VMR (49)

Sudbury, Massachusetts

Assessment of Wastewater Management Needs for the Route 20 Business District

June 2001

Weston&Sampson
ENGINEERS, INC.

Report

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1.0 INTRODUCTION

1.1 Background Information

The town of Sudbury relies almost entirely on individual, on-site, subsurface systems for the disposal and treatment of wastewater. While this does not appear to be a widespread problem in the residential areas of town, commercial property owners are increasingly having difficulty treating and disposing of wastewater in an economically feasible manner due to physical and regulatory constraints (e.g. soil conditions, depth to groundwater, aquifer protection, Title 5 regulations, etc.).

Approximately 383 acres in Sudbury is currently zoned commercial or in commercial use. With the exception of a few acres in other parts of town, the commercial districts are located in and around the Route 20 corridor, hereinafter referred to as the Route 20 business district. In addition to the economic concerns of providing adequate wastewater disposal systems in this commercial district, protection of the town's water supply is also of concern since the central portion of the Route 20 business district is within Zone II of the town's main drinking water wells at the Raymond Road Aquifer.

A 1995 study entitled "Sudbury Wastewater Disposal Options, Route 20 Business District" determined that the risk of contamination of groundwater in the Raymond Road Aquifer is mitigated by the silt and clay layer, which exists beneath some or all of the Route 20 business district. The study further states, however, that evidence of contamination reaching the Sudbury Water District's #2 well (Raymond Road Aquifer) suggests that the clay layer is not providing complete protection from activities in the Route 20 area. Furthermore, the study found that some septic systems in the area appear to be at maximum use with no potential for expansion or repair.

Subsequent to the 1995 study, a 1999 survey conducted by the Chamber of Commerce further substantiated that the expansion potential of existing businesses might be limited by existing subsurface wastewater disposal systems.

There is increasing pressure in Sudbury to achieve economic sustainability by balancing the recent surge in residential growth with an economically viable commercial sector. The town is seeking to assess the wastewater management needs for the Route 20 Business District and to identify whether there are feasible alternatives to individual septic systems within the district or portions thereof.

The 1999 annual Sudbury town meeting appropriated funds for the completion of a wastewater needs assessment. In May of 2000, the town retained Weston & Sampson Engineers, Inc. (WSE) to assist in the assessment of wastewater management needs for the Route 20 business district, including a preliminary evaluation of alternatives for wastewater treatment and disposal.

1.2 Scope of Work

The specific scope of work for this project was developed by a Technical Advisory Committee (TAC) of the Town of Sudbury. The scope of services includes:

- Assessment of current conditions in the study area with respect to natural environment, land use, water supply and usage, and wastewater disposal.
- Assessment of future conditions in the study area with respect to potential build-out under current zoning.
- Completion of a matrix-type analysis to identify the adequacy of existing wastewater disposal systems to meet existing and projected needs in the study area.
- Preliminary evaluation of potential alternatives for the disposal and treatment of wastewater for the study area.
- Report preparation including submission of a draft report for review by the TAC, attendance at a public meeting to solicit comments on the draft report, and submission of a final report. The report is intended to summarize the study's findings, conclusions, and recommendations.

The study area focuses on the above mentioned Route 20 business district, which includes over 100 business properties on Route 20 and Union Avenue.

1.3 Review of Existing Data

In performing this evaluation and preparing this report, WSE used historic documents prepared for the town by other sources. These documents included the following:

- Sudbury Zoning Map and Street Index, dated 1999.
- Sudbury, MA, Soil Conservation Services Map, dated 1989.
- Sudbury Assessor's Maps, revised 1991.
- F.I.R.M. Map, Federal Emergency Management Association, revised November 20, 1998.
- Water Resource Protection Districts, Town of Sudbury, MA, revised February 1, 1994.
- Sudbury Wastewater Disposal Options, Route 20 Business Districts, prepared for the Town of Sudbury Wastewater Disposal Options Task Force, by Woodard & Curran Inc., dated August 18, 1995.
- Chamber of Commerce Wastewater Survey, dated March 1999
- Hydrology and Ground Water Resources of Sudbury, Massachusetts, prepared for the Town of Sudbury Planning Board, by Ward S. Motts, Hydrogeologist, dated February 1977.
- Hydrogeologic Study, Raytheon Company, Equipment Development Laboratories, prepared for Raytheon Company, Sudbury, Massachusetts, by Goldberg-Zoino & Associates, Inc., dated May 1990.
- Groundwater Model Documentation Supplement to Prolonged Pumping Test Report for New Well No. 9, Sudbury, Massachusetts, compiled for the Sudbury Water District, by H20 Engineering Consulting Associates, Inc., dated February 13, 1992.
- Nitrogen Loading Analysis for Groundwater Supplies for the Sudbury Water District, Sudbury, MA, by H20 Engineering Consulting Associates, Inc., dated December 1993.
- Report on Raymond Road Aquifer Study, prepared for the Sudbury Water District, Sudbury, MA, by H20 Engineering Consulting Associates, Inc., dated January 1985.
- Sustainable Sudbury, Draft Master Plan, by the Sudbury Planning Board, dated 1999.
- IRA Status Report, Gravestar, Inc., Sudbury Plaza, Sudbury, MA, Document No. 3169-003-101, dated April 1996.
- December 2000 Sudbury Build-Out Analysis, by the Metropolitan Area Planning Council.

2.0 ASSESSMENT OF CURRENT CONDITIONS

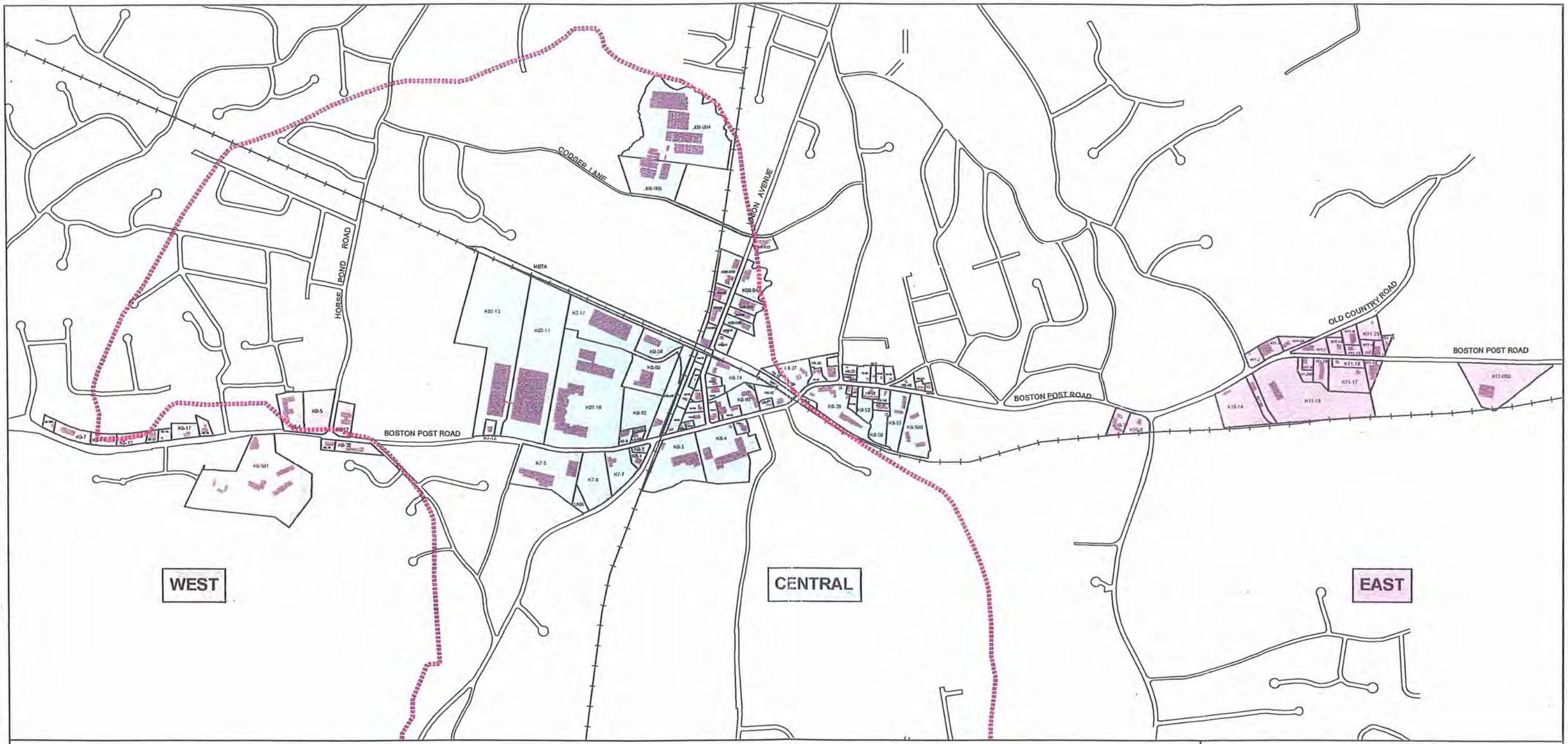
This section provides an assessment of the existing conditions present in the Route 20 business district of Sudbury. WSE reviewed existing information from various sources in order to gain an understanding of the existing conditions in the Route 20 business district. These sources included previous reports prepared for the town (as listed in Section 1.3), Board of Health (BOH) records, and interviews with the Health Agent.

2.1 Planning Area Description

The town of Sudbury, Massachusetts, is a suburban community, located in Middlesex County. It is bordered on the north by Maynard and Concord, the east by Lincoln and Wayland, the south by Framingham, and the west by Stow, Hudson and Marlborough. It is divided by Route 20 and Route 117 running east to west and Route 27 running north to south. Sudbury encompasses an area of approximately 24.6 square miles with 383 acres in town currently zoned commercial or in commercial use. With the exception of a few acres in other parts of town, the commercial districts are located in and around Route 20.

The study area for this evaluation is referred to as the Route 20 business district. This was defined by the TAC as follows: "Properties fronting on Route 20, zoned business, industrial, or multi-family residential from the Wayland line to Lafayette Road, and Union Avenue, from Route 20 to Codjer Lane, and including the residentially zoned Cavicchio property on Codjer Lane." The planning area, which includes 103 parcels, has been identified on Figure 2-1.

The study area was broken down into three distinct areas (West, Central and East) separated by non-business districts. The West area contains properties fronting Boston Post Road (Route 20) from Lafayette Drive to Dudley Road. The Central area includes Boston Post Road from Raytheon Company EDL to Massasoit Avenue and Union Avenue from Boston Post Road to Codjer Lane. The East area begins at Bay Path condominiums on Boston Post Road and continues to the Wayland town line.



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Legend

- DEP Approved Zone II
- Central
- East
- West

N
W E
S

1,200 0 1,200
SCALE IN FEET

FIGURE 2-1
TOWN OF SUDBURY, MASSACHUSETTS
WASTEWATER MANAGEMENT
NEEDS ASSESSMENT

PLANNING AREA

April 2001
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2.1.1 Geology and Soils

This section involves a cursory review of the general soil types within the project area. A more detailed review of the soil as it relates to a parcel's suitability for on-site disposal of wastewater will be covered in Section 3.0 of this report.

Glaciers that receded about 13,000 years ago molded Sudbury's landscape. Therefore, the predominant soils found within the project area are of glacial origin. Some of these soils were directly deposited by glacial ice (till), while other soils were deposited by glacial meltwater.

More than one third of Sudbury's soils present severe limitations for the siting of septic systems due to wetness, slope, depth to bedrock, flooding, and other unfavorable features. The Soil Conservation Service (SCS) classifies soils with slight, moderate, and severe limitations for on-site disposal of sewage.

Soil mapping in the 1989 Middlesex County Soil Survey by the SCS indicates that the soils in the project area are, generally, not suitable for on-site septic systems. It should be noted that specific soil conditions may vary significantly within a soil classification as presented by the SCS and that the SCS soil characterizations are generally shallow and may not necessarily reflect the individual site-specific conditions for on-site disposal. Where available, BOH records were utilized and supersede the SCS classifications.

Most of the soil types in the project area are classified as having moderate to severe limitations for on-site disposal systems. Throughout the project area, high groundwater is a prevalent limitation. In the West area, the soil type is mainly defined as Windsor series. Windsor series has only moderate limitations due to steepness of slope or rapid to very rapid permeability. In the Central area, the soil type varies from Deerfield loamy sand to Freetown Muck, and the on-site disposal system limitations range from slight to severe. The moderate to severe limitations are due to very poorly drained soil with high groundwater to excessively drained soils. The soils in the East area are predominantly Udorthents. Udorthents are defined as soils that consist of very deep, well drained to excessively drained soils where soil material has been excavated and

of nearby areas where the material has been deposited. These soils differ greatly from place to place; thus SCS does not establish limitations for on-site disposal systems.

2.1.2 Topography

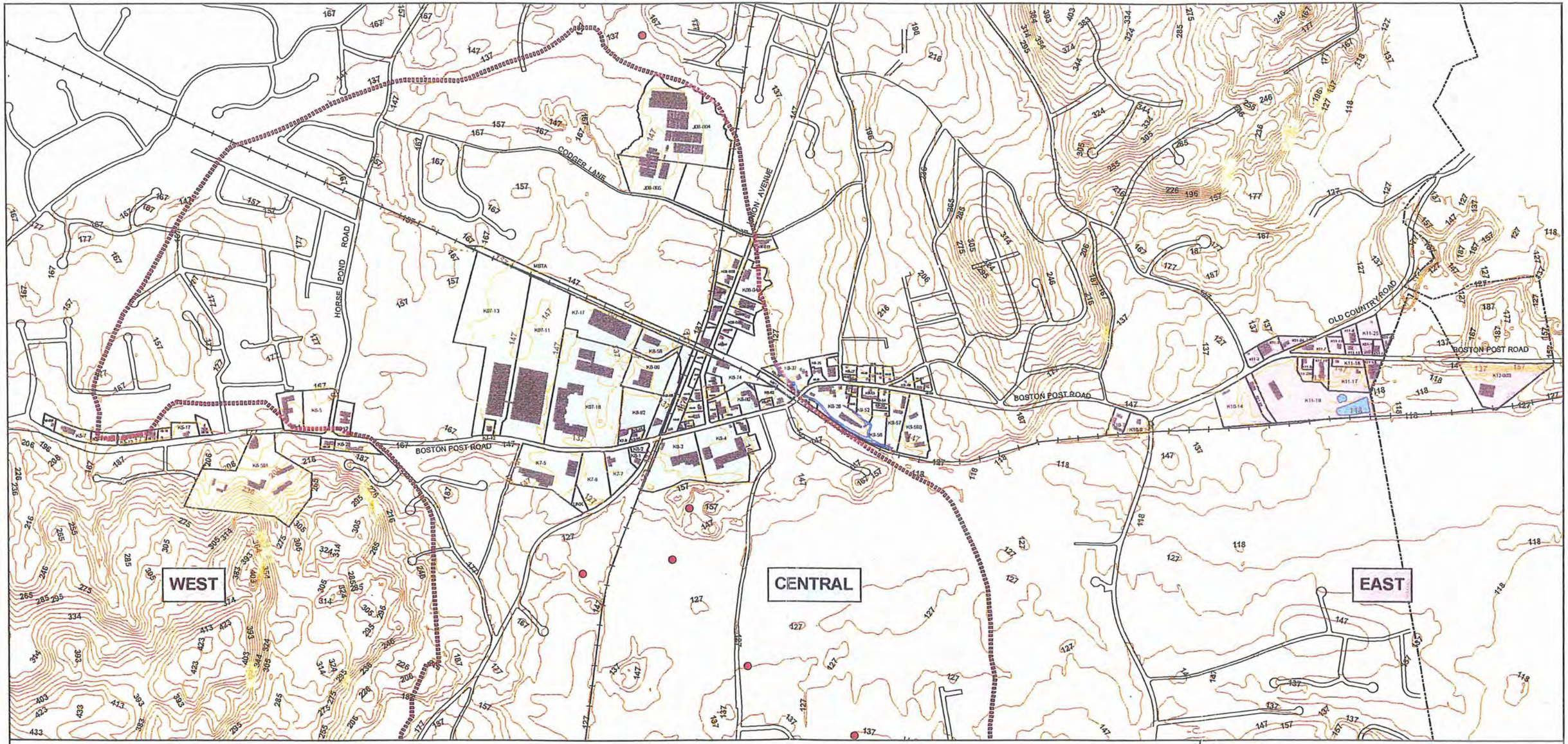
Nobscot Hill, with a summit of 600 feet above mean sea level (msl), and the Sudbury River, with a low point at 100 feet above msl, are the two geologic features in Sudbury that represent the highest and lowest elevations respectively in the area.

The project area has many topographic features within and surrounding the area. These include floodplains, wetlands, brooks, streams and ponds. Most notable are Hop Brook, Dudley Brook, Allowance Brook and Blanford Pond. Dudley Brook drains into Hop Brook, which flows into the Sudbury River. Allowance Brook flows through the Raymond Road well field. Blanford Pond is north of Codjer Lane and surrounded by lands owned by the family of Cavicchio (Assessor Numbers: J07-401, J07-007, J08-004 and J08-005). Topographically, most parcels in the planning area are relatively flat. Generally, grades in the planning area do not change more than 5-10 feet over a parcel. The West area is at a higher elevation than the Central and East areas. Figure 2-2 depicts the general topography in the project area.

2.1.3 Watershed

According to the Massachusetts Geographical Information System, MassGIS, the entire project area is located within the Concord River Basin. Sudbury participates as a partner in the SuAsCo Watershed Coalition, which includes stakeholders in the Sudbury, Assabet and Concord River watersheds.

There are several smaller watersheds that encompass the project area. The Hop Brook drainage area covers most of the project area. The other minor watersheds include the Dudley Brook, Landham Brook and Woodside Brook watersheds.



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Legend

- DEP Approved Zone II
- Central
- East
- West
- Hydrography
- Public Water Supply Wells
- Town Line

N
W E
S

1,200 0 1,200
SCALE IN FEET

FIGURE 2-2
TOWN OF SUDBURY, MASSACHUSETTS
WASTEWATER MANAGEMENT
NEEDS ASSESSMENT

AREA TOPOGRAPHY

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2.2 Land Use and Zoning

Highlights of the existing land use and zoning information pertaining to the project area are presented below. Historical and current conditions relating to land use and zoning classifications are reviewed herein. Future predictions are discussed in Section 4.

2.2.1 Land Use

The Route 20 business district is approximately a five-mile corridor. The corridor consists primarily of businesses, with residences sparsely interspersed. The project area includes multi-family housing, commercial, industrial and agricultural lands. The businesses are a mix of retail, office, restaurant and industrial uses.

2.2.2 Land Use Issues

Recently, commercial building activity has been significantly slower than residential development. The Planning Board's master plan, Sustainable Sudbury, strives to balance future development "within the limits of environmental constraints." The goal is to base future development on the capacity of the aquifer to supply enough high quality water while achieving adequate wastewater disposal. This must be achieved without placing "financial burdens on particular segments of the population."

Sudbury hopes to balance the recent surge in residential growth with an economically viable commercial sector. However, due to physical and regulatory constraints, wastewater treatment costs are increasing for businesses in the Route 20 business corridor. Also, the 1999 Chamber of Commerce survey indicated that businesses in the Route 20 corridor have limited expansion potential because of existing wastewater disposal options.

2.2.3 Zoning

There are 11 zoning districts in Sudbury, as well as the Water Resource Protection Districts. The Water Resource Protection Districts are made up of Aquifer Zone II and III. The Zone II area is shown on Figure 2-1. Approximately 90 percent of the land area in town is zoned residential and

approximately four percent is zoned business, industrial, or research. Sudbury's commercial base is almost entirely located within several business districts along Route 20. Zoning districts in the project area include: business, limited business, village business, industrial, limited industrial and industrial park districts.

2.2.4 Development Potential

Of the areas in town currently zoned commercial/industrial/research, only approximately 20 acres are vacant and available for development. There are several open space areas, including municipally-owned and permanently protected properties. One lot that has potential for additional development is Sullivan Tire (K07-007). The following table shows the vacant lots and associated area in the Route 20 business district:

Lot Number	Street	Lot Area [Acres]
K06-005	Boston Post Road	4.05
K08-057	Union Avenue	1.02
K08-062	480 Boston Post Road	4.69
K08-073	Union Avenue	0.42
K11-024	Boston Post Road	0.10
K11-050	Old County Road	0.63

The project area is near full development; and, in many instances, the parcels themselves are densely developed. Lots that are less than or equal to a half acre are difficult to site a septic system on.

2.3 Environmental Conditions

2.3.1 Groundwater Resources

The entire town of Sudbury receives its drinking water from underground aquifers situated in various locations throughout town. Therefore, it is imperative to have a contaminant prevention-oriented goal for groundwater supplies. Groundwater contamination can occur as a general deterioration of groundwater quality over a wide area due to diffuse non-point sources; such as failing and inadequate septic systems. There are a number of known groundwater contamination sites within the project area.

The Raymond Road Aquifer lies under the Central area and a portion of the West area. Most of the Central area and some of the West area falls within an approved DEP Zone II wellhead protection area (Zone II). This Zone II (as shown on Figure 2-1) was delineated to define the recharge area for the five wells situated in the Nobscot Road and Raymond Road area (Raymond Road Aquifer), as well as to establish the zone as a nitrogen sensitive area. New septic system designs within Zone II are strictly governed for nitrogen loading, but existing failing and inadequate septic systems located within the recharge areas pose a threat to groundwater quality. A report by H20 Engineering Consulting Associates, Inc., on the Raymond Road Aquifer Study dated January, 1985, discusses threats to the groundwater quality and states, "the worst area along the aquifer boundary is at the north side, where commercial development and industry are concentrated along Route 20."

2.3.2 Surface Water Resources

As previously stated, the major surface waters are the Hop Brook, Dudley Brook, Allowance Brook and Blanford Pond. The Massachusetts 303(d) List of Impaired Surface Waters lists Hop Brook as suffering from nutrients and organic enrichment/low dissolved oxygen, suspended solids, and noxious aquatic plants. Most of these conditions can be attributed to wastewater discharge from the Easterly wastewater treatment plant in Marlborough although failing and inadequate septic systems may also be contributing.

2.3.3 Wetlands

A significant portion of the land in Sudbury is wetlands. There are numerous wetland areas within the project area. The majority of the wetlands are associated with the Hop, Dudley and Allowance brooks. There are also some isolated wetlands in the Chiswick Industrial Park area.

2.3.4 Floodplains

All of the previously mentioned brooks have a floodplain area associated with them. The Federal Emergency Management Agency (FEMA) has delineated the major floodplains within the town. There is a significant floodplain area associated with the Hop Brook.

2.3.5 Rare Species and Sensitive Habitats

Rare species and sensitive habitats within the project area have been identified and mapped by the 2000 – 2001 Edition of the Massachusetts Natural Heritage & Endangered Species Program Atlas. These areas include estimated habitats of rare wildlife, certified vernal pools and priority sites of rare species habitats.

The atlas does not identify any habitats or certified vernal pools abutting or within the properties in the West and Central areas. The East area has priority habitats of rare species and estimated habitats of rare wildlife abutting or within parcels in the project area. The species protected within Sudbury are the Blue-Spotted Salamander, Eastern Box turtle, Spotted Turtle, Common Moorhen and the American Bittern.

2.4 Existing Wastewater Facilities

The town of Sudbury currently utilizes Title 5 to regulate all on-site wastewater systems designed for discharges of less than 15,000 gallons per day (gpd). In 1995, Title 5 was revised to lower the threshold to 10,000 gpd. Existing discharges larger than 15,000 gpd and new facilities greater than 10,000 gpd require a wastewater treatment facility.

Wastewater treatment facilities in Sudbury require a special permit issued by the Planning Board and are regulated by Sudbury's Regulation of Small Sewage Treatment Facilities (Section 4500). Furthermore, the Water Resource Protection Districts (Section 4200) restrict wastewater treatment facilities from operating in areas favorable for potable water supply development.

2.4.1 On-Site Subsurface Disposal

Although most of the businesses in the project area use on-site systems to dispose of wastewater, the complexity and effectiveness of the systems vary. Most of the systems separate liquids and solids in a septic tank or cesspool. The liquid waste flows out of the tank or cesspool while the solids are retained and undergo biological decomposition over time. The residual solids, called septage, must be periodically pumped and transported to a septage treatment facility. The liquid

waste is distributed to a leaching area, which provides a higher level of treatment to the effluent before it enters the groundwater. It is the handling of the liquid waste that varies in both the level of treatment required and the cost of providing the necessary treatment. This is discussed in greater detail later in this report.

Typical signs of system failure include surface breakout, frequent pumping, and system back-up. In an area of excessively well-drained soils and high groundwater, existing failures may be masked until a thorough inspection is performed.

The development of on-site systems in the project area can be broken into three different time periods. In 1978, DEP promulgated Title 5 regulations. Prior to that date, design and construction requirements for septic systems were much less stringent. Therefore, septic systems built before Title 5 have a high likelihood of failure under the current regulations.

In 1995, DEP amended Title 5. New construction or repair of systems designed between 1978 and 1995 are generally characterized as septic tanks with leaching facilities, such as trenches, fields, beds, or chambers. Recent repairs/modifications have indicated that these components were generally undersized by current 1995 standards.

Any system installed after 1995 should have been designed and constructed in accordance with the current Title 5 regulations. Since the new Title 5 regulations have been in effect (March 31, 1995), septage haulers have been required to supply the BOH with all septage pump out records. This information includes location, amount pumped, date, and type of system.

2.4.2 Innovative/Alternative Technologies

There are a few properties in the project area that utilize an advanced treatment process prior to disposing to a leach area. Best Friends Pet Kennel, 1776 Plaza (Sudbury Farms), and the Lotus Blossom each use FAST systems. The FAST system is a patented biological treatment process approved by MA-DEP as an innovative alternative system. This technology allows a property owner to obtain a variance from Title 5. Use of an approved innovative alternative system can allow up to a 50% reduction in leach area or may help meet enhanced nitrogen removal

requirements. The FAST system as well as other innovative alternative technologies is described in greater detail later in this report.

2.4.3 Treatment Facilities

Currently, there is only one wastewater treatment facility within the project area. The Raytheon site on Route 20 currently operates a sequencing batch reactor secondary treatment facility with nitrogen reduction and groundwater disposal via open sand beds. The plant is permitted by DEP for a groundwater discharge of up to 50,000 gallons per day (gpd) and based on recent monitoring reports is currently only handling approximately 30,000 gpd. The potential may exist for the town to utilize the remaining capacity in conjunction with an alternative wastewater disposal option for a portion of the Route 20 business district. This alternative is discussed in greater detail later in this report.

2.4.4 Collection Systems

The town of Sudbury does not currently own or maintain any system for the collection and/or conveyance of wastewater to a wastewater treatment facility. The Sudbury/Wayland Septage Treatment Facility is designed only to treat septage.

3.0 WASTEWATER NEEDS IDENTIFICATION

This section includes a matrix analysis developed for the Route 20 business district. The matrix provides a tool to evaluate the adequacy of the existing on-site disposal systems. The matrix also provides a mechanism to evaluate the need for alternative solutions to on-site wastewater problems. Data provided by the documents listed in Section 1.3, as well as information from the BOH agent and from the files in the BOH office, was used to complete the Wastewater Needs Matrix (Table 3-1).

3.1 Matrix Criteria

After reviewing several DEP approved matrices compiled for wastewater management needs assessments in other municipalities, the matrix categories and corresponding point values were decided upon through discussions with the TAC. The matrix is composed of criteria that were selected to indicate the condition of on-site wastewater disposal within the scope of this project with regard to system age, condition of system, soils classification, groundwater levels, lot size, and environmental concerns. Information compiled from previous investigations, review of the BOH files, and interviews with the Health Agent is more specific to actual conditions on the individual parcels, and this information has been shaded in blue on the matrix. Remaining data was compiled from other available sources (i.e. SCS maps, Motts Hydrology study, etc.) and is representative of the general conditions in the immediate area of the subject parcel. Rating points were assigned for each of the criteria and the highest rating was assigned to categories that indicate actual and imminent failures. Lesser values were awarded for areas that exhibited the potential for imminent failure or had health/water quality issues associated with them.

The specific criteria used to compile information for each column in the matrix are as follows:

- **Design Flow:** One of three methods was used to arrive at the design flow. Figures highlighted in blue were taken directly from BOH records. All other figures were derived from either water use records or from 310 CMR 15.203 (2) through (5). These design flow figures are assumed to be the current Title 5 system design flows.

TABLE 3-1
WASTEWATER NEEDS MATRIX

WASTEWATER MANAGEMENT NEEDS ASSESSMENT

Street Number	Assessor's Number	Use - Business Name	Design Flow [gpd]	Built Before 1978 Code (4 pts)	Built Between 1978-1995 Codes (3 pts)	Required Leach Field Repair (4 pts)	Insufficient land area for Repair or Expansion (4 pts)	Disposal > 10,000 gpd without GW Discharge Permit (4 pts)	Severe Soil Restrictions (2 pts)	Depth To Groundwater (< 5') (2 pts)	Setback for Resource Area or within Floodplain (2 pts)	Frequency Of Pumping (>2/yr) (2 pts)	Within Nitrogen Sensitive Area (2 pts)	Nitrogen Sensitive Area with >440 gpd per acre (2 pts)	Total
BOSTON POST RD															
33 BP	K12-003	DC REALTY TRUST	588	X					X	X					8
78 BP	K11-012	CAR WASH(leachfield in Wayland)	3,750	X					X	X					8
83 BP	K11-015	HAVENCRAFT	1,050	X			X			X	X				12
84 BP	K11-013	TOWN LINE HARDWARE	200				X		X	X					8
88 BP	K11-011	ANTIQUE SHOP	200				X			X					6
95 BP	K11-017	MASS HIGHWAY	200							X	X	X			6
100 BP	K11-010	AUTO DIAGNOSTICS	977	X						X	X				8
103 BP	K11-016	RESTAURANT (New System)	3,520												0
104 BP	K11-008	PAPA GINOS	3,520		X					X		X			7
111 BP	K11-101	OFFICE - VILLAGE EAST	1,635		X		X								7
119 BP	K11-018	RETAIL - FRANK'S SPOKE	207		X										3
120 BP	K11-007	SKY RESTAURANT	8,050			X			X			X			8
121 BP	K11-200	OFFICE - RKK REALTY	364		X										3
128 BP	K11-004	OFFICE - STANMAR	1,700		X					X					5
136 BP	K11-003	NURSING HOME - WINGATE	14,200		X			X		X		X			11
141 BP	K11-019	ATHLETIC FACILITY	5,737							X	X				4
150 BP	K11-002	BEST FRIENDS PET KENNEL [1]	8,000				X			X					6
151 BP	K11-020	BUDDY DOG	540	X			X		X	X	X				14
163 BP	K10-014	BOSTON EDISON SUBSTA.	0												0
209 BP	K10-008	GAS - SUDBURY AUTO	220		X	X									7
215 BP	K10-007	OFFICE - BAY PATH	1,720		X				X						5
316 BP	K09-405	AUTO REPAIR - ALEXANDER	200	X			X			X					10
320 BP	K09-401	BEARLY READ BOOKS	200	X			X			X					10
321-325 BP	K09-590	OFFICE - MILL BROOK II	5,250		X				X		X				7
327-329 BP	K09-057	OFFICE - MILL BROOK I	765		X					X	X				7
330 BP	K09-049	HUNT HOUSE BED	450		X										3
333 BP	K09-056	OMEGA MORTGAGE	200		X				X	X	X				9
335 BP	K09-055	CLOUD 9 TOYS	200		X										3
339 BP	K09-054	RKK REALTY	200		X	X									7
344 BP	K09-032	OFFICE - QUILTED OR NOT	576				X		X						6
345 BP	K09-053	OFFICE - SUDBURY PLACE	892		X		X								7
346 BP	K09-031	OFFICE, CLINICAL COMMUN.	200	X		X									8
348 BP	K09-030	HITCHCOCK STORE	410		X										3
351 BP	K09-052	OFFICE - NE TELEPHONE	200	X			X		X		X				12
353 BP	K09-051	MEMORY GARDEN	200		X		X								7
354 BP	K09-029	OFFICE SUDBURY MUSIC	200		X		X			X					9
357 BP	K09-050	RETAIL - MAGGIE FLOOD	200	X			X				X				10
361-389 BP	K08-026,029	MILL VILLAGE (several systems)	2,025	X	X	X	X		X	X	X	X			23
370 BP	K08-036	OFFICE -BARTON PROP.	200		X										3

TABLE 3-1 (Cont'd.)

Street Number	Assessor's Number	Use - Business Name	Design Flow [gpd]	Built Before 1978 Code (4 pts)	Built Between 1978-1995 Codes (3 pts)	Required Leach Field Repair (4 pts)	Insufficient land area for Repair or Expansion (4 pts)	Disposal > 10,000 gpd without GW Discharge Permit (4 pts)	Severe Soil Restrictions (2 pts)	Depth To Groundwater (< 5') (2 pts)	Setback for Resource Area or within Floodplain (2 pts)	Frequency Of Pumping (>2/yr) (2 pts)	Within Nitrogen Sensitive Area (2 pts)	Nitrogen Sensitive Area with >440 gpd per acre (2 pts)	Total
378 BP	K08-037	DUNKIN DONUTS	910		X						X	X			7
394 BP	K08-082	LOTUS BLOSSOM[1]	2,100				X		X	X	X		X	X	14
400 BP	K08-081	PRUDENTIAL REALTY	200	X			X		X	X	X		X		16
410 BP	K08-080	RUGGED BEAR PLAZA	1,740		X		X			X	X		X	X	15
415 BP	K08-006	POLICE STATION	400		X		X			X			X	X	13
418-420 BP	K08-079	RETAIL/RESTAURANT/OFFICE	1,030		X		X			X			X	X	13
423 BP	K08-004	SUDBURY CROSSING MALL	4,200		X		X			X			X		11
424-428 BP	K08-078, 079	BLOCKBUSTER, SDBY PIZZA	540	X		X	X			X		X	X	X	20
430 BP	K08-077	COLONIAL AUTO	656		X		X			X			X	X	13
432 BP	K08-069	GAS STATION - MOBIL	600	X						X			X	X	10
439 BP	K08-003	RETAIL-SUDBURY FARMS[1]	7,706		X	X	X		X		X		X		17
440 BP	K08-067	JEWELRY STORE	315		X				X	X			X	X	11
442 BP	K08-058	RETAIL - WESTPORT GAS	300	X					X				X	X	10
450 BP	K08-066	OFFICE - COMMUNITY	188	X					X	X	X		X		12
454 BP	K08-065	CLAPPERS	570		X		X			X	X		X		13
465 BP	K08-002	SUDBURY GAS STATION	200	X			X		X				X		12
470 BP	K08-064	SUDBURY GULF (Public Petro)	300	X			X		X				X	X	14
474 BP	K07-008	RETAIL - KAPPY'S LIQUORS	420		X		X		X				X	X	13
477 BP	K07-007	SULLIVAN TIRE COMPANY	500	X						X			X		8
480 BP	KO8-062	VACANT	420	X					X	X	X		X		12
490 BP	K07-018	INDUST. - CHISWICK PARK	6,441		X				X	X			X		9
505, 507-525 BP	K07-05, 06	RETAIL - STAR PLAZA	6,630		X	X							X		9
526-528 BP	K07-011-013	R&D - RAYTHEON	50,000		X								X		5
593 BP	K06-026	RETAIL - DUDLEY SQUARE	696		X										3
616 BP	K06-012	SUDBURY MEDICAL CENTER	1,532		X	X	X			X			X	X	17
621 BP	K06-028	BARNSTEAD SHOPS	1,231		X		X					X			9
642 BP	K06-04	NURSING HOME (in failure)	14,000	X		X		X		X		X	X	X	20
642 BP	K06-05	VACANT (nursing home)	0							X			X		4
655 BP	K06-501	LONGFELLOW GLEN/ 4 Systems	32,000		X			X							7
684 BP	K05-019	AUTO REPAIR	712	X			X			X					10
694 BP	K05-017	RESTAURANT - BLUE LION	4,900	X						X		X			8
708 BP	K05-015	DENTIST	820	X						X					6
712 BP	K05-013	SUDBURY RENTAL	260	X											4
730 BP	K05-012	RETAIL - WAYSIDE PLAZA	1,724		X		X					X			9
736 BP	K05-011	FRUGAL FLOWERS	592								X				2
738 BP	K05-07	HOTEL - CLARION CARRIAGE	5,500		X		X					X			9

TABLE 3-1 (Cont'd.)

Street Number	Assessor's Number	Use - Business Name	Design Flow [gpd]	Built Before 1978 Code (4 pts)	Built Between 1978-1995 Codes (3 pts)	Required Leach Field Repair (4 pts)	Insufficient land area for Repair or Expansion (4 pts)	Disposal > 10,000 gpd without GW Discharge Permit (4 pts)	Severe Soil Restrictions (2 pts)	Depth To Groundwater (< 5') (2 pts)	Setback for Resource Area or within Floodplain (2 pts)	Frequency Of Pumping (>2/yr) (2 pts)	Within Nitrogen Sensitive Area (2 pts)	Nitrogen Sensitive Area with >440 gpd per acre (2 pts)	Total
740 BP	K05-05	OFFICE - SUDBURY DESIGN	1,452	X								X			6
CONCORD RD															
5-15,17,19 C	K08-035	RETAIL - MACKINNONS	1,418		X										3
8 C, 356 BP	K09-027,028	OFFICE - NB TAYLOR	426	X											4
CODJER LANE															
57 CL / U	J08-23	SUDBURY DENTAL CENTER	2,000		X					X	X				7
110 CL	J08-04, 05	CAVICCHIO GREENHOUSES	825										X		2
KING PHILIP RD															
68 KP	K09-033	OFFICE BUILDING/RESIDENTIAL	200	X											4
NOBSCOT RD															
237-239 N	K08-001	FUEL SVC - INTERSTATE OIL	200		X	X							X		9
OLD COUNTY RD															
35 OC	K11-009	DANCER' STORE SHOP	200	X						X					6
9 OC	K11-025	INDUST. - LEWIS PROPERTY	3,000		X					X					5
UNION AVENUE															
1 U	K08-070	OFFICE - DESIGNWISE	700		X		X		X	X			X	X	15
15 U	K08-071	SUDBURY COFFEE, PRINTER	360		X	X			X	X		X	X	X	17
18 U	K08-076	POST OFFICE	1,194		X		X		X	X		X	X	X	17
21 U	K08-090	OFFICE - MCNEIL VET.	255		X		X			X			X		11
22 U	K08-075	OFFICE - FLEET	352	X					X	X		X	X	X	14
23 U	K08-073	VACANT (BAYBANK ATM)	200	X						X			X		8
25U	K08-060	WAREHOUSE - NE DOOR	1,540	X			X			X	X		X		14
27U	K08-056	SAXONVILLE LUMBER	100	X						X			X		8
28 U	K08-074	SUDBURY LUMBER	418	X			X		X	X			X		14
33 U	K07-017	WAREHOUSE - CHISWICK	2,400		X		X			X		X	X		13
39 U	K08-053	BOSEKY LTD/CARPET CARSEL.	642	X			X		X	X		X	X	X	18
46 U	K08-041	PRECOURT CHARLES	200	X					X	X			X		10
55-57 U	K08-052	EDWARD TUCKER	1,094	X			X		X	X			X	X	16
56 U	K08-044	GRANCO REALTY TRUST	532	X			X		X	X			X	X	16
60 U	K08-045	GRANCO REALTY TRUST	944		X		X		X	X			X	X	15
64 U	K08-046	MACOT REALTY TRUST	390		X		X		X	X	X		X		15
65 U	K08-051	METHODS, INC.	1,214		X		X		X	X	X	X	X	X	19
75-83 U	K08-050	EDWARD TUCKER	2,604	X					X	X	X		X	X	14
80 U	K08-047	SCHOFIELD/Union & Palmer	180	X			X		X	X	X		X		16
		Total Existing Design Flow	**244,319**											**Total**	**981**

Avg Points = 10

LEGEND:

Blue shaded cells	= Information that was provided by the BOH.
Non-Priority Property	= Property that totaled 0-6 points.
Priority Property	= Property that totaled 7-12 points.
Critical Property	= Property that totaled 13+ points.

NOTE:

[1] FAST sytem in use on site.

- **Built Before 1978 Code:** Four (4) points are assigned to this category. This category takes note that a system is not designed in accordance with the 1978 code, because records indicate that the septic system was built before the 1978 code was enacted. This category inherently targets systems older than 22 years.
- **Built Between 1978-1995 Codes:** Three (3) points are assigned to this category, because records indicate that the septic system design was prior to the amended Title 5 standards.
- **Required Leach Field Repair:** Four (4) points are assigned for a leach field that was previously cited by the Board of Health as a failed system.
- **Insufficient land area for Repair or Expansion:** Four (4) points are given to a lot that does not have sufficient room to bring a system into compliance with the current 1995 code or to expand the system. This category targets parcels that have less than 20,000 square feet available and site conditions that limit available disposal area. Site plans and the Board of Health agent's experience with a site were used to determine if a parcel fell into this category.
- **Disposal > 10,000 gpd without GW Discharge Permit:** Four (4) points are assigned to a property that has subsurface disposal of over 10,000 gpd as required by current 1995 code without a groundwater discharge permit.
- **Severe Soil Restrictions:** Two (2) points are assigned when a system is built on a site that has severe soil restrictions. These restrictions include less than four (4) feet of naturally occurring pervious material (according to historic town records) or soils that the Soil Conservation Service and the Middlesex Conservation District deem "severe" for septic tank absorption fields.
- **Depth to Groundwater:** Two (2) points are assigned when groundwater depth is known or estimated to be less than five (5) feet on a site. Where site specific groundwater data was not available, data was used from the report entitled, "Hydrology and Ground Water Resources of Sudbury, Massachusetts" dated February, 1977, prepared by Ward S. Motts.

- **Setback for Resource Area or Within Floodplain:** If a septic system location or the majority of a lot does not meet the 1995 Title 5 setback requirements for a resource area or a floodplain, it is given two (2) points.
- **Frequency of Pumping:** Two (2) points are assigned if historic town records indicate a system needs pumping more than two times per year.
- **Within Nitrogen Sensitive Area:** A system sited within a nitrogen sensitive area (in this case, Zone II) receives two (2) points for being within a sensitive area.
- **Nitrogen Sensitive Area with >440 gpd per acre:** An additional two (2) points are assigned to a system if sited within a nitrogen sensitive area **and** designed for more than 440 gpd per acre. (The flow per acre is determined by dividing the parcel's design flow by the acreage.) Title 5 does not allow systems serving new construction in nitrogen sensitive areas to receive more than 440 gpd per acre. Therefore, a system sited within a nitrogen sensitive area with a design flow greater than 440 gpd per acre receives a total of four (4) points.

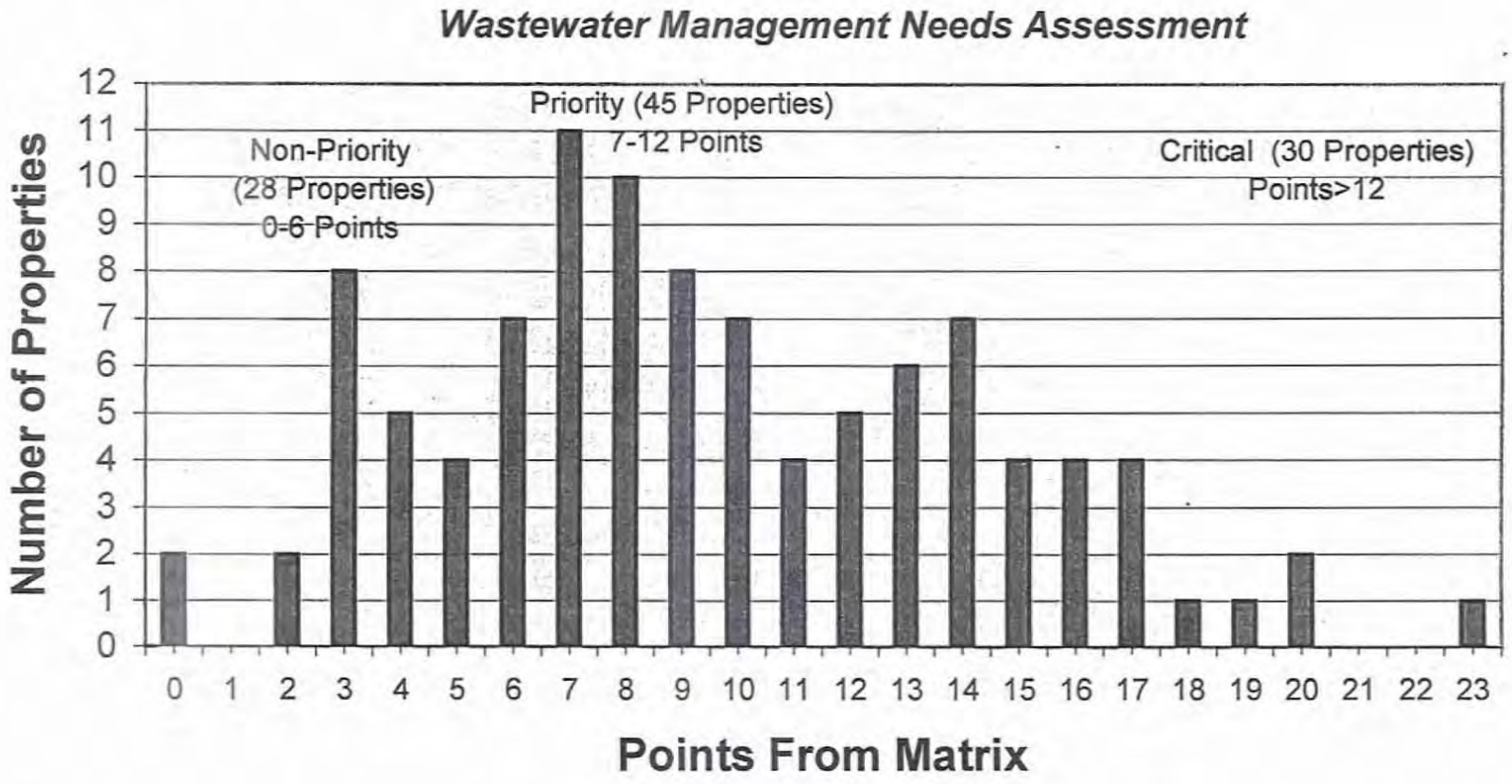
3.2 Matrix Scoring Distribution

Based on the established rating criteria, 28 points is the maximum amount of points a property could receive. Of the 103 properties in the study area, the rating points received ranged from zero to 23 with an average rating of about 10.

Once the points were established for each property, it was necessary to characterize them by creating levels of need for wastewater management alternatives. First, a Point Rating Histograph was developed by totaling the number of properties that received the same point values in the matrix and plotting these totals against the distribution of points received (Figure 3-1). Based on the range of values, the distribution graph was divided into three levels of need within the project area: non-priority, priority, and critical.

Previous DEP-approved Needs Assessments often rank any property that received points in excess of the average value as a "needs" area. However, recent trends in similar Massachusetts communities have supported a higher "break-point" than the "average" value to substantiate

Figure 3-1
Point Rating Histograph



need. In order to establish this project's need "break-point," further input from the Health Agent was solicited, and a few sample properties with known conditions were analyzed to fit into the three need categories. The final determination was that parcels receiving zero (0) to six (6) points would be classified as "Non-priority Properties," parcels totaling seven (7) to twelve (12) points would be classified as "Priority Properties," and a "Critical Property" would be any property that totaled more than twelve (12) points (i.e. thirteen points or higher). The distribution provided 28 "Non-priority Properties" (27% of the parcels in the project area), 45 "Priority Properties" (44%), and 30 "Critical Properties" (29%).

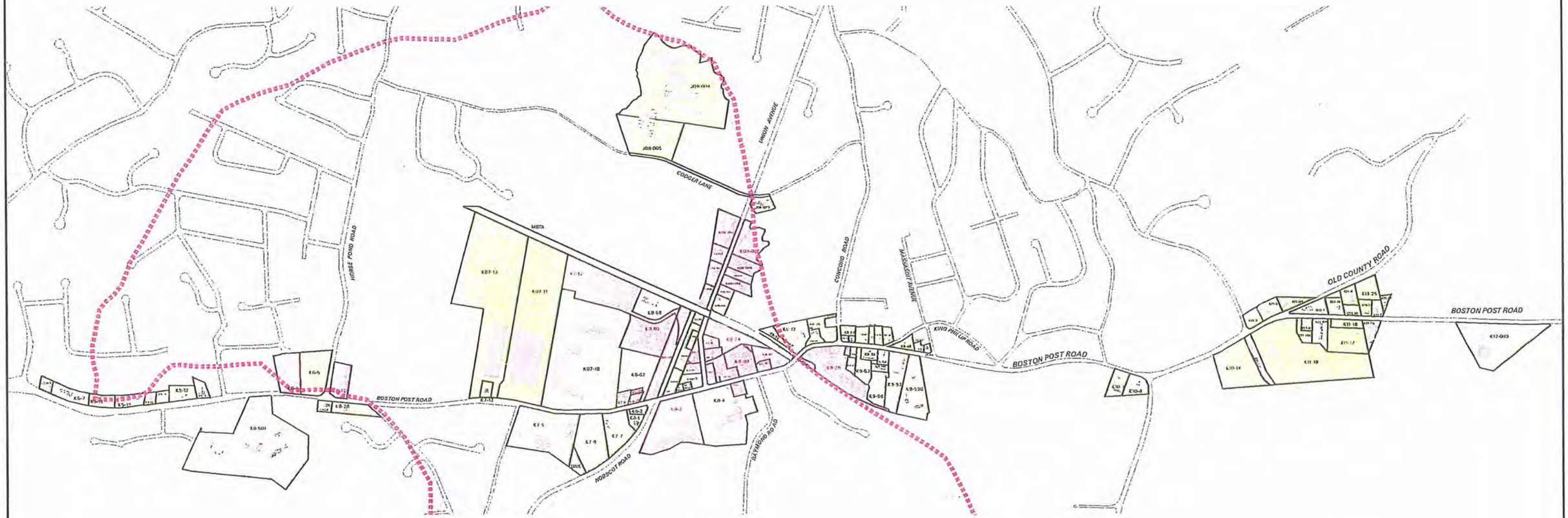
3.3 Matrix Results

The following color code was used in the "Total" column of the matrix (Table 3-1) to represent a property's level of need: green indicates a "Non-priority Property," yellow represents a "Priority Property," and pink indicates a "Critical Property." The properties are shown with their level of need similarly shaded on Figure 3.2, Parcel Ranking.

3.4 Conclusions

There are only two "Critical Properties" within the West area; the remainder of the parcels in the West area are split evenly between "Non-priority" and "Priority" properties. The two "Critical Properties" are 642 Boston Post Road (Sudbury Pines Nursing Home) and 616 Boston Post Road (Sudbury Medical Center). Both of these parcels are sited in areas of high groundwater within a nitrogen sensitive area (Zone II) and are operating above the advised density factor of 440 gpd per acre. Also, both parcels have been cited by the BOH for a system failure. The nursing home property is currently operating without a groundwater discharge permit even though flows (based on current Title 5) require one. Although, they are currently pursuing a groundwater discharge permit. Therefore, it is possible that this property may soon be considered a "Non-priority Property."

The majority (27) of the project area's "Critical Properties" are clustered within the Central area, as are the majority (29) of the project's "Priority Properties." A large number of the "Critical



LEGEND

- Non-Priority property, totaled 0 - 6 points
- Priority property, totaled 7 - 12 points
- Critical property, totaled 13 + points
- Zone II Aquifer Zone

Weston & Sampson
ENGINEERS INC.

N

1200 0 1200
SCALE IN FEET

FIGURE 3-2
TOWN OF SUDBURY, MASSACHUSETTS
WASTEWATER MANAGEMENT
NEEDS ASSESSMENT

PARCEL RANKING

April 2001
Weston & Sampson Engineers, Inc.

sud_na1

Properties" do not have enough land area for repair or expansion and have groundwater and/or severe soil restrictions.

The East area has only one "Critical Property," 151 Boston Post Road (Buddy Dog). The owner of this site is in discussions to work out their wastewater disposal problems by utilizing a neighbor's land. There are twelve "Non-priority Properties" in the East area. This area has more "Non-priority Properties" than any other project area. The East area also has more "Non-priority Properties" than its "Priority" and "Critical Properties" added together. The most repeated problems within the East area are depth to groundwater and age of systems.

4.0 ESTIMATED FUTURE WASTEWATER FLOWS

In order to assess the Route 20 business district's wastewater disposal needs and recommend appropriate wastewater disposal solutions, it is necessary to develop the future daily wastewater flow estimates for the district. This section provides an overview of the potential future wastewater conditions in the Route 20 business district.

4.1 Potential Flows

There is potential for some currently undeveloped areas of the Route 20 business district to be developed if off-site solutions to the existing wastewater problems were implemented. Previously, the 1995 study entitled "Sudbury Wastewater Disposal Options, Route 20 Business District" was based on limited expansion potential in all three districts.

For purposes of this Needs Assessment, the recent (December 2000) Metropolitan Area Planning Council (MAPC) build-out analysis was used to predict future wastewater conditions in the planning area. Potential build-out capacities according to land use and zoning requirements were addressed in the build-out analysis. This analysis determined the ultimate development level in the town and consequently, the ultimate (build-out) water flows.

The MAPC build-out analysis supplied an anticipated water usage per zoning district. MAPC's build-out analysis was intended as a planning tool for the area as a whole and did not address specific parcel-by-parcel impacts. This section of the report correlates the MAPC's area-wide build out analysis to a parcel-by-parcel estimate of future wastewater flows.

4.2 Zoning Regulations

The MAPC build-out analysis utilized existing zoning regulations to determine the ultimate development level in the town, with the assumption that the wastewater was not to be a limiting factor. Discussion of the impact of Sudbury Zoning Bylaws Section 4200, Water Resource Protection Districts, and Section 4500, Wastewater Treatment Facilities, is in Section 2.4 of this report, as well as in Appendix C.

4.3 Planning Assumptions

MAPC performed the Route 20 business district analysis based on existing site and zoning conditions, while utilizing a few assumptions provided to MAPC by Sudbury's Town Planner. The Town Planner requested that MAPC review the area for redevelopment without rezoning under the following assumptions:

- Wastewater limitations were negated.
- A mix of uses similar to the current mix of uses.
- If Raytheon were to close their facility, half of the building square footage would remain R & D space and the other half would become office space.
- Five percent of the office buildings in the redevelopment area could be constructed with one additional floor of residential apartments.
- 25% impervious surface restriction in Zone II of the Water Resource Protection District.

4.4 Future Water Use

It is important to understand the district's water demands in order to predict the amount of wastewater the district could generate. MAPC's estimated build-out water usage for areas titled "Outside of wetlands, 100-year floodplain, and 100'-200' river zone" was used for each zoning district. The estimated future water demand for each zoning district in the project area is found in Table 4-1 (located at the end of this section), in the column entitled, "Build-out (Increase in) Water Use [gpd]."

4.5 Future Wastewater Flows

The water use projected in Section 4.4 was used to predict future wastewater design flows. Because of consumptive uses, such as watering lawns and plantings, washing vehicles, etc., the amount of water returned to the sewer system is always less than the metered water usage. Therefore, the water usage is adjusted down, typically using 80-85 percent of the metered water consumption to determine wastewater flows. Eighty-five percent of the water use predicted in Section 4.4 was used to estimate the potential increase in wastewater flows as shown in Table 4-1, in the column entitled "Build-out (Increase in) Wastewater Flow [gpd]." Since this Needs Assessment looks at parcels on an individual basis, the "Build-out (Increase in) Wastewater

Flow" was apportioned from a zoning district basis to an individual parcel basis. A percent for each zoning district was calculated by dividing the "Build-out (Increase in) Wastewater Flow" by the existing design flow per zoning district. This percent increase was applied to each parcel within a particular zoning district, to give the estimated future wastewater design flow per parcel. The estimated future wastewater design flow for each parcel is shown on Table 4-2 (included at the end of this section) in the column entitled, "Build-out Flow."

4.5.1 Peak Flows

The design of septic systems is based on Title 5, where design flows (maximum daily) are often equated to 200% of average daily water usage. The hydraulic design of pipelines and pumping facilities must account for daily variations in average flow rates, which result in high (peak) and low (minimum) flows. For commercial/industrial use, 200% of average daily flows is often sufficient for estimating peak wastewater flows; therefore, the peak wastewater flows are roughly equivalent to the Title 5 design flows. Due to the conservative nature of the build-out analysis and to the assumptions used in that analysis, it was determined that applying this peaking factor to the estimated potential increase in wastewater flow would be too conservative. Therefore, estimated future wastewater design flows as shown in Table 4-2 were calculated by adding the existing wastewater design flows from Table 3-1 to the potential increase in average wastewater flows.

4.5.2 Infiltration/Inflow

Estimates of system flows should include an allowance for extraneous flows, flows that are not sanitary wastewater but find their way into the wastewater collection system. These extraneous flows include infiltration and inflow (I/I). Infiltration is typically groundwater, which enters a sewer system from the ground through means that include leaking pipes, pipe joints, connections and manholes. Infiltration is typically associated with high groundwater levels and is not typically associated with pressure sewers since the pressure inside the pipeline exceeds the groundwater pressure outside the pipe.

Inflow is similar to infiltration but includes those flows which directly flow into a sewer system from cross connections between sanitary sewers and storm drains, catch basins, roof leaders,

basement and yard drains, manhole covers, surface runoff and other drainage features. Inflow is typically associated with rainfall events.

I/I is typically estimated based on the length and diameter of the sewer pipeline in the system. The length in miles multiplied by the diameter in inches provides a measurement in inch-miles of pipeline. This number is multiplied by an average infiltration rate in gallons per day per inch-mile of pipeline (gpdim). This rate is then applied to the length of gravity sewer proposed for a given project. At this time, it remains unclear how much of this project's potential collection system may be gravity sewers. Some or all of a proposed collection system could include pressure sewers, which generally have no associated I/I. For the purposes of this study, I/I will be assumed to be negligible.

4.6 Flow Analysis

The existing design flow for the entire West area is 65,419 gpd, and the future design flow for the entire West area is estimated to be 73,449 gpd. These flows are summarized by parcel on Table 4-3. A further breakdown on Table 4-4 shows the West area's "Critical" and "Priority" flows as 36,136 gpd. The "Critical" flow for the West area is 17,708 gpd, as shown on Table 4-5.

The entire Central area's existing design flow is 69,322 gpd and the future design flow is estimated to be 106,808 gpd. Table 4-6 summarizes the entire Central area but excludes Raytheon, because they are currently operating an approved wastewater treatment facility. A further breakdown on Table 4-7 shows the Central area's "Critical" and "Priority" flows as 96,707. The "Critical" flow for the Central area is 44,725 gpd, as shown on Table 4-8.

The entire East area's existing design flow is 59,578 gpd and the future design flow is estimated to be 103,275 gpd. These are summarized by parcel on Table 4-9. A further breakdown on Table 4-10 shows the East area's "Critical" and "Priority" flows as 53,755 gpd. There is only one "Critical Property" in this area with a flow of 1,028 gpd.

The future wastewater design flows have been summarized for each project area and broken down according to level of need (see Table 4-11).

TABLE 4-1

FUTURE WASTEWATER FLOWS PER ZONING DISTRICT

WASTEWATER MANAGEMENT NEEDS ASSESSMENT

Zoning District	Build-out (Increase in) Water Use [gpd][1]	Build-out (Increase in) Wastewater Flow [gpd][2]	Current Wastewater Design Flow[3]	Projected Percent Increase[4]
VBD	24,165	20,540	15,522	132
BD-1	14,916	12,679	39,097	32
BD-5	4,896	4,162	12,438	33
BD-6	4,417	3,754	15,960	24
BD-15	2469	2,099	1,927	109
BD-16	1,744	1,482	1,940	76
LBD-1	2,560	2,176	15,532	14
LBD-2	1,366	1,161	6,630	18
LBD-6	4,171	3,545	12,306	29
ID-2	3,949	3,357	10,625	32
ID-4	14,078	11,966	13,253	90
ID-6	7,047	5,990	588	1019
ID-8	615	523	900	58
ID-11	7,548	6,416	1,700	377
ID-12	6,074	5,163	3,000	172
LID-1	27,572	23,436	60,901	38

[1] Estimated increase in water use for each zoning district based onMAPC's build-out analysis for areas outside of wetlands, 100-yr. floodplain, and 100' - 200' river zone.

[2] Increase in wastewater flow for each zoning district calculated as85% of build-out water use

[3] Total of current wastewater design flow per zoning district.

[4] Build-out wastewater flow divided by the current wastewater design flow, multiplied by 100.

TABLE 4-2
FUTURE WASTEWATER FLOWS PER PARCEL

Street #	Assessor's #	Use - Business Name	Zoning District	Existing Design Flow [gpd][1]	Flow Increase [gpd][2]	Build-out Flow [gpd][3]
78 BP	K11-012	CAR WASH(leachfield in Wayland)	BD-1	3,750	1,216	4,966
84 BP	K11-013	TOWN LINE HARDWARE	BD-1	200	65	265
88 BP	K11-011	ANTIQUE SHOP	BD-1	200	65	265
100 BP	K11-010	AUTO DIAGNOSTICS	BD-1	977	317	1,294
104 BP	K11-008	PAPA GINOS	BD-1	3,520	1,141	4,661
120 BP	K11-007	SKY RESTAURANT	BD-1	8,050	2,611	10,661
136 BP	K11-003	NURSING HOME - WINGATE	BD-1	14,200	4,605	18,805
150 BP	K11-002	BEST FRIENDS PET KENNEL[4]	BD-1	8,000	2,594	10,594
35 OC	K11-009	DANCER' STORE SHOP	BD-1	200	65	265
593 BP	K06-026	RETAIL - DUDLEY SQUARE	BD-15	696	758	1,454
621 BP	K06-028	BARNSTEAD SHOPS	BD-15	1,231	1,341	2,572
209 BP	K10-008	GAS - SUDBURY AUTO	BD-16	220	168	388
215 BP	K10-007	OFFICE - BAY PATH	BD-16	1,720	1,314	3,034
394 BP	K08-082	LOTUS BLOSSOM[4]	BD-5	2,100	703	2,803
400 BP	K08-081	PRUDENTIAL REALTY	BD-5	200	67	267
410 BP	K08-080	RUGGED BEAR PLAZA	BD-5	1,740	582	2,322
418-420 BP	K08-079	RETAIL/RESTAURANT/OFFICE	BD-5	1,030	345	1,375
424-428 BP	K08-078, 079	BLOCKBUSTER, SDBY PIZZA	BD-5	540	181	721
430 BP	K08-077	COLONIAL AUTO	BD-5	656	219	875
432 BP	K08-069	GAS STATION - MOBIL	BD-5	600	201	801
440 BP	K08-067	JEWELRY STORE	BD-5	315	105	420
442 BP	K08-058	RETAIL - WESTPORT GAS	BD-5	300	100	400
450 BP	K08-066	OFFICE - COMMUNITY	BD-5	188	63	251
454 BP	K08-065	CLAPPERS	BD-5	570	191	761
470 BP	K08-064	SUDBURY GULF (Public Petro)	BD-5	300	100	400
474 BP	K07-008	RETAIL - KAPPY'S LIQUORS	BD-5	420	141	561

TABLE 4-2 (Cont'd.)

Street #	Assessor's #	Use - Business Name	Zoning District	Existing Flow Design [gpd][1]	Flow Increase [gpd][2]	Build-out Flow [gpd][3]
1 U	K08-070	OFFICE - DESIGNWISE	BD-5	700	234	934
15 U	K08-071	SUDBURY COFFEE, PRINTER	BD-5	360	120	480
18 U	K08-076	POST OFFICE	BD-5	1,194	399	1,593
21 U	K08-090	OFFICE - MCNEIL VET.	BD-5	255	85	340
22 U	K08-075	OFFICE - FLEET	BD-5	352	118	470
23 U	K08-073	VACANT (BAYBANK ATM)	BD-5	200	67	267
28 U	K08-074	SUDBURY LUMBER	BD-5	418	140	558
684 BP	K05-019	AUTO REPAIR	BD-6	712	167	879
694 BP	K05-017	RESTAURANT - BLUE LION	BD-6	4,900	1,153	6,053
708 BP	K05-015	DENTIST	BD-6	820	193	1,013
712 BP	K05-013	SUDBURY RENTAL	BD-6	260	61	321
730 BP	K05-012	RETAIL - WAYSIDE PLAZA	BD-6	1,724	406	2,130
736 BP	K05-011	FRUGAL FLOWERS	BD-6	592	139	731
738 BP	K05-07	HOTEL - CLARION CARRIAGE	BD-6	5,500	1,294	6,794
740 BP	K05-05	OFFICE - SUDBURY DESIGN	BD-6	1,452	342	1,794
128 BP	K11-004	OFFICE - STANMAR	ID-11	1,700	6,416	8,116
9 OC	K11-025	INDUST. - LEWIS PROPERTY	ID-12	3,000	5,163	8,163
57 CL/U	J08-23	SUDBURY DENTAL CENTER	ID-2	2,000	632	2,632
110 CL	J08-04, 05	CAVICCHIO GREENHOUSES	ID-2	825	261	1,086
39 U	K08-053	BOSEKY LTD/CARPET CARSEL.	ID-2	642	203	845
46 U	K08-041	PRECOURT CHARLES	ID-2	200	63	263
55-57 U	K08-052	EDWARD TUCKER	ID-2	1,094	346	1,440
56 U	K08-044	GRANCO REALTY TRUST	ID-2	532	168	700
60 U	K08-045	GRANCO REALTY TRUST	ID-2	944	298	1,242
64 U	K08-046	MACOT REALTY TRUST	ID-2	390	123	513
65 U	K08-051	METHODS, INC.	ID-2	1,214	384	1,598
75-83 U	K08-050	EDWARD TUCKER	ID-2	2,604	823	3,427
80 U	K08-047	SCHOFIELD/Union & Palmer	ID-2	180	57	237

TABLE 4-2 (Cont'd.)

Street #	Assessor's #	Use - Business Name	Zoning District	Existing Flow Design [gpd][1]	Flow Increase [gpd][2]	Build-out Flow [gpd][3]
83 BP	K11-015	HAVENCRAFT	ID-4	1,050	948	1,998
95 BP	K11-017	MASS HIGHWAY	ID-4	200	181	381
103 BP	K11-016	RESTAURANT (New System)	ID-4	3520	3,178	6,698
111 BP	K11-101	OFFICE - VILLAGE EAST	ID-4	1,635	1,476	3,111
119 BP	K11-018	RETAIL - FRANK'S SPOKE	ID-4	207	187	394
121 BP	K11-200	OFFICE - RKK REALTY	ID-4	364	329	693
141 BP	K11-019	ATHLETIC FACILITY	ID-4	5,737	5,180	10,917
151 BP	K11-020	BUDDY DOG	ID-4	540	488	1,028
163 BP	K10-014	BOSTON EDISON SUBSTA.	ID-4	0	0	0
33 BP	K12-003	DC REALTY TRUST	ID-6	588	5,990	6,578
465 BP	K08-002	SUDBURY GAS STATION	ID-8	200	116	316
477 BP	K07-007	SULLIVAN TIRE COMPANY	ID-8	500	290	790
237-239 N	K08-001	FUEL SVC - INTERSTATE OIL	ID-8	200	116	316
616 BP	K06-012	SUDBURY MEDICAL CENTER	LBD-1	1,532	215	1,747
642 BP	K06-04	NURSING HOME (in failure)	LBD-1	14,000	1,961	15,961
642 BP	K06-05	VACANT (nursing home)	LBD-1	0	0	0
505, 507-525 BP	K07-05, 06	RETAIL - STAR PLAZA	LBD-2	6,630	1,161	7,791
415 BP	K08-006	POLICE STATION	LBD-6	400	115	515
423 BP	K08-004	SUDBURY CROSSING MALL	LBD-6	4,200	1,210	5,410
439 BP	K08-003	RETAIL-SUDBURY FARMS[4]	LBD-6	7,706	2,220	9,926
480 BP	KO8-062	VACANT	LID-1	420	162	582
490 BP	K07-018	INDUST. - CHISWICK PARK	LID-1	6,441	2,479	8,920
526-528 BP	K07-011-013	R&D - RAYTHEON	LID-1	50,000	19,241	69,241
25 U	K08-060	WAREHOUSE - NE DOOR	LID-1	1,540	593	2,133
27 U	K08-056	SAXONVILLE LUMBER	LID-1	100	38	138
33 U	K07-017	WAREHOUSE - CHISWICK	LID-1	2,400	924	3,324

TABLE 4-2 (Cont'd.)

Street #	Assessor's #	Use - Business Name	Zoning District	Existing Design Flow [gpd][1]	Flow Increase [gpd][2]	Build-out Flow [gpd][3]
316 BP	K09-405	AUTO REPAIR - ALEXANDER	VBD	200	265	465
320 BP	K09-401	BEARLY READ BOOKS	VBD	200	265	465
321-325 BP	K09-590	OFFICE - MILL BROOK II	VBD	5,250	6,947	12,197
327-329 BP	K09-057	OFFICE - MILL BROOK I	VBD	765	1,012	1,777
330 BP	K09-049	HUNT HOUSE BED	VBD	450	595	1,045
333 BP	K09-056	OMEGA MORTGAGE	VBD	200	265	465
335 BP	K09-055	CLOUD 9 TOYS	VBD	200	265	465
339 BP	K09-054	RKK REALTY	VBD	200	265	465
344 BP	K09-032	OFFICE - QUILTED OR NOT	VBD	576	762	1,338
345 BP	K09-053	OFFICE - SUDBURY PLACE	VBD	892	1,180	2,072
346 BP	K09-031	OFFICE, CLINICAL COMMUN.	VBD	200	265	465
348 BP	K09-030	HITCHCOCK STORE	VBD	410	543	953
351 BP	K09-052	OFFICE - NE TELEPHONE	VBD	200	265	465
353 BP	K09-051	MEMORY GARDEN	VBD	200	265	465
354 BP	K09-029	OFFICE SUDBURY MUSIC	VBD	200	265	465
357 BP	K09-050	RETAIL - MAGGIE FLOOD	VBD	200	265	465
361-389 BP	K08-026,029	MILL VILLAGE (several systems)	VBD	2,025	2,680	4,705
370 BP	K08-036	OFFICE -BARTON PROP.	VBD	200	265	465
378 BP	K08-037	DUNKIN DONUTS	VBD	910	1,204	2,114
5-15,17,19 C	K08-035	RETAIL - MACKINNONS	VBD	1,418	1,876	3,294
8 C, 356 BP	K09-027,028	OFFICE - NB TAYLOR	VBD	426	564	990
68 KP	K09-033	OFFICE BUILDING/RESIDENTIAL	VBD	200	265	465
655 BP	K06-501	LONGFELLOW GLEN/ 4 Systems	-	32,000	0	32,000
			TOTALS	**244,319**	**108,449**	**352,768**

[1]Existing design flow as shown on Table 3-1.

[2]Percent increase (Table 4-1) applied to existing design flow.

[3]Existing design flow plus flow increase.

[4]FAST system in use.

TABLE 4-3
WEST AREA FLOW

WASTEWATER MANAGEMENT NEEDS ASSESSMENT

Address	Assessor's Number	Use - Business Name	Existing Flow [gpd]	Build-Out Flow [gpd]
BOSTON POST RD				
593 BP	K06-026	RETAIL - DUDLEY SQUARE	696	1,454
616 BP	K06-012	SUDBURY MEDICAL CENTER	1,532	1,747
621 BP	K06-028	BARNSTEAD SHOPS	1,231	2,572
642 BP	K06-04, 05	NURSING HOME (in failure)	14,000	15,961
655 BP	K06-501	LONGFELLOW GLEN/ 4 Systems	32,000	32,000
684 BP	K05-019	AUTO REPAIR	712	879
694 BP	K05-017	RESTAURANT - BLUE LION	4,900	6,053
708 BP	K05-015	DENTIST	820	1,013
712 BP	K05-013	SUDBURY RENTAL	260	321
730 BP	K05-012	RETAIL - WAYSIDE PLAZA	1,724	2,130
736 BP	K05-011	FRUGAL FLOWERS	592	731
738 BP	K05-07	HOTEL - CLARION CARRIAGE	5,500	6,794
740 BP	K05-05	OFFICE - SUDBURY DESIGN	1,452	1,794
		TOTAL	**65,419**	**73,449**

TABLE 4-4
WEST AREA "CRITICAL" AND "PRIORITY" FLOW

WASTEWATER MANAGEMENT NEEDS ASSESSMENT

Address	Assessor's Number	Use - Business Name	Existing Flow [gpd]	Build-Out Flow [gpd]
BOSTON POST RD				
616 BP	K06-012	SUDBURY MEDICAL CENTER	1,532	1,747
621 BP	K06-028	BARNSTEAD SHOPS	1,231	2,572
642 BP	K06-04, 05	NURSING HOME (in failure)	14,000	15,961
684 BP	K05-019	AUTO REPAIR	712	879
694 BP	K05-017	RESTAURANT - BLUE LION	4,900	6,053
730 BP	K05-012	RETAIL - WAYSIDE PLAZA	1,724	2,130
738 BP	K05-07	HOTEL - CLARION CARRIAGE	5,500	6,794
Critical & Priority Properties		TOTAL	29,599	36,136

TABLE 4-5
WEST AREA "CRITICAL" FLOW

WASTEWATER MANAGEMENT NEEDS ASSESSMENT

Address	Assessor's Number	Use - Business Name	Existing Flow [gpd]	Build-Out Flow [gpd]
BOSTON POST RD				
616 BP	K06-012	SUDBURY MEDICAL CENTER	1,532	1,747
642 BP	K06-04, 05	NURSING HOME (in failure)	14,000	15,961
Critical Properties		TOTAL	15,532	17,708

TABLE 4-6
CENTRAL AREA FLOW

WASTEWATER MANAGEMENT NEEDS ASSESSMENT

Address	Assessor's Number	Use - Business Name	Existing Flow [gpd]	Build-Out Flow [gpd]
BOSTON POST RD				
316 BP	K09-405	AUTO REPAIR - ALEXANDER	200	465
320 BP	K09-401	BEARLY READ BOOKS	200	465
321-325 BP	K09-590	OFFICE - MILL BROOK II	5,250	12,197
327-329 BP	K09-057	OFFICE - MILL BROOK I	765	1,777
330 BP	K09-049	HUNT HOUSE BED	450	1,045
333 BP	K09-056	OMEGA MORTGAGE	200	465
335 BP	K09-055	CLOUD 9 TOYS	200	465
339 BP	K09-054	RKK REALTY	200	465
344 BP	K09-032	OFFICE - QUILTED OR NOT	576	1,338
345 BP	K09-053	OFFICE - SUDBURY PLACE	892	2,072
346 BP	K09-031	OFFICE, CLINICAL COMMUN.	200	465
348 BP	K09-030	HITCHCOCK STORE	410	953
351 BP	K09-052	OFFICE - NE TELEPHONE	200	465
353 BP	K09-051	MEMORY GARDEN	200	465
354 BP	K09-029	OFFICE SUDBURY MUSIC	200	465
357 BP	K09-050	RETAIL - MAGGIE FLOOD	200	465
361-389 BP	K08-026,029	MILL VILLAGE (several systems)	2,025	4,705
370 BP	K08-036	OFFICE -BARTON PROP.	200	465
378 BP	K08-037	DUNKIN DONUTS	910	2,114
394 BP	K08-082	LOTUS BLOSSOM	2,100	2,803
400 BP	K08-081	PRUDENTIAL REALTY	200	267
410 BP	K08-080	RUGGED BEAR PLAZA	1,740	2,322
415 BP	K08-006	POLICE STATION	400	515
418-420 BP	K08-079	RETAIL/RESTAURANT/OFFICE	1,030	1,375
423 BP	K08-004	SUDBURY CROSSING MALL	4,200	5,410
424-428 BP	K08-078	BLOCKBUSTER, SDBY PIZZA	540	721
430 BP	K08-077	COLONIAL AUTO	656	875
432 BP	K08-069	GAS STATION - MOBIL	600	801
439 BP	K08-003	RETAIL-SUDBURY FARMS	7,706	9,926
440 BP	K08-067	JEWELRY STORE	315	420
442 BP	K08-058	RETAIL - WESTPORT GAS	300	400
450 BP	K08-066	OFFICE - COMMUNITY	188	251
454 BP	K08-065	CLAPPERS	570	761
465 BP	K08-002	SUDBURY GAS STATION	200	316
470 BP	K08-064	SUDBURY GULF (Public Petro)	300	400
474 BP	K07-008	RETAIL - KAPPY'S LIQUORS	420	561
477 BP	K07-007	SULLIVAN TIRE COMPANY	500	790
480 BP	KO8-062	VACANT	420	582
490 BP	K07-018	INDUST. - CHISWICK PARK	6,441	8,920
505, 507-525 BP	K07-05, 06	RETAIL - STAR PLAZA	6,630	7,791
CONCORD RD				
5-15,17,19 C	K08-035	RETAIL - MACKINNONS	1,418	3,294
8 C, 356 BP	K09-027,028	OFFICE - NB TAYLOR	426	990

TABLE 4-7 (continued)
CENTRAL AREA "CRITICAL" AND "PRIORITY" FLOW

WASTEWATER MANAGEMENT NEEDS ASSESSMENT

Address	Assessor's Number	Use - Business Name	Existing Flow [gpd]	Build-Out Flow [gpd]
UNION AVENUE				
1 U	K08-070	OFFICE - DESIGNWISE	700	934
15 U	K08-071	SUDBURY COFFEE, PRINTER	360	480
18 U	K08-076	POST OFFICE	1,194	1,593
21 U	K08-090	OFFICE - MCNEIL VET.	255	340
22 U	K08-075	OFFICE - FLEET	352	470
23 U	K08-073	BAYBANK ATM VACANT	200	267
25U	K08-060	WAREHOUSE - NE DOOR	1,540	2,133
27U	K08-056	SAXONVILLE LUMBER	100	138
28 U	K08-074	SUDBURY LUMBER	418	558
33 U	K07-017	WAREHOUSE - CHISWICK	2,400	3,324
39 U	K08-053	BOSEKY LTD/CARPET CARSEL.	642	845
46 U	K08-041	PRECOURT CHARLES	200	263
55-57 U	K08-052	EDWARD TUCKER	1,094	1,440
56 U	K08-044	GRANCO REALTY TRUST	532	700
60 U	K08-045	GRANCO REALTY TRUST	944	1,242
64 U	K08-046	MACOT REALTY TRUST	390	513
65 U	K08-051	METHODS, INC.	1,214	1,598
75-83 U	K08-050	EDWARD TUCKER	2,604	3,427
80 U	K08-047	SCHOFIELD/Union & Palmer	180	237
Critical & Priority Properties		TOTAL	64,617	96,707

TABLE 4-8
CENTRAL AREA "CRITICAL" FLOW

WASTEWATER MANAGEMENT NEEDS ASSESSMENT

Address	Assessor's Number	Use - Business Name	Existing Flow [gpd]	Build-Out Flow [gpd]
BOSTON POST RD				
361-389 BP	K08-026,029	MILL VILLAGE (several systems)	2,025	4,705
394 BP	K08-082	LOTUS BLOSSOM	2,100	2,803
400 BP	K08-081	PRUDENTIAL REALTY	200	267
410 BP	K08-080	RUGGED BEAR PLAZA	1,740	2,322
415 BP	K08-006	POLICE STATION	400	515
418-420 BP	K08-079	RETAIL/RESTAURANT/OFFICE	1,030	1,375
424-428 BP	K08-078	BLOCKBUSTER, SDBY PIZZA	540	721
430 BP	K08-077	COLONIAL AUTO	656	875
439 BP	K08-003	RETAIL-SUDBURY FARMS	7,706	9,926
454 BP	K08-065	CLAPPERS	570	761
470 BP	K08-064	SUDBURY GULF (Public Petro)	300	400
474 BP	K07-008	RETAIL - KAPPY'S LIQUORS	420	561
UNION AVENUE				
1 U	K08-070	OFFICE - DESIGNWISE	700	934
15 U	K08-071	SUDBURY COFFEE, PRINTER	360	480
18 U	K08-076	POST OFFICE	1,194	1,593
22 U	K08-075	OFFICE - FLEET	352	470
25U	K08-060	WAREHOUSE - NE DOOR	1,540	2,133
28 U	K08-074	SUDBURY LUMBER	418	558
33 U	K07-017	WAREHOUSE - CHISWICK	2,400	3,324
39 U	K08-053	BOSEKY LTD/CARPET CARSEL.	642	845
55-57 U	K08-052	EDWARD TUCKER	1,094	1,440
56 U	K08-044	GRANCO REALTY TRUST	532	700
60 U	K08-045	GRANCO REALTY TRUST	944	1,242
64 U	K08-046	MACOT REALTY TRUST	390	513
65 U	K08-051	METHODS, INC.	1,214	1,598
75-83 U	K08-050	EDWARD TUCKER	2,604	3,427
80 U	K08-047	SCHOFIELD/Union & Palmer	180	237
Critical Properties		TOTAL	32,251	44,725

TABLE 4-9
EAST AREA FLOW

WASTEWATER MANAGEMENT NEEDS ASSESSMENT

Address	Assessor's Number	Use - Business Name	Existing Flow [gpd]	Build-Out Flow [gpd]
BOSTON POST RD				
33 BP	K12-003	DC REALTY TRUST	588	6,578
78 BP	K11-012	CAR WASH(leachfield in Wayland)	3,750	4,966
83 BP	K11-015	HAVENCRAFT	1,050	1,998
84 BP	K11-013	TOWN LINE HARDWARE	200	265
88 BP	K11-011	ANTIQUE SHOP	200	265
95 BP	K11-017	MASS HIGHWAY	200	381
100 BP	K11-010	AUTO DIAGNOSTICS	977	1,294
103 BP	K11-016	RESTAURANT (New System)	3,520	6,698
104 BP	K11-008	PAPA GINOS	3,520	4,661
111 BP	K11-101	OFFICE - VILLAGE EAST	1,635	3,111
119 BP	K11-018	RETAIL - FRANK'S SPOKE	207	394
120 BP	K11-007	SKY RESTAURANT	8,050	10,661
121 BP	K11-200	OFFICE - RKK REALTY	364	693
128 BP	K11-004	OFFICE - STANMAR	1,700	8,116
136 BP	K11-003	NURSING HOME - WINGATE	14,200	18,805
141 BP	K11-019	ATHLETIC FACILITY	5,737	10,917
150 BP	K11-002	BEST FRIENDS PET KENNEL	8,000	10,594
151 BP	K11-020	BUDDY DOG	540	1,028
163 BP	K10-014	BOSTON EDISON SUBSTA.	0	0
209 BP	K10-008	GAS - SUDBURY AUTO	220	388
215 BP	K10-007	OFFICE - BAY PATH	1,720	3,034
OLD COUNTY RD				
35 OC	K11-009	DANCER' STORE SHOP	200	265
9 OC	K11-025	INDUST. - LEWIS PROPERTY	3,000	8,163
		TOTAL	**59,578**	**103,275**

TABLE 4-10
EAST AREA "CRITICAL" AND "PRIORITY" FLOW

WASTEWATER MANAGEMENT NEEDS ASSESSMENT

Address	Assessor's Number	Use - Business Name	Existing Flow [gpd]	Build-Out Flow [gpd]
BOSTON POST RD				
33 BP	K12-003	DC REALTY TRUST	588	6,578
78 BP	K11-012	CAR WASH(leachfield in Wayland)	3,750	4,966
83 BP	K11-015	HAVENCRAFT	1,050	1,998
84 BP	K11-013	TOWN LINE HARDWARE	200	265
100 BP	K11-010	AUTO DIAGNOSTICS	977	1,294
104 BP	K11-008	PAPA GINOS	3,520	4,661
111 BP	K11-101	OFFICE - VILLAGE EAST	1,635	3,111
120 BP	K11-007	SKY RESTAURANT	8,050	10,661
136 BP	K11-003	NURSING HOME - WINGATE	14,200	18,805
151 BP	K11-020	BUDDY DOG	540	1,028
209 BP	K10-008	GAS - SUDBURY AUTO	220	388
Critical & Priority Properties		**TOTAL**	**34,730**	**53,755**

TABLE 4-11

SUMMARY OF BUILD-OUT WASTEWATER DESIGN FLOWS (gpd)

WASTEWATER MANAGEMENT NEEDS ASSESSMENT

Area	"Non-priority" Flows	"Priority" Flows	"Critical" Flows	Total Flows
West	37,313	18,428	17,708	73,449
Central	10,101	51,982	44,725	106,808
East	49,520	52,727	1,028	103,275
Totals	**96,934**	**123,137**	**63,461**	**283,532**

5.0 WASTEWATER MANAGEMENT ALTERNATIVES

This section identifies potential long-term wastewater management alternatives for the properties identified in Section 3 of this report. The alternatives investigated include: 1) Title 5 repairs/upgrades, including innovative/alternative (I/A) technologies; 2) shared septic systems; and 3) decentralized wastewater collection, treatment, and disposal. This section includes a preliminary screening of the identified alternatives as well as a screening of potential wastewater treatment facility and effluent disposal locations. Table 5-1 at the end of this section summarizes the wastewater management alternatives.

5.1 Alternative 1 – Title 5 Repairs/Upgrades

As discussed in Section 2 of this report, the entire project area currently utilizes some type of on-site system for wastewater disposal. Under this alternative, on-site systems designed and maintained under Title 5 (310 CMR 15.00) will continue to be utilized for the disposal of wastewater throughout the project area. The purpose of Title 5 of the Massachusetts Environmental Code, also known as 310 CMR 15.000, is to "provide for the protection of public health, safety, welfare and the environment by requiring the proper siting, construction, upgrade, and maintenance of on-site sewage disposal systems and appropriate means for transport and disposal of septage." It is administered and enforced by the Massachusetts Department of Environmental Protection (DEP) in coordination with local approving authorities. In Sudbury, the town's BOH acts as the local approving authority.

5.1.1 Alternative 1A – Conventional Septic Systems

According to Title 5 of the Massachusetts Environmental Code, 310 CMR 15.000, effective March 31, 1995, the standard components of the conventional Title 5 septic system include: a building sewer, an adequately sized septic tank, a distribution box or dosing chamber, a soil absorption system (SAS), and a reserve area. Wastewater exits the establishment through its building sewer and enters the septic tank where solids are settled and retained. The septic tank effluent flows through the distribution box where it is distributed to the SAS for discharge to the subsurface soils. There are also other requirements regarding construction, materials, setbacks, and depth to groundwater. Variances from Title 5 may be granted by the local BOH for septic

system repairs/upgrades that are unable to meet setback requirements or other certain provisions of Title 5.

Physical factors that should be evaluated when considering on-site systems include, but are not limited to: lot size and configuration, soil characteristics, depth to groundwater, and slope. Many of the properties in the area are severely limited or prevented from complying with Title 5 because of one or more of these factors. For example, in areas with percolation rates greater than 2 minutes per inch, five feet of separation are required from the bottom of the soil absorption system (leaching fields, trenches, etc.) to the maximum seasonal high groundwater level. Properties with minimal depth to groundwater may require a mounded system to attain this separation from groundwater. A mounded system consists of adding soil between the seasonal high groundwater level and the soil absorption system until the required separation is reached. Properties with these mounded systems, and those with steep slopes, may require waterproof, concrete retaining walls and possibly effluent pumping systems to carry the flow from the septic tank to the soil absorption system. These systems are difficult to accommodate on small lots.

In the project area, there are cases in which variances to SAS area and groundwater separation requirements are necessary because the construction of a compliant system is not possible. Setback variances are also required for many properties, including setbacks to property lines, foundations, water supply lines, and slopes. There are also distance requirements between components of a system and between neighboring systems. Given the density in the project area, compliance with these requirements is not possible on a widespread basis.

Due to the evident constraints on many properties and the environmentally sensitive nature of the study area, construction of Title 5 systems requires widespread variances from the Board of Health and DEP. Variances compromise the level of protection intended by Title 5. For example, conventional on-site systems can be a significant contributor of nitrogen and other nutrients to groundwater resources. Nitrate-Nitrogen concentrations greater than 10 milligrams per liter in drinking water may cause Methemoglobinemia (Blue Baby Syndrome). Nitrogen, in high concentrations, may cause excessive growth of algae and plants in wetlands. In densely populated areas such as the project area, these systems can substantially raise the nitrogen concentration in the groundwater.

Under Title 5 regulations, a septic system inspection is required before any sale, expansion, change in use, or transfer of property. This, especially, affects business owners in the project area since meeting Title 5 compliance or upgrading a system can be more difficult and financially restrictive due to site constraints. Property owners in the Route 20 business district have problems with expansion, change of use, and selling property due to wastewater disposal problems.

Construction of upgrades and new systems on problematic lots is often difficult, expensive, and aesthetically unappealing. Although some limited financial assistance is available, owners are rarely assisted financially with the costs of complying with Title 5. Costs for constructing compliant conventional systems (i.e. commercial/industrial properties with design flows under 2,000 gpd) on difficult properties can range from a low of $8,000 to in excess of $70,000. Historic data in Sudbury has revealed that the need to bring in suitable material has driven the average cost of a small conventional system repair (i.e. flows of 440 gpd) into the $20,000 to $30,000 range. For the purposes of this report, a generic order of magnitude cost of $50,000 per lot for a conventional Title 5 repair of a commercial/industrial property with design flow under 2,000 gpd will be used. This cost includes construction costs, engineering costs, and contingencies and assumes a mounded system and/or retaining wall will be required. For properties with design flows higher than 2,000 gpd, larger more expensive septic systems that include pressure dosed soil absorption systems are required. Therefore, properties with design flows between 2,000 and 10,000 gpd are estimated to have Title 5 repair costs significantly greater than $50,000 per lot (see Section 5.1.3).

In addition, Title 5 systems require periodic inspection and pumping. Assuming normal use and care, the recommended pumping frequency is once every two years. Many commercial establishments require grease traps. Grease traps are usually pumped much more frequently than septic tanks, and pumping is based on size and use. Mounded systems require periodic repair or replacement of pumps. The annual maintenance cost for commercial properties with conventional septic systems is dependent on type of business and flow rate. For instance, a small office can have annual septic system operation and maintenance expenses that are less than the $100 cost per year for a residential system; whereas, a large restaurant with a grease trap could

have annual operation and maintenance expenses in excess of $5,000 a year. For the purposes of this report, we will assume an annual maintenance cost of $500.

Historically, Sudbury's commercial septic systems have had a life of up to 30 years, but commercial establishments in Sudbury that have high nutrient loads and greases have a shorter life span of approximately 15 years. For purposes of this report, an assumed design life of a compliant Title 5 system is 20 years. However, it is important to note that the expected lifetime of systems built in marginal conditions and with the increased complexity of pumps, terracing, mounds, etc., is often much less.

5.1.2 Alternative 1B – Tight Tanks

In the most extreme cases, an existing septic system requires the issuance of multiple variances that compromise public health and environmental protection, and an attempt at a maximum feasible upgrade is futile. In these remedial (not for expansion of system) cases, tight tanks are used. Tight tanks are vessels designed to hold wastewater for periodic pumping. Land requirements are lower because a SAS is typically not used. All wastewater is transported off-site for treatment and disposal.

Tight tanks are sized to handle five times (5X) the daily design flows as established by Title 5. The system would include an alarm to alert the property owner when the liquid level reaches a high point. Frequent pumping of tight tanks produces odors and requires pumping trucks to travel through the lot on a regular basis. DEP may also require above-ground suction piping to facilitate the frequent pumping. DEP requires special approval for tight tanks and can also request monthly maintenance reports. Title 5 regulations allow tight tanks only for very specific applications, and they are typically considered as a last resort. DEP does not encourage the widespread use of tight tanks as a wastewater management solution. For the purposes of this report, tight tanks will not be considered further.

5.1.3 Alternative 1C – Innovative/Alternative (I/A) Systems

A Title 5 system is not designed to achieve a high level of treatment of biochemical oxygen demand (BOD) or total nitrogen removal. Title 5 septic tanks do not remove a high level of

for system components, variances from Title 5 and local regulations would probably still be required. This option would also be a financial burden on the property owners because of the higher costs of the systems. Therefore, the general use of I/A technology does not provide a reasonable solution for improving the existing problems.

The remedial use of I/A systems may allow designers to take advantage of one of the following: 50% reduction of leaching field area, two-foot reduction of the groundwater separation requirement, or two-foot reduction of the requirement for four feet of naturally occurring pervious soil. In the project area, the leaching field area reduction and the groundwater separation requirement would both be advantageous. To determine the benefit of an I/A system, a typical lot is considered. Many lots in this project area have minimum depth to groundwater and small lot size. A lot with these characteristics would require fill and a retaining structure for the leaching field. The remedial use of an I/A system and subsequent reduction in the leaching field area would only reduce the length and width, not the height, of the retaining structure. Even with a reduced footprint, setback variances may still be required. If the I/A reduction for groundwater separation were invoked, a mounded system would still be necessary and setback variances would not be reduced.

I/A systems increase the cost of the overall system and carry higher yearly operating and maintenance costs than conventional on-site systems without I/A technologies. An on-site system utilizing I/A technology can range from $8,000 to $400,000 for an upgrade or replacement, depending on the flows and the site conditions. Representative Title 5 systems utilizing I/A installations in Sudbury (for commercial/industrial properties with design flow between 2,000 and 10,000 gpd) have been in the $300,000 to $400,000 range. A generic order of magnitude cost that will be used for comparison is $200,000.

The yearly costs for these systems includes a DEP required service contract for the life of the system, quarterly testing of the system for the first three years (after which time the frequency is often reduced), and electricity costs. For the first three years, this amounts to approximately $1,100 per year. If the system is functioning normally and testing becomes annual this is reduced to approximately $680. For the purposes of this report, we have assumed annual operating costs of $800.

5.2 Alternative 2 – Shared Septic Systems

Provisions included in the Title 5 regulations allow for the construction of shared (also known as clustered) treatment and disposal systems. Shared systems require special approval from DEP, as well as legal agreements and documentation regarding ownership, maintenance, and other issues. Shared systems must be pumped once per year. The maximum design flow allowed under Title 5 for a shared system without acquiring a minor groundwater discharge permit is 10,000 gallons per day.

A conventional shared system would include a low-pressure or gravity collection system, a large septic tank, a dosing (pump) chamber, and a large SAS. Each shared system would require an adequately sized "localized" parcel of land with suitable soil, geologic, and groundwater conditions for effluent disposal. For aggregated design flows over 5,000 gallons per day, leaching trenches are the only type of soil absorption system allowed by DEP. Assuming the use of leaching trenches, the footprint for a 10,000 gpd soil absorption system would be approximately 1 acre or more, including sufficient reserve area.

Due to the lot size restrictions prevalent in the project area, it is unlikely that shared systems will provide a total solution to the existing problems. Section 6 investigates the limited potential of this alternative in certain sections of the project area. Due to the many variables involved, generic costs were not generated for this alternative.

5.3 Alternative 3 – Decentralized Wastewater Treatment

Large-scale wastewater treatment requires some form of a wastewater collection system to transport wastewater flows to a treatment plant. If wastewater flows in excess of 10,000 gpd are disposed of in one location, they require a groundwater discharge permit and a minimum of secondary treatment prior to discharge to a groundwater.

A package or small wastewater treatment facility refers to the assembly of various individual treatment process equipment into a compact area. Small facilities are found in the design flow range from individual facilities (300 gpd +/-) up to the range of approximately 100,000 gpd.

Small facilities can achieve the same level of treatment as larger municipal wastewater treatment facilities; however, they must be monitored effectively by a certified operator. DEP design requirements necessitate redundant equipment for design flows in excess of 40,000 gpd and local regulations necessitate redundant equipment for design flows in excess of 10,000 gpd. Redundancy increases the complexity of the facility operation and associated capital and operating cost.

A typical custom wastewater treatment facility may consist of the following components:

- Preliminary treatment.
- Primary treatment.
- Flow equalization.
- Secondary/advanced treatment.
- Sand filtration.
- Disinfection.

The size and type of each of these processes will depend on the discharge permit conditions that will have to be met and the amount of flow to be treated. Disinfection may not be necessary for subsurface discharge. An operations building would typically include the electrical controls, a laboratory, operations office, effluent filtration equipment, solids dewatering equipment, and a utility/equipment storage room.

The amount of land required for the wastewater treatment facility and related site items varies with the hydraulic treatment capacity of the plant. Potential size, cost, and siting of a treatment facility will be discussed in Section 6 of this report.

The treatment categories and technologies capable of achieving the required level of treatment in order to meet the typical discharge permit requirements from the EPA and/or DEP have been included in Appendix B.

5.3.1 Wastewater Collection Alternatives

This section identifies the wastewater collection alternatives typically utilized to convey wastewater from individual residences and businesses. All of the "off-site" alternatives for wastewater management that have been identified, require the conveyance of wastewater from each property to a decentralized location for further treatment prior to effluent disposal.

The following technologies are typically utilized for wastewater collection and have been evaluated for use in this project:

- Conventional gravity sewers, pump stations, and force mains.
- Grinder pumps and low-pressure sewers.
- Vacuum sewers.
- A combination of these technologies.

The following sections provide a description of each wastewater collection technology evaluated as part of this plan.

5.3.1.1 Conventional Gravity Sewers

A gravity sewer system consists of sewer lines that allow customers to discharge into a sanitary system consisting of gravity pipes, which flow downhill and are not pressurized. Gravity sewer systems operate by collecting the wastewater via continuously sloped pipe, typically eight inches minimum diameter, and transport the wastewater to localized low points in the collection system. The design of a gravity sewer system is dependent on the velocity of the wastewater within the pipes. Minimum velocities (approximately 2 feet per second (fps)) are set to assure that suspended matter does not settle out in the conduit, while maximum velocities (typically 8-10 fps) are set to prevent excessive scouring of the pipe. Extremely flat or hilly terrain poses a problem to gravity sewer installations since the gravity sewers must continually slope downward. This results in the sewer becoming increasingly deep or the need for a wastewater pumping station. Pump stations are located at low points to collect and pump the wastewater to the next high point in the collection system, then the process of gravity flow resumes.

This alternative is, typically, the most cost-effective and reliable long-term option and allows for future service area expansion without significant upgrade requirements. Installation costs are impacted by the presence of ledge, high groundwater, poor soils, and severe topography that impacts the depth of excavation.

5.3.1.2 Grinder Pumps with Low-Pressure Sewers

A low-pressure sewer system has proven to be a viable alternative where implementation of gravity sewer systems is impractical and/or uneconomical. A low-pressure sewer system includes small diameter pressure sewers fed by individual grinder pumps at each source or configured to serve multiple sources. A pressure sewer system makes use of small diameter piping, ranging in size from 1-1/4 to 4 inches in diameter, buried at a shallow depth following the profile of the ground. The pressure main and service pipe are generally manufactured from polyvinyl chloride (PVC) or high-density polyethylene (HDPE). The pressure sewer mains and laterals are buried just below the depth of frost penetration and will follow the contour of the ground.

The pressure sewer system is separated into branches of sewers of different sizes depending on the number of connections to each branch. Standard manholes are not required in a pressure sewer system. Instead, flushing connections/drain manholes are installed at the end of branches and at major changes in direction or changes in pipe diameter. Air relief/vacuum valve manholes are installed at high points in the system to allow trapped air to escape. Each customer utilizes a grinder pump for discharge of sewerage into the main. Each grinder pump unit is equipped with a grinder pump, check valve, tank, and all necessary controls. The units can be buried outdoors close to each customer's existing septic tank or cesspool, so the connection to the existing service pipe exiting the building can be made easily. The units can also be located inside the building. The grinder pump macerates the solids present in the wastewater, produces slurry, and discharges wastewater to the pressure sewer collection pipes. Depending on design flow, some commercial users may require a larger unit with increased reserve capacity. If a malfunction occurs, a high liquid alarm is activated. This alarm may be a light mounted on the outside of the building or an audible alarm that can be silenced by the customer. The customer will then notify the town or a town-approved technician or contractor to come and make the necessary repair.

A low-pressure sewer system collects and transports the wastewater from each customer located in low points to the nearest gravity sewer or, if appropriate, to the decentralized wastewater treatment facility. Within the right-of-way, air relief manholes with air and vacuum valves would be installed at all high points, and terminal flushing drain manholes would be installed at all low points. In addition, cleanouts would be installed approximately every 500 to 1,000 feet to provide access for periodic maintenance.

Grinder pumps and low-pressure sewers are increasingly prevalent due to the lower capital costs, long history of use, and adaptability in poor subsurface conditions (ledge, groundwater, etc.). Public acceptance may be lower due to the presence of a pump at each business. Additionally, pressure sewers rely on a consistent electrical power supply, and negative environmental impacts may occur during extended power failures due to the potential for backups and overflows.

5.3.1.3 Vacuum Sewers

Similar to pressure sewers, vacuum sewers use small diameter sewer mains to collect wastewater from individual users. The vacuum pipeline, however, is not continuously filled with wastewater as with pressure sewers. A central vacuum sewer collection station equipped with vacuum pumps provides a constant negative pressure (gauge) in the mains. Sufficient suction is generated to carry wastewater from individual building connection inlets through the vacuum main to the collection station. The collection station is typically equipped with conventional sewage pumps to transmit the collected wastewater to a nearby interceptor sewer or WWTF.

Building connections in a vacuum sewer system consist of a valve chamber, with a pneumatically controlled valve that allows wastewater to enter the vacuum main as it accumulates in the valve chamber. A single valve chamber and service connection may be used to serve up to four individual users. The service connection pipeline from the valve chamber to the main is typically 3-inches in diameter. Mains are installed generally following ground surface contours, but allowable elevations changes are more limited than with pressure sewers.

5.3.1.4 Combination of Gravity Sewers and Grinder Pumps

The utilization of a combination of conventional wastewater collection system components, grinder pumps, and pressure sewers has proven to be a cost-effective approach on many recent projects in Massachusetts. These combined systems are designed to maximize the use of gravity sewers; however, where the topography or subsurface conditions (ledge, groundwater, etc.) warrant, a cost-effective approach is to utilize grinder pumps and low-pressure sewers to reduce capital construction costs. The evaluation of this approach is typically completed during the preliminary design of the collection system, when more detailed information (topographic mapping and borings) is available.

5.3.2 Effluent Disposal Alternatives

Wastewater treatment processes typically include effluent discharge facilities designed to minimize the impacts of nearby surface or ground waters. Potential impacts include groundwater mounding or increasing pollutant loads to a receiving water body. The following sections describe the available effluent disposal methods.

5.3.2.1 Surface Water Discharge

At this time, the DEP is not readily issuing any new surface water discharge permits. Therefore, this option was not considered as an alternative for this project.

5.3.2.2 Subsurface Discharge to Groundwater

The discharge of treated wastewater to groundwater is the most common option for disposal of treated wastewater currently being permitted in Massachusetts. This disposal option would involve the discharge of highly treated effluent from a wastewater treatment facility into an infiltration bed or subsurface distribution system, designed to handle the design flows. For purposes of this discussion, the location of the discharge is considered independent of the location of the treatment facility since the treated effluent could be transmitted by force main to the infiltration bed or subsurface distribution system.

The requirements for groundwater discharge of wastewater are outlined in the Groundwater Discharge Permit Program (314 CMR 5.00 and 6.00). The principal constituent of concern for groundwater discharges is nitrates, a primary component of treated wastewater. A subsurface discharge sited in Zone II would require advanced treatment to reduce nitrogen loading. Potential sites for use as a groundwater disposal site must be comprised of sandy or gravely soils that exhibit medium infiltration rates. Sites, which contain poor soil permeability, high groundwater levels, and ledge, inhibit the downward flow of water and are generally unacceptable. Soil properties can be amended by excavating and amending the soils in the discharge area; this approach may be infeasible for the larger systems designed for large wastewater flows but may be appropriate for small systems.

5.3.2.3 Wastewater Reuse

Another option is to reuse the wastewater for non-potable needs. With proper treatment, reclaimed wastewater demonstrates few health risks, while providing the community with an alternative water source. Typical methods of reuse include watering landscape and agriculture. The main problem with this option is that a backup system must be in place to handle the wastewater when it cannot be used for irrigation.

Due to New England's climate, the irrigation method cannot be used year round because the water cannot penetrate the frozen ground; therefore, a subsurface disposal system is still required for the entire quantity of effluent disposal.

Since this option requires duplication of disposal areas, this option is not advised for use in Subury.

5.4 Summary of Alternatives

Table 5-1 summarizes the advantages and disadvantages of the various wastewater treatment and disposal alternatives investigated in this section.

TABLE 5-1
ADVANTAGES AND DISADVANTAGES - TREATMENT ALTERNATIVES

WASTEWATER MANAGEMENT NEEDS ASSESSMENT

	Advantages	Disadvantages
Alternative 1A Conventional Septic Systems	➢ Low Annual Maintenance Cost ➢ No Municipal Investment ➢ Mechanically Simple	➢ High Capital Cost ➢ Limits Development Potential ➢ Mound Systems Aesthetically Unpleasant ➢ Public Health & Environmental Issues ➢ Property Value Impacts ➢ Difficult Siting System
Alternative 1B Tight Tanks	➢ Lowest Capital Cost ➢ Simple Technology ➢ Less Land Area Req'd ➢ No Significant Public Health & Environmental Issues if Operated Properly	➢ DEP Disapproves for Long-Term Solution ➢ Limits Development Potential ➢ High Operating Costs ➢ Property Value Impacts ➢ Quarterly Monitoring Req'd ➢ Odor Concerns
Alternative 1C Innovative/Alternative Systems	➢ Greater Environmental Protection than Alt. 1A ➢ Reduces Title 5 Soil Absorption System Requirements ➢ No Municipal Investment	➢ High Capital and Operating Cost ➢ Limits Development Potential ➢ Quarterly Monitoring Req'd ➢ Service Agreements Req'd ➢ Property Value Impacts ➢ Aesthetic Concerns
Alternative 2 Shared Title 5 Systems	➢ Shared Costs ➢ Better Site Options	➢ More Regulatory Approvals Req'd ➢ Limits Development Potential ➢ Legal Agreements Req'd ➢ Yearly Pumping ➢ Large Area Req'd
Alternative 3 Decentralized Systems	➢ Greater Environmental Protection than Other Alternatives ➢ Betterments Used to Assess Costs to Sewered Properties ➢ Low Capital Cost (per unit) ➢ Potential SRF Funding ➢ No Mound or Pumped Systems ➢ Increased Property Value	➢ High Total Capital and Operating Cost ➢ Quarterly Monitoring Req'd ➢ Ownership Agreements Req'd ➢ Service Agreements Req'd ➢ Discharge Permit

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6.0 SCREENING OF ALTERNATIVES AND RECOMMENDED PLAN

This section provides a screening of the wastewater management alternatives discussed in Section 5 and analyzes their potential effectiveness in addressing the problems identified in Section 3. Planning level costs are given for the investigated alternatives and recommendations are provided.

6.1 Title 5 Repairs/Upgrades Screening

This alternative relies on the continued use of Title 5 to regulate the design of new systems and repairs/upgrades to all systems throughout the project area. Historic repair costs as outlined in Section 5 have been utilized to develop the planning period costs. Although this alternative does not provide the same environmental benefit as may be found with alternatives that provide a significantly higher level of treatment prior to discharge to the groundwater, it was used as a "baseline" to evaluate the long-term capital and operations/maintenance costs of other alternatives.

For the purposes of this analysis, it was assumed that: 1) all "Non-priority" properties (green shaded areas on Figure 3-2) were compliant with Title 5 and could continue to utilize their current system with no repairs; 2) any "Priority" or "Critical" property (yellow and pink shaded areas on Figure 3-2) with an anticipated future design flow less than 2,000 gpd would require a conventional Title 5 repair at an average cost of $50,000, and 3) any "Priority" or "Critical" property with an anticipated future design flow greater than 2,000 gpd would require an I/A technology at an average cost of $200,000. Table 6-1 outlines the costs involved with this alternative. To summarize Table 6-1, it is estimated that, if the entire project area were left to rely on Title 5 systems, the overall capital cost to bring these systems into compliance would be approximately $7,650,000. The total annual operation and maintenance costs borne by the individual property owners would be approximately $59,300.

TABLE 6-1

TITLE 5 REPAIRS/ UPGRADES - COST ANALYSIS

WASTEWATER MANAGEMENT NEEDS ASSESSMENT

Area	[1]"Non-priority" Systems (#)	[2]Design Flow <2000 gpd		[3]Design Flow >2000 gpd		[4]Capital Costs		[5]Annual O&M Costs
		"Priority"	"Critical"	"Priority"	"Critical"	"Critical" Only	"Priority" & "Critical"	
EAST	12	4	1	6	0	$50,000	$1,450,000	$13,300
WEST	6	1	1	5	1	$250,000	$1,300,000	$8,800
CENTRAL	10	22	20	7	7	$2,400,000	$4,900,000	$37,200
TOTALS	28	27	22	18	8	$2,700,000	$7,650,000	$59,300

Notes:

[1]"Non-priority" properties, assumed to be in compliance with Title 5.

[2]Average repair cost for systems with design flows less than 2000 gpd = $50,000.

[3]Average repair cost for systems with design flows greater than 2,000 gpd = $200,000.

[4]Capital Costs = ((Design Flow <2000 gpd)*($50,000))+((Design Flow >2000 gpd)*($200,000))

[5]O+M Costs = [(("Non-priority" Systems)+(Design Flow <2000 gpd))*($500)] + [(Design Flow >2000)*($800)]

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6.2 Shared Septic Systems Screening

Shared septic systems can be used for a cluster of businesses where wastewater is collected and treated (conventional Title 5 or I/A technologies) and ultimately discharged using subsurface disposal. This category does not include a treatment plant; therefore, this alternative is for flows less than 10,000 gpd. Each shared system would require a "localized" parcel of land with suitable soil, geologic, and groundwater conditions for effluent disposal.

Within the West portion of the project area there are two properties identified as "Critical", a nursing home (K6-4) and Sudbury Medical Center (K6-12). The current wastewater flow at the nursing home is 14,000 gpd with an anticipated future flow of 16,000 gpd. DEP does not allow one property that generates greater than 10,000 gpd to solve their problem by splitting flow between septic systems; therefore, a shared system is not an option for this facility. Since this leaves only one "Critical" property in the West area, the option of a shared system was not investigated further for this portion of the project area.

Considering that there is only one "Critical" property in the East portion of the project area (Buddy Dog, K11-20), the option of a shared system was not investigated for this area either.

The central portion of the project area includes 27 "Critical" properties with a total projected build-out flow of approximately 45,000 gallons. To accommodate this flow, at least five shared systems would be required. Throughout the Central area, especially in the areas of "Critical" need, the open land needed for these systems is not available with sufficient soils and depth to groundwater. For this reason, shared systems were not considered further for this area of the project.

6.3 Decentralized Wastewater Treatment Screening

The final alternative investigated involves the use of decentralized wastewater treatment. As discussed in Section 5 of this report, this option requires some form of a wastewater collection system to transport flows to a treatment plant. Considering that of the 30 properties identified as "Critical", 27 of them are located in the Central portion of the project, we will assume a treatment plant located in the Central area. Based on the geographic configuration of the needs

areas, we do not recommend the extension of long lengths of pipe to include the three outlying "Critical" areas (two in the West area and one in the East area). This leaves us with the previously mentioned design flow of approximately 45,000 gpd to provide wastewater treatment to all of the "Critical" properties in the Central area. Under this alternative, the wastewater treatment facility would be designed to meet groundwater discharge effluent limits of 30 mg/l BOD and TSS. In addition, it would be assumed that the discharge would be within Zone II, and total Nitrogen concentration of the effluent must be less than 10 mg/l based on DEP regulation and 5 mg/l based on Sudbury's current Regulation of Small Sewage Treatment Facilities.

6.3.1 Wastewater Treatment Facility Siting

The wastewater treatment facility must be sited to function properly and minimize potential impacts during construction and operations. The purpose of this section is to identify and screen alternative locations to site a treatment facility. A review of the assessor's maps and resource information has resulted in eight (8) disposal sites for evaluation. Figure 6-1 depicts the location of all the potential wastewater treatment facility sites investigated. The investigation was a preliminary screening that did not include soil testing or negotiations for the use of the land. The following is a brief description of each site:

Site 1 – Raytheon Company EDL

The first site identified for this evaluation is the Raytheon property located at 526 – 528 Boston Post Road. This site shares its eastern property line with Chiswick Park. The property has over 49 acres between Assessor's Lots K07-11 and K07-13. The parcels have been developed and have some wetland resources bordering the property. This property is in the Central area and is not in the immediate area of residences. While this site is within Zone II, Raytheon currently operates a wastewater treatment facility on its premises with a leaching area designed for 50,000 gpd of effluent disposal. It is possible that the land is capable of accepting additional wastewater disposal. Representatives from Raytheon have expressed interest in further discussing options for the town to share the use of the treatment facility. Records indicate that this facility is currently operating at 20,000 gpd below design capacity. Expansion may be possible to accommodate the design flows from the needs area. Based on the proximity of this facility, this alternative should be considered for further evaluation.

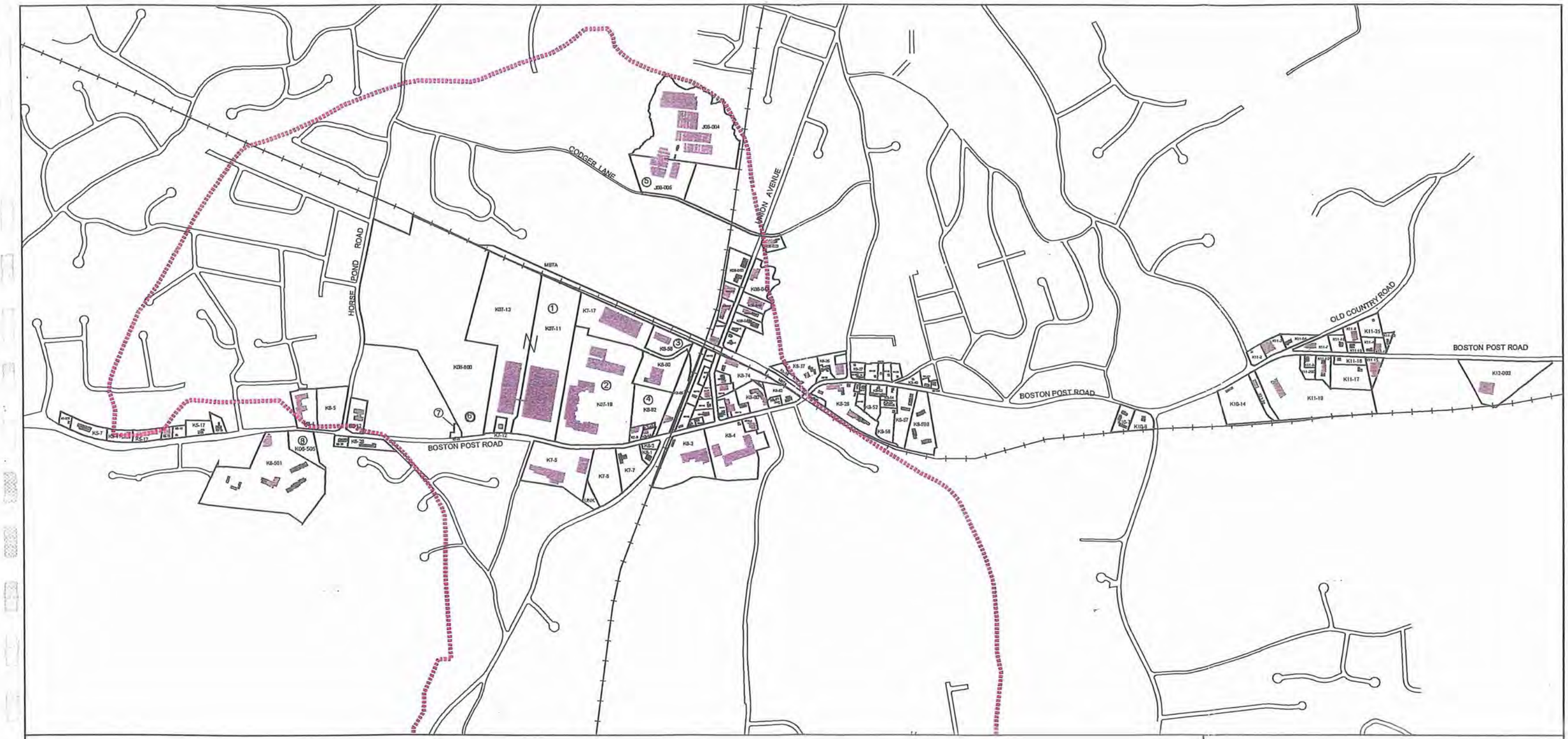

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FIGURE 6-1
TOWN OF SUDBURY, MASSACHUSETTS
WASTEWATER MANAGEMENT
NEEDS ASSESSMENT

TREATMENT FACILITY SITE SCREENING

April 2001
Weston & Sampson Engineers, Inc

Site 2 – Chiswick Park

This potential site is located at 490 Boston Post Road (35 Union Avenue) (K07-017 and K07-018). The property is in the Central area and borders the Raytheon Company EDL property. The total land area of this parcel is 35 acres. The land is developed with two large buildings. There are many wetland resource areas covering portions of this site and historic groundwater models show groundwater less than five feet below the existing ground surface. The site is within Zone II. The site's soils are classified with severe soil restrictions for subsurface disposal. Although this site may be able to take a portion of the effluent and could potentially accommodate treatment facilities, it does not appear to have sufficient continuous land area available nor ideal subsurface conditions for large quantity effluent disposal. This site is away from residential development, and the owner has expressed interest in this land being part of a solution to the Route 20 Business district's wastewater treatment problems.

Site 3 – Saxonville Lumber

This site (K08-056) is at 27 Union Street near the middle of the Central area. The total land area is 3.0 acres. Currently, the parcel is developed with a 1,120 square foot building. Historic groundwater models show groundwater is at less than five feet below the existing ground surface, and the site is within Zone II. This site may have enough land area available to accept the projected 45,000 gpd, but the site may require a mound system because of a high groundwater table.

Site 4 – Vacant Land

This site consists of an undeveloped 4.5 acre parcel in the Central area adjacent to the east of Chiswick Park (Assessor Map K08, Lot 62). The majority of this site is covered by wetlands and the site is also within Zone II. It does not appear as though this site has enough suitable land for large quantity effluent disposal.

Site 5 – Cavicchio Property

This site, located on Codjer Lane, is the only site reviewed that does not front either Boston Post Road or Union Avenue. It is composed of six lots (J07-007, 041; J08-004, 005, 006, 501) and is the northern most site in the Central area, making it remote relative to the majority of properties within the area. The property is approximately 75 acres and is heavily developed with agricultural land use and structures on it. The Cavicchio property is a heavy water user, but the

majority of the water is used for agricultural purposes. The lot borders Blanford Pond and is within Zone II. The owner has stated that he is not interested in this property being used for wastewater treatment for the Route 20 Business district.

Site 6 - Stone Farm and Site 7 – Bartlett Property

The Stone Farm site (K06-600) is located adjacent to Raytheon's western most property line, and the Bartlett Property (K07-014) shares the Stone Farm's western property line. These properties are nearly level, with a sandy glacial outwash and groundwater estimated at greater than five feet. The Stone Farm property is under a permanent agricultural permitted restriction. The Bartlett property has approximately 12 acres in Chapter 61A (agricultural use). Therefore, neither property can be considered for siting of the above ground structures necessary for a treatment plant. However, the town may be able to gain permission to use this site for subsurface disposal. This option would require one of the other identified properties to be used for the treatment plant in conjunction with effluent disposal on Site 6 and/or Site 7.

Site 8 -Town of Sudbury Property

This site is located at 641 Boston Post Road (K06-505) adjacent to Longfellow Glen's eastern property line. This is a town owned property with no structures currently built on the land. A portion of the land was taken out of conservation restriction (70,000 square feet) and is available for municipal use. The site's soils were tested during previous investigations of potential development of the adjacent Weisblatt property. There are indications that the soils are appropriate for wastewater disposal. Although this site is distant and up gradient from the Central area, the site could be used for wastewater disposal for properties within the West area.

The parameters that should be used to evaluate the above sites for suitability are as follows:

- Land Area – The land area to site a facility would have be a minimum of 1 acre. Larger land areas are preferred because they will allow for reserve/open areas around the site.
- Proximity to Service area – The proximity to the service area is important so the raw wastewater does not have to be conveyed significant distances prior to treatment.
- Proximity to Disposal Site(s) – The proximity to disposal sites is important to minimize the distance that the effluent must be pumped. However, more efficient pumps can be utilized to

pump effluent than raw sewage therefore having a location that is closer to disposal is not as significant as the proximity to the service areas.

- Ownership – Town-owned land is preferential. Otherwise, private land or use thereof will have to be obtained by the Town for use as a facility site.
- Proximity to Residential Areas – The preferred siting of a treatment facility is away from developed residential areas. Even though treatment facilities can be designed and constructed to be aesthetically pleasing and non-odorous, preferential selection would be given to sites that area located away from residential areas.
- Minimal Adverse Construction Impacts – This parameter deals with the impacts that the construction of such a facility would have on the site and streets within the area. Areas that are tightly situated within existing developments would have higher impacts.
- Environmental Impacts – This parameter deals with the impacts that construction and operation of the facility would have on the surrounding environment.

Sites 1, 3, 6, and 7 will be considered as sites capable of receiving the full quantity of the design flow effluent for subsurface disposal. Site 2 will be considered as a site capable of receiving a portion of the wastewater treatment facility design flow effluent for subsurface disposal. Additional field investigations will be necessary to confirm the optimum area for subsurface disposal. For the time being, the sites will be considered for effluent disposal based on the assumption that an adequate effluent disposal site of sufficient size can be identified. Site 8 could be used for wastewater disposal for properties in the West area.

6.4 Recommended Plan

Based on the geography of the area, the recommended plan has been divided into the three sub-areas discussed in this report.

6.4.1 East Area

Due to the limited number of "Critical" needs properties (1), it is recommended that this area continue to rely on on-site systems, with each individual property owner responsible for septic system repairs in accordance with Title 5.

6.4.2 West Area

Due to the limited number of "Critical" needs properties (2), it is recommended that this area also continue to rely on on-site solutions, with each property owner responsible for septic system repairs or, if necessary, compliance with state requirements for a private wastewater treatment facility. It may be possible for a shared system to be constructed on the municipal use area at Site 8.

6.4.3 Central Area

The significant number of "Critical" need properties in the Central area warrant further study of a solution developed by the town. It is recommended that the town pursue further investigation of the following recommended plan:

6.4.3.1 "Critical" Area Only

- Wastewater collection fronting the "Critical" need (pink colored) properties located in the Central area shown on Figure 3-2.
- Decentralized wastewater treatment and groundwater discharge of approximately 45,000 gpd serving the properties identified on Table 4-8.
- Utilization of available capacity at the Raytheon Facility (Site 1) and evaluation of expansion of the Raytheon Facility's permitted flow.
- Evaluation of a second site for decentralized wastewater treatment at the Chiswick Park property (Site 2).

The total design flow of the service area may exceed 45,000 gpd should the town choose to provide service for properties fronted by the collection system that were not "Critical" need properties. However, for the purposes of this report, it was assumed that the design flow of the recommended plan was 45,000 gpd and only those fronted "Critical" need properties will connect to the system.

6.4.3.2 "Critical" and "Priority" Areas

- Wastewater collected from "Critical" need (pink colored) and "Priority" need (yellow colored) in the Central area shown on Figure 3-2.
- Decentralized wastewater treatment and groundwater discharge of approximately 97,000 gpd serving the properties identified on Table 4-7.
- Utilization of available capacity at the Raytheon Facility (Site 1) and evaluation of expansion of the Raytheon Facility's permitted flow.
- Evaluation of a second site for decentralized wastewater treatment at the Chiswick Park property (Site 2).

It may be necessary to combine these two areas in order to make the decentralized solution more cost effective. Also, many of the properties recommended for further investigation for treatment plant siting are located in "Priority" areas.

6.4.3.3 Preliminary Opinion of Probable Costs

In order to prepare a preliminary, budget level opinion of probable construction and operation and maintenance costs, the following assumptions were made regarding the decentralized wastewater treatment option for the Central area:

- The Central area requires approximately 6,000 feet of collection system pipeline to front the "Critical" need properties listed on Table 4-8. The Central area requires approximately 7,000 feet of sewer to front both the "Critical" and "Priority" properties listed on Table 4-7.
- The collection system will be comprised of gravity sewers located in Route 20 and Union Avenue, with one lift station required due to the flat grade.
- Lower cost options to utilize existing capacity at the Raytheon Facility do not become available, and one new decentralized wastewater treatment facility with groundwater discharge is required.

The cost for construction of the collection system has been estimated at $125 per foot of sewer and $200,000 for the pump station. The cost of a 45,000 gpd packaged wastewater treatment

plant permitted, designed and constructed under current local and DEP requirements, in accordance with requirements for municipally designed and constructed facilities, with a groundwater discharge within Zone II, has been estimated at $1,100,000. The cost of a similar 97,000 gpd packaged wastewater treatment plant is estimated at $1,800,000. These costs do not include land acquisition costs.

Cost of additional required services were assumed as a percentage of the estimated construction cost as follows:

- Limited additional wastewater planning for MEPA approval, final design (including detailed hydrogeological investigations, groundwater modeling, and permitting for groundwater discharge within Zone II in addition to typical design services) at 15%.
- Construction services at 15%.
- Contingency at 10%.

This information is summarized as follows:	"Critical Only"	"Critical" and "Priority"
Construction costs:		
Collection system:	$ 950,000	$1,075,000
Treatment facility with groundwater discharge:	$ 1,100,000	$1,800,000
Construction Subtotal:	$ 2,050,000	$2,875,000
Additional services (40% of subtotal)	$ 820,000	$1,150,000
TOTAL	$ 2,870,000	$4,025,000

It should be noted that this total assumes that DEP and MEPA will accept this report as a significant portion of the project's wastewater planning document and that limited additional wastewater planning will be required for MEPA approval.

It should also be noted that this total does not include land acquisition costs. It was assumed that three acres of land would be required for treatment facilities and subsurface disposal area. However, estimation of negotiated land acquisition costs at this point was not recommended

given the issues impacting future possible negotiations between the town and the potentially impacted property owner(s).

Operation and maintenance costs will be the responsibility of the users. Based on similar wastewater treatment facilities and collection systems in Massachusetts similar to the system identified above, it is estimated that the total annual operation and maintenance costs will be approximately $60,000 per year. These costs assume privatization of the wastewater treatment and collection system operation and maintenance. The costs also assume that state and local regulations apply.

Table 6-2 provides a cost comparison of on-lot repairs versus a decentralized treatment option for "Critical" and "Priority" properties in the Central area.

TABLE 6-2

COST COMPARISON OF ALTERNATIVES (One Time Capital Costs Only)

WASTEWATER MANAGEMENT NEEDS ASSESSMENT

Central Area	Number of Properties	On-lot Repair Costs	Cost Per Property	Decentralized Costs	Cost Per Property
"Critical" Properties Only	27	$2,400,000	$89,000	$2,870,000	$106,000
"Critical" & "Priority" Properties	56	$4,900,000	$88,000	$4,025,000*	$72,000

*Assumes adequate available land area for groundwater disposal and does not include land acquisition costs.

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APPENDIX A – I/A TECHNOLOGIES

1. *Recirculating Sand Filter*

A recirculating sand filter is an I/A treatment technology that consists of a septic tank, a recirculation tank and pump, a sand filter with underdrains, and a soil absorption system. This sand filter arrangement is a non-proprietary system. Effluent flows from the septic tank to the recirculation tank where it is pumped to the top of the filter and over the media. A portion of the flow is re-circulated back to the septic tank while the other portion flows to the SAS.

Advantages to this system include:

- Proven wastewater treatment technology dating back to the 1970's.
- Does not require a high level of technical skill to operate and maintain.
- Higher level of treatment, allowing for a reduction in SAS size and enhanced protection of the groundwater.
- Flexibility to reduce the level of nutrients to the SAS.

Some disadvantages to the system include:

- Higher level of maintenance required.
- Capital cost generally high.
- Solids removed from the septic tank periodically.
- Requires an electrical control panel for the recirculation pump.

2. *Amphidrome™ Process*

The Amphidrome process is a fixed media sequencing batch biological filter. The system combines filter technology with an equalization tank, a clear well and along with the other standard components of a septic system. Wastewater flows from the building to an equalization tank (Septic Tank) where it is mixed with recycle flow from the clearwell. Wastewater flows by gravity from the equalization tank through the biofilter to the clearwell. Wastewater is then pumped in reverse up through the biofilter to the

equalization tank. This batch of wastewater is recycled through the biofilter several times prior to discharge.

Some advantages of the Amphidrome treatment process include:

- Septage pumping requirements similar to a standard septic tank.
- Utilizes a technology with a proven history.
- Higher level of treatment, allowing for a reduction in SAS size and enhanced protection of the groundwater.

Some disadvantages include:

- Higher capital and operating costs than a standard septic system.
- High pumping requirements with internal recycles.
- Requires an electrical control panel for the recirculation pump.
- Equipment maintained periodically.
- May require a backup power source.

3. *Bioclere™ System*

The Bioclere system is a trickling filter and pump unit that is enclosed in one package. This process can be incorporated into a traditional septic system to provide a high degree of treatment. Effluent from the septic tank is pumped to a distributor which evenly spreads the wastewater over the top of the plastic media in the filter. Effluent is collected in the base of the filter and recirculated back to the septic tank or the distributor. A portion of the effluent is discharged to a SAS.

The unit is a self-contained tank with a filter, distributor and pump system. The type of process can be installed into an existing septic system process or incorporated into the design of a new system. The system is capable of handling flow variations with the ability to adjust the recirculation rates. This type of system can also be modified to provide nutrient removal.

Some advantages to the Bioclere system include:

- Lower operational and maintenance cost in comparison to other I/A systems.

- Septage pumping requirements similar to a standard septic system installation.
- A high degree of treatment, potentially minimizing the SAS size and enhanced groundwater protection.
- Operational flexibility to remove nutrients.

A list of the disadvantages include:

- Cost for the equipment and installation is higher than a typical septic system.
- Equipment maintained periodically.
- May require a backup power source.

4. *RUCK® System*

The RUCK system is designed to split the different types of wastewater from the house and treat it separately. Blackwater is the wastewater from toilets and sinks that have grinders on them. This water is sent to a septic tank and then passed through a filter system. The effluent from this filter system is then collected in a second septic tank. The greywater, discharge from showers and other sinks, passes directly to the second septic tank. From here the waste is disposed of through a traditional leaching system. The system needs approximately six (6) weeks to build up the biological mass to treat the wastewater effectively and continuous wastewater flow is necessary to maintain treatment. This type of system uses a very small pump, therefore, reducing the overall operational and maintenance cost.

Advantages to this system include:

- A lower capital cost than other I/A technologies.
- A higher level of treatment, is allowing for a reduction in SAS size and enhanced protection of the groundwater.
- Flexibility to reduce the level of nutrients to the SAS.

Some disadvantages to the system include:

- A higher level of maintenance.
- Needs continuous wastewater flow to achieve treatment.
- Solids removed from the septic tank periodically.

- Requires an electrical control panel for the recirculation pump.
- May be sensitive to cold temperatures.
- Equipment maintained periodically.
- May require a backup power source.
- Requires area for two septic tanks.
- Plumbing in the building separated to allow separation of black water from grey water.

5. *Fast® System*

The FAST (fixed activated sludge treatment) system is a submerged filter unit installed below ground. Wastewater enters the primary settling zone of the tank where heavy solids drop out. The flow is then recirculated through the FAST filter located at the back end of the tank. A fraction of the wastewater recycled through the system is discharged to the SAS. An enclosed above-ground chamber houses the blower used to supply air to the FAST filter.

Advantages of the FAST system include:

- Septage pumping requirements are typical to a standard septic system.
- All mechanical systems are located above ground for ease of maintenance and accessibility.
- The footprint of the system is similar to a septic system.

Some disadvantages of the FAST system include;

- High capital cost of the system.
- Blower system may produce unwanted levels of noise.
- Mechanical equipment needs maintenance and a backup power supply.

APPENDIX B - TREATMENT FACILITY ALTERNATIVES

1. Components of a Wastewater Treatment Facility

The following sections present the typical components of a wastewater treatment facility:

a. Preliminary Treatment

Preliminary treatment is utilized to remove large pieces of debris that may enter the collection system and also remove abrasive materials (grit) that may have an adverse affect on downstream pieces of equipment such as pumps and valves. Preliminary treatment includes screening or grinding of the wastewater followed by a means of grit removal.

b. Primary Treatment

Primary treatment is a process used to remove settleable solids from the wastewater. Primary treatment is not required for all wastewater treatment technologies. Typically, this process utilizes gravity settling to promote the removal of these solids. Primary treatment methods can be accomplished using constructed settling tanks with mechanical equipment to collect the solids at the bottom of the tank or a series of septic tanks that would be pumped out on a regular schedule.

The septic tank option is typically used in smaller flow applications (under 100,000 gpd) but could be utilized in series to provide adequate treatment in larger facilities. In a larger setting, they would require more frequent pumping but less maintenance.

c. Flow Equalization

Flow equalization is utilized to even out the hydraulic peaks at a treatment facility. Flow equalization utilizes a storage tank to retain high flows during the peak periods and discharge into the treatment process more evenly throughout the 24-hour period. Provisions for aeration and mixing may need to be considered for this process.

d. Secondary/Advanced Treatment

The secondary treatment process is typically designed as a biological treatment process to remove solids (characterized as total suspended solids, TSS) and organic matter (characterized as BOD_5). Advanced treatment processes are utilized to remove nutrients, such as nitrogen and phosphorus, which may be harmful to sensitive environmental resources.

Biological treatment typically uses microorganisms that will utilize the organic material in wastewater for an energy source to sustain life and promote cellular growth. An engineered biological system provides conditions to promote this utilization of organic material. These microorganisms are then removed from the process waste stream with a secondary clarification process.

Biological processes can be classified by the physical configurations used for promoting the microbial growth. The following are the three general types of biological treatment processes:

- *Attached Growth:* Attached growth processes utilize a fixed media of plastic, stone, sand or other material on which the microorganisms (biomass) can grow and multiply. The wastewater flows past and contacts the biomass on the fixed media. The biomass will then utilize the pollutants in the wastewater for growth. Attached growth processes include tricking filters, rotating biological contactors (RBCs), packed bed biofilters and fluidized beds. With most attached growth processes, secondary clarification is necessary to capture any biomass that sloughs off of the fixed media.

- *Suspended Growth:* Suspended growth processes are biological processes, which maintain a concentrated supply of microorganism suspended in the wastewater. This mixture of wastewater and biomass is called the mixed liquor. This process is accomplished aerobically; therefore, outside air is added. The added air serves two purposes. It provides microorganisms with their needed

supply of oxygen and also maintains the suspension of biomass. After this mixture is allowed a contact aperiod, the flow then passes through a clarification process. The solids generated in the process are returned to the mixed liquor for more pollutant uptake. Examples of a suspended growth process include conventional activated sludge and sequencing batch reactors (SBR's).

- *Combined Growth:* As the name indicates, the combined growth treatment process includes some attributes of suspended and fixed film systems. Typically, this type of system involves the addition of plastic media, or other fixed film material, into a suspended growth system, such as an activated sludge tank.

e. Sand Filtration

This step in the treatment process will most likely be required if the disposal of wastewater is to a subsurface disposal system within the project area. Groundwater disposal will most likely require the addition of filtration to the treatment facility. During this process, the wastewater is filtered through a sand media to remove smaller particles that have passed through the treatment process to this point. This process typical uses backwash pumps and an air scour system to clean the filter media periodically.

f. Disinfection

Disinfection requirements are based on the type of effluent disposal technique used. This step would be required for discharge to open sand beds, but would not be required for subsurface discharges. In the past, chlorine was used as the primary method for disinfecting the wastewater. More recently, ultraviolet radiation (UV) has been utilized because of the concern with chlorine toxicity and the by-products formed during this chemical reaction.

2. Secondary/Advanced Treatment System Alternatives

The following descriptions identify several different secondary treatment processes, which are currently utilized by municipalities for the treatment of wastewater in the project's design flow range.

a. Aerated Lagoons

Aerated lagoons are a tried and true method for the secondary treatment of wastewater. Aerated lagoons evolved from the facultative stabilization ponds when surface aerators were installed to eliminate odors from the organically overloaded ponds. The aerated lagoon process is very similar to the conventional extended activated sludge process except that earthen basins are utilized as opposed to concrete tankage. The typical detention time in this type of system is above 20 days.

These aerated lagoon use surface aerators to supply oxygen supporting the biological decay of material. Usually, these lagoons are followed by a settling process to separate the liquid and the solids. This process does not have a lot of flexibility to meet stringent permit limitation and nutrient removal requirements and is typically found in rural areas where site constraints and abutters are not prevalent.

b. Conventional Activated Sludge

In the conventional activated sludge (CAS) process, treatment is accomplished using microorganisms in suspension (suspended growth process). The process usually consists of a rectangular shaped aeration tank and a final clarifier, which separates out the biomass for either wasting or recycling back to the aeration tanks. An aerobic environment is maintained in the reactor tanks by means of diffused or mechanical aerators. These aerators maintain an oxygen level in the

water allowing the biomass to degrade the waste constituents, as well as provide mixing within the tanks.

The activated sludge process can be modified to increase the removal of nitrogen and phosphorus using selector zones and wastewater recycle within the reactor tanks.

Some advantages to a CAS include:

- Relatively low capital and operational costs
- May not need a primary treatment process.
- Effective for nutrient removal.
- Flexible in operational and process control.

Some of the disadvantages include:

- Requires skilled operators.
- Higher-energy costs.
- High process control requirements to optimize the treatment efficiency.

c. Sequencing Batch Reactors

Sequencing batch reactors (SBRs) are a modification of the conventional activated sludge process (suspended growth). As the name implies, SBRs are a batch process incorporating the reactor and settling tanks into one. The different cycles of the SBR process include: fill, react-fill, react, settle, and decant. The timing of the cycles can be altered to optimize the process for nutrient removal or more efficient BOD/TSS removals. Wastewater enters the basin during the fill and react-fill cycles. Aeration is provided during the react-fill and react cycles. The aeration can be cycled during these phases to promote nutrient removal. All mechanical equipment is shut off during the settle phase allowing the solids to collect at the bottom of the basin. Clarified liquid is pulled off the top of the basin during the decant cycle.

Advantages to the SBR system include:

- Ideal settling conditions.
- Small land area requirements.
- Highly flexible for nutrient removal.
- Flexibility to achieve high levels of treatment.

Disadvantages of an SBR system include:

- Process reliability on computer controls.
- Overall reactor size slightly larger than an aeration tank of a conventional system, but overall footprint smaller due to the elimination of secondary clarifiers.

d. Rotating Biological Contactors

Rotating biological contactors (RBCs) are a fixed film process. Large plastic disks are mounted on rotating shafts that are half submerged in wastewater. As the disks rotate through the wastewater, the biomass on the plastic disks utilizes the waste constituents for growth. As the disk rotates above the wastewater, oxygen is utilized by the bacteria. Periodically, the biomass builds up to a point where it sloughs off and is captured in the secondary settling tanks.

RBCs can be used for nitrogen removal, however, phosphorus removal is limited in this type of system. Some advantages to the RBC system include: low energy requirements, low operational requirements, and an established process for standard levels of treatment. The disadvantages to the RBC system include: the need for primary treatment, high capital cost, cold weather performance necessitates covers, and minimal process control and flexibility.

e. Membrane Technology

The membrane technology process is a modified activated sludge process contained in a baffled reactor tank. This technology is relatively new (within the last 10 years), but provides a very high level of treatment. The typical process

MBR

flow configuration conveys wastewater into the first, anoxic chamber where nitrogen removal can occur. The liquid then flows to aerobic chambers where the organic material is utilized as in a typical activated sludge process. Effluent from this chamber is removed through a polymer membrane filter system. This filtration process is capable of eliminating organic matter, bacteria and viruses from the effluent. This treated effluent can now be discharged without further treatment to a groundwater discharge system.

The advantages to membrane technologies include:

- High level of treatment achieved by the treatment process.
- Use of low-tech technologies for operational control.
- Smaller site requirements.

The disadvantages include:

- Higher capital and operating cost in comparison to other technologies.
- Technology does not have a significant history.

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APPENDIX C - INSTITUTIONAL ISSUES

Should the town decide to proceed with the implementation of a limited sewer system and treatment facility to serve the needs area described in Section 6, certain actions must be taken. These actions include a feasibility study, a public participation program, providing finance for the construction of the recommended plan, and taking other administrative, legislative, legal, and political steps to assure the viability of the plan.

Feasibility Study/EIR

Although it is assumed that DEP and MEPA will accept this report as a significant portion of the project's wastewater planning document, additional wastewater planning for MEPA approval will be necessary. Further evaluation of the recommended alternatives will be needed to determine the feasibility of the recommended plan. This would include discussions with DEP and MEPA officials and field tests to evaluate the practicability of siting treatment facilities and groundwater discharge sites. The field tests of the recommended effluent disposal sites would constitute preliminary hydrogeological investigation. If warranted, DEP may require a more detailed hydrogeological study of the final effluent disposal site.

Institutional Organization

Should the town decide to proceed with the implementation of a limited sewer system and treatment facility as described in Section 6, the town will need to implement institutional procedures and programs to operate and maintain the completed infrastructure.

Management

A management entity must be established to fulfill administrative responsibilities and management tasks. The administrative responsibilities include: create an overall wastewater policy and plan for the sewer area, seek necessary approvals, pursue funding opportunities, obtain property rights, secure necessary professional services contracts, implementing its plan and providing related services. The management tasks involve overseeing the actual wastewater treatment facility operations. This entity could be a town department or quasi town department.

Bylaws

A series of bylaws would be developed and approved by Town Meeting vote to establish a framework for rules and regulations that would be prepared and approved by the Board of Selectmen. Some of the bylaws are discussed below.

1. Sewer Betterment Assessment Bylaw

   Massachusetts General Laws (MGL) Chapter 83, "Sewers, Drains and Sidewalks," governs the methods governing the assessment of sewer betterments. Assessments are made by a fixed uniform rate or a rate based upon a uniform unit method as outlined in Chapter 83, Section 15, which states:

   > "A fixed rate shall be...according to the frontage of such land on any way in which a sewer is constructed, or according to the area of such land within a fixed depth from such way,...or according to both such frontage and area... A uniform unit method shall be based upon sewerage construction costs divided among the total number of existing and potential sewer units to be served..."

   Chapter 83, Section 15 goes on to define "sewer units" as follows: "Each sewer unit shall be equal to a single family residence. Potential sewer units shall be calculated on the basis of zoning then in effect. Existing and potential multifamily, commercial, industrial and semi-public uses shall be converted into sewer units on the basis of residential equivalents."

   Usually, the sewer betterment assessment is due once the completed sewer is approved for use, but some communities have assessed sewer betterments before construction is complete. The town can assess a portion of the cost as an "estimated assessment" under Chapter 83, Section 24 of the General Laws. Some communities use this method of early payments when cash flow is an issue. However, with a betterment assessment based on actual construction cost, it would not be appropriate to assess the betterment until construction is complete (or nearly).

The town can require that each business fronted by the sewer be required to connect to the sewer within a specific time frame. This would assure that every business that was included in the design actually participates.

There are large water users in the project area that could be hit by a $250,000 to $500,000 capital expense to replace their existing on-site septic system. It could be said that these businesses would benefit disproportionately to smaller businesses in the project area by being included in a sewer system. There have been instances in communities where classes of users have paid a disproportionate share of sewer assessments, but the legality of assessing different classes of users on a different basis has not been tested or validated by the MA Department of Revenue.

2. Delineation of Sewer Service Area

A sewer service area can be established through a general bylaw to define the area and confine sewer service to properties within that area. The bylaw requires a majority vote at town meeting.

3. Sewer User Charge System

The user charge system must be established pursuant to Chapter 83, Section 16 of the MGL. Since all properties connected to the town's drinking water supply system are currently metered, the meter readings could be used as a basis for assessing sewer user charges. The Board of Selectmen or Sewer District could set the charge per 1000 gallons or per 100 cubic feet for sewer service annually. The rate and revenues collected should be set at a rate sufficient to cover all costs of labor, materials, fuel, maintenance, influent/effluent quality monitoring, and all other costs associated with operation and maintenance of the collection and treatment system.

Those users that use large quantities of water, but do not have proportional quantities of wastewater, could have a separate meter for water not discharging to the sewer system. Every user whose property is connected to the public sewer would pay an annual charge in proportion to the volume of wastewater (and possibly the waste strength) contributed

to the sewer system. If possible, the rate should be structured to encourage water conservation.

4. Sewer System Extension Control Bylaw

   The town may wish to take additional steps both within the sewer service area bylaw and through other means to control sewer system extensions and connections beyond the properties recommended to be served. Possible steps available to the town with the bylaw include:

   - Cost recovery programs for future sewer extensions and/or increased use of connected properties.
   - Provisions for extending sewer service to nearby properties with failed septic systems, including requirements for town meeting action.
   - Establishing requirements of a "super majority" or two-thirds vote at town meeting to extend the limits of the sewer service area.

   It may also be possible for the town, through a home-rule petition, to request that the General Court pass a special act to assure unilateral enforcement of and the legality of the sewer service area bylaw.

   Furthermore, existing bylaws may require amending. For instance, the zoning bylaw, Article IX.V, Section 4500, currently restricts wastewater treatment facilities from operating in areas favorable for potable water supply development. Sites selected in this assessment are in a moderately favorable area.

Finance

There are various sources of income available for capital expenses. Some of the common methods for funding a wastewater project are state or federal public grants or loans, local bonds, private loans, betterments, surplus cash, and tax revenues.

Some common sources of income for operational and administrative expenses are sewer user fees, development fees, special tax assessments, and tax revenues.

One widely used state/federal loan program is the state revolving fund program (SRF). The SRF makes loans to local governmental units that are financing the costs of planning or construction of water pollution abatement projects. The program provides below market interest rate loans to eligible governmental units.

An application must be submitted to and approved by DEP. Eligibility does not necessarily mean that the project will be funded. DEP will score the submission based on a set of established criteria. The score the project receives will allow DEP to establish the projects rank amongst other projects' submissions.

SRF Planning Stage

The application for a planning project requires: authority to file, local appropriation, a plan of study, MEPA compliance, Massachusetts Historical Commission approval, and draft agreements for all professional services with detailed fee breakdown. The local appropriation must demonstrate that sufficient funds are available to cover the eligible and ineligible project costs.

SRF Construction Stage

At the construction stage of the project, the SRF application requires: authority to file, local appropriation, design plans and specifications, a detailed project schedule, engineer's estimate of construction costs, documentation certifying ownership or easement rights for all necessary properties, DEP's approval of the wastewater management plan, demonstration that project is consistent with existing water resource and wastewater planning requirements, an established user charge system, a sewer use ordinance, federal and/or state wastewater discharge permits, a site hearing if site not previously used as a wastewater treatment plant facility, construction permits, certificates and licenses, MEPA compliance, flood insurance participation, MHC approval, special legislation, draft professional services agreements and detailed fee breakdowns, provisions of operation and maintenance program, and a plan of operation.

Regulatory Considerations

The town of Sudbury has legislation that affects wastewater treatment facilities within the town. The regulation of Small Sewage Treatment Facilities (SSTF) prohibits: privately-owned sewage treatment facilities designed for more than 40,000 gpd, SSTFs located in Zone II, an SSTF from

receiving sewage from any facility on a different lot, and components constructed less than 2 feet above high water level in a flood plain.

The SSTF regulation also requires a five-foot separation distance between the maximum elevation of the groundwater level and the bottom of the leach area. This separation distance includes the effects of groundwater mounding predictions from effluent disposal.

The SSTF regulation requires designs for denitrification of the effluent's total nitrogen as nitrogen content to be 5 milligrams per liter or less. Clorination is prohibited as a method of disinfection. Furthermore, the regulation requires a reserve leach area equal to 200% of the primary leach area and strict disposal setbacks.

In 1988, the town voted to amend their bylaws with regard to wastewater treatment facilities. The amendment requires SSTFs within areas designated as "Wastewater Treatment Facility Restricted Zones" to obtain a special permit from the Planning Board, but it further states no wastewater treatment facility with a design discharge in excess of 20,000 gpd shall be permitted or any WWTF operating within a 1/2-mile of any other WWTF's discharge point if within the same drainage area.

For this project to move forward to the next stage, it is recommended that the above-referenced local by-laws be considered relative to the recommended plan outlined in Section 6.

The following list contains important state and federal regulations that must be considered to implement the recommended plan.

MASSACHUSETTS PROGRAMS & LEGISLATION	REGULATIONS
Inland Wetlands Restriction Act	MGL Ch. 131 § 40A
Massachusetts Clean Act	MGL Ch. 131 §§ 42A-142J
Massachusetts Clean Waters Act	MGL Ch. 21 § 26-56 and 314 CMR § 1.00 *et seq.* § 4.06; 314 CMR § 3.00, 4.00 *et seq.* and 7.00; 314 CMR § 1.00 *et seq.* § 4.06;
Massachusetts Environmental Policy Act (MEPA)	MGL Ch. 30 § 61-62H & 301 CMR 11-12
Massachusetts Hazardous Waste Management Act	MGL Ch. 21C § 4 and

	310 CMR 30.00 *et seq.* § 106
Massachusetts Historic Commissions	MGL Ch. 9, § 26-27C
Massachusetts Natural Heritage and Endangered Species Act	321 CMR 10.00 *et seq.*
Massachusetts Wetlands Protection Act	MGL Ch. 131 § 40-40A
Title 5 (Minimum Requirements for the Subsurface Disposal of Sanitary Sewage)	MGL Ch. 111 § 31 and 310 CMR 15.00

FEDERAL PROGRAMS & LEGISLATION	REGULATIONS
Endangered Species Act (ESA)	16 U.S.C. 1531 *et seq*
Federal Emergency Management Agency (FEMA)	
Federal Water Pollution Control Act	
Clean Water Act	33 U.S.C. 1251 *et seq.*
National Pollutant Discharge Elimination System (NPDES)	40 CFR 122
Water Quality Act of 1987	
U. S. Army Corps of Engineers Fill Permits	P.L. 92-500 § 404
National Environmental Policy Act	42 U.S.C. 4321 *et seq.*
Resource Conservation and Recovery Act (RCRA)	42 U.S.C. 6901
Safe Drinking Water Act (SDWA) of 1974	42 U.S.C. 300(f) *et seq.*

Private Ownership

Should the town elect not to proceed with public ownership of a limited sewer system and treatment facility to serve the needs area, the businesses could form an alliance for private ownership of a system. However, DEP prefers public ownership over private ownership in a multi-party system. A private ownership would need to prove to DEP that sufficient operational and financial responsibility were in place. DEP presently requires that a private entity be identical to its users, and they are fully accountable and own the land on which the treatment facility is sited. The private entity would also be required to have reserved funds for future capital expenses and emergencies.

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