus:

- Within the next 15 years, a new academic building of approximately 50,000 gross square feet.
- Within the next 15 - 20 years, a new campus center. The representative from the University stated that the construction of the new campus center has been discussed, but is unlikely to occur. Even if a new campus center were constructed, the current campus center would be closed, thus creating no additional wastewater flow contribution.
- Expansion of restroom facilities at the Swenson Athletic Complex for public use and locker room areas.

Using the above population estimates and Silva Engineering Associates estimates for per capita flows at BSU adjusted based on water conservation, Table 3-2: Bridgewater State University-Estimated Future Wastewater Flows presents a summary of the BSU projected future wastewater flows.

Table 3-2: Bridgewater State University – Estimated Future Wastewater Flows

	People	Unit Flow (GPCD)	Wastewater Flow (Gallons Per Day)
Students			
Commuter [1]	7,680	7	53,760
Residents [1]	4,320	26	112,320
Staff/Faculty	1,110	7	7,770
New Academic Bldg.[2]			3,750
Swenson Athletic Complex Improvements [3]			TBD
Total Estimated Future Flow	**13,110**		**177,600 +**
Estimated Existing Flow	12,247		149,510
Differential Future Flow			**28,090 +**

Notes:
[1] Assumes 64% of students are commuter, 36% are residents.
[2] New 50,000 gsf building at 75 gpd/1,000 gsf per Title 5
[3] Once more information is known about the future improvements at the athletic complex, this future flow estimate will be updated.

As shown above, the likely future flows for the University are approximately 20% lower than the system capacity that the College has previously stated they have been allocated in the past (220,000 gpd). As of the writing of this report, not enough information was available on the Swenson Athletic Complex future project, but this is a potential additional flow source that may require a significantly higher flow allocation.

3.6 Future Wastewater Flows and Loads

Future wastewater flows for the Town of Bridgewater need to include the existing system flows, with provisions for changes within the existing sewer system, and future flows from sewer extensions and planned development that will utilize the sewer system. As discussed in Section 2 of this report, the historic average daily flows (ADF) to the WWTF have been trending below 1.0 mgd based on a 12-month rolling average, as calculated for permit reporting (ADF was approximately 0.96 mgd as of July 2016). For planning purposes, additional flow allowances must be included for infill within the sewered area, future sewer extensions identified in this report, planned development in and around the sewered area (consistent with community planning), future changes to flows from Bridgewater State University, and any other changes that may be known or anticipated (e.g. increase in sewered population, changes in water use, etc.).

Table 3-3: Future Wastewater Flows to WWTF presents a summary of wastewater flow information for planning purposes, including future flow allocations aligned with various anticipated needs. Some flow components are presented with a low and high range flows to depict variability in those components.

Table 3-3
Future Wastewater Flows to WWTF

Flow Description	*Current Flows*	Future Flows	
	Average	Low Range	High Range
Existing influent flow to WWTF (unspecified)	0.151 mgd	0.116 mgd	0.176 mgd
Existing flow from BSU	0.150 mgd	0.185 mgd	0.185 mgd
Existing Infiltration	0.620 mgd	0.620 mgd	0.620 mgd
Existing Inflow	0.080 mgd	0.080 mgd	0.080 mgd
Future Flow fromSewered Properties Not Yet Connected	0 mgd	0.038 mgd	0.038 mgd
Future flow from Population Increase within Sewered Area	0 mgd	0.054 mgd	0.054 mgd
Future flow from PHPP	0 mgd	0.097 mgd*	0.110 mgd**
Future flow from Re-development/Development	0 mgd	0 mgd***	0.075 mgd
Future flow from BSU	0 mgd	0.029 mgd	0.065 mgd
Future flow from Needs areas	0 mgd	0.130 mgd	0.130 mgd
Future Infiltration - Removal Anticipated	0 mgd	0 mgd	0 mgd
Totals	**1.000 mgd**	**1.347 mgd**	**1.532 mgd******

* *Includes anticipated flow contributions from Approved 40B's that have not or are currently being built.*
** *Includes full buildout of Waterford Village 40R, but no other Approved 40B's that haven't been built.*
*** *New future flows from this component will need to be off-set with unrealized future flows from other categories or no flow increase re-development projects.*
**** *Requires additional NPDES capacity or a supplemental groundwater discharge.*

It is important to note based on the wastewater flow projections presented above that while it is possible for the future flow values to be within the current permitted discharge capacity of 1.44 mgd, there is a potential future scenario where flows may exceed this value. Based on these projections, however, future WWTF flows could be within the 10% more than permitted capacity range.

For planning purposes, the anticipated flows and loads for the Bridgewater WWTF are summarized in the following Table 3-4: Future WWTF Influent Loadings. These are based on average daily flows at design conditions, per the above discussion. The observed BOD_5 and TSS loads measured at the WWTF headworks were discussed in Section 2 of this report. The BOD_5 load presented is based on observed concentrations, which while relatively strong are consistent with expected values. The observed TSS concentrations were very high, and as such do not appear to be representative of expected raw wastewater concentrations. We have therefore assumed more typically, yet relatively strong domestic wastewater contribution of 350 mg/l for TSS. No specific data or detailed information on influent nitrogen and phosphorus concentrations is available for the Bridgewater WWTF – we therefore present typical domestic wastewater concentrations for these parameters for planning purposes.

Table 3-4
Future WWTF Influent Loadings

Parameter	Design Loading *
Design Flow, ADF	1.44 mgd
BOD_5	291 mg/l 3,495 lbs/day
TSS	350 mg/l 4,205 lbs/day
Total Nitrogen	40 mg/l 480 lbs/day
Total Phosphorus	8 mg/l 96 lbs/day

* These loads are projected raw influent, without septage contribution.

While these flow and load values are sufficient for planning purposes, some detailed refinement of these numbers, particularly for waste loadings, will be needed prior to finalization of design options for WWTF improvements.

3.7 Water Supply & Demand

3.7.1 Future Demand and Supply Analysis

This section discusses future water demand and supply within the Bridgewater Water Department (BWD) service area. This is a general discussion based on available population projections and water use assumptions. Because all WMA permits in the Taunton River Basin are scheduled for review and renewal starting in 2015, a discussion of the WMA process and the likely effects of new SWMI regulations are included. Since The WMA permits are issued for a 20 year period, this analysis uses a 20 year projection period for future water needs.

3.7.2 Future Demand

Estimates of future demand are based on population projections provided by regional planning agencies and the Census Bureau. For the purposes of the BWD WMA permit renewal, Department of Conservation and Recreation (DCR) Water Needs Forecast (WNF) will be a basis for estimating future water demand. The Water Resources Commission issued a policy guidance document in 2009 stipulating the process for preparing a WNF.

DEP has indicated that except in unusual circumstances, they do not expect permits to be issued for a volume that exceeds the 20 year WNF for a town such as Bridgewater. The 20-year forecast will consider economic growth (population and employment) and assumes efficient water use, represented by the State Water Conservation Standards of 65 residential gallons per capita per day (RGPCD) and 10% unaccounted-for water (UAW). Since BWD currently has a UAW of 5% and a RGPCD of less than 65, we have developed preliminary water use projections based on RGPCD of 65 GPD.

The WMF includes consideration of the following:

- Water supply information, including metered volumes of water pumped, water purchased, and water sold.
- Water-use information based on actual metering;
- A breakdown of water use into residential, nonresidential, unaccounted-for, and treatment

plant loss categories;
- Service population, both year-round and seasonal;
- Other related information as determined by WRC staff after initial consultations.

The evaluation is constrained by the standard for unaccounted-for water (10% of the total amount of water entering the distribution system) and the standard for residential water use (65 gallons per capita per day (gpcd)).

3.7.2.1 *Population Projections (DCR, Regional Planning)*

Total town population estimates and forecasts are available from the US Census (historical population) and the Old Colony Regional Planning Commission (2011) for projections. Table 3-5: Town of Bridgewater Population summarizes this information. Since the BWD serves approximately 90% of the population of the town's residents, adjusted population figures are used to report per capita residential water demand and as a basis of future water needs estimates, discussed below.

Table 3-5: Town of Bridgewater Population

Bridgewater Population

	Year	population	interval	% Increase
Census	1950	9512		
Census	1960	10276	1950-60	8.03%
Census	1970	12902	1960-70	25.55%
Census	1980	17202	1970-80	33.33%
Census	1990	21249	1980-90	23.53%
Census	2000	25185	1990-00	18.52%
Census	2010	26563	2000-10	5.47%
Forcast	2017	27442	2010-17	3.31%
	2020	27997	2017-20	2.02%
	2025	28200	2020-25	0.73%
	2030	28674	2025-30	1.68%
	2035	29370	2030-35	2.43%

Source: CEDS Report, Old Colony Regional Planning, 2011

3.7.2.2 *Projections of Future Demand*

Preliminary projections of future water needs are presented below. It is generally consistent with DCR methodology used in the WMA permitting process. However, BWD will need to consult with DEP during renewal of their WMA permit and as a result assumptions regarding changes in population and other water demand factors may result in different projections.
Based on DCR and WRC methodology, water future needs reflect both increased population and increased commercial uses. The analysis used population projections from Old Colony Regional Planning and incorporates 3% growth in non-residential water demand per 5 year increment. The scenario considers increased demand by BSU but does not include the MCI facility which receives its water from Taunton.

BWD has experienced fluctuations in per capita residential water use (RGPCD). In the past 10 years BWD has reported RGPCD between 45 and 61. The 10 year average is 51 RGPCD. As a result 2 scenarios are shown below: 55 and 65 RGPCD, both assuming 5% UAW

Table 3-6: Future Needs Based on 65 RGPCD

Projection Date	Community	Average Year-Round Town Pop.	Future Pop. Served	Future Res. Consumption Rate (gpcd)	Future Non-Res. ADD (MGD)	Future Total ADD (MGD)	Future Total Annual Demand (65 gpd) (MGY)
Baseline 2013	Bridgewater	26,563			0.228		
2017	Bridgewater	27442	24,698	65.0	0.235	1.982	724.083
2020	Bridgewater	27997	25,197	65.0	0.242	2.024	739.316
2025	Bridgewater	28,200	25,380	65.0	0.249	2.044	746.693
2030	Bridgewater	28,674	25,807	65.0	0.257	2.081	760.265
2033	Bridgewater	29,370	26,433	65.0	0.264	2.133	778.931

Table 3-7: Future Needs Based on 55 RGPCD

Projection Date	Community	Average Year-Round Town Pop.	Future Pop. Served	Future Res. Consumption Rate (gpcd)	Future Non-Res. ADD (MGD)	Future Total ADD (MGD)	Future Total Annual Demand (60 gpd) (MGY)
Baseline 2013	Bridgewater	26563			0.228		
2017	Bridgewater	27442	24697.8	55	0.235	1.722	628.862
2020	Bridgewater	27997	25197.3	55	0.242	1.758	642.170
2025	Bridgewater	28200	25380	55	0.249	1.776	648.842
2030	Bridgewater	28674	25806.6	55	0.257	1.809	660.770
2033	Bridgewater	29370	26433	55	0.264	1.854	677.021

Under both scenarios, the BWD will not exceed its existing permit.

- At 65 rgpcd, BWD will exceed baseline but not its existing permit.
- At 55 RGPCD, BWD will exceed its baseline only in the last 5-year increment of the permit period.

Because the BWD may exceed its calculated baseline, under the proposed permitting requirements of the WMA, BWD would need to take steps to minimize water use. Under the proposed regulations, BWD could be required to mitigate water use beyond its baseline if the additional withdrawals are shown to change the existing designation of the affected subbasin. The proposed regulations and their potential implications are discussed below.

3.7.3 Future Supply

3.7.3.1 Existing Sources and Permits

BWD has groundwater sources that are registered and permitted. The combined permitted withdrawal is shown in Table 3-8: Baseline and Existing Permit Summary. According to proposed regulations, renewal of the BWD permit must consider a baseline using the average of 2003-2005 or 2005 whichever is larger. As shown in Table 3-8: Baseline and Existing Permit Summary the water use for 2005 is larger than the 2003-05 average, and so 665.00 MGY (1.822 MGD) is the baseline under the new SWMI regulations. Note that the baseline calculated under the propose regulations is greater that the baseline reported in the WMA permit issued in 2007.

Table 3-8: Baseline and Existing Permit Summary

SWMI Baseline (MGY)		WMA permit (MGY)	Baseline per WMA permit (amended May 29, 2007) special condition 1	
2005 + 5%	**Avg 2003-05**	**Permit + Registration**	**2005 Use**	
665.00	622.06	897.00	1.74 MGD	635.1 MGY

3.7.3.2 Effect of New Regulations on WMA Permit Renewal

Projections indicate existing permit plus registration sufficient to meet demands over the next 20 years. In addition, the projections indicate that the demand would be below the 2005 baseline calculated consistent with SWMI guidelines. This would mean BWD would not need an increase in its permitted amount or over its baseline. The implications to BWD permit renewal are discussed below.

3.7.4 WMA Permitting

This section provides information on the likely implications of the Commonwealth's Sustainable Water Management Initiative (SWMI) Framework to Bridgewater's next 20-year WMA permits. The Taunton River Basin is scheduled to begin WMA permitting in 2015 and, as discussed below, the classification of sub-basins from which Bridgewater develops its supplies affects the renewal of its permit.

3.7.4.1 WMA Permitting Process

The WMA permit process is discussed in detail in the "Water management Act Permit Guidance Document" dated March 26, 2014. The following is a brief summary. The WMA permit renewal process begins approximately 18 months prior to the expiration date for existing permits in each basin. The Taunton basin renewal process is scheduled to begin in 2015. The schedule provides that each permit application should be submitted to DEP 12 months prior to expiration of the current permit. However, as a basis for the permit application, DCR Office of Water Resources will contact BWD to begin development of draft water needs forecasts for permit renewal. This contact should occur approximately 18 months prior to permit expiration (6 months before the submittal data). Projected water needs and baseline for each applicant will determine the permit tier for its application and will determine the permit conditions in the final permit. In cases where the water needs forecast exceeds the calculated baseline, consultation meetings would be held with DEP to identify possible offsets to withdrawal impacts.

In river basins with numerous permits, such as the Taunton River Basin, DEP, DCR and DFW will conduct a basin outreach meeting approximately 4 months before the application submittal date. The meeting will cover the permit renewal process, the SWMI process and new demand management and resource protection conditions that may appear in renewed permits.

After submission of the renewal application, DEP will post notice of all renewal applications in the Taunton basin in the Environmental Monitor. Written comments on the renewal application will be accepted for 30 days. In addition to the comment period, the renewal application will undergo a 72 day technical review by DEP. At the close of the 72 day review period, DEP will issue an Order to Complete (OTC) requesting additional information and responses to comments. The OTC may require plans to minimize and mitigate the impacts of withdrawals. BWD will have 90 days to respond to the OTC.

The revised renewal application and supporting material will be subject to an additional 72 day review and if all required information is provided, will deem the application complete. Based on the complete application, the DEP will issue a draft permit or deny the application. If a draft application is issued, DEP will notice the public and accept public comment for 3 days. At the close of public comment, DEP will issue a final permit. There is a 21 day appeal period after issuance of the Final Permit.

3.7.4.2 Modifications in the MWA Process due to the SWMI Regulations

A number of factors play a role in determining what would be required of BWD in the next WMA permitting process. The SWMI framework adds several factors not included in the Bridgewater WMA permit issued in 2007. What BWD must do to comply with the WMA under the SWMI Framework depends on several factors:

- The System Baseline withdrawal volume (reference point against which a request will be considered either an "existing" or an "increasing" withdrawal);
- The Groundwater Withdrawal Category (GWC) of the Sub-basin(s) where the applicant's sources are located, and Net Groundwater Depletion (NGD) of such Sub-basin(s);
- The Biological Category (BC) of the Sub-basin(s) where the applicant's sources are located;
- Which sources have Registrations and which have Permits, and
- The requested water volume

Factors not relevant to renewing the BWD permit (eg withdrawals from multiple basins) are not discussed.

Bridgewater's baseline water use and projected needs determine whether an increased withdrawal is needed. Any withdrawal volume at or below Baseline, is considered an existing withdrawal with its accompanying existing impacts. Minimization may be required, but not Mitigation. A proposed increase over Baseline is considered an increase in withdrawal with new impacts. The SWMI Framework requires that this increase be mitigated.

The GWC and BC of the Sub-basins in which Bridgewater's sources are located, in conjunction with Baseline and the requested volume, determine into which "Tier" the application falls in the SWMI Framework. The Tier in turn specifies what is required during permitting, and what the permit requirements will be.

In Bridgewater, the public water sources are groundwater extractions located in the Taunton Basin. All the groundwater sources are in either Groundwater Withdrawal Category (GWC) 4 (subbasin 24106, Matson River wells) or GWC 5, (subbasin 24024, Carver's Pond wells). These two subbasins are designated as Biological Category 5, the most severely impacted. Coldwater fisheries resources are mapped within subbasin 24050 in the southern portion of the Town of Bridgewater. According to the SWMI, GWC and BC 5 categories cannot be further degraded, i.e., slip into a worse category, or "backslide."

Based on Table 3-6: Future Needs Based on 65 RGPCD and Table 3-7: Future Needs Based on 55 RGPCD, (projected water demand) Bridgewater may not need to request withdrawals above the identified SWMI baseline if average GPCD is maintained at or below 64 gallons per day. Permitting requirements are summarized in the table below from the WMA Permit Guidance Document. According to proposed WMA revisions, with no increased withdrawal, Bridgewater would be subject to (1) the basic conservation required of all permittees, and (2) Minimization. If Bridgewater's permit is for withdrawals below the SWMI baseline, they will not trigger Tier 3 review and both "Minimization" and Mitigation requirements. Specifically, if the BWD request falls in Tier 1, the renewed permit would be subject to conditions relating to:

- Water Conservation
- Performance Standards
  - 65 residential gallons per capita per day (RGPCD) and
  - 10% unaccounted for water (UAW)
- Limits on nonessential outdoor water use

The renewed permit would include requirements regarding minimization of impacts since both subbasins 24106 and 24024 are designated to be greater than 25% August Net Groundwater Depleted. Under the SWMI framework, groundwater withdrawal by permit holders in areas where groundwater has been significantly depleted must minimize their existing impacts on streamflow, even if they are not increasing their withdrawals. These actions are intended to offset or reduce the environmental impact of an existing withdrawal that contributes to net August depletion over 25%.

Based on available information, Bridgewater would be subject to Tier 1 review and conditions if their baseline were not exceeded in the MWA permit renewal. If the permit were to require the baseline to be exceeded, Bridgewater would likely be Tier 2 so long as additional withdrawals in the Matson subbasin (24106) did not cause the basin to change from GWC category 4 to GWC 5. However, if the GWC in the Matson subbasin were to increase from 4 to 5, the permit would be considered Tier 3 and would be subject to mitigation.

According to the draft Guidance and Regulations, requests over Baseline that Fall into Tier 3 will first need to demonstrate that there is "no feasible alternative source that is less environmentally harmful" where the increased volume could be obtained before moving on to develop a Mitigation Plan. To evaluate potential "environmental harm" the Guidance asks applicants to use the parameters and preferences for source optimization for the Coldwater Fishery Resource analysis to compare the current source with possible alternatives. The applicant will also need to consider the feasibility of using an alternative source, which should consider: anticipated environmental improvement, cost, available technology, and the permittee's legal authority to implement the alternative.

If the WMA permit is subject to minimization or mitigation, Bridgewater will need to determine whether to include all its wells in the new permit. Specifically, Carver's Pond wells 1 and 5-a are registered but are not included in Bridgewater's WMA Permit. Minimization and/or Mitigation requirements will be included as conditions in a renewed permit. Bridgewater can apply for a permit with one source, with some sources, or with all their sources included, which may affect whether and where Minimization and/or Mitigation are required. Specifically, if Bridgewater requests that an increased withdrawal be spread across several wells, these wells will become sources with permits if they are not already. This approach gives an applicant such as Bridgewater more flexibility with their sources, since a single permitted well could have operational or emergency problems and be shut down. This approach may, however, involve more Minimization and/or Mitigation if previously Registered sources such as well 1 and 5-a become sources with a Permit.

3.7.5 Water Supply Conclusions

1. BWD relies on groundwater for its supplies.
2. BWD has sources that are either registered or permitted, a few are both.
3. BWD develops its supplies well within its permitted and registered limits.
4. BWD is pursuing system replacement and upgrades to increase reliability
5. BWD is evaluating new supplies and treatment facilities to increase reliability.

6. The BWD permit is scheduled for renewal starting in 2015.
7. The State is adopting new requirements that will affect renewal of the BWD permit.
8. Ongoing demand management and loss control result in RGPCD and UAW well below state requirements.
9. The baseline used to evaluate the BWD permit renewal application may be sufficient to meet future demand; this evaluation is sensitive to RGPCD and nonresidential growth assumptions.
10. If extractions are required above the calculated baseline, minimization and possibly mitigation requirements may be imposed as part of the renewed permit.

3.8 Future Stormwater Management Practices

3.8.1 Federal and State Permitting for Stormwater Discharges

The permit for stormwater discharges from Small Municipal Separate Storm Sewer Systems (MS4 Permit) was re-issued by the Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection (MassDEP) on April 4, 2016, and becomes effective on July 1, 2017. A copy of the 2016 MS4 Permit is included in Appendix H: 2016 & 2003 Permits for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4). Bridgewater must file a Notice of Intent (NOI) seeking authorization to discharge stormwater under this MS4 Permit by September 29, 2017, and then comply with all of the permit's requirements.

A summary of the permit requirements and the timeline for completion is included in Table 3-9: Summary of 2016 EPA MS4 Permit Requirements and Implementation Timeframes. In addition to these requirements, which fall under the six minimum control measures, there are also separate specific requirements related to Total Maximum Daily Loads (TMDLs) and impaired waters. As discussed in Section 2.4.10, the Matfield River (MA62-32) is impaired for bacteria and is included under the Final Pathogen TMDL for the Taunton River watershed. The 2014 Final Integrated List of Waters for Massachusetts also identifies the Matfield River as impaired for total phosphorus, and Mount Hope Bay as impaired for total nitrogen, and requiring the development of a TMDL. There are specific requirements included in the 2016 MS4 Permit regarding discharges to water quality limited water bodies or their tributaries where phosphorus or nitrogen is the cause of the impairment, and there is no approved TMDL. The specific BMPs that must be implemented in order to comply with those requirements for water quality limited waters as they pertain to Bridgewater are included in Table 3-9: Summary of 2016 EPA MS4 Permit Requirements and Implementation Timeframes.

3.8.2 Future Additional Stormwater Discharge Locations

To plan for a future need to discharge large volumes of stormwater in a new location, a study was conducted to locate favorable recharge sites in town. This study investigated geology, protected environmental resources, setbacks from sources of public drinking water, and depth-to bedrock. Acceptable recharge areas were mapped in GIS based on these criteria and included in Figure 3-1: Acceptable Recharge Areas.

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4.0 NEEDS ANALYSIS & PROBLEM IDENTIFICATION

Development of the needs for Bridgewater begins with comparison of future projections to the existing conditions and identification of where gaps exist. Following that step, the specific needs for each infrastructure component are analyzed to determine possible solutions for further analysis. This section of the report describes this process with a focus on wastewater management, but incorporating water supply and stormwater management to capture the full picture of water resources.

4.1 Economic Development Impacts on Existing Infrastructure

Based on trends over the past 40 years, it appears that Bridgewater's growth has already started to level off. Therefore, it is projected that the Town's growth could continue to level off over the next 20 years. Anticipated future growth in Bridgewater is expected to be managed growth characterized by shifts in the type of development. Development is changing from traditional commercial and residential development to mixed use development. The South Coast Rail Community Priority Plan developed for the Town of Bridgewater by the Old Colony Planning Council identified two priority development areas. These included the area at the interchange of Route 24 and 104, and the Downtown Area. The area at the interchange of Route 24 and 104 is already supported by Town sewer and Town water, and the western portion of this area has already been designated as an expedited permitting and priority development site by the State and the Town. The Town has a new Downtown Zoning District, which allows for mixed use development in the downtown area. The Town anticipates that approximately 200 new housing units could be developed downtown. The Town did recently approve a mixed use Zoning Bylaw that allows for mixed commercial and residential development by special permit in the downtown area.

Economic development will have an impact on existing infrastructure, but it is anticipated that available water and sewer capacity will be able to keep pace with future demand since demand is not expected to increase substantially. Stormwater regulations require new developments to manage stormwater on site as much as possible so there should be minimal impacts to existing drainage infrastructure.

4.2 Wastewater Management Needs

Wastewater management needs for the Town of Bridgewater can generally be categorized as individual property wastewater needs, such as the need for off-site sewage disposal, and existing wastewater collection system and treatment needs. For the former, many parts of town are served by individual, on lot (Tile 5) septic systems. A number of these areas have been identified as needing a off-site solutions such as municipal sewer extensions. For the existing municipal system, needs tend to be related to system condition, capacity or other changes – such as permit conditions. Each of these types of needs are discussed in the following sections.

4.2.1 On-site System Area Needs

The initial step in the comprehensive wastewater management planning process was the identification of areas in the Town of Bridgewater with long-term challenges using on-site wastewater treatment and disposal systems. In Massachusetts, Section 310 CMR 15.000, The State Environmental Code (Title 5) governs standard requirements for such on-site systems. These regulations are administered through the local Board of Health. Both the Town Sewer Department and Board of Health have regulations that govern sewer connections and onsite septic systems, respectively. The Board of Health has been encouraging the Water and Sewer Commission to allow hookups to the sewer system for properties adjoining a sewer line including subdivision of property into new lots. Presently, the Water and Sewer Commission has limited connections to the sewer system by allowing only a sewer connection for lots with frontage on existing streets with a sewer main but not allowing for any connections or extensions of sewer mains to service any new subdivisions. This has resulted in new roads being constructed without the developer being required to place a sewer pipe in the road for future use. The Board of Health does not agree with the Water and Sewer Commission limitation on connections and has held to the belief that under the provisions of 310 CMR 15.004(3), "no new system shall be constructed and no system shall be upgraded or expanded, if it is feasible to connect the facility, or any portion of the facility to a sanitary sewer".

4.2.2 Local and State Waivers/Variances

Property owners who are looking to install a new septic system or who need to upgrade or expand their existing system that does not meet the requirements of Title 5 and/or the more stringent local regulations are able to apply for waivers and or variances from the regulations. For existing systems the goal is to achieve maximum feasible compliance.

Upgrades to existing systems are the result of failure of the septic system to adequately recharge leachate into the ground. Such failures can be the result of eventual clogging of the soils, biomat buildup and from poor maintenance or groundwater failure (mostly for systems designed prior to 1995). Other reasons to upgrade include Title 5 Inspection failures, and the desire to increase the amount of flow to the system. This can occur when bedrooms are added to residential homes or when a change of use mandates a system upgrade. Except for increases in design flow and changes in use, the waivers allowed under the provisions of "Maximum Feasible Compliance" apply.

For upgrades of existing systems, the regulations allow for maximum feasible compliance, which allows for deviation from the strict requirements for new systems. The goal is to replace the system with a system that comes as close to that required for new construction except where site constraints prohibit strict compliance. If an upgrade is approved with the waivers of groundwater separation, distance to property line or cellar wall etc.., the stipulation is that the flow cannot be increased from the present level. Since the elevation of the house foundation was typically determined by less scientific methods prior to 1995, replacement septic system often require relief from the required separation to groundwater in order to avoid systems with finished grades higher than the top of foundation.

Other typical waivers include reductions in the soil absorption system separation to property lines, cellar walls and even wetlands. Often times the wetland issue is the result of systems that were constructed prior to the advent of the Wetlands Protection Act which was enacted in the late seventies. Prior to that time, wetlands could be legally filled as part of a development project, and systems were often closer than fifty feet to a wetland.

Board of Health (BOH) Variances from local and state regulations are possible but the justification for granting of such variances must be clearly shown. In the past few years there has been a move to shift responsibility for granting such relief to the local BOH as the Department of Environmental Protection (DEP) has transferred responsibility for certain approvals to the Cities and Towns. Previously, a variance would need to be granted by the BOH, and then, a separate variance request would be filed with the DEP. This process would sometimes take several months to complete usually during a time when the septic system is in failure.

The number of local and state variance requests identified by the Bridgewater Board of Health were few since 1995 and are not tabulated by the BOH. Most were approval to use the results of a sieve (textural) analysis in lieu of a standard percolation test to determine design rate. Responsibility for this approval now rests with the Bridgewater BOH. DEP approval for the use of innovative technologies, shared systems, and tight tank systems, are rarely requested within Bridgewater. One tight tank was documented for a property on Bedford Street. Changes to Title 5 in January 2014 eliminated DEP's need to approve tight tanks.

4.2.3 *Challenges to Using On-Site Systems*

Insufficient area: The existing sewer system initially focused on the center of Bridgewater, most of the extremely undersized lots in the Town have since been connected to town sewer. The subsequent phases of the sewer system expansion were to other older neighborhoods such as "Stanley" where smaller lots were developed for housing in the area of the foundry that employed many residents until it ceased operations in the early 1900's. The homes and businesses near Wall Street and Bolton Place were in the heart of this expansion which consisted of single and two family structures on very small lots. Some of the homes in this area of Bridgewater did not even have indoor plumbing when they were built in the 1800's. In the early 1900's when septic systems were installed they were typically fieldstone lined cesspools. The lot sizes were not large enough to support a conventional septic system consisting of a septic tank connected to a leaching system. Most of these small parcels required variances from the Title 5 rules and regulations, or they were allowed to build a replacement system using the provisions within Title 5 which comply to the extent possible. The Maximum Feasible Compliance relief granted for such systems allowed for leaching system area reductions up to twenty-five percent of the Title 5 requirements and allowed for reductions in the separation to groundwater and proximity to property lines.

Proximity to resource areas: The original systems which were generally cesspools were sometimes positioned close to wetlands, rivers and in some cases were in the flood plain. When the systems failed, a second cesspool, overflow trench or field was added or a direct pipe to the river, stream or wetlands. With the advent of environmental awareness and regulations these environmentally sensitive areas required additional setbacks to protect them from potential wastewater impacts. Existing house lots in the older sections of Town lacked the required space to comply with the regulations. This resulted in informal and sometimes formal relief in the form of a variance from one or more of the dimensional setbacks and to some extent diminished protection of the resource areas. In Bridgewater, septic systems that fully comply with local and state regulations maintain a seventy-five foot separation from the leaching system to the wetlands. The State requirement is fifty feet.

High groundwater: A third challenge for adequate wastewater treatment using onsite septic systems is separation to high groundwater. In some areas, high groundwater is an issue because adequate removal of pollutants such as nitrates and phosphates, as well as pathogens, takes place as the effluent filters through the unsaturated ground below the leaching area. If there is not enough separation between the leaching system and the groundwater level, limited treatment occurs and these substances may enter the groundwater. This is a concern for two reasons: first, because the Town obtains the majority of its drinking water, both municipal and private, from the groundwater supply; and secondly, because of the potential impact on wetlands and other environmental resources. In order to protect groundwater, Title 5 requires a minimum four foot separation between the bottom of the leaching system and the groundwater level for percolation rates slower than two minutes an inch. In sandy material where water movement through the soils is quite rapid, resulting in rates less than or equal to two minutes an inch, an additional foot of separation is required to allow for adequate treatment and removal of contaminants in the wastewater. Full compliance with these provisions is sometimes impossible especially where existing homes were constructed such that the foundation has minimal concrete reveal or low window sills prohibiting re-grading of the yard to allow for raising of the septic system. Approval of new systems in areas of high groundwater, often requires relief of at least one foot from the groundwater separation requirement and possibly the construction of retaining walls to minimize problems with breakout. This can often result in awkward and unsightly transitions to other features within the yard.

The method of determining the depth to or elevation of groundwater has changed quite a bit over time. Early systems before a public health regulation had been established, resulted in systems that were installed in or near the seasonal high groundwater elevation. These leaching systems were connected hydraulically to the water table but no purification of the effluent occurred. Even when regulations were promulgated in 1978 to provide for a four foot separation, the majority of septic systems were still constructed too low. Groundwater from 1978-1994 was the observed depth of water in the test pit excavated when the percolation test was completed. Percolation testing season generally ran from November 1st to June 1st and given the year to year seasonal variability, a dry season may suggest that water is much lower than the actual annual high water elevation. The end result was and is systems often times were constructed below the water table. These systems would function for an extended life span because of the submersion but the treatment of the effluent was inadequate. Only anaerobic bacteria are present in this scenario depriving the cleaning of wastewater in the unsaturated zone by aerobic bacteria.

To build or upgrade septic systems on many parcels in areas of high groundwater, the systems have been and will continue to be built as mounded leaching systems to achieve this separation. Mounded systems can be less than desirable aesthetically and are generally more costly to construct. Request for waivers from strict compliance are typically requested and granted for house lots where foundations are close to existing grade. Granting of separation relief is consistent with the provision of Maximum Feasible Compliance but does reduce aerobic contact by twenty percent for a five foot to four foot separation and twenty-five percent reduction in contact for a four foot to three foot separation. These systems often require a pump chamber to lift the effluent portion of flow from the septic tank to an elevated leaching area.

Soils and bedrock: Some lots have challenges involving the type of soil that exists in their area or with the presence of bedrock close to the ground surface. These are difficult challenges to overcome and often require the footprint of the leaching area to be larger or mounded, which again leads to more costly construction and more challenging design, especially with existing building foundations at lower elevations. The most challenging soils are related to silt, clay and dense glacial till. These types of compact and fine grained soils have extremely slow percolation rates and also impede vertical movement of water resulting in a perched water table. Both conditions are not desirable for septic systems. Variances from system size requirements and setbacks to property or foundation are common. Reductions in groundwater separation to minimize the grading changes are often sought from the BOH. Many of these were done with approval of the Health Agent.

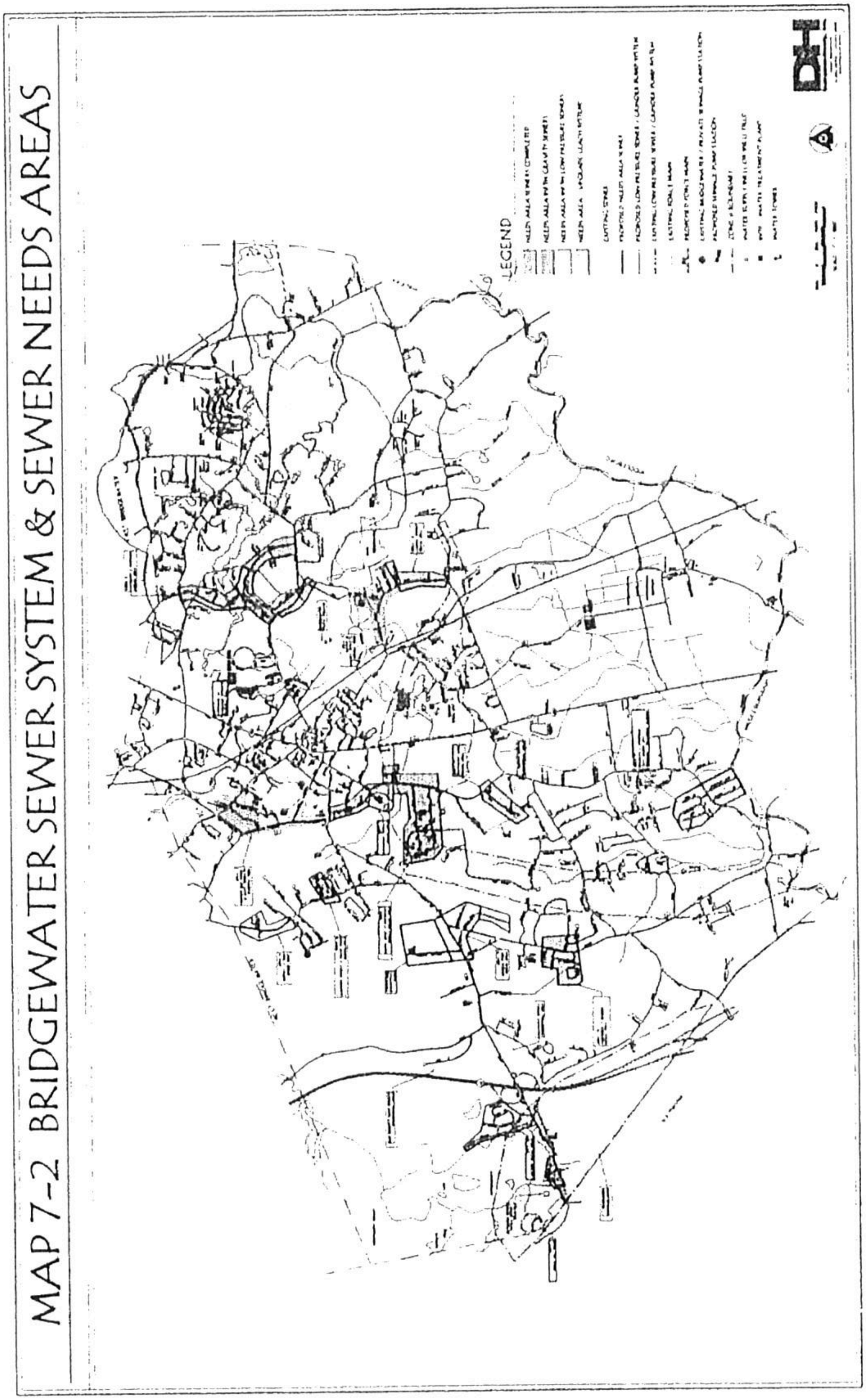
4.2.4 On-site System Needs Analysis

In 2000, as part of the Bridgewater Master Plan Dufresne-Henry, Inc. Consulting Engineering (DH) illustrated in Map 7-2 Bridgewater Sewer System and Sewer Needs Areas by DH, below, an update to the status of the needs areas that were completed and identified needs areas that needed sewer service extensions. Table 4-1: Current Status of Prior Sewer Needs Areas below identifies the twelve areas and the status of sewer service expansion.

Table 4-1: Current Status of Prior Sewer Needs Areas

Prior Needs Area	Current Status
Hayward/Whitman*	½ complete
Laurel Street	Complete
Stephanie Lane	Complete
Crescent Street/Drive	Complete
North/Tami	Complete
Lantern Lane/Willis Rd	Complete
South Drive	Complete
Scotland Industrial Park	Complete
Norlen Park	Not Complete
Aberdeen/Dundee	Not Complete
Lakeside Drive expanded to include Goodwater way	Not Complete
Birch Hill - **COMPLETE**	Raynham Sewer
Douglas/Atkinson/Fisk	Not Complete
South/Sunrise	Not Complete

Silva Engineering Associates (SEA) started with the needs areas identified by DHCE in the preceding evaluations that have not, as yet, been sewered. The areas were overlaid with GIS and parcel mapping and were reviewed to determine if the areas should still be considered a priority for off-site septic solutions. The factors examined were the underlying zoning/lot size; access to town water; soil characteristics; groundwater conditions and proximity to wetlands and flood hazard areas. Each of the areas are discussed below. SEA also reviewed BOH records for septic failures and repairs. As stated previously, many of the septic system repairs were completed without substantial documentation.


MAP 7-2 BRIDGEWATER SEWER SYSTEM & SEWER NEEDS AREAS
LEGEND

In December of 2013 the BOH gave SEA a spreadsheet of all the permits they had on record. Unfortunately the records are not consistent. The list starts with 389 permits for the year 1995 and represents systems on record prior to 1996. This does not represent install dates only the first time a list was made. There is no data for permits issued from 1996 to 2002. The remainder of the data is summarized below in Table 4-2: Number of Permits on Record.

Table 4-2: Number of Permits on Record

Year	Number of Permits on Record
≤1995	389
1996-2002	No list of Permits available
2003	99
2004	119
2005	No list of Permits available
2006	114
2007	87
2008	64
2009	64
2010	37
2011	No list of Permits available
2012	78
2013	92

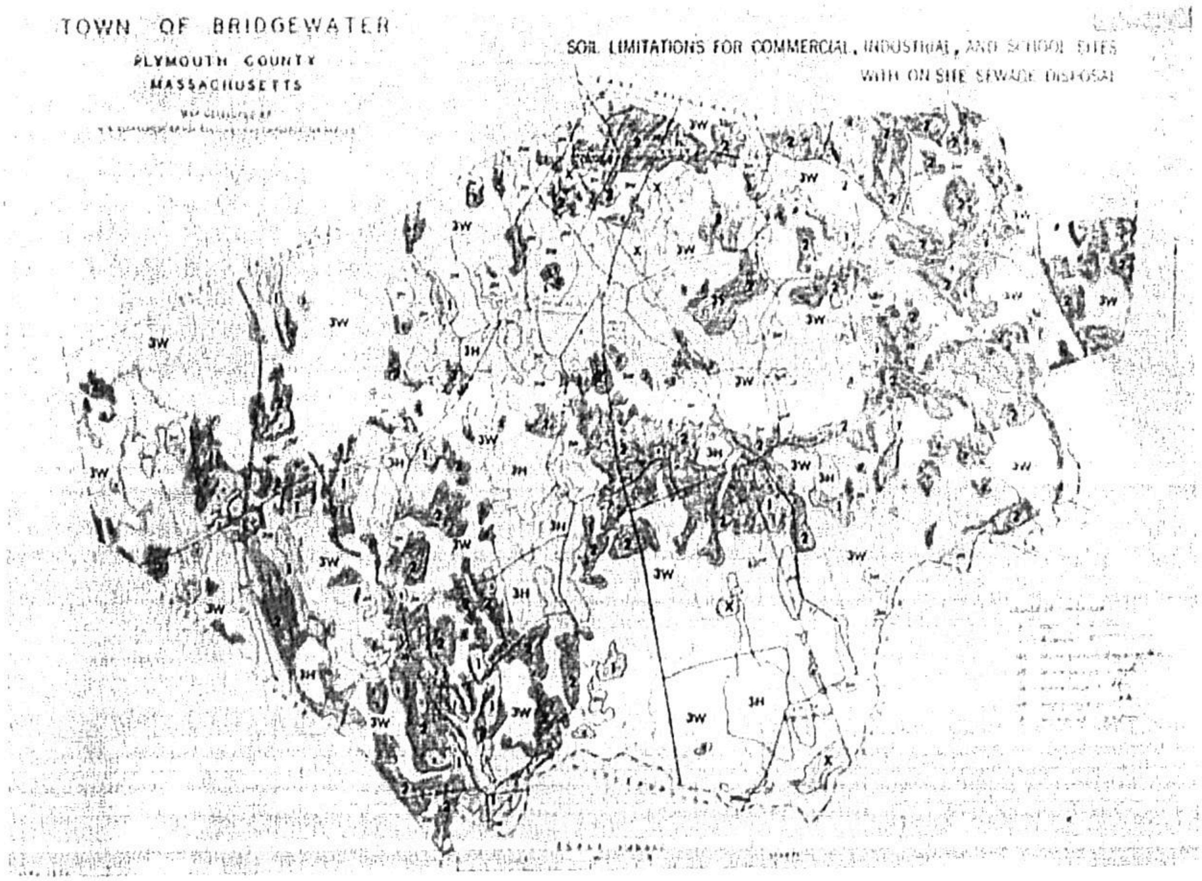
The introduction of commuter rail to Bridgewater and the construction of Route 495 spurred a surge in new home construction on parcels of farm land and significant wooded areas. The growth trend that started in the early 1980's continued at a torrid pace for the next thirty years. Many of these homes, mostly in non-sewered areas were sometimes designed under the "old rules" and are now approaching or have exceeded their expected useful life expectancy. The systems constructed with the benefit of the newer Title 5 provisions, will probably fair better and last longer than the earlier designs. More awareness of the maintenance requirements of septic systems; by more informed homeowners, has resulted in septic tanks being pumped regularly, and homeowners are now more cautious about disposal of grease and other products that decrease the performance of septic systems. Also the improvements in the method of high groundwater determination has reduced the number of hydraulic failures.

It should also be noted that for many years the BOH in Bridgewater (and many other towns) allowed for onsite system repairs that were not engineered. System installers working under the direction of the BOH Agent, completed "best fit" repairs/upgrades. They were, for the most part, prudent decisions motivated by the desire to reduce the cost to the homeowner and achieve a positive outcome for the environment. These type of repairs are not as well documented in the BOH records, and, at best, these locations include an asbuilt sketch or plan of the actions taken.

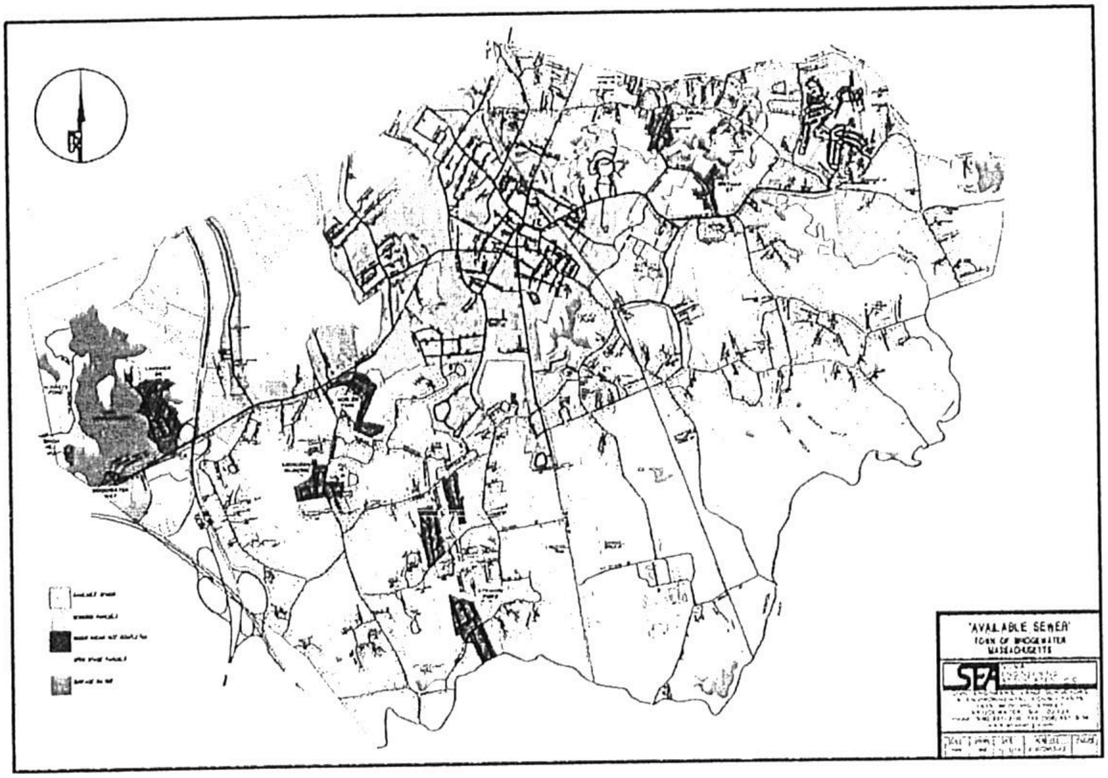
As stated earlier, sanitary sewer in Bridgewater began in the center of Town and expanded outward in response to identified needs. To determine the conditions that will affect the remaining life expectancy of existing systems and the challenges facing the upgrade of systems in various areas of town, available information about the surficial geology, soil characteristics and groundwater characteristics were reviewed. In addition, the identification of sensitive areas such as aquifer protection zones, wetlands and flood plains was completed. The aquifer protection areas require septic systems to conform to denitrification requirements; and a wetland setback in Bridgewater of seventy-five feet that is fifty percent larger than the State requirement of fifty feet. Revised FEMA mapping of flood hazard areas are important when grades need to be raised thereby reducing available flood storage volume in designated low-lying Flood Hazard areas. Also of importance are those areas of Town that are not on municipal water since the separation of septic system to a drinking water well is a further constraint to new septic system placement.

With information available from the Massachusetts Office of Geographic Information (MassGIS), including wetlands, town parcels, flood plain and surficial geology as well as personal knowledge of the Town, SEA developed a series of drawings depicting Town's needs areas. "Surficial Geology" maps were compiled from MassGIS datalayers for surficial geology showing the location of sand and gravel deposits and areas of fine-grained deposits and floodplains. "Flood Plain & Wetland Considerations" figures represent the current effective flood risk data by the Federal Emergency Management Agency (FEMA) as well as wetlands data by the National Wetlands Inventory (NWI) project, administered by the U.S. Fish and Wildlife Service (USFWS).

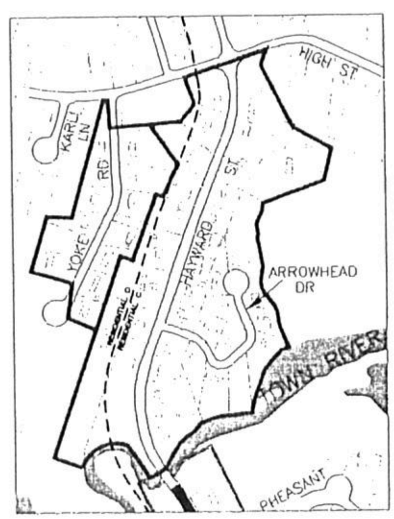
In the 1970's, the US Department of Agriculture – Soil Conservation Service developed a map entitled "Soils Limitations for Commercial, Industrial and School sites with On-Site Sewerage Disposal." Although the map is outdated, the generalizations around Bridgewater are still quite accurate and became the basis for an overview of the conditions of soils around Town as it measured the degree of limitation from "slight" to "severe". These figures are labeled "Soils Limitations" throughout this section of the report.



In 2014, Silva Engineering Associates (SEA) developed a map, below, that illustrates the areas in Bridgewater currently sewered and highlights the properties that are currently listed as connected to sewer. From the Sewer Departments list of users as of January 2014 approximately thirty percent of the Town parcels are served by municipal sewer. The figure below illustrates areas of Bridgewater that sewer is available and those that have the ability/right to connect based on proximity to existing sewer mains. With this illustration it is seen that five of the existing needs areas abut an existing sewer line (Goodwater Way; Lakeside Drive; Norlen Park; Hayward Street; Whitman Street).

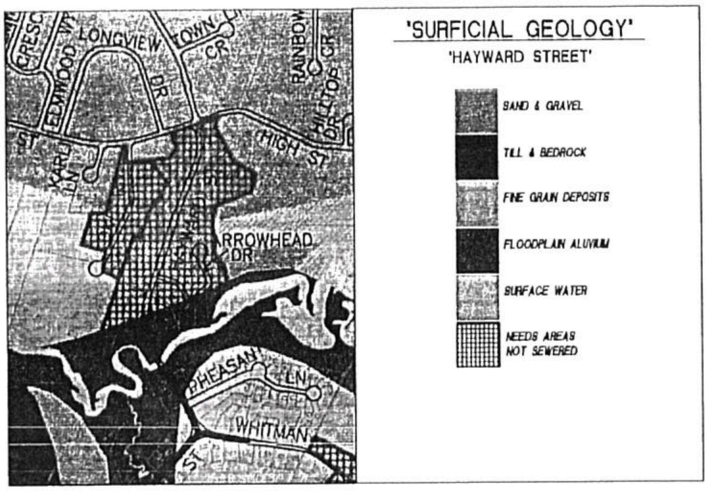


4.2.4.1 Haywood Street Area



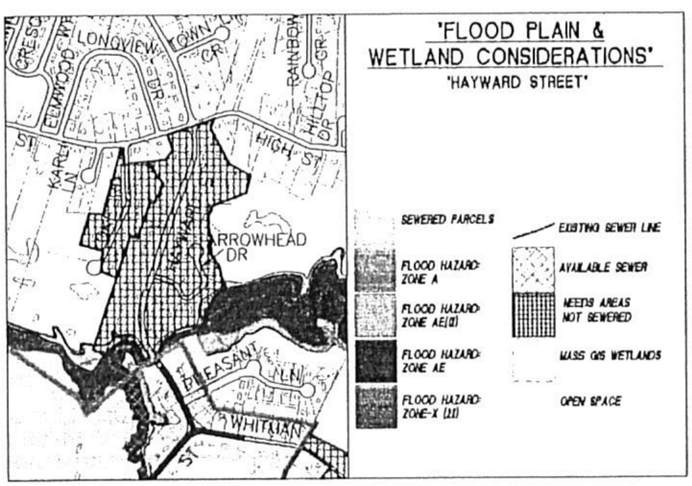
This area consists of that portion of Hayward between High Street and the Town River including Arrowhead Drive. This area is primarily in the Residential C Zoning district with the average lot size for these thirty-eight parcels is 30,000 square feet with four over an acre. Single-family house lots in this district require only 18,500 square feet of land area. Duplex construction in Residential C Zones require a minimum lot size of 30,000 square feet of land. This residential zone requires 125 feet of frontage and the upland area needs to be fifty percent of the minimum area required by Zoning. The Town Assessor's information available for this area indicates that there are thirty-five single family dwellings with three or four bedrooms most built in the 1960 and 1970's. Of those, eleven percent of the septic systems have documented repairs on file with the BOH from 2003 to 2010. This is a very small statistical sample partially because many repairs completed in Bridgewater were done without an engineered plan.

Immediately west of Hayward Street is Yoke Road. This long cul-de-sac slopes steeply down from High Street toward the Town River. Elevations at High Street are approximately 84 and drop dramatically to elevation 44 near the cul-de-sac. A stream that feeds into the Town River drains a large flat outwash area beyond the cul-de-sac. The upper and middle portions of the roadway and lots were cut deeply in to the grade and the lower section matched closely the pre-construction grades. A forty foot right of way and utility lot does exist between Hayward and Yoke and could provide a convenient location to run sewer between the two roadways.



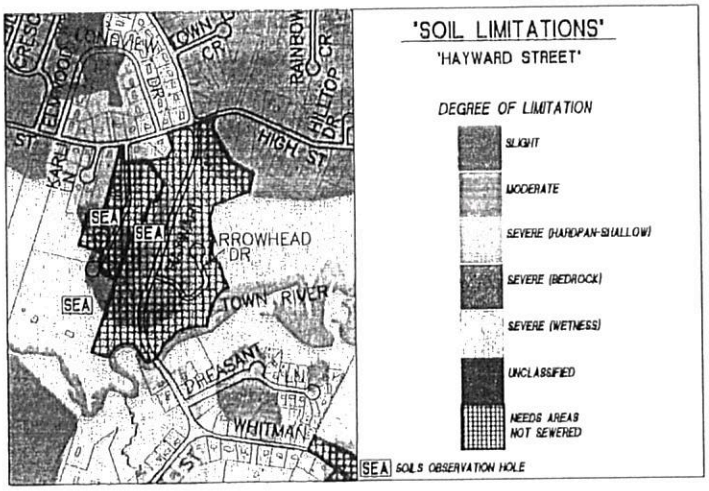
Unlike Hayward Street, Yoke Road is located within the Residential D zoning district. Single family houses are permitted in the district on 18,500 square feet of area similar to that allowed in the Residential C district. Duplexes, however, are allowed on lots with a minimum area of 20,000 square feet, thirty-three percent smaller than the 30,000 square feet requirement along Hayward Street.

Yoke Road currently includes thirteen duplex lots or twenty-six units with an average of 12,000 square feet per unit. Built before the advent of the Title 5 overhaul of 1994, these residential units were built between 1987 and 1989. Thirty percent of the septic systems required replacement after only sixteen years of service. Most of the earlier designs consisted of separate 1,000 gallon septic tanks connected to a common leaching system. A number of the replacement systems included individual systems for each unit separated from each other by only a membrane liner. Since the lots are so small, the replacement systems were often constructed in the same area of the failed system. The fine grain deposits more prevalent with proximity to the Town River have required larger leaching systems that push the limits of available space of these narrow lots of 125± feet frontage. It would appear prudent to include Yoke Road within the Hayward Needs area.



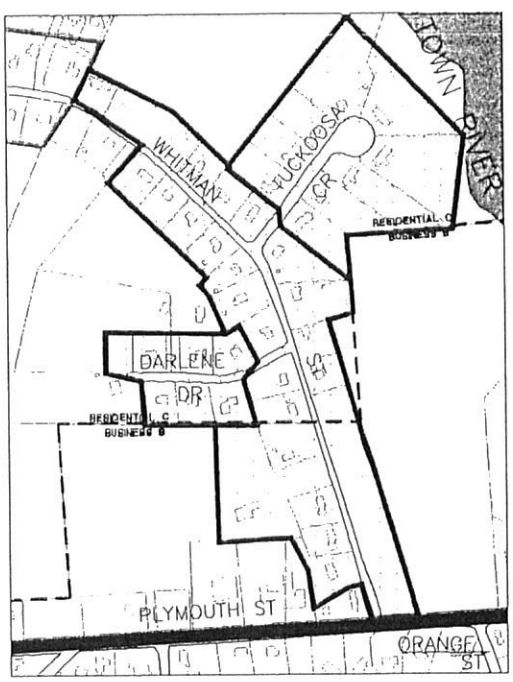
The Hayward-Yoke Road area is served by Town water and has a required septic system setback to wetlands of 75 feet (local by-law, State requires 50 foot minimum). To achieve the allowed utilization of properties in this area, the use of on-site septic systems is problematic. The presence of wetlands and floodplain occurs primarily in the southern portion towards the Town River.

The southerly end of Hayward Street near the Town River has fine-grained deposits with more favorable sand and gravel deposits in the northern part of Hayward Street nearest High Street. The majority of the sand and gravel areas are classified as "severe wetness" usually because of confining soil horizons of silt and clay that create perched groundwater conditions. Given the characteristics of the soils and high groundwater in this area, Hayward Street should remain a "needs area". Sewer is currently available from the south and could easily be expanded to Hayward Street and Yoke Road.

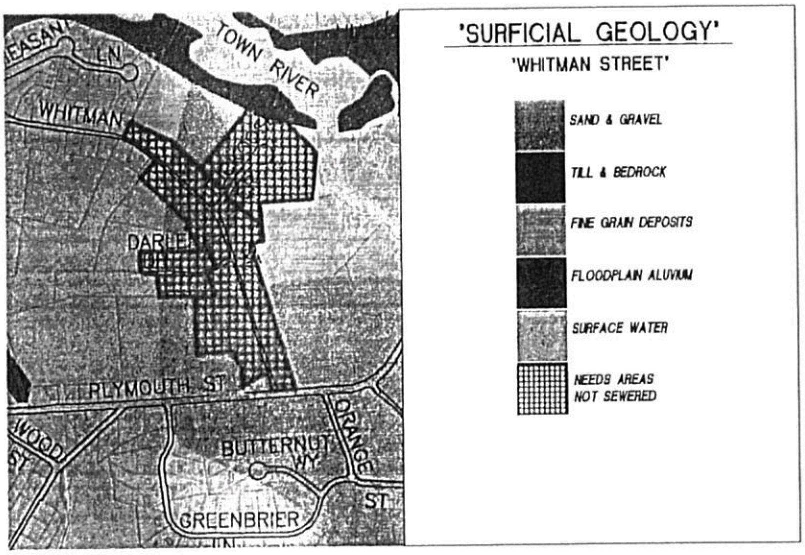


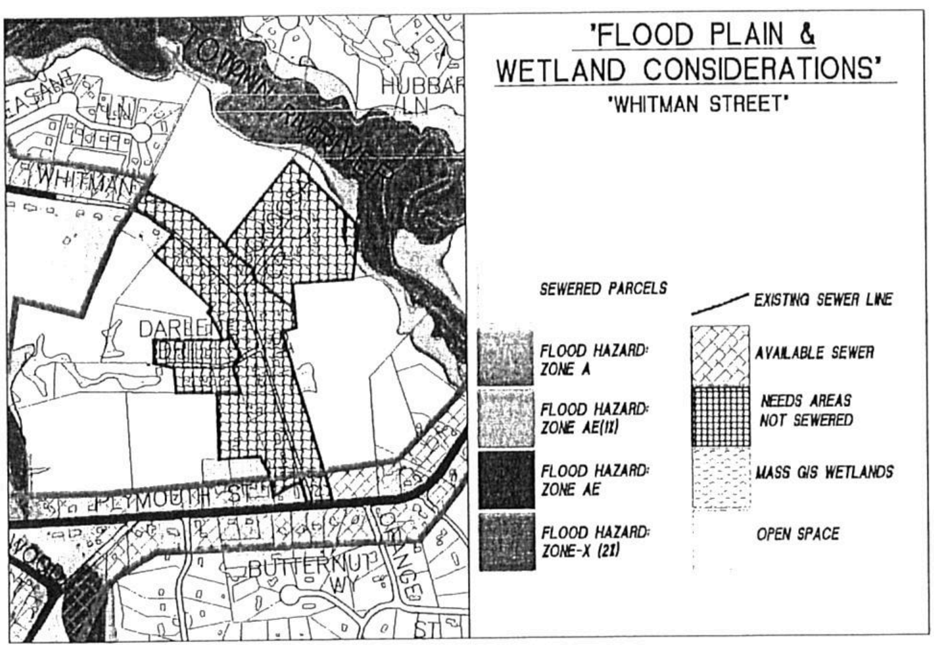
4.2.4.2 *Whitman Street Area*

section 3.1.1 text here This previously defined needs area extended along Whitman Street to Plymouth Street as shown. This area includes Residential C Zoning from Darlene Drive north and Business B southerly to Plymouth Street. Lot sizes in the Residential C are 18,500 square feet for single family and 30,000 square feet for duplex construction but Business B lots can be quite small (10,000 square feet), although generally building lots are larger to meet the businesses demands.

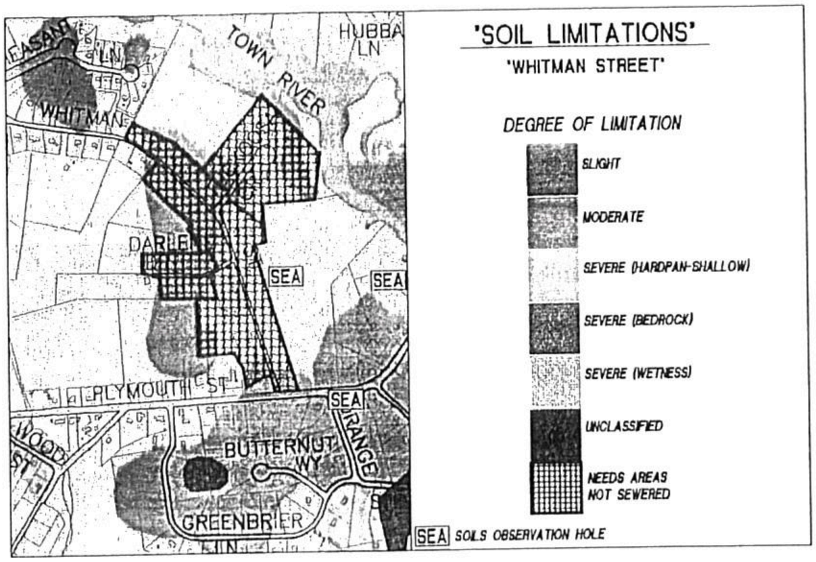


The soils in the northerly and central portions of this zone are fine grain deposits not extremely conducive to construction of septic systems that will provide long term use. The remainder of this zone does indicate sand and gravel deposits. Wet areas can be found along the entire area except nearest Plymouth Street, and sewer currently serves the properties along the road. Most of the Business B land in this needs area exhibits moderate to severe witness. Recent test pits along the easterly side of Whitman Street south of Tuckoosa Circle revealed unsuitable soils and shallow groundwater conditions.



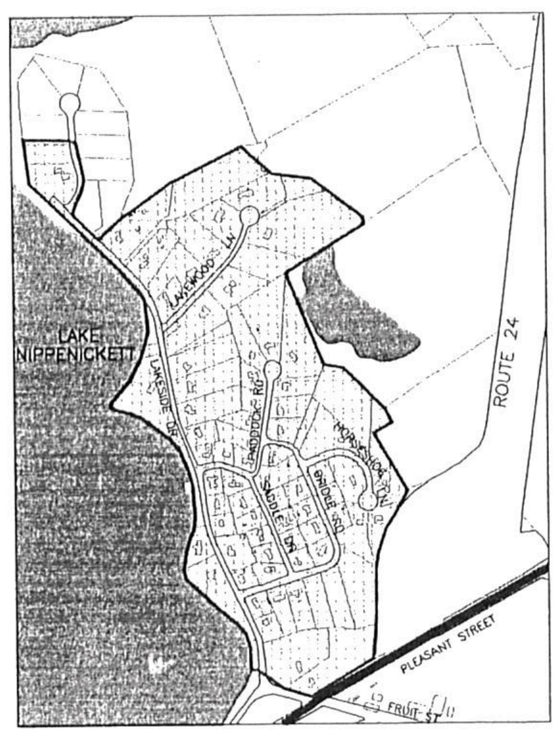


The nature of the twenty-four parcels in this area are a mix. There are some two-family; a commercial business; the majority are three or four bedroom single family lots. The average size is 30,000 square feet with three undeveloped parcels. With sewer available on both sides of this needs area, extension of sewer along this portion of Whitman Street would be beneficial and would provide relief to half acre lots developed in the 1970's and 1980's. The absence of street drainage exacerbates the flooding of front yard leaching systems in this area where front yards are at street elevations.



Adjacent to this needs area is a subdivision that includes nine houses on Darlene Drive and nine on Tuckoosa Circle. The BOH records indicate thirty-three percent of the septic systems have required replacement due to failures of the leaching systems over the past eighteen years. In addition, two large tracks of land with a total of thirty-four acres are available for residential and business development on the easterly side of Whitman Street, north and south of Tuckoosa Circle. While these parcels are not prime consideration as a needs area, Darlene Drive and Tuckoosa Circle should be considered for inclusion in the current needs area based on the number of failures and groundwater conditions.

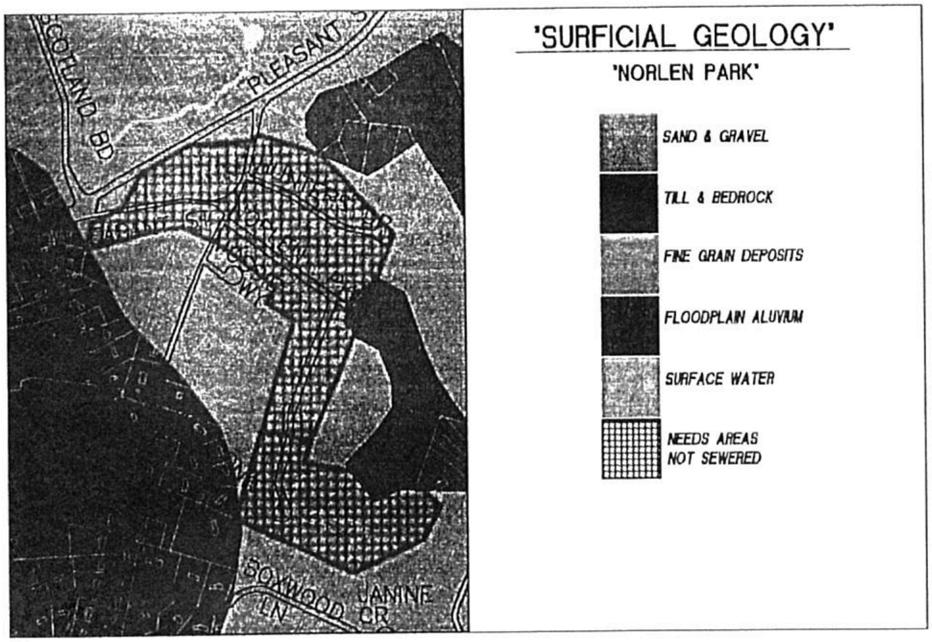
4.2.4.3 Lakeside Drive Area



This needs area, located on the east side of Lake Nippenicket, extends north from Pleasant Street to Farm House Lane. There are seventy-three parcels of land in this area including sixty-six single family lots. Seven parcels are designated conservation land. The original subdivision permitted in 1970 included Saddle Drive, Bridle Road and Paddock Road. At that time the Residential B Zone required only one half acre for a single family lot.

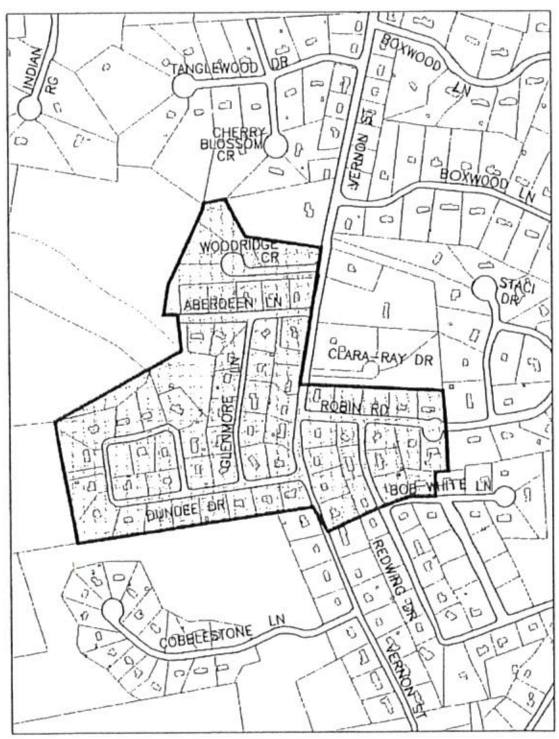
In the early 1990's Lakeside Drive was expanded to include Lakewood Lane and Farm House Lane. Zoning requirements were then increased to one acre lots in the Residential A/B District.

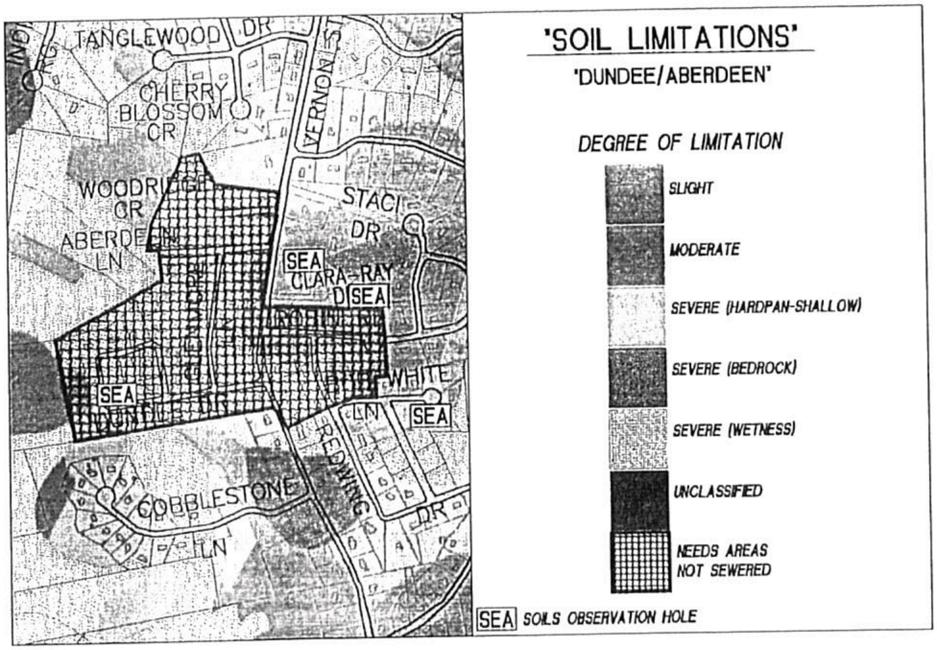
The oldest home in this area is listed as 1783 and located on conservation land. The majority of the homes range from 1900 to 2013. The BOH records indicated that fifteen permits have been issued including eight for new construction and seven sewer repairs from 2007 to 2013. The majority of the



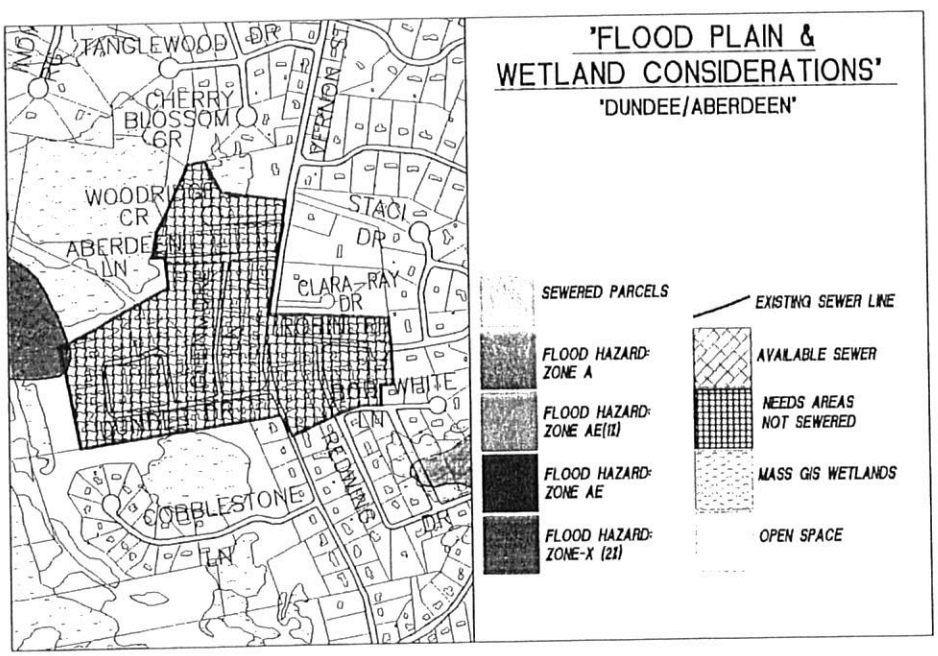
4.2.4.7 Dundee Drive/Aberdeen Lane Area

<u>Dundee/Aberdeen</u> – This previously defined needs area is centered along Vernon Street and includes a number of subdivision streets completed in the 1970s and 1980s. The eastern portions of the needs area includes Vernon Street, Robin's Road and portions of Bob White Lane and Redwing Drive. The soils in this area have moderate limitations and the southernmost area severe wetness. The western portion of the needs area includes Woodbridge Circle, Aberdeen Lane, Dundee Drive and Glenmore Lane. This portion of the needs area has areas of compact glacial till and severe wetness throughout.



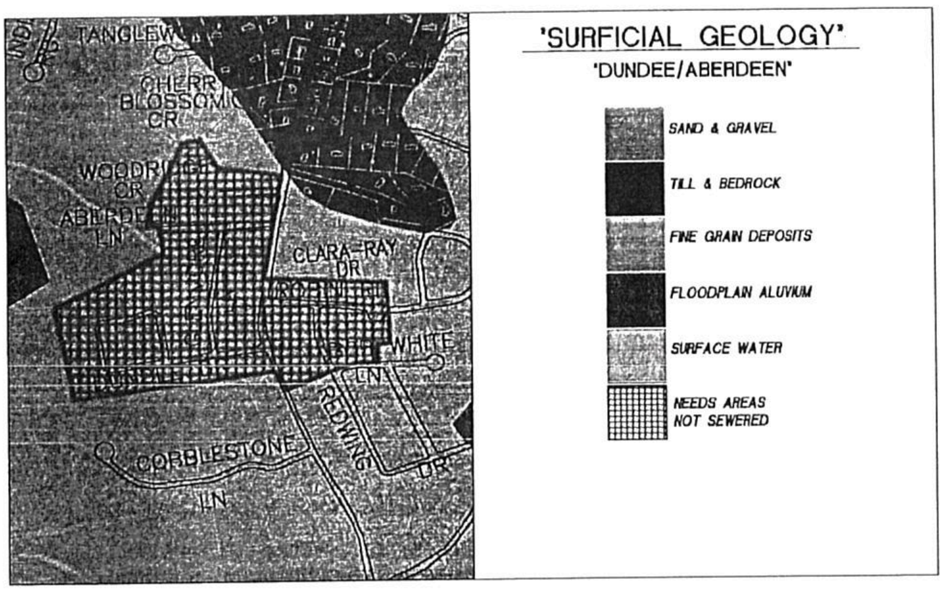


The homes within this needs area span in age from the oldest in 1947 to the recent construction in 2012. Many of the oldest lots and homes front on Vernon Street and most of the house lots throughout the needs area are half acre in size from the Residential B Zoning designation. The Zoning currently in place (Residential A/B) requires one acre.



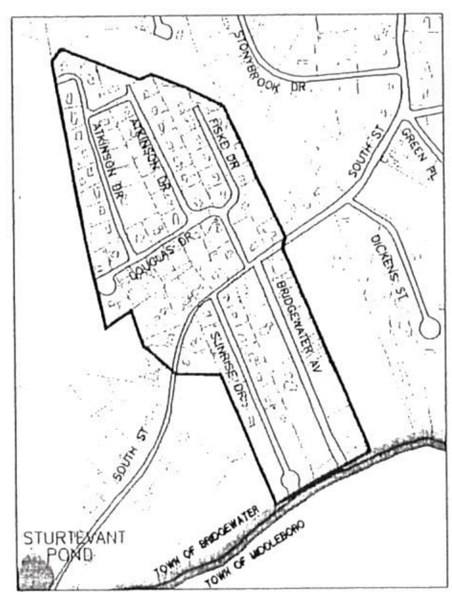
There are a total of sixty house lots in this area and twenty-two percent of them have had septic repairs. The BOH has records for thirteen repair permits; two in 1995 and the twelve others range from 2003 to 2013.

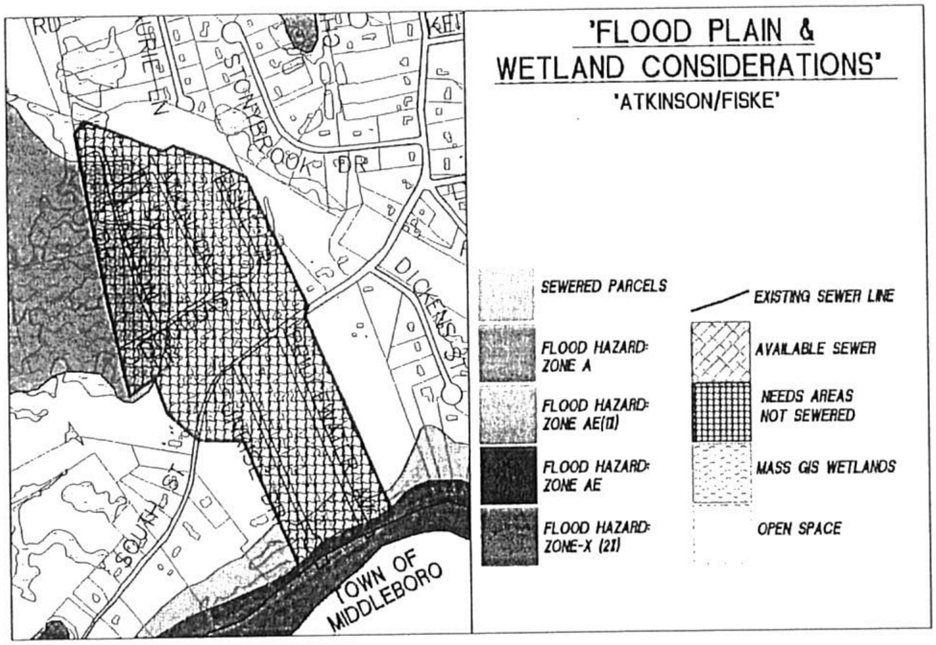
This needs area is the most critical based on soils and groundwater conditions. The variable soils and high groundwater conditions were not evaluated using post Title 5 (1994) criteria and have allowed homes and septic systems to be constructed within the high groundwater elevations. Although much of the area is identified as sand and gravel, most of these areas have soil horizons with a thin restrictive layer of silt that impedes vertical movement of recharge, perching groundwater during spring and rainy periods. This needs area should remain because of the prevailing smaller lot sizes and system construction without proper separation to groundwater.



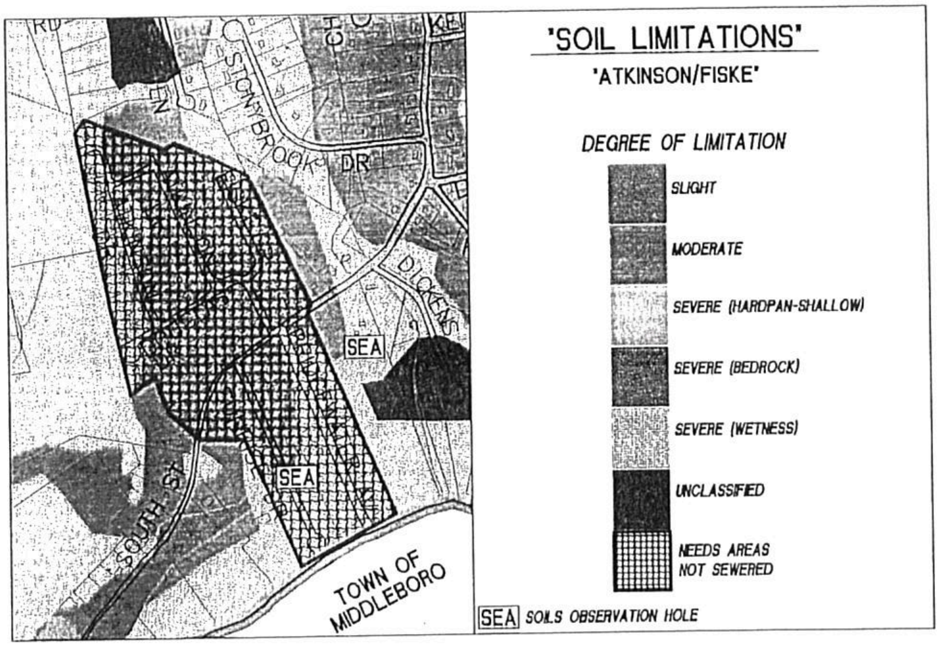
4.2.4.8 Atkinson /Fiske Drive Area

This needs area is located along the southerly stretch of South Street, where South Street has a northeast to southwest orientation. On the north side of this needs area is a residential subdivision constructed in the 1970s that includes Fiske Drive, Atkinson Drive and Douglas Drive. On the south side of this needs area is Bridgewater Ave and Sunrise Drive, both of which extend south towards the Taunton River.



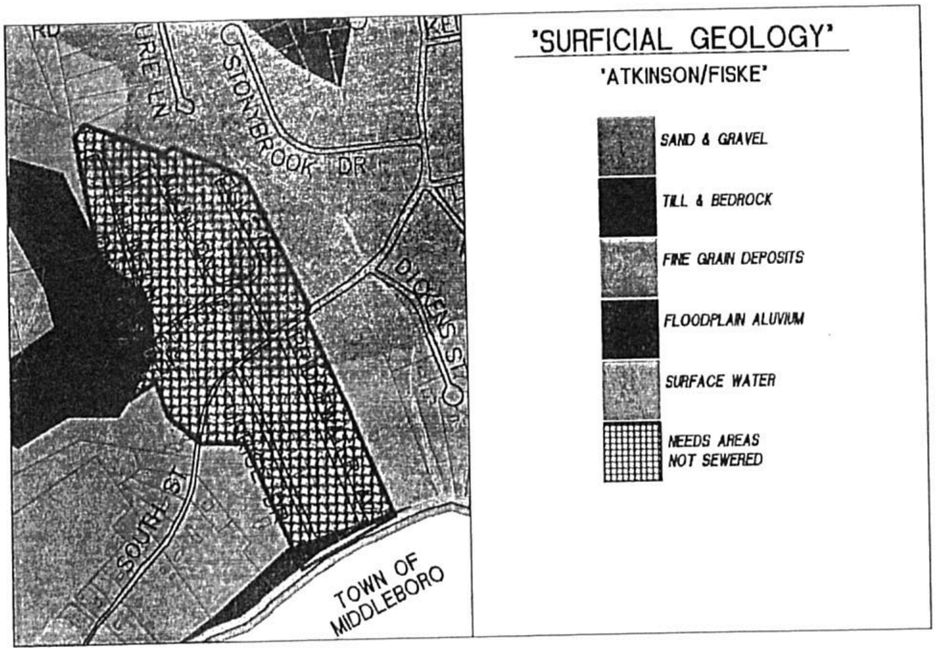


The homes within this needs area range from those dating back to 1700 (on South Street) to more recent construction in 2009 (on Bridgewater Ave). The oldest homes can be found along historic South Street. Portions of Atkinson Drive are located within a designated flood hazard area as are the southerly extents of Bridgewater Ave and Sunrise Drive. Many of the house lots along Atkinson Drive are within a designated Flood Plain but have successfully received removal letters in the form of Letter of Map Amendments which show that the lots were raised by fill when the subdivision was developed.



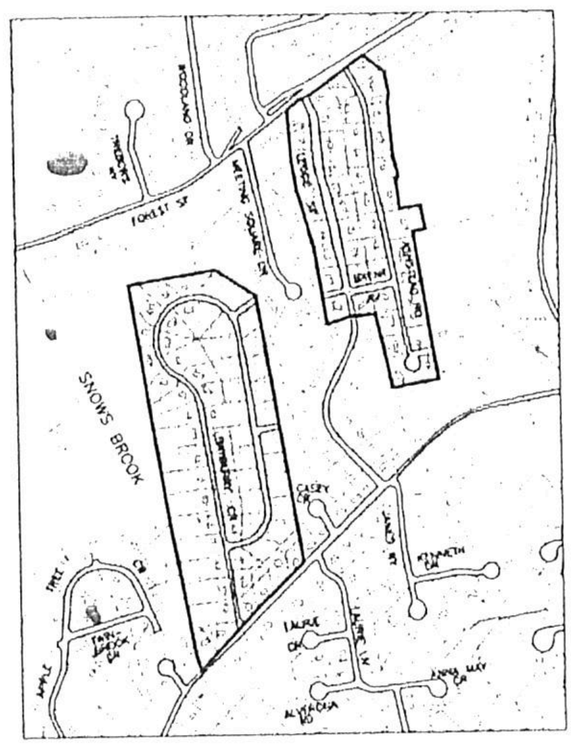
The northerly portions of the needs area is within an area of moderate soil limitations and the southerly section of Sunrise Drive and most of Bridgewater Ave, are in an area of severe wetness. The northeast quadrant of the needs area has glacial till and bedrock conditions while the remainder of the area has fine grain deposits.

Current zoning designation is Residential A/B requiring one acre lots. In the 1970's Residential B Zone allowed for half acre lots. Lot sizes range from 18,750 square feet to one acre. With approximately ninety-one developed lots in this area and nineteen repair permits on record the rate of repairs in this region is twenty-one percent and rising given the age of the homes. More than half the homes were built in the 1960's and 1970's expansion of this needs area northerly and southerly along South Street would be justified.

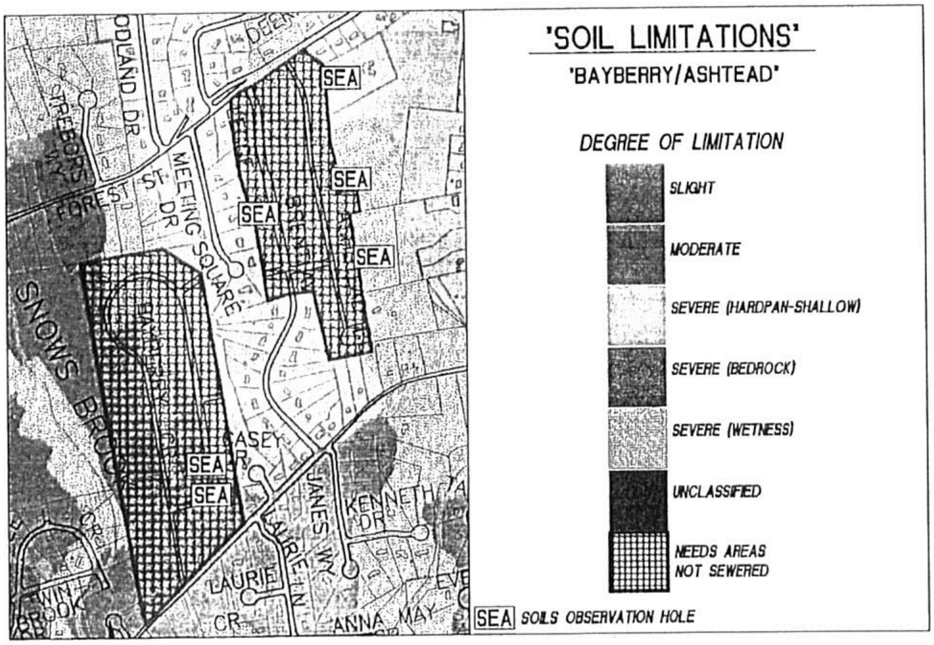


4.2.4.9 Bayberry Circle/Ashtead Road Area

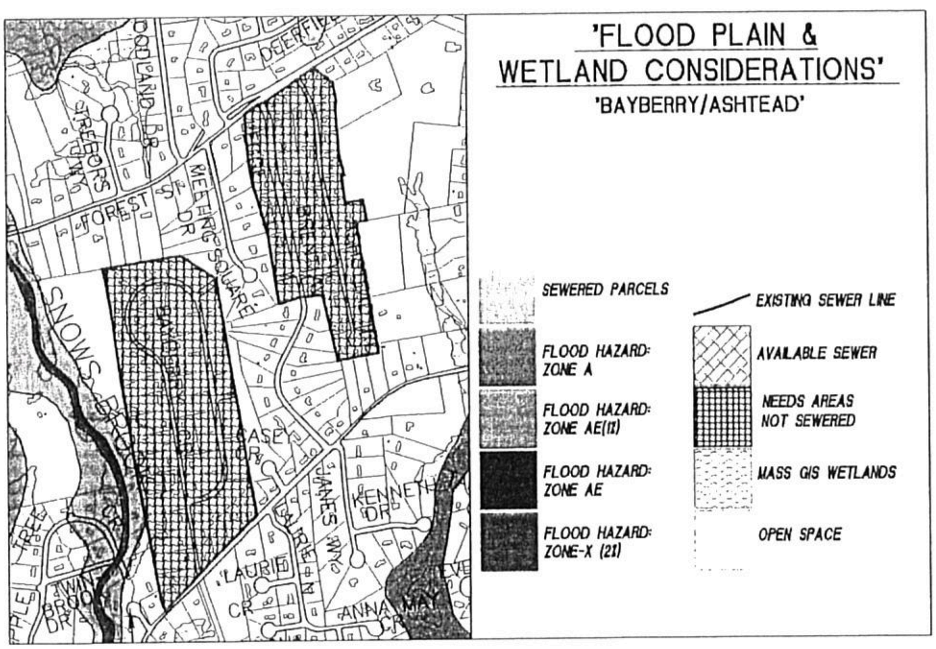
Based upon similar review of other areas of Bridgewater not previously identified as a needs areas, consideration should be given to include the Bayberry Circle, Meeting House Square, Legge Street and Ashtead Drive Area.



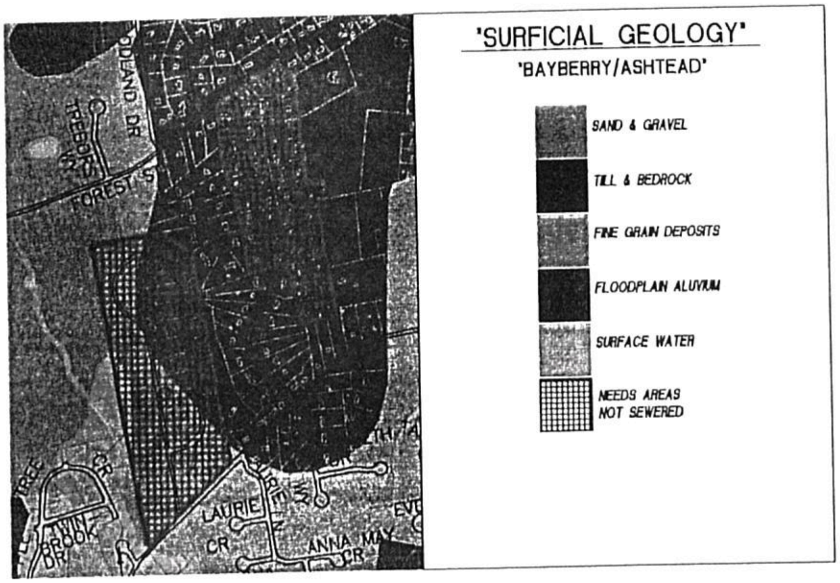
Bayberry Circle, Meeting House Square, Legge Street and Ashtead Drive represent a region of previously developed residential subdivisions built in the late 1970's that are located in dense glacial till and fine grained deposits not conducive to septic system construction.



Septic system replacements are frequent (ten repair permits from 2003 to 2013) and suitable soils require extensive remove and replace of unsuitable soils sometimes in excess of twelve feet. The hard pan glacial till results in perched water tables which also lend to failure of systems and significantly elevated replacement systems.



The Zoning in this area is currently Residential A/B which now requires one acre lots. The average lot size of these 104 lots is 26,000 square feet which is consistent with the Residential B half acre zoning previously required. On the east side of Bayberry Circle are twenty-two lots that are undeveloped due to perched groundwater.



4.2.4.10 On-Site System Needs Area Conclusions

The needs areas outlined in this section would benefit from the extension of sewer. The smaller lots and challenging soils make replacement of existing systems difficult, expensive and sometimes awkward. Most require removal and replacement of soil to depths which increase the cost of system replacement significantly. The off-site alternatives and preliminary sewer connection layouts (where applicable) are provided in Section 5 of this report. Since the purpose of the study is for planning purposes, the findings herein are not intended to provide information on individual parcels or to replace actual Title 5 inspection results.

4.2.5 Wastewater Treatment Facility Evaluation of Needs

Improvement needs for wastewater treatment facilities are often separated into three primary categories:

- Modernization needs, including condition and functional needs,
- Efficiency needs, including energy and process efficiency,
- Permit driven needs, including capacity needs and need for improvements driven by regulatory changes.

For each of these categories, we have reviewed system conditions related to these needs, and have prepared the following discussion – including general, plant-wide issues and process area summaries.

4.2.5.1 WWTF Discharge Permit Conditions

Permit and regulatory driven needs for the Bridgewater WWTF include treatment capacity and effluent quality considerations. Each of these are discussed separately, though the permit issues and capacity are directly inter-related, and have direct effect on each other.

Representatives of U.S. EPA, Massachusetts DEP and the Town met at the WWTF site in the summer of 2013 to discuss future permit conditions. At that time, a preliminary draft of the future NPDES permit was shared by EPA staff. After the basin planning was advanced, and several other facilities in the Taunton River basin were issued new draft permits, the EPA issued Bridgewater a draft NPDES permit in the summer of 2014. The new draft NPDES permit included new effluent limits and effluent quality provisions, several of which the existing WWTF cannot meet. Table 4-3: New Draft NPDES Permit Limits presents a summary of the requirements of the new draft NPDES permit issued by the U.S. EPA. A copy of the draft NPDES permit is included in Appendix F: New Draft of NPDES Permit for WWTF & Comment Letter.

Table 4-3
New Draft NPDES Permit Limits

Effluent Characteristic	**Discharge Limitation**			**Measurement Requirement**
	Average Monthly	**Average Weekly**	**Maximum Daily**	
Flow (MGD)	1.44		Report	Continuous Recorder
BOD_5 (mg/l) (lbs/day)	20 240	30 360	Report	2x/week, 24 hour composite
TSS (mg/l) (lbs/day)	20 240	30 360	Report	2x/week, 24 hour composite
pH Range (S.U.)	6.5 to 8.3			1/Day, Grab
Total Residual Chlorine (ug/l)	24		42	3/day, Grab
Total Phosphorus (ug/l)	200 ug/l		Report	1x/week, 24-hour composite
Total Copper (ug/L)	11		15	1/Month, 24 hour composite
Whole Effluent Toxicity	Acute LC50 ≥ 100% Chronic C-NOEC ≥ 45%			4/year, 24 hour composite
The permit requires quarterly reporting for Hardness, Ammonia Nitrogen as N, Total Recoverable Aluminum, Total Recoverable Cadmium, Total Recoverable Nickel, Total Recoverable Lead, and Total Recoverable Zinc.				
Only from April 1 – October 31:				
Dissolved Oxygen (mg/l)	Not less than 6.0			1/day, Grab
Escherichia Coli (cfu/100 ml)	126		409	2x/week, Grab
Ammonia Nitrogen (mg/l) (lbs/day)	3.0 36.0			3x/week, 24 hour composite
Total Nitrogen (mg/l) (lbs/day)	Report 60		Report	2/x Week, 24 hour composite
Only from November 1 – March 31:				
The permit requires monthly reporting only in the winter season for Ammonia Nitrogen, Total Kjeldahl Nitrogen, and Nitrite Nitrogen and Nitrate Nitrogen.				

In response to this draft permit, the town (acting through Weston & Sampson and Stantec) prepared a comment letter providing input on the draft limits. A copy of the town's comment letter is included in Appendix F: New Draft of NPDES Permit for WWTF & Comment Letter. As part of this commentary, the town urged U.S. EPA to not issue Bridgewater's permit until the permits for the larger WWTFs (Brockton and Taunton) in the Taunton River basin were finalized. An appeal of the Taunton permit was resolved in the late spring of 2016, and the remaining permits in the basin are expected to be issued soon.

The most significant changes from the existing (2003) discharge permit to the new draft are the nutrient (nitrogen and phosphorus) limits, as summarized in Table 4-4: Comparison of Existing and Proposed NPDES Permit Limits.

Table 4-4
Comparison of Existing and Proposed NPDES Permit Limits

Effluent Characteristic	Existing (2003) NPDES Permit Limit	New Draft NPDES Permit Limit	Notes
Total Phosphorus	1.0 mg/l 12 lbs/day	0.2 mg/l	Existing permit limit is seasonal. New limit is year-round.
Total Nitrogen	Report	60 lbs/day	Existing permit has a seasonal ammonia limit only.
Dissolved Oxygen	Not less than 5.0 mg/l	Not less than 6.0 mg/l	

The lower phosphorus limit is challenging for the Bridgewater WWTF, and will require modification to the WWTF process. The nitrogen limit is more challenging – the Bridgewater WWTF was designed to be able to nitrify, and thereby meet an ammonia limit, but denitrification is more challenging with the existing process. This nitrogen removal challenge is further complicated by the limited space on the WWTF site (which is surrounded by wetlands on all sides). Significant modification to the WWTF process will be needed to meet the new nitrogen limit. The presentation of the nitrogen limit as an effluent loading in pounds per day provides a small initial relief for compliance, as current average flows are still around 1.0 mgd, but the long term projections show the facility up against the 1.44 mgd design capacity, meaning that the plant must be upgraded to meet a consistent limit of 5.0 mg/l for total nitrogen.

4.2.5.2 WWTF Capacity

In general, the existing capacity (1.44 mgd, ADF) of the Bridgewater WWTF is nominally enough to meet existing and near future conditions in the town sewer service area. The future flow and load projections for the town system, including allowances for sewering the defined needs areas, provisions for infill connections and economic development within the sewer system, and provisions for future flows from Bridgewater State University, show that additional capacity at the WWTF may be needed in the future to meet all town and institutional wastewater needs.

4.2.6 WWTF Process and Support Area Needs

4.2.6.1 Headworks

The headworks is generally in need of modernization – capacity does not appear to be a significant issue. Specifically, the preliminary treatment systems (grinder and grit removal) are near then end of their useful service life. The grinder and grit equipment need replacement and the systems need upgrading.

Grit removal still appears effective in the aerated grit chamber, though grit handling and dewatering equipment is aging. The grit chamber blowers are beyond their useful life and would benefit from more efficient systems. Refurbishment or replacement of all of the grit systems is warranted.

The influent grinder is also at the end of its service life. The staff have noted concern with the passage of solids to the process from the headworks, and would prefer influent screening to replace the grinder system. Screening options should be reviewed, and appropriate improvements included in the recommended WWTF upgrades.

4.2.6.2 Septage Receiving

Septage receiving is generally adequate in configuration and capacity, but equipment is in general need of modernization. Sepatge mixers, pumps and ancillary equipment should be scheduled for replacement. Septage receiving and storage tanks should be drained, cleaned and inspected during the facility upgrade preliminary design to confirm whether concrete tankage and or coatings need attention.

4.2.6.3 Primary Treatment

The primary clarifiers are in need of attention from a structural and operational position – the depressed design creates challenges for proper maintenance. The 7 foot side water depth of the clarifiers is also a concern. Metals and concrete are in poor condition - the structures and systems are also old and near the end of their useful life. Major clarifier modifications are needed, including modernization and functional improvements. Elevating the primary clarifiers in the hydraulic profile should be considered, with relocation of forward flow pumping (currently primary effluent) to the primary influent side of the process.

The new permit limits for phosphorus removal will likely require a multi-barrier approach to phosphorus removal. As such, a chemically enhanced primary treatment (CEPT) approach would play a significant part in effective phosphorus removal. This should be considered in the design of replacement clarifiers.

4.2.6.4 Forward Flow Pumping

The forward flow pumping system is functional, but also has equipment nearing the end of its useful service life. While modernization is appropriate for this system, consideration is needed for changes in the plant hydraulic profile. Hydraulic profile need issues include possible changes to the level of primary clarifiers, and possible process changes needed in response to new permit limits that could affect hydraulic profile needs. There is a defined need to more carefully assess the forward flow pumping process, with a minimum requirement for refurbishment and a maximum requirement for complete replacement.

Recognizing that the forward flow pumps run continuously throughout the day, energy conservation is a key consideration in this process. A plan to replace or improve the forward flow pump system should include enhanced energy management – including pump, motor and control enhancements.

4.2.6.5 Secondary Biological Treatment

The biological treatment process has needs on every level. The existing RBC system continues to be subject to the effects of aging. Several RBC trains have already been upgraded due to ongoing active failures (including media failures, shaft bearing failures and related issues). If the RBCs are to remain in service, the systems need to be fully refurbished – any remaining old media will need replacement, and frames, drives and other ancillary systems will need refurbishment.

The RBC tanks are also an issue hydraulically, as minimal freeboard was provided in the RBC tank and channel design, and the staff has noted that the limiting factor for processing hydraulic flow through the plant is the RBC channel. The channels tend to overflow when peak flows through the plant reach approximately 3.5 mgd. This hydraulic issue needs to be addressed in any upgrade.

The new permit conditions make the continued use of the attached growth RBC process more challenging, as the plant was built with provisions to nitrify, but the RBC system lacks the flexibility to denitrify. A process change needs to be considered that can support nitrification and denitrification, or an add-on denitrification process will be needed. Consideration of process alternatives is needed to define a plan going forward for the overall treatment process.

4.2.6.6 Secondary Clarification

The load on the secondary clarifiers is limited due to the attached growth process and the lack of return activated sludge (RAS) needs. The clarifiers are nonetheless limited in their efficiency due to a shallow sidewater depth (10 feet), and are in need of refurbishment. This system needs to be considered in the overall treatment process consideration, but as a minimum modernization will be needed.

4.2.6.7 Disinfection

The disinfection system needs efficiency improvements and some degree of modernization. The plant staff have indicated that it can be difficult to find gas suppliers for their chlorine gas cylinders and sulfur dioxide gas. The plant staff have stated a preference for replacement with liquid hypochlorite and liquid bisulfite for dechlorination. The systems need evaluation and selection of the best process, and process improvements will be required.

4.2.6.8 Outfall

The outfall system does not have any defined needs based on capacity or condition. For modernization, if the plant implements instrumentation and control improvements, the addition of an automated level monitoring system for the river water level at the outfall should be considered.

4.2.6.9 Sludge Storage and Dewatering

The sludge processing facilities at the WWTF are in need of general modernization. The existing equipment related to sludge storage and transfer is near the end of its expected service life, as are the belt filter presses used for dewatering, and their support systems. Specifically polymer and chemical feed systems need to be modernized to improve their efficiency and operability. The structures (tanks and processing areas appear to be in serviceable condition, and space provided for dewatering and support appears adequate.

Efficiency improvements in sludge dewatering are generally important to the economics of municipal WWTF operations – and as such systems offering improved sludge dryness are typically recommended for evaluation. In the case of the Bridgewater WWTF, these concerns are less significant due to the proximity of the town's composting area – sludge transport costs here are not as significant. The major focus in selecting replacement dewatering equipment, and support systems should be the operations staff's preference for ease of operation and maintenance (O&M).

Sludge processing capacity has not been an issue historically, and should not be a problem with future increased loadings to the plant. However, the new permit changes triggering significant