

**COMPREHENSIVE WASTEWATER
MANAGEMENT PLAN
EXISTING CONDITIONS CHAPTER
FOR
TOWN OF NORTH ANDOVER**

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1. EXISTING CONDITIONS

1.1 Introduction

The Comprehensive Wastewater Management Plan (CWMP) for the Town of North Andover, Massachusetts is formulated in response to the needs of the Town, and designed to protect the environmental resources both within North Andover and within the broader regions surrounding the Town. Before the CWMP can be developed, the existing environmental conditions of the area must be documented to provide a context for wastewater needs and solutions. Chapter 1 provides a summary of this background as well a description of the Town's existing wastewater system. Section 1.2 details the Town's built environment, including the Town's land use and zoning, information on the Town's buildout analysis and population information. Section 1.3 provides an overview of the natural environment within North Andover and within the boundaries of the river basins in which the Town resides. The Town's public sewer system is described in Section 1.4, and the Town's Infiltration and Inflow (I/I) abatement measures are summarized in Section 1.5. The final section evaluates the Town's public drinking water supplies and demand projections.

It should be noted that the Town has invested in other town-wide planning reports in the past ten years that support this CWMP. These reports include the Town of North Andover Master Plan (April, 2000), the North Andover Open Space and Recreation Plan (2000), Town of North Andover Community Development Plan (May, 2004) and the North Andover Reconnaissance Report (May, 2005). The information in these reports support the development of this CWMP.

1.2 Built Environment

The Town of North Andover encompasses an area of approximately 27 square miles in northeastern Massachusetts and is part of Essex County. It is bordered by North Reading and Middleton to the south, and Methuen, Haverhill, Groveland and Georgetown to the north. Andover and Lawrence abuts the west side of North Andover and Boxford is located to the east. The northwest section of North Andover is located on the banks of the Merrimack River. North Andover is included in the Merrimack Valley Planning Commission (MVPC) planning area.

Interstate 495 runs through the northwest corner of North Andover, bringing access to the Lawrence Municipal Airport, industrial parks and residential areas. Route 114 crosses through the southern half of the Town and provides connections to Routes 125 and Route 133. Figure 1-1: Land Use and Cultural Resources identifies the location of the Lawrence Municipal Airport and displays how land in North Andover is currently generally being used.

1.2.1 Land Use & Zoning

Historic land use development, as described in the Town of North Andover Master Plan, began with the original settlement of the area in the 1640's for agricultural purposes. Settlers were attracted to the flat fertile land and abundant water supply and the founders chose to live near the location that is now known as the Old Center. The Old Center was the crossroads for travel throughout the region including roads to Salem, Newbury, Haverhill and Billerica. Residential, agricultural, and commercial enterprises such as saw and grist mills build up around the crossroads throughout the 1800's.

The industrial revolution played a definite role in the Town’s growth and development history because of its location adjacent to the Merrimack River. Land along both sides of the river was developed and a dam was constructed to supply waterpower for new textile mills. The Cochichewick Brook, which runs from Lake Cochichewick to the Merrimack River, provided waterpower to fuel industries all along its banks. The Brook became the site of woolen factories and machine shops in the 1800’s. These manufacturing facilities were concentrated away from Old Center in the northern section of the North Parish, which soon became the “new” center of North Andover. The introduction of the railroad in the 1850’s increased the Town’s changing character with the construction of a train depot adjacent to the mill village.

North Andover was the location of several successful mills which resulted in a huge population increase during the mid-1800’s. Manufacturing continued to be a major economic force in the Town through the 1950’s eventually replacing agriculture as the primary driver of the economy in the Town. The proliferation of automobiles and the construction of Interstate 93 in 1960 and Interstate 495 in 1967 changed the Town of North Andover from an industrial village to a suburban development. The construction of Interstate 93 and Interstate 495 enabled people to live in North Andover and work in major cities such Lowell to the west, Portsmouth to the north, or Boston to the south. Suburban development rapidly expanded to outlying areas of the Town as the highway transportation attracted more and more people into the community. Former estates and farmsteads were subdivided into residential lots, and large office parks were created off of Route 114. Public water and sewer systems also enabled the development of outlying areas in the Town. Zoning districts were established in the Town to help mitigate and plan suburban development. The Town’s zoning districts are listed in Table 1.1 – North Andover Zoning Districts. Figure 1-2: Town Zoning displays each zoning district.

**Table 1.1
North Andover Zoning Districts**

Residential Districts	
R1 – Residence 1 District	Minimum lot size: 87,120 square feet
R2 – Residence 2 District	Minimum lot size: 43,560 square feet
R3 – Residence 3 District	Minimum lot size: 25,000 square feet
R4 – Residence 4 District	Minimum lot size: 12,500 square feet
VR – Village Residential District	Minimum lot size: 43,560 square feet
R-5 – Residence 5 District	Minimum lot size: 43,560 square feet
R-6 – Residence 6 District	Minimum lot size: 130,560 square feet
Business Districts	
B1 – Business 1 District	Minimum lot size: 25,000 square feet
B2 – Business 2 District	Minimum lot size: 25,000 square feet
B3 – Business 3 District	Minimum lot size: 120,000 square feet
B4 – Business 4 District	Minimum lot size: 80,000 square feet
VC – Village Commercial District	Minimum lot size: 90,000 square feet
GB – General Business District	Minimum lot size: 25,000 square feet
PCD – Planned Commercial Development	Minimum lot size: 150,000 square feet
Industrial Districts	
I1 – Industrial 1 District	Minimum lot size: 80,000 square feet
I2 – Industrial 2 District	Minimum lot size: 80,000 square feet
I3 – Industrial 3 District	Minimum lot size: 435,600 square feet
I4 – Industrial 4 District	Minimum lot size: 50,000 square feet
Conservancy Districts	
Watershed Protection District (Overlay District)	
Floodplain District (Overlay District)	

This summary is based on the Town of North Andover Zoning Bylaw, amended July 10, 2006.

The Town’s Community Development Plan states the Town’s existing zoning is, “complicated and contains a number of subtle but important inconsistencies.” It notes the zoning bylaw allows ten commercial and industrial districts, but these districts are sometimes not interconnected. The Community Development Plan also points out that commercial and industrial districts were created for particular projects instead of the result of planned choices. The plan explains that there are minimal options to rezone additional land for non-residential use, but the Town can encourage more intensive use of land in existing commercial and industrial zones. The zoning breakdown for the Town is described in the following information

Approximately 86-percent of North Andover is zoned for single family residency, with the breakdown of 38.9-percent R-1, 31.8-percent R-2, 8.3-percent R-3 and 6.9-percent R-5. Multifamily residential zoning accounts for 3.4-percent of the land area, 2.4-percent low density and 1.0-percent medium density. Commercial zoning accounts for 2-percent of the zoning area with 1.5-percent as General Business and 0.5-percent Limited Business. Industrial zoning accounts for 8.6-percent, 6.8-percent as general industry and 1.8-percent light industry.

The Watershed Protect District is an overlay district that is intended to protect Lake Cochichewick, the Town’s sole source public drinking water supply. The district physically surrounds Lake Cochichewick, and regulations within this district are intended to conserve the natural environment in order to protecting the health, safety and welfare of the public.

The Floodplain District is an overlay district that serves to ensure public safety; eliminate new hazards to emergency response officials; prevent public emergencies resulting from water quality, contamination and pollution caused by flooding; avoid loss of utility services; eliminate costs associated with the response and cleanup of flooding conditions; and reduce damage to public and private property from flood waters. The district is defined by the 100-year floodplain as depicted on the Flood Insurance Rate Maps (FIRM) for North Andover provided by the Federal Emergency Management Agency (FEMA).

The Town’s Master Plan identifies the need for greater commercial and industrial growth in North Andover to offset cost of providing municipal services to the Town’s residents. According to the Town’s Open Space and Recreation Plan (OSRP), the North Andover zoning configuration has historically favored residential development over commercial or industrial growth.

1.2.2 Buildout Analysis

North Andover currently has a population of 30,145. As discussed in the previous section, the majority of the parcels in Town are residential. The breakdown of the current usage of Town’s parcels according to the Town’s Property Assessor is listed in Table 1.2 – North Andover Parcel Use Breakdown.

**Table 1.2
North Andover Parcel Use Breakdown**

Number of Parcels	Use of Parcels
Residential	
6,143	Single Family Houses
435	Two Family Houses
46	Three Family Houses
51	More than three dwellings in one buildings (Apartments, townhouses, etc.)
Commercial	
438	Hotels, Warehouses, Gas Stations, Shopping Centers, etc.
81	Manufacturing

The Merrimack Valley Planning Commission (MVPC) performed a buildout analysis for North Andover in Spring of 2001. The MVPC buildout analysis determined the development capacity of the Town based on zoning and environmental land constraint issues to determine the population of North Andover if the Town were to fully develop the available land. The purpose of such an analysis is to determine the development potential in the community on the basis of existing zoning and consequently what the demands of such build-out might require in terms of infrastructure and services.

1.2.2.1 Residential Buildout Analysis

The MVPC buildout analysis applied current zoning regulations and by-laws to the total undeveloped residentially zoned land that existed at the time of the analysis. The analysis also considered the following constraints to development:

- 100 Year Flood Plain District (partial constraint)
- Rivers Protection Act 200-foot Buffer and 100-foot Wetlands Buffer (partial constraint)

The results of the analysis are presented in Table 1.3 – Residential Zoning Districts and Future Population, and indicate a potential for an additional 2,300 dwelling units and 6,800 additional residents. The number of residents at buildout is based on 2.94 persons per household derived from the 1990 United States Census. The buildout population was calculated to be 34,034 by adding 6,832 to the population of the Town in the year 2000. Since the buildout analysis was completed in Spring of 2001, we have assumed that the 2000 Town recorded census population of 27,202 was used as the base population for the Town’s buildout analysis.

**Table 1.3
Residential Zoning Districts and Future Population**

District	Zoning Requirements	Net Buildable Land Area (acres)	MVPC Projected Dwelling Units	New Population
R1	Min. lot size = 87,120 s.f.	1,006	503	1,479
R2	Min. lot size = 43,560 s.f.	777	777	2,284
R3	Min. lot size = 25,000 s.f.	245	427	1,254
R4	Min. lot size = 12,500 s.f.	49	180	529
VR	Min. lot size = 43,560 s.f.	107	429	1,261
R5	Min. lot size = 43,560 s.f.	8	8	25
R6	Min. lot size = 130,560 s.f.	0.05	0	0
Total Dwelling Units			2,324	6,832

1.2.2.2 Commercial/Industrial Buildout Analysis

The MVPC buildout analysis also applied current zoning regulations and by-laws to the total undeveloped commercial and industrial zoned land that existed at the time of the analysis. The PCD (Planned Commercial Development) district did not exist at the time of the buildout analysis and is therefore not included in the data. Table 1.4 – Business and Industrial Zoning Districts displays the buildable areas associated with each zoning district.

**Table 1.4
Business and Industrial Zoning Districts**

Zoning District	Net Buildable Land Area (acres)	MVPC Projected New Commercial & Industrial Space (sf)
B1	7	91,476
B2	2	65,340
B3	1.62	28,257
B4	15.44	336,248
VC	17.55	290,492
GB	4.80	83,566
I1	61.29	1,334,908
I2	263.90	5,747,668
I3	3.93	85,538
IS	13.88	302,303
Total Projected Buildable Business and Industrial Square Footage		8,063,493

These statistics are calculations based on a methodology that looks at constraints on development and allowable buildout based on zoning regulations. They are not estimates of rate of growth or the manner in which that growth will take place. Other factors clearly impact the actual development trends in the community and are discussed elsewhere in this report.

1.2.3 Historical Population/Demographics

The Town of North Andover was first established as primarily an agricultural economy in the 1600's. During the 19th century, the construction of mills along the Cochichewick River near the Merrimack River enabled textile manufacturing, which developed a commercial center near the mills and close to the City of Lawrence. The population of North Andover increased significantly in the 20th century because textile mills attracted immigrants to the area to work. The population of less than 5,000 in 1890 nearly doubled to approximately 10,000 people in 1950. After World War II, textile manufacturing moved to the southern United States, and textile manufacturing in North Andover was replaced with new industry, such as the large Western Electric plant at 1600 Osgood Street which is now owned by Ozzy Properties. The Town underwent a culture change during the second half of the 20th century when the major transportation corridors of Interstate 93 and Interstate 495 were constructed. These highways put North Andover within driving distance of employment in the Metropolitan Boston region, and thus made the Town attractive to commuters. The increase in the Town's population in the late 1900's was primarily a result of people moving into new residential developments in Town and commuting to work.

According to the Town's OSRP, as with many other towns in Massachusetts, the residents of North Andover have been experiencing a shift away from manufacturing jobs and a shift toward high tech, service employment. Recent population growth has changed North Andover from a blue-collar to a white-collar community.

Based on data provided on the MVPC's website and the Massachusetts Institute for Social and Economic Research (MISER) over the 80-year period between 1920 and 2000, the population grew by over 300%. Total population in 1920 was 6,265 and 27,202 in 2000 (US Census Data). Over the past decade, the Town has experienced an approximately 1.8% rate of annual growth. The population at the time of this report for 2007 was obtained from the Town Clerk's records. Population figures by decade are provided in Table 1.5 - Historic and Projected Population.

**Table 1.5
Historic and Projected Population**

Year	Population	Average Annual Percent Change
1920	6,265	---
1930	6,961	1.11%
1940	7,524	0.81%
1950	8,429	1.20%
1960	10,908	2.94%
1970	14,000	2.83%
1980	21,300	5.21%
1990	22,333	0.50%
2000	27,202	2.18%
2007	30,145	1.55%
2010*	30,082	-0.07%
2020*	32,153	0.70%
2027**	36,431	N/A

* Projections conducted by MISER (“Middle” Projection) based on 2000 Census Data.

** Projection based on 1.8% annual population growth.

It is interesting to note that the current population for the year 2007 of 30,145 is higher than the population of 30,082 that was projected for the year 2010 by MISER based on the 2000 Census data. This shows that North Andover continues to show increase in population, even while the overall State of Massachusetts is experiencing a decline in population. The 2027 population estimate was calculated based on the population estimate of 32,153 for the year 2020 and a 1.8% rate of annual population growth.

1.2.4 Population Growth Projection

Table 1.5 – Historic and Projected Population includes projected populations extended through the 20-year planning period of this report. However, if population did grow at the 1.8% historic annual growth rate, the projected population of 36,431 would exceed the Town’s projected buildout population of 34,034. It is not likely that the Town will exceed its buildout population. Therefore, for the purposes of this study, the projected buildout population of 34,034 will be used for the 2027 projected population.

1.2.5 Institutional Characteristics

The Town of North Andover has several institutional characteristics that help maintain the Town’s strong reputation as an attractive area to live and work. First, the Town prioritizes providing an excellent education to its students. The Town has five public elementary schools, one middle school and the North Andover High School. North Andover students also have the option of attending the Greater Lawrence Technical School which is located in the neighboring town of Andover. North Andover is the home of Merrimack College, a private college founded in 1947. Merrimack College has approximately 2,000 students. North Andover is also the home of the Brooks School, a private co-educational boarding and day school with approximately 340 students.

The Lawrence Municipal Airport is located in North Andover. This airport is owned by the City of Lawrence and, therefore, provides no tax revenue to the Town of North Andover. The airport has an area of 550 acres, with two asphalt runways. The main runway is 5,000-foot long and 150-foot wide with an instrument landing system. The second runway is 3,900-foot long and 100-foot wide.

The former Lucent Technologies Merrimack Valley Works plant is located at 1600 Osgood Street in the north section of North Andover. This large industrial plant was originally built in 1956 by Western Electric. For three decades, Western Electric employed 10,000 to 20,000 people in North Andover. Lucent Technologies purchased the property in 1996. In 2004, the 169 acre property was purchased by Ozzy Properties, Inc. with the goal of attracting high-tech/high-end industrial tenants. Ozzy Properties is currently in the planning, design, and approval stages of the proposed redevelopment of the property. The new use of this significant property will be critical to the Town's overall planning goals.

An old mill complex that is currently being used as commercial space is located at One High Street in North Andover. Two of its current tenants include Schneider Automation, Inc. and Converse, Inc.

North Andover is also the home of the Museum of Textile History, historical districts, and national and state landmarks.

1.2.6 Economy

According to the Town's Community Development Plan, North Andover's labor force has grown by 18% from 1995 to 2004. The Community Development Plan noted that North Andover has over 18,000 jobs within the Town. Nevertheless, less than 25% of the Town's employed residents work locally. Approximately 43% commute more than 30 minutes to and from work.

Before 1957, manufacturing jobs made up more than 95% of the Town's total employment. In the 1990s, manufacturing employment in the Town declined by almost 50%. Approximately 3,000 additional manufacturing jobs were lost when Lucent Technologies closed in North Andover. Although the Town is experiencing a loss in manufacturing jobs, the residents in the Town continue to be a well educated workforce.

As mentioned previously in this report, the Town's Master Plan identified the need for greater commercial and industrial growth in North Andover to offset cost of providing municipal services to the Town's residents. As part of the Town's commitment to establish more commercial and industrial growth, the Town is working with Ozzy Properties to develop the former Lucent Technologies site at 1600 Osgood Street so that it will be an asset to the Town's economy.

1.3 Natural Environment

1.3.1 Topography and Landscape

The land area of North Andover is approximately 27 square miles and includes a myriad of natural resources. The land in the Town is made up of open fields, meadows, farmland, and shorelines along streams and ponds. The Town also includes forested land with wooded trails and a large amount of untouched woodlands. Table 1.6 – Land Use Summary summarizes the land use in the Town according to information from the Massachusetts Department of Environmental Protection.

**Table 1.6
Land Use Summary**

Percentage of Town	Land Use
4.1%	Water
6.3%	Agriculture
6.6%	Commercial, Industrial & Transportation
28%	Residential
55%	Forest, Wetlands & Open Space

North Andover’s topography is made up of a highland on the outer edge of the Merrimack River Valley where four separate watersheds meet. According to the Town’s OSRP, the North Andover landscape was formed by continental glaciations which is most noticeable because of many oval-shaped hills and irregularly shaped swamps and bogs that resulted from disrupted drainage patterns. These irregularly shaped hills are known as drumlins. They are described as gently rolling hills in the Town and are identified as Osgood, Weir, Town Farm, Bear, Boston, Byers, Barker, Claypit, Woodchuck, and Mills Hills. According to the Town’s Master Plan, Clay Pit, Boston, Woodchuck, Town Farm and Bear Hills are protected for their scenic value. The Weir, Byers and Barker Hills are protected for water quality reasons. Figure 1-3A: USGS Quadrangle Map shows the topographic features of North Andover and Figure 1-3B: Contour Map displays 10-foot contours within the Town.

1.3.2 Hydrologic Conditions and Water Resources

The majority of North Andover is a highland at the junction of three watersheds: the Merrimack River and the headwaters of two rivers: the Ipswich River (via Boston Brook and Mosquito Brook) and the Parker River. In general, the southern and southeastern sections of the Town flow into the Ipswich River, and the western and northern sections of the Town drain into the Merrimack River. The Shawsheen River and Cochichewick Brook are two significant subdrainage areas of the Merrimack River. Refer to Figure 1-4: River Watersheds for the limits of the watersheds in North Andover and identification of the Town’s major rivers. Another major water resource in North Andover is Lake Cochichewick. Lake Cochichewick is the Town’s surface water public water supply. Descriptions of the four major watersheds in North Andover and Lake Cochichewick are included in the following sections.

1.3.2.1 Merrimack River Watershed

The Merrimack River Watershed is located in central Massachusetts, southern New Hampshire and northeastern Massachusetts. In total, the river itself runs approximately 180 miles and has a drainage area that covers a total of 5,010 square miles. The Merrimack River flows in a well-defined channel that ranges in width from approximately 400-feet to 1,400-feet. The Merrimack River flows through or adjoins 15 towns, and ranges in altitude from sea level to about 300-feet above sea level.

Lake Cochichewick, the Town’s surface water drinking water source, is located in the Merrimack River Watershed. Therefore, the Town withdraws water from the Merrimack River Watershed for its drinking water. The Greater Lawrence Sanitary District which treats the Town’s wastewater flows received from the Town’s sewers discharges to the Merrimack River. Therefore, the Town’s treated wastewater discharges to the Merrimack River Watershed.

The Merrimack River Watershed is made up of 17 subwatersheds. A subwatershed is defined as an area which groundwater and surface water drains and contributes to flow to another body of water. The second body of water contributes flow to the main watershed. The Shawsheen River which runs through the Northwest section of North Andover is one of the subwatersheds of the Merrimack River. This northwest section of North Andover is part of the Lower Shawsheen River Watershed. The following section describes the Shawsheen River Watershed.

1.3.2.2 Shawsheen River Watershed

The Shawsheen River Watershed is located in northeastern Massachusetts. It has a total drainage area of approximately 78 square miles, and is considered to be one of the smaller watersheds in the state of Massachusetts. The Shawsheen River flows 25 miles from its headwaters in Bedford, and loses 70 feet in elevation as it travels to its confluence with the Merrimack River in Lawrence. The watershed has an urban character throughout and supports a population of approximately 250,000 people. The Shawsheen River is the only major tributary to the Merrimack River that does not have a dam or any other man-made obstruction from its confluence to the Atlantic Ocean.

A 5-year Watershed Action Plan was established for the Shawsheen River Watershed in 2003 to guide local and state environmental efforts within the Shawsheen River Watershed thru 2008. North Andover does not receive any of its water supply directly from the Shawsheen River Watershed.

1.3.2.3 Ipswich River Watershed

The Ipswich River Watershed is located in northeast section of Massachusetts and encompasses approximately a 155 square-mile area. The river itself extends approximately 45 miles from its westernmost headwaters in the towns of Burlington and Wilmington to its mouth at Essex Bay and Plum Island Sound. The Ipswich River Watershed includes all or portions of 22 Massachusetts cities and towns.

The southern half of North Andover is included in the Ipswich River Watershed. The Ipswich River Watershed is divided into three subsections: the upper, middle and lower watersheds. The section of North Andover that is in the Ipswich River Watershed is in the middle watershed. The Fish Brook and Boston Brook are located in North Andover and are two major tributaries to the Ipswich River.

The Ipswich River Watershed Association created an Ipswich River 5-Year Watershed Action Plan in October of 2003 that is being used to guide local and state environmental efforts within the Watershed, as well as implement the goals of the Executive Office of Environmental Affairs.

1.3.2.4 Parker River Watershed

A small northeast section of North Andover is included in the Parker River Watershed. The Parker River Watershed covers approximately 82 square miles in northeastern Massachusetts, and the river itself is approximately 23 miles in length. The Parker River Watershed includes all or part of nine towns, and ranges in altitude from less than 200-feet above sea level to 400-feet above sea level in some bedrock hills.

1.3.3 Water Supply Protection - Lake Cochichewick

Lake Cochichewick is the Town's sole source of public drinking water. It is a surface water drinking water source located in the north section of North Andover. Refer to Figure 1-5: Wetlands, Aquifers and Water Supply for its location. The boundary of the watershed protection district is shown in Figure 1-2: Zoning. The south border of the Merrimack River watershed is coincident with the Lake Cochichewick watershed protection district. Approximately 25% of all land in the Lake Cochichewick watershed is protected open space. This includes Osgood Hill and the Trustees of Reservations' Weir Hill Reservation, Mazurenko and Rea's Pond Conservation Areas, a large section of the Town Farm, a portion of the Smolak Farm and a small conservation easement.

The North Andover Water Treatment Plant (WTP) was built in 1991 in response to *giardia* contamination of Lake Cochichewick in 1986. Since the contamination, the Town has implemented a number of steps to protect its drinking water supply. These steps include the creation of a Watershed Protection District, Board of Health Rules and Regulations, Wetland Regulations, land acquisitions, increased street sweeping and sewer system extensions.

1.3.4 Hydrogeology

According to the Town's OSRP, there are two major bedrock zones underlie the Town of North Andover. The Merrimack belt lies in the extreme northern portion of the Town, and the Nashoba zone underlies the remainder of the Town. The Merrimack belt is made of mainly metamorphosed sandstone and siltstone, while the Nashoba zone is mainly Andover granite and Sharpners Pond Diorite.

The two major bedrock zones in Town are split by a major structure feature identified as the Clinton-Newbury fault. This fault runs southwest to northeast just north of Lake Cochichewick, and through southern New England. It was most active 250 million years ago, but has caused occasional minor earthquakes. It was identified as being active in 1990 in the Town of Littleton, Massachusetts.

The surficial geology for the Town of North Andover, as characterized by the United States Geological Survey (USGS), includes three distinct categories. A majority of the Town is characterized till or bedrock materials. Areas of sand and gravel deposits, which represent the productive aquifers, were identified in the northeast corner and southern half of the Town. Small amounts of floodplain alluvium are located in the north section of Town bordering the Merrimack River consistent within the Federal Emergency Management Agency (FEMA) designated 100-year and 500-year floodplains and wetland areas.

The southern and southeastern portion of North Andover consists of ground moraine or "bedrock covered by a thin sheet of till." This clay-rich fill has poor draining capabilities, which has resulted in many swamps, marshes, bogs throughout Town. Areas that have poorly-drained soils and abundant wetlands present limitation for development.

1.3.5 Geology and Soils

According to the Town's OSRP, the soils in North Andover can be classified into the following four major associations.

- Paxton-Woodbridge-Montauk Association
- Canton-Charlton-Sutton Association
- Charlton-Rock Outcrop-Medisapristis Association
- Hinkley-Windsor-Merrimack Association

S E A evaluated soil percentages for the Town using available Natural Resources Conservation Service (NRCS) Geographical Information Systems (GIS) soil data for North Andover. North Andover is included in the Essex County, Northern Part soil data information. The four major classifications listed previously total approximately 79% of the Town's land. Approximately 5% of the Town is classified as Urban Land, or soil that is not native to the land but instead brought in as fill. Approximately 3% of the Town's land consists of Ridgbury soil type and another 3% consists of Whitman soil type. Approximately 2% of the Town's land is made of Scarboro soil type. The remaining 5% of the Town's land consists of miscellaneous soils taking up 1% or less of the Town's land area that are too numerous to list. The percentage breakdown and predominant characteristics of these four classifications are described in Table 1.7 – Soil Classifications for the Town of North Andover.

**Table 1.7
Soil Classifications for the Town of North Andover***

Soil Association (% of Town)	Breakdown	Description	Depth to High Water Table
Paxton-Woodbridge- Montauk , Canton-Charlton- Sutton, Charlton-Rock Outcrop-Medisapristis Hinkley-Windsor- Merri-mack (79%)	Paxton- Woodbridge- Montauk (24%)	Deep, nearly level to steep, well drained and moderately well drained, loamy soils formed in compact glacial till.	Paxton & Montauk: 72” Woodbridge: 18- 36”
	Canton- Charlton- Sutton (32%)	Deep, nearly level to steep, well drained and moderately well drained, loamy soils formed in friable glacial till.	Canton & Charlton: 72” Sutton: 18-42”
	Charlton-Rock Outcrop- Medisapristis (17%)	Deep, nearly level to steep, well drained, loamy soils formed in glacial till; Rock outcrop; and deep, nearly level, very poorly drained, mucky soils formed in organic deposits.	Charlton: 72”
	Hinkley- Winsor- Merri-mack (6%)	Deep, nearly level to steep, excessively drained and somewhat excessively drained, sandy and loamy soils formed in outwash deposits.	72 inches
Ridgbury (3%)	Ridgbury to Ridgbury & Leicester	Poorly draining soil in depressions and along drainage ways, slopes smooth and concave	0-18 inches
Whitman (3%)	Whitman	Very poorly draining soil, located in depressions and low areas	0-6 inches
Scarboro (2%)	Scarboro	Very poorly draining soil, nearly level soil in depressions.	0-12 inches
Urban Land Fill (5%)	Urban Land Udorthents	Variable	No data available.
Miscellaneous (7%)	Too numerous to list.	n/a	n/a

*Descriptions of soils from *Interim Soil Report for Essex County, Massachusetts (Northern Part), 1981*.

Soil characteristics greatly influence an area’s suitability for on-site sewage disposal. The United States Department of Agriculture evaluates soil properties in relationship to construction of a septic tank absorption field. S E A used the classifications included in the Interim Soil Report to evaluate the percentage of severe, moderate and slight soil limitations for septic systems of the soils in North Andover. The result of the evaluation showed that approximately 60% of the Town’s soil is classified as having severe limitations for septic tanks, 20% of the soils are considered to have moderate limitations and 5% have a slight limitation. The remaining 15% were soils that had no classification for a septic tank absorption field and include land use such as rock outcrops, urban land or fill, gravel pits or landfills. The results of this evaluation are summarized in Table 1.8 – Land Use Summary and displayed in Figure 1-6: Soils Limitation Map.

**Table 1.8
Land Use Summary**

Soil use for SAS Classification	Percentage of Land in North Andover
Slight Limitation	5%
Moderate Limitation	20%
Severe Limitation	60%
No SAS Description	15%

1.3.6 Species Habitat and Wetlands

There are four Estimated Habitats of Rare Wildlife (EH) in the Town of North Andover, based on rare species records maintained in the Natural Heritage & Endangered Species Program (NHESP) database. Resource areas and buffer zones in these habitats are within the jurisdiction of the local conservation commission under the Massachusetts Wetlands Protection Act Regulations (310 CMR 10). There are also six areas in North Andover designated as Priority Habitats of Rare Wildlife (PH) under the Massachusetts Endangered Species Act (321 CMR 10), based on NHESP records. NHESP identifies each EH or PH area with a polygon identification. Table 1.9 – North Andover Rare Wildlife Estimated Habitats & Priority Habitats lists the NHESP polygon identification and a general description of the location of the area in North Andover. An information request would need to be filed with NHESP to find out the species that are included in the polygon area.

**Table 1.9
North Andover Rare Wildlife Estimated Habitats & Priority Habitats**

Habitat Identification	Location Description
EH 819/PH 1222	<ul style="list-style-type: none"> • Northern end of the Town • Section along the Merrimac River • Area northeast of Lake Cochichewick. <p><i>The wildlife habitat and priority habitats overlap and stretch into the Towns of Lawrence, Methuen, Haverhill and Boxford.</i></p>
PH 16	<ul style="list-style-type: none"> • Located west of Lake Cochichewick, following the western shore, bounded on the east by Osgood Street and Hawkaway Road.
EH 191/PH 818	<ul style="list-style-type: none"> • Located in the center of the Town. <p><i>The wildlife habitat and priority habitats overlap and are located to the east of the Old Town Center between Great Pond Road and Salem Street/Dale Street.</i></p>
EH 852/PH 25	<ul style="list-style-type: none"> • Located in the southeast corner of the Town. <p><i>The wildlife habitat and priority habitats overlap and extend into Boxford & Middleton.</i></p>
EH 476/PH 1128	<ul style="list-style-type: none"> • Located in the southwest corner of the Town. <p><i>The wildlife habitat and priority habitats overlap and extend into North Reading.</i></p>
PH 201	<ul style="list-style-type: none"> • Located west of the intersection of Turnpike Street and Boston Street

There are sixty-eight certified vernal pools within the Town of North Andover, according to the NHESP records, based on their guidelines for certification of vernal pool habitat. Most of the vernal pools are located in the southern half of the Town and the pools are most dense in the section of town abutting North Reading. These certified vernal pools are protected if they fall under the jurisdiction of the Massachusetts Wetlands protection Act. These vernal pools are also afforded protection under the state Water Quality Certification regulations (401 Program), Title 5 regulations and Forest Cutting Practices Act regulations. A majority of the certified vernal pools are located within or adjacent to wetlands areas.

1.3.7 Flood Plain Locations

North Andover is located in the floodplain of the Merrimack and Shawsheen Rivers to the north and west. The Town is located in the floodplain of various tributaries of the Ipswich River in the south and the east. It is common for the southeastern and southern area of North Andover to flood during a 100-year event storm. Floodplain zoning was adopted by the Town in 1979, and Figure 1-4: River Watersheds shows the locations of floodplains in North Andover based on the Flood Insurance Rate Maps (FIRM).

1.3.8 Chapter 61 Lands

Chapter 61, 61A and 61B lands are privately held properties governed for tax purposes by Massachusetts General Law Chapter 61. These categories afford some level of protection against undesirable development and helps preserve open space. Chapter 61 protects forest land, Chapter 61A includes protection of agricultural and horticultural land, and Chapter 61B encompasses recreation land. The property owner applies to the Town's assessors for classification of his or her land as forest land, agricultural, horticultural or recreational land. The assessors, upon approval of classification of the land, apply a very favorable land tax to the property. Tax incentives exist for the owner to maintain these lands for the stated classification.

The owner may take these lands "out of Chapter" for development or other purposes. If dropped from the protected classification, the owner must pay the appropriate withdrawal tax penalties and roll-back taxes if applicable. If the owner chooses to sell the property to a developer, the Town has the first right of refusal to purchase, and must be provided a reasonable time to consummate the sale. This includes time to appraise the property and appropriate funds at Town Meeting, as well as the time necessary to close on the property.

1.3.8.1 Forest Resources

According to the Town's Master Plan, close to fifty percent of the Town of North Andover is forested land. This percentage does not include accounting for residential subdivisions that are not seen through aerial photography. As of the Town's Master Plan, only 41 acres of the Town's forest land was protected by Chapter 61. It is thought that many landowners are hesitant to agree to a 10-year "no development" agreement with the Town.

1.3.8.2 Agriculture

North Andover was predominantly farmland when it was first settled. Since 1950, the majority of the Town's farmland has been replaced with residential development. According to the Town's Master Plan, there are only two active farms remaining in North Andover. As of the writing of the Town's OSRP, approximately 1,300 acres of the Town's land is protected through Chapter 61A.

1.3.9 Climatology

The City of Lawrence maintains a weather station that is located the closest to North Andover. The Lawrence weather station records the normal temperature in January as 24.7 °F and the normal temperature in July as 72.5 °F. The normal annual precipitation at the Lawrence weather station is 42.8 inches annually.

1.3.10 Historical Resources

The Town of North Andover has one historic district known as the Old Centre Historic District. The Town's Historic Commission oversees work in this district. The Town owns Osgood Hill, which is an 1886 estate listed on the National Register with 164 acres on Lake Cochickewick. Historic areas that include historic homes, churches, mills and stores in Town are identified in Figure 1-1: Land Use and Cultural Resources.

It was voted at the Spring of 2007 to designate the Machine Shop Village area as a conservation district. This designation needs to be approved by the State and, therefore, will not become in effect for a year. Restrictions of redevelopment in a conservation district are not as strict as rules within a historic district.

1.3.11 Archaeological Resources

The Massachusetts Historical Commission reports that a few archaeological sites have been unearthed along the present shoreline of Lake Cochichewick. Before the area was developed by Europeans, the area within North Andover was used as seasonal hunting grounds, and possibly for small gardens.

1.4 Existing Public Sewer System

The Town of North Andover operates a municipal sanitary sewer system that serves approximately 69 percent of the community. The percentage of the population being serviced by sewer was calculated based on of the number of parcels in Town that have access to Town sewer versus the total number of parcels in Town. The remainder of the community is served by standard on-site wastewater disposal systems, often referred to as septic systems. The Town is a member of the Greater Lawrence Sanitary District (GLSD) and, therefore, the Town's municipal sewer system discharges to the GLSD for treatment and disposal. The Town has been a member of the GLSD since its operations began in April of 1977. The GLSD includes the municipalities of Lawrence, Methuen, Andover, North Andover and Salem, New Hampshire. The GLSD Wastewater Treatment Plant receives from the entire district and is located in North Andover.

1.4.1 General System Components

North Andover's sewerage system, originally begun in 1894, presently serves the highly developed northwest area of Town, the less densely developed west area of Town, the Lake Cochichewick watershed and a southern section of Town. A map of the existing sewer system map is included in Appendix 1 – North Andover Existing Sewer System Map. This map shows the locations of the existing gravity sewer, force main, pump stations and the location of GLSD. It also identifies the parcels in the Town that have access to public sewer.

The Town's sewer system includes approximately 87 miles of gravity sections, ranging in diameter from 6 inches to 36 inches. The older constructed pipe material is vitrified clay, reinforced concrete, cast iron and ductile iron, while sections of pipe that have been installed since the 1980s are Polyvinyl Chloride (PVC) pipe. The sewer system includes approximately 1,700 sewer manholes. The older manholes are built from brick, while the manholes built since 1985 are pre-cast concrete. There are no siphons in the North Andover sewer system.

Three major interceptor sewers convey wastewater to the GLSD treatment plant. These are the "Westside Interceptor," the "Eastside Interceptor," and the "Central Interceptor." The Westside Interceptor ranges in size from 12 to 36 inches in diameter, and transports wastewater from the western and southern edges of Town to the GLSD treatment plant that is located in the northwest corner of the Town. The Eastside Interceptor transports wastewater from the east and south areas of Town to the GLSD, and ranges in diameter from 12 to 36 inches. Finally, the Central Interceptor is 10 inch to 20 inches in diameter, and transports wastewater from the downtown North Andover to the GLSD treatment plant.

Because of the hilly nature of the terrain in North Andover, there are currently 20 wastewater pumping stations that collect wastewater from low lying areas and pump it to gravity sewers in higher areas. The locations of the pumping stations are shown the Existing Sewer System Map included in Appendix 1. The types of pumping stations include drypit/wet well pump stations, submersible pump stations and pneumatic ejector station. The sewer system also has 60,900 linear feet of force main, ranging from 2 inches to 10 inches in diameter to convey wastewater from a pump station to a downstream gravity sewer. Force mains 4 inches or more in diameter are cast iron or ductile iron, and force mains smaller than 4 inches are plastic.

1.4.2 Existing Flows

Wastewater flow generated within the municipal sewer system in North Andover discharges to the GLSD treatment plant. The treatment plant is designed to receive an average daily flow of 52 million gallons per day (MGD), and receives average daily flows between 31 and 38 MGD. North Andover typically contributes 10 to 12 percent of the flow to the GLSD treatment plant. North Andover has contributed an average flow of 3.78 MGD for the past three years. The Town’s max day flow in the past three years was 9.97 MGD.

The wastewater flow from North Andover to the GLSD treatment plant is measured by two GLSD flow meters identified as Meter #2 and Meter #3. Meter #2 is located on North Main Street, and measures the flow from the Eastside and Central Interceptors. Meter # 3 is located in the rear of the 90 Sutton Street property, and measures the wastewater flow from the Westside Interceptor. The Town also has a meter on the Westside Interceptor.

A breakdown of the gallons of wastewater generated by each customer type in the Town was calculated as part of this CWMP. Since there are typically no wastewater flow meters on building sewer services, wastewater usage is typically based on recorded water usage. The Town’s water billing system does not have a means to generate water usage by customer type. Therefore, a breakdown of usage by customer type was developed based on the highest water consumers.

Residential wastewater flow was calculated based on 69 percent of the Town’s population being serviced by municipal sewer system and generating seventy gallons of wastewater per person per day. Industrial and commercial wastewater flow was developed by adding the metered water usage from all customers in the Town that consumed more than 100 cubic feet of water in a billing period. Municipal flow was estimated based on the water usage of the schools in Town that consumed more than 100 cubic feet of water in a billing period. These numbers were increased by ten percent to account for the usage from industrial, commercial and municipal users that use less than 100 cubic feet per billing period. Infiltration and inflow was estimated by the difference between the Town’s average yearly metered wastewater flow and the calculated flows from residential, commercial and industrial and municipal customers.

Table 1.10 – North Andover Wastewater Flow Breakdown lists the Town’s calculated wastewater flow by user type. Total metered flow was based on an average of the metered wastewater flows to the GLSD for 2004, 2005 and 2006.

**Table 1.10
North Andover Wastewater Flow Breakdown**

	Wastewater Flow (GPD)
Residential Flow	1,456,000
Industrial & Commercial Flow	260,000
Municipal Flow	16,000
Total Flow from Users (GPD)	1,732,000
Total Metered Flow (GPD)	3,780,000
Infiltration/Inflow (GPD)	2,048,000

1.4.3 GLSD Agreement

North Andover has been a member of the Greater Lawrence Sanitary District (GLSD) since its inception in April of 1977. A copy of the legislation that created the GLSD is included in Appendix 2 – GLSD Legislation and NPDES Permit. A copy of the GLSD’s National Pollution Discharge Elimination System (NPDES) permit is also included in Appendix 2.

According to its website (<http://www.glsd.org>), the GLSD includes a District Commission that consists of seven members, including three members from the City of Lawrence, two from the City of Methuen and one each from the Towns of Andover and North Andover. The Town of Salem, New Hampshire has one non-voting member. These members oversee the GLSD’s Executive Director who is appointed by the District Commission. A treasurer is also appointed by the Commission. North Andover would be allowed to appoint an additional Commission member if its population reached 40,000 people.

The GLSD treatment facility is designed for an average daily flow of 52 million gallons per day (MGD). According to the GLSD Long Term Control Plan (November 2002), the facility was originally designed to handle a peak flow of 94 MGD, but was recently upgraded to handle 135 MGD. The changes to the facility through this upgrade now classify the GLSD treatment facility as a “wet weather” facility. During wet weather events, a portion of facility’s influent is diverted to be treated with primary clarification and chlorination only.

Through its NPDES permit, the GLSD is allowed an annual rolling monthly average discharge of 52 million gallons per day (MGD) to the Merrimack River. The GLSD treatment facility currently receives dry weather flow ranging between 25 MGD and 30 MGD. The facility’s 2002 Long Term Control Plan projects the 2020 wastewater flow to be 40 MGD.

1.4.4 Wastewater Collection System Improvements

1.4.4.1 *Lake Cochichewick Protection*

The Town began a program in 1988 to protect the Lake Cochichewick watershed. As discussed previously in this chapter, Lake Cochichewick is the Town’s only drinking water supply. To protect this critical resource, the Town established a goal of abandoning all septic systems in the lake’s watershed. To accomplish this goal, the Town has been constructing sewers in areas within the Lake Cochichewick watershed so that septic systems within that area could be abandoned. This plan is now in its final stages, with several construction projects now completed, and one construction project remaining to complete the full sewerage goal. A total of ten miles of sewerage have been constructed as part of this program.

1.4.4.2 *Sewer Capacity Increases*

The North Andover sewer system has been expanding from the urban downtown area to the rural areas located on the outside of the downtown area. This expansion was accelerated because of the desire of many homeowners to replace their septic systems with Town sewer, and the Town’s desire to protect the Lake Cochichewick watershed from contamination. The increased flow caused some of the Town’s major interceptors to surcharge. To prevent further sewer system surcharge, the Town has facilitated several projects to replace sections of the Interceptor sewers with larger pipe.

In 1995, approximately 1,000 feet of 18-inch vitrified clay pipe was replaced with 27-inch reinforced concrete pipe to alleviate surcharging along Sutton Street. This pipe replacement improved capacity in the Eastside Interceptor.

In 1997, the North Main Street sewer, which conveys wastewater from the Eastside and Central Interceptors, was replaced. The existing 24-inch reinforce concrete pipe in North Main Street was replaced with 36-inch ductile iron pipe.

From 1999 to 2001, the Town constructed approximately 6,000 feet of new 30-inch and 36-inch ductile iron sewer pipe to alleviate flow constraints in the Westside Interceptor sewer. This project increased the sewer capacity within a section of the Westside Interceptor sewer from the intersection of Waverly Road and Greene Street to the manhole upstream of the GLSD metering chamber. The existing interceptor section in Shawsheen Road between Waverly Road and Sutton Street was abandoned, and the new section of interceptor was constructed in Waverly Road, Massachusetts Avenue, Beverly Street to Sutton Street.

In 2003, approximately 4,000 feet of existing 18-inch clay interceptor pipe was replaced with 24-inch PVC pipe. This replacement work was accomplished between Sewer Manhole No. 5 and East Water Street.

1.4.4.3 Sewer System Evaluation (SSES) Programs

In 1992 and 1998, the Town conducted sewer system evaluation programs to locate damaged piping, undercapacity sewers, and sources of infiltration and inflow. These programs were funded by the Commonwealth of Massachusetts through the State Revolving Fund program. The evaluations resulted in several sewer rehabilitation projects and an inflow removal program that included locating and removing inflow from private sources such as sump pumps and open building sewer cleanouts.

1.4.4.4 Sewer System Rehabilitation

Due to the age of the Town's sewer system, the majority of the sewer system has been in need of replacement or repair. As part of the Town's SSES program, the Town has invested in pipe inspections, repairs, and rehabilitations of its sewer system. In 1995, the town conducted a major sewer system rehabilitation project. This program included the replacement of approximately 4,000 linear feet of gravity sewer, repair of 110 manholes, and the replacement of 160 manhole frame and covers. In 1997, the Town chemically grouted approximately 35,000 linear feet of gravity sewer to help prevent infiltration into the sewer system.

1.4.5 Sewer Capacity Needs

An engineering report was completed in 2005 to develop and evaluate alternatives for the rehabilitation, relocation or replacement of approximately 4,800 linear feet of sewer in Waverly Road between Greene Street and Turnpike Street. This section of sewer was evaluated because it is known as a restrictive section of pipeline in the Town's sewer system and a location where sewer surcharges have occurred. The 2005 engineering report recommended that a new 30-inch sewer be constructed parallel to the existing Waverly Road sewer and the existing sewer be abandoned in place. The increased sewer diameter would relieve undersized sections of the existing 18-inch and 21-inch Waverly Road gravity sewer.

Sewer system back-ups have occurred twice into the basement of the Schneider Electric Building located at One High Street during periods of heavy, prolonged rain in the past two years. This building has two sewer service connections and is serviced by the Eastside Interceptor. An engineering analysis of the Eastside Interceptor is to be performed at this location to evaluate the cause of this problem. The Town is currently seeking a proposal from its consulting engineers, S E A Consultants, Inc. (S E A) to perform this study. An engineering report will be produced to summarize the methodology, findings, conclusions and recommendations of the analysis.

1.4.6 Infiltration & Inflow (I/I)

The Town of North Andover maintains a Sewer Mitigation Account to set aside funds for continued I/I identification and mitigation activities. This account is funded through a fee the Town charges to property owners and developers who are tying into the Town's sewer system with a new sewer connection. This revenue source is expected to perpetuate, and the Town intends to continue to use the Sewer Mitigation Account to problems in its sewer system related to I/I.

The operation and maintenance of the Town's sewer system is funded through a Sewer Enterprise Fund that is completely separate from the Town's tax revenue. The revenue for the Sewer Enterprise Fund is obtained through sewer usage billings and hook up fees. This revenue is used for expenses such as the salaries of operations personnel, material and equipment costs, GLSD fees, settlements, debt services, indirect sewer system costs, as well as for the purchases of sewer system major equipment. For example, the Town's Sewer Enterprise Fund was used to purchase sewer video inspection equipment and a jet flushing and rodding truck. This major equipment is used to help the Town identify I/I problems in its sewer system. The Town's Capital Improvement Plan (CIP) identifies projects that are bonded with debt serviced by the Enterprise Fund.

1.4.7 MA DEP Administrative Order

In 1998, the Town was served with an Administrative Consent Order (ACO) by the Massachusetts Department of Environmental Protection (MA DEP). The ACO was filed because the North Andover sewer system experienced several sanitary sewer overflows that caused raw wastewater to discharge into the Shawsheen River. The overflows were associated with a manhole at the end of Glenwood Street located near the Shawsheen River, which is part of the Westside Interceptor. In November of 1978, the MA DEP had issued an order to the Town requiring it to correct these overflow problems. The problems continued to occur. Therefore, in 1998, the ACO was completed and signed by the MA DEP and the Town. Table 1.11 – North Andover ACO Summary of Action Items summarizes the ACO requirements and the completion status of each requirement.

**Table 1.11
North Andover ACO Summary of Action Items**

ACO Requirement	Deadline Date	Date Completed
No new connections to the Westside Interceptor.	-	-
No new building permits for properties served by the Westside Interceptor., unless: <ul style="list-style-type: none"> • Use will not result in increase in flow, or • An equal amount of I/I will be removed from properties controlled by Owner. 	-	Ongoing
The Westside Interceptor Sewer shall be on-line by December 31, 2000.	12/31/00	10/31/00.
Perform a capacity evaluation of the Central and Eastside Interceptors, and submit the evaluation to MA DEP.	9/1/98	9/25/98
Submit a plan and schedule to MA DEP for constructing a temporary bypass to the Town of Andover Interceptor that is located in the City of Lawrence.	5/29/98	5/29/98
Submit a plan and schedule to MA DEP to eliminate all illegal connection of stormwater discharges to the sewer system.	7/1/98	6/26/98
Submit quarterly reports to MA DEP documenting its work under the ACO.	-	Ongoing

1.5 I/I Abatement Effort

As discussed previously, in the early 1990’s the Town conducted a sewer system evaluation program to identify and determine cost-effective means for resolving sewer system problems related to the Town’s aging and undersized sewer system infrastructure. In the mid-1990’s and early 2000, the Town implemented the recommendations of the SSES program, and has removed significant amounts of infiltration and inflow. Through a Private Inflow Removal Program begun in the late 1990s, the Town has been removing inflow from sources such as, privately owned sump pumps, roof leaders, floor drains and open building sewer cleanouts.

In 2006, North Andover was required to develop and implement an Infiltration / Inflow (I/I) Control Plan as part of the GLSD National Pollution Discharge Elimination System (NPDES) permit requirements. As a member of the GLSD, North Andover is considered a co-permittee, and is therefore required to comply with the GLSD’s NPDES permit. A copy of the NPDES permit MA 0100447, dated October 10, 2005 is included in Appendix 2. Guertin Elkerton & Associates developed an Infiltration / Inflow Control Plan dated April 2006 to meet this NPDES requirement. North Andover is required to submit annual summary I/I reports to the Environmental Protection Agency (EPA) and the MA DEP.

According to the Town’s I/I Control Plan, the two SSES programs the Town performed in the early and late 1990s helped the Town to obtain a good understanding of the I/I issues that exist within its wastewater collection system. Also, implementation of recommendations from the two SSES programs allowed the Town to eliminate significant quantities of I/I from its system. In the past ten years, the Town has performed the following sewer repair work to help eliminate I/I from its system.

- Replaced 3,600 linear feet of gravity sewer.
- Performed 220 gravity sewer spot repairs.
- Replaced 60 service laterals.

- Replaced 6 sewer manholes.
- Repaired 520 sewer manholes.
- Installed 50 grouting sleeves in gravity sewer as an internal spot repair.
- Lined 35,000 linear feet of gravity sewer with chemical grout.
- Replaced 1 sewer service cap for an unused sewer service.
- Performed 2,200 linear feet of sewer video inspection.
- Installed 7 waterproof sewer manhole covers.
- Inspected 30 manholes for infiltration.

The Town's private inflow removal has removed quantifiable amounts of inflow from the Town's sewer system. From 1998 to 2006, approximately 0.68 MGD of inflow has been removed from the system. This inflow elimination was achieved by removing 201 sump pumps, 336 open cleanout pipes, 61 floor drains, 195 perimeter drains, 18 driveway drains, 18 roof leaders and 10 stairwell drains.

According to the Town's I/I Control Plan, the Town intends to continue its Private Inflow Removal Program until all clean water discharges are removed from the Town's sanitary sewer system. The Town intends to use this CWMP report as a foundation for performing additional I/I removal projects.

1.6 Water Supply

The town's sole public drinking water supply is the surface water source of Lake Cochichewick. This 4.3 billion gallon lake and the surrounding watershed cover approximately 5.14 square miles. The surface area of the lake itself is 564 acres with an average depth of 23 feet. Approximately 13.4 percent of the watershed area is located in the Town of Boxford.

The water from Lake Cochichewick is treated before distribution into the Town's drinking water system. The North Andover Water Treatment Plant (WTP) was built in 1991 in response to *giardia* contamination of Lake Cochichewick in 1986. The WTP was constructed on the southern shore of Lake Cochichewick to filter and disinfect the raw water before distribution. The location of the Town's WTP is identified on Figure 1.6: Wetlands, Aquifers and Water Supply.

The WTP includes a six step treatment process, including intake, ozonation, rapid mix, flocculation, sedimentation and filtration. The untreated water from Lake Cochichewick flows by gravity from the intake structure in the lake directly into the Low Lift Pump Station, where it passes through a water screen to remove any floating debris and into the wetwell. It then gets pumped from into an ozone contact tank, where ozone gas is bubbled throughout the water to help kill harmful organisms and aid in settling particles from the water. Next, the water enters the WTP's two double stage rapid mix basins. Potassium hydroxide is added to adjust the pH of the water before entering the rapid mix basins and alum and polymer are added.

This next treatment stage occurs in the flocculation basins. This process is used to remove the majority of solids from the water as precipitation.

After the flocculation basins, the water enters the four sedimentation basins to give the floc time to settle out. The thin layer of solid particles that settle to the bottom of the sedimentation basins are periodically removed from the bottom of each basin by a moving siphon and transferred by gravity to a storage tank. The final treatment process is the water flowing to eight deep bed dual granular activated carbon and sand filters to remove any remaining impurities. Sodium hypochlorite is added to the water to provide the chlorine residual that ensures disinfection throughout the distribution system.

The finished water is stored in a 620,000 gallon clearwell that is located beneath the WTP. It is then pumped from the clearwell into the Town’s water distribution system. The WTP has four finish water pumps with a total pumping capacity of 12 million gallons per day.

The quality of North Andover’s public drinking water is very good and continues to have exemplary compliance with all State and Federal drinking water standards. Common water quality parameters include a pH of 7.37, a Fluoride level of 1.10 parts per million (ppm), a sodium content of 25 ppm and a hardness of 27 ppm which signifies very soft water.

1.6.1 Water Withdrawal Limits

The Town is registered with the MA DEP to withdraw a daily average volume of water from Lake Cochichewick of 2.66 MGD. The Town’s current Registration Statement will expire on January 1, 2008 and will therefore need to be renewed prior to this date. The Town is also permitted to withdrawal additional volume of water based on its Water Management Act Permit #9P2-3-13-210.01 dated April 16, 2003. Table 1.12 – Lake Cochichewick Authorized Raw Water Withdrawals lists the Town’s authorized Lake Cochichewick raw water withdrawals. The Massachusetts Department of Environmental Management’s water demand projections were used to determine the authorized volumes in Periods Two, Three and Four.

**Table 1.12
Lake Cochichewick Authorized Raw Water Withdrawals**

Period	Permitted Daily Average (MGD)	Registered Daily Average (MGD)	Total Average (MGD)	Total Annual (MGY)
Period Two (4/16/03 to 11/30/04)	0.88	2.66	3.54	1,291.80
Period Three (12/1/04 to 11/28/09)	1.31	2.66	3.97	1,448.75
Period Four (12/1/09 to 11/30/14)	1.74	2.66	4.40	1,605.70

The Town’s Water Management Act Permit limits the maximum withdrawal of water in a day to not exceed 12 MGD, which is the WTP intake design capacity. The Firm Yield of Lake Cochichewick is 4.66 MGD. This firm yield considers both surface water and groundwater contributions. Based on this Firm Yield, surface water withdrawals at the intake must not exceed an average annual rate of 4.66 MGD.

The Department of Environmental Management Demand Projections indicates a future water demand for North Andover of 4.79 MGD in the year 2015. As previously discussed, the limitation of the Firm Yield of Lake Cochichewick is 4.66 MGD. Therefore, the MA DEP has identified that the Town will have the need to develop an additional drinking water source during the next twenty-year permitting period, and recommends that the Town begin the planning process by determining a long-term water supply solution to meet the future needs of its water system.

1.6.2 Water Usage

As part of this CWMP, the Town's Annual Statistical Water Report for 2004, 2005 and 2006 were reviewed to understand the Town's current water use. Table 1.13 – North Andover Historic Water Usage list the total finished water pumped from the Town's WTP. All of the water services in North Andover are metered, including the Town's municipal buildings.

Table 1.13
North Andover Historic Water Usage

Year	Gallons of Finished Water Pumped (MG)
2004	1,036.2303
2005	1,116.1704
2006	1,005.7880

According to the Statistical Reports, residential metered water usage is the highest water consumer using approximately 55 percent of the Town's pumped finished water. Based on the Town's population, this residential water usage equates to approximately 57 gallons per person per day. Agricultural and industrial services are the second highest consumer type by using approximately 16.5 percent of the Town's finished water pumped. Commercial water usage accounts for approximately ten percent, while municipal buildings use approximately 1.5 percent. Approximately three percent of the water is consumed by major water main breaks, fire protection, hydrant testing, water main flushing, tank overflow and street cleaning. Approximately fourteen percent of the Town's water is unaccounted for.

1.6.3 Water Conservation

The Town of North Andover works diligently to conserve its drinking water. Public education is a key factor in water conservation. Therefore, the North Andover Water Department publishes water conservation information in the water bills, on the Town's website and in the annual Water System Annual Quality Report. The Town has a Drought Management Plan which allows the Town to impose outside water use restrictions in times of drought, and also requires rain sensors on new irrigation systems. The irrigation water use is charged the higher rate of the Town's two-tiered billing structure. Frequent water billing typically helps to conserve water use. Therefore, the Town has a quarterly meter reading program, which means that its customers are billed four times each year. The Town has a Meter Replacement Program that involves replacing water service meters over ten years old, calibrating master meters each year, and testing large meters over 3-inches in diameter every three years. All service connection in the water system are metered including all public buildings. Water saving devices and low flow toilets are required to be installed in new construction and building rehabilitation projects. Finally the Town performs a leak detection survey on its water distribution system once every two years.