Report

Town of Sudbury

Project Evaluation Report

June 2012
(Town Revisions incorporated June 2013)

Prepared for:
Town of Sudbury
Planning & Community Development
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EXECUTIVE SUMMARY

The Town of Sudbury has been investigating wastewater options for the Route 20 business district for approximately the past 20 years. To find the best solutions to Sudbury's wastewater management challenges, the following principles were emphasized throughout the planning process:

- Detailed Review of wastewater needs information.
- Thorough and thoughtful review of appropriate alternatives.
- Recognition of the importance of maintaining or enhancing local water balance.
- Selection of recommended plan based upon documented need.
- Broad-based public participation and stakeholder involvement.

Over the last 10 years, the framework for the development of a viable wastewater solution to satisfy the needs of the Route 20 business district has been set. As part of that effort, the wastewater needs of those properties within the Route 20 business district have been assessed, future wastewater flows have been estimated, potential treatment and disposal sites have been identified, hydrogeological site evaluations have been completed, and wastewater treatment and disposal alternatives have been examined, as described in more detail herein.

Evaluating Needs and Alternatives

In 1995, the Town completed an initial study assessing the need for alternative wastewater disposal options other than the current method of individual on-site disposal systems. The Town of Sudbury retained Weston & Sampson in May of 2000 to assist with a wastewater needs assessment, which substantiated the concern that septic systems are a limiting factor in the economic development of existing businesses along the Route 20 corridor. The Town's drinking water supply is, located in close proximity to the Route 20 business district, was also at risk due to malfunctioning septic systems.

Areas within the Route 20 business district with challenges to using on-site wastewater treatment and disposal systems were identified. Factors such as system age, system condition, soil conditions, groundwater levels, lot size, and environmental concerns were considered. Through this assessment, the West and Central areas were found to have more properties with greater need than the East area.

Potential long-term wastewater management alternatives for the properties identified were then evaluated. The alternatives investigated include: 1) Title 5 repairs/upgrades, including innovative/alternative (I/A) technologies; 2) shared septic systems; 3) decentralized wastewater collection, treatment, and disposal; and 4) regional solutions. After screening the investigated alternatives, the best alternative identified was a decentralized wastewater treatment system, and a more in depth hydrogeologic investigation was completed to further evaluate potential groundwater discharge sites. The Curtis Middle School was identified as the site most suitable for the development of a large-scale soil absorption system.

The final step included finalizing alternatives for wastewater management in the Route 20 business district by assessing environmental impacts, developing a recommended plan (including design and construction schedules), analyzing project costs, cost allocations and financing, and arranging for project implementation.

The Recommended Plan

The Recommended Plan for wastewater management in the Route 20 business district includes the following components:

- Construction of a decentralized wastewater treatment system for between 208,500 and 268,400 gpd.
- Gravity-collected wastewater flows from the Central Area collected at a pump station located on Route 20 in the vicinity of Nobscot Road and transmitted to the proposed wastewater treatment facility by force main.
- Pressure sewers and individual grinder pumps to serve all properties located in the West Area.
- A Wastewater Treatment Facility located on town property at 641 Boston Post Road (Parcel K06-505) consisting of a 1.6 acre parcel located away from developed residential areas and with no current structures.
- A membrane bioreactor (MBR) process with a denitrification sand filter for wastewater treatment, allowing the treated effluent to be discharged without further treatment to an effluent disposal system.
- A 1.7 mile force main, beginning at the wastewater treatment facility, following along Horse Pond Road, and discharging onto the Curtis Middle School athletic fields.
- Continued reliance of the East Area on on-site systems, with each individual property owner responsible for septic system repairs in accordance with Title 5.

More detail on the Recommended Plan is included in Section 8 of the PER. A map showing the areas served by the recommended plan is included as Figure 8.1.

The Recommended Plan is necessary and appropriate for the Route 20 business district because:

- It addresses the needs of most of the lots identified as having a significant need for an off-site wastewater solution.
- It protects the public health and the environment by addressing problem systems in sensitive areas.
- It specifically protects water resources (both ground and surface water), from a quantity and quality standpoint
- It balances affordability, feasibility and local interests.

Impacts and Mitigation

The Recommended Plan has been evaluated for its expected environmental impacts. The effects of the recommended sewer installation program will have some short-term construction related impacts, but will result in significant long-term benefits to the community, as identified above.

The proposed project falls under the following MEPA review thresholds: construction of a new wastewater treatment facility and/or disposal facility with a capacity of 100,000 gallons per day (gpd) or more; construction of one or more new sewer mains that are five or more miles in length; and new discharge to groundwater of 50,000 gpd or more of sewage. Therefore, an expanded Environmental Notification Form (ENF) and potentialy a single Environmental Impact Report (EIR) will be required.

Cost of the Recommended Plan

The total cost of the recommended plan is estimated at $15 million. This includes design, permitting and construction. It is recommended that this total be paid through the use of a combination of state and local funds. It is assumed that available state funding for the construction portion of the project, which is estimated at $14 million, will be in the form of a two-percent (2%) interest rate State Revolving Fund (SRF) Loan. Local funds to finance the project will include a combination of funds raised through taxation and through betterment assessments for sewered properties. Sewer rates (i.e. user charges) should only be used for operation and maintenance of the completed system.

Public Participation

Extensive public participation efforts were made throughout the wastewater planning process. The process was designed to involve business owners within the Route 20 business district. The public participation process has included:

- Establishing the Technical Advisory Committee (TAC), which has met regularly throughout the planning process.
- Publishing various articles in the Sudbury Town Crier, the Metro West Daily News and the Sudbury Patch discussing the project.
- Development of a list of Frequently Asked Questions regarding the proposed project.
- Sending letters to area businesses and holding a meeting with the Chamber of Commerce to discuss the proposed project.
- Presenting the project at Town Meeting.
- Holding a panel discussion/public meeting with residents and business owners to answer questions about the project.
- Posting of all of the above information on the Town's website for public access.

Next Steps

Although the appropriation of monies for the design and permitting of the WWTF and associated collection system were approved with a two-thirds majority vote at the 2011 Town Meeting, the ballot vote held on June 7, 2011 as part of the Special Election was defeated.

The Board of Selectmen has since re-established the Citizens Advisory Committee and established a Sewer Steering Committee. Their purpose is to provide an avenue for public involvement in the planning process, and to provide guidance and coordination to all committees and groups working on the wastewater management planning process.

Once the project is approved, the next step is the filing of an Environmental Notification Form and if required, a single Environmental Impact Report for the project.

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1.0 BACKGROUND

1.1 Project Purpose

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 finding it increasingly difficult to treat and dispose 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 are 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 appeared 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 residential growth the Town has seen over the last two decades with an economically viable commercial sector. The purpose of this project is to continue the town's ongoing efforts to assess the wastewater management needs for the Route 20 Business District and to identify a feasible alternative to individual septic systems within the district or portions thereof.

1.2 Prior Planning Efforts

The Town of Sudbury has been investigating wastewater options for the Route 20 business district for approximately the past 20 years. In 1995, the Town completed an initial study, as referenced in Section 1.1, which assessed the need for alternative wastewater disposal options other than the current method of individual on-site disposal systems. 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. In 1999, at Town Meeting, funds were appropriated for the completion of a wastewater needs assessment, and the town retained Weston & Sampson in May of 2000 to assist with this assessment. The needs assessment, completed in June of 2001 and entitled "Assessment of Wastewater Management Needs for the Route 20 Business District", substantiated the concern that septic systems are a limiting factor in the economic development of existing businesses along the Route 20 corridor. It also provided a preliminary evaluation of alternatives for wastewater treatment and disposal within the Rte. 20 corridor. The results and recommendations from that assessment have been incorporated herein and expanded upon as needed to reflect the current needs of the Route 20 business district. During this same time period, the Metropolitan Area Planning Council (MAPC) completed a build-out analysis for Sudbury, which identified the amount of growth that the town could experience under their current zoning standards.

In December 2001, reps of the Town and Weston & Sampson met with the Department of Environmental Protection (DEP) to discuss their comments on the June 2001 Needs Assessment. Before this meeting, it was determined that the next major step in the planning process would be to submit a Project Evaluation Report (PER) to the DEP. At that meeting, DEP requested that the Town submit a scope of services for the PER for approval prior to commencing work on this task. Before starting work on the PER, the Town's next step was to find a viable site with adequate capacity for groundwater discharge. Based on the June 2001 Needs Assessment, the site needed to be able to handle at least 100,000 gpd of treated effluent.

In 2002, the Town researched each of the eight (8) potential disposal sites identified in the 2001 Needs Assessment. Based on the research conducted, Weston & Sampson recommended that the Town perform limited hydrogeological investigations at three of the sites to supplement existing information. Between 2002 and 2004, the Town screened 86 potential sites. In June 2004, Schofield Brothers performed a preliminary evaluation of vacant land at the Town-owned DPW parcel to assess its potential for disposal of at least 100,000 gpd of treated wastewater effluent.

In June 2007, Weston & Sampson and the Town drafted a Scope of Services for the Project Evaluation Report (PER) in an attempt to move the project forward. This scope was submitted to DEP for review and approval. At the same time, the Needs Assessment was updated as well as the available information on potential disposal sites. In March 2008, Weston & Sampson put together a memo discussing the possible options and associated preliminary costs for the Town of Sudbury to provide wastewater service to the Route 20 Business District.

In February 2010, Weston & Sampson completed an assessment of three different sites in Sudbury to evaluate their potential for subsurface disposal of treated wastewater effluent (Haskell Field, Curtis Middle School, 293/301 Old Lancaster Road). A test boring and monitoring well program was conducted at each site. A viable groundwater discharge site was identified at the Curtis Middle School thereby moving the project forward. In August 2010, Weston & Sampson prepared a Wastewater Management Plan Update. This document provided an overview of the wastewater planning efforts performed to date, as well as the current status of the process and the next critical steps. This timeline of events brings us to the current project, which includes preparation of this Project Evaluation Report.

1.3 Scope of Work

The specific scope of work to be completed as part of this PER was developed by Weston & Sampson and a Sewer Assessment Technical Advisory Committee (TAC) for the Town of Sudbury. The draft scope, which was presented to DEP for review and comment, includes:

- Update of the needs-analysis matrix, incorporation of residential and other properties as identified by the TAC into the matrix, and reassessment of the 2001 needs area evaluation to reflect any changes in Board of Health and Town data.
- Update of existing and future wastewater flows using water use data, current Title 5 flows, and updated build-out data.
- Evaluation of alternatives and potential sites for the disposal and treatment of wastewater for the study area, including the identification and assessment of both short-term and long-term environmental impacts.
- Hydrogeologic assessment of potential sites for effluent disposal to evaluate their suitability for groundwater discharge.
- Development of a preliminary design layout for the recommended collection, treatment and disposal system, including development of a preliminary cost estimate for the design, construction and the operation & maintenance of the proposed system.
- Evaluation of financing alternatives for the recommended plan including the use of State Revolving Fund (SRF) Loan Assistance along with different combinations of betterments and taxes for SRF loan repayment.
- Identification of regulatory issues associated with implementation of the recommended plan including the requirements of the Massachusetts Environmental Policy Act (MEPA), as well as legal/institutional changes required for implementation of the proposed alternative.
- Report preparation including submission of a draft Project Evaluation Report for review by the TAC, as well as attendance at a public hearing and public meeting to solicit comments on the recommended plan, including the estimated cost and proposed financing plan.

In addition to those items outlined above, this PER also includes findings from prior planning efforts, covering the time period from the 2001 Needs Analysis to the 2010 Wastewater Management Plan Update, as identified in Section 1.2.

2.0 ASSESSMENT OF GENERAL CONDITIONS

2.1 Planning Area Description

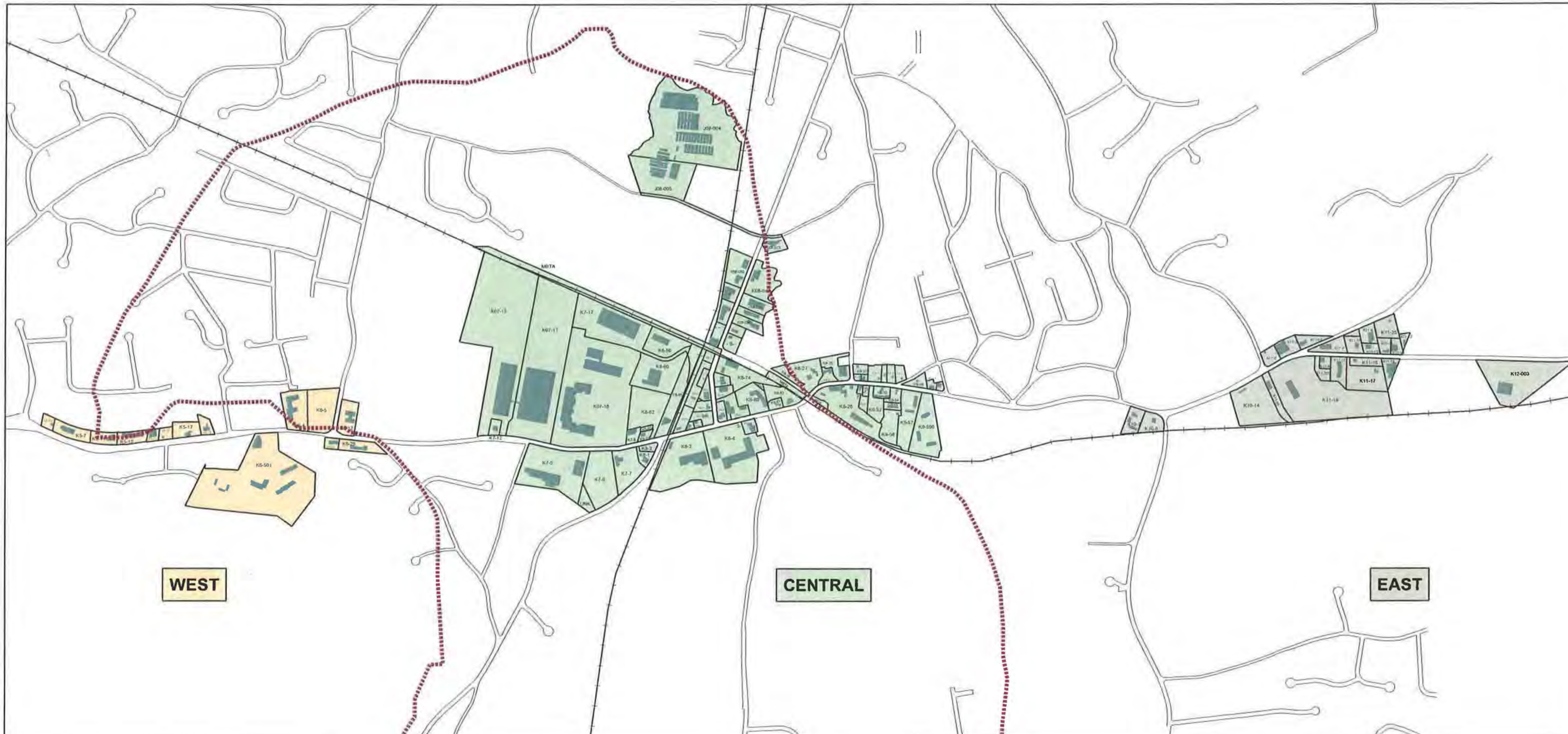
The Town of Sudbury, Massachusetts, is a suburban community, located in Middlesex County. It is bordered on the north by Maynard and Concord, the east by Lincoln and Wayland, the south by Framingham, and the west by Stow, Hudson and Marlborough. It is divided by Route 20 and Route 117 running east to 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 initially 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." The initial planning area, which included 103 non-residential parcels, has been identified on Figure 2-1. As discussed in subsequent chapters herein, the definition and limits of the planning area evolved slightly over time.

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 Patti Brothers Lighting on Boston Post Road and continues to the Wayland town line.

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 of this report.



Weston & Sampson
ENGINEERS, INC.

Legend

- DEP Approved Zone II
- Central
- East
- West

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1,200 0 1,200
SCALE IN FEET

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

PLANNING AREA

April 2001
Weston & Sampson Engineers, Inc

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. 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.

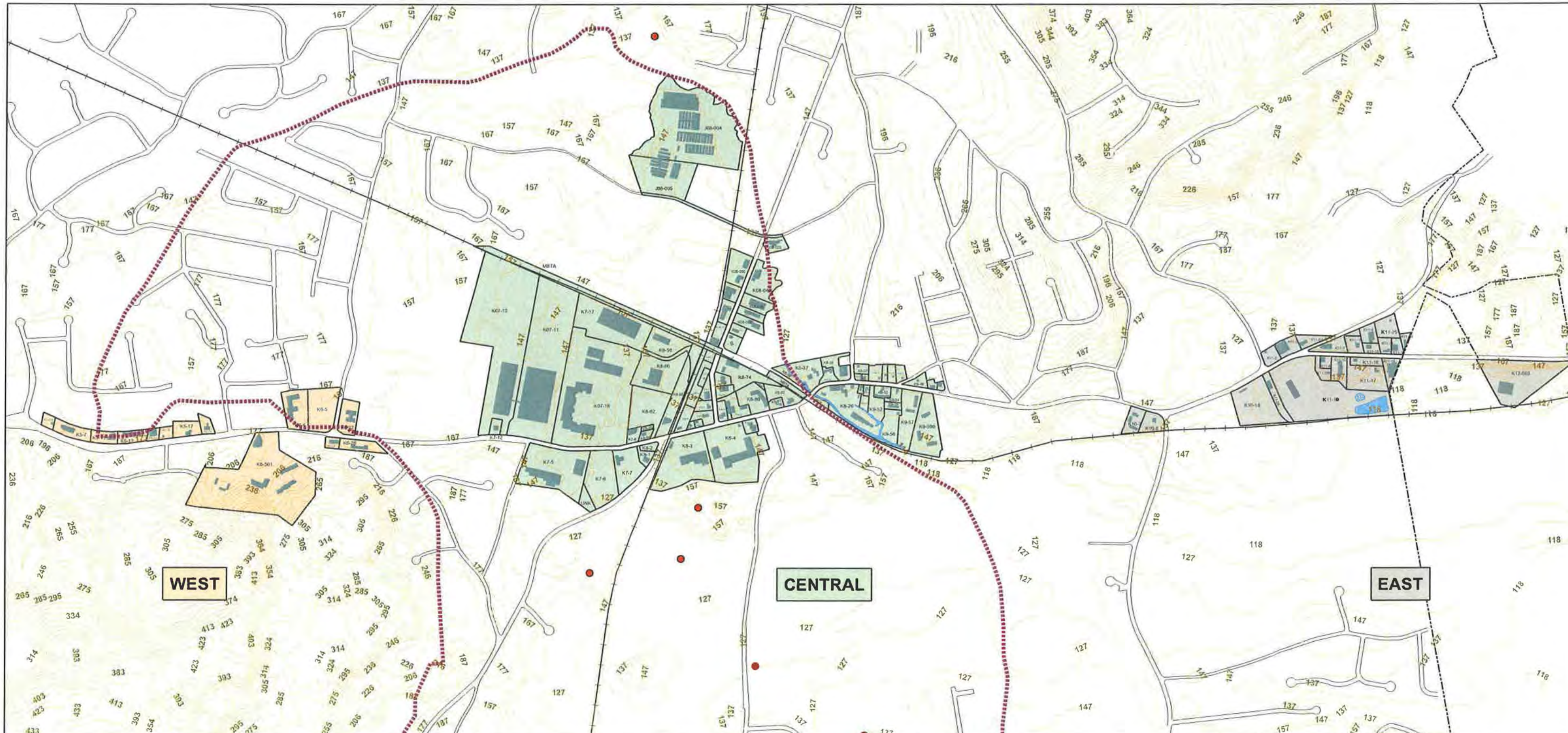
2.1.3 Watershed

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.

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.



Legend

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

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SCALE IN FEET

Weston & Sampson
ENGINEERS, INC.

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

AREA TOPOGRAPHY

April 2001
Weston & Sampson Engineers, Inc

2.2.1 Land Use

The Route 20 business district is approximately a five-mile corridor. The corridor consists primarily of businesses, with some residences interspersed. The project area includes single and 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 2001 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 surge in residential growth over the last two decades with an economically viable commercial sector. However, wastewater constraints (physical, financial and regulatory) limit expansion of some commercial properties. Growing the commercial sector along the Route 20 business district has become increasingly more difficult.

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 previously presented. 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 list below provides the vacant lots and associated area within the Route 20 business district:

Lot Number	Street	Lot Area [Acres]
K06-005	Boston Post Road	4.05 (next to Sudbury Pines)
K08-057	Union Avenue	1.02
K08-062	480 Boston Post Road	4.69 (restricted)
K08-073	Union Avenue	0.42
K11-024	Boston Post Road	0.10 (Outside the sewer district)
K11-050	Old County Road	0.63 (Outside the sewer district)
K08-055	Union Avenue	21.00 (Primarily wetlands)
K08-002	Route 20 & Nobscot	0.35

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 also 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 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, pathogens, 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 along Route 20 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 Hop Brook.

2.3.5 Rare Species and Sensitive Habitats

Rare species and sensitive habitats within the project area were identified and mapped in the 13th Edition of the Massachusetts Natural Heritage & Endangered Species Program Atlas, and were effective beginning October 1, 2008. 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 Central area. The West and East areas have 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 down 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 leaching area. Sudbury Coffee Works (15 Union Avenue), the Post Office (18 Union Avenue), Sudbury Pines Nursing Home (642 Boston Post Road), Best Friends Pet Kennel (150 Boston Post Road), Sudbury Farms including Friendly's (439, 447, 457 Boston Post Road), 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 (I/A) system can allow up to a 50% reduction in leach area or 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. However, this system is located within a Zone II Wellhead Protection Area and will likely require upgrades for advanced nitrogen removal. This alternative is discussed in greater detail later in this report.

At the time this document was completed, the Longfellow Glenn Property (K06-501) was in the process of installing a membrane bioreactor (MBR) wastewater treatment facility to treat 32,000 gpd.

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.

3.0 WASTEWATER NEEDS ANALYSIS

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. Information provided by the Town, including the Town's BOH agent, were 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.
- **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

TABLE 3-1
WASTEWATER NEEDS MATRIX

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	Built Between 1978-1995 Codes	Required Leach Field Repair	Insufficient land area for Repair or Expansion	Disposal > 10,000 gpd without GW Discharge Permit	Severe Soil Restrictions	Depth To Groundwater (< 5')	Setback for Resource Area or within Floodplain	Frequency Of Pumping (>2/yr)	Within Nitrogen Sensitive Area	Nitrogen Sensitive Area with >440 gpd per acre	Total
				(4 pts)	(3 pts)	(4 pts)	(4 pts)	(4 pts)	(2 pts)	(2 pts)	(2 pts)	(2 pts)	(2 pts)	(2 pts)	
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.

records indicate that the septic system was built before the 1978 code was enacted. This category inherently targets systems older than 34 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.

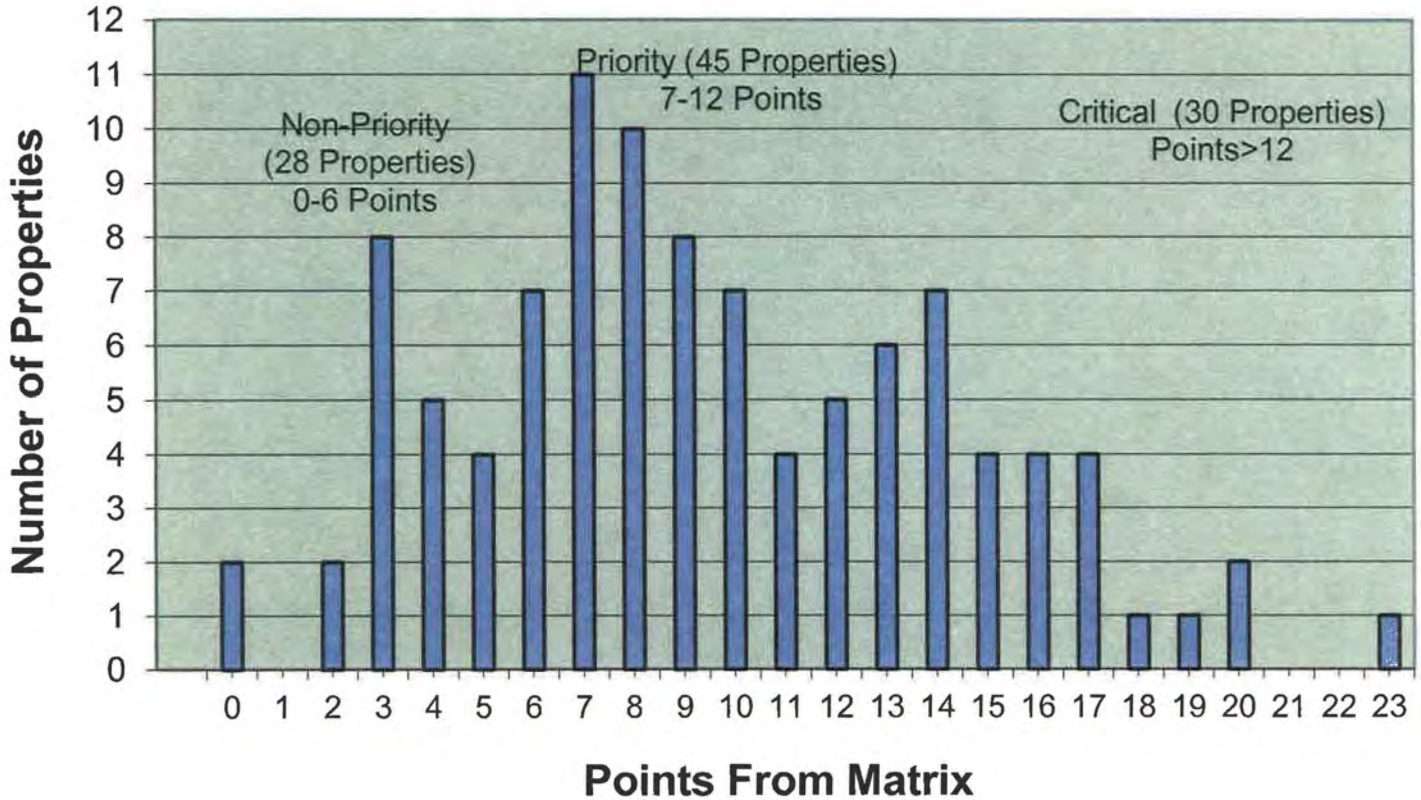
3.2 Matrix Scoring Distribution

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 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%).

Figure 3-1
Point Rating Histograph



3.3 Matrix Results and Conclusions

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.

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 Sudbury Pines Nursing Home was operating without a groundwater discharge permit even though flows (based on current Title 5) require one (see Section 3.4 for further discussion).

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 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 was in discussions to work out their wastewater disposal problems by utilizing a neighbor's land (See Section 3.4 for further discussion). 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 "Priority" and "Critical Properties" added together. The most recurring problems within the East area are depth to groundwater and age of systems.

Weston & Sampson ENGINEERS, INC.

Legend

- Zone II Aquifer Zone
- Building Footprint
- Property Points That Totaled 0-6 Points
- Property Points That Totaled 7-12 Points
- Property Points That Totaled 13 + Points

N W E S

1,200 0 1,200

SCALE IN FEET

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

PARCEL RANKING

April 2001
Weston & Sampson Engineers, Inc

3.4 2011 Matrix Updates

Since the Needs Analysis was completed in 2001 (as described in Sections 3.1 through 3.3 above), the level of need associated with some properties has changed. Weston & Sampson has met with the Board of Health periodically since 2001 to update matrix information including Title 5 failures, system repairs, variances granted and I/A systems that have been installed since 2001. Parcels for which matrix information has changed are identified below along with any change in level of need.

- Town Line Hardware (#84 BP) – Title 5 failure, not upgraded yet. (Increased from 8 to 12 points - Remains a "Priority" Property)
- Stanmar (#128 BP) – use change. Is a BMW dealership. Installing new Title 5 system. (Reduced from 5 to 2 points - Remains a "Non-Priority" Property)
- Buddy Dog (#151 BP) - issued a permit to replace the entire septic system including the addition of a MicroFAST 3.0 unit. (Reduced from 14 to 10 points – Changed from a "Critical" Property to a "Priority" Property)
- Day Care Facility (#307 BP) – failing leach area replaced 12/08 with design flow of 3,127 gpd. (not included on original matrix – system updated – "Non-Priority" Property)
- Bearly Red Books (#320-324 BP) – failed leach area replaced and 400 gallon tight tank installed 6/08; Spend $800/yr on pumping. (Reduced from 10 to 8 points - Remains a "Priority" Property)
- Office – Mill Brook II (#321-325 BP) – 3 septic tanks & leach fields replaced 8/09 with design flows of 703 gpd, 889 gpd, and 680 gpd. (Reduced from 7 to 4 points - Changed from a "Priority" to a "Non-Priority" Property)
- Mill Village (#361-389 BP) – Of the 4 disposal fields, one is in failure. They are pumping more than twice per year. (No change in points - Remains a "Critical" Property)
- Lotus Blossom (#394 BP) – uses a FAST system. They replaced the leaching area because flow was not going through the grease trap. A 10,000 gallon grease trap was installed and the leach field was replaced in September 2009. The system appears to be working now. (No change in points - Remains a "Critical" Property)
- #416-420 BP - Retail space – Failed Title 5 inspection. Pumping more than twice per year. (Increased from 13 to 19 points - Remains a "Critical" Property)

- #424-428 BP – Sudbury Pizza – new septic tank and leach field installed 5/09. (Reduced from 20 to 12 points - Changed from a "Critical" to a "Priority" Property)

- #457 BP – Friendly's Restaurant - new septic tank, pump chamber, FAST unit and leach field installed on 8/09 (2,450 GPD) (Part of Sudbury Farms – No change in points - Remains a "Critical" Property)

- #465 BP – Sudbury Gas Station is no longer located here; site is vacant and contaminated (Reduced from 12 to 8 points – Remains a "Priority" Property).

- #505, #507-525 – Sudbury Plaza - 8,000 gallon septic tank upgrade & 1,500 gallon grease trap installed in 2006; 8,800 gpd leach field replaced in 2010 (Reduced from 9 to 2 points – Changed from a "Priority" to a "Non-Priority" Property)

- Sudbury Pines Nursing Home (#642 BP) – a new FAST system was installed and a groundwater discharge permit (>10,000 gpd) was obtained. (Reduced from 20 to 6 points - Changed from a "Critical" to a "Non-Priority" Property)

- Longfellow Glen (#655 BP) – Longfellow Glen entered into a Consent Order with DEP for groundwater discharge violations associated with operation of four septic systems with a design flow exceeding 24,000 gpd. The order required Longfellow Glen to apply for a groundwater discharge permit and construct a wastewater treatment plant. They submitted a Notice of Intent to DEP to apply for a General Groundwater Discharge Permit, which covers proposed small wastewater treatment facilities designed to receive less than 50,000 gpd of flow. This permit has been granted and they are currently working to finalize their wastewater treatment system and leaching field design. This general permit expires in 2014. The consent order requires the new wastewater treatment facility to be up and running by June 1, 2014. Once construction is complete, Longfellow Glen will change from a "Priority" to a "Non-Priority" Property.

- Blue Lion Restaurant (#694 BP) – name change to Acapulco's.

- Frugal Flowers (#736 BP) – upgraded system to 1,412 gpd. No variance required. (No change in points - Remains a "Non-Priority" Property)

- Sudbury Coffee (#15 U) – Upgraded to FAST system. Variance for wetland setback (<50-ft). (Reduced from 17 to 8 points - Changed from a "Critical" to a "Priority" Property)

- Post Office (#16-18 U) – no longer a full service PO – name change to PO Annex. Installed FAST system for 630 gpd. Perc < 2 mpi. Variance – 3-ft. to groundwater. (Reduced from 17 to 12 points - Changed from a "Critical" to a "Priority" Property)

- Saxonville Lumber (#27 U) – name change to Sudbury Lumber. Upgraded to 740 gpd. No variance. (No change in points - Remains a "Priority" Property)

- Edward Tucker (#55-57 U, #75-83 U) – name change to Santangelo Landscaping.

Based upon the matrix scoring distribution described in Section 3.2 and incorporating the changes in need identified above, the number of "Non-Priority Properties" has increased from 28 to 31, the number of "Priority Properties" has increased from 45 to 47, and the number of "Critical Properties" has decreased from 30 to 25. Three properties within the Central area changed from "Critical" to "Priority" and two properties changed from "Priority" to "Non-Priority." One property in the West Area changed from "Critical" to "Non-Priority." One property in the East Area changed from "Critical" to "Priority." A majority of the project area's "Critical Properties" are still clustered within the Central area, as are a majority of the project's "Priority Properties." Based on the updated information, the 2001 Parcel Ranking (Figure 3-2) has been updated in Figure 3-3, Revised Parcel Ranking.

Weston & Sampson
ENGINEERS, INC.

Legend

- Zone II Aquifer Zone
- Building Footprint
- Property Points That Totaled 0-6 Points
- Property Points That Totaled 7-12 Points
- Property Points That Totaled 13 + Points

N
W E
S

1,200 0 1,200
SCALE IN FEET

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

REVISED PARCEL RANKING

May 2012
Weston & Sampson

Path: \\gisdatasrv\gis\DataStore\Client\Sudbury MA\Project\2100718.B\PER\Sudbury_3-3_RevisedParcelRanking_2012.mxd **User:** caryj **Saved:** 5/1/2012 12:24:18 PM **Opened:** 5/1/2012 12:24:21 PM

4.0 ASSESSMENT OF FUTURE CONDITIONS

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 for both commercial and residential properties 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 are 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 the purposes of the Needs Assessment, the 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 wastewater disposal 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.

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 redundant. 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 is unclear how much of this project's collection system will be gravity sewers. Some or all of a proposed collection system will likely include pressure sewers, which generally have no associated I/I. For the purposes of this section of the report, I/I will be assumed to be negligible.

4.6 Initial Flow Analysis (2001 Needs Assessment)

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 (included at the end of this section). A further breakdown on Table 4-4 (included at the end of this section) 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 (included at the end of this section).

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 (included at the end of this section) 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 (included at the end of this section) 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 (included at the end of this section).

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 (included at the end of this section). A further breakdown on Table 4-10 (included at the end of this section) 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, as presented in the 2001 Needs Analysis, have been summarized for each project area and broken down according to level of need below:

Table 4-11

Summary of Build-Out Wastewater Design Flows (Based on 2001 Analysis)

Area	"Non-priority" Flows (gpd)	"Priority" Flows (gpd)	"Critical" Flows (gpd)	Total Flows (gpd)
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**

4.7 2010 Update

As part of the 2010 Wastewater Management Plan Update, the 2001 estimated build-out wastewater flows for properties in the project area were revisited. This update was required for a number of reasons including the following:

- Additional commercial parcels in the Route 20 Business District were identified that are zoned residential but should be included in the study area.
- Residential properties were excluded in the initial analysis due to the "no-growth" sentiment of the Town. However, the DEP requested an analysis of all residential properties within the study area since denying access to any property fronted by the proposed municipal collection system would require special legislation.
- Through discussions with the Health Agent, information regarding Title 5 failures, changes in treatment systems, changes in commercial property uses, and changes in approved wastewater discharges in the study area have been updated. These updates were discussed in Section 3.5.
- The need for a more comprehensive solution to individual Title V septic systems has increased since 2001.

All of the above information was incorporated into an updated assessment of the potential build-out wastewater design flows as follows:

Table 4-12

Updated Build-Out Wastewater Design Flows

Area	Flows (gpd)
West	102,767
Central	112,598
East	103,275
Total	**318,640**

Based on this information, the estimated flows in the East area remained the same, flows in the Central area showed a slight increase, and the West area exhibited the largest increase since the 2001 analysis, due primarily to the inclusion of residential properties in this area.

4.8 2011 PER Updates

Based on the needs identified in Chapter 3 and the ultimate recommendations of Chapter 8, a more detailed analysis of the current and anticipated wastewater flows in the Central and West Areas was performed and compiled in Table 4-13, which can be found at the end of this section.

Weston & Sampson worked closely with the TAC, the Planning Department, and the Board of Health to compile this information based on a parcel by parcel review utilizing the following information/criteria:

- Where BOH information was available, the approved Title 5 design flows were used as the existing flows.
- Where the BOH approved flows were not available, design flows were estimated based on Title 5 Regulations.
- Existing water use records from 2009 through 2011 were utilized to provide a reality check with the Title 5 numbers and to fill in the holes where necessary using 200% of average daily water use as a typical comparison to Title 5 flows.

- Projected increases in wastewater flow were calculated using the MAPC build-out numbers detailed in Section 4.4 and outlined in Table 4-1, with some adjustments based on local knowledge.

Based on this analysis, the total existing wastewater flows for these areas is 208,500 gpd with an estimated future build-out flow of 268,400 gpd. This information has been further broken down as follows:

Table 4-14:	Final Proposed West Area Flows (Properties included in 2001 Analysis only)
Table 4-15:	Final Proposed Central Area Flows (Properties included in 2001 Analysis only)
Table 4-16:	Additional Potential Flows from Fronted Properties in the West & Central Areas (Not included in 2001 Analysis)

These tables can be found at the end of this section.

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 on MAPC'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 as 85% 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 Flow Design [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 Design Flow [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 Flow Design [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

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

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 4-6 (continued)
CENTRAL AREA FLOW

Address	Assessor's Number	Use - Business Name	Existing Flow [gpd]	Build-Out Flow [gpd]
CODJER LANE				
57 CL / U	J08-23	SUDBURY DENTAL CENTER	2,000	2,632
110 CL	J08-04, 05	CAVICCHO GREENHOUSES	825	1,086
KING PHILIP RD				
68 KP	K09-033	OFFICE BUILDING/RESIDENTIAL	200	465
NOBSCOT RD				
237-239 N	K08-001	FUEL SVC - INTERSTATE OIL	200	316
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
All Central Area Properties, Except Raytheon*		**TOTAL**	**69,322**	**106,808**

*Raytheon was excluded, because it is currently operating a WWTF under a DEP approved groundwater discharge permit.

TABLE 4-7
CENTRAL 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				
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
333 BP	K09-056	OMEGA MORTGAGE	200	465
339 BP	K09-054	RKK REALTY	200	465
345 BP	K09-053	OFFICE - SUDBURY PLACE	892	2,072
346 BP	K09-031	OFFICE, CLINICAL COMMUN.	200	465
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
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
CODJER LANE				
57 CL / U	J08-23	SUDBURY DENTAL CENTER	2,000	2,632
NOBSCOT RD				
237-239 N	K08-001	FUEL SVC - INTERSTATE OIL	200	316

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

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

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**

Address	Assessor's Number	Use - Business Name	Existing Water Use from 2009 to 2011 (gpd)	200% of Existing Water Use (gpd)	BOH Approved Title 5 Design Flows [gpd]	Estimated Design Flows Based on Title 5 Regs [gpd]	Existing Title 5 Design Flow [gpd]	Estimated Betterment Units Based on Existing Flows	Zoning District	Projected Increase[1]	Estimated Build-Out Flow [2] [gpd]	Estimated Additional Betterment Units Based on Future Flows	Total Units (Existing & Future)	Comments
BOSTON POST RD														
307 BP	K09-0060	NEXT GENERATION CHILDREN'S CENTER			3,127		3,127	9	RES A-1	0.24	3,862	2	11	
316 BP	K09-0405	AUTO REPAIR - ALGE ALEXANDER (2 BAYS)	34	68		200	200	1	VBD-1	0.33	266	0	1	
320-324 BP	K09-0401	BEARLY READ BOOKS/HAIR SALON	29	58	400		400	1	VBD-1	0.33	532	0	1	Tight Tank Installed 6/08; Spend $800/yr on pumping
321-325 BP	K09-0059	OFFICE - MILL BROOK II	804	1,608	5,250		5,250	16	VBD-1	0.33	6,983	5	21	3 Septic Tanks & Leach Fields replaced 8/09
327-329 BP	K09-0057	OFFICE - MILL BROOK I	540	1,080	765		765	2	VBD-1	0.33	1,017	1	3	
330 BP (61 KP)	K09-0049	HUNT HOUSE BED		0		880	880	3	VBD-1	0.33	1,170	1	4	
333 BP	K09-0056	OMEGA MORTGAGE	46	92	200		200	1	VBD-1	0.33	266	0	1	
335 (337) BP	K09-0055	CLOUD 9 TOYS	14	28		200	200	1	VBD-1	0.33	266	0	1	
339 BP	K09-0054	COUNTRY LIVING PLACE (RKK REALTY/NAIL SALON)	290	580		527	527	2	VBD-1	0.33	701	1	3	
344 BP	K09-0032	OFFICE - (QUILTED OR NOT, OR RES.?)	319	638	576		576	2	VBD-1	0.33	766	1	3	
345 BP	K09-0053	OFFICE - SUDBURY PLACE	275	550	892		892	3	VBD-1	0.33	1,186	1	4	
346 BP	K09-0031	OFFICE, CLINICAL COMMUN. (RES?)	174	348		550	550	2	VBD-1	0.33	732	1	3	
348 BP	K09-0030	ABRAHAM WOOD PLACE (CLAPPERS HOME & HEALTH; ORGANIC MATTRESS)	205	410	410		410	1	VBD-1	0.33	545	0	1	
351 BP	K09-0052	VERIZON	640	1,280		365	365	1	VBD-1	0.33	485	0	1	
353 BP	K09-0051	MEMORY GARDEN (NEW NAME?)	79	158		200	200	1	VBD-1	0.33	266	0	1	
354-356 BP	K09-0029	OFFICE SUDBURY MUSIC/APARTMENT	87	174		420	420	1	VBD-1	0.33	559	0	1	Assume apt. is 2-bed
357 BP	K09-0050	RETAIL - MAGGIE FLOOD	13	26		200	200	1	VBD-1	0.33	266	0	1	
361-389 BP	K08-0026,0029	MILL VILLAGE (several systems)	4,762	9,524	2,025		2,025	6	VBD-1	0.33	2,693	2	8	4 disposal fields pumping more than twice per year
370 BP	K08-0036	SUDBURY PROFESSIONAL BUILDING	371	742		517	517	2	VBD-1	0.33	688	1	3	
378 BP	K08-0037	DUNKIN DONUTS	1,163	2,326	910		910	3	VBD-1	0.33	1,210	1	4	
394 BP	K08-0082	LOTUS BLOSSOM	3,031	6,062	7,930		7,930	24	BD-5	0.33	10,584	8	32	10,000 gallon grease trap installed & leach field replaced on 9/09
395 BP	K08-0013	Aragon Art Studio w/2-bed Apartment				420	420	1	RES A-1	0.24	519	0	1	
400 BP	K08-0081	PRUDENTIAL REALTY	39	78		200	200	1	BD-5	0.33	267	0	1	
407 BP	K08-0007	Small office building	57	114		200	200	1	RES A-1	0.24	247	0	1	
410 BP	K08-0080	RUGGED BEAR PLAZA	1,069	2,138	1,740		1,740	5	BD-5	0.33	2,322	2	7	
415 BP	K08-0006	POLICE STATION	223	446	400		400	1	LBD-6	0.29	515	0	1	
416-420 BP	K08-0079	RETAIL/RESTAURANT/OFFICE	710	1,420		2,444	2,444	7	BD-5	0.33	3,262	2	9	Recently sold? Failed Title 5 inspection - pumping more than twice/year
423 BP (421,425,435,437 BP)	K08-0004	SUDBURY CROSSING MALL	2,613	5,226	4,200		4,200	13	LBD-6	0.29	5,410	4	17	
424-428 BP (426 BP)	K08-0078	SUDBURY PIZZA	321	642	460		460	1	BD-5	0.33	614	0	1	New septic tank & leach field installed 5/09
430 BP	K08-0077	COLONIAL AUTO	58	116		656	656	2	BD-5	0.33	876	1	3	
432 BP	K08-0069	GAS STATION - MOBIL	118	236	600		600	2	BD-5	0.33	801	1	3	
439 BP (447,457 BP)	K08-0003	RETAIL-SUDBURY FARMS, FRIENDLY'S	4,753	9,506	7,706		7,706	23	LBD-6	0.29	9,926	7	30	Friendly's installed new septic tank, pump chamber, FAST unit and leach field on 8/09 (2,450 GPD)
440 BP	K08-0067	JEWELRY STORE	151	302	315		315	1	BD-5	0.33	420	0	1	
442 BP (444 BP)	K08-0058	RETAIL - WESTPORT GAS	14	28		300	300	1	BD-5	0.33	400	0	1	
450 BP	K08-0066	OFFICE - COMMUNITY	175	350	188		188	1	BD-5	0.33	251	0	1	
454 BP	K08-0065	MIDDLESEX SAVINGS BANK	70	140	570		570	2	LID-1	0.38	789	1	3	
465 BP	K08-0002	ABANDONED		0			0	0	LBD-2	0.18	330	1	1	Contaminated Site
470 BP	K08-0064	SUDBURY GULF (Public Petro)	36	72		300	300	1	BD-5	0.33	400	0	1	
474 BP	K07-0008	RETAIL - KAPPY'S LIQUORS	142	284	420		420	1	BD-5	0.33	561	0	1	
477 BP (475 BP)	K07-0007	SULLIVAN TIRE COMPANY	151	302	500		500	2	LBD-2	0.18	588	0	2	
490 BP (29/31 Union)	K07-0018	INDUST. - CHISWICK PARK & EMERSON BUILDING	3,153	6,306	8,441		8,441	26	LID-1	0.38	11,689	10	36	
505, 507-525 BP	K07-0005, 0006	RETAIL - SUDBURY PLAZA	1,855	3,710	8,800		8,800	27	LBD-2	0.18	10,341	5	32	8,000 gallon septic tank upgrade & 1,500 gallon grease trap installed '06; 8,800 gpd leach field replaced in 2010
526-528 BP	K07-0011-0013	RAYTHEON	12,848	25,696		30,000	30,000	91	LID-1	0.38	50,000	61	152	
540 BP (550 BP)	K07-0012	SUDBURY FIRE STATION	96	192		400	400	1	LID-1	0.38	554	0	1	
554 BP	K06-0602	Res/Comm (Farm)	320	640		550	550	2	RES A-1	0	550	0	2	
555 BP	K07-0002	Single Family Home	84	168		330	330	1	RES A-1	0	330	0	1	
559 BP	K07-0001	Single Family Home	148	296		330	330	1	RES A-1	0	330	0	1	
566 BP	K07-0014	Single Family Home	284	568		330	330	1	RES A-1	0	330	0	1	
573 BP	K06-0019	Two Family Home	204	408		440	440	1	RES A-1	0	440	0	1	
577 BP	K06-0020	Single Family Home	168	336		220	220	1	RES A-1	0	220	0	1	
578 BP	K06-0015, 0016, 0017, 0018	Bartlett Greenhouses	4,329	8,658		1480	1,480	4	RES A-1	0.24	1,828	1	5	
BP (between 577 & 587)	K06-0021	Undeveloped		0		330	330	1	RES A-1	0	330	0	1	
587,589,593 BP	K06-0022	Res/Comm	326	652		420	420	1	RES A-1	0.24	519	0	1	
598, 604 BP	K06-0014	Dog Pound	205	410		420	420	1	RES A-1	0.24	519	0	1	
610 BP	K06-0013	Single Family Home	136	272		330	330	1	RES A-1	0	330	0	1	
615 BP	K06-0026	RETAIL - DUDLEY SQUARE	1,249	2,498			637	2	BD-15	1.09	1,331	2	4	
616 BP	K06-0012	SUDBURY MEDICAL CENTER	604	1,208		1,532	1,532	5	LBD-1	0.14	1,747	1	6	
621 BP	K06-0028	BARNSTEAD SHOPS	1,888	3,776	1,231		1,231	4	BD-15	1.09	2,572	4	8	
625 BP	K06-0029	Single Family Home	101	202		330	330	1	RES C-1	0	330	0	1	

Address	Assessor's Number	Use - Business Name	Existing Water Use from 2009 to 2011 (gpd)	200% of Existing Water Use (gpd)	BOH Approved Title 5 Design Flows [gpd]	Estimated Design Flows Based on Title 5 Regs [gpd]	Existing Title 5 Design Flow [gpd]	Estimated Betterment Units Based on Existing Flows	Zoning District	Projected Increase[1]	Estimated Build-Out Flow [2] [gpd]	Estimated Additional Betterment Units Based on Future Flows	Total Units (Existing & Future)	Comments
631 BP	K06-0502	Office	239	478		420	420	1	RES C-1	0.24	519	0	1	
642 BP	K06-0004, 0005	SUDBURY PINES NURSING HOME (in failure)	6,610	13,220	14,000		14,000	42	LBD-1	0.14	15,961	6	48	New FAST system & groundwater discharge permit
648 BP	K06-0040	Single Family Home	264	528		440	440	1	RES A-1	0	440	0	1	
655 BP	K06-0501	LONGFELLOW GLEN/ 4 Systems	12,889	25,778	32,000		32,000	97	RES C-1	-	32,000	0	97	Subsidizied Housing
656 BP	K06-0003	Funeral Home	432	864		440	440	1	RES A-1	0.24	543	0	1	
662 BP	K06-0002	Animal Hospital	405	810		640	640	2	RES A-1	0.24	687	0	2	
665 BP	K06-0504	Single Family Home	244	488		440	440	1	RES A-1	0	440	0	1	
676 BP	K05-0020	American Legion	96	192		400	400	1	RES A-1	0.24	494	0	1	
684 BP	K05-0019	AUTO REPAIR	117	234		712	712	2	BD-6	0.24	879	1	3	
687 BP	K05-0213	Single Family Home	69	138		330	330	1	RES C-1	0	330	0	1	
693 BP	K05-0212	Single Family Home	124	248		220	220	1	RES C-1	0	220	0	1	
694 BP	K05-0017	RESTAURANT - ACAPULCO'S	2,305	4,610	4,900		4,900	15	BD-6	0.24	6,053	3	18	
708 BP	K05-0015	DENTIST	101	202	820		820	2	BD-6	0.24	1,013	1	3	
712 BP	K05-0013	SUDBURY RENTAL	191	382	260		260	1	BD-6	0.24	321	0	1	
725 BP	K05-0225	Townhouses	2,164	4,328		3,520	3,520	11	RES C-1	0.24	4,347	3	14	
730 BP	K05-0012	RETAIL - WAYSIDE PLAZA	1,369	2,738	1,724		1,724	5	BD-6	0.24	2,130	1	6	
735 BP	K05-0226	Single Family Home	200	400		330	330	1	RES C-1	0	330	0	1	
736 BP	K05-0011	FRUGAL FLOWERS	811	1,622	1,412		1,412	4	BD-6	0.24	1,744	1	5	No variance required
738 BP	K05-0007	HOTEL - CLARION CARRIAGE	1,365	2,730	5,500		5,500	17	BD-6	0.24	6,794	4	21	
740 BP	K05-0005	OFFICE - SUDBURY DESIGN	108	216		513	513	2	BD-6	0.24	634	0	2	
761 BP	K05-0031	Orchard Hill Assisted Living (part Childcare Center)	3,252	6,504		7,175	7,175	22	RES C-1	0.24	8,861	5	27	
CONCORD RD														
5-15,17,19 C	K08-0035	RETAIL - MACKINNONS	814	1,628	1,418		1,418	4	VBD-1	0.33	1,886	1	5	
8, 10 C	K09-0027	OFFICE - NB TAYLOR	197	394		330	330	1	VBD-1	0.33	439	0	1	
HIGHLAND ST														
55 H	K07-0003	Single Family Home	296	592		440	440	1	RES A-1	0	440	0	1	
57 H	K07-0102	Single Family Home	173	346		440	440	1	RES A-1	0	440	0	1	
59 H	K07-0103	Single Family Home	193	386		440	440	1	RES A-1	0	440	0	1	
MAPLE AVE														
4 M	K08-0025	Single Family Home	92	184		220	220	1	RES A-1	0	220	0	1	
NOBSCOT RD														
237-239 N	K08-0001	FUEL SVC - INTERSTATE OIL	272	544		200	200	1	LBD-2	0.18	235	0	1	
NOKOMIS RD														
9 NO	K05-0001	Single Family Home	31	62		330	330	1	RES C-1	0	330	0	1	
14 NO	K05-0032	Single Family Home	78	156		330	330	1	RES C-1	0	330	0	1	
RAYMOND RD														
250 R	K08-0012	Single Family Home	209	418		440	440	1	RES A-1	0	440	0	1	
STATION RD														
0 ST	K08-0038	VACANT				200	200	1	ID-2	0.32	263	0	1	
34-36 ST	K08-0039	Commercial / Residential	292	584		544	544	2	ID-2	0.32	716	1	3	
38-40 ST	K08-0040	Auto Repair Shop	111	222		417	417	1	ID-2	0.32	549	0	1	
STONE RD														
8 S	K06-0303	Child Care Center	281	562		220	220	1	RES A-1	0	220	0	1	
UNION AVENUE														
0 U	K08-0073	VACANT				200	200	1	BD-5	0.33	267	0	1	
1 U	K08-0070	OFFICE - DESIGNWISE	319	638	700		700	2	BD-5	0.33	934	1	3	
15 U	K08-0071	SUDBURY COFFEE, PRINTER	374	748	360		360	1	BD-5	0.33	480	0	1	Upgraded to FAST system; variance for wetland setback < 50 feet
18 U	K08-0076	POST OFFICE	281	562	630		630	2	BD-5	0.33	841	1	3	Installed FAST system, perc less than 2 min/in, variance 3-feet to groundwater
21 U	K08-0090	OFFICE - MCNEIL VET.	202	404	255		255	1	LID-1	0.38	353	0	1	
22 U	K08-0075	OFFICE - FLEET	126	252		746	746	2	BD-5	0.33	996	1	3	
23 U	K08-0073-0091	BAYBANK ATM VACANT				200	200	1	BD-5	0.33	267	0	1	
25U	K08-0060	WAREHOUSE - NE DOOR	30	60		1,540	1,540	5	LID-1	0.38	2,133	2	7	
27U	K08-0056	SAXONVILLE LUMBER	18	36	740		740	2	LID-1	0.38	1,025	1	3	
28 U	K08-0074	SUDBURY LUMBER	76	152		1,004	1,004	3	ID-8	0.58	1,586	2	5	
33 U	K07-0017	WAREHOUSE - CHISWICK	1,008	2,016	2,400		2,400	7	LID-1	0.38	3,324	3	10	
37 U	K08-0054	VACANT				200	200	1	BD-5	0.33	267	0	1	
39 U	K08-0053	BOSEKY LTD/CARPET CARSEL.	70	140		593	593	2	ID-2	0.32	780	1	3	
44-46 U	K08-0041	PRECOURT CHARLES	1,659	3,318		200	200	1	ID-2	0.32	263	0	1	
50 U	K08-0042	JOHNSTON PAVING	70	140		200	200	1	ID-2	0.32	263	0	1	
55-57 U	K08-0052	SANTANGELO LANDSCAPING	192	384		861	861	3	ID-2	0.32	1,133	1	4	
56 U	K08-0044	GRANCO REALTY TRUST	351	702		609	609	2	ID-2	0.32	801	1	3	
60 U	K08-0045	GRANCO REALTY TRUST	162	324		900	900	3	ID-2	0.32	1,184	1	4	
64 U	K08-0046	MACOT REALTY TRUST	73	146		1,200	1,200	4	ID-2	0.32	1,579	1	5	
65 U	K08-0051	METHODS, INC.	437	874		1,668	1,668	5	ID-2	0.32	2,195	2	7	
71 U	K08-0087	METHODS, INC.	334	668		4,206	4,206	13	IP-1	0.32	5,535	4	17	
75-83 U	K08-0050	EDWARD TUCKER	658	1,316		1,380	1,380	4	ID-2	0.32	1,816	1	5	

Address	Assessor's Number	Use - Business Name	Existing Water Use from 2009 to 2011 (gpd)	200% of Existing Water Use (gpd)	BOH Approved Title 5 Design Flows [gpd]	Estimated Design Flows Based on Title 5 Regs [gpd]	Existing Title 5 Design Flow [gpd]	Estimated Betterment Units Based on Existing Flows	Zoning District	Projected Increase(1)	Estimated Build-Out Flow (2) [gpd]	Estimated Additional Betterment Units Based on Future Flows	Total Units (Existing & Future)	Comments
80 U	K08-0047	SCHOFIELD/Union & Palmer	1,030	2,060	180		180	1	ID-2	0.32	237	0	1	
UPLOOK DR														
6 UP	K05-0211	Single Family Home	701	1,878		330	330	1	RES C-1	0	330	0	1	
7 UP	K05-0210	Single Family Home	257	514		330	330	1	RES C-1	0	330	0	1	
Entire Area	**TOTAL**						208,511	**638**			268,437	**178**	**816**	

Notes:

(1) MAPC calculated the build-out water use for each Zoning District as part of their December 2000 build-out analysis. The build-out wastewater flow was calculated as 85% of the MAPC's build-out water use for that zoning district. The projected increase in wastewater flow was calculated as the build-out wastewater flow divided by the current wastewater design flow for a particiuar district.

(2) The estimated build-out flow for a particular parcel was calculated by multiplying the projected increase by the existing Title 5 design flow and then adding the existing Title 5 design flow to that value.

TABLE 4-14
FINAL PROPOSED WEST AREA FLOWS
(Properties Included in 2001 Analysis Only)

WASTEWATER MANAGEMENT NEEDS ASSESSMENT

Address	Assessor's Number	Use - Business Name	Existing Title 5 Design Flow [gpd]	Estimated Betterment Units Based on Existing Flows	Zoning District	Projected Increase	Estimated Build-Out Flow (2) [gpd]	Estimated Additional Betterment Units Based on Future Flows	Comments
BOSTON POST RD									
615 BP	K06-026	RETAIL - DUDLEY SQUARE	637	2	BD-15	1.089	1,331	2	
616 BP	K06-012	SUDBURY MEDICAL CENTER	1,532	5	LBD-1	0.14	1,747	1	
621 BP	K06-028	BARNSTEAD SHOPS	1,231	4	BD-15	1.09	2,572	4	
642 BP	K06-04, 05	SUDBURY PINES NURSING HOME (in failure)	14,000	42	LBD-1	0.14	15,961	6	New FAST system & groundwater discharge permit
655 BP	K06-501	LONGFELLOW GLEN/ 4 Systems	32,000	97	RES C-1	-	32,000	0	Subsidizied Housing
684 BP	K05-019	AUTO REPAIR	712	2	BD-6	0.24	879	1	
694 BP	K05-017	RESTAURANT - ACAPULCO'S	4,900	15	BD-6	0.24	6,053	3	
708 BP	K05-015	DENTIST	820	2	BD-6	0.24	1,013	1	
712 BP	K05-013	SUDBURY RENTAL	260	1	BD-6	0.24	321	0	
730 BP	K05-012	RETAIL - WAYSIDE PLAZA	1,724	5	BD-6	0.24	2,130	1	
736 BP	K05-011	FRUGAL FLOWERS	1,412	4	BD-6	0.24	1,744	1	No variance required
738 BP	K05-07	HOTEL - CLARION CARRIAGE	5,500	17	BD-6	0.24	6,794	4	
740 BP	K05-05	OFFICE - SUDBURY DESIGN	513	2	BD-6	0.24	634	0	
		TOTAL	**65,241**	**198**			**73,178**	**24**	

Notes:
(1) MAPC calculated the build-out water use for each Zoning District as part of their December 2000 build-out analysis. The build-out wastewater flow was calculated as 85% of the MAPC's build-out water use for that zoning district. The projected increase in wastewater flow was calculated as the build-out wastewater flow divided by the current wastewater design flow for a particluar district.

(2) The estimated build-out flow for a particular parcel was calculated by multiplying the projected increase by the existing Title 5 design flow and then adding the existing Title 5 design flow to that value.

TABLE 4-15
FINAL PROPOSED CENTRAL AREA FLOWS
(Properties included in 2001 Analysis Only)

Address	Assessor's Number	Use - Business Name	Existing Title 5 Design Flow [gpd]	Estimated Betterment Units Based on Existing Flows	Zoning District	Projected Increase[1]	Estimated Build-Out Flow [2] [gpd]	Estimated Additional Betterment Units Based on Future Flows	Comments
BOSTON POST RD									
307 BP	K09-0060	NEXT GENERATION CHILDREN'S CENTER	3,127	9	RES A-1	0.24	3,862	2	
316 BP	K09-405	AUTO REPAIR - ALEXANDER (2 BAYS)	200	1	VBD-1	0.33	266	0	
320-324 BP	K09-401	BEARLY READ BOOKS/HAIR SALON	400	1	VBD-1	0.33	532	0	Tight Tank Installed 6/08; Spend $800/yr on pumping
321-325 BP	K09-0059	OFFICE - MILL BROOK II	5,250	16	VBD-1	0.33	6,983	5	3 Septic Tanks & Leach Fields replaced 8/09
327-329 BP	K09-057	OFFICE - MILL BROOK I	765	2	VBD-1	0.33	1,017	1	
330 BP (61 KP)	K09-049	HUNT HOUSE BED	880	3	VBD-1	0.33	1,170	1	
333 BP	K09-056	OMEGA MORTGAGE	200	1	VBD-1	0.33	266	0	
335 BP	K09-055	CLOUD 9 TOYS	200	1	VBD-1	0.33	266	0	
339 BP	K09-054	COUNTRY LIVING PLACE (RKK REALTY/NAIL SALON)	527	2	VBD-1	0.33	701	1	
344 BP	K09-032	OFFICE - (QUILTED OR NOT, OR RES.?)	576	2	VBD-1	0.33	766	1	
345 BP	K09-053	OFFICE - SUDBURY PLACE	892	3	VBD-1	0.33	1,186	1	
346 BP	K09-031	OFFICE, CLINICAL COMMUN. (RES?)	550	2	VBD-1	0.33	732	1	
348 BP	K09-030	ABRAHAM WOOD PLACE (CLAPPERS HOME & HEALTH; ORGANIC MATTRESS)	410	1	VBD-1	0.33	545	0	
351 BP	K09-052	VERIZON	365	1	VBD-1	0.33	485	0	
353 BP	K09-051	MEMORY GARDEN (NEW NAME?)	200	1	VBD-1	0.33	266	0	
354, 356 BP	K09-029	OFFICE SUDBURY MUSIC/APARTMENT	420	1	VBD-1	0.33	559	0	Assume apt. is 2-bed
357 BP	K09-050	RETAIL - MAGGIE FLOOD	200	1	VBD-1	0.33	266	0	
361-389 BP	K08-026,029	MILL VILLAGE (several systems)	2,025	6	VBD-1	0.33	2,693	2	4 disposal fields pumping more than twice per year
370 BP	K08-036	SUDBURY PROFESSIONAL BUILDING	517	2	VBD-1	0.33	688	1	
378 BP	K08-037	DUNKIN DONUTS	910	3	VBD-1	0.33	1,210	1	
394 BP	K08-082	LOTUS BLOSSOM	7,930	24	BD-5	0.33	10,584	8	10,000 gallon grease trap installed & leach field replaced on 9/09
400 BP	K08-081	PRUDENTIAL REALTY	200	1	BD-5	0.33	267	0	
410 BP	K08-080	RUGGED BEAR PLAZA	1,740	5	BD-5	0.33	2,322	2	
415 BP	K08-006	POLICE STATION	400	1	LBD-6	0.29	515	0	
416-420 BP	K08-079	RETAIL/RESTAURANT/OFFICE	2,444	7	BD-5	0.33	3,262	2	Recently sold? Failed Title 5 inspection - pumping more than twice/year
423 BP (421,435,437 BP)	K08-004	SUDBURY CROSSING MALL	4,200	13	LBD-6	0.29	5,410	4	
424-428 BP (426 BP)	K08-078	BLOCKBUSTER, SDBY PIZZA	460	1	BD-5	0.33	614	0	New septic tank & leach field installed 5/09
430 BP	K08-077	COLONIAL AUTO	656	2	BD-5	0.33	876	1	
432 BP	K08-069	GAS STATION - MOBIL	600	2	BD-5	0.33	801	1	
439 BP (447,457 BP)	K08-003	RETAIL-SUDBURY FARMS, FRIENDLY'S	7,706	23	LBD-6	0.29	9,926	7	Friendly's installed new septic tank, pump chamber, FAST unit and leach field on 8/09 (2,450 GPD)
440 BP	K08-067	JEWELRY STORE	315	1	BD-5	0.33	420	0	
442 BP (444 BP)	K08-058	RETAIL - WESTPORT GAS	300	1	BD-5	0.33	400	0	
450 BP	K08-066	OFFICE - COMMUNITY	188	1	BD-5	0.33	251	0	
454 BP	K08-065	MIDDLESEX SAVINGS BANK	570	2	LID-1	0.38	789	1	
465 BP	K08-002	ABANDONED	0	0	LBD-2	0.18	330	1	Contaminated Site
470 BP	K08-064	SUDBURY GULF (Public Petro)	300	1	BD-5	0.33	400	0	
474 BP	K07-008	RETAIL - KAPPY'S LIQUORS	420	1	BD-5	0.33	561	0	
477 BP (475 BP)	K07-007	SULLIVAN TIRE COMPANY	500	2	LBD-2	0.18	588	0	
490 BP (29/31 Union)	K07-018	INDUST. - CHISWICK PARK & EMERSON BUILDING	8,441	26	LID-1	0.38	11,689	10	
505, 507-525 BP	K07-05, 06	RETAIL - SUDBURY PLAZA	8,800	27	LBD-2	0.18	10,341	5	8,000 gallon septic tank upgrade & 1,500 gallon grease trap installed '06; 8,800 gpd leach field replaced in 2010
526-528 BP	K07-011-013	RAYTHEON	30,000	91	LID-1	0.38	50,000	61	
540, 550 BP	K07-0012	SUDBURY FIRE STATION	400	1	LID-1	0.38	554	0	
CONCORD RD									
5-15,17,19 C	K08-035	RETAIL - MACKINNONS	1,418	4	VBD-1	0.33	1,886	1	
8/10 C	K09-027,028	OFFICE - NB TAYLOR	330	1	VBD-1	0.33	439	0	

TABLE 4-15
FINAL PROPOSED CENTRAL AREA FLOWS
(Properties included in 2001 Analysis Only)

WASTEWATER MANAGEMENT NEEDS ASSESSMENT

Address	Assessor's Number	Use - Business Name	Existing Title 5 Design Flow [gpd]	Estimated Betterment Units Based on Existing Flows	Zoning District	Projected Increase(1)	Estimated Build-Out Flow (2) [gpd]	Estimated Additional Betterment Units Based on Future Flows	Comments
NOBSCOT RD									
237-239 N	K08-001	FUEL SVC - INTERSTATE OIL	200	1	LBD-2	0.18	235	0	
UNION AVENUE									
0 U	K08-0073	VACANT	200	1	BD-5	0.33	267	0	
1 U	K08-070	OFFICE - DESIGNWISE	700	2	BD-5	0.33	934	1	
15 U	K08-071	SUDBURY COFFEE, PRINTER	360	1	BD-5	0.33	480	0	Upgraded to FAST system; variance for wetland setback < 50 feet
18 U	K08-076	POST OFFICE	630	2	BD-5	0.33	841	1	Installed FAST system, perc less than 2 min/in, variance 3-feet to groundwater
21 U	K08-090	OFFICE - MCNEIL VET	255	1	LID-1	0.38	353	0	
22 U	K08-075	OFFICE - FLEET	746	2	BD-5	0.33	996	1	
23 U	K08-073 (91)	BAYBANK ATM VACANT	200	1	BD-5	0.33	267	0	
25U	K08-060	WAREHOUSE - NE DOOR	1,540	5	LID-1	0.38	2,133	2	
27U	K08-056	SAXONVILLE LUMBER	740	2	LID-1	0.38	1,025	1	
28 U	K08-074	SUDBURY LUMBER	1,004	3	ID-8	0.58	1,586	2	
33 U	K07-017	WAREHOUSE - CHISWICK	2,400	7	LID-1	0.38	3,324	3	
37 U	K08-0054	VACANT	200	1	BD-5	0.33	267	0	
39 U	K08-053	BOSEKY LTD/CARPET CARSEL	593	2	ID-2	0.32	780	1	
44/46 U	K08-041	PRECOURT CHARLES	200	1	ID-2	0.32	263	0	
50 U	K08-0042	JOHNSTON PAVING	200	1	ID-2	0.32	263	0	
55-57 U	K08-052	SANTANGELO LANDSCAPING	861	3	ID-2	0.32	1,133	1	
56 U	K08-044	GRANCO REALTY TRUST	609	2	ID-2	0.32	801	1	
60 U	K08-045	GRANCO REALTY TRUST	900	3	ID-2	0.32	1,184	1	
64 U	K08-046	MACOT REALTY TRUST	1,200	4	ID-2	0.32	1,579	1	
65 U	K08-051	METHODS, INC.	1,668	5	ID-2	0.32	2,195	2	
71 U	K08-0087	METHODS, INC.	4,206	13	IP-1	0.32	5,535	4	
75-83 U	K08-050	EDWARD TUCKER	1,380	4	ID-2	0.32	1,816	1	
80 U	K08-047	SCHOFIELD/Union & Palmer	180	1	ID-2	0.32	237	0	
All Central Area Properties		**TOTAL**	**118,104**	**365**			**166,179**	**144**	

Notes:
(1) MAPC calculated the build-out water use for each Zoning District as part of their December 2000 build-out analysis. The build-out wastewater flow was calculated as 85% of the MAPC's build-out water use for that zoning district. The projected increase in wastewater flow was calculated as the build-out wastewater flow divided by the current wastewater design flow for a particluar district.

(2) The estimated build-out flow for a particular parcel was calculated by multiplying the projected increase by the existing Title 5 design flow and then adding the existing Title 5 design flow to that value.

TABLE 4-16
Additional Potential Flows from Fronted Properties in the West & Central Areas (Not Included in 2001 Analysis)

Address	Parcel	Zoned As	Description	Existing Title 5 Design Flow [gpd]	Estimated Betterment Units Based on Existing Flows	Zoning District	Estimated Build-Out Flow (2) [gpd]	Estimated Additional Betterment Units Based on Future Flows
BOSTON POST RD								
395 BP	K08-0013	Residential	Art Studio	420	1	RES A-1	519	0
407 BP	K08-0007	Residential	Small office building	200	1	RES A-1	247	0
554 BP	K06-0602	Residential	Res/Comm (Farm)	550	2	RES A-1	550	0
555 BP	K07-0002	Residential	Single Family Home	330	1	RES A-1	330	0
559 BP	K07-0001	Residential	Single Family Home	330	1	RES A-1	330	0
566 BP	K07-0014	Residential	Single Family Home	330	1	RES A-1	330	0
573 BP	K06-0019	Residential	Two Family Home	440	1	RES A-1	440	0
577 BP	K06-0020	Residential	Single Family Home	220	1	RES A-1	220	0
578 BP	K06-0015, 0016, 0017, 0018	Residential	Greenhouses	1,480	4	RES A-1	1,828	1
BP (between 577 & 587)	K06-0021	Residential	Undeveloped	330	1	RES A-1	330	0
587,589,593 BP	K06-0022	Residential	Res/Comm	420	1	RES A-1	519	0
598, 604 BP	K06-0014	Residential	Dog Pound	420	1	RES A-1	519	0
610 BP	K06-0013	Residential	Single Family Home	330	1	RES A-1	330	0
625 BP	K06-0029	Residential	Single Family Home	330	1	RES C-1	330	0
631 BP	K06-0502	Residential	Office	420	1	RES C-1	519	0
648 BP	K06-0040	Residential	Single Family Home	440	1	RES A-1	440	0
656 BP	K06-0003	Residential	Funeral Home	440	1	RES A-1	543	0
665 BP	K06-0504	Residential	Single Family Home	440	1	RES C-1	440	0
662 BP	K06-0002	Residential	Animal Hospital	640	2	RES A-1	687	0
676 BP	K05-0020	Residential	American Legion	400	1	RES A-1	494	0
687 BP	K05-0213	Residential	Single Family Home	330	1	RES C-1	330	0
693 BP	K05-0212	Residential	Single Family Home	220	1	RES C-1	220	0
725 BP	K05-0225	Residential	Townhouses	3,520	11	RES C-1	4,347	3
735 BP	K05-0226	Residential	Single Family Home	330	1	RES C-1	330	0
761 BP	K05-0031	Residential	Orchard Hill Assisted Living (part Childcare Center)	7,175	22	RES C-1	8,861	5
HIGHLAND ST								
55 H	K07-0003	Residential	Single Family Home	440	1	RES A-1	440	0
57 H	K07-0102	Residential	Single Family Home	440	1	RES A-1	440	0
59 H	K07-0103	Residential	Single Family Home	440	1	RES A-1	440	0

TABLE 4-16
Additional Potential Flows from Fronted Properties in the West & Central Areas (Not Included in 2001 Analysis)

Address	Parcel	Zoned As	Description	Existing Title 5 Design Flow [gpd]	Estimated Betterment Units Based on Existing Flows	Zoning District	Estimated Build-Out Flow (2) [gpd]	Estimated Additional Betterment Units Based on Future Flows
MAPLE AVE								
4 M	K08-0025	Residential	Single Family Home	220	1	RES A-1	220	0
NOKOMIS RD								
9 NO	K05-0001	Residential	Single Family Home	330	1	RES C-1	330	0
14 NO	K05-0032	Residential	Single Family Home	330	1	RES C-1	330	0
RAYMOND RD								
250 R	K08-0012	Residential	Single Family Home	440	1	RES A-1	440	0
STATION RD								
0 ST	K08-0038	Industrial	Vacant	200	1	ID-2	263	0
34-36 ST	K08-0039	Industrial	Commercial / Residential	544	2	ID-2	718	1
38-40 ST	K08-0040	Industrial	Auto Repair Shop	417	1	ID-2	550	0
STONE RD								
8 S	K06-0303	Residential	Child Care Center	220	1	RES A-1	220	0
UPLOOK DR								
6 UP	K05-0211	Residential	Single Family Home	330	1	RES C-1	330	0
7 UP	K05-0210	Residential	Single Family Home	330	1	RES C-1	330	0
				25,166	**75**		**29,084**	**10**

Notes:

(1) MAPC calculated the build-out water use for each Zoning District as part of their December 2000 build-out analysis. The build-out wastewater flow was calculated as 85% of the MAPC's build-out water use for that zoning district. The projected increase in wastewater flow was calculated as the build-out wastewater flow divided by the current wastewater design flow for a particluar district.

(2) The estimated build-out flow for a particular parcel was calculated by multiplying the projected increase by the existing Title 5 design flow and then adding the existing Title 5 design flow to that value.

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; 3) decentralized wastewater collection, treatment, and disposal; and 4) regional solutions. 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 nutrients from the wastewater before it enters the SAS. Properly designed, installed, and maintained systems still discharge pollutants into the groundwater. Unsaturated soils in a SAS are effective at removing bacteria, viruses, and most nutrients (with the exception of some forms of nitrogen). Systems with saturated soils, an inadequate separation between the soil absorption system and the groundwater, rapidly percolating soils, an inadequately designed soil absorption system, or other limitations will contribute even higher levels of pollutants to the groundwater. Therefore, it is sometimes desirable, particularly in sensitive areas, to achieve a higher level of treatment than a conventional Title 5 system can provide.

The current Title 5 regulations allow for the use of innovative and alternative (I/A) technologies under the provisions of CMR 15.280 – 15.289. Alternative systems provide substitutes or alternatives for one or more of the components of a conventional system while providing equal or greater environmental and health protection. Some of these technologies provide enhanced wastewater treatment with nitrogen reduction. The Title 5 regulations specifically identify the requirements for approval of I/A technologies and classify the level of approval as remedial, piloting, provisional, and general. These alternatives are being used throughout the state for upgrades of systems on sites, which cannot accommodate a conventional system. I/A systems are also being used for new construction when enhanced wastewater treatment is necessary, such as in identified "nitrogen sensitive areas." An I/A technology can be utilized for a single unit or a cluster of units with a total average daily wastewater flow less than 10,000 gpd based on Title 5 flow projections.

MA-DEP maintains a list that provides a description and status for a variety of I/A technologies. Over the last few years a significant number of system manufacturers have developed wastewater treatment technologies for small systems. Some of the approved technologies which could be considered for evaluation include the Recirculating Sand Filter(s), the Amphidrome™ Process, the Bioclere™ System, the RUCK® System, and the FAST® System. Descriptions of these I/A systems are included in Appendix A.

In the Route 20 business district, a common difficulty is the lack of on-lot space for on-site system construction or repair. Since variances due to site constraints are required for conventional Title 5 systems and since I/A systems usually present additional area requirements for treatment 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 on a wide-scale basis.

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 \$20,000 to \$500,000 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 \$500,000 range. A generic order of magnitude cost that will be used for comparison is \$300,000.

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 \$1,200 per year. If the system is functioning normally and testing becomes annual this is reduced to approximately \$700. For the purposes of this report, we have assumed annual operating costs of \$1,000.

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 and poor soil conditions throughout, 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 groundwater.

A package or small wastewater treatment facility refers to the assembly of various individual treatment process equipment components 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 ensure 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 end points and 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 wastewater treatment facility (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 to 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, that 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 Sudbury at this time.

5.4 Alternative 4 – Regional Solutions

The Route 20 Sewer Citizen's Advisory Committee (CAC) has investigated 2 alternatives to a decentralized wastewater system. One is to transport the wastewater to Framingham, for treatment through their MWRA system at Deer Island, and the other is to transport it to

Marlborough for treatment at their Easterly Treatment Plant. Below is an assessment of these alternatives by the CAC.

5.4.1 Framingham/Massachusetts Water Resources Authority

The option of discharging Sudbury's wastewater via Framingham's wastewater collection system for treatment was investigated. Framingham's wastewater system is part of the Massachusetts Water Resources Authority (MWRA) system. Wastewater flow from Framingham is treated at the Deer Island Wastewater Treatment Facility and discharged into the Massachusetts Bay. Framingham has an extensive wastewater transport system which includes over 50 pump stations, gravity sewers and hundreds of miles of pipes. Framingham also purchases all of its drinking water from MWRA.

In order for Sudbury to utilize the MWRA system in Framingham, it will be required to purchase water from MWRA, as the ultimate discharge point for the wastewater - Massachusetts Bay - would be considered an out-of-basin transfer of water by the Department of Environmental Protection and would be prohibited. Without the purchase of MWRA water, the transfer of Sudbury's groundwater to Massachusetts Bay could have serious long term effects on Sudbury's aquifer. The only way to avoid the out-of-basin transfer issue would be to purchase water from MWRA. Water purchase would only be necessary for the properties within the proposed sewer district. A system of water distribution pipes would need to be installed throughout the sewer district area.

The legislative ability to utilize Framingham for wastewater treatment and disposal would be complicated. Sudbury is not included in the MWRA service area, therefore it would require Town Meeting and legislative approval to join. An inter-municipal agreement between the Towns would dictate the terms of provision of services. Given the open town meeting form of government in both towns, this could be a time consuming and complex process.

Currently the MWRA sewer system is constrained, which limits its capacity to permit new communities from joining the Authority. MWRA Policy # OP.11 lists the admission criteria for new communities to utilize MWRA services, which includes significant mitigation payments for upgrades to the MWRA infiltration and inflow systems (I/I), and the consideration of all feasible alternatives. Department of Environmental Protection approval is also required.

The I/I fee is required for all incoming MWRA member communities to fix existing infiltration issues during rain events when storm water overwhelms the MRWA sewer lines. This fee is based on the community's 3 year average flow (180,000/gpd) multiplied by four. With an estimated cost to 'fix' infiltration issues of $5-$8 / gallon, this cost would be $3,600,000-$5,760,000 for Sudbury's current flow. These funds are used to decrease storm water from seeping into the MWRA sewer line either in Framingham or in communities down the line.

Additional upfront costs anticipated would be MWRA sewer and water entrance fees, construction costs of installing water and sewer pipes from Sudbury to the appropriate connection in Framingham off Harrington Road (approximately 1.5 miles), and a proportional shared operation and maintenance fee covering recent capital upgrades made to the system in Framingham. On-going costs (typically paid for by users of the system) would include user fees and future capital improvement costs to the system as needed. Capital improvement costs are difficult to predict, as there is significant infrastructure in the Framingham transport system, and its condition varies. System users would also be responsible for maintaining any pipes and pump stations needed in Sudbury.

The benefits from joining with Framingham/MWRA are the ability to expand the district's flow as redevelopment in Sudbury occurs. There does not appear to be a capacity issue within the Framingham system which would prevent expansion.

Based on the complexity of the legislative approval process, the up-front costs of the I/I mitigation, the need to also purchase water for the sewer district properties, and the uncertainty of future capital improvements to the complex Framingham transport network, this alternative will not be further explored.

5.4.2 Marlborough Easterly Treatment Plant

The Marlborough Easterly Wastewater Treatment Plant (WWTP) is located at 860 Boston Post Road and has a design flow of 5.5 MGD. It discharges to an unnamed tributary of Hop Brook, which winds its way through Sudbury and eventually flows into the Sudbury River. Since the Marlborough Easterly WWTP is located within 1 mile of the Sudbury Town line on its western border, the option of discharging wastewater flows from Sudbury into Marlborough's system was explored.

The Marlborough Easterly WWTP has been ordered by the Environmental Protection Agency to be upgraded at a cost of approximately $40 million, which began construction in 2012. The cost for the upgrade will be paid for by the users, and according to the Marlborough Director of Public Works, Ronald LaFrienere, a rate increase is anticipated.

In order to create the legal authority for Sudbury and Marlborough to work together, an Inter-Municipal Agreement would need to be created. Any agreement between the Towns would need Mayor/City Council approval in Marlboro, and Town Manager/Board of Selectmen approval in Sudbury. There are models for this type of agreement, as Marlborough treats wastewater from Northborough, Southborough and Berlin at its Westerly Wastewater Treatment Plant, however such agreements are intricate and require careful legal review.

Only Sudbury's wastewater would be treated in Marlboro, with no need to provide water service. The discharge from the Easterly WWTP is Hop Brook, which would not constitute an out-of-basin transfer according to DEP. However, Sudbury would need to explore the downstream impacts of additional flow on the watershed with this alternative. With the issuance of the revised EPA permit, and construction of the plant upgrade, it is anticipated that there would be no detrimental impact.

Upfront costs anticipated with the Marlboro alternative would be construction costs of installing 3.3 miles of sewer pipes from Sudbury into Marlboro at approximately $1 million per mile, and a proportional share of the plant upgrade. It is assumed that this would be based on Sudbury's flow volume, which is approximately 7.3% of the total plant capacity (400,000 gpd/ 5,500,000 total volume of the plant). Given the known cost of the upgrade at \$40 million, 7.3% would be approximately \$2,920,000, however this cost has not been negotiated with Marlboro and is unknown at this time. On-going costs (typically paid for by users of the system) would include user fees and capital improvement costs to the system as needed, however all infrastructure in this system would be new and capital costs could be minimal for many years. System users would also be responsible for maintaining any pipes and pump stations needed in Sudbury.

Sudbury is continuing to explore this alternative, as it would remove the need to construct a treatment plant and disposal field in Sudbury.

5.5 Summary of Alternatives

Table 5-1 on the following page 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

	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 Required ➢ 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 Required ➢ 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 Required ➢ Service Agreements Required ➢ Property Value Impacts ➢ Aesthetic Concerns
Alternative 2 Shared Title 5 Systems	➢ Shared Costs ➢ Better Site Options	➢ More Regulatory Approvals Required ➢ Limits Development Potential ➢ Legal Agreements Required ➢ Yearly Pumping ➢ Large Area Required
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 Required ➢ Ownership Agreements Required ➢ Service Agreements Required ➢ Discharge Permit
Alternative 4 Regional Solutions	➢ Increased Environmental Protection ➢ Betterments Used to Assess Costs to Sewered Properties ➢ Potential SRF Funding ➢ No Mound or Pumped Systems ➢ Increased Property Value	➢ High Capital and Operating Costs ➢ NPDES Permit Limit Exceedances ➢ Out-of Basin Transfer of Flow ➢ Inter-municipal Agreements Required

6.0 SCREENING OF ALTERNATIVES

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. It also provides a screening of potential wastewater treatment facility and effluent disposal locations.

6.1 Title 5 Repairs/Upgrades Screening ("No Action" Alternative)

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 operation/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 previously presented) 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 $300,000. 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 $9,350,000. The total annual operation and maintenance costs borne by the individual property owners would be approximately $63,000.

TABLE 6-1

TITLE 5 REPAIRS/ UPGRADES - COST ANALYSIS

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	5	0	6	0	$0	$2,050,000	$14,500
WEST	7	1	1	5	0	$50,000	$1,600,000	$9,500
CENTRAL	12	25	17	5	7	$2,950,000	$5,700,000	$39,000
TOTALS	**31**	**31**	**18**	**16**	**7**	**$3,000,000**	**$9,350,000**	**$63,000**

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 = $300,000.

[4]Capital Costs = ((Design Flow <2000 gpd)*($50,000))+((Design Flow >2000 gpd)*($300,000))

[5]O+M Costs = [(("Non-priority" Systems)+(Design Flow <2000 gpd))*($500)] + [(Design Flow >2000)*($1,000)]

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, the Sudbury Medical Center (K6-12) is the only property identified as "Critical". Since there is only one "Critical" property in the this area, the option of a shared system was not investigated further for this portion of the project area.

Considering that there are not any "Critical" properties in the East portion of the project area, the option of a shared system was not investigated for this area either.

The central portion of the project area includes 24 "Critical" properties with a total projected build-out flow of approximately 50,000 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. Soil conditions in this area are consistently poor. 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 25 properties identified as "Critical", 24 of them are located in the Central portion of the project, it was initially assumed that the treatment plant and discharge would be located in or in close proximity to the Central area. Based on the geographic configuration of the needs areas, the extension of long lengths of pipe to include the West and East areas was not initially considered. This left the previously mentioned design flow of approximately 50,000 gpd to provide wastewater treatment to all of the "Critical" properties in the Central area and approximately 100,000 gpd to provide wastewater treatment to all of the "Critical" and "Priority" 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 (or possibly even lower) based on DEP regulation and 5 mg/l based on Sudbury's current Regulation of Small Sewage Treatment Facilities.

6.3.1 Initial Wastewater Treatment Facility & Discharge Siting (2001 Analysis)

Considering that finding a suitable site and determining the permitable flow under the Department of Environmental Protection's (DEP) groundwater discharge requirement is generally what drives project design and costs, the need to identify feasible sites for the discharge of treated effluent was established early in the planning process. Sites that meet DEP permitting criteria for disposal generally are underlain by permeable soils, have sufficient depth to groundwater, and have a significant saturated thickness, allowing for the assimilation of discharge into a given watershed. Additionally, these sites must have little to no impact on environmentally sensitive resources.

Initial review of the assessor's maps and resource information as part of the 2001 Needs Assessment resulted in eight (8) initial sites for evaluation (see Figure 6-1). This initial investigation was a preliminary screening that did not include soil testing or negotiations for the use of the land. The parameters used to evaluate the initial sites for suitability are as follows:

- Land Area – The land area to site a facility would have to be a minimum of 1 acre. Larger land areas are preferred for disposal because they will allow for reserve/open areas around the site.
- Proximity to Service area – The proximity of the WWTF 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 of the WWTF 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 WWTF

Weston & Sampson
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Legend

DEP Approved Zone II

N
W E
S

1,200 0 1,200
SCALE IN FEET

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

TREATMENT FACILITY SITE SCREENING

April 2001
Weston & Sampson Engineers, Inc

location that is closer to disposal is not as significant as the proximity of the WWTF to the service areas.

- Ownership – Town-owned land is preferential. Otherwise, private land or use thereof would have to be obtained by the Town for use as a facility site.
- Proximity to Residential Areas – The preferred siting of a WWTF 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 are located away from residential areas.
- Minimal Adverse Construction Impacts – This parameter deals with the impacts that the construction of a WWTF 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 WWTF and the disposal site would have on the surrounding environment.

The following is a brief description of each of the eight initial sites recommended for consideration:

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 groundwater discharge permit for 50,000 gpd of effluent disposal. Records indicate that this facility operates approximately 20,000 gpd below discharge capacity. Initial thoughts were that some additional flow from nearby critical properties could be connected to this facility but considering this would only solve a small part of the problem at the potential cost of taking ownership of this aging facility, this concept was eliminated from consideration. Recent discussions with Raytheon have, however, revealed an interest on their part to decommission their facility and share in the cost of new Town facility. Under this scenario, consideration could be given to utilizing the 50,000 gpd discharge permit as part of the effluent disposal system for the new Town facility.

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 three 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 contiguous 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 potentially 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. Although this site may have enough land area available to accept some flow for disposal, the site may require a mound system because of high groundwater table. Considering this and that it is in active use, this site was not explored further.

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) with a 8,500 gpd system serving the Chiswick/Emerson Medical Building. 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 additional effluent disposal.

Site 5 – Cavicchio Property

This site, located on Codjer Lane, fronts on Union Avenue. It is composed of six lots (J07-007, 041; J08-004, 005, 006, 501) and is just outside the Central area to the north, making it proximate to the project 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 site is privately owned and 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

The Stone Farm site (K06-600) is located adjacent to Raytheon's western most property line. This property is 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. Therefore, the property cannot be considered for siting of the above ground structures necessary for a WWTF.

Site 7 - Bartlett Property

The Bartlett Property (K07-014) shares the Stone Farm's western property line. This property is nearly level, with a sandy glacial outwash and groundwater estimated at greater than five feet. The Bartlett property has approximately 12 acres in Chapter 61A (agricultural use) and contains several acres of greenhouse structures. 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 WWTF in conjunction with effluent disposal on Site 7.

Site 8 -Town of Sudbury "Bushey" 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 but the site is too small to accommodate the desired flows. It is centrally located and could, however, be considered for the WWTF.

6.3.2 The Continued Search for a Discharge Site

From 2001 to 2010, the TAC was focused on identifying a site that could accommodate groundwater disposal of no less than 100,000 gpd of treated wastewater effluent. Recharging these daily volumes requires a site of sufficient size to accommodate the Soil Absorption System (SAS) as well as the associated infrastructure (e.g., tanks, pumping equipment, controls). The site may, but does not have to, include the WWTF.

The site screening process for this project began by looking at all town-owned parcels in close proximity to Route 20. This search was hampered by the close proximity of the Town's drinking water supply wells (i.e. Zone II) and high groundwater conditions, which are the same conditions plaguing the existing Title 5 systems in the Route 20 Business District. The search was then expanded to all town-owned parcels within one mile of Route 20 and private parcels in close proximity to Route 20. When this once again proved unsuccessful, the search was expanded to include all large parcels within three miles of Route 20. Table 6-2 provides a brief description of the 86 screened (or potential) parcels, including a brief description as to why they were eliminated from consideration (also see Figure 6-2).

The TAC ultimately tested nine (9) of the 86 screened sites that had been identified as potential parcels in this analysis. Chapter 7 provides details on the hydrogeologic investigations performed.

TABLE 6-2
SCREENED PARCELS FOR GROUNDWATER DISCHARGE

Site Name	Address	Assessor Map	Acreage	Description	Tested?
POTENTIAL PARCELS					
Cavicchio	Codjer Lane	J07-41,J08-4,5,6,501	75	Potential parcel, Landowner currently not interested	
DPW	275 Old Lancaster	H08-049	4 usable	Lens of clay, anticipated mounding close to garage floor elevation; soil testing completed, TOWN OWNED	Yes
Clark (Cavicchio)	Codjer Lane	J07-012	10	Previous landfill; uncooperative owner	
Stone Farm	Horse Pond Rd	K06-600	58	APR, possible land swap, soils questionable; Zone 2; owner not interested	
Military Training Field	Old County Rd	K11-006	3.17	Historic site; TOWN OWNED	
Haskell Field	Fairbank Road	F05-005	29	Recreational Use, Zone 2, irrigation wells; TOWN OWNED	Yes
Curtis Middle School	Pratts Mill Road	H07-027	43.56	Zone 3; good possibility. distance to Route 20 an issue; TOWN OWNED	Yes
TESTED PARCELS					
Meader	Horse Pond Rd	K06-009,010,011	5	7-8' to water table, vernal pool; recently developed into subdivision	Yes
Sykes	625 Boston Post Rd	K06-29	2.76	Bad soils, no capacity, high gw	Yes
Bushey	Boston Post Rd	K06-505	1.6	Too small, single house lot only capacity available.	Yes
Mahoney	Old Framingham Rd	M07-004,005	40	Slope issues. Drops off quickly to wet area/upland glacial, 15-30 mpi, boulders	Yes
Young	804 Boston Post Rd	K04-0015	7	Zone 3; soils not adequate for system size	Yes
Johnson	301 Old Lancaster Rd	H08-0037,040	6	Zone 3, may be too small	Yes
OTHER POTENTIAL PARCELS/ NO KNOWN SOIL INFO					
Site Name	**Address**	**Assessor Map**	**Acreage**	**Description**	**Tested?**
Wright	333 Maynard Rd	E06-0004	8.1	Zone 2, may be too small, distance to Route 20 an issue	
Atkins	343 Maynard Rd	E06-0005	4.15	Zone 2, may be too small, distance to Route 20 an issue	
Chesnais	152 New Bridge Rd	F10-0017	6.81	May be too small, distance to Route 20 an issue	
Saini	154 New Bridge Rd	F10-0018	5.46	May be too small, distance to Route 20 an issue	

TABLE 6-2
SCREENED PARCELS FOR GROUNDWATER DISCHARGE

Site Name	Address	Assessor Map	Acreage	Description	Tested?
Feudo	136 New Bridge Rd	F10-0029	5.82	May be too small, distance to Route 20 an issue, potential wetlands	
Rosen	27 Sawmill Ln	F10-0313	6.58	May be too small, distance to Route 20 an issue, potential wetlands	
Peppercorn	28 Sawmill Ln	F11-0316	8	May be too small, distance to Route 20 an issue, potential wetlands	
Ionescu	17 Oakridge Rd	F11-0317	5	May be too small, distance to Route 20 an issue, potential wetlands	
DeGregory	11 Oakridge Rd	F11-0318	5	May be too small, distance to Route 20 an issue, potential wetlands	
Dickey	Newbridge Road	G11-500	73.5	Distance to Route 20 an issue	
Wollensak	60 Pennymeadow Rd	H08-0012	5.46	Zone 3, may be too small	
Weaver	Old Lancaster Road	H08-008	11.5	Zone 3; near DPW Building	
Sullivan	28 French Rd	J04-0004	5.15	Zone 3, may be too small, distance to Route 20 an issue, potential wetlands	
Kerns	247 Dutton Rd	J04-0106	7	Zone 3, distance to Route 20, potential wetlands	
Silvester	150 Wayside Inn Rd	K02-0002	9.53	Zone 3	
Lorant	194 Wayside Inn Rd	K02-0318	6.08	Zone 3	
Pavlan	188 Wayside Inn Rd	K02-0319	5.02	Zone 3; wetlands, but may be possible if combined with parcel 318	
Schirmer	850 Boston Post Rd	K04-0001	5.6	Zone 3	
Levy	64 Peakham Road	K04-009	5	Zone 3	
Longfellow Glen	655 Boston Post Rd	K06-501	22.61	Zone 3; large system currently on site but possible redevelopment	
Devine	33 Boston Post Rd	K12-0003	8.8	Zone 3; Richey and Clapper	
Peed	Boston Post Rd	L02-0200	5.01	Zone 3	
EXCLUDED PARCELS					
Site Name	**Address**	**Assessor Map**	**Acreage**	**Reason for Exclusion**	**Tested?**
Hodder/Topham	DeMarco Rd	G08-033	4.09	Wetlands	
Libby	77 Water Row	H11-400	31	Recently acquired by Town for open space	
Raytheon	526-528 Boston Post Rd	K07-11,13	49	Not interested. DEP ordered upgrade. Flow=28,000 (of 50,000) GPD	

TABLE 6-2
SCREENED PARCELS FOR GROUNDWATER DISCHARGE

Site Name	Address	Assessor Map	Acreage	Description	Tested?
Bartlett	Boston Post Rd	K07-14	12	Wetlands	
Chiswick Park	490 Boston Post Rd	K07-17,18	35	Room for WWTF, not for gw disposal	
Saxonville Lumber	27 Union Ave	K08-56	3	Sold to Sudbury Lumber. High gw & limited space	
Reider Property	480 Boston Post Road	K08-62	4.5	Sold to Emerson Medical; fully developed	
George	Boston Post Rd	K10-110,111	1.12	Wetlands	
WS Septage Facility	Boston Post Rd	K12		Viable site, costly, questionable capacity, in between 2 landfills	
Sudbury Water District	Nobscot Rd	L07-018	2.8	Near active well	
Lettery	Landham Rd	L09-600	28	Vernal pools & wetlands; recently developed into subdivision	
Newell	Old Framingham Rd	M07-006	30	Recently developed into senior housing	
Hodder	136 Hudson Road	G08-0700	7.52	Unsuitable soils; Zone 3	
Fairbank School	40 Fairbank Road	F06-0001	8.05	Zone 2; very limited land area	
Grinham	97 Fairbank Road	F06-0005	4.1	Zone 2; wetlands	
Haynes	Morse Road	F09-0004	9.6	High groundwater, poor soils	
Featherland Park	Morse Road	F09-0006	5.77	High groundwater, poor soils	
McCormick	55 Hunt Road	F09-0217	5.13	Poor soils	
Nixon School	Concord/Newbridge Road	F09-030	21	Possibly, depends on land area needed	
555 Concord Road LLC	555 Concord Road	F10-0010	5.8	Unsuitable soils, topography	
Gelsinon	520 Concord Road	F10-0019	4.07	Wetlands	
Booma	233 Concord Road	H09-0016	8.8	Zone 3; shallow soils	
Beers	277 Old Sudbury Road	H09-0051	9	Zone 3; wetlands	
Greenberg	171 Dutton Road	J03-0006	10	Zone 3; topography; soils limited	
Rhome	161 Dutton Road	J03-0007	5	Zone 3; topography; soils limited	
Abrams	153 Dutton Road	J03-0008	5.06	Zone 3; topography; soils limited	
Casey	145 Dutton Road	J03-0009	5.67	Zone 3; topography; soils limited	

TABLE 6-2
SCREENED PARCELS FOR GROUNDWATER DISCHARGE

Site Name	Address	Assessor Map	Acreage	Description	Tested?
Adams	137 Dutton Road	J03-0010	5.34	Zone 3; topography; soils limited	
Bell	48 French Road	J04-0002	8.61	Zone 3; topography; soils limited	
Sittler	76 Old Lancaster Road	J09-0022	4.15	Zone 3; unsuitable soils	
Lowell	35 Dutton Road	K03-0001	5.28	Zone 3; topography; soils limited	
Fryling	61 Dutton Road	K03-0003	5.09	Zone 3; topography; soils limited	
Winter	71 Dutton Road	K03-0004	5.04	Zone 3; topography; soils limited	
Morgan	87 Dutton Road	K03-0005	5.6	Zone 3; topography; soils limited	
Sacherski	101 Dutton Road	K03-0006	5	Zone 3; topography; soils limited	
Wendel	111 Dutton Road	K03-0007	5.35	Zone 3; topography; soils limited	
Maroni	123 Dutton Road	K03-0008	5.45	Zone 3; topography; soils limited	
Watts	133 Dutton Road	K03-0009	6.67	Zone 3; topography; soils limited	
Henderson	Boston Post Rd	K06-0005	4.05	Zone 2; wetlands	
Precourt	Union Ave	K08-0038	4.07	Zone 2; poor soils	
Milt Bartlett	Off Union Ave	K08-055	21.3	Zone 2; wetlands	
McCarthy	55 Maple Ave	K09-0074	4.07	Zone 2; poor soils	
Shylovsky	192 Boston Post Rd	K10-0018	8.54	Wetlands	
Gupta	202 Wayside Inn Rd	L01-0001	5.02	Zone 3; high groundwater	
Keelan	1095 Boston Post Rd	L02-0204	5	Zone 3; topography	
Duvall	Bowditch Rd	L02-0211	5.04	Zone 3; topography	
Robelen	Bowditch Rd	L03-0211	5.06	Zone 3; topography	
Hubelbank	167 Maynard Rd	F07-0012	5.22	Zone 3; unsuitable soils	
Clark	Nobscot Rd	L07-200	27	Zone 2, too close to well field	
Wayside Inn	Wayside Inn Rd	L03-001,002		Zone 3; high groundwater, historic site	
O'Kelley	16 French Rd	J04-0005	8.87	Wetlands	

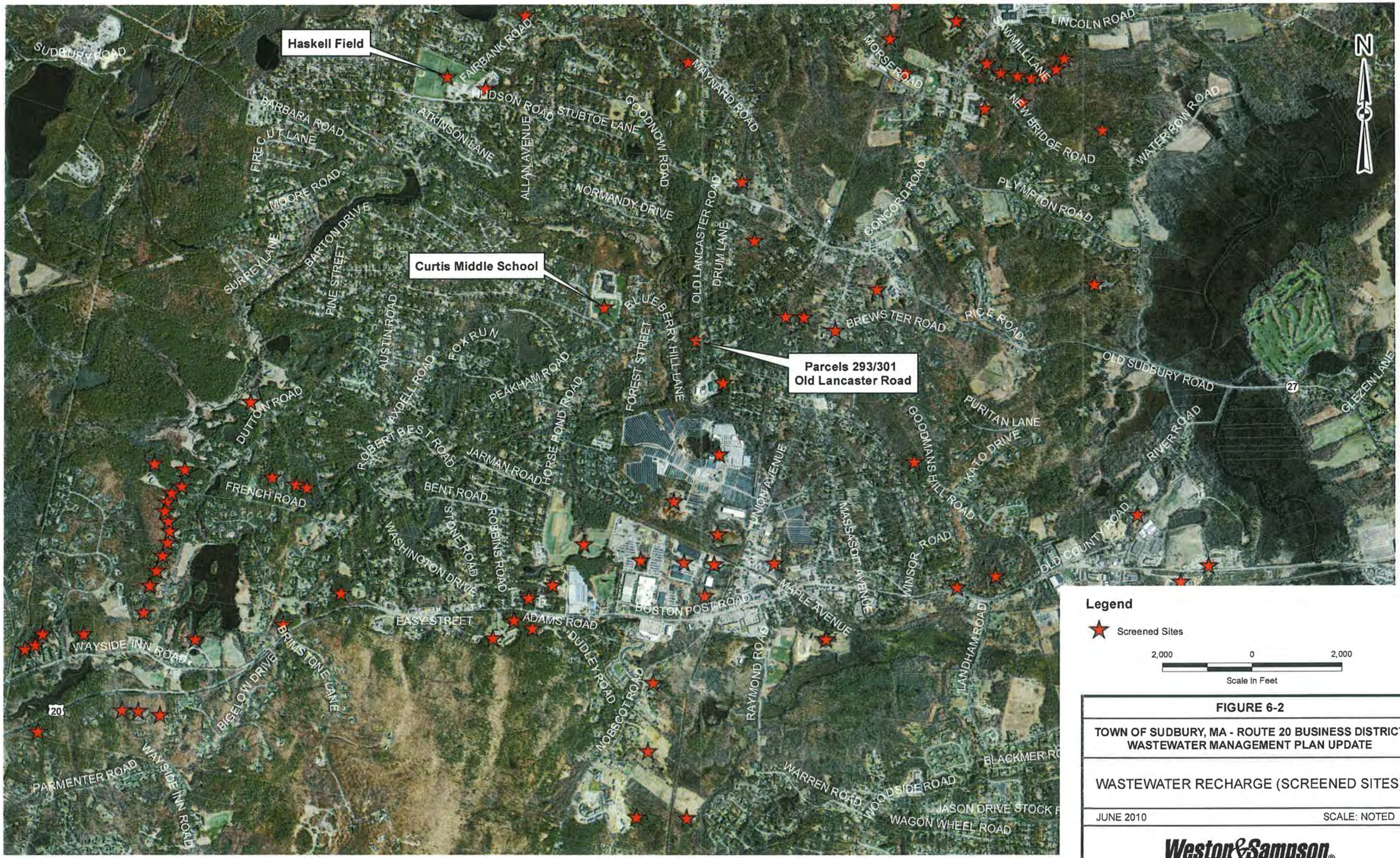


FIGURE 6-2

TOWN OF SUDBURY, MA - ROUTE 20 BUSINESS DISTRICT
WASTEWATER MANAGEMENT PLAN UPDATE

WASTEWATER RECHARGE (SCREENED SITES)

JUNE 2010 SCALE: NOTED

Weston&Sampson

7.0 HYDROGEOLOGIC INVESTIGATION FOR DISPOSAL SITES

7.1 Site Selection

As discussed in Section 6.0, the TAC screened 86 sites for disposal of treated wastewater effluent and performed some level of soil testing at nine (9) sites. The six initial sites for testing were as follows:

- The Meader Property – Horse Pond Road (K06-009,010,011)
- The Sykes Property – 625 Boston Post Road (K06-29)
- The Former Bushey Property – 641 Boston Post Road (K06-505)
- The Mahoney Property – Old Framingham Road (M07-004,005)
- The Young Property – 804 Boston Post Road (K04-0015)
- DPW – 275 Old Lancaster Road (H08-049)

Brief descriptions of the findings on these parcels are included in Table 6-2, previously presented in Section 6.0. Available specific information on the testing at these sites can be found in Appendix C.

Following this preliminary work and expansion of the search area, several more potentially viable sites were identified for further evaluation, including:

- Haskell Field - Fairbank Road (F05-005)
- Johnson Property - 293/301 Old Lancaster Road (H08-0037,040)
- Curtis Middle School – Pratts Mill Road (H07-027)

These sites, as well as all other screened parcels, are depicted on Figure 6-2, previously presented in Section 6.0.

Initially, each of the three sites was evaluated by Weston & Sampson to identify any potentially sensitive environmental receptors including critical habitat, wetlands, private and public well systems, and state designated Areas of Critical Environmental Concern (ACECs). These evaluations indicated that each site had no serious restrictions with respect to state permitting requirements, although the property along Old Lancaster Road was in close proximity to Hop Brook.

Following the initial environmental evaluations, subsurface borings were conducted at each location. The borings were intended to:

- Determine depth to groundwater.
- Define stratigraphy or layering of subsurface deposits.
- Identify depth to bedrock.
- Evaluate saturated thickness and permeability of subsurface deposits.

If subsurface conditions were suitable, the information collected could be used to evaluate groundwater mounding below these fields, calculate preliminary flow rates and complete a conceptual design of the proposed subsurface absorption system.

The results of the subsurface investigation were presented to the TAC in a summary report dated February 18, 2010, which is included in Appendix D. Fine grained silts and silty sand deposits were found to limit the amount of treated wastewater that could be discharged at the Haskell field site and the property on Old Lancaster Road. In contrast, soil deposits below the playing fields of Curtis Middle School were found to be suitable for the development of a large scale SAS. Subsurface testing focused on the Curtis Middle School site to further assess viability and determine capacity. The Curtis Middle School property is shown on Figure 7-1 along with the location of initial borings at this site.

7.2 Test Drilling

Per the approved hydrogeologic work plan submitted to DEP on August 6, 2010 and included in Appendix E, seven additional wells were installed at the Curtis Middle School site, in addition to the three existing wells, for a total of 10 wells. Both the new (Wells A through G) and previously installed well locations are provided in Figure 7-2.

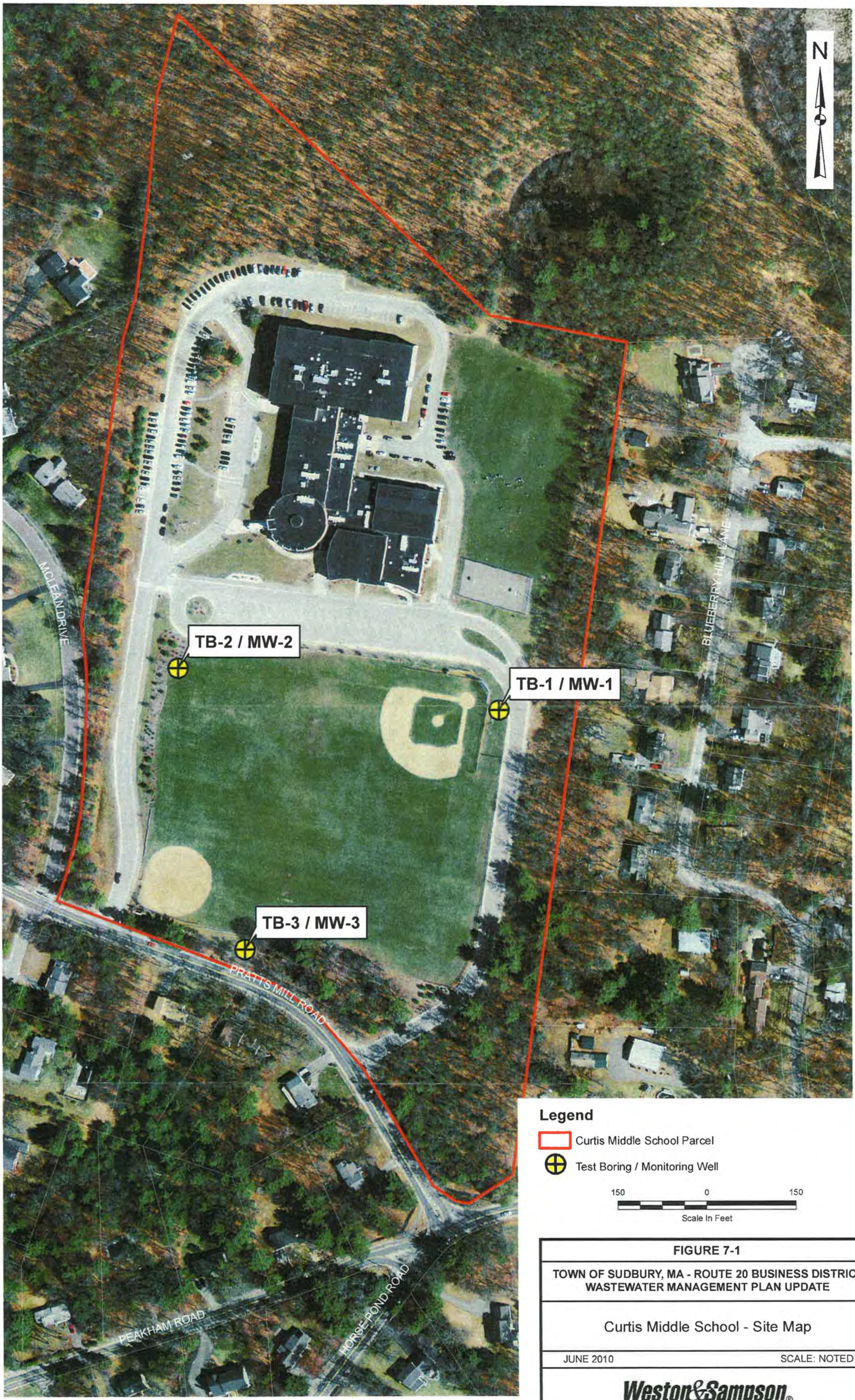


FIGURE 7-1

TOWN OF SUDBURY, MA - ROUTE 20 BUSINESS DISTRICT WASTEWATER MANAGEMENT PLAN UPDATE

Curtis Middle School - Site Map

JUNE 2010 | SCALE: NOTED

Weston&Sampson®

FIGURE 7-2
Hydrogeologic Investigation
CURTIS MIDDLE SCHOOL

Staff Gauge

Existing Boring/Monitoring Well

Proposed Observation Network
Curtis Middle School Property
Infiltration Basin

PROPOSED OBSERVATION NETWORK

0 60 120 240 Feet

Weston&Sampson

Q:\DataStage\Sudbury\projects\hydrogeo eval proposal\observation network Curtis Middle School.mxd 7/20/2010 10:31:14 AM higginsm

Test wells C-1, C, A, B, D, and E were installed close to the excavated infiltration pit. These wells all exhibited a similar subsurface stratigraphy where the upper 5-7 feet consists of varying amounts of cobbles, demolition debris and compacted sands, gravel and clay. Undisturbed glacial deposits, underlying these reworked construction materials, generally consisted of fine to medium sand. This sand deposit has a variable silt content ranging from 1-2% up to approximately 15%. In general this unit coarsened with depth until 51 feet below grade. These coarse deposits included highly permeable sand and gravel with cobbles. At a depth of 51 feet, all borings indicated a low permeability. Silt deposits exist with varying amounts of find sand and clay stringers. This low permeability layer was significant, extending to a minimum depth of 60-65 feet thus representing a lower impermeable layer impeding vertical groundwater movement. Due to this significant and laterally extensive deposit, borings were not continued beyond these depths. Boring logs are provided in Appendix E.

Representative samples for sieve analysis were selected and submitted for laboratory grain size analysis. Sieve analysis is provided in Appendix E. Sieve analysis in wells A, C, and D were selected to represent the range of permeable deposits through which treated effluent must be discharged. Estimates of hydraulic conductivity can be gained from sieve analysis using methods developed by Shepard and through the Fair-Hatch Equation.

Samples from Well A between 20-25 feet represent a sand deposit with the highest observed content of silt. This area would represent a conservative estimate of the permeability of deposit at the site. In addition to a representative sample from lower permeability deposits, samples from wells C and D were selected for sieve analysis. These samples were selected from saturated zones above the lower silt and clay layer (51' and below). These samples were representative of the dominant sand units in which lateral flow would occur below the mound. A final sample was selected from Well G to confirm that the permeable sand deposits are laterally extensive and continue towards Hop Brook and regional discharge features. The results of both the Fair-Hatch evaluation and the calculations made using methods developed by Shepard are presented in Table 7-1.

Table 7-1

Hydraulic Conductivity Estimates

Well ID	Interval (ft bgs)	D_{50} (mm)	Hydraulic Conductivity Estimate (ft/d)	
			Shepard	Fair-Hatch
Well A	20-25	0.3094	68	54
Well C	40-45	4.2102	5,015	1,775
Well D	35-40	1.6937	1,116	330
Well G	25-30	0.6174	211	158

7.3 Load Scale Test

The load scale test was conducted between December 19th and 26th, 2010. The 7-day test included antecedent water level monitoring in 13 wells. Per agreement with DEP, streamflow monitoring and shallow piezometers were not necessary due to the distance to Hop Brook and the lack of standing water in nearby topographic swales.

Injection water for the test was taken from the municipal water system. A flow control valve and a new calibrated 1-inch water meter were used to regulate flow. Instantaneous readings were made daily while the meters totalizer was read daily to ascertain cumulative flow volumes. Water was routed to the pit via 1.5-inch polyethylene piping. Discharge into the 20 x 20 foot square pit was routed onto a hay bale with plastic sheeting to avoid erosion within the base of the pit. The pit was excavated to 3.5-feet, a level that exposed natural, tan medium sand deposits directly below the construction fill, which was prevalent at the site.

Both hand measurements and electronic data loggers (pressure transducers) were used to measure changes in groundwater levels. Water levels in the injection pit remained at a constant depth of 19" throughout the test. Water level data during the test and during the recovery period are provided in Appendix E. Although 6-12 inches of snow was recorded during the test, freezing conditions and snow did not affect water in the pit, which remained clear and free of ice. Discharge rates remained constant throughout the test and averaged 46,000 gpd.

Water level responses are shown in Table 7-2 and are represented graphically in Figure 7-3. Water level mounding was most pronounced in Well A, northeast of the injection pit. Wells A &

B are in the downgradient direction and revealed maximum mound heights of 1.82 and 1.06 feet, respectively. Similarly, Well E to the southwest revealed 1.46 feet of change. The test was terminated as water levels tended towards stabilization with all wells showing less than 0.1 feet of change over the final 24 hours.

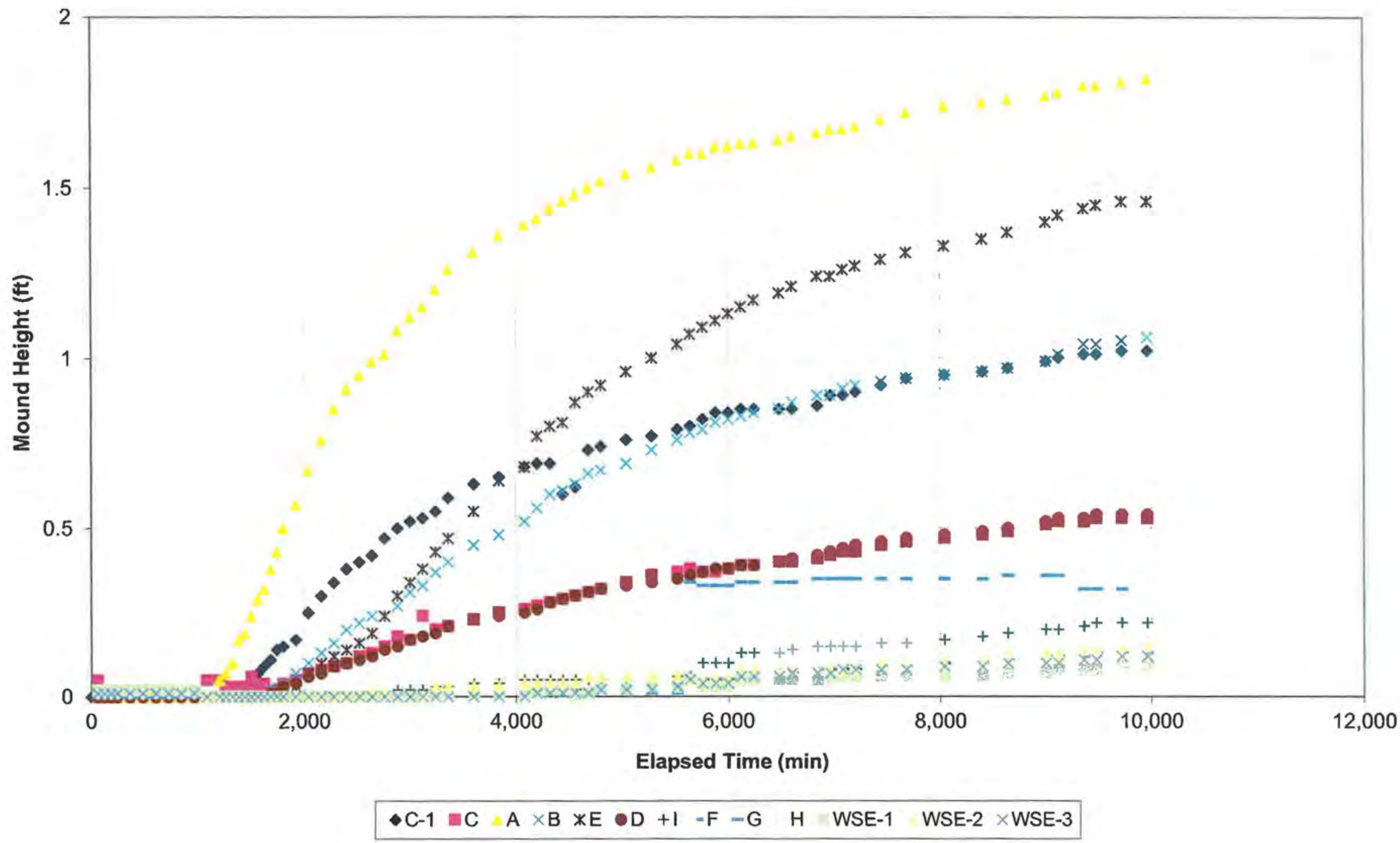
Table 7-2

Groundwater Elevations

Well_ID	Well Elevation	Water Elevation (static)	Water Elevation (end of test)	Water Level Change (end of test)
C-1	187.53	153.63	154.65	1.02
C	187.25	153.67	154.20	0.53
A	187.15	153.48	155.30	1.82
B	187.21	153.07	154.13	1.06
E	186.30	153.16	154.62	1.46
D	187.50	153.63	154.17	0.54
I	185.78	153.78	154.00	0.22
F	186.90	152.64	152.77	0.13
G	185.83	152.52	152.61	0.09
H	188.46	151.40	151.39	-0.01
WSE-1	186.17	153.14	153.23	0.09
WSE-2	184.68	154.86	155.01	0.15
WSE-3	184.54	153.55	153.67	0.12

Response to the injection test was evident at all corners of the athletic field compound. The minor rise in wells WSE-1, 2, and 3 indicate that the permeable subsurface deposits between 30 and 51 feet are laterally extensive and are in good hydraulic communication. This connection is ideal for the long-term assimilation of the planned discharge. Well H, located a significant distance from the proposed discharge did not reveal a change in water level. As similar deposits are present to the northeast of the school, this athletic field area potentially represents an area for reserve capacity or may be designated as a replacement area for potential future use.

Figure 7-3:
Curtis Middle School Infiltration Test Mounding Results



7.4 Analytical Modeling

The mounding analysis was completed in a two-step process. The first step was to calibrate and validate aquifer characteristics. Initially calculated hyrdraulic parameters were input into a program developed by the Colorado School of Mines. The program uses the modified Hantush (1967) equation to estimate radial flow and mound height from a recharge source. In this instance, the actual conditions from the load scale test were used; specifically, a discharge field, 20 feet by 20 feet was used with a loading rate or input flow of 45,000 gallons per day. Assuming the silt and clay deposits at 51' below grade represent an impermeable layer, and static water levels were approximately 33' below grade, initial saturated thicknesses were 18 feet. The most conservative, measured hydraulic conductivity of 68 ft/day was then used to simulate the test conditions. Water levels in Well A were compared against model results (see Appendix E). Calculations using the model predict a water level of 1.811 feet would occur at Well A after discharging 45,000 gpd for 7 days. Actual test data revealed a water level rise of 1.82 feet indicating excellent correlation with the simulated values.

The second process then is to use the analytical model to predict the mound height under a properly sized field. This predictive effort is generally an interactive process where various flow rates and discharge field sizes are used. The summary of this process is described below.

Field size plays a critical role in most mound height calculations. Given DEP wastewater guidance for wastewater treatment facilities, treated effluent beds are limited to 3 gpd per square foot of discharge bed. Assuming a common trench style system, a 200'x 300' field would allow the discharge of 180,000 gpd of treated effluent. Thus 2 disposal fields approximately 50 feet apart were used to model varying flow rates. Model simulations were made for 180 days to approximate steady state conditions. Results of the modeling are provided in Appendix E and are summarized in Table 7-3.

Table 7-3

Mound Height Calculations for Various Discharge Rates

Discharge Rate (gpd)	Max Mound Height (feet)
150,000	4.7
250,000	7.1
350,000	9.3
400,000	10.28

Note: Model reflects 2 discharge fields, 200 x 300 feet separated 50 feet apart

With a conceptual trench design requiring 4-5' bury depths for the field piping, a static water level of 33' and a seasonal fluctuation of 5', it was determined that a maximum mound height of 10.28 should easily be accommodated at this site.

A final consideration for impacts is the mound height at radial distances away from the proposed discharge location. The predicted radial mound at a discharge of 350,000 gpd (may build-out plus approximately 10 percent) is shown in Table 7-4.

Table 7-4

Mound Height at Varying Distances (Q = 350,000 gpd)

Distance from Field Center (ft)	Predicted Mound Height (feet)
15	9.26
50	9.1
500	4.38
1000	3.22

Thus, the model predicts that at approximately 1000 feet away groundwater elevations may increase by as much as 3.2 feet. Subsurface variations and changes in groundwater gradients (e.g. near hillsides, etc.) and local or regional discharge features (wetlands, lakes, or rivers) may alter this result. In general, this minimal mound height represents a relatively small impact at radial distances beyond 1,000 feet.

7.5 Conclusions and Recommendations

The load scale test and field data collected from the test borings and water level information indicate the following:

1. Static water levels are approximately 33 feet below grade
2. Anticipated discharges of 350,000 gpd should be assimilated by the deposits of the Curtis Middle School Site
3. Modeled response to these discharges, assuming two (2), 200 x 300 foot infiltration systems (e.g. standard subsurface absorption system (SAS) design using lateral trenches) results in a maximum mound height of 9.3 feet and a calculated mound height of 3.22 feet approximately 1,000 feet from the center of the SAS.

In summary, the Curtis Middle School property provides a viable option for the discharge of a sufficient volume of treated wastewater effluent and is therefore the recommended discharge site for the decentralized treatment option. Considering 1) the distance from the service area; 2) the extensive area required for the discharge beds and the subsequent limited remaining space; and 3) the aesthetics of the school property, it is recommended that the wastewater treatment process equipment/facility be located elsewhere.

The Technical Advisory Committee, in conjunction with the Board of Selectmen, also concluded that a viable location for the siting of the WWTF is on Town-owned property located at 641 Boston Post Road (Parcel K06-505), as initially discussed in Chapter 6 and further detailed in Chapter 8. This property fronts Boston Post Road and provides a fairly central collection point for the Central and West project areas, and is located near the intersection of Horse Pond Road. Its designation as general municipal land allows this use.

8.0 RECOMMENDED PLAN

8.1 Introduction

Over more than a decade, the framework for the development of a viable wastewater solution to satisfy the needs of the Route 20 business district has been set. As part of that effort, the wastewater needs of those properties within the Route 20 business district have been assessed, future wastewater flows have been estimated, potential treatment and disposal sites have been identified, hydrogeological site evaluations have been completed, and wastewater treatment and disposal alternatives have been examined.

Based on the work completed to date, a recommended solution to satisfy the wastewater needs of the Route 20 business district has been developed and is presented in this section.

8.2 Service Area

The recommended solution requires defining the service area. As discussed in Section 2.0, the study area was broken down into three distinct areas: West, Central and East. Based on the needs assessment completed for each area, along with their location within the project area, each area was evaluated for inclusion in the recommended plan as described in more detail below.

East Area

Due to the limited number of "Critical" needs properties in this area and its distance from 641 Boston Post Road, the site proposed for the WWTF as discussed in Chapter 7, 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.

West Area

Although this area has a limited number of "Critical" needs properties as well, it is recommended that this area be included as part of the recommended plan due to its proximity to the site of the proposed WWTF, which is actually located in the West Area.

Central Area

The significant number of "Critical" needs properties in the Central area identified in Chapter 3 warrants this area to be the focus of the recommended decentralized plan.

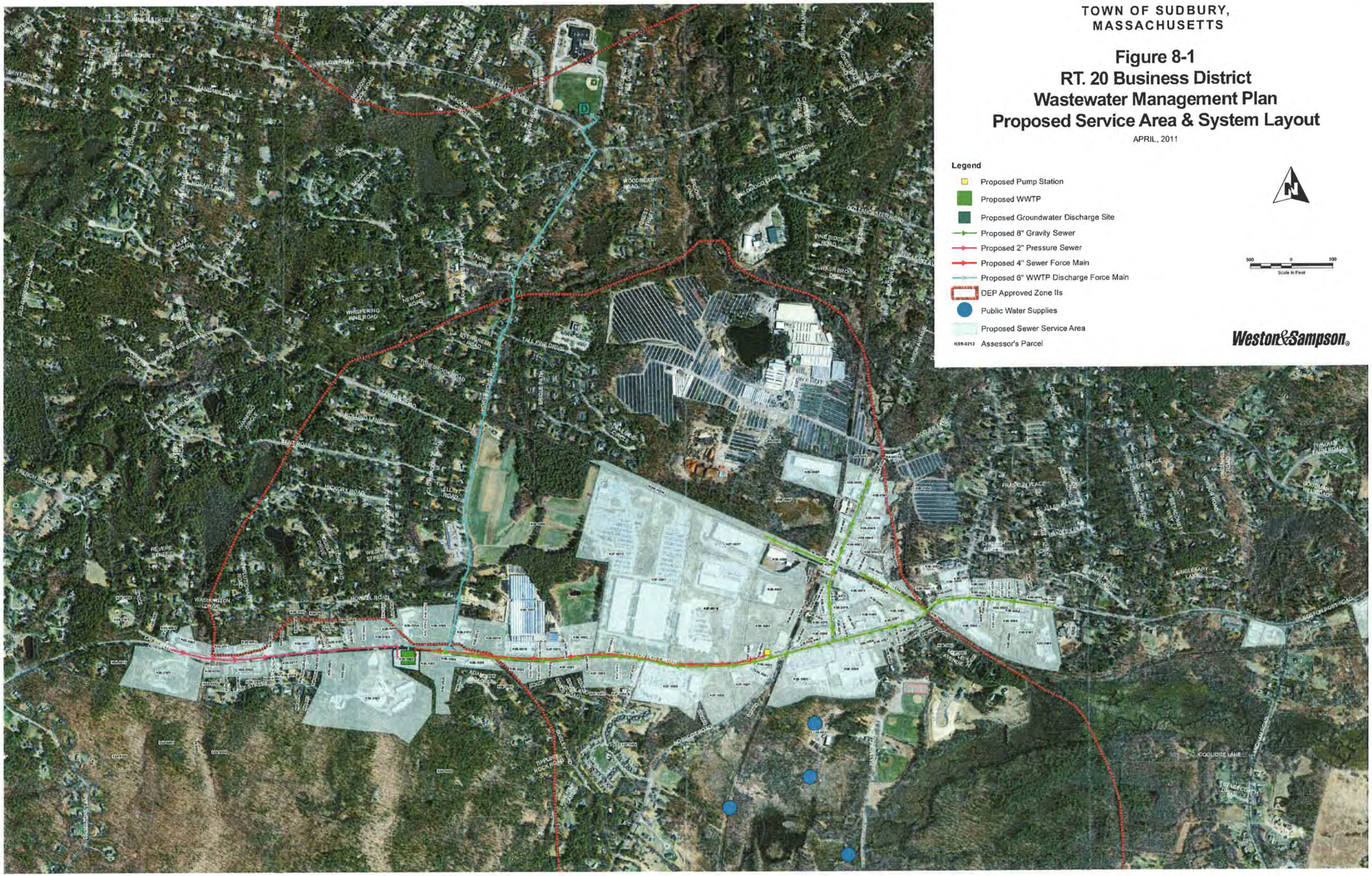
Proposed Service Area

Based on 1) the estimated capacity of the proposed discharge site at the Curtis Middle School (see Chapter 7); 2) the close proximity of the Central and West Areas to the proposed WWTF on Boston Post Road (See Chapter 7); and 3) the total estimated build out flow of these areas (see Chapter 4), the proposed system would provide service to all properties within the West and Central areas that are fronted by the collection system regardless of their level of need. This includes residential properties, which were not previously evaluated as part of the Needs Analysis. The service area would include the commercial and residential properties along Rte. 20 from Lafayette Drive to Massasoit Avenue, and on Union Avenue from Rte. 20 to just south of Codjer Lane, as well as selected properties on Station Road from just west of Union Avenue to the Rte. 20 intersection. The service area to be included as part of the recommended plan is shown on Figure 8-1. A list of properties included in this area is shown on Table 4-13, previously presented, along with their total estimated design flow and future build-out flow. The total estimated build-out flow for all properties within the service area is approximately 268,400 gpd.

The selected alternative is a Decentralized Wastewater Treatment System with groundwater discharge to service the West and Central areas. By servicing both areas, it makes the decentralized solution more cost effective.

8.3 Wastewater Treatment Facility

As discussed in Chapter 7, the proposed location for siting of the WWTF is on town property located at 641 Boston Post Road (Parcel K06-505). There are no structures currently built on this parcel. A portion of this property was taken out of conservation restriction (70,000 square feet) and is available for municipal use. The site is centrally located within the service area, and is in close proximity to Boston Post Road. Once the collected wastewater is treated, it will be transmitted through a force main to the Curtis Middle School athletic fields for discharge into the ground. Additional detail regarding the preliminary design of the WWTF and groundwater disposal system is presented later in Section 8.5.



TOWN OF SUDBURY,
MASSACHUSETTS

Figure 8-1
RT. 20 Business District
Wastewater Management Plan
Proposed Service Area & System Layout

APRIL, 2011

8.4 Environmental Impacts

The selection of the recommended plan for wastewater management was made with consideration to potential environmental impacts. This section is intended to summarize the direct and indirect environmental impacts associated with the recommended plan. It includes a discussion of both the environmental benefits and any adverse impacts associated with the recommended plan. Mitigation measures, where necessary to limit any negative impacts, are also discussed. A more in-depth discussion of the potential impacts along with the proposed mitigation measures will be presented as part of the Environmental Notification Form to be completed as part of the MEPA process.

8.4.1 Direct Impacts

Direct environmental impacts relate directly to the implementation of the wastewater management alternatives and occur either temporarily during construction or permanently as a result of the project. Direct impacts include disturbance of sensitive historical, archaeological, cultural or recreational areas, disturbance of wetlands and plant species habitats, impacts on surface water and groundwater quality, and impacts to normal traffic, business operations or other daily activities in the project area.

8.4.1.1 Historic, Archaeological and Cultural Resources

The impact of any portion of the selected plan on historic, archaeological and cultural resources will be addressed in the ENF and subject to review by the Massachusetts Historical Commission. However, impacts to historic resources are expected to be minimal, as the proposed sewer alignment is within existing roadways, which have been previously disturbed. The WWTF will be sited on town-owned land that was taken out of conservation restriction (70,000 square feet) and is available for municipal use. The groundwater disposal system is also located in a previously disturbed area at the playing fields at the Curtis Middle School. The fields will be restored to their current use once construction is complete.

8.4.1.2 Recreation

Recreational impacts should be mostly temporary in nature, due to the construction noise, traffic access and air quality impacts. As discussed above, the groundwater disposal system will be constructed in the same location as the recreational fields at the

Curtis Middle School. There will be temporary impacts during construction, but the long-term use of the site for recreational purposes will not be impacted. To the extent possible, construction should be scheduled at a time that would be least disruptive to the Middle School, preferably during the summer months when school is out, but also taking into account the schedule for use of the playing fields.

8.4.1.3 Wetlands and Floodplains

There are a large number of wetlands within Sudbury and the impact of the recommended alternative on buffering wetlands should be positive with regard to groundwater discharge once failing septic systems are removed from service.

Temporary wetland impacts associated with construction will be considered during the final design. Any work in wetland buffer zones will be identified in a Notice of Intent to be submitted to DEP and the local conservation commission for approval. As a minimum, erosion and sedimentation control measures will be used in these areas during construction to mitigate any potential impacts.

8.4.1.4 Water Quality

Surface water and groundwater quality would be improved and protected with the implementation of the selected plan. The elimination of wastewater discharges to surface waters and contamination of groundwater resources due to inadequate and failing on-site disposal systems will be beneficial to the Town's water resources by improving water quality. These discharges could contain pollutants and contaminants, which would have the potential to cause health and environmental problems.

8.4.1.5 Groundwater

The presence of failing septic systems has a potential negative impact on the Town's groundwater resources. The recommended plan will improve groundwater quality through the removal of septic discharges within a Zone II Wellhead Protection Area. In addition, since highly treated effluent from the WWTF will be discharged back into the groundwater supply, it will serve to recharge the Town's aquifers.

The disposal area is located adjacent to, but not within the Zone II of a public drinking water supply.

8.4.1.6 Surface Water

With implementation of the recommended plan, there should be an improvement in surface water quality as discharges from failing on-site wastewater disposal systems in the project area are eliminated.

8.4.1.7 Displacement of Traffic, Households, Businesses and Services

Since the proposed sewer alignment is within existing roadways, there will be temporary construction related impacts on vehicular traffic patterns, as well as business access within the Rte. 20 business district. Traffic impacts due to increased volume from construction vehicles will be seen and roadway construction may have some short-term effect on existing traffic patterns. To minimize these effects, construction documents should require, when and wherever possible, provisions that all work on major roads be performed so as to allow two lanes of traffic. Work on roadways experiencing less traffic volume should include provisions for maintenance of at least a single lane of traffic. Adequate traffic controls shall also be provided.

Since a majority of the proposed construction is within the Rte. 20 business district, coordination with businesses during construction will be essential to ensure safe vehicle and pedestrian access during business hours and to limit overall disruption to the businesses.

8.4.1.8 Air Quality and Noise

The major impacts to air quality and noise would be short-term due to construction and equipment operation. Sensitive air quality and noise receptor sites, such as residential areas, schools and elderly housing will be identified. It is anticipated that the WWTF will be equipped with a state of the art odor control system and noise from the WWTF will be minimal.

8.4.1.9 Vegetation and Wildlife

To minimize impacts to vegetation and wildlife habitats, the use of existing roadways for the installation of pipelines has been maximized.

8.4.1.10 Violation of Surface Water Quality Standards

The recommended plan will reduce the impacts of failing and inadequate on-site wastewater disposal systems on groundwater and surface water resources in the area.

8.4.2 Indirect Impacts

Indirect environmental impacts result from induced changes in the patterns of land use and population growth. Specific indirect impacts of the recommended plan include the potential for increased development or redevelopment, an increase in consumer tax rates and reallocation of resources currently utilized to address wastewater disposal system problems.

8.4.2.1 Growth

The installation of the proposed wastewater collection system may result in some induced growth within the service area. This growth would result from the development or expansion of properties that were previously constrained by Title 5 or that prevented the installation of an on-site wastewater disposal system.

In order to control development, the Town plans to enhance their existing regulatory mechanisms to ensure that the Town's traditional development patterns are preserved and to ensure accommodative growth along Route 20.

8.4.2.2 Economic Impacts

The recommended plan includes the expenditure of capital, of which a significant portion is typically borne by those benefiting directly from the project as betterment units. The financing plan will be prepared to assume that impacts on area taxpayers and system users are fair and equitable.

By replacing failing septic systems within the Rte. 20 business district with a municipal wastewater system, property values may increase and the Town may be able to attract new businesses thereby increasing the Town's tax base, while also expanding the goods and services offered to Town residents.

8.4.3 Summary of Environmental Considerations

Based on the above discussion, the recommended plan has been evaluated for its expected environmental impacts. The effects of the recommended sewer installation program will have some short-term construction related impacts. The recommended plan will, however, result in significant long-term benefits to the community, both in water quality and quality of life.

8.5 Preliminary Design

In order to develop a better understanding of both the costs and permitting requirements associated with the design and construction of a decentralized wastewater treatment system capable of meeting the future needs of the study area, a conceptual layout of the proposed wastewater system was developed. This layout was based on the assumptions that 1) a proposed disposal site at the Curtis Middle School could handle all of the proposed wastewater from the Central and West Areas (including additional residential parcels on Route 20 between these areas); and 2) that the WWTF would be sited at the Town owned "Bushey" parcel in the West Area on Boston Post Road. As previously discussed, the East Area was determined to be the least critical, and its distance to the treatment and disposal facilities resulted in its elimination as part of the recommended plan. Therefore, the potential system would only be initially designed for the West and Central Areas.

8.5.1 Design Basis

Conceptually, municipal wastewater systems can be divided into three key components including:

- Collection System
- Wastewater Treatment Facility
- Subsurface Disposal System

8.5.2 Preliminary Design

This section of the report is intended to provide an overview of the entire system and a discussion on each of the major system components. A conceptual schematic layout of the major components of the proposed wastewater system is shown in Figure 8-1, previously presented.

8.5.2.1 *Collection System*

Based on the above criteria, a conceptual collection system layout was developed for the Central and West Needs areas. Although significant design work is still needed, current potential conceptual design includes a combination of gravity and pressure sewers with a wastewater pump station and force main to convey wastewater to the proposed treatment plant site. It also includes a discharge pump station and force main to transmit treated effluent from the treatment facility to the disposal site.

8.5.2.1.1 *Gravity Sewers, Pump Station and Force Main*

Gravity sewers are depicted to serve all properties located in the Central Area, including Route 20, Union Avenue and Station Road. The gravity-collected wastewater flows would collect at a pump station located on Route 20 in the vicinity of Nobscot Road and would then be transmitted to the proposed wastewater treatment facility by force main.

8.5.2.1.2 *Pressure Sewers*

Preliminary elevation profiles of the West Area indicate that gravity sewers may not be a cost effective means of transporting wastewater due to large differences in elevation between the West Area and the proposed wastewater treatment facility. As a result, pressure sewers and individual grinder pumps are envisioned at this time to serve all properties located in the West Area.

8.5.2.2 *Wastewater Treatment Facility*

Primary issues related to the wastewater treatment facility include siting and process selection. Siting a facility is often driven by the economics of land cost. Thus, municipal facilities are often sited on property owned or controlled by the municipality. The selected treatment process must meet multiple criteria, but in general should be cost effective over the life of the facility, minimize operational problems, and provide a sufficient level of treatment that meets both state and local requirements. The potential plant site and the conceptual process design are discussed below.

8.5.2.2.1 WWTF Siting

Wastewater generated in the West and Central Areas would be transmitted to the wastewater treatment facility via the previously mentioned collection system. As previously mentioned, the Wastewater Treatment Facility would be located on town property at 641 Boston Post Road (Parcel K06-505). This property is adjacent to Longfellow Glen's eastern property line. There are no structures currently built on this parcel. A portion of this property was taken out of conservation restriction (70,000 square feet) and is available for municipal use. This property is most favorable for siting of the wastewater treatment facility for the following reasons:

- It is a town-owned property so permission does not need to be obtained from a private entity.
- It is situated away from developed residential areas.
- It is located within the West Area and is in close proximity to the Central Area so that raw wastewater does not have to be conveyed significant distances prior to treatment.
- At 1.6 acres, the available land area to site the facility is sufficient.

The attached Figure 8-2 depicts a conceptual site plan of the proposed WWTP.

8.5.2.2.2 WWTF Process

The membrane bioreactor (MBR) process is being considered for wastewater treatment. The MBR process is based on the Modified Ludzack-Ettinger (MLE) activated sludge process, which includes an anoxic zone for denitrification, followed by an aerobic zone for BOD removal and nitrification prior to membrane filtration. Effluent from this chamber is removed through a polymer membrane filter system that acts as the

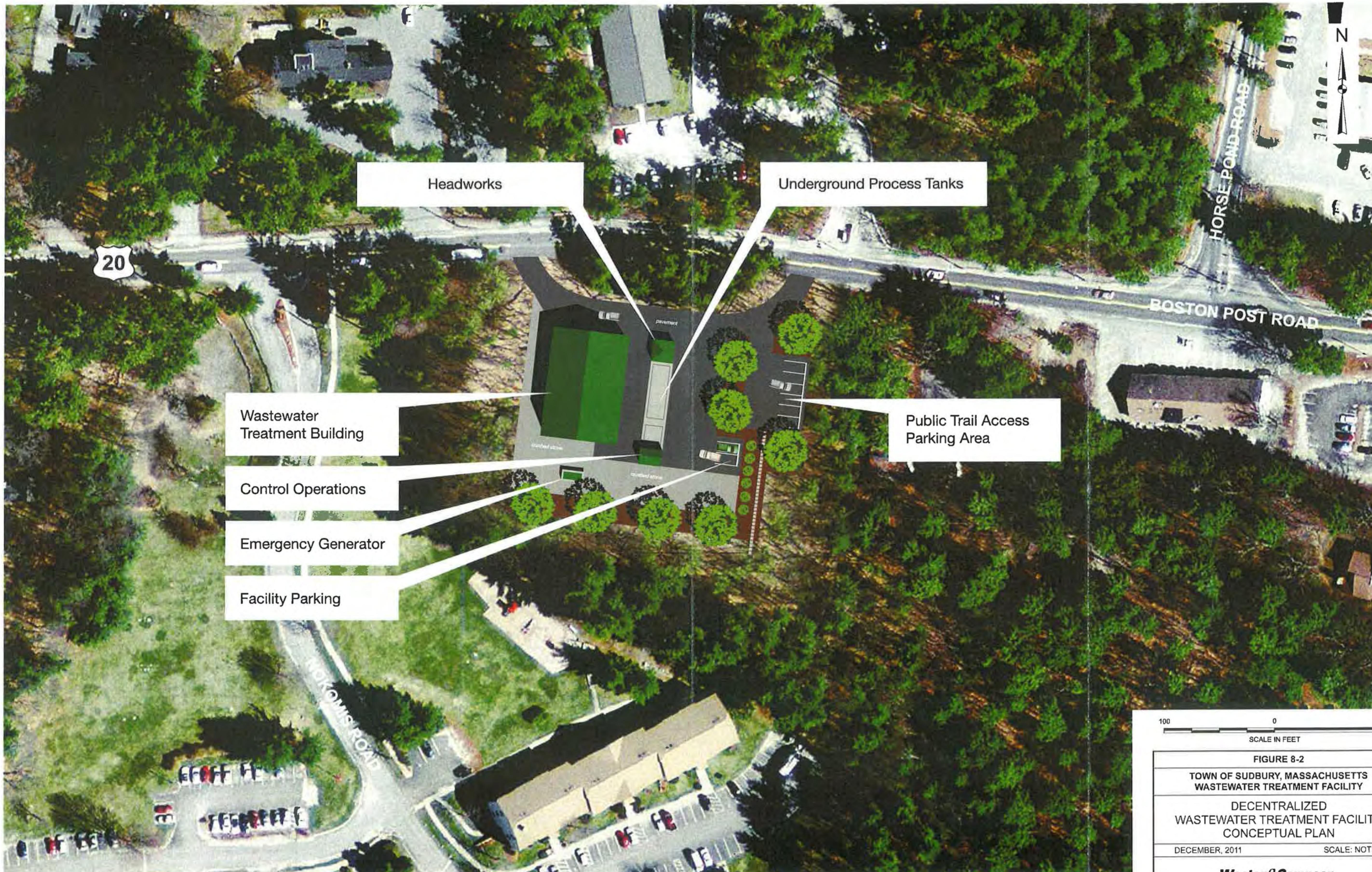


FIGURE 8-2

TOWN OF SUDBURY, MASSACHUSETTS
WASTEWATER TREATMENT FACILITY

DECENTRALIZED
WASTEWATER TREATMENT FACILITY
CONCEPTUAL PLAN

DECEMBER, 2011 SCALE: NOTED

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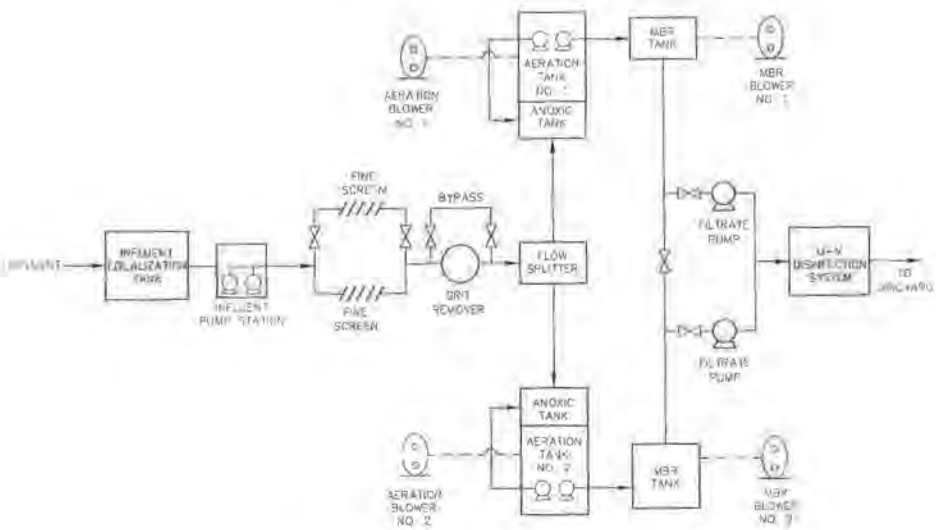
clarification process. This filtration process will be capable of eliminating a high percentage of organic matter, bacteria and viruses from the effluent. Following disinfection by chemical or ultra-violet (UV) means, this treated effluent can be discharged without further treatment to an effluent disposal system. To meet the proposed effluent discharge limit of ≤5 mg/l total nitrogen, a denitrification sand filter will be included with the MBR treatment process (See Figure 8-3).

Figure 8.3 Schematic MBR Process



MBR plants do not rely on the settling of sludge for proper operation, but rather on positive filtration, which thereby allows a WWTF to operate at higher than normal mixed liquor (sludge) concentrations. Since the MBR plant can operate at high sludge concentrations, the volume of process tankage is greatly reduced, which can result in a smaller footprint for the WWTF than other activated sludge processes. Operating at high mixed liquor concentrations allows the plant to operate efficiently during flow and load variations. This technology also has the ability to meet the stringent permit requirements for groundwater discharge and the potential for reuse.

The advantages to the MBR process include:

- High level of treatment is achieved.
- Smaller site requirements.

- Use of low-tech technologies for operational control.

Based on the design of past MBR wastewater treatment facilities and their associated flows, it is estimated that an area of approximately 25,000 square feet (0.57 acres) will be required to accommodate a wastewater treatment facility of adequate size to treat the identified flows associated with the West and Central Areas. This does not include the required area associated with the subsurface disposal system discussed below.

8.5.2.3 Treated Effluent Discharge and Groundwater Disposal

Once the collected wastewater is treated, it will be transmitted through a force main to the Curtis Middle School athletic fields for discharge into the ground. The proposed discharge force main (see Figure 8-1, previously presented) begins at the wastewater treatment facility and follows Horse Pond Road for approximately 1.7 miles until the Middle School is reached. Horse Pond Road is the most favorable route for discharge for the following reasons:

- It is the most direct route to the discharge site.
- Since it is the most direct route, it is also the most cost effective route.
- The route is completely within the Town Right of Way and thereby does not require easements on private property.

Figure 8-4 provides a footprint of the area at the Curtis Middle School that would potentially be utilized for installation of the SAS system. It is important to note that it is not anticipated that the entire area would be disturbed as a portion of the area would be set aside as a reserve area as required by DEP. In the event of failure of the original leaching area, an adequate reserve area capable of replacing the capacity of the original leaching area is required. The existing leaching field for the school would remain in its current location and function independently from the proposed system.

There are no odor, health, or visual impacts associated with the proposed SAS system. The effluent from the MBR process will actually be of a much higher quality compared

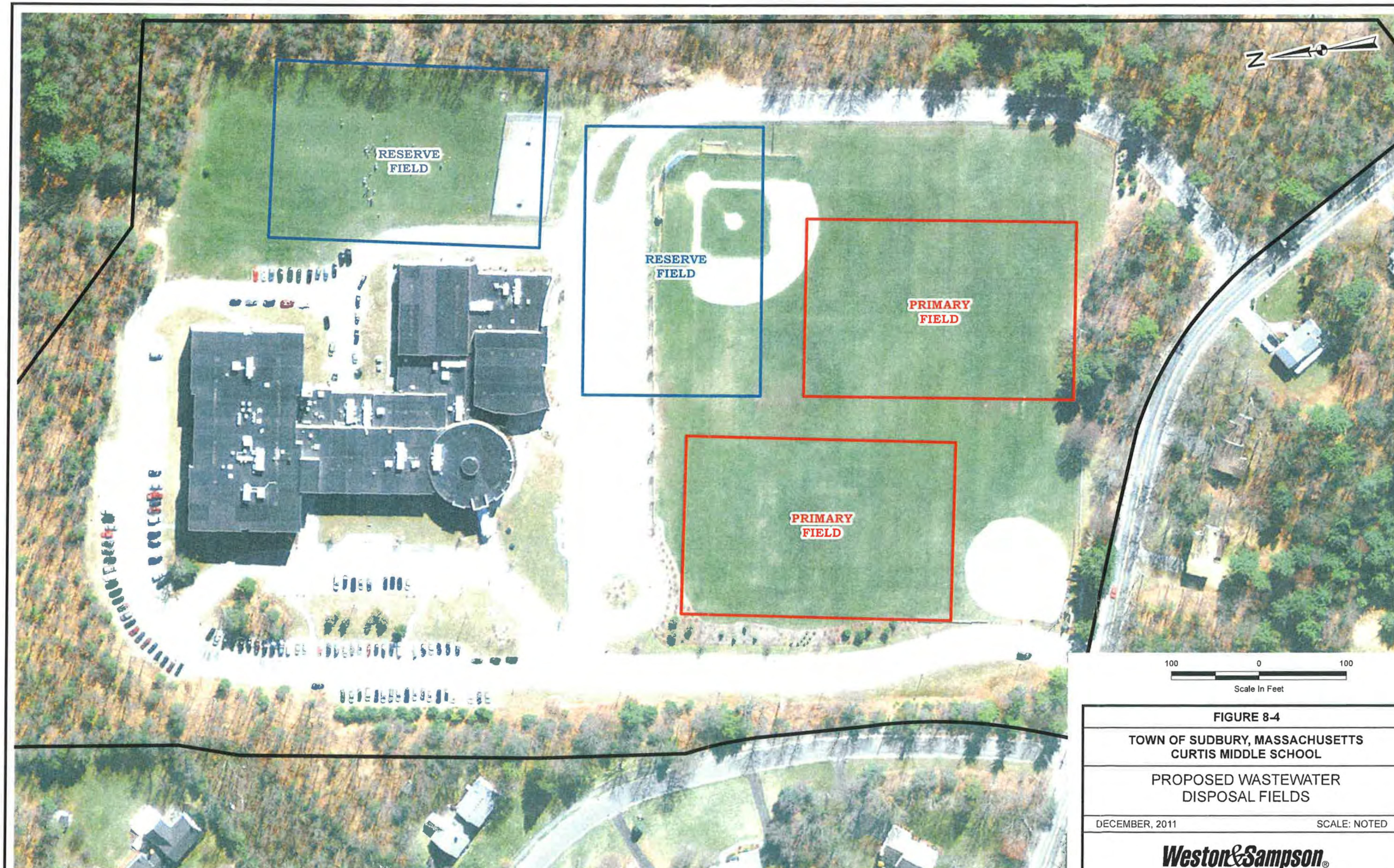


FIGURE 8-4

TOWN OF SUDBURY, MASSACHUSETTS
CURTIS MIDDLE SCHOOL

PROPOSED WASTEWATER
DISPOSAL FIELDS

DECEMBER, 2011 SCALE: NOTED

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with the effluent associated with the existing septic system at the Curtis Middle School. Table 8-1 provides a comparison of the effluent quality associated with septic systems as compared with the effluent associated with a MBR wastewater treatment facility.

Table 8-1

Septic System vs. MBR Plant Effluent Quality Comparison

Parameter	Septic System Effluent	MBR Plant Effluent
BOD_5	100-250 mg/L	< 2 mg/l
Ammonia	25-40 mg/L	< 0.3 mg/l
Total Nitrogen	30-50 mg/L	< 3.0 mg/l
Phosphorous	7-20 mg/L	< 0.3 mg/l
TSS	20-140 mg/L	< 3.0 mg/l
Fecal Coliform	$0.1 \times 10^6 - 100 \times 10^6$ CFU/100 mL	<10 CFU/100 mL

The MBR effluent is purified effluent, which does not contain any solids. Due to the high quality of the effluent, it can be reused for non-potable needs such as irrigation and toilet water. As a result of the U-V disinfection that occurs at the MBR plant, there are no odors associated with the effluent.

The Soil Absorption System is located entirely below grade so there are no apparent visual impacts. If the system were located at the Curtis Middle School as proposed, the playing fields would be restored to their pre-construction condition. The long-term use of the site for recreational purposes will not be impacted. The groundwater discharge of effluent will comply with the requirements of DEP's Groundwater Discharge Permit Program.

8.6 Design and Construction Costs

At the current conceptual stage of this project, there are still a number of variables present that could result in a wide variation in the cost of the project. At this time, based on the information discussed herein, estimated costs for design and construction are outlined in Table 8-2. These costs were developed based upon unit costs for the design and construction of similar facilities.

Table 8-2

Estimated Design, Permitting and Construction Costs

Final Design and Permitting	
Additional Hydrogeologic Effort (if required)	$20,000
Final Conceptual Design	$10,000
MEPA (Expanded ENF, not including EIR if required)	$50,000
Groundwater Discharge Permit	$100,000
Final Design	$720,000
Local Support, Permitting & Funding	$80,000
Subtotal	$980,000
Construction	
Collection & Transmission System	$3.2M
SAS System (@ Curtis Middle School)	$1.5M
WWTF (MBR System @ Bushey Property)	$7.5M
Engineering Construction Services	$1.5M
Police Details	$200,000
Land/Legal/Other	$100,000
Subtotal	$14M
Total Estimated Cost	**$15M**

The estimated cost for the design and construction of the proposed collection, treatment and disposal system is $15 million. This estimate is based on a treatment plant design flow of up to 300,000 gpd and an estimated 630 equivalent dwelling units (EDUs).

8.7 O&M Considerations

The proposed wastewater collection, transmission, treatment and disposal system will require the establishment of a mechanism to ensure the adequate administration, operation and maintenance of all facilities. It is assumed that the operation of the wastewater utility will fall under the responsibilities of the Department of Public Works, and the oversight of the system will be the direct responsibility of a newly established Sewer Superintendent. The Town of Sudbury may want to consider having the system run by a private firm that specializes in wastewater O&M services during and after the first few years following system construction. Once the recommended system is constructed, it is anticipated that the Town will arrange for present or new administrative personnel for billing purposes and to provide oversight of the daily operations by the outside firm hired to provide O&M services. The establishment of a separate budget to properly operate and maintain the WWTF and collection system will be necessary, and the system will likely be operated under a distinct wastewater enterprise fund.

A summary of estimated operation and maintenance costs for the recommended wastewater facilities, based on data from similar facilities, is presented in Table 8-3. The total annual costs for the O&M services should be distributed amongst all system users based upon the ratio of individual flow to total average daily flow.

Other operational requirements, such as aesthetics and odor control, should be part of the regular O&M plan for the facility. Screening of the WWTF site from nearby development and the street should be provided. Adequate housekeeping and care of the groundwater disposal system is also recommended. The disposal field will serve the same intent at the Curtis Middle School after construction is complete.

Table 8-3
Estimated Operation and Maintenance Costs

Description of Item	Quantity		Unit Cost	Cost
WWTF Operation & Maintenance Costs: (1)				
Operator Salaries, full-time, including benefits	2	operators	$83,000	$166,000
Electrical Power Costs, Equipment & Lighting	400,000	kW-hr	$0.15	$60,000
Telephone Service Costs	12	months	$100	$1,200
Heating Fuel Costs	12	months	$300	$3,600
Sludge Disposal Costs (including trucking)	900,000	gallons	$0.10	$90,000
Process Chemical Costs	12	months	$1,500	$18,000
Chlorine for Disinfection	12	months	$2,000	$24,000
Equipment Service & Repair Budget	1	budget	$10,000	$10,000
Technical Services Assistance Budget	1	budget	$12,000	$12,000
Miscellaneous Parts & Supplies	12	months	$200	$2,400
Collection & Transmission System Costs:				
Annual Pipeline Maintenance Costs	3	miles	$500	$1,500
Pump Station O&M Assistance Allowance	1	budget	$10,000	$10,000
Pump Station O&M Power Costs	50,000	kW-hr	$0.15	$7,500
Pump Station Miscellaneous Utility Costs	1	station	$1,000	$1,000
Administrative Costs: (Billing)	200	customers	$15.00	$3,000
Subtotal Annual O&M Cost				$410,200
Contingency	5%			$20,500
Total Annual Wastewater Operation & Maintenance Budget				$430,700

Notes:

(1) WWTF O&M Costs are approximated based on WWTF design for groundwater discharge.

9.0 IMPLEMENTATION OF RECOMMENDED ALTERNATIVE

9.1 Introduction

Implementation of the recommended alternative will require the design and construction of the wastewater collection, treatment, and disposal facilities. The following discussion addresses organizational issues, proposes a financial plan based on the cost estimates and allocations discussed, reviews the betterment assessment methods and proposes an implementation and scheduling plan for the project.

9.2 Organizational Context

The Town of Sudbury is governed by a three-person elected Board of Selectmen. Day-to-day activities are managed and addressed by the appointed Town Manager. The Board of Health governs individual on-site sewage disposal systems. The Town's Health Agent, appointed by the Board of Health, oversees the day-to-day on-site system issues, including design review, system installation inspections, and enforcement of Town and Title 5 regulations. Should the Town vote to proceed with the implementation of the proposed sewer system to serve its identified needs areas, the Town will also need to implement institutional procedures and programs to operate and maintain the completed infrastructure, as discussed herein.

9.3 Financing Alternatives

As previously discussed, the total remaining cost of the recommended plan is estimated at $15 million. This includes design, permitting and construction. A discussion of financing alternatives and total project costs is included below.

9.3.1 State Revolving Fund Loan Program

The primary mechanism in the Commonwealth of Massachusetts for financing public wastewater projects is currently the State Revolving Fund (SRF), as administered by the Massachusetts DEP and the Massachusetts Water Pollution Abatement Trust (MWPAT). This program provides assistance to cities and towns in the form of low interest loans to cover eligible project costs. The current program in Massachusetts provides for loans at an interest rate of 2% per year, which is lower than the current interest rates otherwise available to the town for local bonds. There are also 0% SRF loans available for certain projects. Although obtaining a 0% SRF Loan is rather optimistic, it could certainly be pursued. SRF financing can cover the eligible construction costs of the project, including the cost of engineering during construction, but related costs for design are generally not eligible under the program. To apply for funding, a Project Evaluation Form (PEF) must be submitted. A competitive process for rating projects occurs annually, and the projects that demonstrate the highest needs and most complete planning are made eligible for funding by placement on the Intended Use Plan (IUP).

It is recommended that the capital costs for the project, which are estimated at $15 million, be paid through the use of a combination of state and local funds. It is assumed that available state funding for the construction portion of the project, which is estimated at $14 million, will be in the form of a two-percent (2%) interest rate SRF Loan. The SRF Loan could be financed over a 20-year loan period. A 30-year loan period may also be possible; however, it could mean an interest rate higher than 2%. Local funds to finance the project will include a combination of funds raised through taxation and funds raised through betterment assessments for sewered properties (see discussion below). Sewer rates (i.e. user charges) are distributed proportionately among the users of the system, are typically based on water usage and should only be used to cover the operation and maintenance costs of the completed system.

As indicated above, the SRF program will not finance the costs for design and permitting of the project. The design and permitting costs are estimated at $1 million and, at this time, it is assumed these costs will be recovered entirely through local funds. The Town looked at the cost to taxpayers to finance the cost of design and permitting over a 5-year period. It was estimated that on the average residential property, which is valued at $628,000, taxes would increase by approximately $35 per year for a total tax increase of approximately $175 over the five-year period. For a commercial or industrial property with an average value of $810,357, taxes would increase by approximately $60 per year for a total tax increase of approximately $300.

For the purposes of preparing the financial plan for the estimated $14 million cost of construction, an SRF loan period of 20 years with equal annual payments was assumed. For a total loan amount of $14 million, the estimated annual municipal payment is approximately $850,000 and the total interest paid over the life of the loan is approximately $3 million.

9.4 Betterment Assessment Methods

The methods governing the assessment of sewer betterments are Massachusetts General Laws (MGL) Chapter 83, "Sewers, Drains and Sidewalks". 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 multi-family, commercial, industrial and semi-public uses shall be converted into sewer units on the basis of residential equivalents."

Some of the issues relative to sewer betterment assessments that need to be addressed include:

- A decision needs to be made on the preferred method of making Betterment Assessments including 1) sewer units; 2) property frontage; 3) property area; or 4) a combination of methods 2 and 3
- Cost allocation strategies (i.e. a breakdown of the percentage of the construction costs to be paid through sewer betterments and general taxation)

With regard to the assessment of betterments, the Uniform Unit Method of assessment is preferred as it provides for assessments in proportion to the total number of existing and potential sewer units to be served, with each unit equal to a single family residence. Multi-family, commercial and industrial uses are converted to sewer units on the basis of residential equivalents. While the "units" for municipal properties are calculated and used in the analysis, municipal and non-profit properties are not generally assessed (i.e., the Town does not charge themselves).

One critical decision facing the Town of Sudbury, its financial advisors, and ultimately its residents, is the development of a local cost allocation strategy that is fair and affordable to both sewered property owners and non-sewered property owners. The Town needs to develop a system to allocate which portion of the total project costs are to be repaid through sewer betterment assessments and which portion will be paid through property tax increases. Assistance from Sudbury's Finance Department should be sought to develop the final financing plan for the wastewater collection system, wastewater treatment plant and disposal areas.

The allocation of capital costs to betterments (the users) and taxes (the Town as a whole) can be politically charged. The entire Town will benefit directly from the construction of the sewer in the following ways:

- Increased protection of sensitive environmental resources (e.g., Sudbury's water supply)
- Recharge of Sudbury's groundwater from treated wastewater effluent via the subsurface disposal system
- Potential economic growth within the sewered commercial areas (e.g., the Rte. 20 business district)
- Associated public works improvements (e.g., paving and roadway improvements)

Property owners who receive sewer service directly benefit in the following ways:

- Increased property value
- Relief from potentially expensive Title 5 repairs
- Fewer O&M requirements

One argument is that property owners receiving the direct benefit (i.e. sewer service) should pay for the entire project through betterments. This scenario would be very costly in Sudbury, due to the relatively small number of overall system users. Another argument would be that the entire project should be funded through property taxes. This would increase the tax burden unfairly on those property owners, most of which are residential, who do not see a direct benefit. For this reason, the recommended plan is to adopt a mixed cost allocation strategy that minimizes increases to taxes while offering an affordable solution to those residents entering the system. Different combinations of cost allocations were considered and the current recommendation is that a 75/25 split is the fairest. Under this scenario, 75% of the total project cost would be paid by betterments and the remaining 25% would be paid by taxes initially. Although originally 25% of the money would be recovered through taxes over a 20-year period, the property tax impact could be reduced if the projected build out occurs. Future potential compensatory privilege fees are estimated at over $3 million or approximately 25% of the total cost and, if collected, would serve to reduce property taxes to be paid. It is important to note that the total amount collected through assessments cannot exceed the cost of the project. Below is a sample financial analysis (with certain assumptions) based on the recommended 75/25 split:

- The total construction cost is estimated at $14 million.
- Costs to be recovered through betterments are approximately $10.5 million ($14 million x 75%).
- Costs per betterment unit are approximately $16,750 ($10.5 million/627 existing assessment units per Table 4-13).
  - Assumes all large users would participate including Raytheon, Longfellow Glen and Sudbury Pines.
- Properties choosing to apportion betterment unit payments over 20 years will pay approximately $1,230 per year per betterment unit (assuming an interest rate of 4%).
- Assuming full build-out as outlined in Table 4-13, an additional 175 betterment units will be assessed as compensatory privilege fees over time, which would result in additional assessment fees collected of approximately $3 million.
  - Based on this assumption, the Town will not collect assessment fees in excess of the total project cost.
  - This would also reduce the tax rate impacts over time.
- 25% of the cost recovered through taxes would add approximately $150 per year to the average residential property (assessed valuation of $628,000) and approximately $250 per year to the average commercial/industrial property (assessed valuation $810,000) for 20 years.

9.5 Implementation

9.5.1 Sewer Rules and Regulations

Rules and Regulations (Rules) should be developed by the Town for management of the sewer system. These Rules should define policy for assessing betterments, granting deferrals for both betterments and connections, filing an appeal with the sewer governing board, user fees and overall management of the system.

The rules can also be utilized to control growth and limit connections to the system. Some key components that the Town may want to incorporate into the Rules include:

- Policy for new connections, connection fees and construction requirements.
- Deferral conditions and application procedure.
- Licensing requirements for contractors.
- Sewer user charges schedule.
- Cost recovery (privilege fees) for future connections not covered by the initial betterments.
- Establishing requirements of a "super majority" or two-thirds vote at Town meeting to extend the limits of the sewer service area.

The Board of Selectmen would administer the Sewer Use Rules and Regulations, approve sewer connections, and develop the annual sewer budget for approval at Town Meeting. Administration of the system is discussed in more detail below.

A management plan to deal with implementation of the system and potential growth issues should be considered by the Town. Growth can occur through infill and build-out of larger parcels, as well as redevelopment (e.g., "tear downs") of existing parcels. All of these methods of growth may have an impact on the proposed sewer system. New bylaws and/or Rules and Regulations will need to be developed by the Planning Board, Board of Health, or other Town entity, with bylaws requiring Town Meeting approval. The overall goals of the management plan should:

- Quantify potential growth
- Balance growth management with wastewater planning
- Draft appropriate growth management tools
- Gain support at Town Meeting to adopt growth management measures

At a minimum, it is recommended that Sudbury address growth through sewer use regulations and established policies. Some of the other options fall under the jurisdiction of the Planning

Board and may be used in areas where infill and redevelopment are not a desired result of sewer installation for the Town. Mechanisms to manage growth effectively include adopting the following measures:

- Establish formal Sewer District
- Define sewer system regulations
- Establish fees and betterment structure/policy including commercial and large residential tie-ins
- Review current zoning to assess weaknesses
- Establish Overlay District zoning to encourage development in target areas

One of the conditions that the Town must meet as a result of accepting state and federal funding assistance through the SRF program is development of an equitable system of user charges wherein users are assessed the entire cost of operating and maintaining the collection and treatment system. In Massachusetts, such user charge systems are established pursuant to MGL Chapter 83, Section 16.

Since all properties in Sudbury connected to the Town's drinking water supply system are metered, such meter readings should be used as a basis for assessing sewer user charges. The governing board for the sewer system would set the rate per 1,000 gallons (or rate per 100 cubic feet) for sewer service annually. The rate, and revenues collected should be set at a level 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.

Every user whose property is connected to the public sewer, excluding municipal facilities, would pay an annual charge in proportion to the volume of wastewater each contributed to the system.

9.5.2 Groundwater Discharge Permit

As discussed in Section 8, the recommended alternative involves the discharge of highly treated effluent from a wastewater treatment facility into subsurface disposal areas. The requirements for groundwater discharge of wastewater are outlined in the Groundwater Discharge Permit Program (314 CMR 5.00 and 6.00), which is administered by the DEP.

The principal constituent of concern for groundwater discharges is nitrates, a primary component of treated wastewater. The groundwater discharge option is also restricted by discharge standards, which prohibit degradation of the groundwater and therefore require a strict level of treatment prior to discharge. In particular, discharge into Zone II areas of public water supplies must meet the aquifer recharge requirements for Reclaimed Water use. The recommended alternative does not include discharge of treated effluent in any Zone II areas, making the issue of nitrates of less concern. Regardless, the treatment technology chosen for this project has a high level of nutrient removal. The Town will work closely with the DEP during the design and permitting process to ensure that all discharge limitations are met. The design of the wastewater treatment plant must be completed prior to submitting the application for a groundwater discharge permit, in order to ensure the appropriate technology is being proposed to achieve effluent limits.

9.5.3 Design and Construction Administration

Once the Town has adopted the recommended alternative and funds have been appropriated, design of the sewage collection system, wastewater treatment plant, and subsurface disposal areas must be completed. Preparation of final plans and specifications, as well as required MEPA filings and DEP reviews is included in the design and permitting process. The design engineer should assist the Town through the Bid and Award process.

Once the project has been bid, the Town should consider retainage of a consultant or other professional to act as a construction administrator for the project. The construction administrator would be responsible for coordination with contractors, review of shop drawings, authorization of payment for pay requests, processing and approval of change orders, construction oversight and progress reporting to the Town.

9.6 Project Schedule

9.6.1 MEPA Process

Once the PER is complete and funding is in place for final design and permitting of the project, the next step in getting authorization to construct the project is the Massachusetts Environmental Policy Act (MEPA) process. MEPA is a formal administrative review process that is designed to create a uniform system of agency compliance while involving all potential stakeholders. The primary goal of the MEPA review is to facilitate environmental planning and mitigate impacts on the environment from the proposed project. MEPA review is required if a project triggers the

MEPA review thresholds. For wastewater projects, the mandatory ENF review thresholds are as follows:

- Construction of a new wastewater treatment facility and/or disposal facility with a capacity of 100,000 gallons per day (gpd) or more.
- Expansion of an existing wastewater treatment and/or disposal facility by the greater of 100,000 gpd or 10% of existing capacity.
- Construction of one or more new sewer mains that (a) result in an expansion in the flow to a wastewater treatment or disposal facility by 10% of existing capacity; (b) are five or more miles in length; or (c) are ½ or more miles in length, provided the sewer mains are not located in the right-of-way of existing roadways.
- New discharge or expansion in discharge to (a) a sewer system of 100,000 or more gpd of sewage; (b) a surface water of 100,000 or more gpd of sewage; and (c) groundwater of (i)10,000 or more gpd of sewage within an area, zone or district established, delineated or identified as necessary or appropriate to protect a public drinking water supply, an area within 200 feet of a tributary to a public surface drinking water supply, or an area within 400 feet of a public surface water drinking supply; and (ii) 50,000 or more gpd of sewage within any other area.
- New capacity or expansion in capacity for (a) combustion or disposal of any amount of sewage sludge, sludge ash, grit, screenings , or other sewage sludge residual materials; or (b) storage, treatment, or processing of 50 or more wet tons per day of sewage sludge or sewage sludge residual materials.

The proposed project falls under the following MEPA review thresholds identified above: construction of a new wastewater treatment facility and/or disposal facility with a capacity of 100,000 gallons per day (gpd) or more; construction of one or more new sewer mains that are five or more miles in length; and new discharge to groundwater of 50,000 gpd or more of sewage. Therefore, it appears as though the best approach for this project is to submit an expanded Environmental Notification Form (ENF). Hopefully, an Environmental Impact Report (EIR) will not be required but if it is, it is assumed that it will be a single EIR.

It is anticipated that the MEPA process would commence within two to three months of Town Meeting and voter approval to proceed. The expanded ENF process can take anywhere from two to six months to navigate. If an EIR is determined to be required, this could add another six months or more to the process. For the purposes of this section, a funding appropriation date of May 2013 will be used.

9.6.2 Final Design and Permitting (including SRF Application)

Assuming the MEPA process proceeds at a reasonable pace, initial comments from the MEPA unit could be secured as early as September 2013 and the project could proceed to final design and permitting at that time. Assuming the project qualifies for the CY 2014 SRF funding, the anticipation would be to have the final design (plans and specifications) ready for submittal with the SRF application in October 2014. Final permits and SRF approval would be secured by the end of 2014. The Town did submit a PEF in August of 2010 for SRF funding, and was placed on the CY 2011 IUP List. Although they were not able to take advantage of the funding at this time, it is a good indicator of potential future qualifications for this program. A new PEF would need to be submitted in August 2013 to qualify for CY2014 funding.

9.6.3 Groundwater Discharge Permit

Submitting the required application and obtaining a groundwater discharge permit requires completion of a significant portion of the treatment process design, including a detailed site plan, the actual infiltration system, a hydraulic profile of the process, and process flow diagram. Assuming that the design commences in July 2013 as discussed above, it is possible that the groundwater discharge permit process could commence in September 2013, with the hope of securing the actual permit by September 2014.

9.6.4 Bidding and Construction

It is not uncommon for projects of this nature to be divided into two separate construction contracts, one for the collection system and the other for the treatment system. Based on timeframes discussed above, it is anticipated that the advertising and bidding process could commence in January 2015 and continue through April 2015. Construction would commence in the spring of 2015 and continue through the end of 2016.

9.6.5 Schedule Overview

The proposed schedule for project implementation is dependent upon approval of the necessary funding. Assuming a successful ballot vote and Town Meeting appropriation, the estimated schedule for implementation is as summarized in Table 9-1.

Table 9-1

Project Implementation Schedule

Town Meeting Authorization of Funding for Permitting & Design	May 2013
Town-wide Ballot Vote	June 2013
MEPA Process	July 2013 – September 2013
Final Design and Permitting	July 2013 – December 2014
Re-Submittal of Project Evaluation Form for SRF Funding	August 2013
Groundwater Discharge Permit	September 2013 – September 2014
Town Meeting Authorization of Construction Funding	May 2014
Public Bid/Award Process	January – April 2015
Construction	May 2015 - December 2016

10.0 PUBLIC PARTICIPATION

10.1 Sewer Assessment Technical Advisory Committee

The Sewer Assessment Technical Advisory Committee (TAC) is comprised of individuals from various town departments with different relevant areas of technical expertise. The TAC was appointed by the Board of Selectmen in 1999 and given the responsibility of assessing the feasibility of installing a sewer system to serve the Route 20 business district. Since 1999, the TAC has been instrumental in moving the project forward and disseminating information to the general public regarding the proposed project. This includes presenting the findings from the 2001 Needs Assessment during several public forums in 2000 and 2001.

Once the Town identified a suitable disposal site for the treated wastewater, their focus shifted to gaining public support to move the project forward into the permitting and design phase. Since the beginning of 2011, the TAC has been distributing public education materials and has held various meetings with area residents and businesses regarding the need for the proposed project. The TAC's public participation effort to date, which includes a presentation at the May 2011 Town Meeting, are discussed in more detail in this section.

10.2 Public Education Materials

The TAC, with assistance from Adam Ploetz, an outside consultant, put together various public education materials to answer questions and garner support for the project in preparation for Town Meeting.

10.2.1 Newspaper Articles

The TAC published a series of articles in the Sudbury Town Crier to educate the public about the need for the project. The first article was published on March 31, 2011. The article included information regarding the recommended plan to provide wastewater treatment to the commercial and residential properties along Route 20. In particular, the article provided background information regarding what exactly a decentralized wastewater treatment system is and how the system would look if it were constructed in Sudbury. A copy of this article is included in Appendix F.

The second article was published in the Sudbury Town Crier on April 28, 2011. This article focused on the environmental and economic benefits associated with installing a decentralized wastewater treatment system in Sudbury. It also addressed how the vision for the Route 20 Area will be created, including discussion of the Town's plan to form a Citizens Advisory Committee to direct this vision. The Town also indicated that emphasis will be placed on preserving Sudbury's character and limiting overdevelopment, while still creating development opportunities. A copy of this article is included in Appendix F.

In addition to those articles published in the Sudbury Town Crier that were orchestrated by the TAC, additional articles have been published regarding the proposed project in the Town Crier, the Sudbury Patch and the Metro West Daily News. The Sudbury Town Crier published articles on November 18, 2010 and March 3, 2011. The November 18th article discussed the hydrogeological testing that was proposed for the Curtis Middle School and provided an overview of the project as presented to the Board of Selectmen on November 16, 2010. The March 3, 2011 Sudbury Town Crier and Metro West Daily News articles discussed the March 1, 2011 presentation made to the Board of Selectmen regarding options for funding the proposed project. Another article discussing the project appeared in the April 7, 2011 edition of the Sudbury Town Crier. This article provided the viewpoints of various business owners towards the proposed project. In addition to those articles published in the Sudbury Town Crier and the Metro West Daily News, an article was also published in the online newsletter, the Sudbury Patch on April 15, 2011. This article highlighted the April 12th meeting held with the Sudbury Chamber of Commerce. A copy of each of these articles is included in Appendix F.

10.2.2 Frequently Asked Questions

In preparation for Town Meeting, the TAC put together a list of Frequently Asked Questions to provide residents and business owners with more information regarding the proposed project. This document touched upon the environmental and economic benefits of the project, while also providing insight regarding the proposed wastewater treatment system and the other wastewater treatment alternatives that were explored. In addition, pressing concerns regarding how development will be controlled and how the project will be funded were also touched upon. A copy of the list of Frequently Asked Questions is included in Appendix F. This document was made available on the Town's website prior to Town Meeting.

10.2.3 Letter to Area Businesses

On April 7, 2011, a letter was sent by the TAC to area business leaders discussing the proposed project and highlighting an upcoming presentation to be made to the Sudbury Chamber of Commerce on April 12, 2011. A copy of this letter is included in Appendix F.

A letter dated April 25, 2011 was sent to the Sudbury Board of Selectmen from members of the Route 20 business community expressing support for the proposed project. The owners of Sudbury Crossing, Shaw's Plaza, the Rugged Bear Plaza, and the Sudbury Farms Plaza, as well as the Chamber of Commerce, offered their support. A copy of this letter is included in Appendix F.

10.2.4 Letter to the Editor

On April 14, 2011, Lisa Eggleston, TAC Chair, wrote a Letter to the Editor following up on an article published in the April 7th edition of the Sudbury Town Crier. A copy of the Letter to the Editor is included in Appendix F. This letter discussed a recent public meeting held with Town officials and business owners to discuss progress on the proposed project, including available financing options.

10.3 Public Meetings

10.3.1 Public Forum – Needs Assessment

On November 7, 2001, the Town held a public forum to present the sewer needs assessment study prepared by Weston & Sampson for the Route 20 business district, and to answer questions from residents and business owners. A copy of the presentation slides from this meeting are included in Appendix F. In addition, copies of articles published in The Sudbury Town Crier and The Boston Globe discussing the public form and the proposed sewering of the Rte. 20 business district are also included in Appendix F.

10.3.2 School Committee Meeting

A meeting was held with the Sudbury School Committee on June 23, 2010. The purpose of this meeting was to gain permission from the School Committee to perform additional hydrogeological testing at the Curtis Middle School playing fields. A copy of the presentation slides from this meeting are included in Appendix F.

10.3.3 Board of Selectmen Meeting

On November 16, 2010, a meeting was held with the Board of Selectmen to update the Board on work completed since the sewer needs assessment in 2001. A copy of the presentation slides from this meeting are included in Appendix F.

10.3.4 Public Meeting with Town Officials and Business Owners

On April 7, 2011, a Public Meeting was held with Town officials and business owners to discuss the sewer project and the 2011 Town Meeting warrant for the design and permitting of the WWTF and associated collection system. A copy of the minutes from this meeting are included in Appendix F.

10.3.5 Chamber of Commerce Meeting

A meeting was held with the Sudbury Chamber of Commerce on April 12, 2011 to discuss the proposed project in more detail and gain support from the Rte. 20 business community.

10.3.6 Town Meeting

At Town Meeting, which was held on May 3, 2011, Lisa Eggleston, the TAC Chair, as well as Eric Poch, a member of the Planning Board, gave presentations regarding the proposed sewer project. The text of Lisa's presentation, along with the presentation slides, are included in Appendix F. In addition, Appendix F includes a written narrative of Eric's presentation along with the slides that he utilized.

At Town Meeting, the appropriation of monies for the design and permitting of the WWTF and associated collection system were approved with a two-thirds majority vote. To secure funding and final approval for the project, the authorization of a $1 million debt exclusion override to pay for engineering design and permitting had to pass on the June 7, 2011 ballot vote held as part of the Special Election.

10.3.7 Panel Discussion

The Town held a Public Meeting on May 25, 2011 with residents and business owners to answers questions about the project prior to the June 7, 2011 ballot vote. Public notice of the meeting was placed in the Sudbury Town Crier on May 19, 2011. A copy of the meeting notice is included in Appendix F. The meeting included a panel discussion with representatives from the Technical Advisory Committee, Planning Board, Board of Selectmen, Sudbury Water District, Board of Health and the Sudbury business community, as well as Weston & Sampson. A copy of the PowerPoint presentation from this meeting is included in Appendix F.

10.3.8 Ballot Vote

The June 7, 2011 ballot vote held as part of the Special Election included a question regarding authorization of a $1 million debt exclusion override to pay for engineering design and permitting of a decentralized wastewater treatment system for the Route 20 service area. The vote was defeated 1,932 to 1,621.

10.4 Citizens Advisory Committee

In the early stages of the project during the Needs Analysis, there was a Citizens Advisory Committee (CAC) for the project. The CAC was re-established on July 5, 2011 by the Sudbury Board of Selectmen to work with the Technical Advisory Committee in the wastewater planning process. Their mission statement, as well as information regarding the committee's responsibilities and functions, is included in Appendix H. The intent of the CAC is to foster public education and provide an avenue for public involvement in the planning of the decentralized wastewater treatment system for the Route 20 service area. The CAC will include subcommittees on creating a vision for Route 20, writing zoning bylaws, preparing bylaws and regulations for the sewer district structure and its operation (including fees and assessments as well as mandatory vs. voluntary tie-in to the wastewater system), reviewing financing and betterment options, planning for other Route 20 streetscape improvements to coincide with construction of the wastewater system, as well as other issues.

10.5 Route 20 Sewer Steering Committee

The Route 20 Sewer Steering Committee was established by the Sudbury Board of Selectmen on July 5, 2011, for the purpose of providing guidance and coordination to all committees and groups working on the wastewater management planning process for the Route 20 service area. Their mission statement and responsibilities are outlined in Appendix F.

APPENDIX A

I/A Technologies

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

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. <u>Aerated Lagoons</u>

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. <u>Conventional Activated Sludge</u>

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 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.

G:\Municipal Wastewater\Sudbury\200210\appendix b.doc

APPENDIX C

Initial Soil Testing Results:

June 16, 2003 Schofield Brothers to Technical Advisory Committee (Former Bushey Property and 625 Boston Post Road)

March 31, 2004 Schofield Brothers to Sudbury Board of Health (Soil Testing at 275 Old Lancaster Road)

June 14, 2004 Schofield Brothers to Technical Advisory Committee (DPW Property 275 Old Lancaster Road)

August 13, 2007 Schofield Brothers to Jody Kablack, Director of Planning and Community Development (Young Property)

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June 16, 2003

21416

Technical Advisory Committee
c/o Lisa Eggleston
55 Old Coach Road
Sudbury, MA 01776

RE: Former Bushey Property on Boston Post Road and 625 Boston Post Road in Sudbury, MA

Dear Lisa:

Pursuant to the request of the Technical Advisory Committee, our office performed a preliminary evaluation of the former Bushey property with regards to its use as a disposal area for 100,000-gallons per day of treated wastewater effluent. In addition, our office performed a soil evaluation at 625 Boston Post Road (Sykes property) to determine the extent of sandy soils at the property and its potential to share a portion of the hydraulic loading with the Bushey property. Please find enclosed a copy of the soil report for 625 Boston Post Road, which is also being sent to the Sudbury Board of Health.

Bushey Property

The Bushey property was evaluated on 1) its ability to provide an adequate area to locate a disposal system of this capacity, and 2) the likelihood that the resulting mounded groundwater table could adversely affect the surrounding area, specifically Boston Post Road and other properties down gradient of the site. Subsurface data for this property was compiled from previous soil investigations performed by our office in 1996 and 1997, and a Hydrogeologic Assessment performed by Team Engineering, Inc. in 1997, which included this site in a larger scope of work.

Based on the soil investigations and the Hydrogeologic Assessment, the soil at this property is comprised of sandy soils overlying bedrock. The depth to bedrock as well as the depth to groundwater table, coupled with the hydraulic conductivity for the soil in the immediate area appears to be conducive for a groundwater discharge site.

Two methods to dispose of treated wastewater effluent are 1) subsurface disposal systems such as stone leaching trenches, leaching pits, or leaching chamber systems or 2) open bed systems, typically comprised of multiple sand beds.

For subsurface disposal systems constructed in sandy soils, stone leaching trenches are limited to a maximum loading rate of 2.5 gallons per day per square foot of leaching area

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occur at the property across Boston Post Road within 2 years and reaches the bottom of the leaching facility within 5 years.

625 Boston Post Road
The soil evaluation revealed a layer of sandy soil overlying glacial till. The thickest layer (approximately 6 feet) of sandy soil was found at Deep Observation Hole 03-1 on a lower portion of the property. As expected, the sand layer diminished heading up the hill. The presence of glacial till makes the area less desirable for a groundwater discharge system. The hydraulic loading rates would be significantly lower than those used for the Bushey property and would therefore require a much larger area that is not available at the site.

Conclusions
The Bushey property appears to be too small for a subsurface disposal system to provide groundwater discharge for 100,000 gallons per day of treated wastewater effluent. Although an open bed system, without 100 percent redundancy, may dimensionally fit on the site, there are other issues that need to be considered. The site lacks the degree of remoteness that is typically used for an open bed system; its proximity to Boston Post Road, residential property, and commercial property may preclude its use. Assuming that an open bed system could be constructed on the site, the computer model predicts breakout is likely to occur within a ten year period or sooner based on the presence of bedrock on the upgradient, south side. Use of the Sykes property does not provide enough space or the same degree of permeable soils to warrant its use in conjunction with the Bushey property.

Based on our preliminary review, we can not recommend the Bushey property or the Sykes property as suitable locations for a 100,000-gallon per day groundwater discharge site.

Very truly yours,
Schofield Brothers of New England, Inc.

Bert Corey

Bert Corey, EIT
Project Engineer

Approved:

Bruce L. Ey

Bruce L. Ey, PE
Senior Vice President

enclosures

ɔcation Address or Lot No. 625 Boston Post Road

On-site Review

Deep Hole Number 03-01 Date: 5/29/03 Time: AM Weather Partly Cloudy

Location (identify on site plan) see sketch

Land Use Residential Slope (%) 10 % Surface Stones None

Vegetation Wooded: Pine, Oak, Maple

Landform Outwash Terrace

Position on landscape (sketch on the back) see sketch

Distances from:

Open Water Body	see sketch	Feet	Drainageway	see sketch	Feet
Possible Wet Area	see sketch	Feet	Property Line	see sketch	Feet
Drinking Water Well	see sketch	Feet	Other		

DEEP OBSERVATION HOLE LOG*

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0 – 2"	A	Sandy Loam	10 YR 3/3	None	Crumb
2" – 12"	Bw	Sandy Loam	10 YR 4/6	None	Massive – Friable
12" – 72"	C1	Loamy Sand	2.5 Y 5/4	None	Massive to Loose
72" – 137"	C2	Sandy Loam (till)	2.5 Y 4/4	None	Structureless, Gravelly, Cobbly, with some Stones and Boulders

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Outwash over Till Depth to Bedrock: > 137"

Depth to Groundwater: Standing Water in the Hole: None Observed Weeping from Pit Face: None Observed

Estimated Seasonal High Ground Water: > 137"

Location Address or Lot No. 625 Boston Post Road

On-site Review

Deep Hole Number 03-03 Date: 5/29/03 Time: AM Weather Partly Cloudy

Location (identify on site plan) see sketch

Land Use Residential Slope (%) 15 % Surface Stones None

Vegetation Wooded: Pine, Oak, Maple

Landform Outwash Terrace

Position on landscape (sketch on the back) see sketch

Distances from:

Open Water Body see sketch Feet Drainageway see sketch Feet

Possible Wet Area see sketch Feet Property Line see sketch Feet

Drinking Water Well see sketch Feet Other

DEEP OBSERVATION HOLE LOG*

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0 – 2"	A	Sandy Loam	10 YR 3/3	None	Crumb
2" – 12"	Bw	Sandy Loam	10 YR 4/6	None	Massive – Friable
12" – 48"	C1	Loamy Sand	2.5 Y 6/3	None Variegated @ 48" 10 YR 5/6	Massive – Very Friable
48" – 122"	C2	Sandy Loam (till)	2.5 Y 4/4	None	Structureless, Gravelly, Cobbly, with some Stones

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Outwash over Till Depth to Bedrock: > 122"

Depth to Groundwater: Standing Water in the Hole: None Observed Weeping from Pit Face: None Observed

Estimated Seasonal High Ground Water: > 122"

Location Address or Lot No. 625 Boston Post Road

COMMONWEALTH OF MASSACHUSETTS

Sudbury Massachusetts

Percolation Test*

Date: 5/29/03 Time: AM/PM

Observation Hole #	03-01	03-02
Depth of Perc (to top of 12 " of water)	30" to 42"	35" to 47"
Start Pre-soak	2:51	10:10
End Pre-soak	3:06	- 10:26
Time at 12"	3:06	10:26
Time at 9"	3:08	11:02
Time at 6"	3:11	11:54
Time (9"-6")	3 minutes	52 minutes
Rate Min./Inch	< 2 MPI	18 MPI

* Minimum of 1 percolation test must be performed in both the primary are AND reserve area.

Site Passed ☐ Site Failed ☐

Performed By: Bert Corey, EIT

Witnessed By: Bob Leupold – Sudbury Board of Health

Comments: 03-02 Overnight soak not performed, run to completion.

Job No. 21416

Location Address or Lot No. 625 Boston Post Road

Determination for Seasonal High Water Table

Method Used:

- [X] Depth observed standing in observation hole None Observed inches
- [X] Depth weeping from side of observation hole None Observed inches
- [X] Depth to soil mottles None Observed inches
- [ ] Ground water adjustment feet

Index Well Number Reading Date Index well level

Adjustment factor Adjusted ground water level

Depth of naturally Occurring Pervious Material

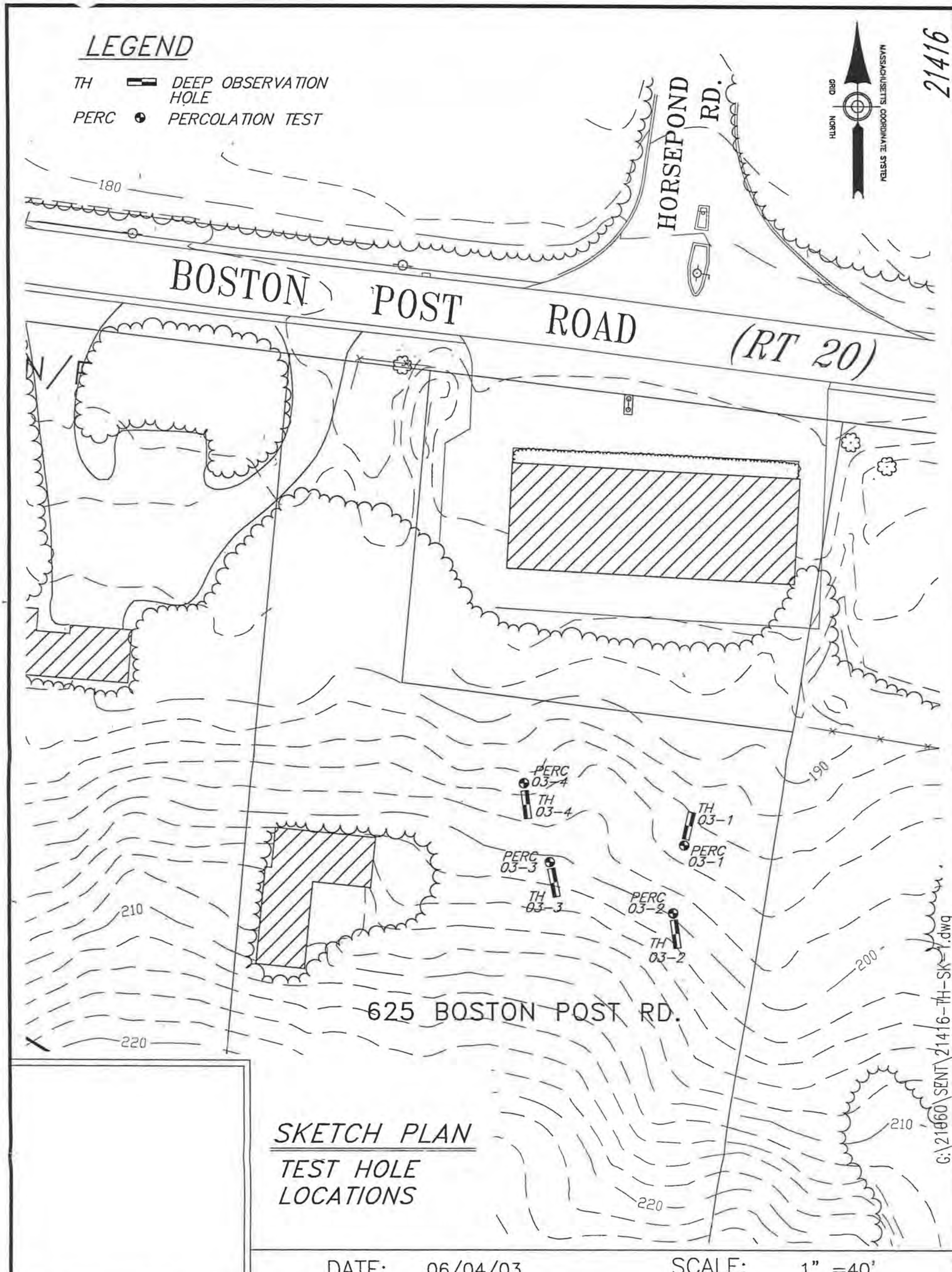
Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system? Yes

If not, what is the depth of naturally occurring pervious material? ______

Certification

I certify that on 11/12/02 (date) I have passed the soil evaluator examination approved by the Department of Environmental Protection and that the above analysis was performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017.

Signature Bert Corey Date 6/13/03



DATE: 06/04/03 SCALE: 1" =40'

PREPARED FOR:
Sudbury Technical Advisory Committee

PROJECT TITLE:

PLAN TITLE:
TH-SK-1

21416

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March 31, 2004

21416

Sudbury Board of Health
275 Old Lancaster Road
Sudbury, MA 01776
Attn: Mr. Robert Leupold

Old Lancaster
RE: Soil Testing at 275 ~~Boston Post~~ Road
Sudbury, MA

Dear Mr. Leupold:

Enclosed please find the Soil Suitability report for the deep observation and percolation test holes performed by our office on Mar 30, 2004 for the Technical Advisory Committee. The approximate test hole locations have been plotted on the attached Test Hole Location Plan.

It appears from our preliminary testing that the soils on the site have a limiting Fine Sandy Loam layer (C2) which would need to be removed to support a sewage disposal leaching facility.

The testing performed has provided good information for us to evaluate the potential of the site for the proposed sewer project. Detail borings would undoubtedly be required to confirm any proposed plans beyond a preliminary stage.

Thank you for your time and patience while witnessing the test holes. Please call myself or Bruce Ey if you have any questions.

Very truly yours,
Schofield Brothers of New England, Inc.

Daniel L. Boucher

Daniel L. Boucher, EIT
Project Engineer

Enclosures
Cc: Technical Advisory Committee

Job No.
No. 21416 **Date:** 3/31/04

Commonwealth of Massachusetts
Sudbury, Massachusetts

Soil Suitability Assessment for On-site Sewage Disposal

Performed By: Daniel L. Boucher, EIT **Date:** 3/30/04

Witnessed By: Bob Leupold – Sudbury Board of Health

Address	275 Old Lancaster Road, Sudbury	Owner's Name,	N/F Sudbury Water District
		Address, and	199 Raymond Road, Sudbury MA 01776
Assessor's Map J-08	Parcel Number (001)	Telephone #	
New Construction	[X] Repair [ ]		

Office Review

Published Soil Survey Available : No [ ] Yes [X]

Year Published 1991 Publication Scale 1:25,000 Soil Map Unit 67B, Windsor

Drainage Class Excessively Soil Limitations Droughtiness, Slope

Surficial Geologic Report Available: No [ ] Yes [X]

Year Published 1974 Publication Scale 1:25,000

Geologic Material (Map Unit) Qsg Sand and gravel undiferentiated

Landform Outwash Terrace

Flood Insurance Rate Map: Community-Panel Number 250217 0003 C

Above 500 year flood boundary No [ ] Yes [X] in test area

Within 500 year flood boundary No [X] Yes [ ] Within 500 yr to the south of test area (wetlands)

Within 100 year flood boundary No [X] Yes [ ]

Wetland Area: South of testing area, See Plan

National Wetland Inventory Map (map unit) N/A

Wetlands Conservancy Program Map (map unit) N/A

Current Water Resource Conditions (USGS): Month February

Range: Above Normal [ ] Normal [X] Below Normal [ ]

Other References Reviewed:

Location Address or Lot No. 275 Old Lancaster Road, Sudbury, MA

On-site Review

Deep Hole Number 04-1 Date: 3/30/04 Time: AM Weather Partly Cloudy 35+/-

Location (identify on site plan) See Plan

Land Use Undeveloped Slope (%) See Plan Surface Stones None

Vegetation Wooded: Lofty White Pines

Landform Outwash Terrace

Position on landscape (sketch on the back) See Plan

Distances from:

Open Water Body	See Plan	Feet	Drainageway	N/A	Feet
Possible Wet Area	See Plan	Feet	Property Line	See Plan	Feet
Drinking Water Well	N/A	Feet	Other		

DEEP OBSERVATION HOLE LOG*

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0 – 11"	A	Sandy Loam	10 YR 3/3	None Observed	Crumb to Massive
11" – 26"	Bw	Sandy Loam	10 YR 5/6	None Observed	Massive – Friable, Roots
26" – 89"	C1	Sand	2.5 Y 6/6	86-90" Band of 5 YR 4/6	Loose Fine to Medium Sand No gravel, stones or cobbles
89" – 132"	C2	Fine Sandy Loam	5 Y 6/3	Some Low Chroma	Massive Friable Fine Sandy Loam w/silt. No gravel stones Or cobbles (Lake Bottom Deposits).

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Outwash over Lake Bottom Deposits Depth to Bedrock: > 132"

Depth to Groundwater: Standing Water in the Hole: None Observed Weeping from Pit Face: None Observed

Estimated Seasonal High Ground Water: @ 86" by Soil Morphology

Location Address or Lot No. 275 Old Lancaster Road, Sudbury, MA

On-site Review

Deep Hole Number 04-2 Date: 3/30/04 Time: AM Weather Partly Cloudy 35+/-

Location (identify on site plan) See Plan

Land Use Undeveloped Slope (%) See Plan Surface Stones None

Vegetation Wooded: Lofty White Pines

Landform Outwash Terrace

Position on landscape (sketch on the back) See Plan

Distances from:

Open Water Body See Plan Feet Drainageway N/A Feet

Possible Wet Area See Plan Feet Property Line See Plan Feet

Drinking Water Well N/A Feet Other

DEEP OBSERVATION HOLE LOG*

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0 – 15"	A	Sandy Loam	10 YR 3/3	None Observed	Crumb to Massive
15" – 37"	Bw	Sandy Loam	10 YR 5/6	None Observed	Massive – Friable, Roots
37" – 52"	C1	Sand	2.5 Y 6/4	None Observed	Loose Fine to Medium Sand No gravel, stones or cobbles
52" – 85"	C2	Fine Sandy Loam	5 Y 6/3	Some Variegated	Massive Friable Fine Sandy Loam w/silt. No gravel stones
85" – 119"	C3	Sand	2.5 Y 6/4	None Observed	Loose Medium Sand No gravel, stones or cobbles
119" – 167"	C4	Fine Sandy Loam	5 Y 6/3	Some Variegated	Massive Friable Fine Sandy Loam w/silt. No gravel stones (Lake Bottom Deposits)

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Outwash over Lake Bottom Deposits Depth to Bedrock: > 167"

Depth to Groundwater: Standing Water in the Hole: None Observed Weeping from Pit Face: None Observed

Estimated Seasonal High Ground Water: >167" (Variegated mottles not indicative of groundwater)

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June 14, 2004

21416

Technical Advisory Committee
c/o Lisa Eggleston
55 Old Coach Road
Sudbury, MA 01776

RE: DPW Property 275 Old Lancaster Road

Dear Lisa:

Pursuant to the request of the Technical Advisory Committee, our office performed a preliminary evaluation of the vacant land on the DPW/Town office property located at 275 Old Lancaster Road. The purpose of the investigation was to determine if the site has potential for the disposal of 100,000-gallons per day of treated wastewater effluent. Our office performed a soil evaluation in the vacant area to the east of the new office building and parking lot on March 30, 2004. Please find enclosed a copy of the soil report sent to the Sudbury Board of Health on March 31, 2004.

The soil logs indicate a C-2 layer of a fine sandy loam that would have to be removed if this area is to be used. In the area of test hole 04-1 (closest to the brook) the C-2 layer was recorded at a depth of 89" to the bottom of the test hole at depth of 132". Mottles indicating spring ground water elevations were found just above this C-2 layer in every test hole. Given the depth of the C-2 layer and distance to Hop Brook, we recommend staying away from this immediate area. In the remaining test holes, the C-2 layer ranged in thickness from 12" to 38" and was encountered at depths of 52" to 111". Soil borings are needed to further analyze the extent of the C-2 layer and the saturated thickness of the sand soil.

Based on the soil investigations and a preliminary hydrogeologic assessment, it appears that this site has potential for the disposal of 100,000 gallons per day of treated effluent. Because of the close proximity to the Town office building and the abutting residence to the east, we only considered a covered leaching system. For subsurface disposal systems constructed in sandy soils, stone leaching trenches are limited to a maximum loading rate of 2.5 gallons per day per square foot of leaching area (gpd/sf) and leaching chambers are limited to a maximum loading rate of 3.0 gpd/sf. A reserve area providing 100 percent redundancy must also be available at the site. A primary leaching trench system would consist of 68 leaching trenches 100' long. An area of approximately 260 feet by 200' would be required.

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Without soil borings and in situ permeability tests, assumptions were made to complete a very rough mounding analysis. The analysis indicated that the ground water mound will come close to the new garage floor elevation. Further, more accurate analysis is warranted.

In conclusion, assuming sandy soils and a saturated depth of 50', it does appear by removing the impervious C-2 layer that the area could be used to dispose of 100,000 gallons per day of treated effluent. It will however, require using all the wooded area to the east of the new Town office parking lot and lowering the grade six to eight feet. A more definitive hydrogeologic study will be required to conclude that this area can be used to dispose of 100,000 gallons per day of treated effluent. Please feel free to contact our office should if you have any questions regarding the above soil testing or if further analysis is requested.

Very truly yours,
Schofield Brothers of New England, Inc.

Bruce L. Ey, PE
Senior Vice President

enclosures

SCHOFIELD BROTHERS
ENGINEERING • SURVEYING • PLANNING

Schofield Brothers of New England Inc
1071 Worcester Road
Framingham, MA 01701-52[illegible]
508-879-0030 • 1-800-696-[illegible]
Fax 508-879-1797
Website www.schofieldb[illegible]

March 31, 2004

21416

MAR 30 2004

Sudbury Board of Health
275 Old Lancaster Road
Sudbury, MA 01776
Attn: Mr. Robert Leupold

RE: Soil Testing at 275 Boston Post Road
Sudbury, MA

Dear Mr. Leupold:

Enclosed please find the Soil Suitability report for the deep observation and percolation test holes performed by our office on Mar 30, 2004 for the Technical Advisory Committee. The approximate test hole locations have been plotted on the attached Test Hole Location Plan.

It appears from our preliminary testing that the soils on the site have a limiting Fine Sandy Loam layer (C2) which would need to be removed to support a sewage disposal leaching facility.

The testing performed has provided good information for us to evaluate the potential of the site for the proposed sewer project. Detail borings would undoubtedly be required to confirm any proposed plans beyond a preliminary stage.

Thank you for your time and patience while witnessing the test holes. Please call myself or Bruce Ey if you have any questions.

Very truly yours,
Schofield Brothers of New England, Inc.

Daniel L. Boucher

Daniel L. Boucher, EIT
Project Engineer

Enclosures
Cc: Technical Advisory Committee

Job No
No. 21416

Date: 3/31/04

Commonwealth of Massachusetts
Sudbury, Massachusetts

Soil Suitability Assessment for On-site Sewage Disposal

Performed By: Daniel L. Boucher, EIT **Date:** 3/30/04

Witnessed By: Bob Leupold – Sudbury Board of Health

Address 275 Old Lancaster Road, Sudbury	Owner's Name, N/F Sudbury Water District
	Address, and 199 Raymond Road, Sudbury MA 01776
Assessor's Map J-08 Parcel Number (001)	Telephone #
New Construction [X] Repair [ ]	

Office Review

Published Soil Survey Available : No [ ] Yes [X]

Year Published 1991 Publication Scale 1:25,000 Soil Map Unit 67B, Windsor

Drainage Class Excessively Soil Limitations Droughtiness, Slope

Surficial Geologic Report Available: No [ ] Yes [X]

Year Published 1974 Publication Scale 1:25,000

Geologic Material (Map Unit) Qsg Sand and gravel undiferentiated

Landform Outwash Terrace

Flood Insurance Rate Map: Community-Panel Number 250217 0003 C

Above 500 year flood boundary No [ ] Yes [X] in test area

Within 500 year flood boundary No [X] Yes [ ] Within 500 yr to the south of test area (wetlands)

Within 100 year flood boundary No [X] Yes [ ]

Wetland Area: South of testing area, See Plan

National Wetland Inventory Map (map unit) N/A

Wetlands Conservancy Program Map (map unit) N/A

Current Water Resource Conditions (USGS): Month February

Range: Above Normal [ ] Normal [X] Below Normal [ ]

Other References Reviewed:

Location Address or Lot No. 275 Old Lancaster Road, Sudbury, MA

On-site Review

Deep Hole Number 04-1 Date: 3/30/04 Time: AM Weather Partly Cloudy 35+/-

Location (identify on site plan) See Plan

Land Use Undeveloped Slope (%) See Plan Surface Stones None

Vegetation Wooded: Lofty White Pines

Landform Outwash Terrace

Position on landscape (sketch on the back) See Plan

Distances from:

Open Water Body See Plan Feet Drainageway N/A Feet

Possible Wet Area See Plan Feet Property Line See Plan Feet

Drinking Water Well N/A Feet Other

DEEP OBSERVATION HOLE LOG*

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0 – 11"	A	Sandy Loam	10 YR 3/3	None Observed	Crumb to Massive
11" – 26"	Bw	Sandy Loam	10 YR 5/6	None Observed	Massive – Friable, Roots
26" – 89"	C1	Sand	2.5 Y 6/6	86-90" Band of 5 YR 4/6	Loose Fine to Medium Sand No gravel, stones or cobbles
89" – 132"	C2	Fine Sandy Loam	5 Y 6/3	Some Low Chroma	Massive Friable Fine Sandy Loam w/silt. No gravel stones Or cobbles (Lake Bottom Deposits).

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Outwash over Lake Bottom Deposits Depth to Bedrock: > 132"

Depth to Groundwater: Standing Water in the Hole: None Observed Weeping from Pit Face: None Observed

Estimated Seasonal High Ground Water: @ 86" by Soil Morphology

Location Address or Lot No. 275 Old Lancaster Road, Sudbury, MA

On-site Review

Deep Hole Number 04-2 Date 3/30/04 Time: AM Weather Partly Cloudy 35+/-

Location (identify on site plan) See Plan

Land Use Undeveloped Slope (%) See Plan Surface Stones None

Vegetation Wooded: Lofty White Pines

Landform Outwash Terrace

Position on landscape (sketch on the back) See Plan

Distances from:

Open Water Body See Plan Feet Drainageway N/A Feet

Possible Wet Area See Plan Feet Property Line See Plan Feet

Drinking Water Well N/A Feet Other

DEEP OBSERVATION HOLE LOG*

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0 – 15"	A	Sandy Loam	10 YR 3/3	None Observed	Crumb to Massive
15" – 37"	Bw	Sandy Loam	10 YR 5/6	None Observed	Massive – Friable, Roots
37" – 52"	C1	Sand	2.5 Y 6/4	None Observed	Loose Fine to Medium Sand No gravel, stones or cobbles
52" – 85"	C2	Fine Sandy Loam	5 Y 6/3	Some Variegated	Massive Friable Fine Sandy Loam w/silt. No gravel stones
85" – 119"	C3	Sand	2.5 Y 6/4	None Observed	Loose Medium Sand No gravel, stones or cobbles
119" – 167"	C4	Fine Sandy Loam	5 Y 6/3	Some Variegated	Massive Friable Fine Sandy Loam w/silt. No gravel stones (Lake Bottom Deposits)

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Outwash over Lake Bottom Deposits Depth to Bedrock: > 167"

Depth to Groundwater: Standing Water in the Hole: None Observed Weeping from Pit Face: None Observed

Estimated Seasonal High Ground Water: >167" (Variegated mottles not indicative of groundwater)

Location Address or Lot No 275 Old Lancaster Road, Sudbury, MA

On-site Review

Deep Hole Number 04-3 Date: 3/30/04 Time: PM Weather Partly Cloudy 35+/-

Location (identify on site plan) See Plan

Land Use Undeveloped Slope (%) See Plan Surface Stones None

Vegetation Wooded: Lofty White Pines

Landform Outwash Terrace

Position on landscape (sketch on the back) See Plan

Distances from:

Open Water Body See Plan Feet Drainageway N/A Feet

Possible Wet Area See Plan Feet Property Line See Plan Feet

Drinking Water Well N/A Feet Other

DEEP OBSERVATION HOLE LOG*

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0 – 12"	A	Sandy Loam	10 YR 3/3	None Observed	Crumb to Massive
12" – 28"	Bw	Sandy Loam	10 YR 5/8	None Observed	Massive – Friable, Roots
28– 111"	C1	Sand	5 Y 7/3	Some Variegated In Stratified Lifts	Loose Stratified Medium to Coarse Sands
111" – 123"	C2	Fine Sandy Loam	5 Y 6/3	Some Variegated	Massive Friable Fine Sandy Loam w/silt. No gravel stones
123" > 148"	C3	Sand	5 Y 6/2	None Observed	Loose Medium to Coarse Sand, coarse gravel w/stones At bottom

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Glacial Outwash Depth to Bedrock: > 148"

Depth to Groundwater: Standing Water in the Hole: None Observed Weeping from Pit Face: None Observed

Estimated Seasonal High Ground Water: >148" (Variegated mottles not indicative of groundwater)

Location Address or Lot No. 275 Old Lancaster Road, Sudbury, MA

On-site Review

Deep Hole Number 04-4 Date: 3/30/04 Time: PM Weather Partly Cloudy 35+/-

Location (identify on site plan) See Plan

Land Use Undeveloped Slope (%) See Plan Surface Stones None

Vegetation Wooded: Lofty White Pines

Landform Outwash Terrace

Position on landscape (sketch on the back) See Plan

Distances from:

Open Water Body See Plan Feet Drainageway N/A Feet

Possible Wet Area See Plan Feet Property Line See Plan Feet

Drinking Water Well N/A Feet Other

DEEP OBSERVATION HOLE LOG*

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0 – 9"	A	Sandy Loam	10 YR 3/3	None Observed	Crumb to Massive
9" – 25"	Bw	Sandy Loam	10 YR 5/8	None Observed	Massive – Friable, Roots
25– 55"	C1	Sand	5 Y 6/4	Some Variegated @ Bottom	Loose Medium to Coarse Sand
55" – 93"	C2	Fine Sandy Loam	5 Y 6/3	Some Variegated Throughout	Massive Friable Fine Sandy Loam w/silt. No gravel stones
93" > 155"	C3	Sand	5 Y 7/1	None Observed	Loose Coarse Sand to light gravel

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Glacial Outwash Depth to Bedrock: > 155"

Depth to Groundwater: Standing Water in the Hole: None Observed Weeping from Pit Face: None Observed

Estimated Seasonal High Ground Water: >155" (Variegated mottles not indicative of groundwater)

Job No 21416
Location Address or Lot No. 275 old Lancaster Road, Sudbury, MA

Determination for Seasonal High Water Table

Method Used:

- [X] Depth observed standing in observation hole None Observed inches
- [X] Depth weeping from side of observation hole None Observed inches
- [X] Depth to soil mottles None Observed inches
- [ ] Ground water adjustment feet

Index Well Number Reading Date Index well level

Adjustment factor Adjusted ground water level

Depth of naturally Occurring Pervious Material

Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system? Except 04-2**

If not, what is the depth of naturally occurring pervious material? ____

** 04-2 lacked a consistent 4' of natural occuring parent material, because of the limiting Fine Sandy Loam C2 layer. In testholes 04-2, 04-3, and 04-4 the Fine Sandy Loam layer (C2) will need to be removed for on-site leaching area suitability.

Certification

I certify that on May 30, 1997 (date) I have passed the soil evaluator examination approved by the Department of Environmental Protection and that the above analysis was performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017.

Signature Daniel Barker Date 3/31/04

Location Address or Lot No. 275 Old Lancaster Road

COMMONWEALTH OF MASSACHUSETTS

Sudbury Massachusetts

Percolation Test*

Date: 3/30/04 Time: PM

Observation Hole #	04-2	04-3
Depth of Perc (to top of 12 " of water)	43 to 55"	47 to 59"
Start Pre-soak	12:04	1:20
End Pre-soak	12:19	1:30
Time at 12"	12:19	N/A
Time at 9"	1:33	Added 25 Gallons of Water and could not maintain pre-soak
Time at 6"	Abandoned @ 8-1/8" @ 2:03	N/A
Time (9"-6")	N/A	N/A
Rate Min./Inch	>30 MPI	<2 MPI

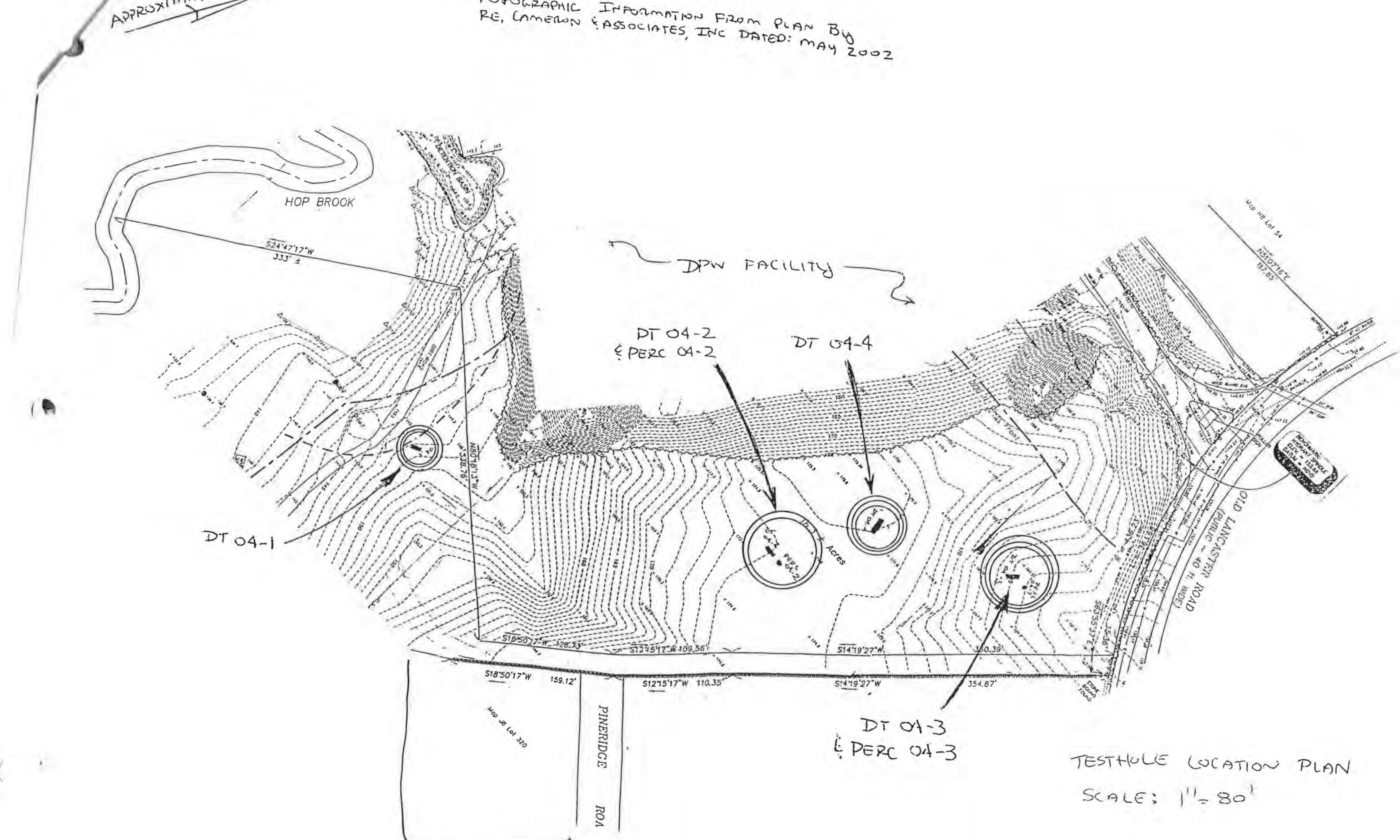
* Minimum of 1 percolation test must be performed in both the primary are AND reserve area.

Site Passed ☐ Site Failed ☐ See comments

Performed By: Daniel L. Boucher, EIT

Witnessed By: Bob Leupold – Sudbury Board of Health

Comments: The limiting Fine Sandy Loam Layer will have to be removed to support a leaching area.



TESTHOLE LOCATION PLAN

SCALE: 1" = 80'

SCHOFIELD BROTHERS
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Fax 508-879-1797
Website www.schofieldbros.com

August 13, 2007

21416

Jody Kablack, Director of Planning and Community Development
278 Old Sudbury Road
Sudbury, MA 01776

RE: Young Property
in Sudbury, Massachusetts

Dear Jody:

Pursuant to your request, I have reviewed the soil testing completed by our office on the above site on July 17, 2007. The purpose of this review was to determine the maximum number of bedrooms that could be serviced by a common septic system.

Test holes 07-1 and 07-4 indicated suitable soils for subsurface sewage disposal. Given the estimated elevation of ground water in the spring of the year, a mounded leaching field would be required in this area. Enclosed please find our sketch plan using the assessor's maps and the MassGIS data indicating a potential leaching field area. The contours were digitized off the Town of Sudbury topographic maps. The test hole locations are approximate.

The best soils for subsurface sewage disposal fall between the existing house and the small mound in the rear of property. Although additional test holes will be required for a more definitive design, it is my opinion that the soil absorption system shown (180' x 93') could service 40 to 49 bedrooms. A more accurate bedroom count can be determined with additional soil testing. A preliminary sketch of proposed units would also be helpful, as the leaching field and housing units begin to compete for area when we stay out of the wetland buffer.

Please feel free to contact our office should you have any questions regarding the above conclusions or if we can be of any further service.

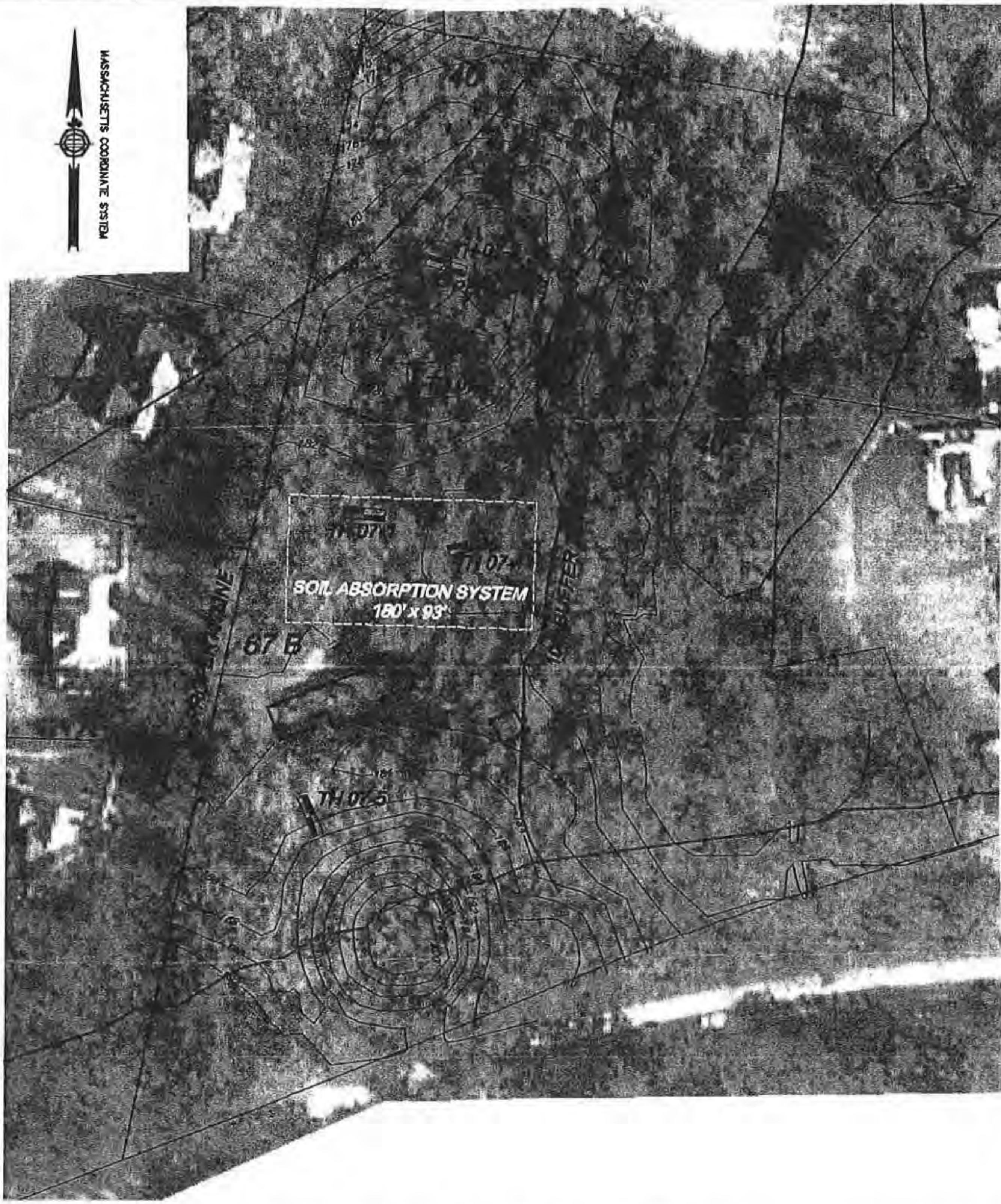
Very truly yours,

Schofield Brothers of New England, Inc.

Bruce L. Ey, PE

Bruce L. Ey, PE

enclosures



Note: Property lines, contours, and 100' Buffer Zone are approximate.

Sketch Plan Sewage Disposal Location 804 Boston Post Road Sudbury, MA *21416*		SCHOFIELD BROTHERS OF NEW ENGLAND, INC. ENGINEERING SURVEYING PLANNING 1071 WORCESTER ROAD FRAMINGHAM, MASS. 01701 DATE: 7/18/07 SCALE: 1"=100' FAX # (508) 879-1797 TEL. # (508) 879-0030 COPYRIGHT © 2007, BY SCHOFIELD BROTHERS OF NEW ENGLAND, INC.

APPENDIX D

Subsurface Data Results:

Letter to Town of Sudbury February 18, 2010

Five Centennial Drive
Peabody, MA 01960-7985
tel: 978-532-1900 fax: 978-977-0100
www.westonandsampson.com

Weston&Sampson

February 18, 2010

Ms Jody Kablack
Town Planner
Flynn Building
278 Old Sudbury Road
Sudbury, MA 01776

RE: Subsurface Data Results

Dear Ms Kablack,

The following letter report summarizes the data collection activities and subsequent analysis conducted for three different areas in Sudbury. The areas or land parcels represent potential subsurface disposal locations for treated wastewater effluent. Although a more thorough analysis is required under DEP's groundwater discharge permitting process, the initial estimates of assimilative capacity are discussed below. Previous memos were developed regarding environmental/ecological constraints for each site.

Data Collection

A test boring and monitoring well installation program was undertaken for three areas. The drilling was undertaken between August 19, 2009 and September 2, 2009. Monitoring wells were constructed at each site in select locations to provide geographic coverage and to determine subsurface stratigraphy at the site. Monitoring well logs and construction diagrams are provided in Appendix A, along with a site schematic showing the approximate location of each boring. Slug testing was undertaken in each monitoring well to aid in evaluating the permeability of subsurface deposits. In addition, sieve analysis on select soil strata was undertaken as another means to evaluate permeability. Each site is discussed below.

Curtis Middle School

Three wells were installed at the Curtis Middle School. Wells were located along the perimeter of the existing playing fields where safe access was available. In general, the borings indicate dense fine-medium sand and fine gravel. Static water levels ranged between approximately 29 and 32 feet below grade. Slug tests conducted indicate that calculated hydraulic conductivities for the site range between 1.45 and 7.23 feet per day (ft/d).

Additional validation of these values was obtained by undertaking grain size distribution analyses. Assuming the deposits are generally anisotropic and relatively poorly sorted, hydraulic conductivity can be estimated using the following formula (Shepherd, 1989):

$$K = 800d^{1.5}$$

Using a ratio of 20:1 or 50:1 provides a more representative vertical hydraulic conductivity given layered or stratified glacial deposits. Vertical hydraulic conductivities range between 4.02 and 8.68 ft/d.

Soil samples were analyzed in boring B1 between 29 and 31 feet below ground surface (bgs) at the Curtis Middle School. This sample was chosen as generally representative of deeper sand and gravel deposits with silt. This sample was also at the same interval as the screen interval for the well. Results shown in Table 1 below indicate good correlation between calculated hydraulic conductivities for both the slug test and the sieved samples. An additional sample was evaluated from boring B3 at the depth of 19-21 feet. This sample was selected as representative of shallow, finer deposits. These deposits would generally represent lower permeabilities for the site and therefore reduce the assimilative capacity of a subsurface disposal system. Graphical analysis of slug test results and grain size sieve analyses are provided in Appendix B.

Table 1 Hydraulic Conductivity Estimates at the Curtis Middle School

		Hydraulic Conductivity (ft/d)			
		Slug Test Analysis		Sieve Analysis	
	Sample Depth (feet)	Bouwer & Rice	Hvorslev	K_h[1]	K_{v50}[2]
B1	29-31	1.450	1.890	433.83	8.68
B2	28-33	5.540	7.230		
B3	19-21			200.95	4.02
B3	32-37	4.220	4.190		

1. K_h = Horizontal hydraulic conductivity as calculated for moderately immature sediments using $K=800d^{1.5}$
2. Kv = Vertical hydraulic conductivity, being 1/50th of K_h

Mounding analysis for the CMS site was conducted using an analytical model developed by the Colorado School of Mines. A summary of the different flow rate scenarios is provided in Table 2, below.

Table 2 Mounding Analysis Summary at Curtis Middle School

Flow Rate (gpd)	Maximum Mound Height (ft)	Predicted Mound Height at 500 Feet
50,000	16.9	9.6
100,000	25.6	14.7
200,000	36.6	25.8

At flow rates of 100,000 gpd, preliminary, conservative estimates indicate 25.6 feet of mound height is calculated under the center of a 210 x 320 foot field. At a radial distance of 500 feet, theoretical mound heights of 14.7 feet are calculated. Actual mound heights should be less as a conservative K was used to reflect the finer deposits. Mounding analyses are provided in Appendix C.

Based on the above estimates, the Curtis Middle School site appears favorable for the disposal of significant quantities of treated wastewater in a soil adsorption system (SAS).

Haskell Field

Borings were completed in two of the three planned locations at Haskell Field. These borings were installed at locations B1 and B3. Due to the similarity of the subsurface deposits, B2 was not installed. Generally, subsurface deposits consist of fine sand and silt. Significantly lower permeability silty sands exist from 9-11 feet bgs throughout the area. Calculated hydraulic conductivities from slug test results ranged between approximately 0.6 and 8.3 ft/day. Similarly, grain size analyses indicate good correlation between calculated vertical hydraulic conductivities and slug test results at the B3 layer (see Table 3 below). Grain size analyses indicate that the predominance of silt in the 9-11 foot layer would yield even lower values for hydraulic conductivity.

Table 3 Hydraulic Conductivity Analysis at Haskell Field

		Hydraulic Conductivity (ft/d)			
		Slug Test Analysis		Sieve Analysis	
	Sample Depth (feet)	Bouwer & Rice	Hvorslev	K_h[1]	K_{v2D}[2]
B1	9-11			N/A[3]	N/A[3]
B1	20-30	8.270	6.340		
B3	19-21			12.44	0.0623
B3	30-35	0.865	0.663		

1. K_h = Horizontal hydraulic conductivity as calculated for moderately immature sediments using $K=800d^{1.5}$
2. Kv = Vertical hydraulic conductivity, being 1/20th of K_h
3. N/A = Sieve analysis did not return D_{50} value needed to calculate hydraulic conductivity

The mounding analysis for this site reveals calculated mound heights readily exceeded 30 feet. The low permeability deposits prevalent at 9-11 feet and again in areas from 19-21 feet, relegate this area as impractical for the construction of high a capacity SAS (see Table 4 below).

Table 4 Mounding Analysis Summary at Curtis Middle School

Flow Rate (gpd)	Maximum Mound Height (ft)	Predicted Mound Height at 500 Feet
50,000	45.4	27.8
100,000	65.3	41.7
200,000	89	62.2

Old Lancaster Road (293/301)

The tested parcels located on Old Lancaster Road revealed the highest degree of variability in subsurface deposits. In general, more permeable deposits exist near boring B1, while finer silt and sand deposits were evident in borings B2 and B3. Slug test results indicate permeabilities of less than 1.5 ft/day (see table 5 below). Screened intervals for these wells were selected from 15-20 feet. In borings B2 and B3, these layers had a dominant silt fraction. Mounding analysis for this site indicates mound heights for 50,000 gpd will exceed 32 feet (see Table 6 below). The fine grained deposits from 15-20 feet and the excessive mound heights indicate this site is impractical for the installation of a high capacity SAS.

Table 5 Hydraulic Conductivity Analysis at Old Lancaster Road

		Hydraulic Conductivity (ft/d)			
		Slug Test Analysis		Sieve Analysis	
	Sample Depth (feet)	Bouwer & Rice	Hvorslev	K_h[1]	K_{v50}[2]
B1[3]	15-20	1.030	1.340		
B2	14-16			25.49	0.51
B2	18-25	0.308	0.402		
B3	9-11			N/A[4]	N/A[4]
B3	18-25	0.413	0.538		

1. K_h = Horizontal hydraulic conductivity as calculated for moderately immature sediments using $K=800d^{1.5}$
2. Kv = Vertical hydraulic conductivity, being 1/50th of K_h
3. Sieve Analysis not conducted at B1.
4. N/A = Sieve analysis did not return D_{50} value needed to calculate hydraulic conductivity

Table 6 Mounding Analysis Summary at Old Lancaster Road

Flow Rate (gpd)	Maximum Mound Height (ft)	Predicted Mound Height at 500 Feet
50,000	32.4	19.5
100,000	47.4	29.4
200,000	65.5	43.5

Conclusions

The Curtis Middle School exhibits the most favorable conditions for the successful installation of an SAS system capable of handling 100,000 gpd. These conditions include permeable deposits and adequate separation from groundwater. Further investigation activities, include test pits and possible load scale testing, would be required to establish final design flow rates, capacity and field size. Installed costs for large scale SAS systems generally range between $12 and $15 per square foot. This value would not include athletic field reparation or changes in other utility infrastructure, if necessary, at this site. Fine grained silt and sand deposits exists at depth for both the Haskell Field and land parcels investigated along Old Lancaster Road. Although smaller SAS systems could accept some flow of treated effluent, systems above 50,000 gpd at these two sites are impractical.

The above information is provided to assist Sudbury in their wastewater planning efforts. Please feel free to contact us if you have any questions.

Very truly yours,

WESTON & SAMPSON, INC.

Blake A. Martin
Environmental Resource Manager

FIGURES

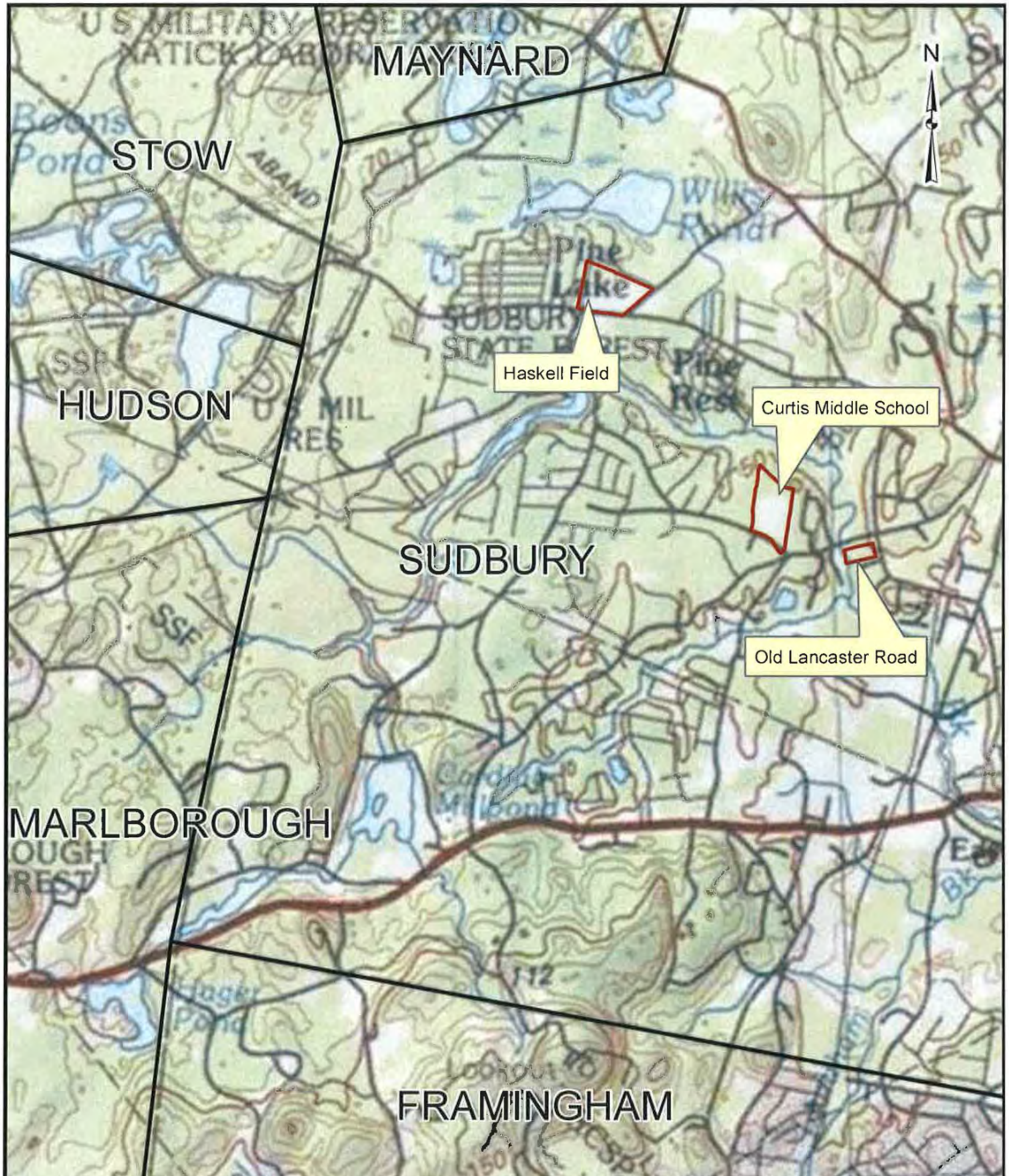


FIGURE 1
SUDBURY SUBSURFACE DISPOSAL CAPACITY
LOCUS MAP

SITE MAP

MA Town Boundaries

3,000 0 3,000

SCALE IN FEET

Weston&Sampson

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FIGURE 2
SUDBURY SUBSURFACE DISPOSAL CAPACITY
CURTIS MIDDLE SCHOOL

SITE MAP

● Boring
Curtis Middle School Property

250 0 250
SCALE IN FEET

Weston&Sampson.

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FIGURE 3
SUDBURY SUBSURFACE DISPOSAL CAPACITY
HASKELL FIELD

SITE MAP

● Borings
Haskell Field Property

250 0 250
SCALE IN FEET

Weston&Sampson

FIGURE 4
SUDBURY SUBSURFACE DISPOSAL CAPACITY
OLD LANCASTER ROAD

SITE MAP

● Boring
▭ Old Lancaster Road Property

250 0 250
SCALE IN FEET

Weston&Sampson®

APPENDIX A

Weston & Sampson ENGINEERS, INC.	PROJECT Sudbury, MA Curtis Middle School	REPORT OF BORING No. B1 SHEET 1 OF 1 Project No. CHKD BY

BORING Co. NH Boring
FOREMAN Todd Penticost
WSE GEOLOGIST: Mel Higgins

BORING LOCATION off driveway by ballfield
GROUND SURFACE ELEV. DATUM
DATE START 8/19/2009 DATE END 8/19/2009

SAMPLER: SAMPLER CONSISTS OF 2" SPLIT SPOON DRIVEN USING A 140 LB HAMMER FALLING 30 IN.
CASING: 5' steel
CASING SIZE: 4" OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
10/16/09		31.99	0 - 28'	

DEPTH (feet)	CASING (bl/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
5		S1	24/23	4-6	27-40 53-37		Topsoil, angular gravel, cobbles, coarse sand		
10		S2	24/10	9-11	20-17 13-15		wet brown coarse sand w/gravel, trace of silt		
15		S3	24/20	14-16	8-13 14-21		wet med dense lt brown med sand, some gravel		
20		S4	24/9	19-21	9-5 10-12		wet med dense sand, trace gravel		
25		S5	24/12	24-26	15-9 11-16		wet med dense fine sand		
30		S6	24/24	29-31	18-21 22-25		wet dense fine sand		
35		S7	24/8	34-36	7-7 7-9		wet med dense fine sand w/trace silt		

GRANULAR SOILS BLOWS/FT	DENSITY	COHESIVE SOILS BLOWS/FT	DENSITY	REMARKS
				2" pvc observation well installed. 28' pvc riser with 5'pvc screen (10 slot). Screen set at 33-28' bgs). Natural material around riser. Bentonite chips as sealer. Road box cemented in.

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. B1

Weston & Sampson *ENGINEERS, INC.*	PROJECT Sudbury, MA Curtis Middle School	REPORT OF BORING No. B2 SHEET 1 OF 1 Project No. CHKD BY

BORING Co NH Boring
FOREMAN Todd Penticost
WSE GEOLOGIST: Mel Higgins

BORING LOCATION off Pratt Hill Rd.
GROUND SURFACE ELEV. DATUM
DATE START 8/19/2009 DATE END 8/19/2009

SAMPLER: SAMPLER CONSISTS OF 2" SPLIT SPOON DRIVEN USING A 300 LB. HAMMER FALLING 30 IN
CASING: 5' steel
CASING SIZE: 4" OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
10/16/09		29.18	0-28'	

DEPTH (feet)	CASING (lb/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
5		S1	24/16	4-6	24-26 21-23		dry dense tan fine sand w/some gravel		
10		S2	24/15	9-11	10-23 18-13		moist dense tan fine sand w/ trace of silt and gravel		
15		S3	24/11	14-16	25-25 16-12		wet dense tan fine sand w/some gravel, trace silt		
20		S4	24/8	19-21	6-6 8-9		wet med dense tan fine sand		
25		S5		24-26	12-10 10-15		wet med dense tan fine sand		
30		S6	24/24	29-31	17-17 27-36		wet dense tan fine sand		
35		S7	24/21	34-35	4-5 3-3		wet dense tan fine sand		

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY

REMARKS:
2" pvc observation well installed. 28' pvc riser with 5'pvc screen (10 slot). Screen set at 33-28' bgs). Natural material around riser. Bentonite chips as sealer. Road box cemented in.

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. B2

Weston & Sampson ENGINEERS, INC.	PROJECT Sudbury, MA Curtis Middle School	REPORT OF BORING No. B3 SHEET 1 OF 2 Project No. CHKD BY

BORING Co. NH Boring
FOREMAN Todd Penticost
WSE GEOLOGIST: Mel Higgins

BORING LOCATION by landscaped area of ballfields
GROUND SURFACE ELEV. DATUM
DATE START 8/20/2009 DATE END 8/20/2009

SAMPLER: SAMPLER CONSISTS OF 2" SPLIT SPOON DRIVEN USING A 300 LB. HAMMER FALLING 30 IN.
CASING: 5' steel
CASING SIZE: 4" OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
10/16/09		29.71	0-32'	

DEPTH (feet)	CASING (lb/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
5									
10		S1	24/16	9-11	9-15 15-17		wet dense tan med sand and some gravel		
15									
20		S2	24/12	19-21	11-8 13-15		wet tan dense med sand w/ trace of silt		
25									
30		S3	24/12	29-31	10-9 11-14		wet tan med density fine to med sand with trace gravel		
35									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY

REMARKS:
2" pvc observation well installed. 32' pvc riser with 5'pvc screen (10 slot). Screen set at 37-32' bgs). Natural material around riser. Bentonite chips as sealer. Road box cemented in.

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE

BORING No. B3

Weston & Sampson
ENGINEERS, INC.

PROJECT	REPORT OF BORING No.	B3
Sudbury, MA	SHEET 2 OF 2	
Curtis Middle Schoo	Project No.	
	CHKD BY	

BORING Co. NH Boring
FOREMAN Todd Penticost
WSE GEOLOGIST: Mel Higgins

BORING LOCATION by landscaped area of ballfields
GROUND SURFACE ELEV. DATUM
DATE START 8/20/2009 DATE END 8/20/2009

SAMPLER: SAMPLER CONSISTS OF 2" SPLIT SPOON DRIVEN USING A 300 LB HAMMER FALLING 30 IN
CASING: 5' steel
CASING SIZE: 4" OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (feet)	CASING (blo/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
40		S4		39-41			wet tan fine sand		
45									
50		S5		49-50			wet tan fine sand		
55									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY

REMARKS:
2" pvc observation well installed. 32' pvc riser with 5'pvc screen (10 slot). Screen set at 37-32' bgs). Natural material around riser. Bentonite chips as sealer. Road box cemented in.

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. B3

Weston & Sampson ENGINEERS, INC.	PROJECT Sudbury, MA Haskell Field	REPORT OF BORING No. B1 SHEET 1 OF 1 Project No. CHKD BY

BORING Co. NH Boring
FOREMAN Todd Penticost
WSE GEOLOGIST: Mel Higgins

BORING LOCATION off of Hudson Rd, off of parking lot
GROUND SURFACE ELEV. DATUM
DATE START 8/20/2009 DATE END 8/20/2009

SAMPLER: SAMPLER CONSISTS OF 2" SPLIT SPOON DRIVEN USING A 300 LB HAMMER FALLING 30 IN
CASING: 5' steel
CASING SIZE: 4" OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
10/16/09		17.25'	0-20'	

DEPTH (feet)	CASING (lb/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
5		S1		4-6			med coarse sand w/some gravel		
10		S2		9-11			fine sand and silt		
15		S3		14-16			fine-med sand		
20		S4		19-21			fine-med sand		
25		S5		24-26			fine-med sand		
30		S6		29-31			fine sand		
		S7		34-36			fine sand		
35									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY

REMARKS:
2" pvc observation well installed. 20' pvc riser with 5'pvc screen (10 slot). Screen set at 20-30' bgs). Natural material around riser. Bentonite chips as sealer. Road box cemented in.

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. B1

Weston & Sampson ENGINEERS, INC.	PROJECT Sudbury, MA Haskell Field	REPORT OF BORING No. B3 SHEET 1 OF 1 Project No. CHKD BY

BORING Co. NH Boring
FOREMAN Todd Penticost
WSE GEOLOGIST: Blake Martin

BORING LOCATION off of Hudson Rd, off of parking lot
GROUND SURFACE ELEV. DATUM
DATE START 8/20/2009 DATE END 8/20/2009

SAMPLER: SAMPLER CONSISTS OF 2' SPLIT SPOON DRIVEN US NG A 300 LB HAMMER FALLING 30 IN
CASING: 5' steel
CASING SIZE: 4" OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
10/16/09		16.07'		

DEPTH (feet)	CASING (lb/ft)	No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
5		S1		4-6			med-course Sand w/some gravel		
10		S2		9-11			fine Sand		
15		S3		14-16			med-fine Sand		
20		S4		19-21			fine Sand w/ some silt		
25		S5		24-26			fine sand		
30		S6		29-31			fine sand		
35		S7		34-36					

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY

REMARKS:
2" pvc observation well installed. pvc riser with 5'pvc screen (10 slot). Natural material around riser.
Bentonite chips as sealer. Road box cemented in.

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. B3

Weston & Sampson	PROJECT	REPORT OF BORING No.	OL-1
	193 Old Lancaster Rd, Sudbury MA	SHEET 1	OF 1
		Project No.	2090428
		CHKD BY	BAM

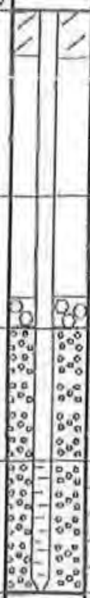
BORING Co. New Hampshire Boring
FOREMAN Vinnie
WSE GEOLOGIST: SQ

BORING LOCATION See attached plan
GROUND SURFACE ELEV. unknown DATUM
DATE START 9/2/09 DATE END 9/2/09

SAMPLER: SPT (Standard Penetration Test)
CASING: 5' - Steel
CASING SIZE: 4" Method Iocone

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
10/16/09		15.75'		



DEPTH (feet)	WELL	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
5				4-6	4/5/7/14		Dry, Brown yellow fine Sand, trace of coarse Sand; Loose.		SAND
10				9-11	5/9/9/10		Brown yellow medium Sand, trace of fine Gravel; Loose.		
15				14-16	(*)		Brown medium Sand, trace of coarse Sand.		
20				19-21	(*)		Brown medium to coarse Sand, some fine Gravel.		SAND & Gravel
25				24-26	(*)		Brown coarse Sand and medium Gravel.		End of boring @ 26 Ft
30									
35									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

REMARKS:
(*) Bag sample from wash water

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. OL-1

Weston & Sampson	PROJECT 193 Old Lancaster Rd, Sudbury MA	REPORT OF BORING No. OL-2 SHEET 1 OF 1 Project No. 2090428 CHKD BY BAM

BORING Co. New Hampshire Boring
FOREMAN Vinnie
WSE GEOLOGIST: SQ

BORING LOCATION See attached plan
GROUND SURFACE ELEV. unknown DATUM
DATE START 9/2/09 DATE END 9/2/09

SAMPLER: SPT (Standard Penetration Test)
CASING: 6' - Steel
CASING SIZE: 4' Method Tricone

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
10/16/09		19.21'		

DEPTH (feet)	WELL	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
5							No sample.		
10				9-11	13/17/18/20		Brown yellow medium Silt, some fine Sand; Moderately dense.		
15				14-16	(*)		Brown yellow medium Silt and fine Sand.		
18									
20				19-21	(*)		Brown yellow coarse Silt and fine Sand.		SILT & Sand
23									
25				24-26	(*)		Brown yellow coarse Silt, some fine Sand.		
30				29-31	(*)		Brown yellow coarse Silt, some fine Sand		
35				34-36			Brown yellow coarse Silt and fine Sand.		End of boring @ 36 Ft

GRANULAR SOILS BLOWS/FT	DENSITY	COHESIVE SOILS BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

REMARKS:
(*) Bag sample from wash water

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. OL-2

O:\Sudbury\WW Disposal Site Eval\Site field data\well boring logs\OL 2.XLS]WS-1

Weston & Sampson	PROJECT 193 Old Lancaster Rd, Sudbury MA	REPORT OF BORING No. OL-3 SHEET 1 OF 1 Project No. 2090428 CHKD BY BAM

BORING Co. New Hampshire Boring
FOREMAN Vinnie
WSE GEOLOGIST: SQ

BORING LOCATION See attached plan
GROUND SURFACE ELEV. unknown DATUM
DATE START 9/2/09 DATE END 9/2/09

SAMPLER: SPT (Standard Penetration Test)
CASING: 5' - Steel
CASING SIZE: 4" Method Tricone

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
10/16/09		16.52'		

DEPTH (feet)	WELL	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
5				4-6	7/10/17/22		Dry Yellow brown fine Sand, little medium Silt; Moderately dense.		
10				9-11	13/17/18/20		Damp wet Yellow brown fine Sand, some fine Silt; Moderately dense.		SAND with some to little Silt (occasional medium Sand)
15				14-16	(*)		Brown yellow fine Sand, Some fine Silt.		
18									
20				19-21	(*)		Brown yellow fine to medium Sand.		
23									
25				24-26	(*)		Brown fine Sand.		
30				29-31	(*)		Brown fine Sand, little Silt.		
35				34-36	(*)		Brown fine Sand, little Silt.		End of boring @ 36 Ft

GRANULAR SOILS BLOWS/FT	DENSITY	COHESIVE SOILS BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

REMARKS:
(*) Bag sample from wash water

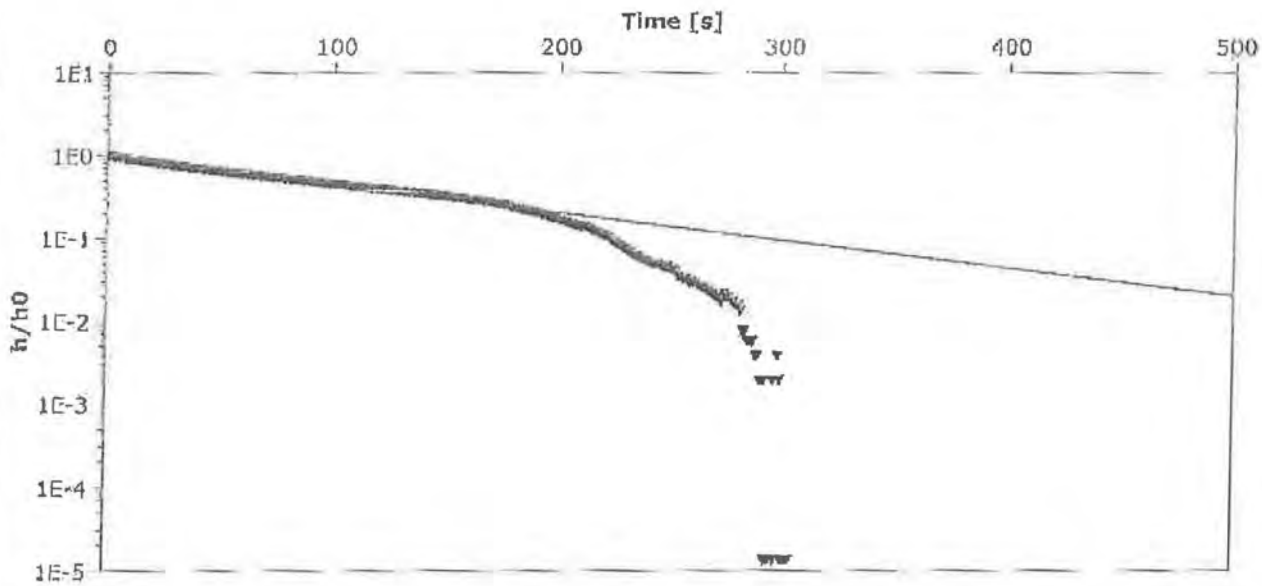
NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. OL-3

APPENDIX B

Weston & Sampson, Inc. 5 Centennial Drive Peabody, MA 01960	Slug Test Analysis Report Project: Sudbury Disposal Site Number: Client: Town of Sudbury

Location: Sudbury, MA	Slug Test: cms1	Test Well: cms1
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	CMS1 Slug Test - Bouwer & Rice	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		

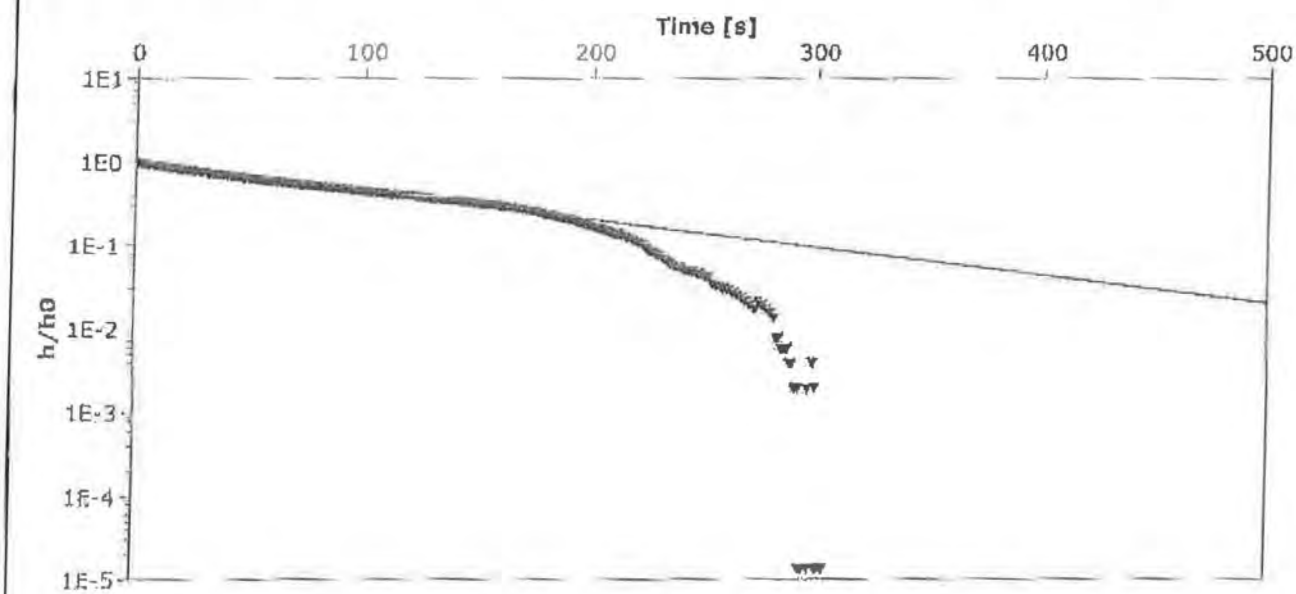


Calculation after Bouwer & Rice

Observation Well	Hydraulic Conductivity [ft/d]
cms1	1.45×10^{0}

Weston & Sampson, Inc. 5 Centennial Drive Peabody, MA 01960	Slug Test Analysis Report Project: Sudbury Disposal Site Number: Client: Town of Sudbury

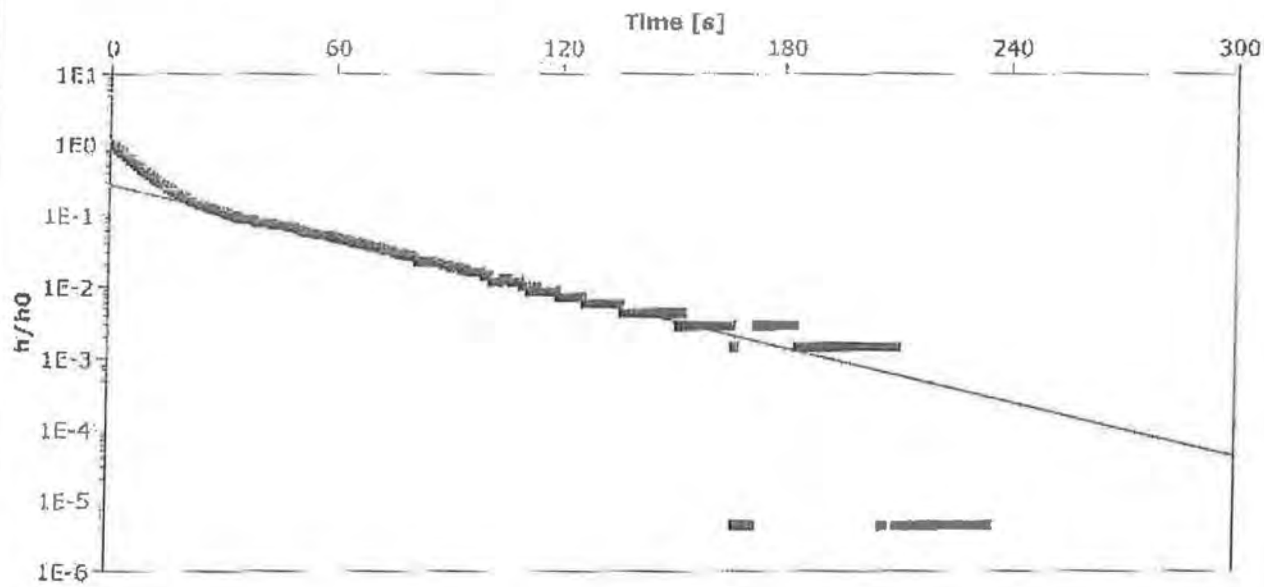
Location: Sudbury, MA	Slug Test: cms1	Test Well: cms1
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	CMS1 Slug Test - Hvorslev	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		



Calculation after Hvorslev

Observation Well	Hydraulic Conductivity [ft/d]
cms1	1.89×10^{0}

Weston & Sampson, Inc. 5 Centennial Drive Peabody, MA 01960		Slug Test Analysis Report Project: Sudbury Disposal Site Number: Client: Town of Sudbury
Location: Sudbury, MA	Slug Test: CMS2	Test Well: cms2
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	CMS2 Slug Test Bouwer & Rice	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		

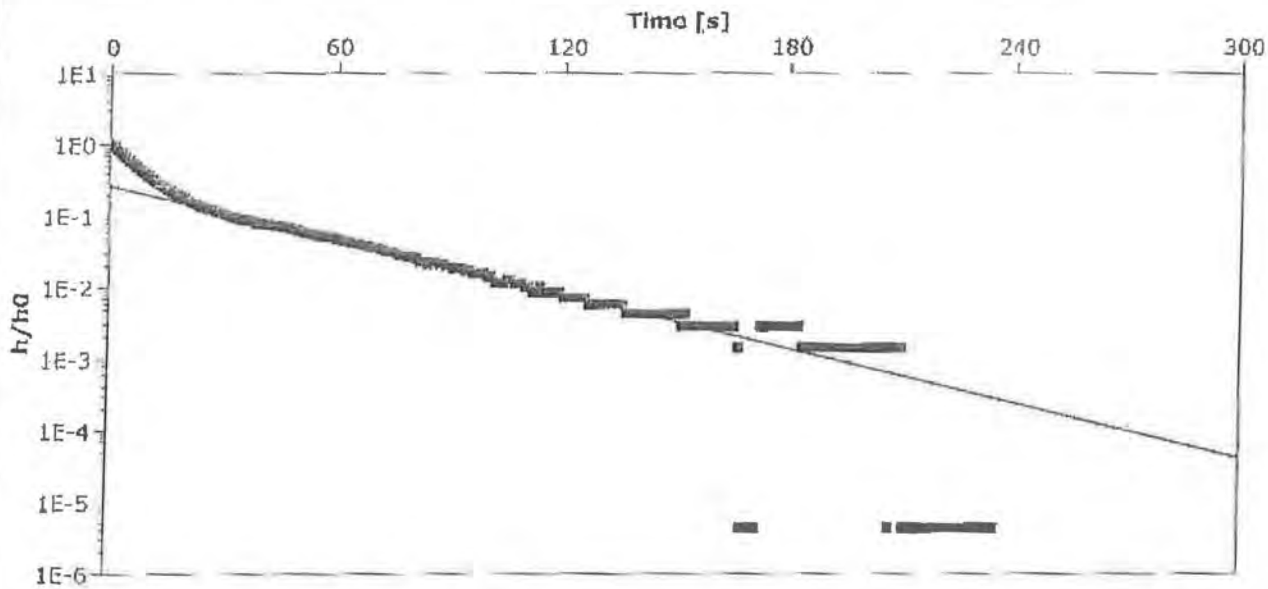


Calculation after Bouwer & Rice

Observation Well	Hydraulic Conductivity [ft/d]	
cms2	5.54×10^{0}	

Weston & Sampson, Inc. **5 Centennial Drive** **Peabody, MA 01960**	Slug Test Analysis Report Project: Sudbury Disposal Site Number: Client: Town of Sudbury

Location: Sudbury, MA	Slug Test: CMS2	Test Well: cms2
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	CMS2 Slug Test - Hvorslev	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		

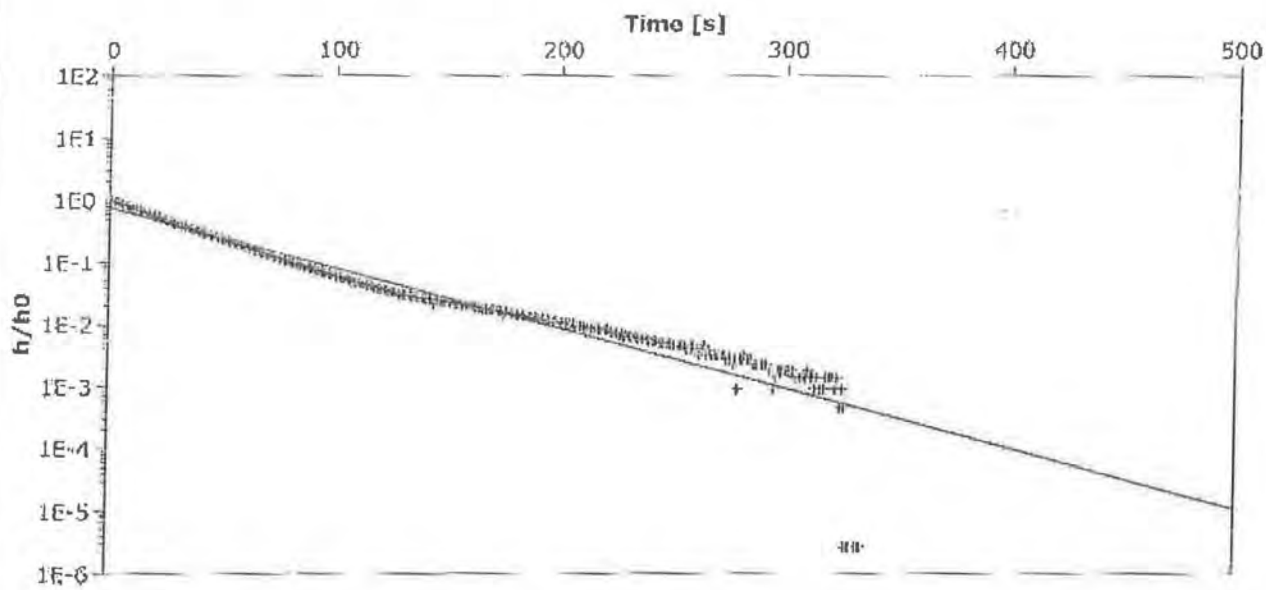


Calculation after Hvorslev

Observation Well	Hydraulic Conductivity [ft/d]
cms2	7.23×10^{0}

Weston & Sampson, Inc. 5 Centennial Drive Peabody, MA 01960	Slug Test Analysis Report Project: Sudbury Disposal Site Number: Client: Town of Sudbury

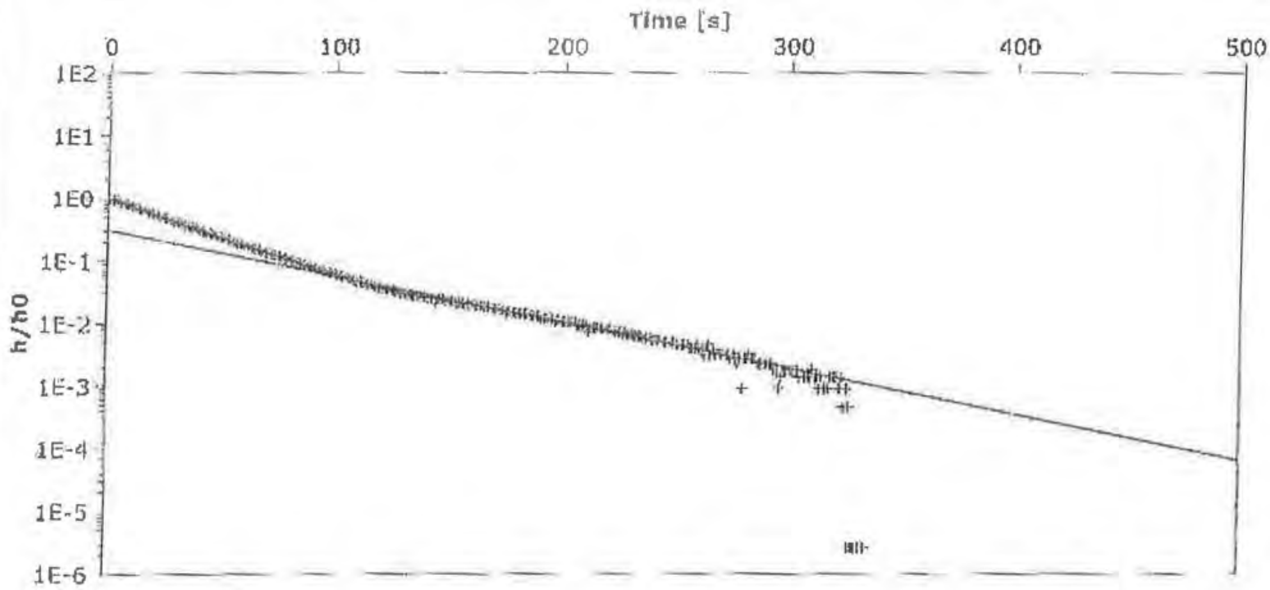
Location: Sudbury, MA	Slug Test: CMS3	Test Well: cms3
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	CMS3 Slug Test - Bouwer & Rice	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		



Calculation after Bouwer & Rice

Observation Well	Hydraulic Conductivity [ft/d]
cms3	4.32×10^{0}

Weston & Sampson, Inc. **5 Centennial Drive** **Peabody, MA 01960**		**Slug Test Analysis Report** Project: Sudbury Disposal Site Number: Client: Town of Sudbury
Location: Sudbury, MA	Slug Test: CMS3	Test Well: cms3
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	CMS3 Slug Test - Hvorslev	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		



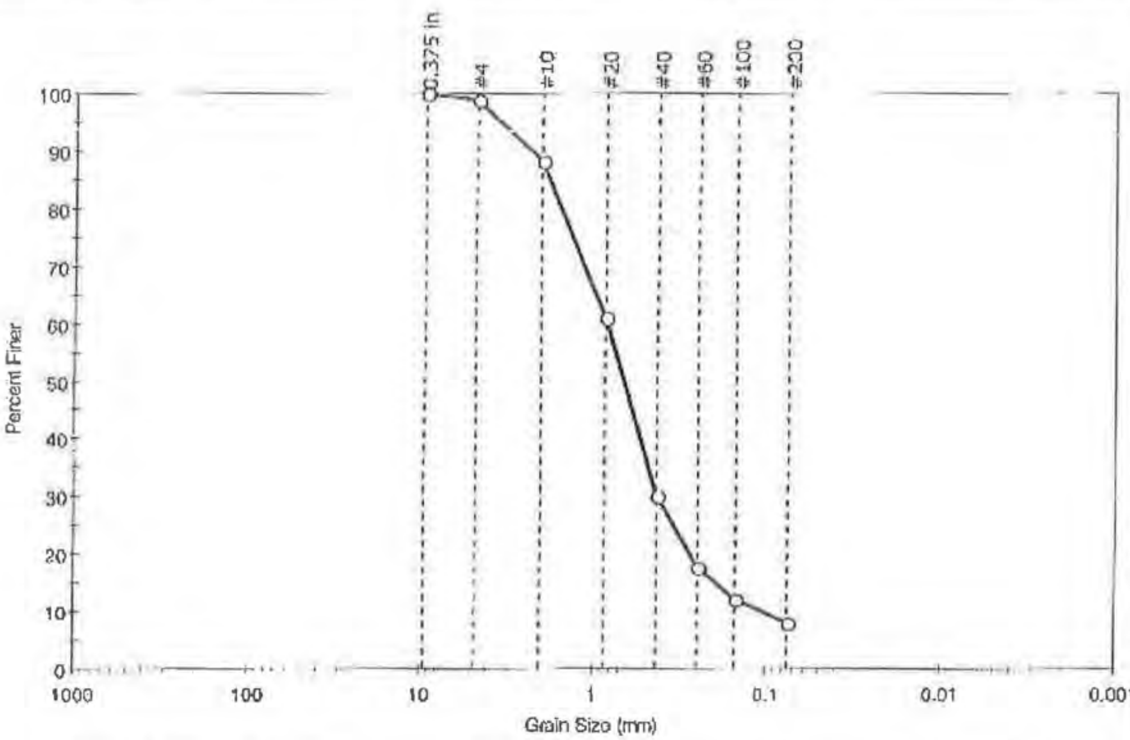
Calculation after Hvorslev

Observation Well	Hydraulic Conductivity [ft/d]
cms3	4.19×10^{0}

GeoTesting express
a subsidiary of Geocomp Corporation

Client:	Weston & Sampson Engineers				
Project:	Sudbury				
Location:	Sudbury, MA			Project No:	GTX-9619
Boring ID:	B-1	Sample Type:	jar	Tested By:	jbr
Sample ID:	S-6 CMS	Test Date:	01/26/10	Checked By:	jdt
Depth :	29.0-31.0 ft	Test Id:	172737		
Test Comment:	---				
Sample Description:	Moist, brownish yellow sand with silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	1.3	90.6	8.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	99		
#10	2.00	88		
#20	0.85	61		
#40	0.42	30		
#60	0.25	18		
#100	0.15	12		
#200	0.075	8		

Coefficients

D_{85} = 1.8122 mm	D_{30} = 0.4235 mm
D_{60} = 0.8325 mm	D_{15} = 0.1967 mm
D_{50} = 0.6650 mm	D_{10} = 0.1050 mm
C_u = 7.929	C_c = 2.052

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : SOFT

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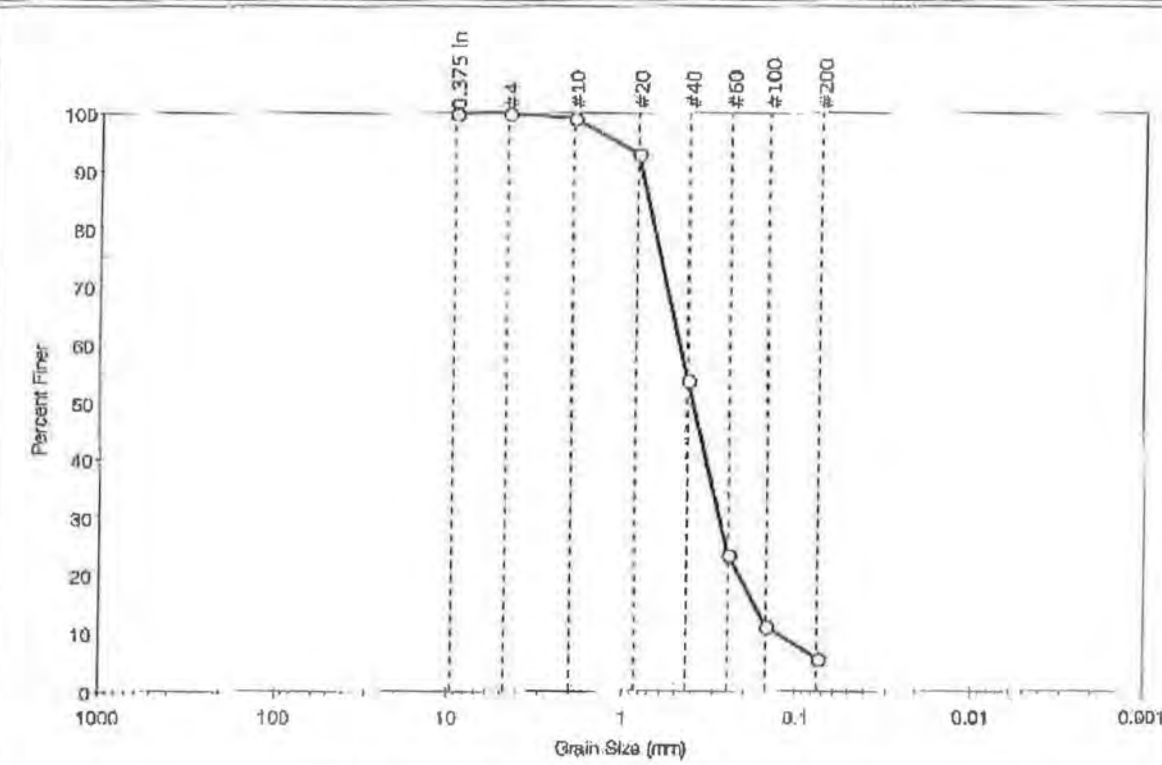
GeoTesting express
a subsidiary of Geocomp Corporation

Client: Weston & Sampson Engineers			
Project: Sudbury			
Location: Sudbury, MA		Project No:	GTX-9619
Boring ID: B-3	Sample Type: jar	Tested By:	jbr
Sample ID: S-2 CMS	Test Date: 01/26/10	Checked By:	jdt
Depth : 19.0-21.0 ft	Test Id: 172738		
Test Comment: ---			
Sample Description: Moist, brownish yellow sand with silt			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)

least permeable



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	—	94.4	5.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	100		
#10	2.00	99		
#20	0.85	93		
#40	0.42	54		
#60	0.25	24		
#100	0.15	11		
#200	0.075	6		

Coefficients

D_{85} = 0.7382 mm	D_{30} = 0.2795 mm
D_{60} = 0.4749 mm	D_{15} = 0.1754 mm
D_{50} = 0.3981 mm	D_{10} = 0.1299 mm
C_u = 3.656	C_c = 1.266

Classification

ASTM N/A

AASHTO Fine Sand (A-3 (0))

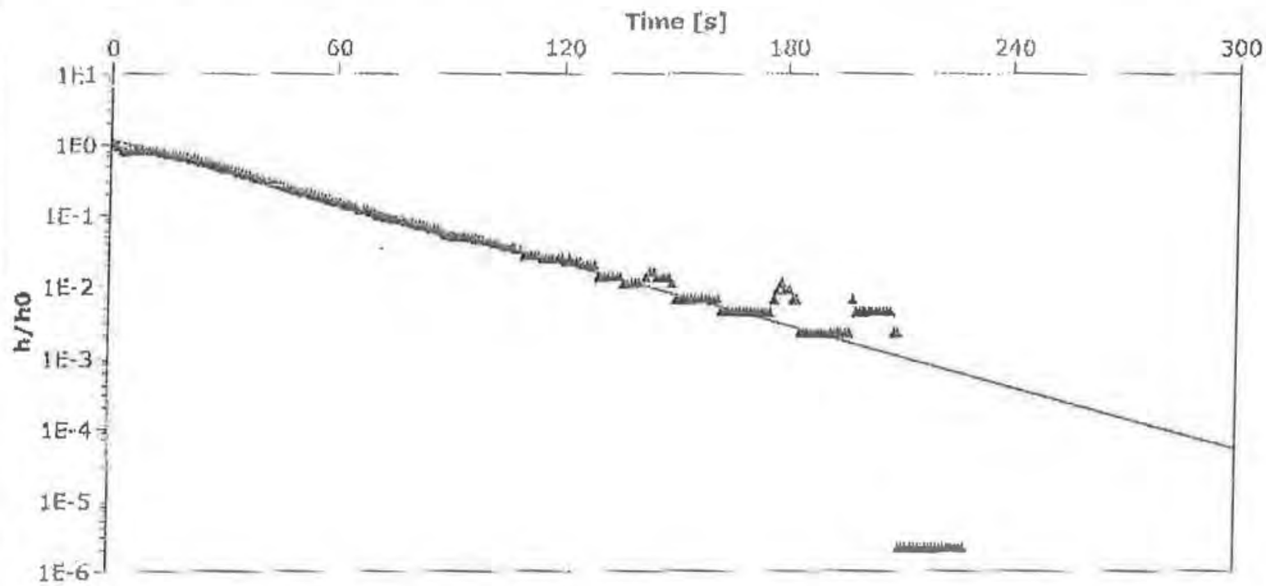
Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Weston & Sampson, Inc. 5 Centennial Drive Peabody, MA 01960	Slug Test Analysis Report Project: Sudbury Disposal Site Number: Client: Town of Sudbury

Location: Sudbury, MA	Slug Test: Slug Test HF1	Test Well: HF1
Test Conducted by:		Test Date: 10/20/2000
Analysis Performed by: Mel Higgins	HF1 Slug Test - Hvorslev	Analysis Date: 10/20/2000
Aquifer Thickness: 40.00 ft		

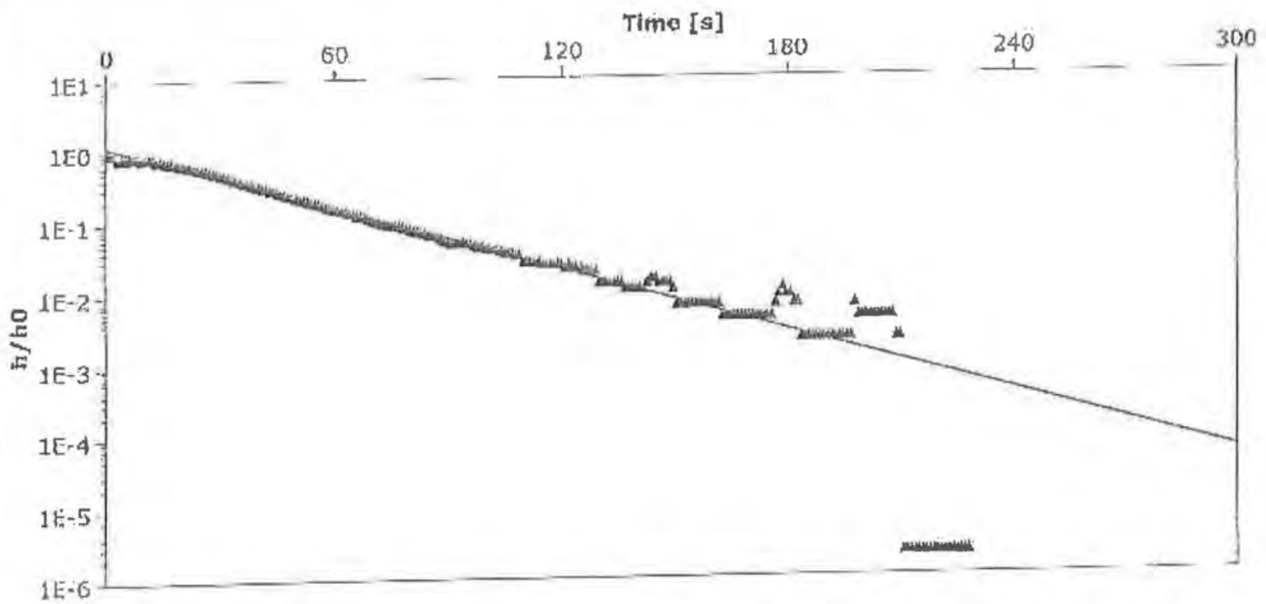


Calculation after Hvorslev

Observation Well	Hydraulic Conductivity [ft/d]
HF1	8.27×10^{0}

Weston & Sampson, Inc. 5 Centennial Drive Peabody, MA 01960	Slug Test Analysis Report Project: Sudbury Disposal Site Number: Client: Town of Sudbury

Location: Sudbury, MA	Slug Test: Slug Test HF1	Test Well: HF1
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	HF1 Slug Test - Bouwer & Rice	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		



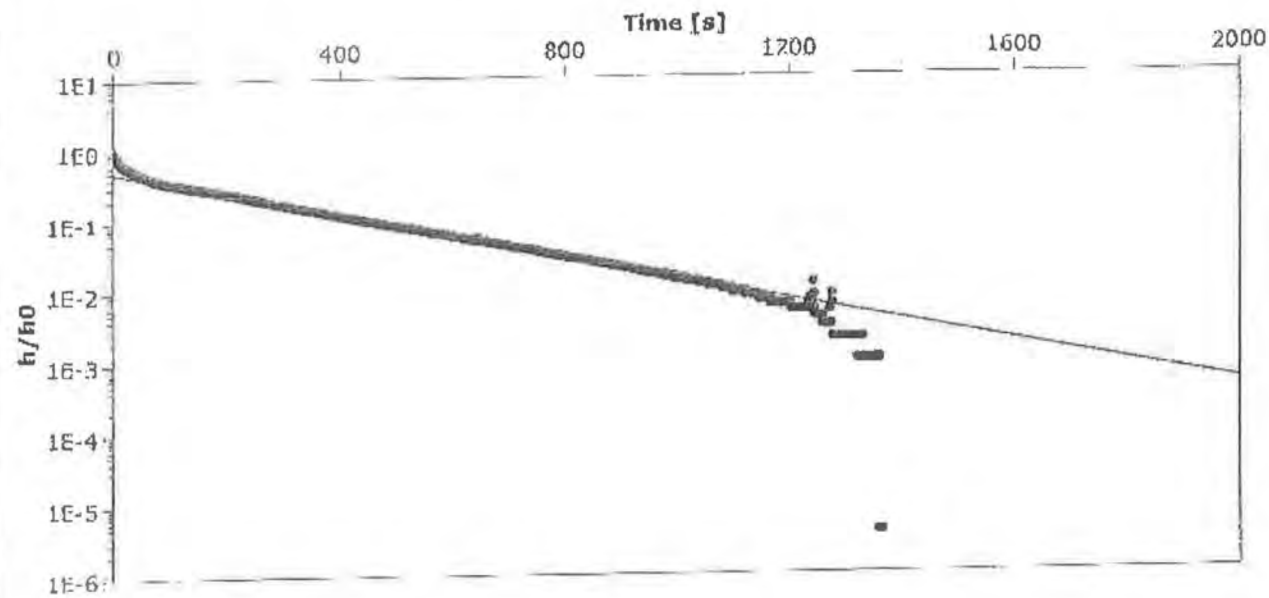
Calculation after Bouwer & Rice

Observation Well	Hydraulic Conductivity [ft/d]
HF1	8.34×10^{0}

Weston & Sampson, Inc.
5 Centennial Drive
Peabody, MA 01960

Slug Test Analysis Report	
Project:	Sudbury Disposal Site
Number:	
Client:	Town of Sudbury

Location: Sudbury, MA	Slug Test: Slug Test HF3	Test Well: HF3
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	HF3 Slug Test - Hvorslev	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		

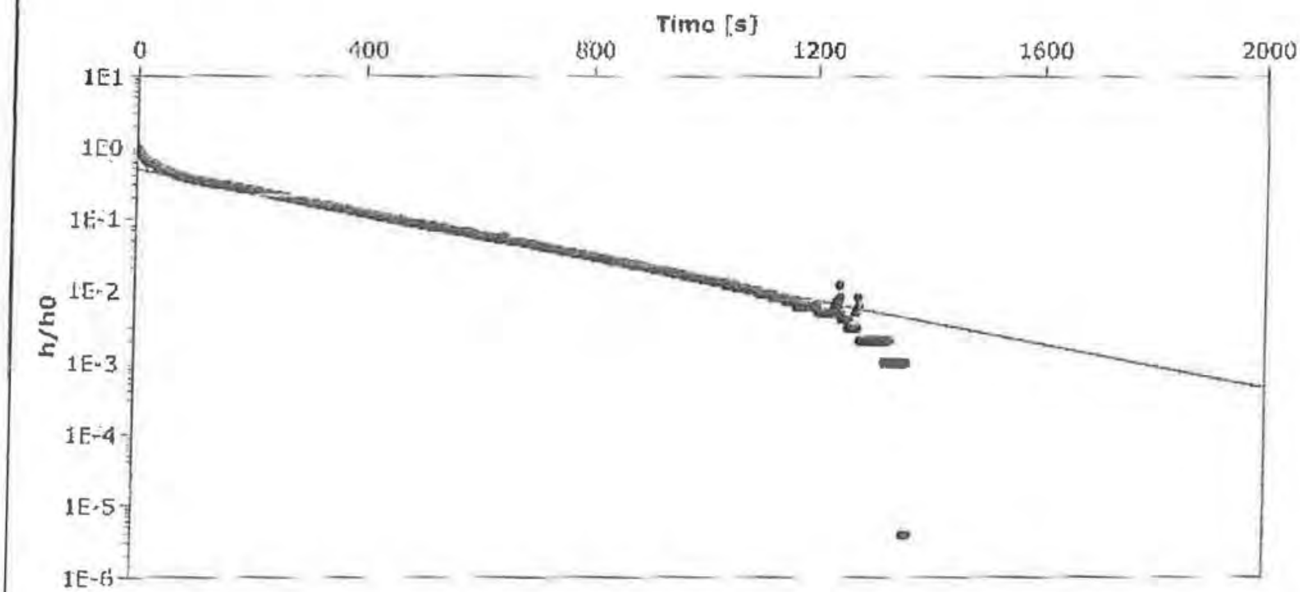


Calculation after Hvorslev

Observation Well	Hydraulic Conductivity [ft/d]
HF3	8.85×10^{-1}

Weston & Sampson, Inc. 5 Centennial Drive Peabody, MA 01960	Slug Test Analysis Report Project: Sudbury Disposal Site Number Client: Town of Sudbury

Location: Sudbury, MA	Slug Test: Slug Test HF3	Test Well: HF3
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	HF3 Slug Test - Bouwer & Rice	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		



Calculation after Bouwer & Rice

Observation Well	Hydraulic Conductivity [ft/d]
HF3	6.63×10^{1}

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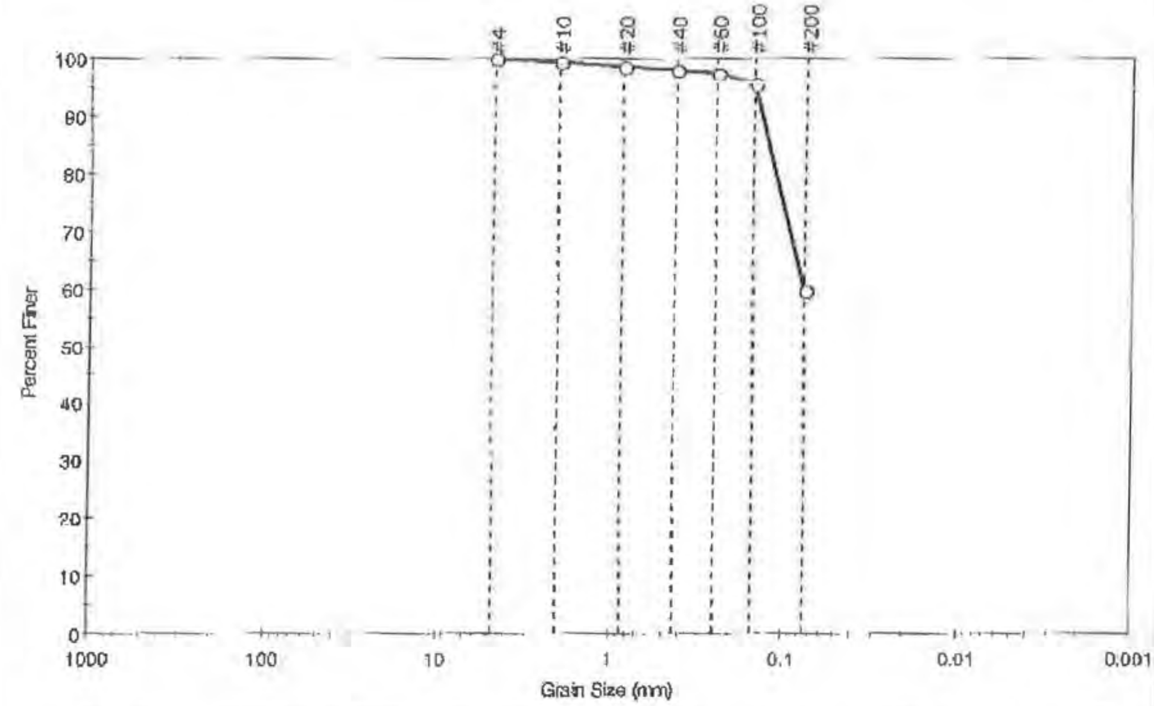
Client: Weston & Sampson Engineers					
Project: Sudbury					
Location: Sudbury, MA				Project No:	GTX-9619
Boring ID: B-1		Sample Type: jar		Tested By:	jbr
Sample ID: S-2 HF		Test Date:	01/26/10	Checked By:	jdt
Depth : 9.0-11.0 ft		Test Id:	172734		
Test Comment: ---					
Sample Description: Moist, light olive brown sandy silt					
Sample Comment: ---					

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	40.6	59.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	99		
#20	0.85	98		
#40	0.42	98		
#60	0.25	97		
#100	0.15	96		
#200	0.075	59		

Coefficients

D_{85} = 0.1224 mm	D_{30} = N/A
D_{60} = 0.0758 mm	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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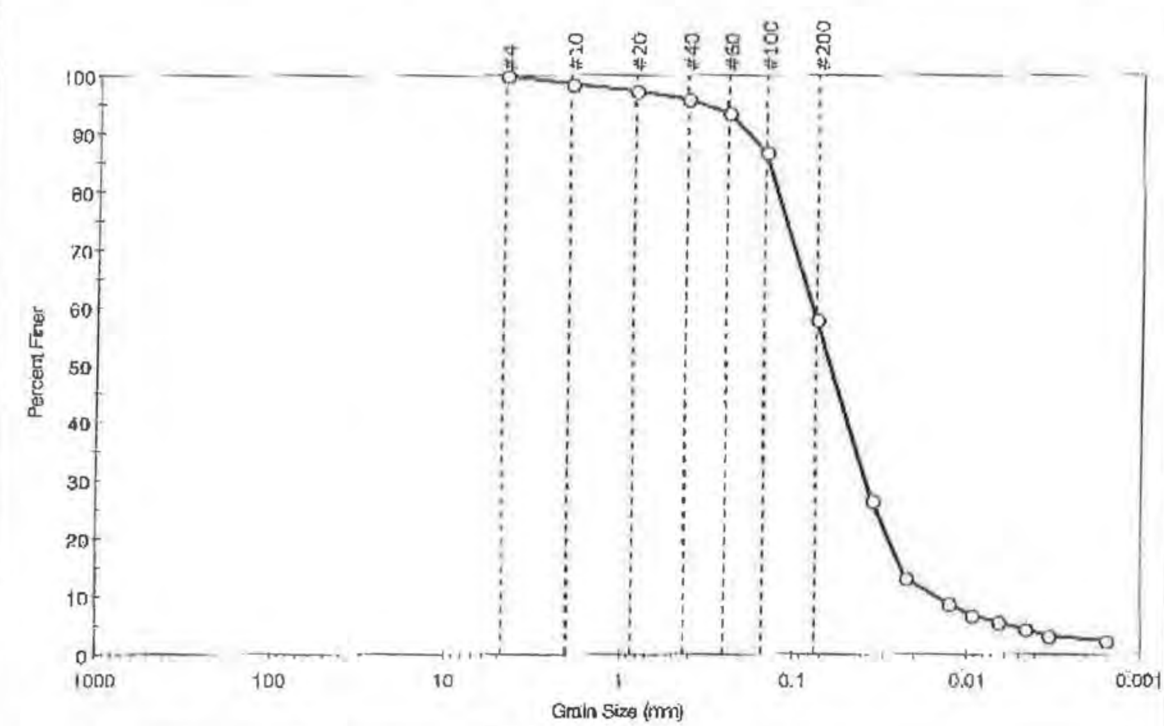
GeoTesting
express
a subsidiary of Geocomp Corporation

Client: Weston & Sampson Engineers			
Project: Sudbury			
Location: Sudbury, MA		Project No:	GTX-9619
Boring ID: B-3	Sample Type: jar	Tested By:	jbr
Sample ID: S-4 HF	Test Date: 01/26/10	Checked By:	jdt
Depth : 19.0-21.0 ft	Test Id: 172739		
Test Comment: ---			
Sample Description: Moist, light olive brown sandy silt			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	42.1	57.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	98		
#20	0.85	97		
#40	0.42	96		
#60	0.25	93		
#100	0.15	87		
#200	0.075	58		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0360	27		
---	0.0229	13		
---	0.0129	9		
---	0.0095	7		
---	0.0065	6		
---	0.0046	4		
---	0.0034	3		
---	0.0016	2		

Coefficients

D_{85} = 0.1440 mm	D_{30} = 0.0390 mm
D_{60} = 0.0789 mm	D_{15} = 0.0243 mm
D_{50} = 0.0623 mm	D_{10} = 0.0150 mm
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

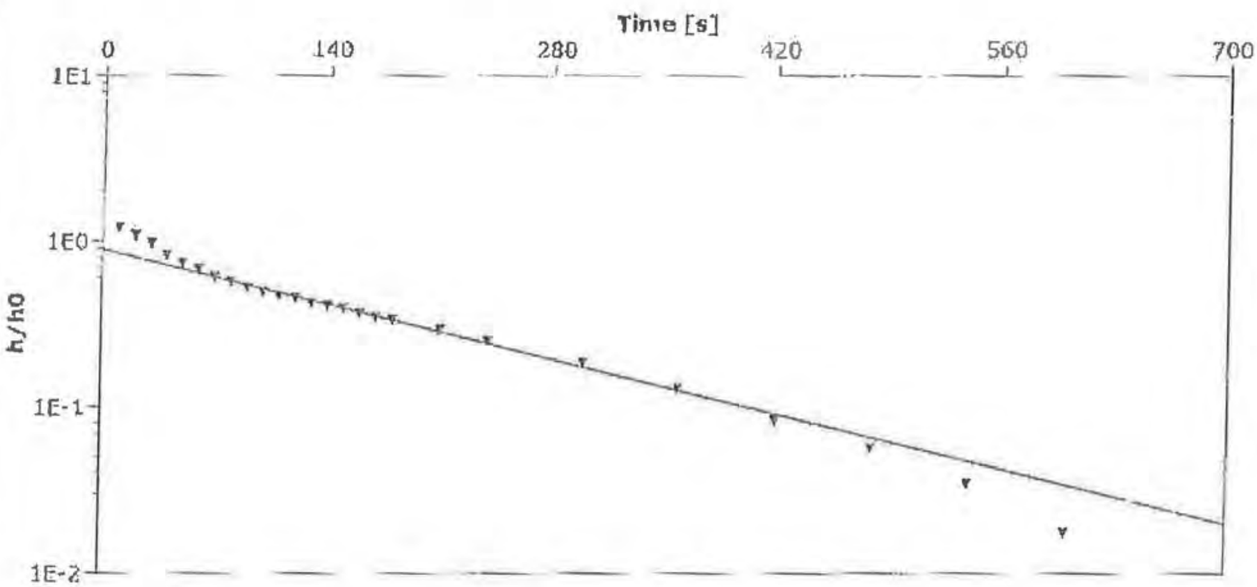
Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Weston & Sampson, Inc. 5 Centennial Drive Peabody, MA 01960	Slug Test Analysis Report Project: Sudbury Disposal Site Number: Client: Town of Sudbury

Location: Sudbury, MA	Slug Test: OL1	Test Well: ol1
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	OL1 Slug Test - Bouwer & Rice	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		



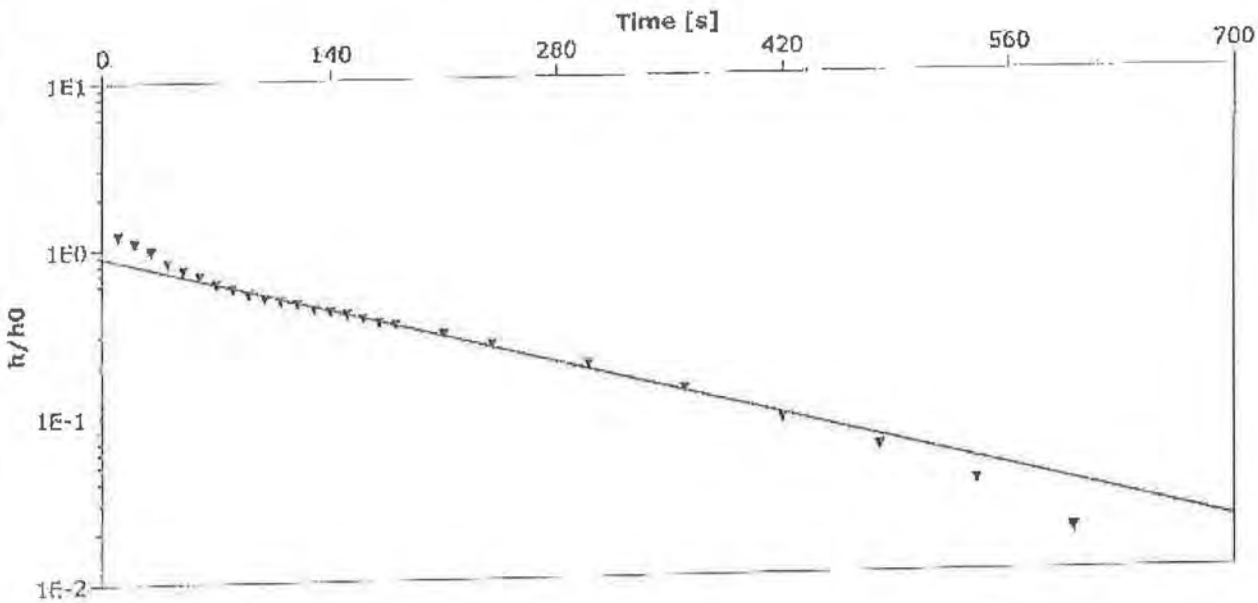
Calculation after Bouwer & Rice

Observation Well	Hydraulic Conductivity [ft/d]
ol1	1.03×10^{0}

Weston & Sampson, Inc.
5 Centennial Drive
Peabody, MA 01960

Slug Test Analysis Report	
Project:	Sudbury Disposal Site
Number:	
Client:	Town of Sudbury

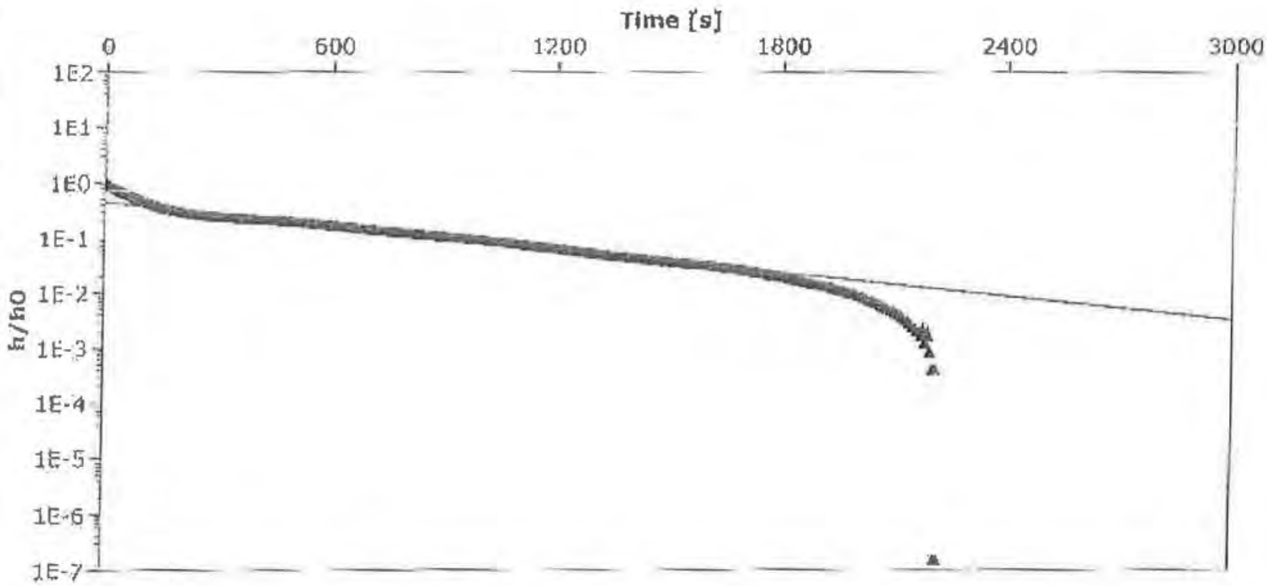
Location: Sudbury, MA	Slug Test: OL1	Test Well: ol1
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	OL1 Slug Test - Hvorslev	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		



Calculation after Hvorslev

Observation Well	Hydraulic Conductivity [ft/d]
ol1	1.34×10^{0}

Weston & Sampson, Inc. **5 Centennial Drive** **Peabody, MA 01960**		Slug Test Analysis Report Project: Sudbury Disposal Site Number: Client: Town of Sudbury
Location: Sudbury, MA	Slug Test: OL2	Test Well: ol2
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	OL2 Slug Test - Bouwer & Rice	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		

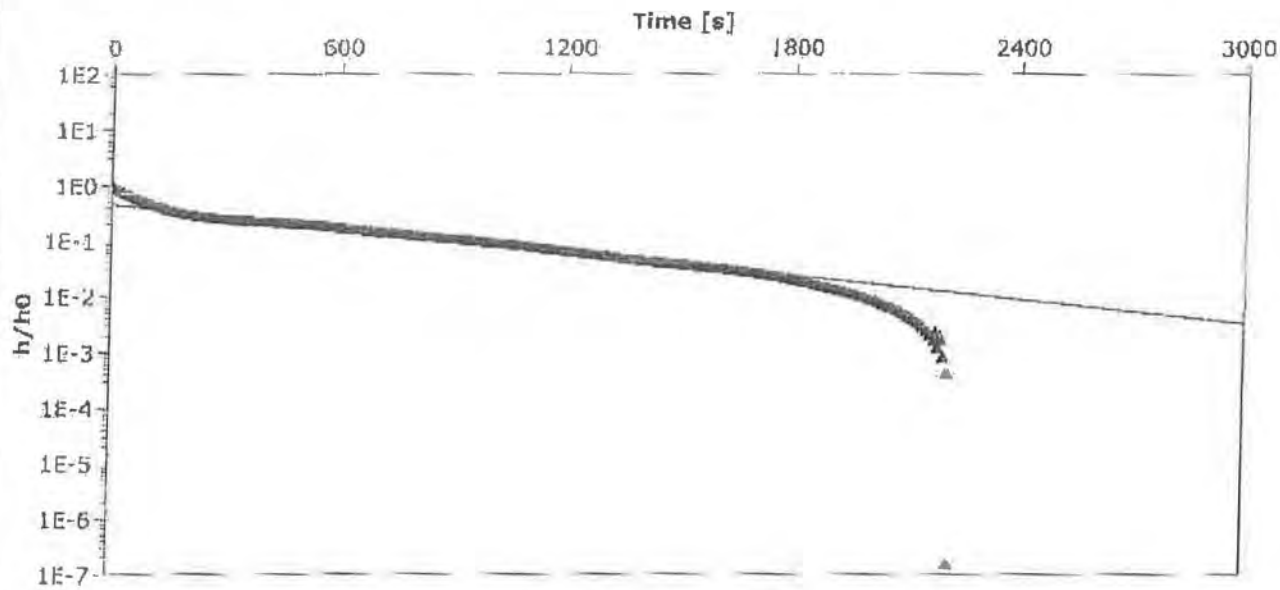


Calculation after Bouwer & Rice

Observation Well	Hydraulic Conductivity [ft/d]	
ol2	3.08×10^{-1}	

Weston & Sampson, Inc. **5 Centennial Drive** **Peabody, MA 01960**		Slug Test Analysis Report Project: Sudbury Disposal Site Number: Client: Town of Sudbury

Location: Sudbury, MA	Slug Test: OL2	Test Well: ol2
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	OL2 Slug Test - Hvorslev	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		

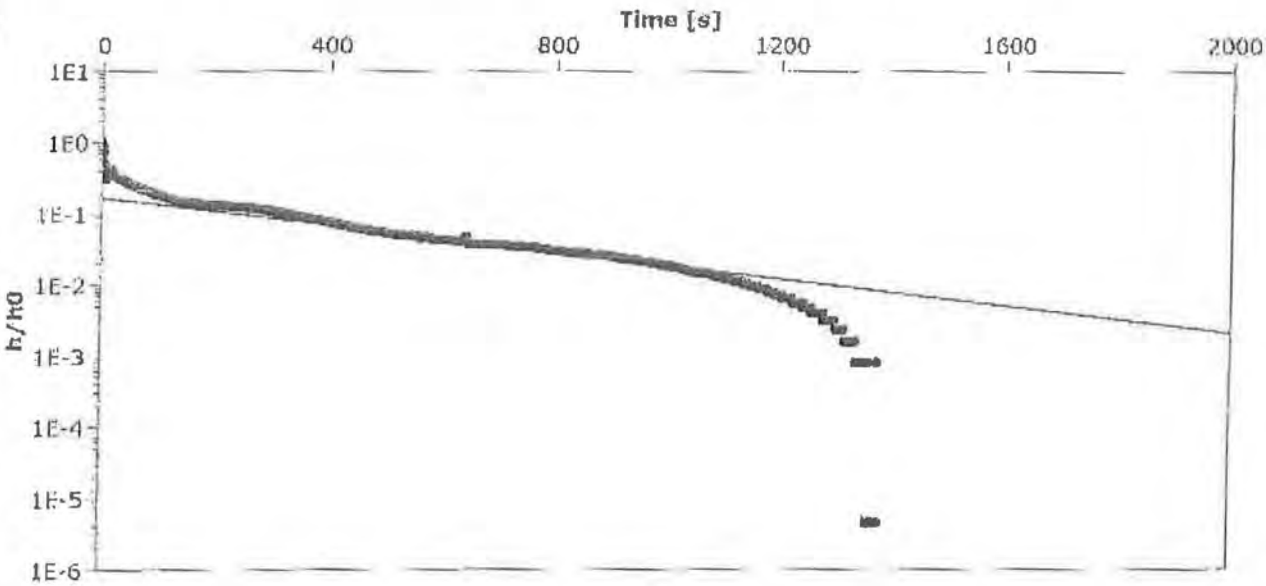


Calculation after Hvorslev

Observation Well	Hydraulic Conductivity [ft/d]	
ol2	4.02×10^{-1}	

Weston & Sampson, Inc. 5 Centennial Drive Peabody, MA 01960	Slug Test Analysis Report Project: Sudbury Disposal Site Number: Client: Town of Sudbury

Location: Sudbury, MA	Slug Test: OL3	Test Well: ol3
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	OL3 Slug Test - Bouwer & Rice	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		

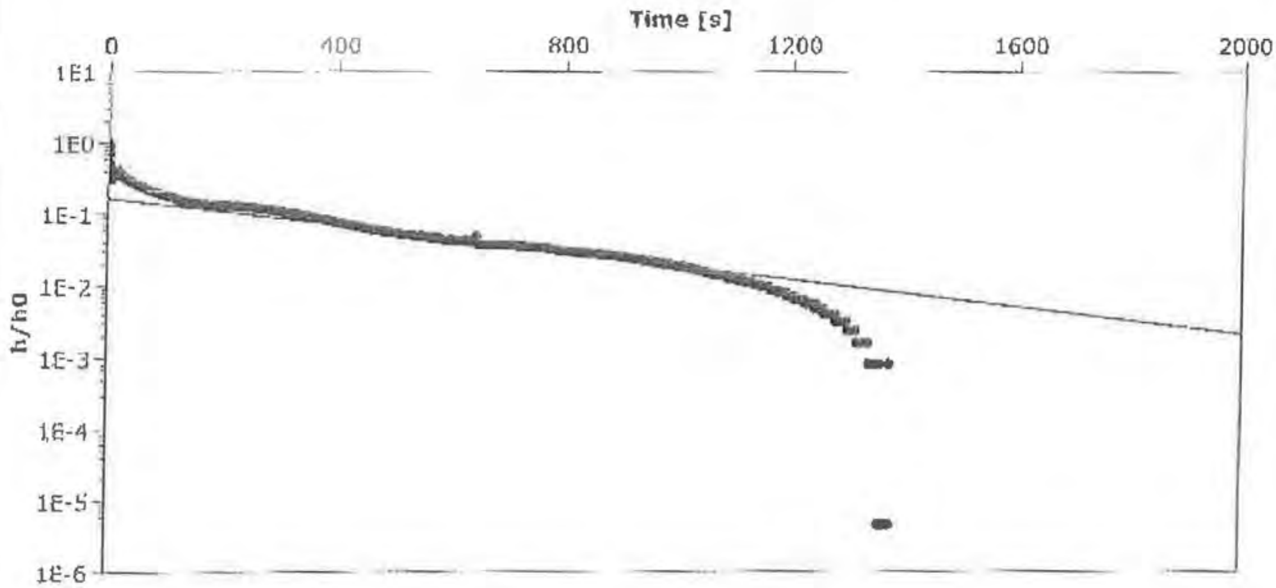


Calculation after Bouwer & Rice

Observation Well	Hydraulic Conductivity [ft/d]
ol3	4.13×10^{-1}

Weston & Sampson, Inc. **5 Centennial Drive** **Peabody, MA 01960**	Slug Test Analysis Report Project: Sudbury Disposal Site Number: Client: Town of Sudbury

Location: Sudbury, MA	Slug Test: OL3	Test Well: ol3
Test Conducted by: Mel Higgins		Test Date: 10/20/2000
Analysis Performed by: Mel Higgins	OL3 Slug Test - Hvorslev	Analysis Date: 10/20/2000
Aquifer Thickness: 40.00 ft		



Calculation after Hvorslev

Observation Well	Hydraulic Conductivity [ft/d]
ol3	5.38×10^{-1}

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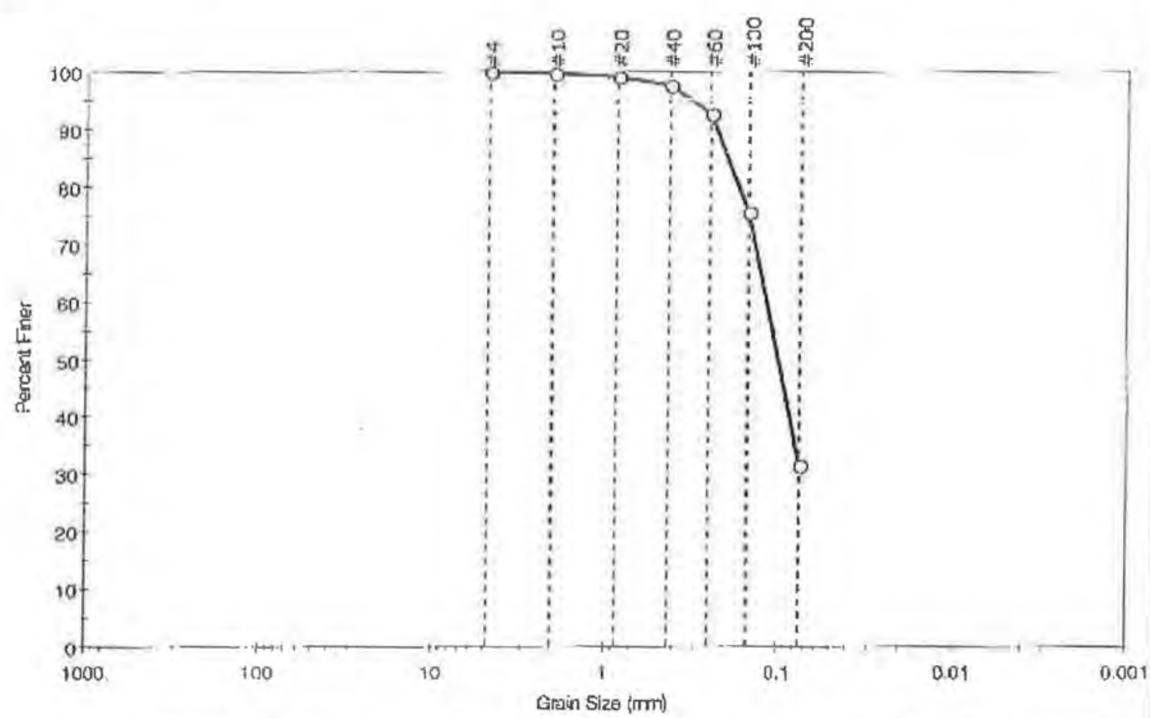
Client: Weston & Sampson Engineers					
Project: Sudbury					
Location: Sudbury, MA				Project No:	GTX-9619
Boring ID: OL-2	Sample Type: jar			Tested By:	jbr
Sample ID:---	Test Date:	01/26/10		Checked By:	jdt
Depth : 14.0-16.0 ft	Test Id:	172735			

Test Comment: ---

Sample Description: Moist, light yellowish brown silty sand

Sample Comment: ---

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	68.5	31.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	99		
#40	0.42	98		
#60	0.25	93		
#100	0.15	75		
#200	0.075	32		

Coefficients

D_{85} = 0.1997 mm	D_{30} = N/A
D_{60} = 0.1176 mm	D_{15} = N/A
D_{50} = 0.1005 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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GeoTesting express

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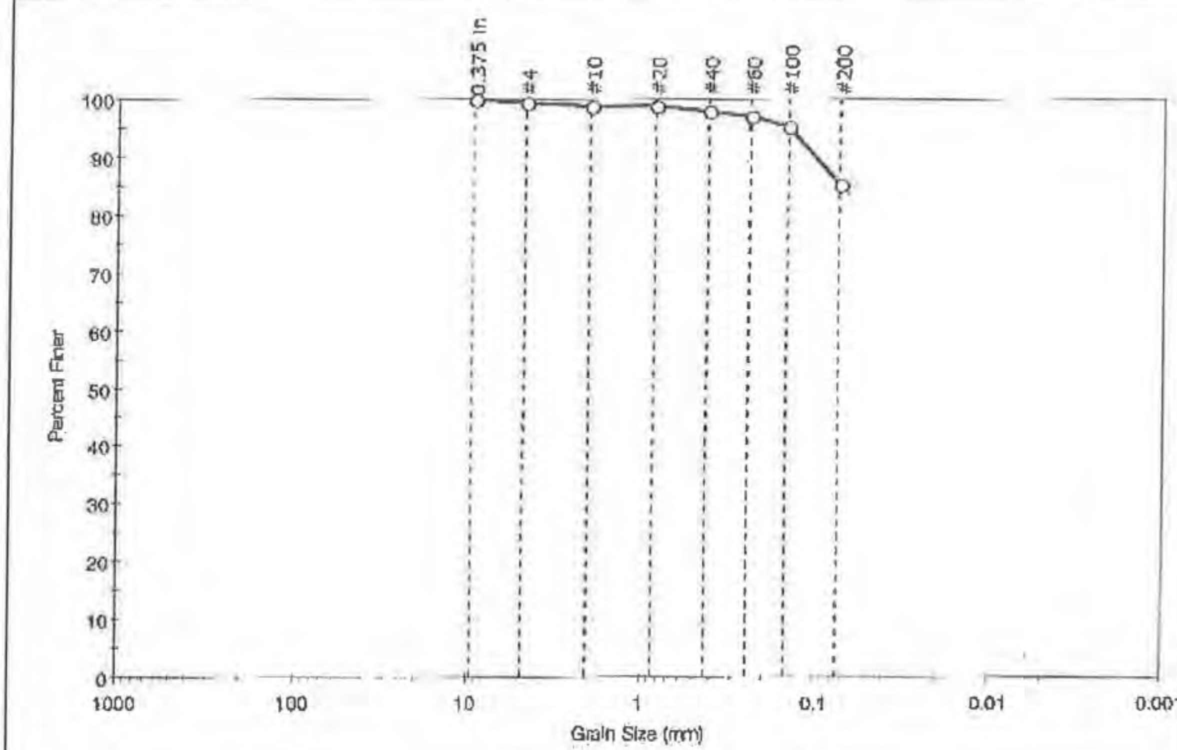
Client: Weston & Sampson Engineers					
Project: Sudbury					
Location: Sudbury, MA				Project No:	GTX-9619
Boring ID: OL-3		Sample Type: jar		Tested By:	jbr
Sample ID: S-2		Test Date:	01/26/10	Checked By:	jdt
Depth : 9.0-11.0 ft		Test Id:	172736		
Test Comment: ---					
Sample Description: Moist, light yellowish brown silty clay					
Sample Comment: ---					

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.6	14.2	85.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	99		
#10	2.00	99		
#20	0.85	99		
#40	0.42	98		
#60	0.25	97		
#100	0.15	95		
#200	0.075	85		

Coefficients

D_{85} = N/A	D_{30} = N/A
D_{60} = N/A	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Conclusion
85% fines

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APPENDIX C

Curtis Middle School

Water Table Mounding calculated based on Hantush 1967 WRR

Enter data in green cells as per their yellow labels, other values will be computed from those entries.

Results are highlighted in pink.

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Zmax Beneath Center of Entire Drain Field (L*W)

Meters and Days	Length of Drain Field Subunit	Width of Drain Field Subunit		Separation between Drain Field Subunits	Fraction of Drain Field Subunit that is Trench Area	Horizontal Hydraulic Conductivity	Specific Yield use 0.001 to approximate steady state at 10 years	time use 10 years to approximate steady state		
	l_s	w_s		Sp	f	Kh	Sy	time		
	ft	ft		ft		ft/days	none	days		
	320	100		6	0.33	4.09	0.15	365		
	L	W	q effective in subunit is x ws	q in trenches	q' effective on LxW	Q	Zmax 12 iterations	Initial Saturated Thickness	alpha	beta
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft		
1	320	100	0.2089	0.6330	0.2089	50000	16.859	20	0.179313312	0.05603541

copy an entire row from above and insert copied cells above this line
to evaluate various loading rates and numbers of subunits

Water Table Rise on Side Slope

Uses Subunit Geometry and Material Properties from Zmax Table

	L	W	q effective in subunit is x ws	q in trenches	q' effective on LxW	Q l/day	Zax 12 iterations	Distance from Center of Drain Field in Long Dimension (x in figure)	Distance from Center of Drain Field in Wide Dimension (y in figure)	Initial Saturated Thickness
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft	ft	ft
1	320	100	0.2089	0.6330	0.2089	50000	2.619	500	500	7

Curtis Middle School

Water Table Mounding calculated based on Hantush 1967, WRR

Enter data in green cells as per their yellow labels, other values will be computed from those entries.

Results are highlighted in pink.

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Zmax Beneath Center of Entire Drain Field (L*W)

Meters and Days	Length of Drain Field Subunit	Width of Drain Field Subunit		Separation between Drain Field Subunits	Fraction of Drain Field Subunit that is Trench Area	Horizontal Hydraulic Conductivity	Specific Yield use 0.001 to approximate steady state at 10 years	time use 10 years to approximate steady state		
	l_s	w_s		Sp	f	Kh	Sy	time		
	ft	ft		ft		ft/days	none	days		
	320	100		9	0.33	4.09	0.15	365		
	L	W	q effective in subunit is x ws	0	q' effective on LxW	Q	Zmax 12 iterations	Initial Saturated Thickness	alpha	beta
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft		
2	320	209	0.2069	0.6057	0.1999	100000	25.623	20	0.179313312	0.117114007

copy an entire row from above and insert copied cells above this line
to evaluate various loading rates and numbers of subunits

Water Table Rise on Side Slope

Uses Subunit Geometry and Material Properties from Zmax Table

	L	W	q effective in subunit is x ws	q in trenches	q' effective on LxW	Q l/day	Zxx 12 iterations	Distance from Center of Drain Field in Long Dimension (x in figure)	Distance from Center of Drain Field in Wide Dimension (y in figure)	Initial Saturated Thickness
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft	ft	ft
2	320	209	0.2089	0.6057	0.1999	100000	14.746	500	500	7

Curtis Middle School

Water Table Mounding calculated based on Hantush 1967, WRR

Enter data in green cells as per their yellow labels, other values will be computed from those entries.

Results are highlighted in pink.

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Zmax Beneath Center of Entire Drain Field (L*W)

Meters and Days	Length of Drain Field Subunit	Width of Drain Field Subunit		Separation between Drain Field Subunits	Fraction of Drain Field Subunit that is Trench Area	Horizontal Hydraulic Conductivity	Specific Yield use 0.001 to approximate steady state at 10 years	time use 10 years to approximate steady state		
	l_s	w_s		Sp	r	Kh	Sy	time		
	ft	ft		ft		ft/days	none	days		
	320	100		9	0.33	4.00	0.15	365		
	L	W	q effective in subunit ls x ws	q in trenches	q' effective on LxW	Q	Zmax 12 iterations	Initial Saturated Thickness	alpha	beta
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft		
4	427	320	0.2089	0.5930	0.1957	200000	10.590	20	0.239271201	0.175313312

copy an entire row from above and insert copied cells above this line
to evaluate various loading rates and numbers of subunits

Water Table Rise on Side Slope

Uses Subunit Geometry and Material Properties from Zmax Table

	L	W	q effective in subunit ls x ws	q in trenches	q' effective on LxW	Q l/day	Zax 12 iterations	Distance from Center of Drain Field in Long Dimension (x in figure)	Distance from Center of Drain Field in Wide Dimension (y in figure)	Initial Saturated Thickness
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft	ft	ft
4	427	320	0.2039	0.5930	0.1957	200000	25.760	500	1500	7

Haskell Field

Water Table Mounding calculated based on Hantush 1967, WRR

Enter data in green cells as per their yellow labels, other values will be computed from those entries.

Results are highlighted in pink.

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Zmax Beneath Center of Entire Drain Field (L*W)

Meters and Days	Length of Drain Field Subunit	Width of Drain Field Subunit		Separation between Drain Field Subunits	Fraction of Drain Field Subunit that is Trench Area	Horizontal Hydraulic Conductivity	Specific Yield use 0.001 to approximate steady state at 10 years	time use 10 years to approximate steady state		
	l_s	w_s		S_p	f	Kh	Sy	time		
	ft	ft		ft		ft/days	none	days		
	320	100		6	0.33	0.6	0.15	365		
	L	W	q effective in subunit is x ws	q in trenches	q' effective on LxW	Q	Zmax 12 iterations	Initial Saturated Thickness	alpha	beta
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft		
1	320	100	0.2089	0.6330	0.2089	50000	45.412	20	0.408164589	0.146301434

copy an entire row from above and insert copied cells above this line
to evaluate various loading rates and numbers of subunits

Water Table Rise on Side Slope

Uses Subunit Geometry and Material Properties from Zmax Table

	L	W	q effective in subunit is x ws	q in trenches	q' effective on LxW	Q l/day	Zax 12 iterations	Distance from Center of Drain Field in Long Dimension (x in figure)	Distance from Center of Drain Field in Wide Dimension (y in figure)	Initial Saturated Thickness
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft	ft	ft
1	320	100	0.2089	0.0330	0.2089	50000	27.012	500	500	7

Haskell Field

Water Table Mounding calculated based on Hantush 1967, WRR

Enter data in green cells as per their yellow labels, other values will be computed from those entries.

Results are highlighted in pink.

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Zmax Beneath Center of Entire Drain Field (L*W)											
Meters and Days	Length of Drain Field Subunit	Width of Drain Field Subunit		Separation between Drain Field Subunits	Fraction of Drain Field Subunit that is Trench Area	Horizontal Hydraulic Conductivity	Specific Yield use 0.001 to approximate steady state at 10 years	time use 10 years to approximate steady state		
	l_s	w_s		Sp	f	Kh	Sy	time		
	ft	ft		ft		ft/days	none	days		
	320	100		6	0.33	0.6	0.15	365		
	L	W	q effective in subunit ls x ws	q in trenches	q' effective on LxW	Q	Zmax 12 iterations	Initial Saturated Thickness	alpha	beta
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft		
2	320	206	0.2089	0.6146	0.2028	100000	65.347	20	0.468104569	0.301380954

copy an entire row from above and insert copied cells above this line
to evaluate various loading rates and numbers of subunits

Water Table Rise on Side Slope Uses Subunit Geometry and Material Properties from Zmax Table										
	L	W	q effective in subunit ls x ws	q in trenches	q' effective on LxW	Q l/day	Zxx 12 iterations	Distance from Center of Drain Field in Long Dimension (x in figure)	Distance from Center of Drain Field in Wide Dimension (y in figure)	Initial Saturated Thickness
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft	ft	ft
2	320	206	0.2089	0.6146	0.2028	100000	11.09[illegible]	500	500	7

Haskell Field

Water Table Mounding calculated based on Hantush 1967, WRR

Enter data in green cells as per their yellow labels, other values will be computed from those entries.

Results are highlighted in pink.

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Zmax Beneath Center of Entire Drain Field (L*W)											
Meters and Days	Length of Drain Field Subunit	Width of Drain Field Subunit		Separation between Drain Field Subunits	Fraction of Drain Field Subunit that is Trench Area	Horizontal Hydraulic Conductivity	Specific Yield use 0.001 to approximate steady state at 10 years	time use 10 years to approximate steady state		
	l_s	w_s		δp	f	Kh	Sy	time		
	ft	ft		ft		ft/days	none	days		
	320	100		6	0.33	0.8	0.15	365		
	L	W	q effective in subunit ls x ws	q in trenches	q' effective on LxW	Q	Zmax 12 iterations	Initial Saturated Thickness	alpha	beta
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft		
4	418	320	0.2089	0.6057	0.1999	200000	89.012	20	0.611539994	0.468104589

copy an entire row from above and insert copied cells above this line
to evaluate various loading rates and numbers of subunits

Water Table Rise on Side Slope										
Uses Subunit Geometry and Material Properties from Zmax Table										
	L	W	q effective in subunit ls x ws	q in trenches	q' effective on LxW	Q l/day	Zsx 12 iterations	Distance from Center of Drain Field in Long Dimension (x in figure)	Distance from Center of Drain Field in Wide Dimension (y in figure)	Initial Saturated Thickness
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft	ft	ft
4	418	320	0.2089	0.6057	0.1999	200000	62.180	500	500	7

Old Lancaster

Water Table Mounding calculated based on Hantush 1967, WRR

Enter data in green cells as per their yellow labels, other values will be computed from those entries.

Results are highlighted in pink.

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Zmax Beneath Center of Entire Drain Field (L*W)											
Meters and Days	Length of Drain Field Subunit	Width of Drain Field Subunit		Separation between Drain Field Subunits	Fraction of Drain Field Subunit that is Trench Area	Horizontal Hydraulic Conductivity	Specific Yield use 0.001 to approximate steady state at 10 years	time use 10 years to approximate steady state			
	l_s	w_s		Sp	f	Kh	Sy	time			
	ft	ft		ft		ft/days	none	days			
	320	100		0	0.33	1.2	0.15	365			
	L	W	q effective in subunit is x ws	q in trenches	q' effective on LxW	Q	Zmax 12 iterations	Initial Saturated Thickness	alpha	beta	
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft			
1	320	100	0.2089	0.6330	0.2089	50000	12.424	20	0.331042355	0.103450736	

copy an entire row from above and insert copied cells above this line
to evaluate various loading rates and numbers of subunits

Water Table Rise on Side Slope Uses Subunit Geometry and Material Properties from Zmax Table										
	L	W	q effective in subunit is x ws	q in trenches	q' effective on LxW	Q l/day	Zxy 12 iterations	Distance from Center of Drain Field in Long Dimension (x in figure)	Distance from Center of Drain Field in Wide Dimension (y in figure)	Initial Saturated Thickness
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft	ft	ft
1	320	100	0.2089	0.6330	0.2089	50000	19.518	500	500	7

Old Lancaster

Water Table Mounding calculated based on Hantush 1967, WRR

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Results are highlighted in pink.

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Zmax Beneath Center of Entire Drain Field (L*W)										
Meters and Days	Length of Drain Field Subunit	Width of Drain Field Subunit		Separation between Drain Field Subunits	Fraction of Drain Field Subunit that is Trench Area	Horizontal Hydraulic Conductivity	Specific Yield use 0.001 to approximate steady state at 10 years	time use 10 years to approximate steady state		
	l_s	w_s		sp	f	Kh	Sy	time		
	ft	ft		ft		ft/days	none	days		
	320	100		6	0.33	1.2	0.15	365		
	L	W	q effective in subunit is x ws	q in trenches	q' effective on LxW	Q	Zmax 12 iterations	Initial Saturated Thickness	alpha	beta
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft		
2	320	206	0.2089	0.6148	0.2026	100000	47.432	20	0.331042355	0.213108516

copy an entire row from above and insert copied cells above this line
to evaluate various loading rates and numbers of subunits

Water Table Rise on Side Slope										
Uses Subunit Geometry and Material Properties from Zmax Table										
	L	W	q effective in subunit is x wa	q in trenches	q' effective on LxW	Q l/day	Zsx 12 iterations	Distance from Center of Drain Field in Long Dimension (x in figure)	Distance from Center of Drain Field in Wide Dimension (y in figure)	Initial Saturated Thickness
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft	ft	ft
2	320	206	0.2089	0.6146	0.2026	100000	29.598	500	500	7

Old Lancaster

Water Table Mounding calculated based on Hantush 1967, WRR

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Zmax Beneath Center of Entire Drain Field (L*W)									
Meters and Days	Length of Drain Field Subunit	Width of Drain Field Subunit		Separation between Drain Field Subunits	Fraction of Drain Field Subunit that is Trench Area	Horizontal Hydraulic Conductivity	Specific Yield use 0.001 to approximate steady state at 10 years	time use 10 years to approximate steady state	
	L_s	w_s		Sp	f	Kh	Sy	time	
	ft	ft		ft		ft/days	none	days	
	320	100		8	0.33	1.2	0.15	365	
	L	W	q effective in subunit ls x ws	q in trenches	q' effective on LxW	Q	Zmax 12 iterations	Initial Saturated Thickness	alpha / beta
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft	
4	418	320	0.2088	0.6057	0.1999	200000	65.745	20	0.432424077 / 0.331042356

copy an entire row from above and insert copied cells above this line
to evaluate various loading rates and numbers of subunits

Water Table Rise on Side Slope — Uses Subunit Geometry and Material Properties from Zmax Table										
	L	W	q effective in subunit ls x ws	q in trenches	q' effective on LxW	Q l/day	Zsx 12 iterations	Distance from Center of Drain Field in Long Dimension (x in figure)	Distance from Center of Drain Field in Wide Dimension (y in figure)	Initial Saturated Thickness
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft	ft	ft
4	418	320	0.2089	0.6057	0.1999	200000	43.529	500	500	7

APPENDIX E

DEP Approved Hydrogeologic Work Plan for
Curtis Middle School Wastewater Disposal

Soil Borings from Load Scale Testing

Sieve Analysis for Wells A, C, D & G

Water Level Data from Load Scale Testing

Mounding Analysis Calculations

Five Centennial Drive
Peabody, MA 01960-7985
tel: 978-532-1900 fax: 978-977-0100
www.westonandsampson.com

Weston&Sampson

August 6, 2010

Mr. Criss Stephens
Mr. Kevin Brander
MassDEP Northeast Region
205B Lowell Street
Wilmington, Massachusetts 01887

RE: Hydrogeologic Work Plan
Curtis Middle School Wastewater Disposal

Gentlemen,

Per our discussion at the July 26th meeting held at your offices in Wilmington, WSE is providing the following hydrogeologic work plan. The plan is intended to gain sufficient subsurface information to characterize the potential impacts and hydraulic response to future discharge of treated effluent. At this time, the Town of Sudbury is seeking to construct a subsurface disposal site to receive treated wastewater from Sudbury's commercial business district. Based on the needs assessment work conducted to date, the anticipated design flow may range from approximately 130,000 to 318,000 gallons per day (GPD).

Subsurface investigations of three discreet parcels in Sudbury were conducted between August and October 2009. Results of these investigations were conveyed to the Town of Sudbury in a letter report dated February 18, 2010 (see Attachment A). This letter report concluded that the Curtis Middle School (Figure 1) exhibits the most favorable conditions for the installation of an SAS system capable of handling greater than 100,000 GPD. In addition, a preliminary screening of environmental conditions indicated that the site is suitable for the development of an appropriately designed SAS with adequate effluent treatment and disinfection (see Attachment B).

As part of the requirements to obtain a groundwater discharge permit, a hydrogeologic investigation must be conducted in accordance with 314 CMR 5.09 that is specific to the site. Before the start of this investigation, a scope of work for the hydrogeologic investigation must be submitted to and approved by Massachusetts DEP. The proposed scope of work for a hydrogeologic investigation at the Curtis Middle School is as follows.

Scope of Work

1.0 Hydrogeologic Assessment

1.1 Site Characterization

Preliminary assessment of the site will include the development of base maps showing all available well information, public water supplies, Zone II recharge areas, surface water protection areas and sensitive habitats. Previous subsurface work has been provided to DEP, however, it is also provided as Attachment A.

As part of the analysis, WSE will also develop maps showing watershed boundaries for Hop Brook, estimated groundwater gradients, and areas of potential water supply development. WSE will review the State data base (from the Massachusetts Well Driller Program) and Board of Health records for private wells within a half mile radius and identify those which are downgradient, upgradient and cross-gradient from the proposed disposal site. Following the load scale test (described below), data will be reviewed to determine potential gradient changes for the respective discharge. Additional subsurface data collected during field activities, described below, will be used to characterize depth-to-bedrock, subsurface stratigraphy, hydraulic mounding response and groundwater elevations.

1.2 Field Evaluations

Additional testing of the site is warranted to determine potential impacts as well as address design criteria for field type location and size. As such, the following field investigation to undertake a loading test is proposed.

1.2.1 Test borings/monitoring wells

Up to nine (9) additional one-inch diameter PVC monitoring wells will be installed. The borings will be advanced to the bedrock surface or refusal and one-inch wells will be completed at each location. Proposed wells are shown on Figure 2. Wells will be constructed as shown in the schematic diagram in Attachment C, but may be finished as flush to grade protective covers. The well locations and anticipated depths are shown in Table 1, below.

Table 1. Observation Network Wells

Well #	**Radial Distance From Recharge Pit**	**Anticipated Screen Interval**
A	20	20-30
B	40	20-30
C	30	20-30
D	75	20-30
E	100	20-30
F	200	15-25
G	500	10-20
H	870	10-20
I	280	10-20
Existing Monitoring Wells		
WSE-1	380	28-33
WSE-2	200	28-33
WSE-3	300	32-37

Following completion, wells will be developed. Static water levels will be taken within 3 days of development. All wells, including the three wells previously installed, will be surveyed for location and elevation.

In addition to the proposed monitoring well network, two staff gauges will be installed in the drainage swale to the east and northeast of the discharge site. Additionally, a staff gauge will be installed and instrumented in the excavation area to measure standing water heights should they occur. Staff gauges will also be surveyed.

1.2.2 Test Pits

Due to potential disruption of playing fields, witnessed test pits will not be developed until November or December. At that time, preliminary field designs will be completed based on the results of the mounding analysis. DEP will be contacted two weeks prior to the test pits to ensure observation and approval of the data and results. Test pits and percolation tests will be planned for each corner of the proposed field and the center. In addition, any historical test pit information will be provided in the final report.

1.2.3 Loading Test

Working with the Town of Sudbury, WSE will construct a 10 x 20 x 2' testing pit. The sides of the pit will be shored with boards and stakes. The base of the excavation will expose coarse deposits below the turf and soil layers at the field. A 72-hour loading test at approximately 50,000 GPD will be undertaken. Water for the load scale test will be routed via 2 or 4 inch flexible hose. Flow will be regulated within a 2-inch Badger style flow meter and a gate valve. Discharge into the excavation area will be diffused using a sheet of plywood elevated from the excavation floor on cinder blocks. It is not anticipated that standing water will occur in the excavation area during the test. If percolation rates cause standing water, flow rates will be diminished/adjusted to maintain a constant head within the excavation. The entire excavation will be encircled with temporary construction site fencing.

Antecedent water level monitoring will be conducted in all available monitoring wells for 5 days prior to the test at 2-hour intervals. Pressure transducers (Solinst) will be utilized. Hand measurements will also be taken 5, 3 and 1 day before the test as a back-up. Meteorological data will be collected for one week prior, during the test, and one week after the test.

Water levels during the loading test will be measured in all wells at one minute intervals for the first 24 hours and at 10-minute intervals thereafter. Hand measurements will be taken at 10-minute intervals in the three closest wells for the first two hours of the test. Hand measurements will be taken hourly for the first 8 hours and every 8 hours thereafter. At the end of 72 hours, the previous 24 hours of water level data will be reviewed to determine mounding fluctuations. If water levels in wells A, B, and C have changed less than 0.1 feet over the previous 8 hours, the test will be terminated and recovery initiated. If water levels show greater fluctuation, the test will be continued for an additional 24 hours.

1.2.4 Water Quality Testing

Groundwater samples will be taken in wells A, WSE-1 and WSE-3 to determine current conditions at the site. These wells have been chosen to identify both the regional groundwater quality and to evaluate current impacts from the existing on-site Title V leaching field.

The following parameters will be analyzed using a state certified laboratory:

- BOD_5
- Ammonia
- Total nitrogen
- Phosphorus
- TSS
- Fecal coliform

1.3 Data Analysis

1.3.1 Data Evaluation

As stated previously, the purpose of the evaluation is to 1) evaluate the site conditions with respect to the ability for the soils to discharge above 100,000 GPD of treated wastewater and b) characterize the potential impacts to local sensitive receptors. Preliminary mounding calculations performed for this site rely heavily on two very sensitive variables (hydraulic conductivity and saturated thickness) in the mound height calculation and are therefore the focus of the field data collection efforts detailed above. The borings advanced will provide Weston & Sampson with the saturated thickness in the proposed discharge area. Hydraulic conductivity can be highly variable with both the discharge area and at distal areas from the proposed discharge location and will be evaluated in a number of ways. First, soils will be collected during the drilling program for characterization and sieve Shepard (1989) and Fair-Hatch (1959) methods will be used to estimate the hydraulic conductivity in the areas drilled. Secondly, the load scale test proposed will allow for measurement of a water level response to 50,000 gallons per day (GPD) of water. An estimate of the hydraulic conductivity can be made using the well function. Hydraulic conductivity values will be determined by graphically analyzing water levels versus time in select observation wells and by evaluating water levels versus distance for the entire data set. From the three estimation methods, a range of K values will constrain the analytical modeling to be completed. Additional site specific variables, such as seasonal high water table and/or depth to restrictive (low permeability) zones, will be used in an analytical solution to determine if mounding or breakout is an issue. Considering the history of soil deposition in this region, an analytical approach using conservative estimates of hydraulic conductivity should prove to be sufficient to determine the mound height laterally and down-gradient of the proposed disposal site.

1.3.2 Analytical Modeling

The analytical model to be used for this evaluation was developed by the Colorado School of Mines and is described in detail in *Guidance for Evaluation of Potential Groundwater Mounding Associated with Cluster and High-Density Wastewater Soil Absorption Systems (2005).* The model is founded on equations developed by Hantush (1967) for prediction of maximum mound height of the water table beneath a rectangular recharge area. In addition to predicting mound height at the center of the discharge area, the model has the ability to predict mound height at distances cross-gradient and downgradient of the discharge area, which is crucial for evaluation of breakout in downgradient areas. The model will be calibrated using the data from the loading test in an effort to determine the appropriate site specific variables of horizontal hydraulic conductivity, specific yield, and saturated thickness. The model outputs will be compared to data from the load scale test to determine the accuracy of the model. The modeler will vary the input data (within supportable ranges) to determine the effect on water levels. When the modeler believes that the water levels generated by the model were a good match for the target data set, the model will be considered calibrated. At this point, the model will be adjusted to simulate the seasonal high water table. This will allow for conservative estimates of mounding under several discharge scenarios. The final step, and the purpose of the other three, is execution. The modeler will use the calibrated model to determine the impact of the proposed discharge water levels at the discharge rates proposed.

1.4 Nutrient Analysis

At this time, the primary intent of the work plan is to identify and describe the field investigation methods for the loading test. However, the overall project has been previously evaluated relative to nutrient removal and watershed health. The intent of the wastewater planning efforts in Sudbury has been to remove wastewater impacts from poorly performing commercial systems along the Rte. 20 corridor. Weston & Sampson's wastewater evaluation of 2001 characterizes these "needs" areas. Collection of this area's wastewater, treatment at a new WWTF, and discharge at the Curtis Middle School will be evaluated in the final report and groundwater discharge permit application anticipated for the overall project. This nutrient loading analysis will seek to quantify new nutrient loads based on planned effluent limits of less than 10 mg/L of total nitrogen and phosphorus levels of less than 1 mg/L. Actual flow rates are dependant on this site's assimilative capacity and the total flows from the eventual sewered areas. The nutrient analysis will look at groundwater discharge zones for local and regional surface waters, potential water quality impacts to Zone II areas, and changes in the total nutrient loads for the watershed.

1.5 Sensitive Receptor Analysis

Sensitive receptors will also be evaluated with data and conclusions provided in the summary hydrogeologic report. As required, this assessment will include potential impacts to abutting properties with respect to breakout, impacts to private wells, septic systems and existing building structures. In addition, sensitive ecological habitat will be identified and an assessment of impacts due to changes in hydrology or water quality will be completed.

1.6 Summary Report

Should the load scale test data indicate that the Curtis Middle School is a viable site for the discharge of sufficient quantities of treated effluent, a summary report will be prepared. The report will be prepared in accordance with current MADEP guidance and will include a characterization of site conditions, potential receptors, groundwater flow and water quality impacts, an assessment of the hydraulic mounding, nutrient impacts and design considerations. The report will provide all collected data, geologic cross sections, and recommendations for field location size and type. Impacts, if any, to the existing Title V field will also be evaluated.

The final report will satisfy current DEP requirements and will document the results of the witnessed test pits. The report will also identify any impacts to potential receptors and changes to groundwater quality and flow patterns. The report will also include a surveyed plan with bounds, showing the proposed location of the final SAS for the treated effluent discharge.

Finally, based on the mounding analysis and identification of any potential receptors, a groundwater monitoring plan will be identified in the report. The plan will include well locations, construction/design details, sampling protocols, sampling frequency, and sample analytes.

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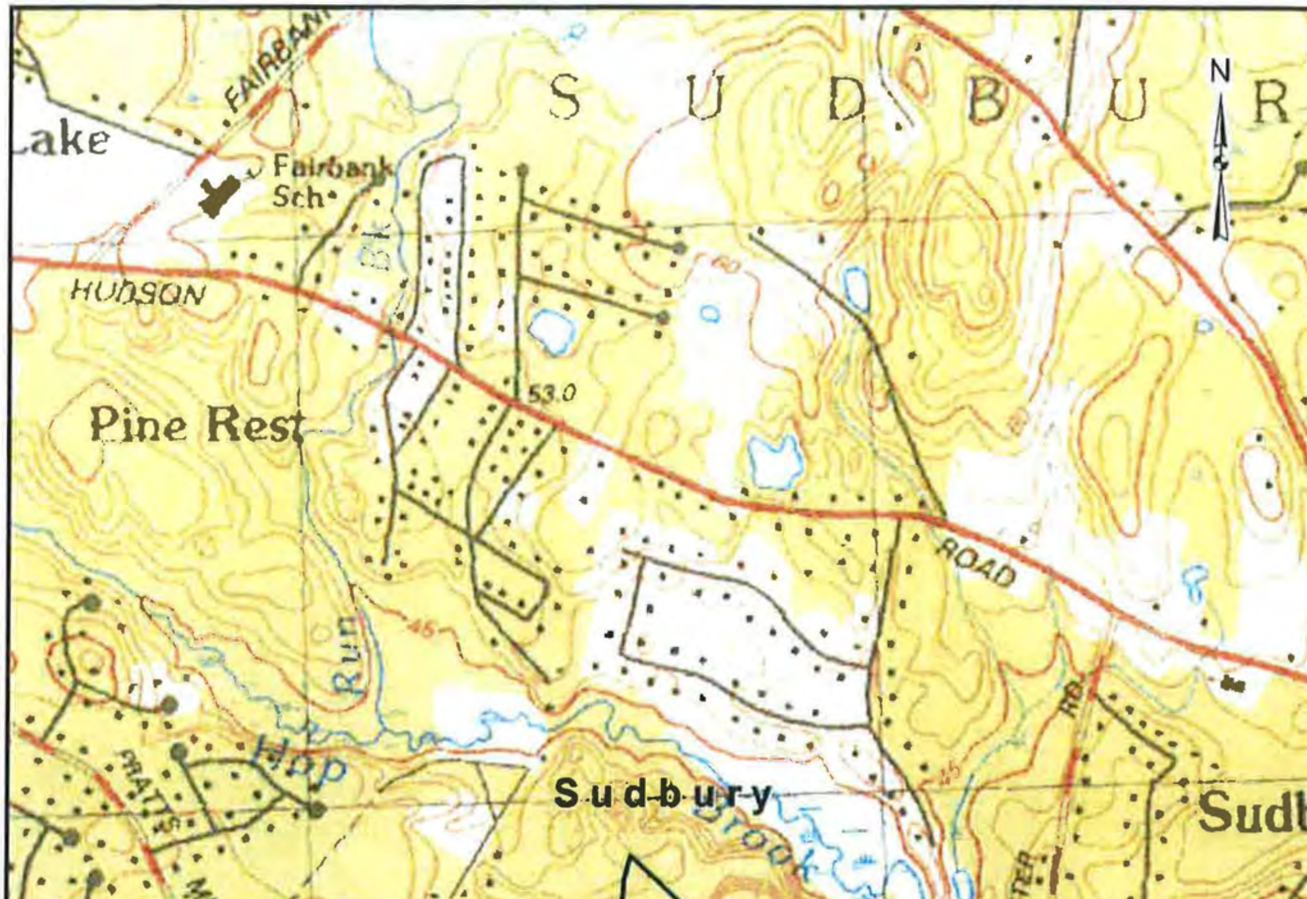


FIGURE 1
Hydrogeologic Investigation Scope of Work
CURTIS MIDDLE SCHOOL

LOCUS

Curtis Middle School Property

1,000 0 1,000
SCALE IN FEET

Weston&Sampson.

FIGURE 2
Hydrogeologic Investigation Scope of Work
CURTIS MIDDLE SCHOOL

PROPOSED OBSERVATION NETWORK

0 50 100 200
Feet

Weston&Sampson.

Attachment A

Subsurface Data Results Letter to Town of Sudbury
February 18, 2010

Five Centennial Drive
Peabody, MA 01960-7985
tel: 978-532-1900 fax: 978-977-0100
www.westonandsampson.com

February 18, 2010

Ms Jody Kablack
Town Planner
Flynn Building
278 Old Sudbury Road
Sudbury, MA 01776

RE: Subsurface Data Results

Dear Ms Kablack,

The following letter report summarizes the data collection activities and subsequent analysis conducted for three different areas in Sudbury. The areas or land parcels represent potential subsurface disposal locations for treated wastewater effluent. Although a more thorough analysis is required under DEP's groundwater discharge permitting process, the initial estimates of assimilative capacity are discussed below. Previous memos were developed regarding environmental/ecological constraints for each site.

Data Collection

A test boring and monitoring well installation program was undertaken for three areas. The drilling was undertaken between August 19, 2009 and September 2, 2009. Monitoring wells were constructed at each site in select locations to provide geographic coverage and to determine subsurface stratigraphy at the site. Monitoring well logs and construction diagrams are provided in Appendix A, along with a site schematic showing the approximate location of each boring. Slug testing was undertaken in each monitoring well to aid in evaluating the permeability of subsurface deposits. In addition, sieve analysis on select soil strata was undertaken as another means to evaluate permeability. Each site is discussed below.

Curtis Middle School

Three wells were installed at the Curtis Middle School. Wells were located along the perimeter of the existing playing fields where safe access was available. In general, the borings indicate dense fine-medium sand and fine gravel. Static water levels ranged between approximately 29 and 32 feet below grade. Slug tests conducted indicate that calculated hydraulic conductivities for the site range between 1.45 and 7.23 feet per day (ft/d).

Additional validation of these values was obtained by undertaking grain size distribution analyses. Assuming the deposits are generally anisotropic and relatively poorly sorted, hydraulic conductivity can be estimated using the following formula (Shepherd, 1989):

$$K = 800d^{1.5}$$

Using a ratio of 20:1 or 50:1 provides a more representative vertical hydraulic conductivity given layered or stratified glacial deposits. Vertical hydraulic conductivities range between 4.02 and 8.68 ft/d.

Soil samples were analyzed in boring B1 between 29 and 31 feet below ground surface (bgs) at the Curtis Middle School. This sample was chosen as generally representative of deeper sand and gravel deposits with silt. This sample was also at the same interval as the screen interval for the well. Results shown in Table 1 below indicate good correlation between calculated hydraulic conductivities for both the slug test and the sieved samples. An additional sample was evaluated from boring B3 at the depth of 19-21 feet. This sample was selected as representative of shallow, finer deposits. These deposits would generally represent lower permeabilities for the site and therefore reduce the assimilative capacity of a subsurface disposal system. Graphical analysis of slug test results and grain size sieve analyses are provided in Appendix B.

Table 1 Hydraulic Conductivity Estimates at the Curtis Middle School

		Hydraulic Conductivity (ft/d)			
		Slug Test Analysis		Sieve Analysis	
	Sample Depth (feet)	Bouwer & Rice	Hvorslev	K_h[1]	K_{v50}[2]
B1	29-31	1.450	1.890	433.83	8.68
B2	28-33	5.540	7.230		
B3	19-21			200.95	4.02
B3	32-37	4.220	4.190		

1. K_h = Horizontal hydraulic conductivity as calculated for moderately immature sediments using $K=800d^{1.5}$
2. Kv = Vertical hydraulic conductivity, being 1/50th of K_h

Mounding analysis for the CMS site was conducted using an analytical model developed by the Colorado School of Mines. A summary of the different flow rate scenarios is provided in Table 2, below.

Table 2 Mounding Analysis Summary at Curtis Middle School

Flow Rate (gpd)	Maximum Mound Height (ft)	Predicted Mound Height at 500 Feet
50,000	16.9	9.6
100,000	25.6	14.7
200,000	36.6	25.8

At flow rates of 100,000 gpd, preliminary, conservative estimates indicate 25.6 feet of mound height is calculated under the center of a 210 x 320 foot field. At a radial distance of 500 feet, theoretical mound heights of 14.7 feet are calculated. Actual mound heights should be less as a conservative K was used to reflect the finer deposits. Mounding analyses are provided in Appendix C.

Based on the above estimates, the Curtis Middle School site appears favorable for the disposal of significant quantities of treated wastewater in a soil adsorption system (SAS).

Haskell Field

Borings were completed in two of the three planned locations at Haskell Field. These borings were installed at locations B1 and B3. Due to the similarity of the subsurface deposits, B2 was not installed. Generally, subsurface deposits consist of fine sand and silt. Significantly lower permeability silty sands exist from 9-11 feet bgs throughout the area. Calculated hydraulic conductivities from slug test results ranged between approximately 0.6 and 8.3 ft/day. Similarly, grain size analyses indicate good correlation between calculated vertical hydraulic conductivities and slug test results at the B3 layer (see Table 3 below). Grain size analyses indicate that the predominance of silt in the 9-11 foot layer would yield even lower values for hydraulic conductivity.

Table 3 Hydraulic Conductivity Analysis at Haskell Field

		Hydraulic Conductivity (ft/d)			
		Slug Test Analysis		Sieve Analysis	
	Sample Depth (feet)	Bouwer & Rice	Hvorslev	K_h[1]	K_{v20}[2]
B1	9-11			N/A[3]	N/A[3]
B1	20-30	8.270	6.340		
B3	19-21			12.44	0.0623
B3	30-35	0.865	0.663		

1. K_h = Horizontal hydraulic conductivity as calculated for moderately immature sediments using $K=800d^{1.5}$
2. Kv = Vertical hydraulic conductivity, being 1/20th of K_h
3. N/A = Sieve analysis did not return D_{50} value needed to calculate hydraulic conductivity

The mounding analysis for this site reveals calculated mound heights readily exceeded 30 feet. The low permeability deposits prevalent at 9-11 feet and again in areas from 19-21 feet, relegate this area as impractical for the construction of high a capacity SAS (see Table 4 below).

Table 4 Mounding Analysis Summary at Curtis Middle School

Flow Rate (gpd)	Maximum Mound Height (ft)	Predicted Mound Height at 500 Feet
50,000	45.4	27.8
100,000	65.3	41.7
200,000	89	62.2

Old Lancaster Road (293/301)
The tested parcels located on Old Lancaster Road revealed the highest degree of variability in subsurface deposits. In general, more permeable deposits exist near boring B1, while finer silt and sand deposits were evident in borings B2 and B3. Slug test results indicate permeabilities of less than 1.5 ft/day (see table 5 below). Screened intervals for these wells were selected from 15-20 feet. In borings B2 and B3, these layers had a dominant silt fraction. Mounding analysis for this site indicates mound heights for 50,000 gpd will exceed 32 feet (see Table 6 below). The fine grained deposits from 15-20 feet and the excessive mound heights indicate this site is impractical for the installation of a high capacity SAS.

Table 5 Hydraulic Conductivity Analysis at Old Lancaster Road

		Hydraulic Conductivity (ft/d)			
		Slug Test Analysis		Sieve Analysis	
	Sample Depth (feet)	Bouwer & Rice	Hvorslev	K_h[1]	K_{v50}[2]
B1[3]	15-20	1.030	1.340		
B2	14-16			25.49	0.51
B2	18-25	0.308	0.402		
B3	9-11			N/A[4]	N/A[4]
B3	18-25	0.413	0.538		

1. K_h = Horizontal hydraulic conductivity as calculated for moderately immature sediments using $K=800d^{1.5}$
2. Kv = Vertical hydraulic conductivity, being 1/50th of K_h
3. Sieve Analysis not conducted at B1.
4. N/A = Sieve analysis did not return D_{50} value needed to calculate hydraulic conductivity

Table 6 Mounding Analysis Summary at Old Lancaster Road

Flow Rate (gpd)	Maximum Mound Height (ft)	Predicted Mound Height at 500 Feet
50,000	32.4	19.5
100,000	47.4	29.4
200,000	65.5	43.5

Conclusions
The Curtis Middle School exhibits the most favorable conditions for the successful installation of an SAS system capable of handling 100,000 gpd. These conditions include permeable deposits and adequate separation from groundwater. Further investigation activities, include test pits and possible load scale testing, would be required to establish final design flow rates, capacity and field size. Installed costs for large scale SAS systems generally range between $12 and $15 per square foot. This value would not include athletic field reparation or changes in other *utility infrastructure*, if necessary, at this site. Fine grained silt and sand deposits exists at depth for both the Haskell Field and land parcels

investigated along Old Lancaster Road. Although smaller SAS systems could accept some flow of treated effluent, systems above 50,000 gpd at these two sites are impractical.

The above information is provided to assist Sudbury in their wastewater planning efforts. Please feel free to contact us if you have any questions.

Very truly yours,

WESTON & SAMPSON, INC.

Blake A. Martin
Environmental Resource Manager

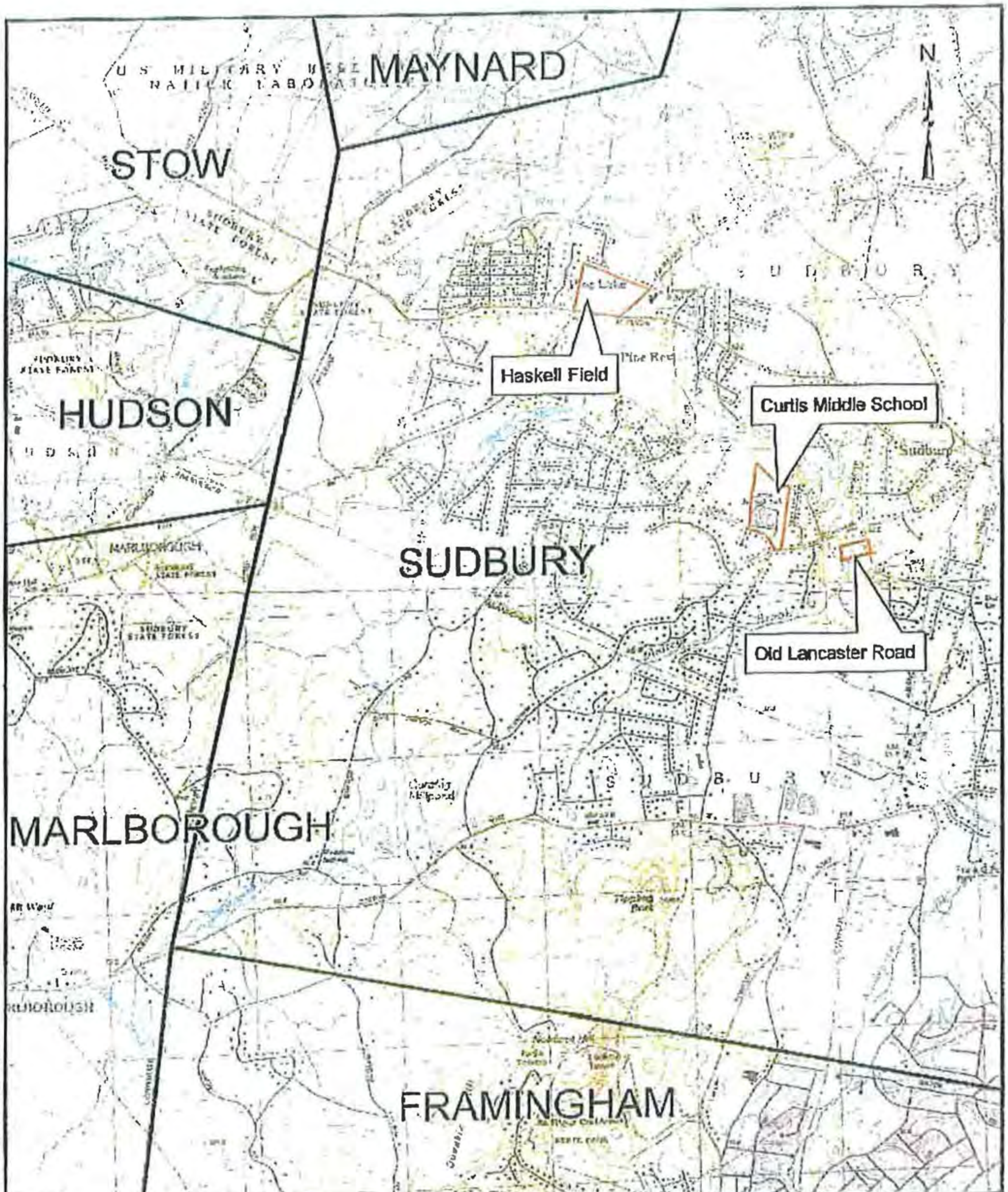


FIGURE 1
SUDBURY SUBSURFACE DISPOSAL CAPACITY
LOCUS MAP

SITE MAP

MA Town Boundaries

3,000 0 3,000
SCALE IN FEET

Weston&Sampson

FIGURE 2
SUDBURY SUBSURFACE DISPOSAL CAPACITY
CURTIS MIDDLE SCHOOL

SITE MAP

● Boring
Curtis Middle School Property

250 0 250
SCALE IN FEET

Weston&Sampson.

FIGURE 3
SUDBURY SUBSURFACE DISPOSAL CAPACITY
HASKELL FIELD

SITE MAP

Borings
Haskell Field Property

250 0 250
SCALE IN FEET

Weston & Sampson

FIGURE 4
SUDBURY SUBSURFACE DISPOSAL CAPACITY
OLD LANCASTER ROAD

SITE MAP

● Boring
Old Lancaster Road Property

250 0 250
SCALE IN FEET

Weston&Sampson.

APPENDIX A

Weston & Sampson ENGINEERS, INC.	PROJECT Sudbury, MA Curtis Middle School	REPORT OF BORING No B1 SHEET 1 OF 1 Project No. CHKD BY

BORING Co. NH Boring
FOREMAN Todd Penticost
WSE GEOLOGIST: Mel Higgins

BORING LOCATION off driveway by ballfield
GROUND SURFACE ELEV. DATUM
DATE START 8/19/2009 DATE END 8/19/2009

SAMPLER: SAMPLER CONSISTS OF 2" SPLIT SPOON DRIVEN USING A 140 LB HAMMER FALLING 30 IN
CASING: 5' steel
CASING SIZE: 4" OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
10/16/09		31.99	0 - 28'	

DEPTH (feet)	CASING (bl/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
5		S1	24/23	4-6	27-40 53-37		Topsoil, angular gravel, cobbles, coarse sand		
10		S2	24/10	9-11	20-17 13-15		wet brown coarse sand w/gravel, trace of silt		
15		S3	24/20	14-16	8-13 14-21		wet med dense lt brown med sand, some gravel		
20		S4	24/9	19-21	9-5 10-12		wet med dense sand, trace gravel		
25		S5	24/12	24-26	15-9 11-16		wet med dense fine sand		
30		S6	24/24	29-31	18-21 22-25		wet dense fine sand		
35		S7	24/8	34-36	7-7 7-9		wet med dense fine sand w/trace silt		

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY

REMARKS:
2" pvc observation well installed. 28' pvc riser with 5'pvc screen (10 slot). Screen set at 33-28' bgs). Natural material around riser Bentonite chips as sealer Road box cemented in.

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. B1

Weston & Sampson ENGINEERS, INC.	PROJECT Sudbury, MA Curtis Middle School	REPORT OF BORING No. B2 SHEET 1 OF 1 Project No. CHKD BY	

BORING Co. NH Boring
FOREMAN Todd Penticost
WSE GEOLOGIST: Mel Higgins

BORING LOCATION off Pratt Hill Rd.
GROUND SURFACE ELEV. DATUM
DATE START 8/18/2009 DATE END 8/19/2009

SAMPLER: SAMPLER CONSISTS OF 2" SPLIT SPOON DRIVEN USING A 300 LB HAMMER FALLING 30 IN.
CASING: 5' steel
CASING SIZE: 4" OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
10/16/09		29.18	0-28'	

DEPTH (feet)	CASING (blf/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
5		S1	24/16	4-6	24-26 21-23		dry dense tan fine sand w/some gravel		
10		S2	24/15	9-11	10-23 18-13		moist dense tan fine sand w/ trace of silt and gravel		
15		S3	24/11	14-16	25-25 16-12		wet dense tan fine sand w/some gravel, trace silt		
20		S4	24/8	19-21	6-6 8-9		wet med dense tan fine sand		
25		S5		24-26	12-10 10-15		wet med dense tan fine sand		
30		S6	24/24	29-31	17-17 27-36		wet dense tan fine sand		
35		S7	24/21	34-35	4-5 3-3		wet dense tan fine sand		

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY

REMARKS:
2" pvc observation well installed. 28' pvc riser with 5'pvc screen (10 slot). Screen set at 33-28' bgs). Natural material around riser. Bentonite chips as sealer. Road box cemented in.

NOTES
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. B2

Weston & Sampson
ENGINEERS, INC.

PROJECT: Sudbury, MA — Curtis Middle School

REPORT OF BORING No. B3
SHEET 1 OF 2
Project No.
CHKD BY

BORING Co. NH Boring
FOREMAN Todd Penticost
WSE GEOLOGIST: Mel Higgins

BORING LOCATION by landscaped area of ballfields
GROUND SURFACE ELEV
DATUM
DATE START 8/20/2009 DATE END 8/20/2009

SAMPLER: SAMPLER CONSISTS OF 2" SPLIT SPOON DRIVEN USING A 300 LB HAMMER FALLING 30 IN.
CASING: 5' steel
CASING SIZE: 4"
OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
10/16/09		29.71	0-32'	

DEPTH (feet)	CASING (bl/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	N (blows/6")	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
5									
10		S1	24/16	9-11	9-15 15-17		wet dense tan med sand and some gravel		
15									
20		S2	24/12	19-21	11-8 13-15		wet tan dense med sand w/ trace of silt		
25									
30		S3	24/12	29-31	10-9 11-14		wet tan med density fine to med sand with trace gravel		
35									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY

REMARKS:
2" pvc observation well installed 32' pvc riser with 5'pvc screen (10 slot) Screen set at 37-32' bgs). Natural material around riser. Bentonite chips as sealer. Road box cemented in.

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE

BORING No. B3

Weston & Sampson ENGINEERS, INC.	PROJECT Sudbury, MA Curtis Middle School	REPORT OF BORING No. B3
		SHEET 2 OF 2
		Project No.
		CHKD BY

BORING Co. NH Boring
FOREMAN Todd Penticost
WSE GEOLOGIST: Mel Higgins

BORING LOCATION by landscaped area of ballfields
GROUND SURFACE ELEV. DATUM
DATE START 8/20/2009 DATE END 8/20/2009

SAMPLER: SAMPLER CONSISTS OF 2" SPLIT SPOON DRIVEN USING A 300 LB HAMMER FALLING 30 IN
CASING: 5' steel
CASING SIZE: 4" OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (feet)	CASING (bl/ft)	SAMPLE No.	SAMPLE PEN/REC (in)	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
40		S4		39-41			wet tan fine sand		
45									
50		S5		49-50			wet tan fine sand		
55									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY

REMARKS:
2" pvc observation well installed. 32' pvc riser with 5'pvc screen (10 slot). Screen set at 37-32' bgs). Natural material around riser. Bentonite chips as sealer. Road box cemented in

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE

BORING No. B3

Weston & Sampson ENGINEERS, INC.	PROJECT Sudbury, MA Haskell Field	REPORT OF BORING No. B1
		SHEET 1 OF 1
		Project No.
		CHKD BY

BORING Co. NH Boring
FOREMAN Todd Penticost
WSE GEOLOGIST: Mel Higgins

BORING LOCATION off of Hudson Rd, off of parking lot
GROUND SURFACE ELEV DATUM
DATE START 8/20/2009 DATE END 8/20/2009

SAMPLER: SAMPLER CONSISTS OF 2" SPLIT SPOON DRIVEN USING A 140 LB. HAMMER FALLING 30 IN

CASING: 5' steel

CASING SIZE: 4" OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
10/16/09		17.25'	0-20'	

DEPTH (feet)	CASING (lb/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
5		S1		4-6			med coarse sand w/some gravel		
10		S2		9-11			fine sand and silt		
15		S3		14-16			fine-med sand		
20		S4		19-21			fine-med sand		
25		S5		24-26			fine-med sand		
30		S6		29-31			fine sand		
		S7		34-36			fine sand		
35									

GRANULAR SOILS BLOWS/FT	DENSITY	COHESIVE SOILS BLOWS/FT	DENSITY

REMARKS:
2" pvc observation well installed. 20' pvc riser with 5'pvc screen (10 slot). Screen set at 20-30' bgs). Natural material around riser. Bentonite chips as sealor. Road box cemented in.

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. B1

Weston & Sampson ENGINEERS, INC.	PROJECT Sudbury, MA Haskell Field	REPORT OF BORING No.	B3
		SHEET 1 OF 1	
		Project No.	
		CHKD BY	

BORING Co.	NH Boring	BORING LOCATION	off of Hudson Rd. off of parking lot
FOREMAN	Todd Penticost	GROUND SURFACE ELEV	DATUM
WSE GEOLOGIST:	Blake Martin	DATE START 8/20/2009	DATE END 8/20/2009

SAMPLER: SAMPLER CONSISTS OF 2" SPLIT SPOON DRIVEN USING A 300 LB HAMMER FALLING 30 IN

CASING: 5' steel

CASING SIZE: 4" OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
10/16/09		16.07'		

DEPTH (feet)	CASING (bl/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
5		S1		4-6			med-course Sand w/some gravel		
10		S2		9-11			fine Sand		
15		S3		14-16			med-fine Sand		
20		S4		19-21			fine Sand w/ some silt		
25		S5		24-26			fine sand		
30		S6		29-31			fine sand		
35		S7		34-36					

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY

REMARKS

2" pvc observation well installed. pvc riser with 5'pvc screen (10 slot). Natural material around riser. Bentonite chips as sealer. Road box cemented in.

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. B3

Weston & Sampson	PROJECT	REPORT OF BORING No.		OL-1
	193 Old Lancaster Rd, Sudbury MA	SHEET	1	OF 1
		Project No.		2090428
		CHKD BY		BAM

BORING Co.	New Hampshire Boring	BORING LOCATION	See attached plan
FOREMAN	Vinnie	GROUND SURFACE ELEV.	unknown DATUM
WSE GEOLOGIST:	SQ	DATE START 9/2/09	DATE END 9/2/09

SAMPLER: SPT (Standard Penetration Test)

CASING: 5' - Steel

CASING SIZE: 4" Method Tricone

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
10/16/09		15.75'		

DEPTH (feet)	WELL	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
5				4-6	4/5/7/14		Dry, Brown yellow fine Sand, trace of coarse Sand; Loose.		SAND
10				9-11	5/9/9/10		Brown yellow medium Sand, trace of fine Gravel, Loose.		
15				14-16	(*)		Brown medium Sand, trace of coarse Sand.		
20				19-21	(*)		Brown medium to coarse Sand, some fine Gravel.		SAND & Gravel
25				24-26	(*)		Brown coarse Sand and medium Gravel.		End of boring @ 26 Ft
30									
35									

GRANULAR SOILS BLOWS/FT	DENSITY	COHESIVE SOILS BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

REMARKS:
(*) Bag sample from wash water

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. OL-1

Weston & Sampson

PROJECT	REPORT OF BORING No.	OL-2
193 Old Lancaster Rd, Sudbury MA	SHEET 1 OF 1	
	Project No.	2090428
	CHKD BY	BAM

BORING Co. New Hampshire Boring
FOREMAN Vinnie
WSE GEOLOGIST: SQ

BORING LOCATION See attached plan
GROUND SURFACE ELEV unknown DATUM
DATE START 9/2/09 DATE END 9/2/09

SAMPLER: SPT (Standard Penetration Test)
CASING: 5' - Steel
CASING SIZE: 4" Method Tricone

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
10/16/09		19.21'		

DEPTH (feet)	WELL	No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
5							No sample.		
10				9-11	13/17/18/20		Brown yellow medium Silt, some fine Sand; Moderately dense.		
15				14-16	(*)		Brown yellow medium Silt and fine Sand.		
18									
20				19-21	(*)		Brown yellow coarse Silt and fine Sand.		SILT & Sand
23									
25				24-26	(*)		Brown yellow coarse Silt, some fine Sand		
30				29-31	(*)		Brown yellow coarse Silt, some fine Sand		
35				34-36			Brown yellow coarse Silt and fine Sand.		End of boring @ 36 Ft

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

REMARKS:
(*) Bag sample from wash water

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. OL-2

Weston & Sampson

PROJECT	REPORT OF BORING No.	OL-3
193 Old Lancaster Rd, Sudbury MA	SHEET 1	OF 1
	Project No.	2090428
	CHKD BY	BAM

BORING Co. New Hampshire Boring
FOREMAN Vinnie
WSE GEOLOGIST: SO

BORING LOCATION See attached plan
GROUND SURFACE ELEV. unknown DATUM
DATE START 9/2/09 DATE END 9/2/09

SAMPLER: SPT (Standard Penetration Test)
CASING: 5' - Steel
CASING SIZE: 4" Method Tricone

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
10/16/09		16.52'		

DEPTH (feet)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
5			4-6	7/10/17/22		Dry Yellow brown fine Sand, little medium Silt; Moderately dense.		
10			9-11	13/17/18/20		Damp wet Yellow brown fine Sand, some fine Silt; Moderately dense.		
15			14-16	(*)		Brown yellow fine Sand, Some fine Silt.		SAND with some to little Silt (occasional medium Sand)
18								
20			19-21	(*)		Brown yellow fine to medium Sand.		
23								
25			24-26	(*)		Brown fine Sand.		
30			29-31	(*)		Brown fine Sand, little Silt		
35			34-36	(*)		Brown fine Sand, little Silt.		End of boring @ 35 Ft

GRANULAR SOILS BLOWS/FT	DENSITY	COHESIVE SOILS BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

REMARKS:
(*) Bag sample from wash water

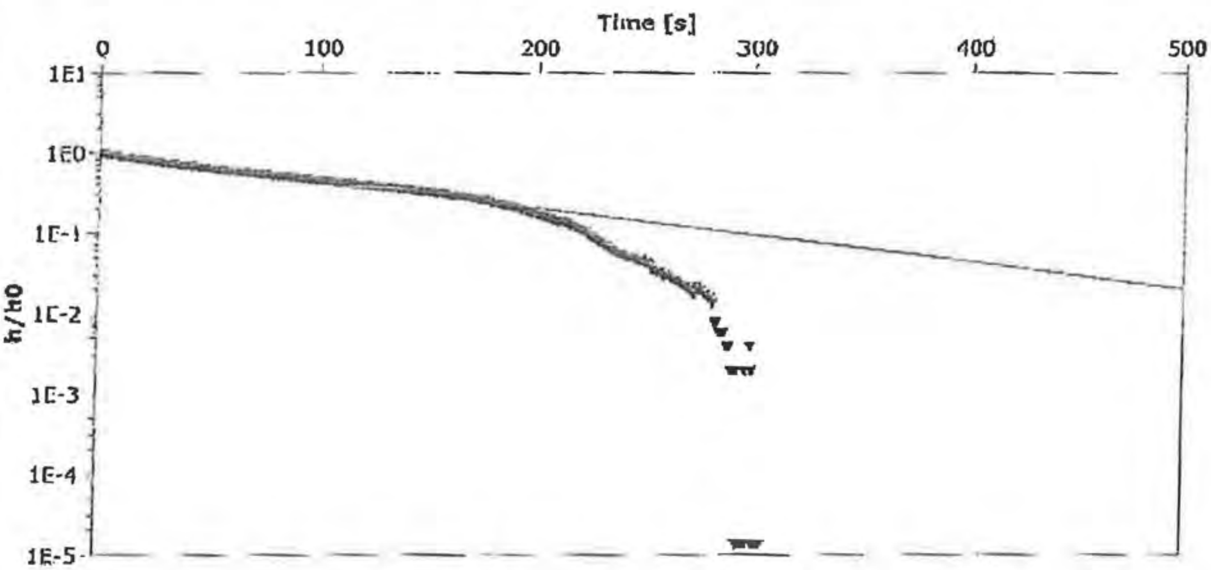
NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. OL-3

APPENDIX B

Weston & Sampson, Inc. **5 Centennial Drive** **Peabody, MA 01960**	Slug Test Analysis Report Project: Sudbury Disposal Site Number: Client: Town of Sudbury

Location: Sudbury, MA	Slug Test: cms1	Test Well: cms1
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	CMS1 Slug Test - Bouwer & Rice	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		



Calculation after Bouwer & Rice

Observation Well	Hydraulic Conductivity [ft/d]
cms1	1.45×10^{0}

Weston & Sampson, Inc.
5 Centennial Drive
Peabody, MA 01960

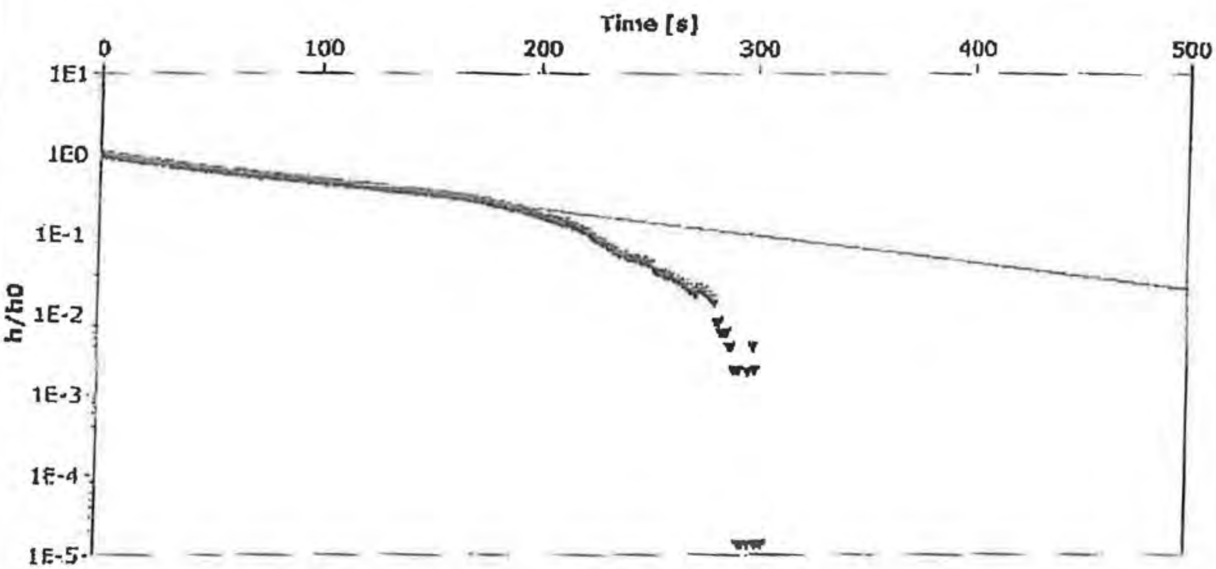
Slug Test Analysis Report

Project: Sudbury Disposal Site

Number:

Client: Town of Sudbury

Location: Sudbury, MA	Slug Test: cms1	Test Well: cms1
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	CMS1 Slug Test - Hvorslev	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		



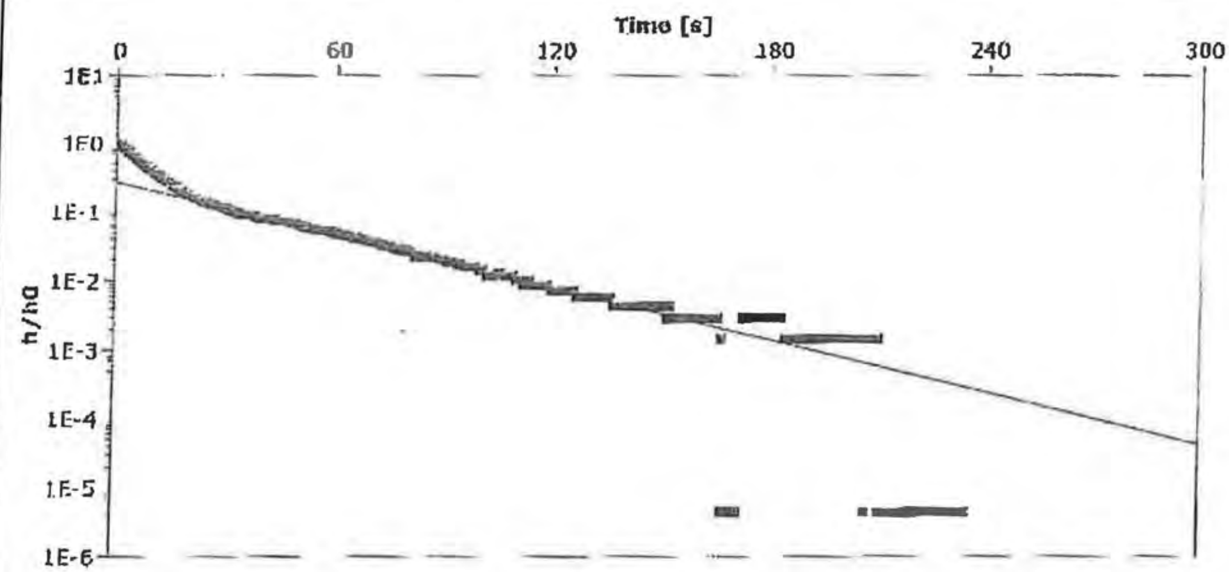
Calculation after Hvorslev

Observation Well	Hydraulic Conductivity [ft/d]
cms1	1.89×10^{0}

Weston & Sampson, Inc.
5 Centennial Drive
Peabody, MA 01960

Slug Test Analysis Report	
Project:	Sudbury Disposal Site
Number:	
Client:	Town of Sudbury

Location: Sudbury, MA	Slug Test: CMS2	Test Well: cms2
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	CMS2 Slug Test Bouwer & Rice	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		

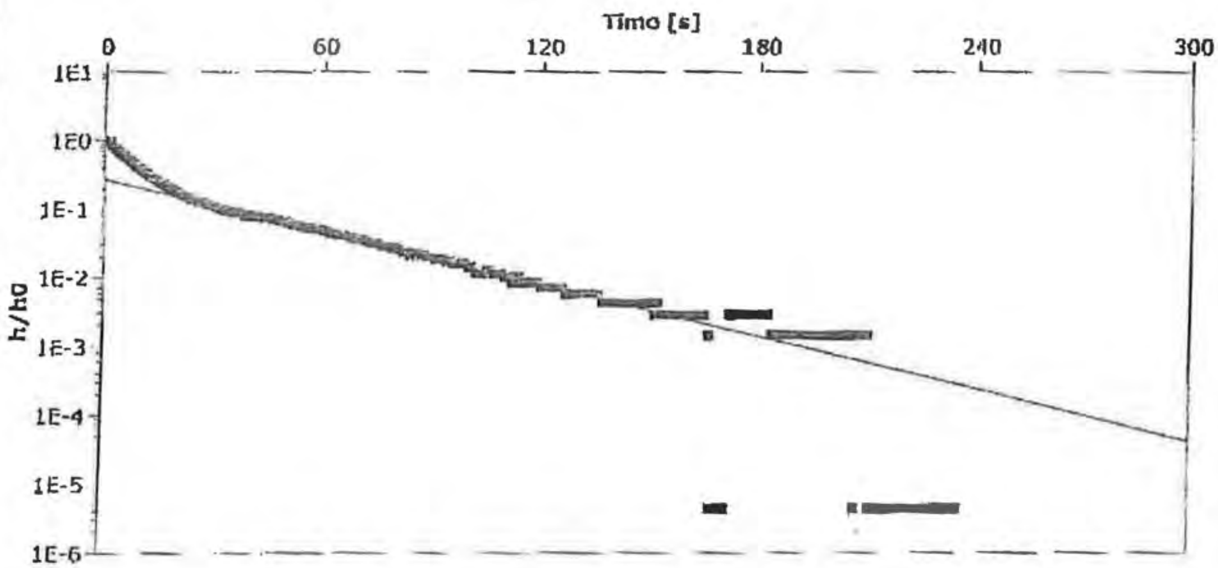


Calculation after Bouwer & Rice

Observation Well	Hydraulic Conductivity (ft/d)
cms2	5.54×10^{3}

Weston & Sampson, Inc. 5 Centennial Drive Peabody, MA 01960	Slug Test Analysis Report Project: Sudbury Disposal Site Number: Client: Town of Sudbury

Location: Sudbury, MA	Slug Test: CMS2	Test Well: cms2
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	CMS2 Slug Test - Hvorslev	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		



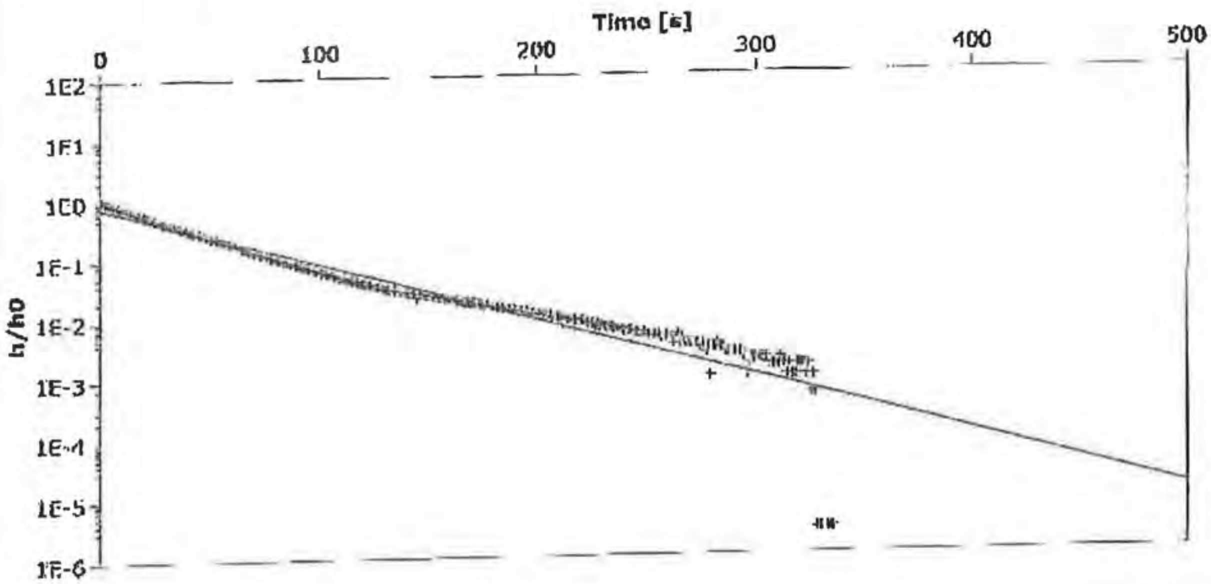
Calculation after Hvorslev

Observation Well	Hydraulic Conductivity [ft/d]
cms2	$7.23 \times 10^{[illegible]}$

Weston & Sampson, Inc.
5 Centennial Drive
Peabody, MA 01960

Slug Test Analysis Report
Project: Sudbury Disposal Site
Number:
Client: Town of Sudbury

Location: Sudbury, MA	Slug Test: CMS3	Test Well: cms3
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	CMS3 Slug Test - Bouwer & Rice	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		

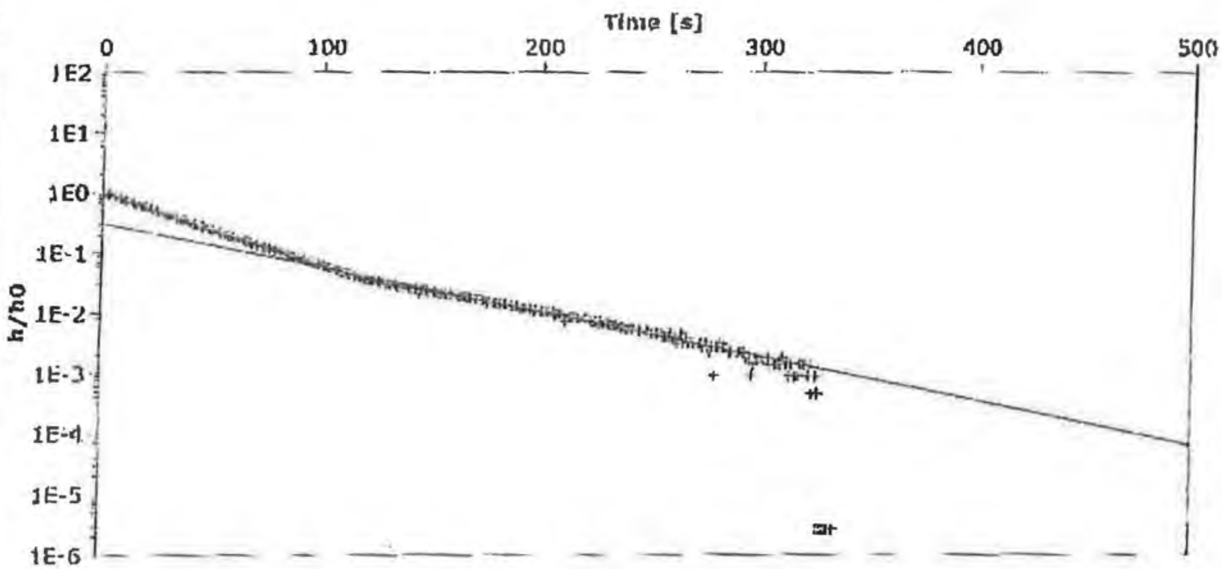


Calculation after Bouwer & Rice

Observation Well	Hydraulic Conductivity [ft/d]
cms3	4.72×10^{0}

Weston & Sampson, Inc. 5 Centennial Drive Peabody, MA 01960	Slug Test Analysis Report Project: Sudbury Disposal Site Number: Client: Town of Sudbury

Location: Sudbury, MA	Slug Test: CMS3	Test Well: cms3
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	CMS3 Slug Test - Hvorslev	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		



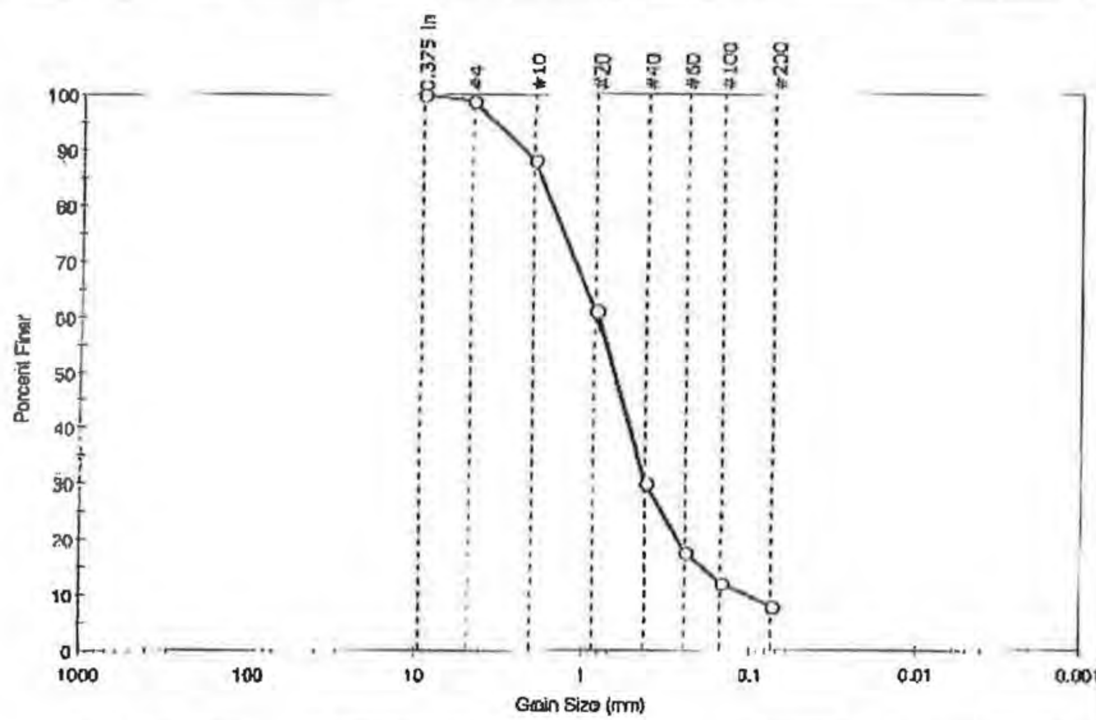
Calculation after Hvorslev

Observation Well	Hydraulic Conductivity [ft/d]
cms3	4.10×10^{0}

GeoTesting
express
a subsidiary of Geocomp Corporation

Client: Weston & Sampson Engineers			
Project: Sudbury			
Location: Sudbury, MA		Project No:	GTX-9619
Boring ID: B-1	Sample Type: jar	Tested By:	jbr
Sample ID: S-6 CHS	Test Date: 01/26/10	Checked By:	jdt
Depth : 29.0-31.0 ft	Test Id: 172737		
Test Comment: ---			
Sample Description: Moist, brownish yellow sand with silt			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	1.3	90.6	8.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.53	100		
#4	4.75	99		
#10	2.00	88		
#20	0.85	61		
#40	0.42	30		
#60	0.25	18		
#100	0.15	12		
#200	0.075	8		

Coefficients

D_{85} = 1.8122 mm	D_{30} = 0.4235 mm
D_{60} = 0.8325 mm	D_{15} = 0.1967 mm
D_{50} = 0.6650 mm	D_{10} = 0.1050 mm
C_u = 7.929	C_c = 2.052

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : SOFT

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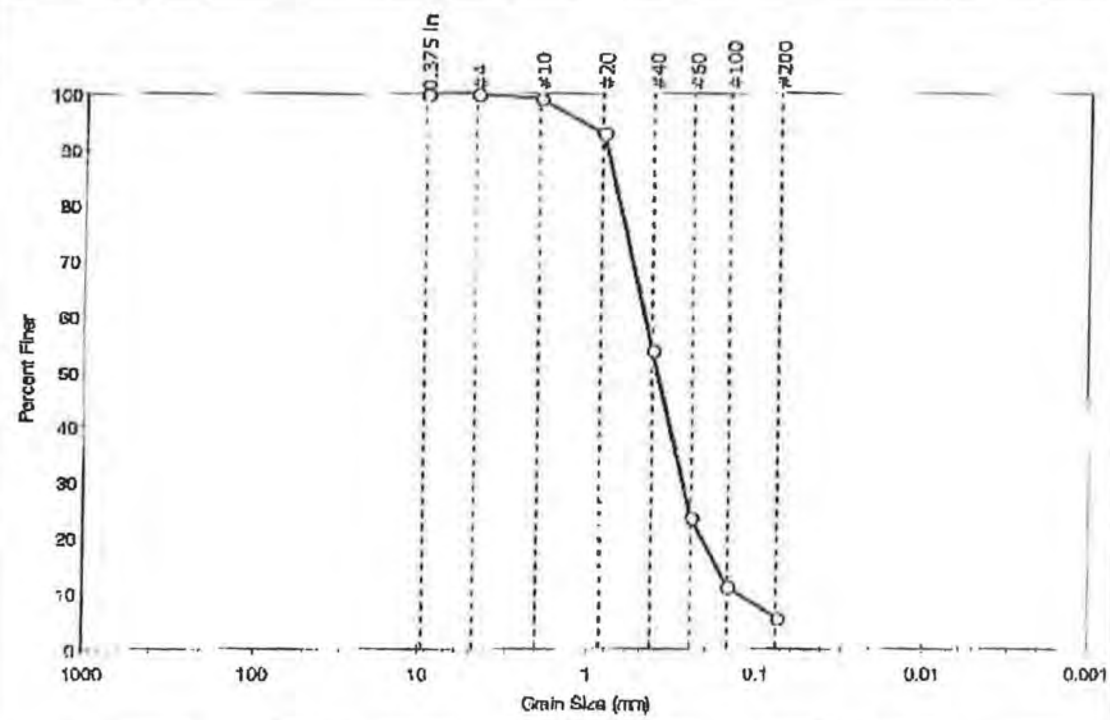
GeoTesting express
a subsidiary of Geocomp Corporation

Client: Weston & Sampson Engineers			
Project: Sudbury			
Location: Sudbury, MA		Project No:	GTX-9619
Boring ID: B-3	Sample Type: jar	Tested By:	jbr
Sample ID: S-2 CMS	Test Date: 01/26/10	Checked By:	jdt
Depth : 19.0-21.0 ft	Test Id: 177738		
Test Comment: ---			
Sample Description: Moist, brownish yellow sand with silt			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



least permeable

% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	---	94.4	5.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	100		
#10	2.00	99		
#20	0.85	93		
#40	0.42	54		
#60	0.25	[illegible]		
#100	[illegible]	[illegible]		
#200	[illegible]	5		

Coefficients

D_{85} = 0.7382 mm　D_{30} = 0.2795 mm
D_{60} = 0.4749 mm　D_{15} = 0.1754 mm
D_{50} = 0.3981 mm　D_{10} = 0.1299 mm
C_u = 3.656　C_c = 1.266

Classification

ASTM N/A

AASHTO Fine Sand (A-3 (0))

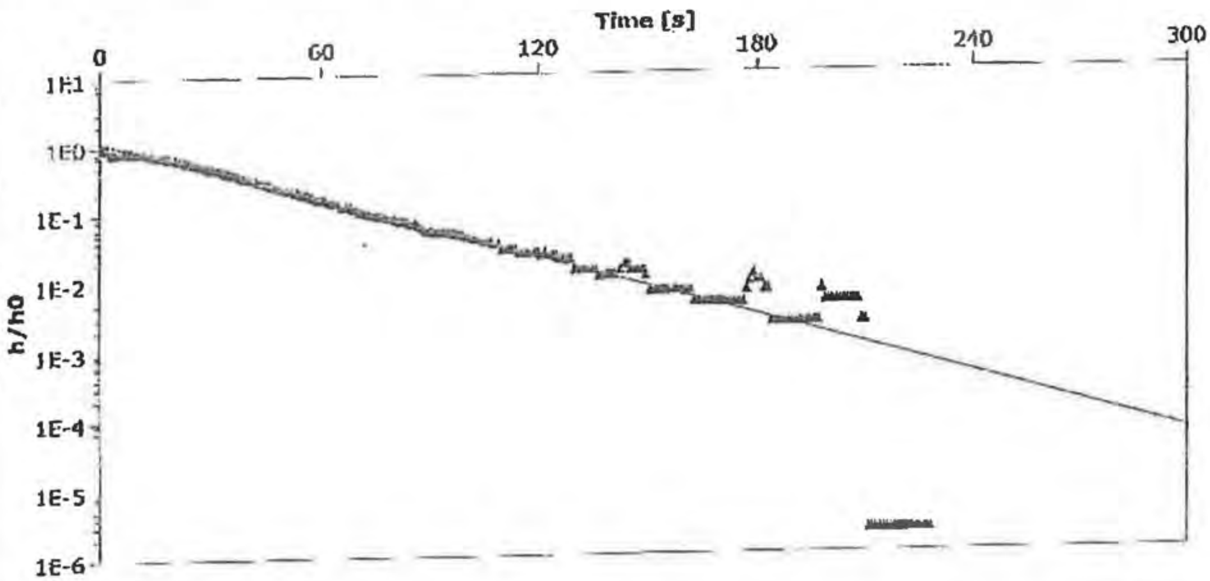
Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Weston & Sampson, Inc. **5 Centennial Drive** **Peabody, MA 01960**	**Slug Test Analysis Report** Project: Sudbury Disposal Site Number: Client: Town of Sudbury

Location: Sudbury, MA	Slug Test: Slug Test HF1	Test Well: HF1
Test Conducted by:		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	HF1 Slug Test - Hvorslev	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		



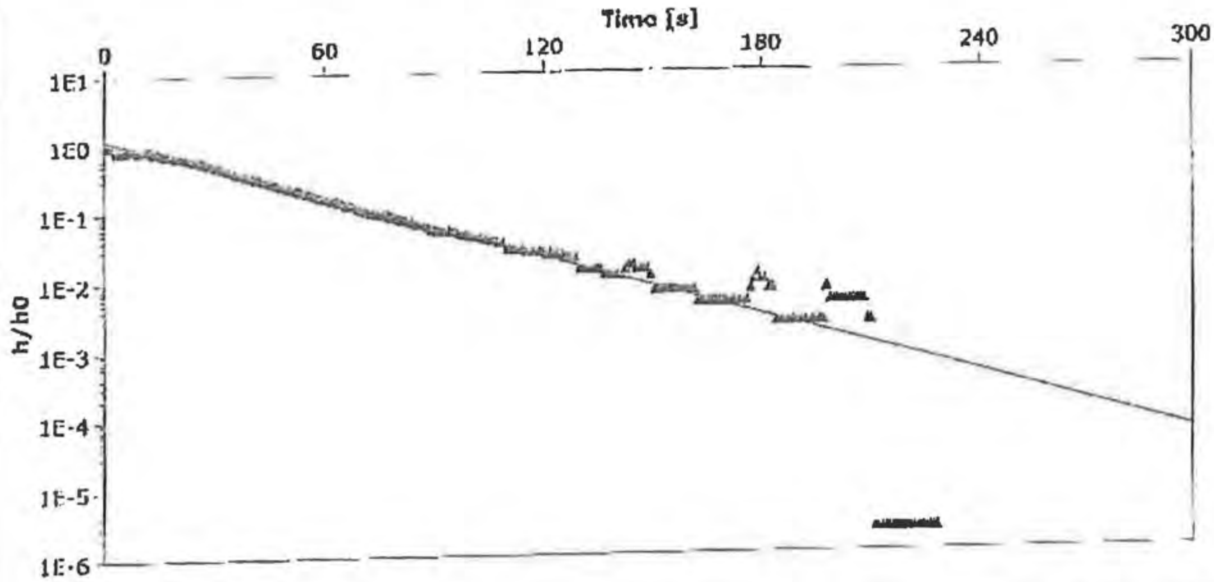
Calculation after Hvorslev

Observation Well	Hydraulic Conductivity [ft/d]
HF1	8.27×10^{0}

Weston & Sampson, Inc.
5 Centennial Drive
Peabody, MA 01960

Slug Test Analysis Report	
Project:	Sudbury Disposal Site
Number:	
Client:	Town of Sudbury

Location: Sudbury, MA	Slug Test: Slug Test HF1	Test Well: HF1
Test Conducted by: Mel Higgins		Test Date: 10/20/2000
Analysis Performed by: Mel Higgins	HF1 Slug Test - Bouwer & Rice	Analysis Date: 10/20/2000
Aquifer Thickness: 40.00 ft		

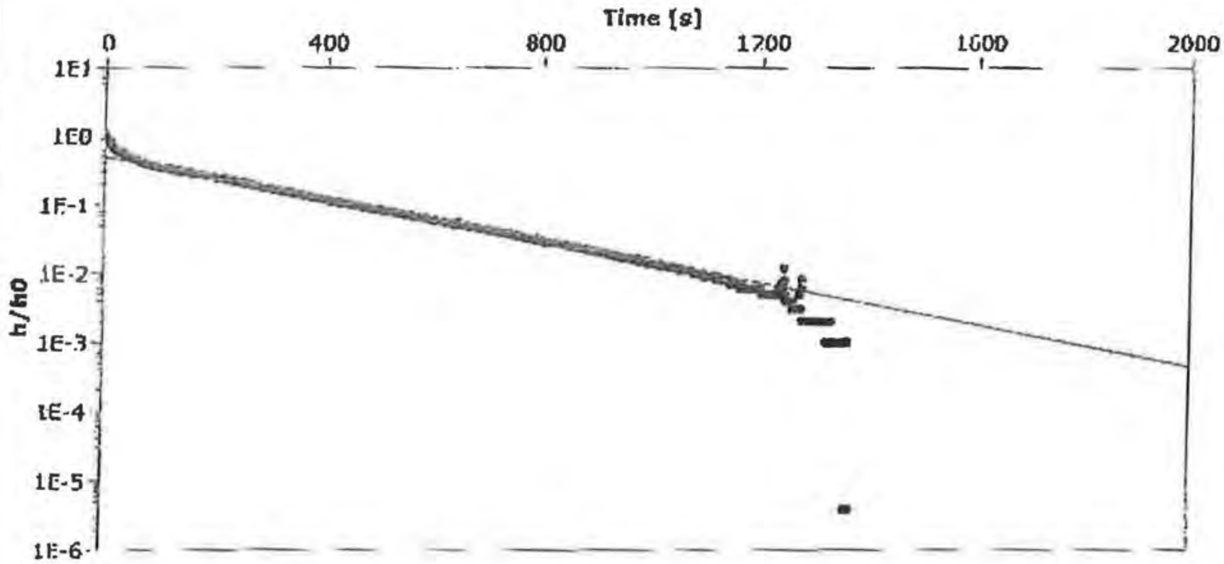


Calculation after Bouwer & Rice

Observation Well	Hydraulic Conductivity [ft/d]
HF1	8.34 × 10[illegible]

Weston & Sampson, Inc. 5 Centennial Drive Peabody, MA 01960	Slug Test Analysis Report Project: Sudbury Disposal Site Number: Client: Town of Sudbury

Location: Sudbury, MA	Slug Test: Slug Test HF3	Test Well: HF3
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	HF3 Slug Test - Hvorslev	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		

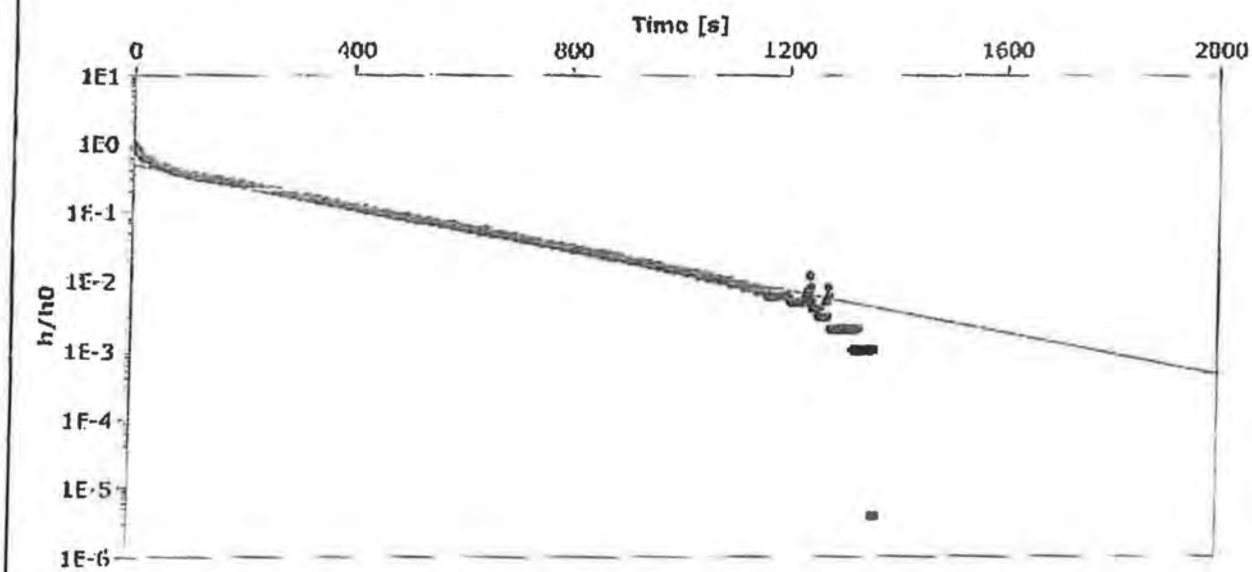


Calculation after Hvorslev

Observation Well	Hydraulic Conductivity [ft/d]
HF3	6.05×10^{-1}

Weston & Sampson, Inc. 5 Centennial Drive Peabody, MA 01960	Slug Test Analysis Report Project: Sudbury Disposal Site Number: Client: Town of Sudbury

Location: Sudbury, MA	Slug Test: Slug Test HF3	Test Well: HF3
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	HF3 Slug Test - Bouwer & Rice	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		



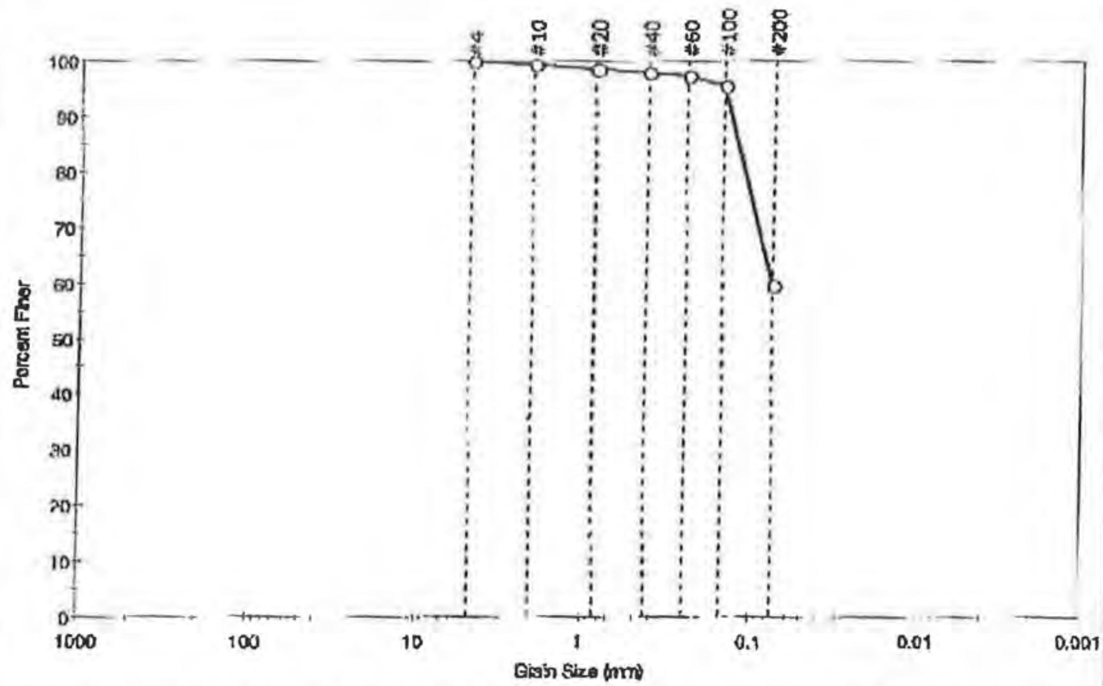
Calculation after Bouwer & Rice

Observation Well	Hydraulic Conductivity [ft/d]
HF3	6.03×10^{-1}

GeoTesting express
a subsidiary of Geocomp Corporation

Client:	Weston & Sampson Engineers				
Project:	Sudbury				
Location:	Sudbury, MA			Project No:	GTX-9619
Boring ID: B-1		Sample Type:	jar	Tested By:	jbr
Sample ID:	S-2 HF	Test Date:	01/26/10	Checked By:	jdt
Depth :	9.0-11.0 ft	Test Id:	172734		
Test Comment:	---				
Sample Description:	Moist, light olive brown sandy silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	40.6	59.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	99		
#20	0.85	99		
#40	0.42	98		
#60	0.25	97		
#100	0.15	96		
#200	0.075	59		

Coefficients

D_{85} = 0.1224 mm D_{30} = N/A
D_{60} = 0.0758 mm D_{15} = N/A
D_{50} = N/A D_{10} = N/A
C_u = N/A C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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GeoTesting express

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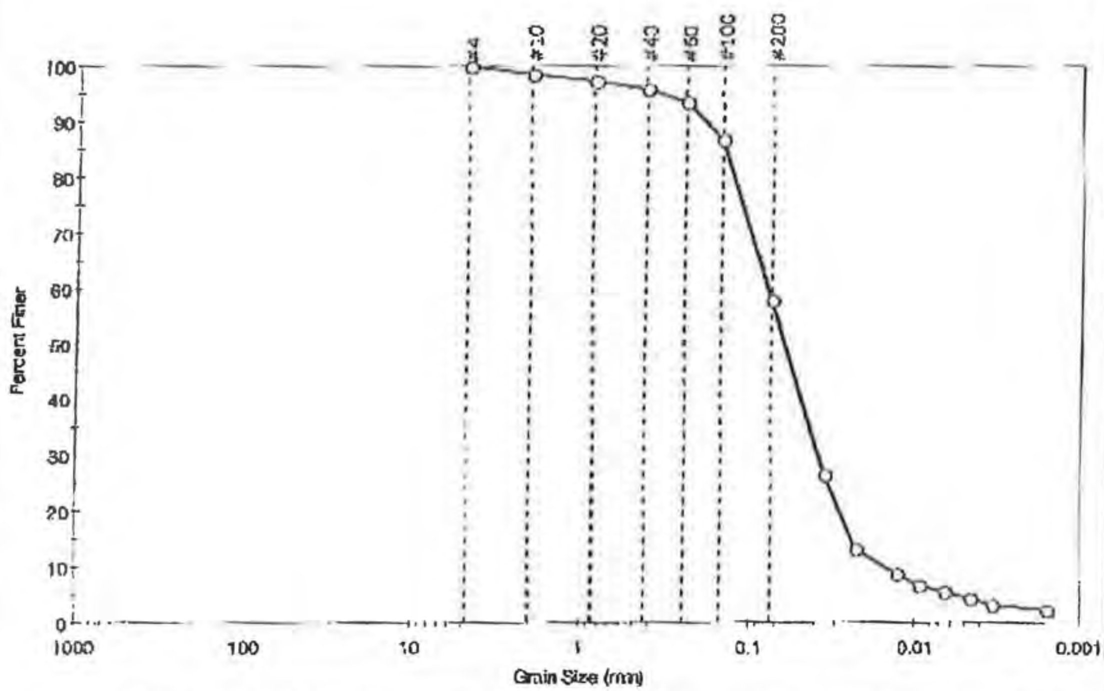
Client: Weston & Sampson Engineers				
Project: Sudbury				
Location: Sudbury, MA			Project No:	GTX-9619
Boring ID: B-3	Sample Type: jar		Tested By:	jbr
Sample ID: S-4 HF	Test Date:	01/26/10	Checked By:	jdt
Depth : 19.0-21.0 ft	Test Id:	172739		
Test Comment: ---				
Sample Description: Moist, light olive brown sandy silt				
Sample Comment: ---				

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	42.1	57.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	99		
#20	0.85	97		
#40	0.42	95		
#60	0.25	94		
#100	0.15	87		
#200	0.075	58		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0309	27		
	0.0222	13		
	0.0124	8		
	0.0095	7		
---	0.0065	5		
---	0.0046	4		
---	0.0034	3		
---	0.0016	2		

Coefficients

D_{85} = 0.1440 mm D_{30} = 0.0390 mm

D_{60} = 0.0789 mm D_{15} = 0.0243 mm

D_{50} = 0.0623 mm D_{10} = 0.0150 mm

C_u = N/A C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Weston & Sampson, Inc.
5 Centennial Drive
Peabody, MA 01960

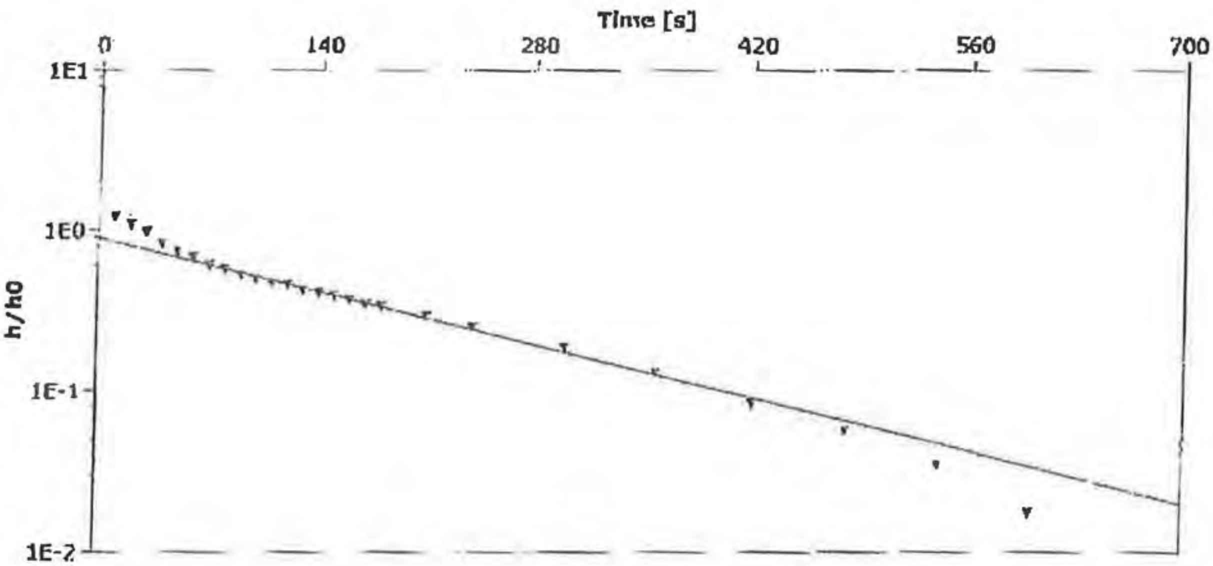
Slug Test Analysis Report

Project: Sudbury Disposal Site

Number:

Client: Town of Sudbury

Location: Sudbury, MA	Slug Test: OL1	Test Well: ol1
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	OL1 Slug Test - Bouwer & Rice	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		

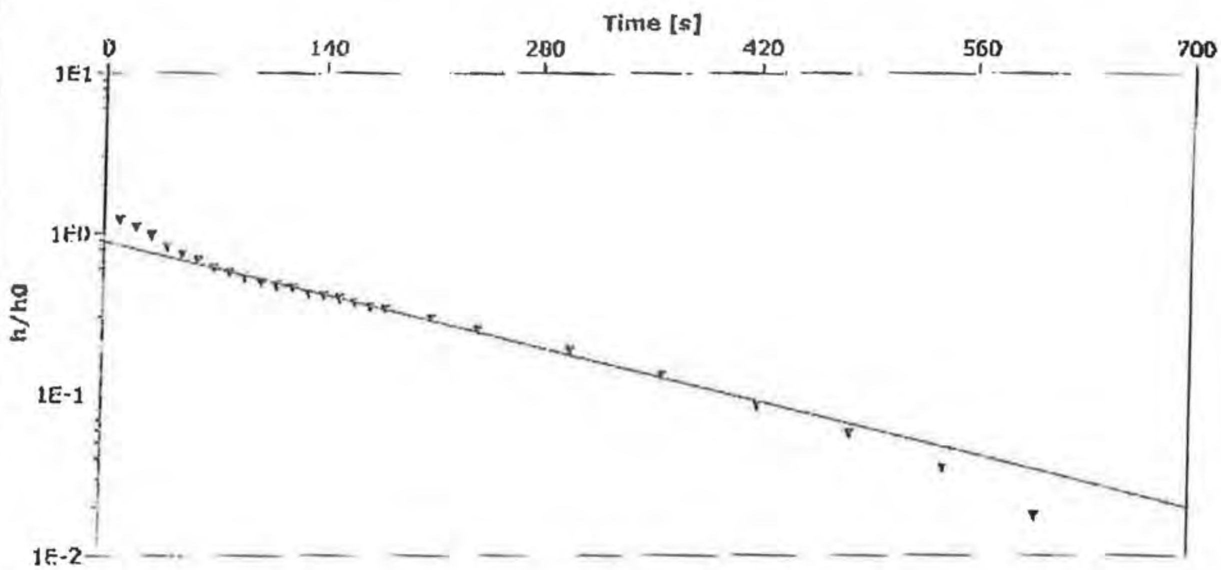


Calculation after Bouwer & Rice

Observation Well	Hydraulic Conductivity [ft/d]
ol1	1.03×10^{0}

Weston & Sampson, Inc. **5 Centennial Drive** **Peabody, MA 01960**	**Slug Test Analysis Report** Project: Sudbury Disposal Site Number: Client: Town of Sudbury

Location: Sudbury, MA	Slug Test: OL1	Test Well: ol1
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	OL1 Slug Test - Hvorslev	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		

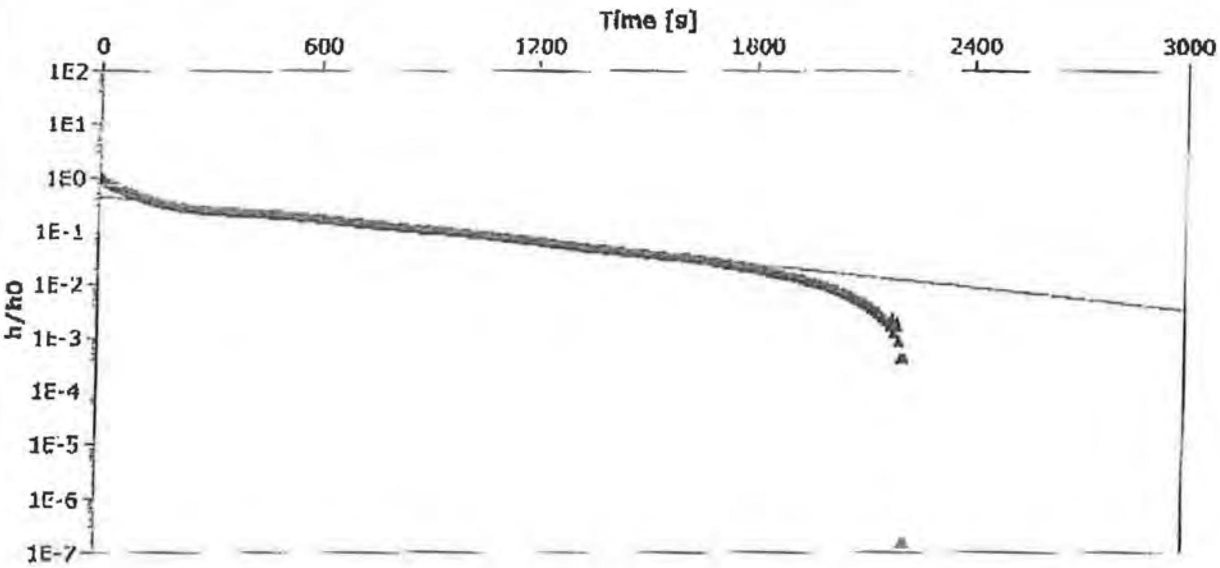


Calculation after Hvorslev

Observation Well	Hydraulic Conductivity [ft/d]	
ol1	1.34 × 10[illegible]	

Weston & Sampson, Inc. **5 Centennial Drive** **Peabody, MA 01960**	**Slug Test Analysis Report** Project: Sudbury Disposal Site Number: Client: Town of Sudbury

Location: Sudbury, MA	Slug Test: OL2	Test Well: ol2
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	OL2 Slug Test - Bouwer & Rice	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		



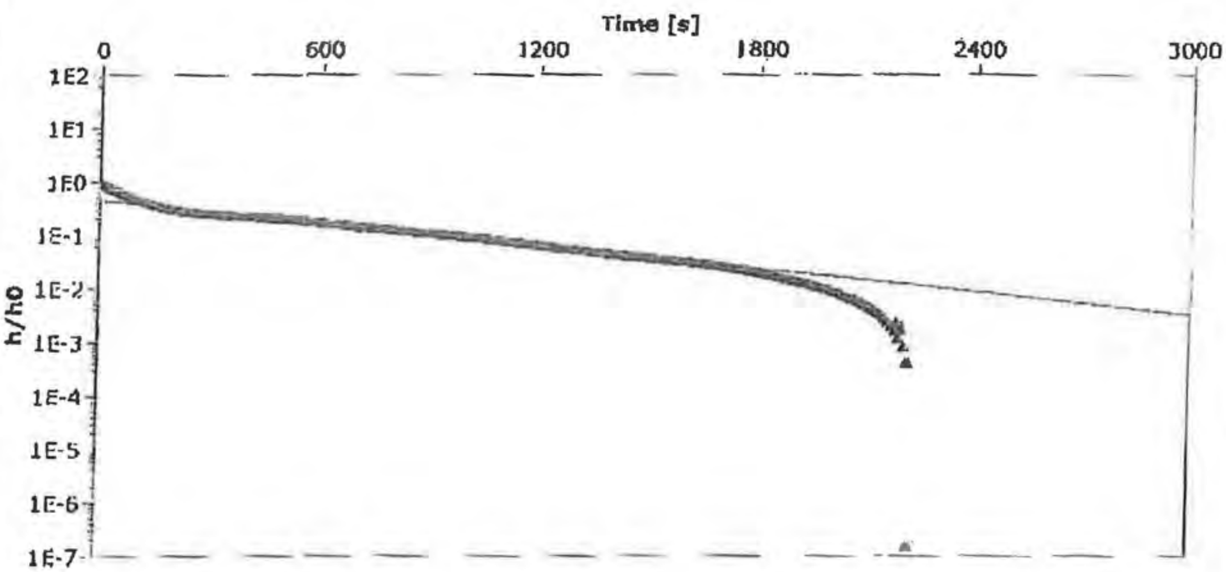
Calculation after Bouwer & Rice

Observation Well	Hydraulic Conductivity [ft/d]
ol2	3.08×10^{-1}

Weston & Sampson, Inc.
5 Centennial Drive
Peabody, MA 01960

Slug Test Analysis Report	
Project:	Sudbury Disposal Site
Number:	
Client:	Town of Sudbury

Location: Sudbury, MA	Slug Test: OL2	Test Well: ol2
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	OL2 Slug Test - Hvorslev	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		

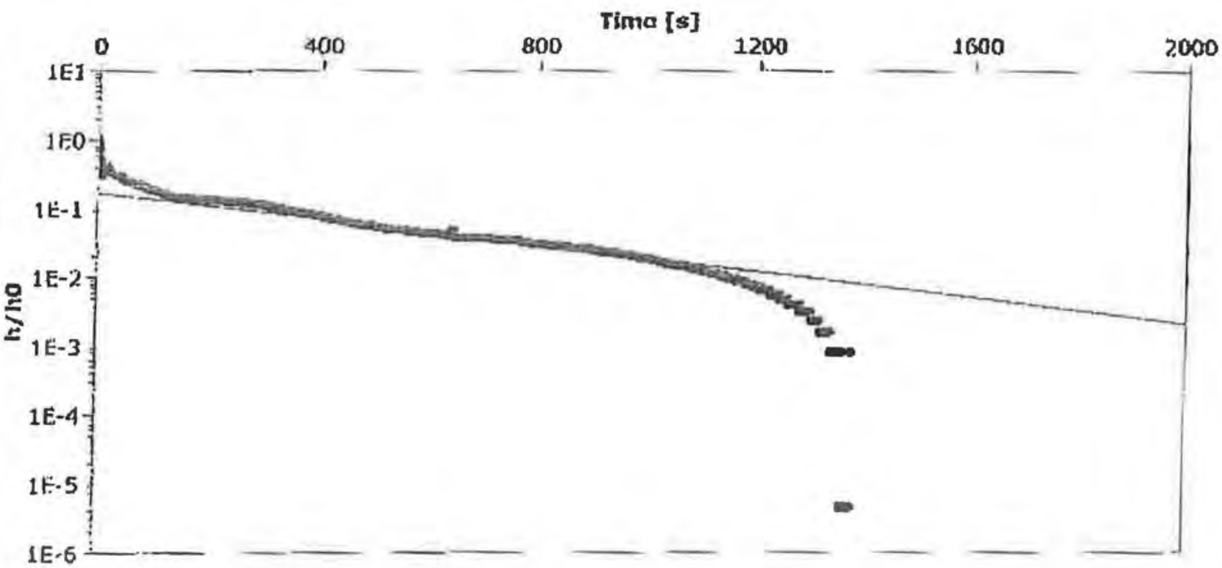


Calculation after Hvorslev

Observation Well	Hydraulic Conductivity [ft/d]
ol2	4.02×10^{-1}

Weston & Sampson, Inc. 5 Centennial Drive Peabody, MA 01960	Slug Test Analysis Report Project: Sudbury Disposal Site Number: Client: Town of Sudbury

Location: Sudbury, MA	Slug Test: OL3	Test Well: ol3
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	OL3 Slug Test - Bouwer & Rice	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		

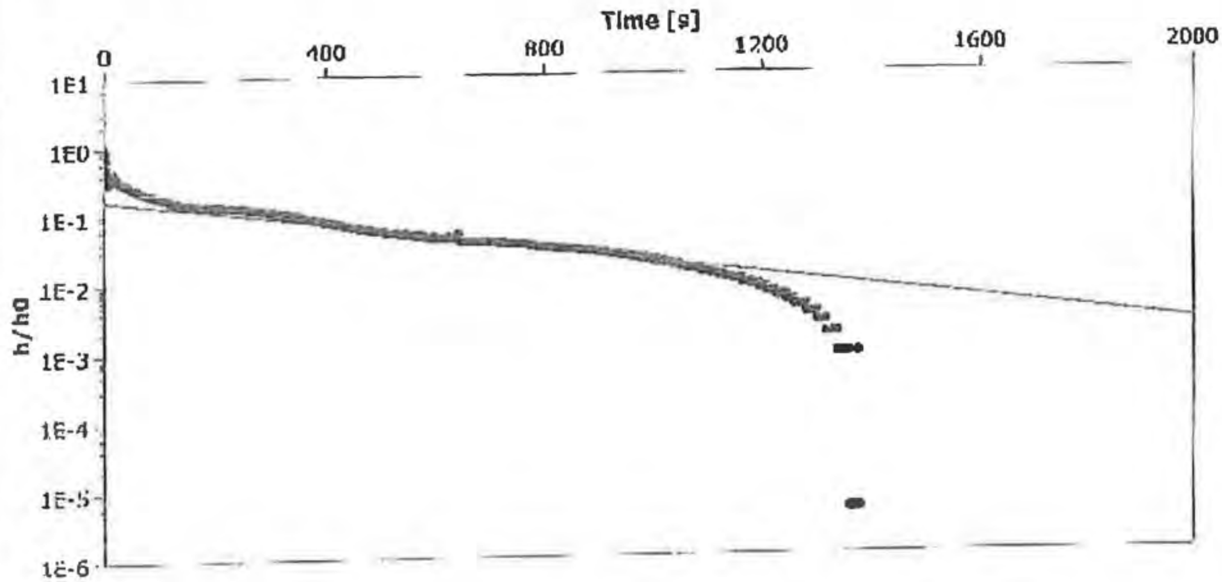


Calculation after Bouwer & Rice

Observation Well	Hydraulic Conductivity [ft/d]
ol3	4.13×10^{-1}

Weston & Sampson, Inc. 5 Centennial Drive Peabody, MA 01960	Slug Test Analysis Report Project: Sudbury Disposal Site Number: Client: Town of Sudbury

Location: Sudbury, MA	Slug Test: OL3	Test Well: ol3
Test Conducted by: Mel Higgins		Test Date: 10/20/2009
Analysis Performed by: Mel Higgins	OL3 Slug Test - Hvorslev	Analysis Date: 10/20/2009
Aquifer Thickness: 40.00 ft		



Calculation after Hvorslev

Observation Well	Hydraulic Conductivity [ft/d]
ol3	5.38×10^{-1}

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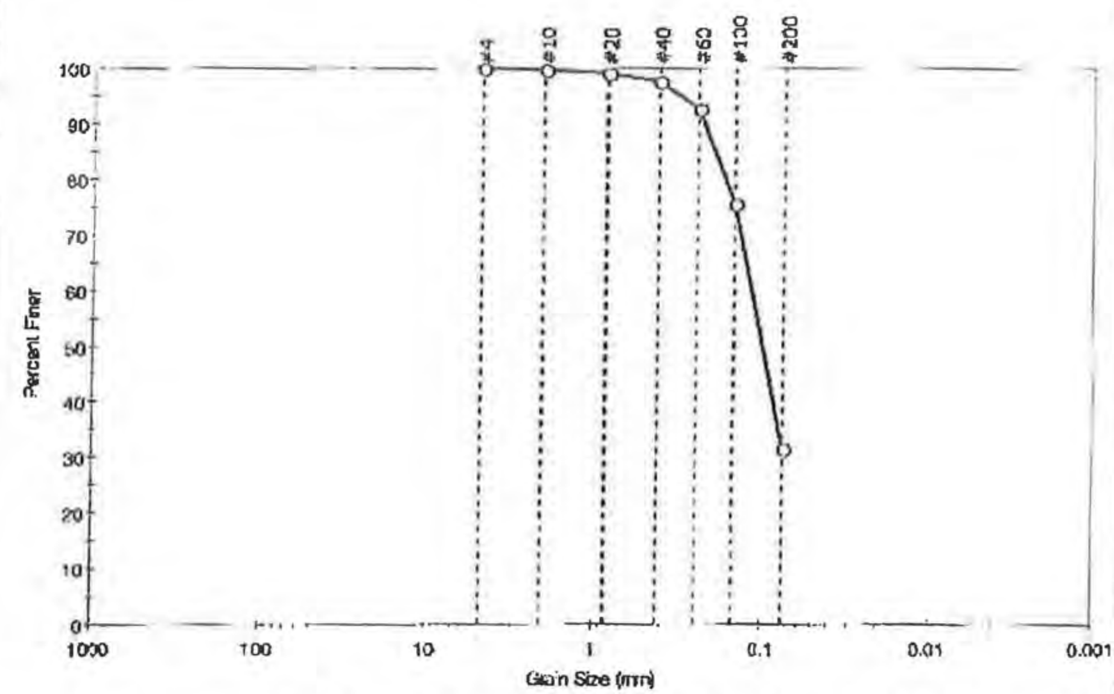
Client:	Weston & Sampson Engineers				
Project:	Sudbury				
Location:	Sudbury, MA			Project No:	GTX-9619
Boring ID:	OL-2	Sample Type:	jar	Tested By:	jbr
Sample ID:	---	Test Date:	01/26/10	Checked By:	jdt
Depth :	14.0-16.0 ft	Test Id:	172735		
Test Comment:	---				
Sample Description:	Moist, light yellowish brown silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	68.5	31.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	99		
#40	0.42	98		
#60	0.25	93		
#100	0.15	75		
#200	0.075	32		

Coefficients

D_{85} = 0.1997 mm	D_{30} = N/A
D_{60} = 0.1176 mm	D_{15} = N/A
D_{50} = 0.1005 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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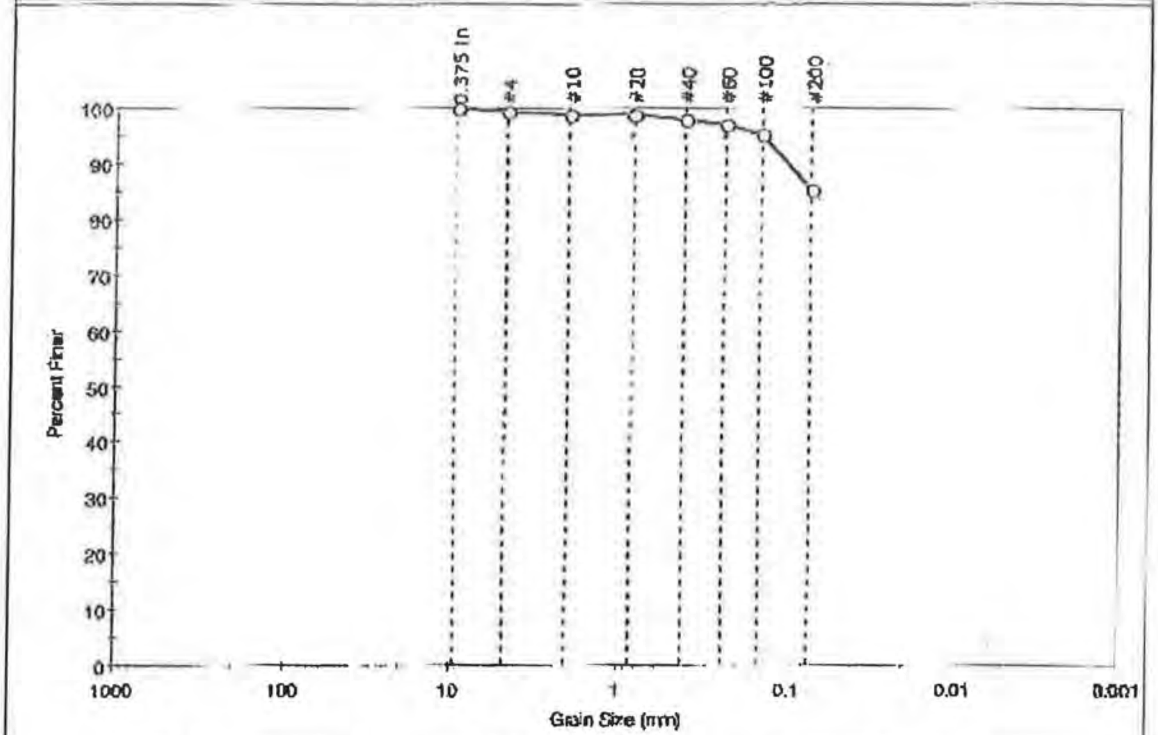
GeoTesting express
a subsidiary of Geocomp Corporation

Client: Weston & Sampson Engineers			
Project: Sudbury			
Location: Sudbury, MA		Project No:	GTX-9619
Boring ID: OL-3	Sample Type: jar	Tested By:	jbr
Sample ID: S-2	Test Date: 01/26/10	Checked By:	jdt
Depth : 9.0-11.0 ft	Test Id: 172736		
Test Comment: ---			
Sample Description: Moist, light yellowish brown silty clay			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.6	14.2	85.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	99		
#10	2.00	99		
#20	0.85	99		
#40	0.42	98		
#60	0.25	97		
#100	0.15	95		
#200	0.075	85		

Coefficients

D_{85} = N/A	D_{30} = N/A
D_{60} = N/A	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Conclusion
85% fines

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APPENDIX C

Curtis Middle School

Water Table Mounding calculated based on Hantush 1967, WRR

Enter data in green cells as per their yellow labels, other values will be computed from those entries.

Results are highlighted in pink.

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Zmax Beneath Center of Entire Drain Field (L*W)

Meters and Days	Length of Drain Field Subunit	Width of Drain Field Subunit		Separation between Drain Field Subunits	Fraction of Drain Field Subunit that is Trench Area	Horizontal Hydraulic Conductivity	Specific Yield use 0.001 to approximate steady state at 10 years	time use 10 years to approximate steady state
	L_s	W_s		Sp	f	Kh	Sy	time
	ft	ft		ft		ft/days	none	days
	320	100		6	0.33	4.00	0.15	365
	L	W	q effective in subunit is x ws	q in trenches	q' effective on LxW	Q	Zmax 12 iterations	Initial Saturated Thickness
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft
1	320	100	0.2089	0.0330	0.2089	50000	18.859	20

alpha beta

0.178313312 0.05603541

copy an entire row from above and insert copied cells above this line
to evaluate various loading rates and numbers of subunits

Water Table Rise on Side Slope

Uses Subunit Geometry and Material Properties from Zmax Table

	L	W	q effective in subunit is x ws	q in trenches	q' effective on LxW	Q l/day	Zmax 12 iterations	Distance from Center of Drain Field in Long Dimension (x in figure)	Distance from Center of Drain Field in Wide Dimension (y in figure)	Initial Saturated Thickness
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft	ft	ft
1	320	100	0.2089	0.0330	0.2089	50000	[illegible]	500	500	7

Curtis Middle School

Water Table Mounding calculated based on Hantush 1957, WRR

Enter data in green cells as per their yellow labels, other values will be computed from those entries.

Results are highlighted in pink.

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Zmax Beneath Center of Entire Drain Field (L*W)

Meters and Days	Length of Drain Field Subunit	Width of Drain Field Subunit		Separation between Drain Field Subunits	Fraction of Drain Field Subunit that is Trench Area	Horizontal Hydraulic Conductivity	Specific Yield use 0.001 to approximate steady state at 10 years	time use 10 years to approximate steady state		
	L_s	W_s		Sp	f	Kh	Sy	time		
	ft	ft		ft		ft/days	none	days		
	320	105		9	0.33	4.09	0.15	365		
	L	W	q effective in subunit is x ws	b	q' effective on LxW	Q	Zmax 12 iterations	Initial Saturated Thickness	alpha	beta
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft		
2	320	209	0.2069	0.5057	0.1958	100000	25.625	20	0.17[illegible]313312	0.117114007

copy an entire row from above and insert copied cells above this line
to evaluate various loading rates and numbers of subunits

Water Table Rise on Side Slope

Uses Subunit Geometry and Material Properties from Zmax Table

	L	W	q effective in subunit is x ws	q in trenches	q' effective on LxW	Q ft3/day	Zxx 12 iterations	Distance from Center of Drain Field in Long Dimension (x in figure)	Distance from Center of Drain Field in Wide Dimension (y in figure)	Initial Saturated Thickness
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft	ft	ft
2	320	209	0.2039	0.6057	0.1959	100000	14.745	500	500	7

Curtis Middle School

Water Table Mounding calculated based on Hantush 1967, WRR

Enter data in green cells as per their yellow labels, other values will be computed from those entries.

Results are highlighted in pink.

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Zmax Beneath Center of Entire Drain Field (L*W)									
Meters and Days	Length of Drain Field Subunit	Width of Drain Field Subunit		Separation between Drain Field Subunits	Fraction of Drain Field Subunit that is Trench Area	Horizontal Hydraulic Conductivity	Specific Yield use 0.001 to approximate steady state at 10 years	time use 10 years to approximate steady state
	L_s	w_s		Sp	f	Kh	Sy	time
	ft	ft		ft		ft/days	none	days
	320	100		0	0.33	4.09	0.15	365
	L	W	q effective in subunit ls x ws	q in trenches	q' effective on LxW	Q	Zmax 12 iterations	Initial Saturated Thickness
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft
4	427	320	0.2060	0.6500	0.1957	200000	15.583	20

0.239271201 0.175313312

copy an entire row from above and insert copied cells above this line to evaluate various loading rates and numbers of subunits

Water Table Rise on Side Slope										
Uses Subunit Geometry and Material Properties from Zmax Table										
	L	W	q effective in subunit ls x ws	q in trenches	q' effective on LxW	Q t/day	Zxy 12 iterations	Distance from Center of Drain Field in Long Dimension (x in figure)	Distance from Center of Drain Field in Wide Dimension (y in figure)	Initial Saturated Thickness
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft	ft	ft
4	427	320	0.7099	0.5930	0.1937	200000	25760	500	1500	[illegible]

Haskell Field

Water Table Mounding calculated based on Hantush 1967, WRR

Enter data in green cells as per their yellow labels, other values will be computed from those entries.

Results are highlighted in pink.

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Zmax Beneath Center of Entire Drain Field (L*W)											
Meters and Days	Length of Drain Field Subunit	Width of Drain Field Subunit		Separation between Drain Field Subunits	Fraction of Drain Field Subunit that is Trench Area	Horizontal Hydraulic Conductivity	Specific Yield use 0.001 to approximate steady state at 10 years	time use 10 years to approximate steady state		
	L_s	W_s		Sp	f	Kh	Sy	time		
	ft	ft		ft		ft/days	none	days		
	320	100		6	0.33	0.8	0.15	365		
	L	W	q effective in subunit is x ws	q in trenches	q' effective on LxW	Q	Zmax 12 iterations	Initial Saturated Thickness	alpha	beta
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft		
1	320	100	0.2089	0.0330	0.2089	50000	245.412	20	0.408164589	0.146301434

copy an entire row from above and insert copied cells above this line
to evaluate various loading rates and numbers of subunits

Water Table Rise on Side Slope Uses Subunit Geometry and Material Properties from Zmax Table										
	L	W	q effective in subunit is x ws	q in trenches	q' effective on LxW	Q ft/day	Zmax 12 iterations	Distance from Center of Drain Field in Long Dimension (x in figure)	Distance from Center of Drain Field in Wide Dimension (y in figure)	Initial Saturated Thickness
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft	ft	ft
1	320	100	0.2089	0.0330	0.2089	50000	27.812	500	500	7

Haskell Field

Water Table Mounding calculated based on Hantush 1967, WRR

Enter data in green cells as per their yellow labels, other values will be computed from those entries.

Results are highlighted in pink.

If this distan
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5

Zmax Beneath Center of Entire Drain Field (L*W)

Meters and Days	Length of Drain Field Subunit	Width of Drain Field Subunit		Separation between Drain Field Subunits	Fraction of Drain Field Subunit that is Trench Area	Horizontal Hydraulic Conductivity	Specific Yield use 0.001 to approximate steady state at 10 years	time use 10 years to approximate steady state
	l_s	w_s		Sp	f	Kh	Sy	time
	ft	ft		ft		ft/days	none	days
	320	100		6	0.33	0.5	0.15	365

Number of subunits, n	L	W	q effective in subunit is x ws	q in trenches	q' effective on LxW	Q	Zmax 12 iterations	Initial Saturated Thickness	alpha	beta
	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft		
2	320	200	0.2069	0.6146	0.2028	100000	[illegible]	20	0.458104589	0.301350954

copy an entire row from above and insert copied cells above this line
to evaluate various loading rates and numbers of subunits

Water Table Rise on Side Slope

Uses Subunit Geometry and Material Properties from Zmax Table

Number of subunits, n	L	W	q effective in subunit is x ws	q in trenches	q' effective on LxW	Q l/day	Zmax 12 iterations	Distance from Center of Drain Field in Long Dimension (x in figure)	Distance from Center of Drain Field in Wide Dimension (y in figure)	Initial Saturated Thickness
	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft	ft	ft
2	320	200	0.2069	0.6145	0.2028	100000	[illegible]	500	500	7

Haskell Field

Water Table Mounding calculated based on Hantush 1967, WRR

Enter data in green cells as per their yellow labels, other values will be computed from those entries.

Results are highlighted in pink.

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Zmax Beneath Center of Entire Drain Field (L*W)

Meters and Days	Length of Drain Field Subunit	Width of Drain Field Subunit		Separation between Drain Field Subunits	Fraction of Drain Field Subunit that is Trench Area	Horizontal Hydraulic Conductivity	Specific Yield use 0.001 to approximate steady state at 10 years	time use 10 years to approximate steady state
	l_s	w_s		Sp	f	Kh	Sy	time
	ft	ft		ft		ft/days	none	days
	320	100		6	0.33	0.6	0.15	365

	L	W	q effective in subunit is x ws	q in trenches	q' effective on LxW	Q	Zmax 12 iterations	Initial Saturated Thickness	alpha	beta
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft		
4	418	320	0.2089	0.0057	0.1999	200000	[illegible]2.012	20	0.611539994	0.458104569

copy an entire row from above and insert copied cells above this line
to evaluate various loading rates and numbers of subunits

Water Table Rise on Side Slope

Uses Subunit Geometry and Material Properties from Zmax Table

	L	W	q effective in subunit is x ws	q in trenches	q' effective on LxW	Q l/day	Zmax 12 iterations	Distance from Center of Drain Field in Long Dimension (x in figure)	Distance from Center of Drain Field in Wide Dimension (y in figure)	Initial Saturated Thickness
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft	ft	ft
4	418	320	0.2088	0.0057	0.1999	200000	[illegible]2.180	500	500	7

Old Lancaster

Water Table Mounding calculated based on Hantush 1967, WRR

Enter data in green cells as per their yellow labels, other values will be computed from those entries.

Results are highlighted in pink.

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then it is ove
otherwise it

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Zmax Beneath Center of Entire Drain Field (L*W)

Meters and Days	Length of Drain Field Subunit	Width of Drain Field Subunit		Separation between Drain Field Subunits	Fraction of Drain Field Subunit that is Trench Area	Horizontal Hydraulic Conductivity	Specific Yield use 0.001 to approximate steady state at 10 years	time use 10 years to approximate steady state		
	L_s	W_s		Sp	f	Kh	Sy	time		
	ft	ft		ft		ft/days	none	days		
	320	100		6	0.33	1.2	0.15	365		
	L	W	q effective in subunit is x ws	q in trenches	q' effective on LxW	Q	Zmax 12 iterations	Initial Saturated Thickness	alpha	beta
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft		
1	320	100	0.2089	0.0330	0.2059	50000	[illegible]	20	0.331042355	0.103450739

copy an entire row from above and insert copied cells above this line
to evaluate various loading rates and numbers of subunits

Water Table Rise on Side Slope

Uses Subunit Geometry and Material Properties from Zmax Table

	L	W	q effective in subunit is x ws	q in trenches	q' effective on LxW	Q ft/day	Zmax 12 iterations	Distance from Center of Drain Field in Long Dimension (x in figure)	Distance from Center of Drain Field in Wide Dimension (y in figure)	Initial Saturated Thickness
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft	ft	ft
1	320	100	0.2069	0.0330	0.2069	50000	[illegible]	500	500	7

Old Lancaster

Water Table Mounding calculated based on Hantush 1967, WRR

Enter data in green cells as per their yellow labels, other values will be computed from those entries.

Results are highlighted in pink.

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Zmax Beneath Center of Entire Drain Field (L*W)											
Meters and Days	Length of Drain Field Subunit	Width of Drain Field Subunit		Separation between Drain Field Subunits	Fraction of Drain Field Subunit that is Trench Area	Horizontal Hydraulic Conductivity	Specific Yield use 0.001 to approximate steady state at 10 years	time use 10 years to approximate steady state			
	l_s	w_s		Sp	f	Kh	Sy	time			
	ft	ft		ft		ft/days	none	days			
	320	100		6	0.33	1.2	0.15	365			
	L	W	q effective in subunit is x ws	q in trenches	q' effective on LxW	Q	Zmax 12 iterations	Initial Saturated Thickness			
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft	alpha	beta	
2	320	206	0.2059	0.0146	0.2028	100000	27.432	20	0.331042356	0.213108516	

copy an entire row from above and insert copied cells above this line
to evaluate various loading rates and numbers of subunits

Water Table Rise on Side Slope Uses Subunit Geometry and Material Properties from Zmax Table										
	L	W	q effective in subunit is x ws	q in trenches	q' effective on LxW	Q /day	Zmax 12 iterations	Distance from Center of Drain Field in Long Dimension (x in figure)	Distance from Center of Drain Field in Wide Dimension (y in figure)	Initial Saturated Thickness
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft	ft	ft
2	320	205	0.2059	0.0146	0.2028	100000	27.325	500	500	7

Old Lancaster

Water Table Mounding calculated based on Hantush 1967, WRR

Enter data in green cells as per their yellow labels, other values will be computed from those entries.

Results are highlighted in pink.

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Zmax Beneath Center of Entire Drain Field (L*W)

Meters and Days	Length of Drain Field Subunit	Width of Drain Field Subunit		Separation between Drain Field Subunits	Fraction of Drain Field Subunit that is Trench Area	Horizontal Hydraulic Conductivity	Specific Yield use 0.001 to approximate steady state at 10 years	time use 10 years to approximate steady state		
	l_s	w_s		Sp	f	Kh	Sy	time		
	ft	ft		ft		ft/days	none	days		
	320	100		8	0.33	1.2	0.15	365		
	L	W	q effective in subunit is x ws	q in trenches	q' effective on LxW	Q	Zmax 12 iterations	Initial Saturated Thickness		
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft	alpha	beta
4	418	320	0.2069	0.0057	0.1000	200000	55.545	20	0.432424077	0.331042355

copy an entire row from above and insert copied cells above this line
to evaluate various loading rates and numbers of subunits

Water Table Rise on Side Slope

Uses Subunit Geometry and Material Properties from Zmax Table

	L	W	q effective in subunit is x ws	q in trenches	q' effective on LxW	Q l/day	Zsx 12 iterations	Distance from Center of Drain Field in Long Dimension (x in figure)	Distance from Center of Drain Field in Wide Dimension (y in figure)	Initial Saturated Thickness
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft	ft	ft
4	418	320	0.2059	0.0057	0.1999	202000	43.529	500	530	7

Attachment B

Curtis Middle School Preliminary Site Screening
November 3, 2009

INTEROFFICE MEMORANDUM

TO: BLAKE MARTIN

FROM: MEL HIGGINS

SUBJECT: SUDBURY – CURTIS MIDDLE SCHOOL SITE SCREENING

DATE: NOVEMBER 3, 2009

CC:

1.0 INTRODUCTION

This report documents the feasibility study for underground wastewater disposal conducted at the Curtis Middle School site, located off of Pratts Mill Road in Sudbury, Massachusetts (**Figure 1**). This study was performed in accordance with the Weston & Sampson proposal dated July 2009. The purpose of the study was to conduct a preliminary desk top site screening using MassGIS data to evaluate the site (**Figure 2**) for wastewater disposal.

2.0 REGIONAL SURVEY

A site screening was conducted to identify probable environmental and ecological receptors within the Old Lancaster Road site. The screening was conducted using data available from MassGIS within ArcGIS.

2.1 PUBLIC WATER SUPPLY WELLS

A review of MassGIS data (updated to July 2009) indicates there are three public water supply wells located within 1-mile of the site (**Figure 3**). These wells, named GP#10, GP#8 and GP#3, are owned by the Town of Sudbury and are located 439, 550 and 1,150 feet north and north-west of the site, respectively. The northern half of the Curtis Middle School site contains the southern extent of the Zone II protection area associated with these wells. There is also a Zone II located 1,650 feet south of the site that is associated with other Sudbury production wells that are to the south of the site and outside of the 1-mile radius .

2.2 SURFACE WATER BODIES AND WATER TABLE

Hop Brook is located approximately 550 feet east of the site and runs in a southerly direction. Dudley Brook flows in an easterly direction roughly 1,580 feet south of the site and joins Hop Brook approximately 1,710 feet south east of the site, with the two continuing to flow in a southerly direction.

2.3 ENVIRONMENTAL RECEPTORS

Based on 1:12,000 scale mapping provided by MassGIS and Massachusetts Department of Environmental Protection (DEP) (**Figure 3**), there are several wetland resource areas mapped near the site, with the closest being 150 feet north of the property boundary. A large wetlands resource area associated with Hop Brook is approximately 400 feet north-east of the site. This wetland area is described by MassGIS as being wooded marsh. There is also a 100-year flood zone associated with Hop Brook that is approximately 400 feet north-east of the site.

There are a number of potential vernal pools within the 1-mile radius of the site, with the closest being approximately 130 feet outside of the site boundary.

The Natural Heritage and Endangered Species Program (NHESP) mapping, updated October 2008, was reviewed for priority habitats of rare species, estimated habitats of rare wildlife, and certified vernal pools. Based on review of the referenced maps and data, there are neither Estimated Habitat of Rare Wildlife areas, Priority Habitat of Rare Species areas nor certified vernal pools mapped within the project property boundaries (**Figure 3**). There are Estimated Habitat of Rare Wildlife areas and Priority Habitat of Rare Species mapped within the 1-mile radius, roughly 3,930 feet from the site boundary.

2.4 GEOLOGIC INTERPRETATION

The surficial deposits throughout the area are mapped as sand and gravel with thicknesses between 50-100 feet (**Figure 4**)

2.5 SOILS

Soil GIS data obtained from MassGIS (last updated October 2008) were mapped to characterize the soils at the site. As illustrated in **Figure 4**, there are two major soil groups within the project property area. The soil types are summarized in Table 1.

Table 1: Soil Survey Characteristics

Soil Symbol	Soil Name and Characteristics
(255A)	Windsor sandy loam, 0 to 3 percent slopes
(656)	Udorthents, urban land complex

The majority of the site is located on Windsor sandy loam. These soils are noted by the USDA soil survey as having rapid or very rapid permeability throughout. The soils survey notes that these soils have few limitations for development.

The playing fields, on the southern half of the site, are located on Udorthents, urban land complex soils. Areas containing these soils have normally been cut to a depth of 2 feet or more or are on areas that have more than 2 feet of fill on them. The permeability of these areas is variable and would require on-site investigation to verify permeability.

2.5 POTENTIAL CONTAMINATION SOURCES

A number of databases were searched in GIS when looking for potential contamination sources within a 1-mile radius of the site. These databases contained information on the following:

- Tier I or Tier II sites
- Solid waste facilities
- Underground storage tanks
- MA DEP BWP major facilities, including
    - Type II groundwater discharge permit

- Type II surface water discharge permit
- Large quantity toxic users
- Large quantity generators
- Hazardous waster recyclers
- Hazardous waste treatment/storage/disposal sites

Only underground storage tanks (USTs) were located within a 1-mile radius of the site. There is one UST within the 1-mile radius. This UST is located approximately 2,500 feet south east of the site.

O:\Sudbury\WW Disposal Site Eval\120 reports - presentations\Environmental Screenings\Curtis Middle School\curtis middle school site screening.doc

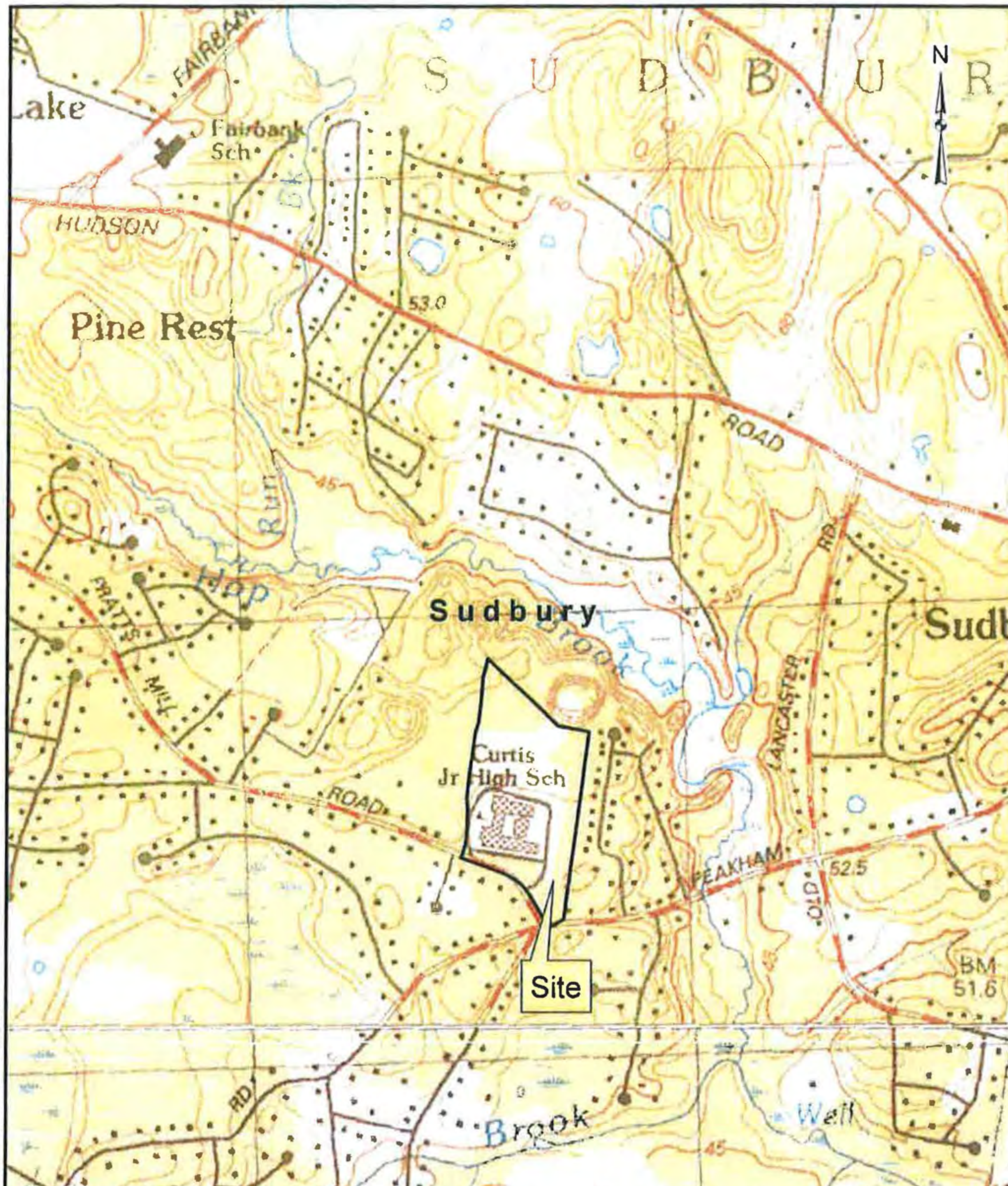


FIGURE 1
SUDBURY SUBSURFACE DISPOSAL CAPACITY
CURTIS MIDDLE SCHOOL

LOCUS

Curtis Middle School Property

1,000 0 1,000
SCALE IN FEET

Weston&Sampson.

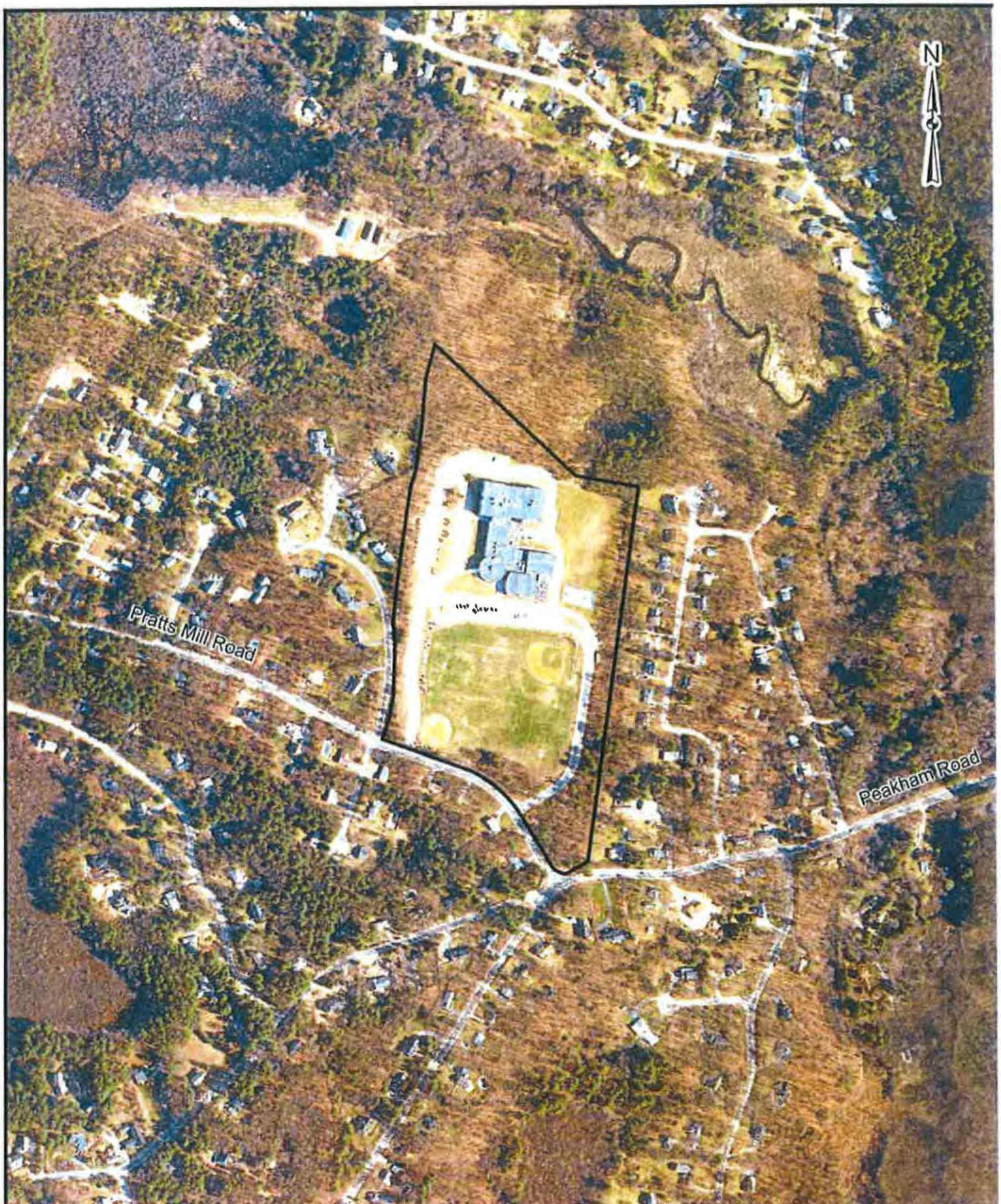


FIGURE 2
SUDBURY SUBSURFACE DISPOSAL CAPACITY
CURTIS MIDDLE SCHOOL

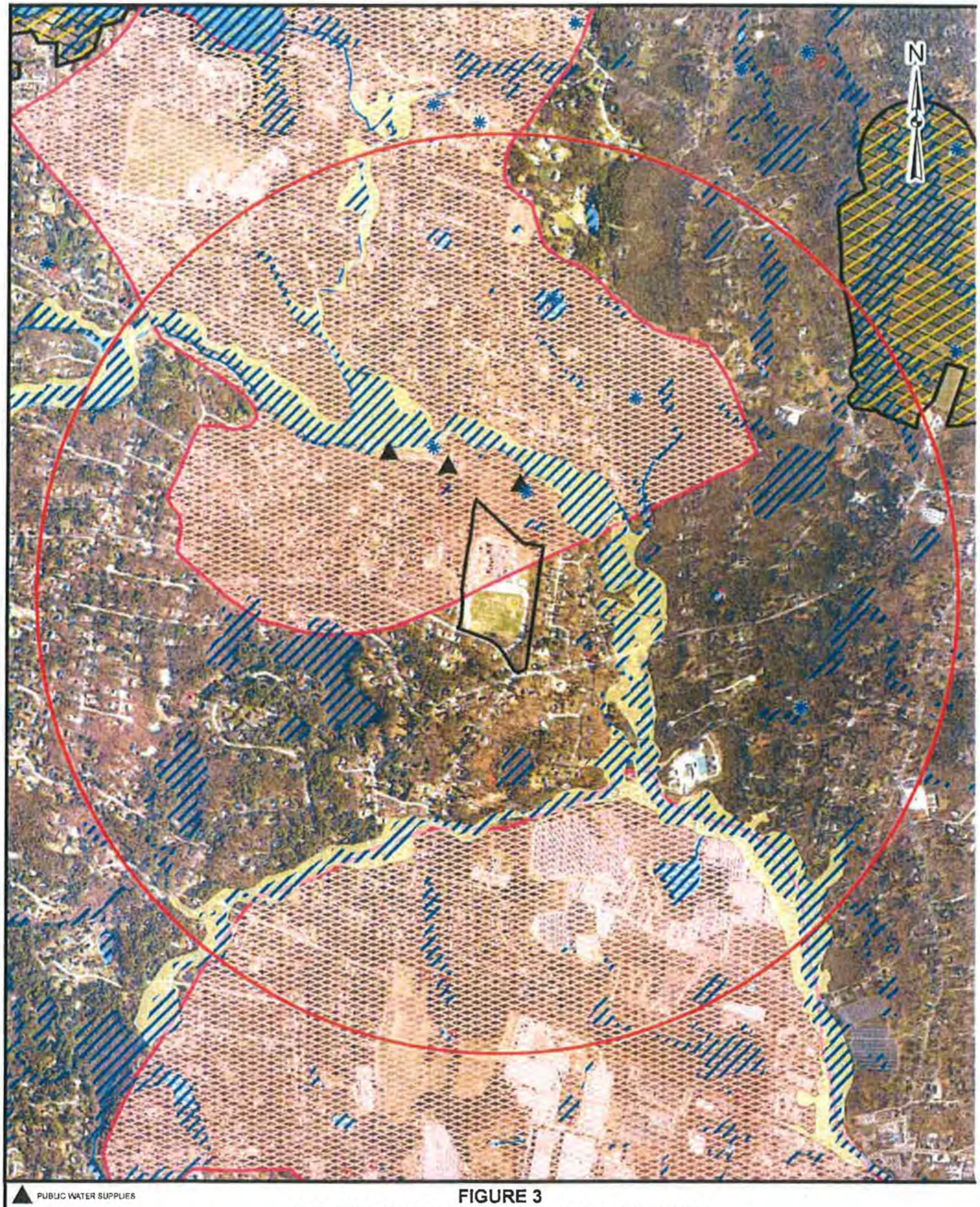
SITE MAP

Curtis Middle School Property

500 0 500

SCALE IN FEET

Weston&Sampson



PUBLIC WATER SUPPLIES
NHESP Certified Vernal Pools
Potential Vernal Pools
Perennial Stream
Pond, Lake, Ocean
1 Mile Radius
Curtis Middle School Property
DEP Wetlands (1:12,000)
DEP Approved Zone IIs
NHESP Priority Habitats of Rare Species
NHESP Estimated Habitats of Rare Wildlife

FIGURE 3
SUDBURY SUBSURFACE DISPOSAL CAPACITY
CURTIS MIDDLE SCHOOL

ENVIRONMENTAL/HUMAN CONSTRAINTS

1,500 0 1,500

SCALE IN FEET

Weston&Sampson

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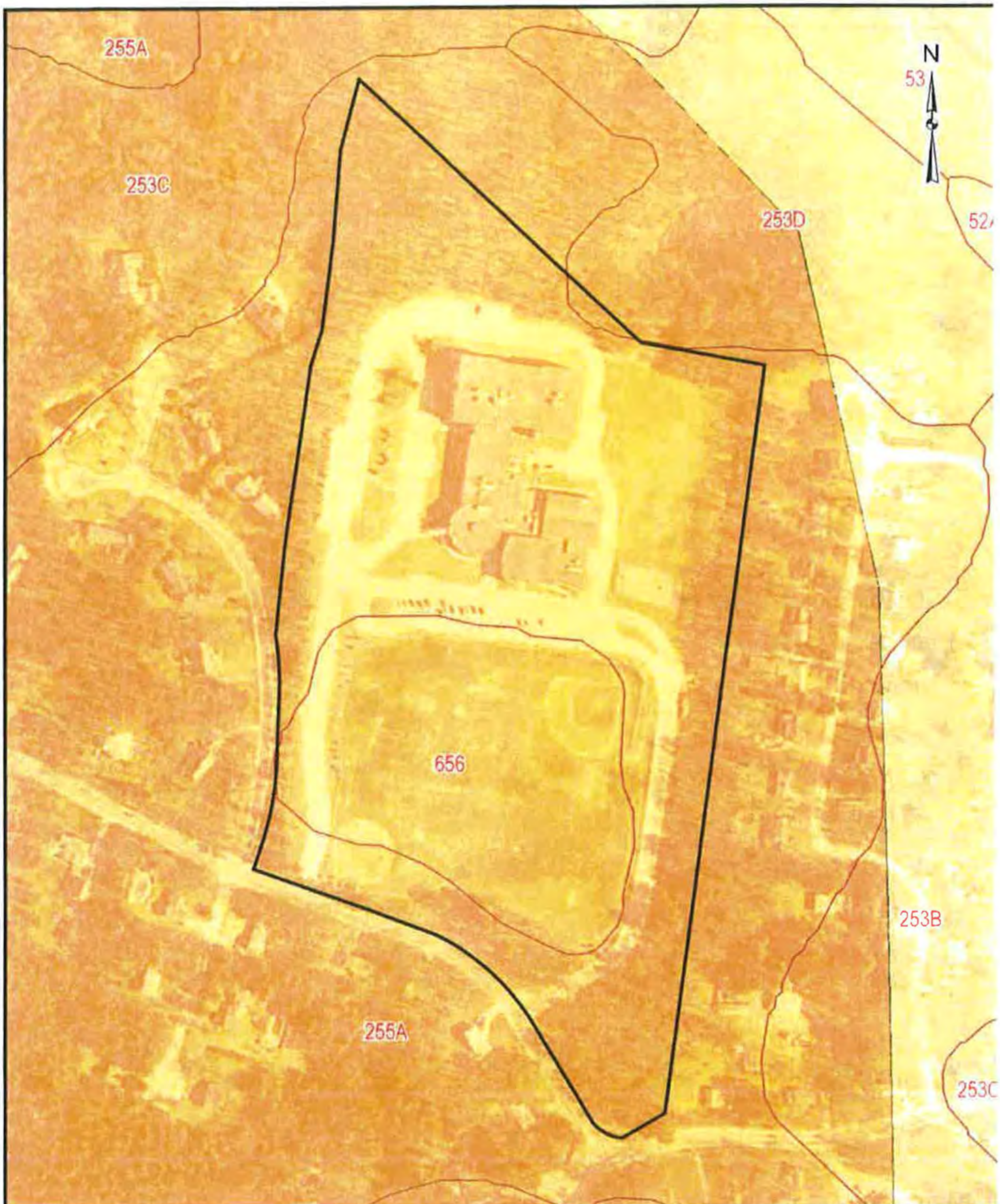


FIGURE 4
SUDBURY SUBSURFACE DISPOSAL CAPACITY
CURTIS MIDDLE SCHOOL

Curtis Middle School Property
Soils
Sand and Gravel, Depth In Feet
0-50
50-100

SOILS AND SURFICIAL GEOLOGY

250 0 250
SCALE IN FEET

Weston&Sampson.

FIGURE 5
SUDBURY SUBSURFACE DISPOSAL CAPACITY
CURTIS MIDDLE SCHOOL

POTENTIAL CONTAMINATION SOURCES

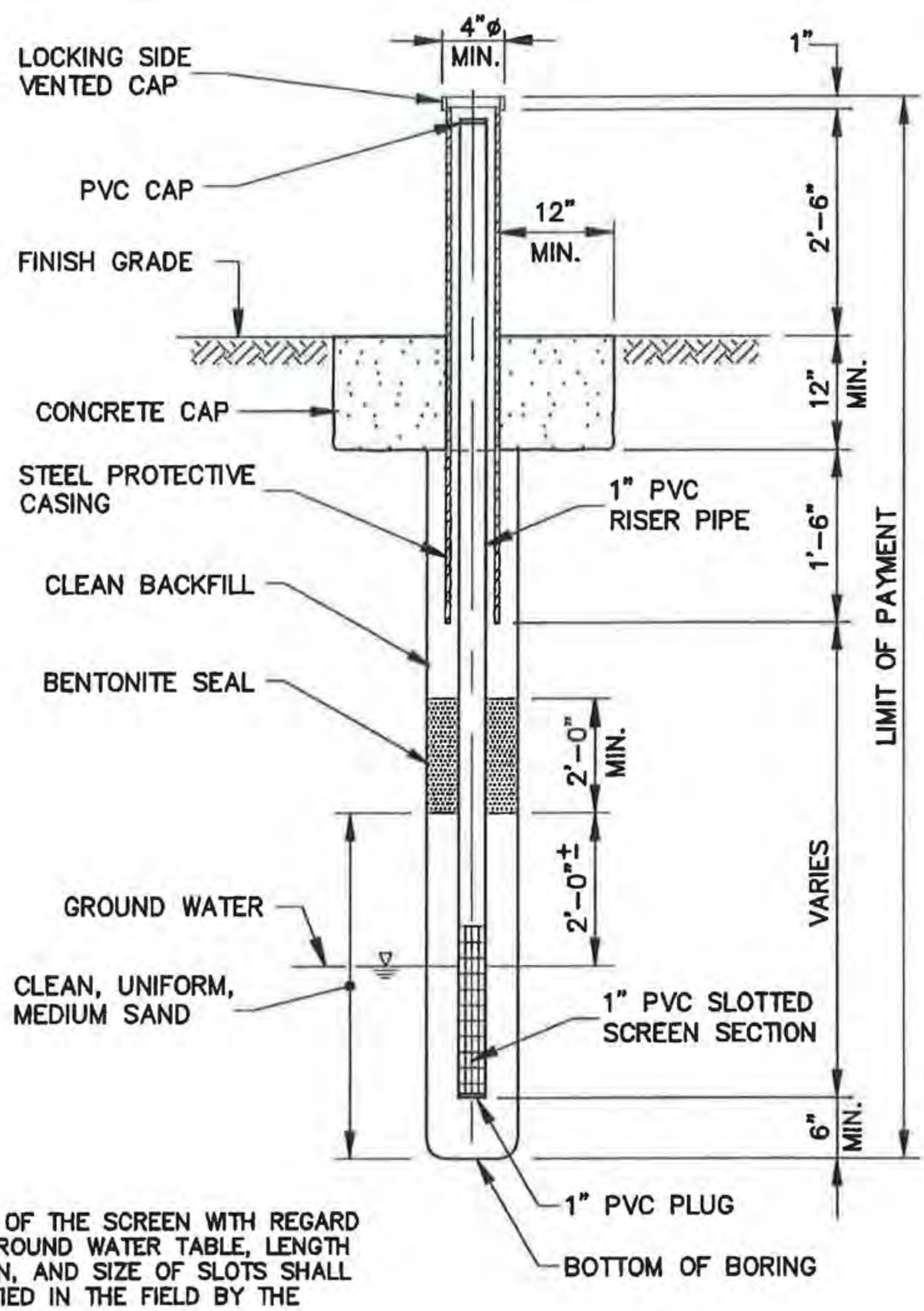
All Underground Storage Tanks
1 Mile Radius
Curtis Middle School Property

1,500 0 1,500
SCALE IN FEET

Weston&Sampson

Attachment C

Well Construction Detail



NOTE:
1. LOCATION OF THE SCREEN WITH REGARD TO THE GROUND WATER TABLE, LENGTH OF SCREEN, AND SIZE OF SLOTS SHALL BE SPECIFIED IN THE FIELD BY THE ENGINEER.

2. FINISH GRADE TO BE MODIFIED TO MEET OWNERS REQUIREMENT.

EXAMPLE
1" MONITORING WELL
NOT TO SCALE

O:\Sudbury\WW Disposal Site Eval\120 reports - presentations\1 Inch Monitoring Well.dwg

Weston & Sampson *ENGINEERS, INC.*	PROJECT Sudbury - Curtis Middle School	REPORT OF BORING No. Well A SHEET 1 OF 2 Project No. 2100403.B CHKD BY

BORING Co. NH Boring/Drillex
FOREMAN
WSE GEOLOGIST: B. Martin

BORING LOCATION
GROUND SURFACE ELEV. DATUM
DATE START November 2010 DATE END

SAMPLER: geoprobe - macro core sampler
CASING:
CASING SIZE: OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (feet)	CASING (lb/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
0.5							Loam		
							Const. fill, silt, cobbles		
3.5							Cobbles, demilition debris, fine fravel		
5							Coarse sand and gravel, compacted clay at 6', some fine sand, little silt		
10							Fine-med. Sand, <5% silt, organic layer at 13'2", fine-med. sand		
15							Medium-coarse sand, <2% silt		
20							Medium - coarse sand, 10-15% silt		
25							Fine - medium coarse sand, fine gravel, <2% silt		
30							Medium coarse sand, fine gravel, occasional cobble		
35									

GRANULAR SOILS		COHESIVE SOILS		REMARKS:
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. Well A

Weston & Sampson *ENGINEERS, INC.*	PROJECT Sudbury - Curtis Middle School	REPORT OF BORING No. Well A; SHEET 2 OF 2; Project No. 2100403.B; CHKD BY

BORING Co. NH Boring/Drillex	BORING LOCATION
FOREMAN	GROUND SURFACE ELEV. DATUM
WSE GEOLOGIST: B. Martin	DATE START November 2010 DATE END

SAMPLER: geoprobe - macro core sampler

CASING:

CASING SIZE: OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (feet)	CASING (lb/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
							coarse sand and fine gravel		
40									
45									
50									
51									
							extensive fine silt with < 2% sand		
55									
58									boring terminated at 58'
60									
65									
70									

GRANULAR SOILS		COHESIVE SOILS		REMARKS:
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. Well A

Weston & Sampson ENGINEERS, INC.	PROJECT Sudbury - Curtis Middle School	REPORT OF BORING No. Well B; SHEET 1 OF 2; Project No. 2100403.B; CHKD BY

BORING Co. NH Boring/Drillex
FOREMAN
WSE GEOLOGIST: B. Martin

BORING LOCATION
GROUND SURFACE ELEV. DATUM
DATE START November 2010 DATE END

SAMPLER: geoprobe - macro core sampler
CASING:
CASING SIZE: OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (feet)	CASING (lb/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
0.5							Loam		
							Const. fill, silt, cobbles		
3.5							Cobbles, demilition debris, fine fravel		
5							Coarse sand and gravel, compacted clay at 6', some fine sand, little silt		
10							Fine-med. Sand, <5% silt, organic layer at 13'2", fine-med. sand		
15							Medium-coarse sand, <2% silt		
20							Medium - coarse sand, 10-15% silt		
25							Fine - medium coarse sand, fine gravel, <2% silt		
30							Medium coarse sand, fine gravel, occasional cobble		
35									

GRANULAR SOILS BLOWS/FT	DENSITY	COHESIVE SOILS BLOWS/FT	DENSITY	REMARKS:

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. Well B

Weston & Sampson ENGINEERS, INC.	PROJECT Sudbury - Curtis Middle School	REPORT OF BORING No. Well B SHEET 2 OF 2 Project No. 2100403.B CHKD BY

BORING Co. NH Boring/Drillex
FOREMAN
WSE GEOLOGIST: B. Martin

BORING LOCATION
GROUND SURFACE ELEV. DATUM
DATE START November 2010 DATE END

SAMPLER: geoprobe - macro core sampler

CASING:

CASING SIZE: OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (feet)	CASING (lb/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
							coarse sand and fine gravel		
40									
45									
50									
51									
							extensive fine silt with < 2% sand		
55									
58									boring terminated at 58'
60									
65									
70									

GRANULAR SOILS		COHESIVE SOILS		REMARKS:
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. Well B

Weston & Sampson *ENGINEERS, INC.*	PROJECT Sudbury - Curtis Middle School	REPORT OF BORING No. Well C SHEET 1 OF 2 Project No. 2100403.B CHKD BY

BORING Co. NH Boring/Drillex
FOREMAN
WSE GEOLOGIST: B. Martin

BORING LOCATION
GROUND SURFACE ELEV. DATUM
DATE START November 2010 DATE END

SAMPLER: geoprobe - macro core sampler
CASING:
CASING SIZE: OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (feet)	CASING (lb/ft)	SAMPLE No.	SAMPLE PEN/REC (in)	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
0.5							Loam		
							Const. fill, silt, cobbles		
3.5							Cobbles, demilition debris, fine fravel		
5							Coarse sand and gravel, compacted clay at 6', some fine sand, little silt		
10							Fine-med. Sand, <5% silt, organic layer at 13'2", fine-med. sand		
15							Medium-coarse sand, <2% silt		
20							Medium - coarse sand, 10-15% silt		
25							Fine - medium coarse sand, fine gravel, <2% silt		
30							Medium coarse sand, fine gravel, occasional cobble		
35									

GRANULAR SOILS BLOWS/FT	GRANULAR SOILS DENSITY	COHESIVE SOILS BLOWS/FT	COHESIVE SOILS DENSITY	REMARKS:

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. Well C

Weston & Sampson ENGINEERS, INC.	PROJECT: Sudbury - Curtis Middle School	REPORT OF BORING No. Well C
		SHEET 2 OF 2
		Project No. 2100403.B
		CHKD BY

BORING Co. NH Boring/Drillex
FOREMAN
WSE GEOLOGIST: B. Martin

BORING LOCATION
GROUND SURFACE ELEV. DATUM
DATE START November 2010 DATE END

SAMPLER: geoprobe - macro core sampler

CASING:

CASING SIZE: OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (feet)	CASING (lb/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
							coarse sand and fine gravel		
40									
							Extremely coarse gravel, pebbles 5% silt		
45									
50									
55							Silt with fine sand		
60									
65									
70									**Boring terminated at 65'**

GRANULAR SOILS		COHESIVE SOILS		REMARKS:
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. Well C

Weston & Sampson *ENGINEERS, INC.*	PROJECT	REPORT OF BORING No. Well C1
	Sudbury - Curtis Middle School	SHEET 1 OF 2
		Project No. 2100403.B
		CHKD BY

BORING Co. NH Boring/Drillex
FOREMAN
WSE GEOLOGIST: B. Martin

BORING LOCATION
GROUND SURFACE ELEV. DATUM
DATE START November 2010 DATE END

SAMPLER: geoprobe - macro core sampler

CASING:

CASING SIZE: OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (feet)	CASING (lb/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
0.5							Loam		
							Const. fill, silt, cobbles		
3.5							Cobbles, demilition debris, fine fravel		
5							Coarse sand and gravel, compacted clay at 6', some fine sand, little silt		
10							Fine-med. Sand, <5% silt, organic layer at 13'2", fine-med. sand		
15							Medium-coarse sand, <2% silt		
20							Medium - coarse sand, 10-15% silt		
25							Fine - medium coarse sand, fine gravel, <2% silt		
30							Medium coarse sand, fine gravel, occasional cobble		
35									

GRANULAR SOILS		COHESIVE SOILS		REMARKS:
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. Well C1

Weston & Sampson *ENGINEERS, INC.*	PROJECT: Sudbury - Curtis Middle School	REPORT OF BORING No. Well C1; SHEET 2 OF 2; Project No. 2100403.B; CHKD BY

BORING Co. NH Boring/Drillex
FOREMAN
WSE GEOLOGIST: B. Martin

BORING LOCATION
GROUND SURFACE ELEV. DATUM
DATE START November 2010 DATE END

SAMPLER: geoprobe - macro core sampler

CASING:

CASING SIZE: OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (feet)	CASING (lb/ft)	SAMPLE No.	SAMPLE PEN/REC (in)	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
							coarse sand and fine gravel		
40									
							Extremely coarse gravel, pebbles 5% silt		
45									
50									
55							Silt with fine sand		
60									
65									
70									**Boring terminated at 65'**

GRANULAR SOILS BLOWS/FT	GRANULAR SOILS DENSITY	COHESIVE SOILS BLOWS/FT	COHESIVE SOILS DENSITY	REMARKS:

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. Well C1

Weston & Sampson *ENGINEERS, INC.*	PROJECT Sudbury - Curtis Middle School	REPORT OF BORING No. Well D SHEET 1 OF 2 Project No. 2100403.B CHKD BY

BORING Co. NH Boring/Drillex
FOREMAN
WSE GEOLOGIST: B. Martin

BORING LOCATION
GROUND SURFACE ELEV. DATUM
DATE START November 2010 DATE END

SAMPLER: geoprobe - macro core sampler

CASING:

CASING SIZE: OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (feet)	CASING (lb/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
1							loam		
							coarse gravel, cobbles, silt from 1' - 2'		
5									
							Medium - coarse sand, fine gravel, occasional pebbles		
10									
							Coarse sand and gravel, occasional cobble		
15									
							Medium - coarse sand, cobbles		
20									
25									
30									
35									

GRANULAR SOILS		COHESIVE SOILS		REMARKS:
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. Well D

Weston & Sampson *ENGINEERS, INC.*	PROJECT: Sudbury - Curtis Middle School	REPORT OF BORING No. Well D; SHEET 2 OF 2; Project No. 2100403.B; CHKD BY

BORING Co. NH Boring/Drillex
FOREMAN
WSE GEOLOGIST: B. Martin

BORING LOCATION
GROUND SURFACE ELEV. DATUM
DATE START November 2010 DATE END

SAMPLER: geoprobe - macro core sampler

CASING:

CASING SIZE: OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (feet)	CASING (lb/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
32							fine silt with cobbles		
40							coarse sand and gravel with occasional cobble and 2% sand		
							medium - coarse sand		
45									
50									
51									
55							Silt		
58									**Boring terminated at 58'**
60									
65									
70									

GRANULAR SOILS BLOWS/FT	DENSITY	COHESIVE SOILS BLOWS/FT	DENSITY	REMARKS:

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. Well D

Weston & Sampson *ENGINEERS, INC.*	PROJECT: Sudbury - Curtis Middle School	REPORT OF BORING No. Well E; SHEET 1 OF 2; Project No. 2100403.B; CHKD BY

BORING Co. NH Boring/Drillex
FOREMAN
WSE GEOLOGIST: B. Martin

BORING LOCATION
GROUND SURFACE ELEV. DATUM
DATE START November 2010 DATE END

SAMPLER: geoprobe - macro core sampler

CASING:

CASING SIZE: OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (feet)	CASING (lb/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
1							loam		
							coarse gravel, cobbles, silt from 1' - 2'		
5									
							Medium - coarse sand, fine gravel, occasional pebbles		
10									
							Coarse sand and gravel, occasional cobble		
15									
							Medium - coarse sand, cobbles		
20									
25									
30									
35									

GRANULAR SOILS		COHESIVE SOILS		REMARKS:
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. Well E

Weston & Sampson ENGINEERS, INC.	PROJECT: Sudbury - Curtis Middle School	REPORT OF BORING No. Well E; SHEET 2 OF 2; Project No. 2100403.B; CHKD BY

BORING Co. NH Boring/Drillex
FOREMAN
WSE GEOLOGIST: B. Martin

BORING LOCATION
GROUND SURFACE ELEV. DATUM
DATE START November 2010 DATE END

SAMPLER: geoprobe - macro core sampler

CASING:

CASING SIZE: OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (feet)	CASING (lb/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
							fine silt with cobbles		
32									
							coarse sand and gravel with occasional cobble and 2% sand		
40									
							medium - coarse sand		
45									
50									
51									
55							Silt		
58									**Boring terminated at 58'**
60									
65									
70									

GRANULAR SOILS BLOWS/FT	DENSITY	COHESIVE SOILS BLOWS/FT	DENSITY	REMARKS:

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. Well E

Weston & Sampson *ENGINEERS, INC.*	PROJECT: Sudbury - Curtis Middle School	REPORT OF BORING No. Well G
		SHEET 1 OF 2
		Project No. 2100403.B
		CHKD BY

BORING Co. NH Boring/Drillex	BORING LOCATION
FOREMAN	GROUND SURFACE ELEV. DATUM
WSE GEOLOGIST: B. Martin	DATE START November 2010 DATE END

SAMPLER: geoprobe - macro core sampler

CASING:

CASING SIZE: OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (feet)	CASING (lb/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
1							Loam		
							Coarse sand (2-3' silt)		
5									
10							Medium - coarse sand with cobbles		
15									
20									
							Medium - coarse sand, 6" silt stinger at 23'		
25							Medium - coarse sand		
30							Medium - coarse sand, cobbles, some gray silt layer at 33'		
35									

GRANULAR SOILS		COHESIVE SOILS		REMARKS:
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. Well G

Weston & Sampson *ENGINEERS, INC.*	PROJECT Sudbury - Curtis Middle School	REPORT OF BORING No. Well G SHEET 2 OF 2 Project No. 2100403.B CHKD BY

BORING Co. NH Boring/Drillex
FOREMAN
WSE GEOLOGIST: B. Martin

BORING LOCATION
GROUND SURFACE ELEV. DATUM
DATE START November 2010 DATE END

SAMPLER: geoprobe - macro core sampler

CASING:

CASING SIZE: OTHER:

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (feet)	CASING (lb/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
							medium - coarse sand		
40									
45									
50									
55									
60									
65									
70									

GRANULAR SOILS		COHESIVE SOILS		REMARKS:
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	

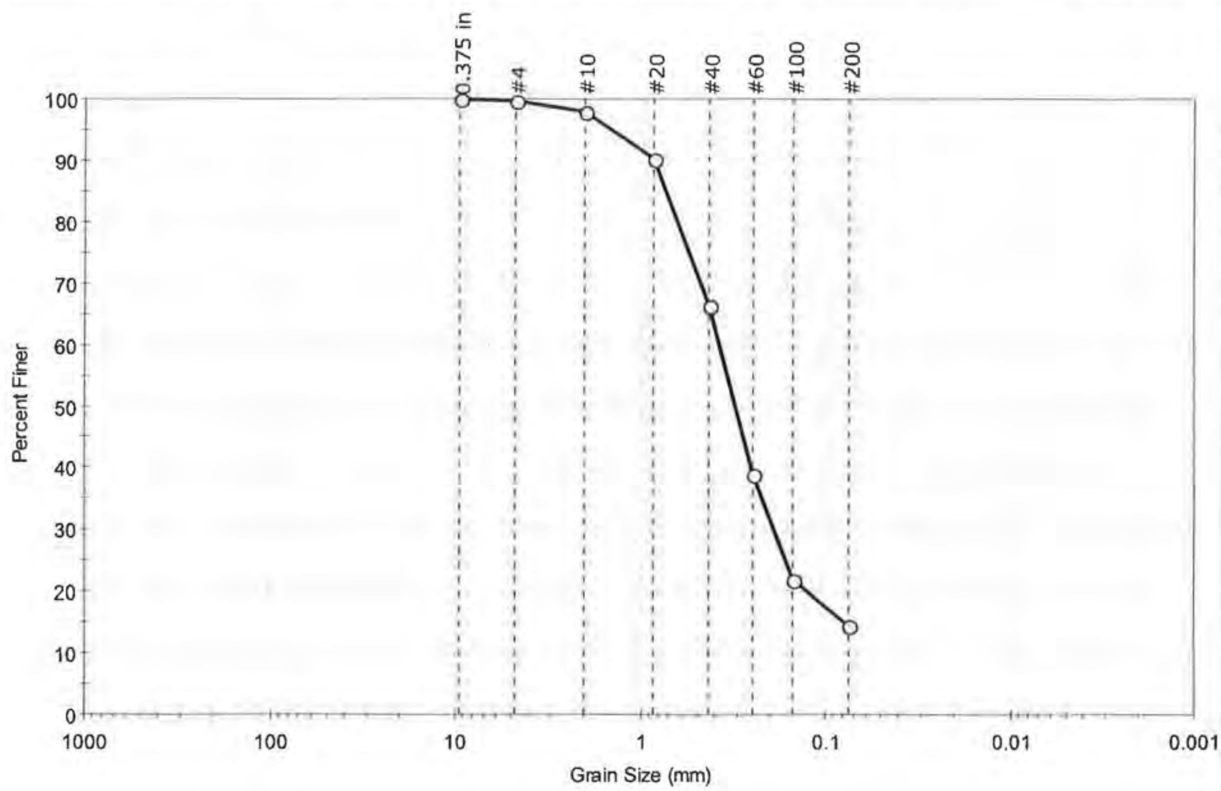
NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. Well G

GeoTesting EXPRESS

Client: Weston & Sampson Engineers			
Project: Curtis Middle School			
Location: Sudbury, MA		Project No:	GTX-10513
Boring ID: ---	Sample Type: bag	Tested By:	jbr
Sample ID: Well A	Test Date: 01/24/11	Checked By:	jdt
Depth : 20-25 ft	Test Id: 203459		
Test Comment: ---			
Sample Description: Moist, brown silty sand			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.2	85.3	14.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	100		
#10	2.00	98		
#20	0.85	90		
#40	0.42	66		
#60	0.25	39		
#100	0.15	22		
#200	0.075	14		

Coefficients

D_{85} = 0.7293 mm D_{30} = 0.1908 mm

D_{60} = 0.3759 mm D_{15} = 0.0788 mm

D_{50} = 0.3094 mm D_{10} = 0.0496 mm

C_u = N/A C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

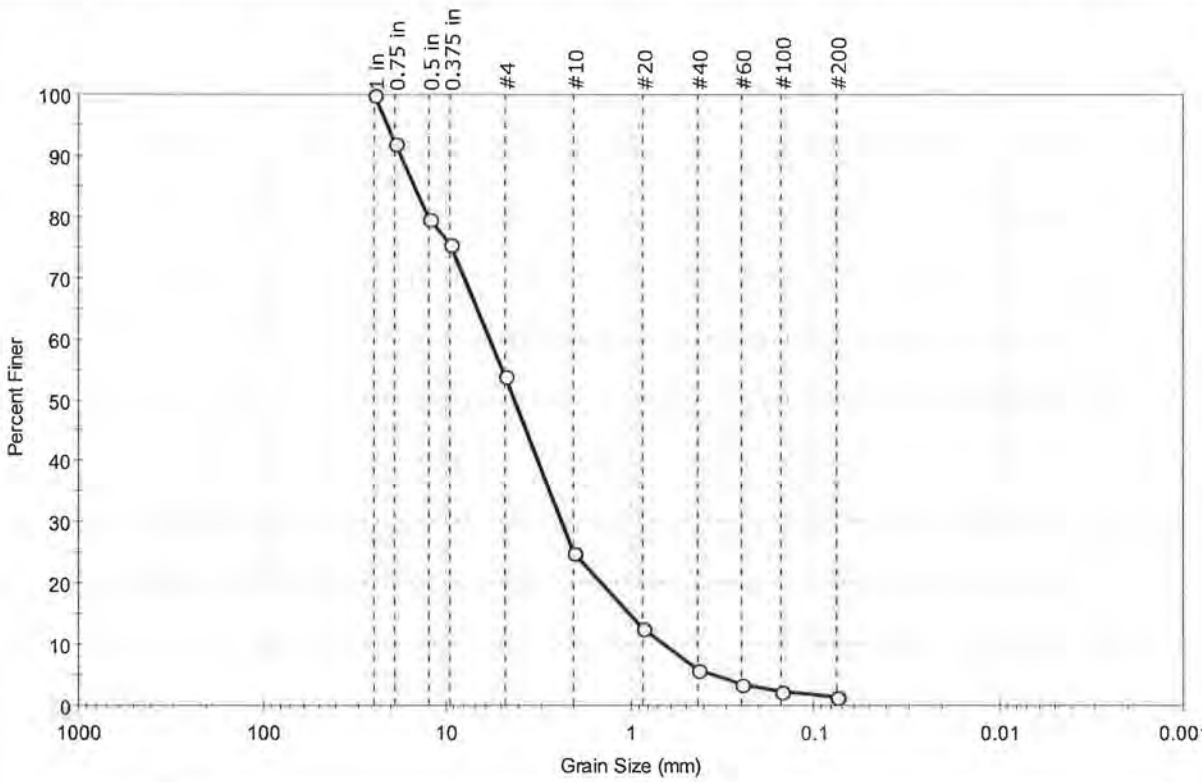
Sand/Gravel Particle Shape :

Sand/Gravel Hardness :

GeoTesting
EXPRESS

Client:	Weston & Sampson Engineers
Project:	Curtis Middle School
Location:	Sudbury, MA
Project No:	GTX-10513
Boring ID:	---
Sample Type:	bag
Tested By:	jbr
Sample ID:	Well C
Test Date:	01/24/11
Checked By:	jdt
Depth :	40-45 ft
Test Id:	203460
Test Comment:	---
Sample Description:	Moist, dark brown sand with gravel
Sample Comment:	---

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	45.9	52.5	1.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	92		
0.5 in	12.50	80		
0.375 in	9.50	75		
#4	4.75	54		
#10	2.00	25		
#20	0.85	13		
#40	0.42	6		
#60	0.25	3		
#100	0.15	2		
#200	0.075	2		

Coefficients

D_{85} = 14.9604 mm	D_{30} = 2.3157 mm
D_{60} = 5.7601 mm	D_{15} = 0.9929 mm
D_{50} = 4.2102 mm	D_{10} = 0.6400 mm
C_u = 9.000	C_c = 1.455

Classification

ASTM Well-graded sand with gravel (SW)

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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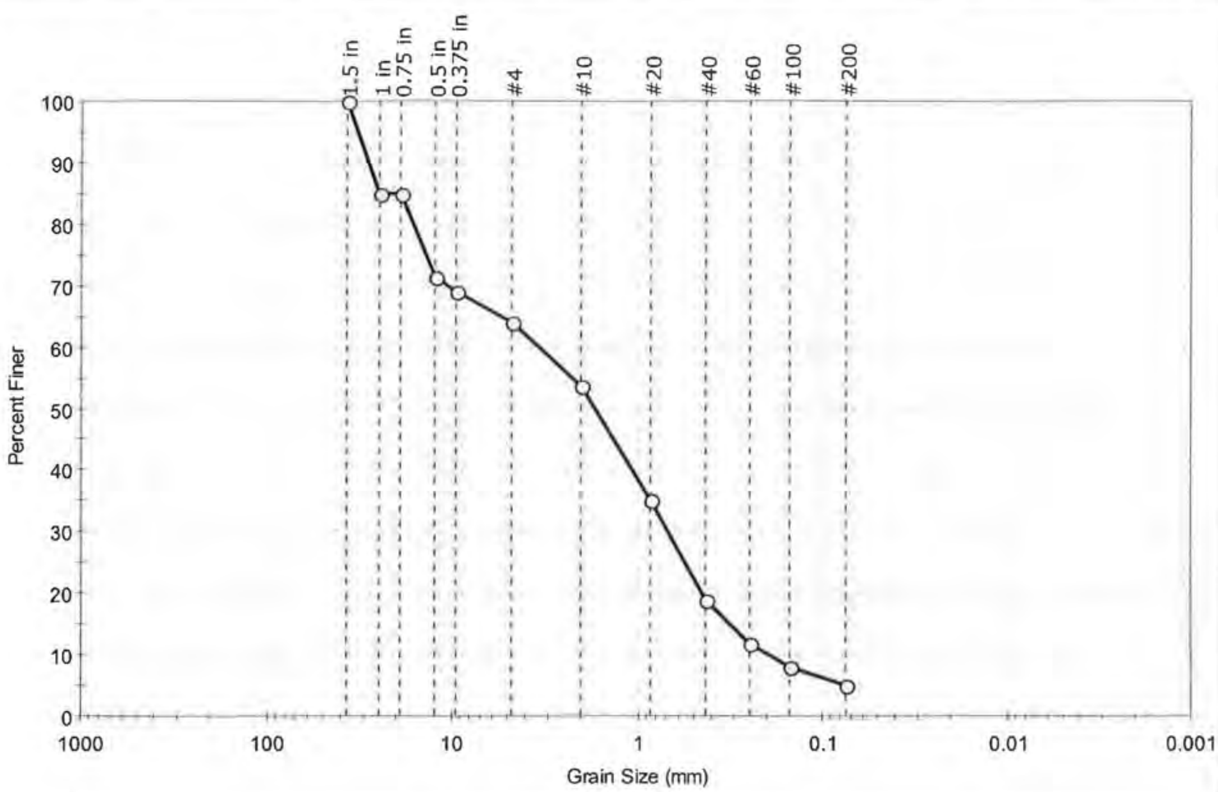
GeoTesting EXPRESS

Client: Weston & Sampson Engineers			
Project: Curtis Middle School			
Location: Sudbury, MA		Project No:	GTX-10513
Boring ID: ---	Sample Type: bag	Tested By:	jbr
Sample ID: Well D	Test Date: 01/24/11	Checked By:	jdt
Depth : 35-40 ft	Test Id: 203461		
Test Comment: ---			
Sample Description: Moist, brown sand with silt and gravel			
Sample Comment: ---			

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	36.0	58.9	5.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	85		
0.75 in	19.00	85		
0.5 in	12.50	71		
0.375 in	9.50	69		
#4	4.75	64		
#10	2.00	54		
#20	0.85	35		
#40	0.42	19		
#60	0.25	12		
#100	0.15	8		
#200	0.075	5		

Coefficients

D_{85} = 18.9697 mm	D_{30} = 0.6819 mm
D_{60} = 3.4007 mm	D_{15} = 0.3176 mm
D_{50} = 1.6937 mm	D_{10} = 0.1980 mm
C_u = 17.175	C_c = 0.691

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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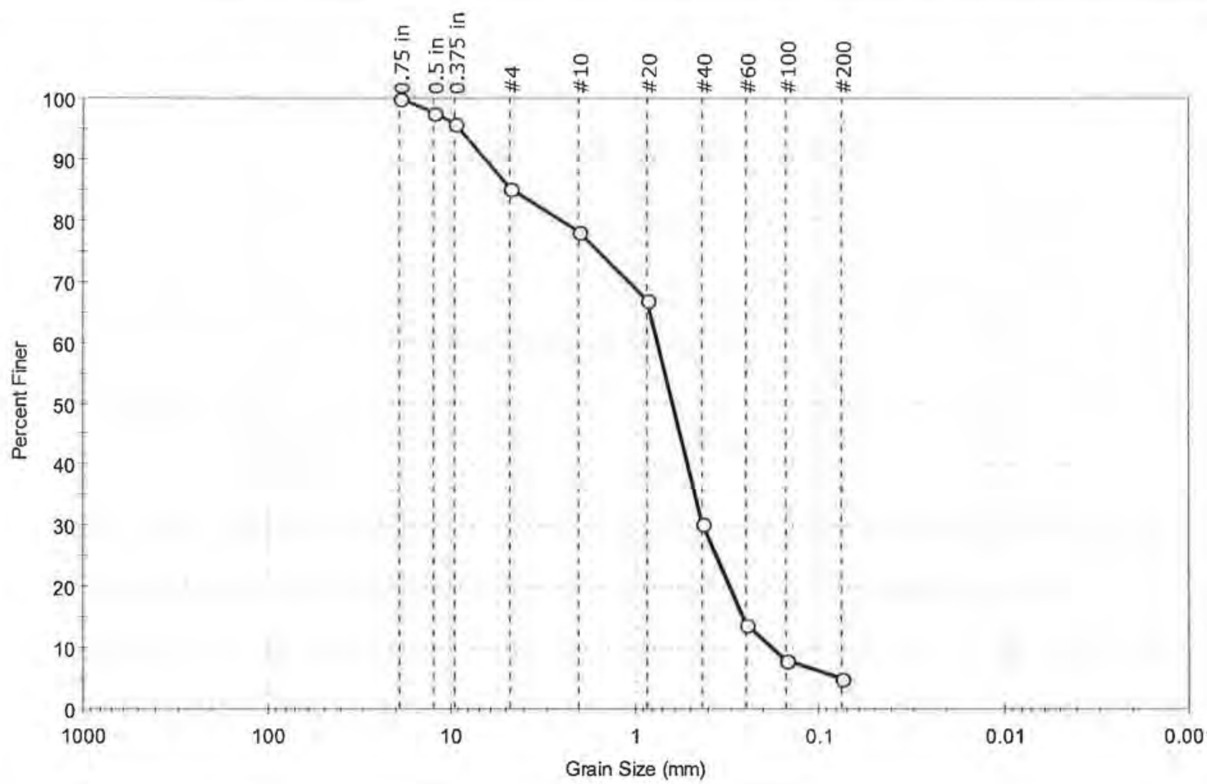
GeoTesting EXPRESS

Client:	Weston & Sampson Engineers				
Project:	Curtis Middle School				
Location:	Sudbury, MA			Project No:	GTX-10513
Boring ID:	---	Sample Type:	bag	Tested By:	jbr
Sample ID:	Well G	Test Date:	01/24/11	Checked By:	jdt
Depth :	25-30 ft	Test Id:	203462		
Test Comment:	---				
Sample Description:	Moist, brown sand with silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	14.6	80.3	5.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	98		
0.375 in	9.50	96		
#4	4.75	85		
#10	2.00	78		
#20	0.85	67		
#40	0.42	30		
#60	0.25	14		
#100	0.15	8		
#200	0.075	5		

Coefficients

D_{85} = 4.5826 mm D_{30} = 0.4202 mm

D_{60} = 0.7466 mm D_{15} = 0.2585 mm

D_{50} = 0.6174 mm D_{10} = 0.1788 mm

C_u = 4.176 C_c = 1.323

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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Time				Well Locations												
DATE	TIME	Date/Time	Elapsed Time	C-1	C	A	B	E	D	I	F	G	H	WSE-1	WSE-2	WSE-3
				187.5323	187.2506	187.1520	187.2109	186.2986	187.5043	185.7848	186.8991	185.8270	188.4581		184.6751	184.5365
12/19/2010	14:30	12/19/10 14:30	-90	33.9	33.58	33.67	34.14	33.14	33.87	32	34.26	33.31	37.06	33.03	29.82	30.99
12/19/2010	16:00	12/19/10 16:00	0	33.9												
12/19/2010	16:01	12/19/10 16:01	1	33.9												
12/19/2010	16:02	12/19/10 16:02	2	33.9												
12/19/2010	16:03	12/19/10 16:03	3	33.9												
12/19/2010	16:04	12/19/10 16:04	4	33.9												
12/19/2010	16:05	12/19/10 16:05	5	33.9												
12/19/2010	16:06	12/19/10 16:06	6	33.9												
12/19/2010	16:07	12/19/10 16:07	7	33.9												
12/19/2010	16:08	12/19/10 16:08	8	33.9												
12/19/2010	16:09	12/19/10 16:09	9	33.9												
12/19/2010	16:10	12/19/10 16:10	10	33.9												
12/19/2010	16:11	12/19/10 16:11	11	33.9												
12/19/2010	16:12	12/19/10 16:12	12	33.9												
12/19/2010	16:13	12/19/10 16:13	13	33.9												
12/19/2010	16:14	12/19/10 16:14	14	33.9												
12/19/2010	16:15	12/19/10 16:15	15	33.9												
12/19/2010	16:20	12/19/10 16:20	20	33.9												
12/19/2010	16:30	12/19/10 16:30	30	33.9												
12/19/2010	16:40	12/19/10 16:40	40	33.9												
12/19/2010	16:50	12/19/10 16:50	50	33.9												
12/19/2010	17:00	12/19/10 17:00	60	33.9	33.53	33.67	34.15	33.15	33.87	32.02	34.28	33.31	37.05	33.01	29.83	30.98
12/19/2010	18:00	12/19/10 18:00	120	33.9	33.56	33.67	34.15	33.15	33.87	32.02	34.28	33.31	37.05	33.01	29.83	30.98
12/19/2010	19:00	12/19/10 19:00	180	33.9	33.56	33.67	34.15	33.15	33.87	32.02	34.28	33.31	37.05	33.01	29.83	30.98
12/19/2010	20:00	12/19/10 20:00	240	33.9	33.56	33.67	34.15	33.15	33.87	32.02	34.28	33.31	37.05	33.01	29.83	30.98
12/19/2010	22:00	12/19/10 22:00	360	33.91	33.56	33.67	34.15	33.15	33.87	32.02	34.28	33.31	37.05	33.01	29.83	30.98
12/20/2010	0:00	12/20/10 0:00	480	33.91	33.56	33.67	34.15	33.15	33.87	32.02	34.28	33.31	37.05	33.01	29.83	30.98
12/20/2010	2:00	12/20/10 2:00	600	33.91	33.56	33.67	34.15	33.15	33.87	32.02	34.28	33.31	37.05	33.01	29.83	30.98
12/20/2010	4:00	12/20/10 4:00	720	33.91	33.56	33.67	34.15	33.15	33.87	32.02	34.28	33.31	37.05	33.01	29.83	30.98
12/20/2010	6:00	12/20/10 6:00	840	33.91	33.56	33.67	34.15	33.15	33.87	32.02	34.28	33.31	37.05	33.01	29.83	30.98
12/20/2010	8:00	12/20/10 8:00	960	33.91	33.56	33.67	34.15	33.15	33.87	32.02	34.28	33.31	37.05	33.01	29.83	30.98
12/20/2010	10:00	12/20/10 10:00	1,080	33.91	33.53	33.67	34.17	33.16	33.87	32.02	34.28	33.3	37.06	33.03	29.82	30.99
12/20/2010	12:00	12/20/10 12:00	1,200	33.91	33.53	33.62	34.16	33.16	33.87	32.02	34.28	33.3	37.06	33.03	29.82	30.99
12/20/2010	13:00	12/20/10 13:00	1,260	33.91	33.55	33.6	34.15	33.16	33.87	32.02	34.28	33.3	37.06	33.03	29.82	30.99
12/20/2010	14:00	12/20/10 14:00	1,320	33.9	33.55	33.57	34.15	33.16	33.87	32.02	34.28	33.3	37.06	33.03	29.82	30.99
12/20/2010	15:00	12/20/10 15:00	1,380	33.89	33.55	33.5	34.15	33.16	33.87	32.02	34.28	33.3	37.06	33.03	29.82	30.99
12/20/2010	16:00	12/20/10 16:00	1,440	33.89	33.55	33.48	34.15	33.16	33.87	32.02	34.28	33.3	37.07	33.03	29.82	30.99
12/20/2010	17:00	12/20/10 17:00	1,500	33.85	33.52	33.43	34.15	33.16	33.87	32.02	34.28	33.3	37.06	33.03	29.82	30.99
12/20/2010	18:00	12/20/10 18:00	1,560	33.83	33.55	33.38	34.15	33.16	33.87	32.02	34.28	33.3	37.06	33.03	29.82	30.99
12/20/2010	19:00	12/20/10 19:00	1,620	33.81	33.54	33.35	34.14	33.15	33.87	32.02	34.28	33.3	37.06	33.03	29.82	30.99
12/20/2010	20:00	12/20/10 20:00	1,680	33.79	33.57	33.29	34.12	33.15	33.86	32.02	34.28	33.3	37.06	33.03	29.82	30.99
12/20/2010	21:00	12/20/10 21:00	1,740	33.76	33.56	33.24	34.12	33.15	33.86	32.02	34.28	33.3	37.06	33.03	29.82	30.99
12/20/2010	22:00	12/20/10 22:00	1,800	33.75	33.54	33.17	34.1	33.13	33.84	32.02	34.27	33.3	37.06	33.03	29.82	30.99
12/21/2010	0:00	12/21/10 0:00	1,920	33.73	33.53	33.1	34.07	33.11	33.83	32.02	34.27	33.3	37.07	33.03	29.82	30.99
12/21/2010	2:00	12/21/10 2:00	2,040	33.65	33.51	33	34.04	33.07	33.81	32.02	34.27	33.3	37.07	33.03	29.82	30.99
12/21/2010	4:00	12/21/10 4:00	2,160	33.6	33.5	32.91	34.01	33.04	33.8	32.02	34.27	33.3	37.07	33.03	29.82	30.99
12/21/2010	6:00	12/21/10 6:00	2,280	33.56	33.49	32.82	33.98	33.02	33.78	32.02	34.27	33.3	37.07	33.03	29.82	30.99
12/21/2010	8:00	12/21/10 8:00	2,400	33.52	33.48	32.76	33.94	33	33.77	32.01	34.27	33.3	37.07	33.03	29.82	30.99
12/21/2010	10:00	12/21/10 10:00	2,520	33.5	33.46	32.72	33.92	32.98	33.76	32	34.27	33.3	37.07	33.03	29.82	30.99
12/21/2010	12:00	12/21/10 12:00	2,640	33.48	33.45	32.68	33.9	32.95	33.75	32	34.27	33.3	37.07	33.03	29.81	30.99
12/21/2010	14:00	12/21/10 14:00	2,760	33.43	33.43	32.66	33.9	32.9	33.73	32	34.27	33.3	37.07	33.03	29.81	30.99
12/21/2010	16:00	12/21/10 16:00	2,880	33.4	33.4	32.59	33.87	32.84	33.72	31.98	34.27	33.3	37.07	33.03	29.84	30.99

Time				Well Locations												
DATE	TIME	Date/Time	Elapsed Time	C-1	C	A	B	E	D	I	F	G	H	WSE-1	WSE-2	WSE-3
12/21/2010	18:00	12/21/10 18:00	3,000	33.38	33.41	32.55	33.83	32.8	33.7	31.98	34.27	33.3	37.07	33.03	29.84	30.99
12/21/2010	20:00	12/21/10 20:00	3,120	33.37	33.34	32.52	33.81	32.76	33.69	31.98	34.27	33.3	37.07	33.03	29.82	30.99
12/21/2010	22:00	12/21/10 22:00	3,240	33.35	33.38	32.47	33.77	32.71	33.68	31.97	34.26	33.3	37.07	33.02	29.79	30.99
12/22/2010	0:00	12/22/10 0:00	3,360	33.31	33.37	32.41	33.74	32.67	33.66	31.97	34.26	33.3	37.07	33.02	29.79	30.99
12/22/2010	4:00	12/22/10 4:00	3,600	33.27	33.35	32.36	33.69	32.59	33.64	31.96	34.26	33.3	37.07	33.02	29.79	30.99
12/22/2010	8:00	12/22/10 8:00	3,840	33.25	33.33	32.31	33.66	32.5	33.63	31.96	34.24	33.3	37.07	33.02	29.79	30.99
12/22/2010	12:00	12/22/10 12:00	4,080	33.22	33.32	32.28	33.62	32.46	33.62	31.95	34.24	33.3	37.07	33.02	29.78	30.99
12/22/2010	14:00	12/22/10 14:00	4,200	33.21	33.31	32.26	33.58	32.37	33.61	31.95	34.24	33.3	37.07	33.02	29.78	30.98
12/22/2010	16:00	12/22/10 16:00	4,320	33.21	33.3	32.23	33.54	32.34	33.59	31.95	34.24	33.3	37.07	33.01	29.78	30.98
12/22/2010	18:00	12/22/10 18:00	4,440	33.3	33.29	32.21	33.53	32.33	33.58	31.95	34.24	33.3	37.07	33.01	29.78	30.98
12/22/2010	20:00	12/22/10 20:00	4,560	33.28	33.28	32.19	33.51	32.27	33.57	31.95	34.24	33.3	37.07	33.03	29.78	30.98
12/22/2010	22:00	12/22/10 22:00	4,680	33.17	33.27	32.17	33.48	32.24	33.56	31.95	34.24	33.3	37.07	33.02	29.76	30.98
12/23/2010	0:00	12/23/10 0:00	4,800	33.16	33.26	32.15	33.47	32.22	33.55	31.95	34.23	33.3	37.07	33.01	29.76	30.97
12/23/2010	4:00	12/23/10 4:00	5,040	33.14	33.24	32.13	33.45	32.18	33.54	31.95	34.23	33.3	37.07	33.01	29.76	30.97
12/23/2010	8:00	12/23/10 8:00	5,280	33.13	33.22	32.11	33.41	32.14	33.53	31.95	34.22	33.3	37.07	33	29.76	30.97
12/23/2010	12:00	12/23/10 12:00	5,520	33.11	33.21	32.09	33.38	32.1	33.52	31.94	34.22	33.3	37.07	33	29.76	30.96
12/23/2010	14:00	12/23/10 14:00	5,640	33.1	33.2	32.07	33.36	32.07	33.51	31.94	34.21	32.97	37.07	32.98	29.77	30.94
12/23/2010	16:00	12/23/10 16:00	5,760	33.08	33.21	32.07	33.35	32.05	33.5	31.9	34.21	32.98	37.07	33	29.77	30.95
12/23/2010	18:00	12/23/10 18:00	5,880	33.06	33.21	32.05	33.33	32.03	33.49	31.9	34.21	32.98	37.07	33	29.77	30.95
12/23/2010	20:00	12/23/10 20:00	6,000	33.06	33.2	32.05	33.32	32.01	33.49	31.9	34.21	32.98	37.07	33	29.77	30.95
12/23/2010	22:00	12/23/10 22:00	6,120	33.05	33.19	32.04	33.31	31.99	33.48	31.87	34.2	32.97	37.07	32.98	29.74	30.93
12/24/2010	0:00	12/24/10 0:00	6,240	33.05	33.19	32.04	33.3	31.97	33.48	31.87	34.2	32.97	37.07	32.98	29.74	30.93
12/24/2010	4:00	12/24/10 4:00	6,480	33.05	33.18	32.03	33.29	31.95	33.47	31.87	34.2	32.97	37.07	32.98	29.74	30.93
12/24/2010	6:00	12/24/10 6:00	6,600	33.05	33.18	32.02	33.27	31.93	33.46	31.86	34.19	32.97	37.07	32.98	29.74	30.92
12/24/2010	10:00	12/24/10 10:00	6,840	33.04	33.17	32.01	33.25	31.9	33.45	31.85	34.18	32.96	37.07	32.98	29.74	30.92
12/24/2010	12:00	12/24/10 12:00	6,960	33.01	33.16	32	33.25	31.9	33.44	31.85	34.18	32.96	37.07	32.98	29.74	30.92
12/24/2010	14:00	12/24/10 14:00	7,080	33.01	33.15	32	33.23	31.88	33.43	31.85	34.18	32.96	37.07	32.97	29.74	30.91
12/24/2010	16:00	12/24/10 16:00	7,200	33	33.15	31.99	33.22	31.87	33.42	31.85	34.18	32.96	37.07	32.97	29.74	30.91
12/24/2010	20:00	12/24/10 20:00	7,440	32.98	33.13	31.97	33.21	31.85	33.41	31.84	34.17	32.96	37.07	32.97	29.72	30.91
12/25/2010	0:00	12/25/10 0:00	7,680	32.96	33.12	31.95	33.2	31.83	33.4	31.84	34.17	32.96	37.07	32.97	29.72	30.91
12/25/2010	6:00	12/25/10 6:00	8,040	32.95	33.11	31.93	33.19	31.81	33.39	31.83	34.16	32.96	37.07	32.97	29.72	30.9
12/25/2010	12:00	12/25/10 12:00	8,400	32.94	33.1	31.92	33.18	31.79	33.38	31.82	34.16	32.96	37.07	32.97	29.71	30.9
12/25/2010	16:00	12/25/10 16:00	8,640	32.93	33.09	31.91	33.17	31.77	33.37	31.81	34.15	32.95	37.08	32.96	29.7	30.89
12/25/2010	22:00	12/25/10 22:00	9,000	32.91	33.07	31.9	33.15	31.74	33.35	31.8	34.14	32.95	37.07	32.96	29.69	30.89
12/26/2010	0:00	12/26/10 0:00	9,120	32.9	33.06	31.89	33.13	31.72	33.34	31.8	34.14	32.95	37.07	32.95	29.69	30.89
12/26/2010	4:00	12/26/10 4:00	9,360	32.89	33.06	31.87	33.1	31.7	33.34	31.79	34.14	32.99	37.07	32.95	29.68	30.88
12/26/2010	6:00	12/26/10 6:00	9,480	32.89	33.05	31.87	33.1	31.69	33.33	31.78	34.13	32.99	37.07	32.95	29.68	30.88
12/26/2010	10:00	12/26/10 10:00	9,720	32.88	33.05	31.86	33.09	31.68	33.33	31.78	34.13	32.99	37.07	32.94	29.68	30.87
12/26/2010	14:00	12/26/10 14:00	9,960	32.88	33.05	31.85	33.08	31.68	33.33	31.78	34.13	33.22	37.07	32.94	29.67	30.87

Time				Well Locations												
DATE	TIME	Date/Time	Elapsed Time	C-1	C	A	B	E	D	I	F	G	H	WSE-1	WSE-2	WSE-3
						31.84										
			1			31.85										
			2													
			3													
			4													
			5				33.09									
			10				33.08									
			15				33.08									
			20			31.86	33.08									
			25			31.85	33.08									
			30				33.08									
			35			31.84	33.08									
			40			31.85	33.08									
			45			31.85	33.08	31.69								
			50			31.84	33.08	31.67								
			60			31.84	33.08	31.67								
			120			31.85	33.08	31.67							29.68	

Water Table Mounding calculated based on Hantush 1967, WRR

Zmax Beneath Center of Entire Drain Field (L*W)

Meters and Days	Length of Drain Field Subunit	Width of Drain Field Subunit		Separation between Drain Field Subunits	Fraction of Drain Field Subunit that is Trench Area	Horizontal Hydraulic Conductivity	Specific Yield use 0.001 to approximate steady state at 10 years	time use 10 years to approximate steady state				
	l_s	w_s		Sp	f	Kh	Sy	time				
	ft	ft		ft		ft/days	none	days				
	20	20		0	1	68	0.28	7				
	L	W	q effective in subunit ls x ws	q in trenches	q' effective on LxW	Q	Zmax 12 iterations	Initial Saturated Thickness	alpha	beta	a2+b2	W part1
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft			NOTE: if a2+b2>0.04, soluti	
1	20	20	15.0401	15.0401	15.0401	45000	2.518	18	0.028583098	0.028583098	0.001633987	5.8411506

Water Table Rise on Side Slope

Uses Subunit Geometry and Material Properties from Zmax Table

	L	W	q effective in subunit ls x ws	q in trenches	q' effective on LxW	Q l/day	Zsx 12 iterations	Distance from Center of Drain Field in Long Dimension (x in figure)	Distance from Center of Drain Field in Wide Dimension (y in figure)	Initial Saturated Thickness
Number of subunits, n	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft	ft	ft
1	20	20	15.0401	15.0401	15.0401	45000	1.811	15	15	18

Water Table Mounding calculated based on Hantush 1967, WRR

Zmax Beneath Center of Entire Drain Field (L*W)

Meters and Days	Length of Drain Field Subunit	Width of Drain Field Subunit		Separation between Drain Field Subunits	Fraction of Drain Field Subunit that is Trench Area	Horizontal Hydraulic Conductivity	Specific Yield use 0.001 to approximate steady state at 10 years	time use 10 years to approximate steady state
	l_s	w_s		Sp	f	Kh	Sy	time
	ft	ft		ft		ft/days	none	days
	200	300		50	0.3	68	0.28	180

Number of subunits, n	L (ft)	W (ft)	q effective in subunit ls x ws (ft/day)	q in trenches (ft/day)	q' effective on LxW (ft/day)	Q (gallons/day)	Zmax 12 iterations (ft)	Initial Saturated Thickness (ft)	alpha	beta	a2+b2	W part1
											NOTE: if a2+b2>0.04, soluti	
2	650	200	0.1671	0.5142	0.1543	150000	4.677	18	0.183191543	0.056366628	0.036736338	2.7631756
2	650	200	0.2785	0.8570	0.2571	250000	7.124	18	0.183191543	0.056366628	0.036736338	2.7631756
2	650	200	0.3899	1.1998	0.3599	350000	9.281	18	0.183191543	0.056366628	0.036736338	2.7631756
2	650	200	0.4456	1.3712	0.4114	400000	10.279	18	0.183191543	0.056366628	0.036736338	2.7631756

Water Table Rise on Side Slope

Uses Subunit Geometry and Material Properties from Zmax Table

Number of subunits, n	L (ft)	W (ft)	q effective in subunit ls x ws (ft/day)	q in trenches (ft/day)	q' effective on LxW (ft/day)	Q l/day (gallons/day)	Zsx 12 Iterations (ft)	Distance from Center of Drain Field in Long Dimension (x in figure) (ft)	Distance from Center of Drain Field in Wide Dimension (y in figure) (ft)	Initial Saturated Thickness (ft)
2	650	200	0.1671	0.5142	0.1543	150000	4.668	15	15	18
2	650	200	0.2785	0.8570	0.2571	250000	7.111	15	15	18
2	650	200	0.3899	1.1998	0.3599	350000	9.264	15	15	18
2	650	200	0.4456	1.3712	0.4114	400000	10.261	15	15	18

max mound Buildout Scenario

Water Table Mounding calculated based on Hantush 1967, WRR

Zmax Beneath Center of Entire Drain Field (L*W)

Meters and Days	Length of Drain Field Subunit	Width of Drain Field Subunit		Separation between Drain Field Subunits	Fraction of Drain Field Subunit that is Trench Area	Horizontal Hydraulic Conductivity	Specific Yield use 0.001 to approximate steady state at 10 years	time use 10 years to approximate steady state
	l_s	w_s		Sp	f	Kh	Sy	time
	ft	ft		ft		ft/days	none	days
	200	300		50	0.3	68	0.28	180

Number of subunits, n	L	W	q effective in subunit ls x ws	q in trenches	q' effective on LxW	Q	Zmax 12 iterations	Initial Saturated Thickness	alpha	beta	a2+b2	W part1
	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft			NOTE: if a2+b2>0.04, soluti	
2	650	200	0.3899	1.1998	0.3599	350000	9.281	18	0.183191543	0.056366628	0.036736338	2.7631756
2	650	200	0.3899	1.1998	0.3599	350000	9.281	18	0.183191543	0.056366628	0.036736338	2.7631756
2	650	200	0.3899	1.1998	0.3599	350000	9.281	18	0.183191543	0.056366628	0.036736338	2.7631756
2	650	200	0.3899	1.1998	0.3599	350000	9.281	18	0.183191543	0.056366628	0.036736338	2.7631756

Water Table Rise on Side Slope

Uses Subunit Geometry and Material Properties from Zmax Table

Number of subunits, n	L	W	q effective in subunit ls x ws	q in trenches	q' effective on LxW	Q l/day	Zsx 12 iterations	Distance from Center of Drain Field in Long Dimension (x in figure)	Distance from Center of Drain Field in Wide Dimension (y in figure)	Initial Saturated Thickness
	ft	ft	ft/day	ft/day	ft/day	gallons/day	ft	ft	ft	ft
2	650	200	0.3899	1.1998	0.3599	350000	9.264	15	15	18
2	650	200	0.3899	1.1998	0.3599	350000	9.099	50	50	18
2	650	200	0.3899	1.1998	0.3599	350000	4.381	500	500	18
2	650	200	0.3899	1.1998	0.3599	350000	3.221	1000	1000	18

radial mound at 350k gpd

Water Table Mounding calculated based on Hantush 1967, WRR

Zmax Beneath Center of Entire Drain Field (L*W)

Meters and Days	Length of Drain Field Subunit	Width of Drain Field Subunit		Separation between Drain Field Subunits	Fraction of Drain Field Subunit that is Trench Area	Horizontal Hydraulic Conductivity	Specific Yield use 0.001 to approximate steady state at 10 years	time use 10 years to approximate steady state				
	l_s	w_s		Sp	f	Kh	Sy	time				
	ft	ft		ft		ft/days	none	days				
	200	300		50	0.3	68	0.28	180				
Number of subunits, n	L ft	W ft	q effective in subunit ls x ws ft/day	q in trenches ft/day	q' effective on LxW ft/day	Q gallons/day	Zmax 12 iterations ft	Initial Saturated Thickness ft	alpha	beta	a2+b2	W part1
											NOTE: if a2+b2>0.04, soluti	
2	650	200	0.2395	0.7370	0.2211	215000	6.307	18	0.183191543	0.056366628	0.036736338	2.7631756
2	650	200	0.2395	0.7370	0.2211	215000	6.307	18	0.183191543	0.056366628	0.036736338	2.7631756
2	650	200	0.2395	0.7370	0.2211	215000	6.307	18	0.183191543	0.056366628	0.036736338	2.7631756
2	650	200	0.2395	0.7370	0.2211	215000	6.307	18	0.183191543	0.056366628	0.036736338	2.7631756

Water Table Rise on Side Slope

Uses Subunit Geometry and Material Properties from Zmax Table

Number of subunits, n	L ft	W ft	q effective in subunit ls x ws ft/day	q in trenches ft/day	q' effective on LxW ft/day	Q l/day gallons/day	Zsx 12 iterations ft	Distance from Center of Drain Field in Long Dimension (x in figure) ft	Distance from Center of Drain Field in Wide Dimension (y in figure) ft	Initial Saturated Thickness ft
2	650	200	0.2395	0.7370	0.2211	215000	6.295	15	15	18
2	650	200	0.2395	0.7370	0.2211	215000	6.175	50	50	18
2	650	200	0.2395	0.7370	0.2211	215000	2.850	500	500	18
2	650	200	0.2395	0.7370	0.2211	215000	2.086	1000	1000	18

radial mound at 215k gpd

APPENDIX F

Public Participation Materials:

- March 31, 2011 Sudbury Town Crier Article
- April 28, 2011 Sudbury Town Crier Article
- November 18, 2010 Sudbury Town Crier Article
- March 3, 2011 Sudbury Town Crier Article
- March 3, 2011 Metrowest Daily News Article
- April 7, 2011 Sudbury Town Crier Article
- April 15, 2011 Sudbury Patch Article
- Frequently Asked Questions
- April 7, 2011 Letter to Rte. 20 Area Business Leaders
- April 25, 2011 Letter of Support from Rte. 20 Business Community
- April 14, 2011 Letter to the Editor in the Sudbury Town Crier
- November 7, 2001 Public Forum (presentation slides)
- November 15, 2001 Sudbury Town Crier Article
- November 26, 2001 Boston Globe Article
- June 23, 2010 School Committee Meeting (presentation slides)
- November 16, 2010 Board of Selectmen Meeting (presentation slides)
- April 7, 2011 Public Meeting with Town Officials & Business Owners (meeting minutes)
- May 3, 2011 Town Meeting Presentation (written narrative & presentation slides)
- May 19, 2011 Sudbury Town Crier Notice for May 25th Panel Discussion
- May 25, 2011 Panel Discussion (presentation slides)
- Citizens Advisory Committee Mission Statement & Responsibilities
- Route 20 Sewer Steering Committee Mission Statement & Responsibilities

March 31, 2011 - Sudbury Town Crier Article

This is the first in a series of articles submitted by the Route 20 Sewer Technical Advisory Committee examining a proposal to improve wastewater treatment along the commercial corridor along Boston Post Road.

The Town of Sudbury relies almost entirely on individual on-site septic systems for disposal and treatment of wastewater. On-site septic systems generally work well in the residential areas of the Town; however, relying on on-site septic systems in commercial areas poses significant environmental and economic challenges.

Since 2000 the Town has analyzed the wastewater treatment issue; based on this analysis the Town believes that the solution to the on-site septic challenges is the installation of a *decentralized wastewater treatment system* for the commercial corridor along Boston Post Road.

What is a Decentralized Wastewater Treatment System?

Decentralized wastewater treatment systems occupy the middle ground between on-site septic systems and traditional sewer systems. The basic elements of an on-site septic system are a septic tank and a leach field. The tank receives wastewater generated in a building and traps the solids allowing only liquid waste to exit through a tank outlet pipe. The wastewater flows to a leach field where it is cleaned as it percolates through the soil back to the groundwater supply. The main drawbacks to on-site septic systems are that they require a large land area to treat wastewater, and as they age are very prone to failure, creating unsanitary conditions, impaired water quality, and the need for expensive repairs.

Traditional sewer systems, like the Massachusetts Water Resources Authority, typically convey wastewater (and stormwater) from expansive areas long distances to a large, centralized treatment plant. Sewer systems are very expensive to build and maintain, pose challenges for containing development, and can redirect treated wastewater outside of watersheds, which reduces the ability to replenish groundwater supplies.

Decentralized wastewater treatment systems are located in close proximity to the source of wastewater being managed. Wastewater from multiple buildings is conveyed to a treatment facility where it is treated and then flows or is pumped to a leach field where it percolates through the soil back to the groundwater supply. Decentralized systems address the limitations of on-site septic systems as they provide a much higher level of treatment before the leaching process and are monitored, which makes them much less prone to failure. Likewise, decentralized systems address the limitations of sewer systems. They are more affordable to build and maintain and they recycle cleaned wastewater back to the groundwater supply. Finally, unlike on-site septic systems, which require large areas for wastewater treatment, and sewers, which promote sprawling development patterns, decentralized wastewater systems can play a critical role in supporting compact development and redevelopment.

What Would a Decentralized Wastewater Treatment System Look Like in Sudbury?

The Town of Sudbury is proposing a decentralized wastewater treatment system that would service the properties, which are primarily commercial, along Boston Post Road east approximately from Massasoit Avenue and west to Lafayette Drive and up Union Avenue along the industrial zones. Weston & Sampson, the Town's civil engineering consultant on this project, analyzed this area to determine the magnitude of the corridor's wastewater disposal needs

including potential new commercial growth. This analysis suggests the need for a treatment facility that can treat no less than 200,000 gallons per day of wastewater. The system would consist of pipes laid under the roads within the service area, pump stations to move the effluent properly, a treatment plant building and a leaching field. The Town has identified a suitable site for the treatment plant at 641 Boston Post Road, the former Bushey property. This site is owned by the Town and is situated away from developed residential areas. The Town also tested several sites that could serve as the system's leach field. After several years of searching, it was determined that the only appropriate site suited for this process is located on the Curtis Middle School property. Cleaned and treated water would travel 1.7 miles from the treatment facility under Horse Pond Road to a leach field under the athletic fields at Curtis Middle School and percolate back to the groundwater aquifer. While this would interrupt the use of the Curtis athletic field temporarily during construction, the field would be fully useable upon completion.

The next step in this process is getting approval at May's upcoming Town Meeting to authorize the Town to contract for the design and permitting of the system. Once designed, a final Town Meeting vote will be needed to authorize funds for construction of the system. Questions regarding this project can be sent to the Technical Advisory Committee at sewertech@sudbury.ma.us .

April 20, 2011 Sudbury Town Crier Article

This is the second article submitted by the Route 20 Sewer Technical Advisory Committee examining a proposal to improve wastewater treatment along the commercial corridor along Boston Post Road.

Our last article described what a decentralized wastewater treatment system was within the Sudbury context. This article will get into some of the details about why Sudbury needs wastewater treatment.

How can a Decentralized Wastewater Treatment System Address Environmental Challenges?

Reliance on on-site septic systems in Sudbury's commercial corridor has created an environmental challenge for the town. Continued on-site septic use will allow environmental risks to continue. These risks are linked to soils along the corridor and the groundwater underneath it. Soil plays a critical role in treating wastewater as it leaches back into the groundwater aquifer. Septic systems require sufficiently permeable soil for water to move through and back to the groundwater aquifer. Adequate depth of soil ensures the wastewater is in contact with soil material for a sufficient period of time for treatment to take place. Unfortunately, the soils along Boston Post Road have moderate to severe limitations for on-site septic treatment, which makes systems more prone to failure. Additionally, the water table is high in this area, which increases the chance of on-site septic system failure by reducing the depth of soil needed for treatment to take place. According to the Sudbury Health Director, 20% of the businesses along Route 20 have repaired or replaced their septic systems in the last 10 years. These repairs provide only a stop gap measure to the problem, and will require additional repairs and replacements in future years. Many of our most viable businesses and plazas are affected, including Sudbury Farms, Shaw's Plaza, Mill Village, Dunkin Donuts, McKinnon's Plaza, Lotus Blossom, Rossini's Plaza, Next Generation Children's Center, Millbrook Condos, Sudbury Coffee Works, and Friendly's.

All of Sudbury receives its drinking water from underground aquifers situated in various locations throughout the Town. The majority of the Boston Post Road corridor identified to be serviced by sewer sits above the Raymond Road Aquifer, which provides almost 60% of Sudbury's drinking water. Inadequate septic systems along the corridor pose a potential threat to public drinking water supplies in this area.

Installing a decentralized wastewater treatment system to service the commercial properties will address environmental issues associated with the area's poor soils and the area's role in providing public drinking water. It will accomplish this by aggregating wastewater from multiple commercial properties, conveying it to a treatment facility where it is treated and then allowed to percolate back into the groundwater aquifer in an area of the Town that is not designated for wellhead protection.

What are the Potential Economic Benefits of Installing a Decentralized Wastewater Treatment System?

Currently, most commercial properties along Route 20 cannot expand due to septic system limitations. Reliance on on-site septic systems severely limits the ability for property owners

along the corridor to attract new tenants particularly restaurants and food services like grocery stores. Restaurants create significant amounts of wastewater but are a critical component of successful retail/commercial areas. Additionally, costly repairs and maintenance of septic systems hurts the bottom line of businesses. Commercial property owners in the Route 20 area have spent over $3 million repairing or replacing their septic systems over the past 10 years, and will be faced with similar costs over the next decade.

Installing a decentralized wastewater treatment system along the corridor would eliminate the costly financial burden of frequent septic system repairs, create opportunities for new tenants, allow property owners to reinvest and redevelop their properties knowing that potential increased wastewater will be managed effectively, and allow the corridor to better compete with surrounding commercial areas, particularly the new Wayland Town Center.

What Does the Town Envision for Route 20 in the Future? Will Sudbury's Commercial Corridor be Able to Grow After Sewers are Installed?

Soon after Town Meeting concludes the Town will initiate a public process involving residents and businesses to begin planning for the future of Route 20 with decentralized wastewater. A Citizens Advisory Committee (CAC) will be formed, which will include subcommittees on creating a vision for Route 20, writing zoning bylaws, preparing bylaws and regulations for the sewer district, planning for other Route 20 streetscape improvements to be executed during the construction period, etc. The CAC will be the catalyst for zoning changes directed by the residents and businesses. There are many good examples in Massachusetts of successful mixed use business districts and corridors, and studying these examples will be the cornerstone of this effort. Preserving the character of Sudbury and creating development opportunities without allowing overdevelopment is of utmost concern, therefore adopting proper zoning controls needs to be carefully studied and executed.

Even without any zoning changes at all, the proposed wastewater system will be designed and constructed to handle approximately 50% additional flow from the existing properties in the service area. This will allow additional restaurants to locate in the existing shopping plazas, accommodate the renovation of vacant 2nd floor office space into residential units and allow for expansion of existing properties where all other zoning bylaws are complied with.

Questions regarding this project can be sent to Technical Advisory Committee at sewertech@sudbury.ma.us

SUDBURY
TOWN CRIER

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Sewage plant for Rte. 20 debated

Middle School fields to be tested for leaching field

By Kathy Uek
STAFF WRITER

The hydrogeological testing scheduled for December at the Curtis Middle School fields will determine the viability of the site for a leaching field and how a $15 million sewage treatment plant for the Rte. 20 business district could be designed.

The leaching field would need to handle 100,000 to 200,000 gallons per day of treated effluent, official said.

Steven Pederson and Blake Martin, of Weston & Sampson project engineers hired by the town, presented an overview of the Rte. 20 Business District Wastewater Management Plan to selectmen Tuesday night.

The testing would also allow the engineers to lay out the next steps in a project engineering report, which would include the design, financing alternatives, regulatory issues and public participation, according to the firm.

After 86 sites were screened and initial testing was performed on some, the playing fields at

SEWAGE, *page 16*

Curtis Middle School have been deemed to have the highest potential.

A schedule, according to the engineers, calls for finishing Phase 2, the design and permitting, in early 2013. Phase 3, bidding and construction, would be finished by summer 2015.

Selectmen Chairman John Drobinski asked the engineers for a ballpark figure to complete the project.

"$15 million," Steven Pederson replied.

State revolving funds could be a possible source for a 2 percent low-interest loan.

"The types of businesses and their ability to expand have for a long time been limited by septic systems that are in varying stages of decline," said Jody Kablack, director of Planning and Community Development.

If tax revenue from businesses increase, it would lessen the burden on homeowners, Kablack said.

"It's not just about the business growth, but a failing septic system that costs money to keep it limping along," said Lisa Eggleston, Technical Advisory chairwoman and an environmental engineer.

The process for building a treatment facility for the business district began nine years ago when the town hired Weston & Sampson.

Various funds and grants helped jump-start the process. Town Meeting this year transferred $90,000 from a 2002 Town Meeting article for the most recent work.

One possible location for the facility would be the Bushey property on Rte. 20, which is owned by the town and would be away from residential areas.

S U D B U R Y
TOWN CRIER

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Funding for sewer system discussed

By Kathy Uek
STAFF WRITER

Several financing plans to install a sewer system for the Rte. 20 business district were discussed by the Board of Selectmen at its Tuesday meeting.

Jody Kablack, director of Planning and Community Development, and Kent Nichols Jr. and Blake Martin, Weston and Sampson project engineers hired by the town, presented various scenarios.

With the hydro geological testing at Curtis Middle School complete, conditions are favorable, officials said. The leaching field could handle up to 350,000 gallons per day of treated effluent, said Martin.

The sewer project, estimated to cost $15 million with a 2015 completion date, would impact 100 business properties from Mill Village to Lafayette Drive with other benefits to the town as a whole, said Kablack.

Expansion of the business district has been limited by the septic system. With expansion, tax revenues would increase and lessen taxpayers' burden, Kablack said previously.

Additionally, the failing system has required costly repairs.

The $1million price tab, from local funding, would pay for design and planning (Phase 1). The $14 million, for bidding and construction (Phase 2), would be eligible for a State Revolving Fund (SRF) loan

"The loans are 0 percent and 2 percent and we would hopefully get a 0 percent loan," said Nichols.

Kablack said from her observation, the Department of Environmental Protection generally does not fund designs.

One proposal presented at the meeting would split the $1 million and present a Town Meeting article for $350,000 this year, which would pay for preliminary design, and request the balance of $650,000, along with the $14 million at another Town Meeting. Another option would be to present articles for $350,000, $650,000 and $14 million at three separate Town Meetings.

Selectman Chairman John Drobinski favored the $350,000 idea.

Nichols said if Town Meeting approves $1 million this year, the project would be ready to put out to bid.

"This is an opportunity to change the face of the business area," said Drobinski. "The important message to the town is that we don't want to start losing businesses because we don't have a sewer system."

"This is not an expense, it's an investment," said Selectman Bob Haarde.

With that investment, the town would appreciate some return from hook-up and usage fees. Kablack planned to have the analysis, to show the level of payback, completed by May.

After 86 sites were screened and initial testing was performed on some, the playing fields at Curtis Middle School were determined to be the most viable. The process for building a treatment facility for the business district began nine years ago with the hiring of Weston and Sampson.

Various funds and grants helped jump-start the process. Town Meeting this year transferred $90,000 from a 2002 Town Meeting article for the most recent work.

METRO WEST DAILY NEWS

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LOCAL

Funding options considered for sewer project

New system to cost $15 million

SUDBURY

By Kathy Uek
DAILY NEWS STAFF

SUDBURY – Selectmen discussed two options for funding the $15 million business district sewer project Tuesday night, favoring neither for now but agreeing that the project needs to happen.

"This is an opportunity to nge the face of the business ɜa," selectmen Chairman John Drobinski said. "The important message to the town is that we don't want to start losing businesses because we don't have a sewer system."

"This is not an expense. It's an investment," Selectman Bob Haarde said.

The town has been looking to build a treatment facility for about 100 business properties along Rte. 20 since 2002, with the Curtis Middle School playing fields recently determined to be the best spot. The sewer project, expected to be finished by 2015, will help businesses that come to the area and the town as tax revenues increase, said Jody Kablack, director of planning and community development.

Selectmen agreed Tuesday night as consultants presented options for funding the project.

Kablack, along with Kent Nichols Jr. and Blake Martin, project engineers with Weston and Sampson, outlined two main scenarios.

Of the $15 million cost, $1 million must come from local funding and will pay for design and planning. The other $14 million, for bidding and construction, will be eligible for a State Revolving Fund loan.

"The loans are zero percent and 2 percent, and we would hopefully get a zero percent loan," Nichols said.

The question is how to raise local funds for the first, $1 million phase.

The proposals both recommend splitting the amount, with $350,000 first for the preliminary design phase, but they differ in whether the total cost would be voted on over two Town Meetings or three.

In the first proposal, the $350,000 would be presented this year, with the remaining $650,000 rolled into the $14 million part of the project at another Town Meeting.

The other proposal has the $350,000, the $650,000 and the $14 million being considered at three separate Town Meetings.

Drobinski said he favored splitting the amount among three Town Meetings.

Selectmen did not offer their suggestion or vote on the funding, but they did say they would discuss the matter again before spring Town Meeting, the deadline for which submitting warrants is quickly approaching.

Nichols said if Town Meeting approves $1 million this year, the project would be ready to put out to bid.

Hook-up and use fees could also provide some revenue. An analysis of those figures will be available in May, Kablack said.

Haarde said yesterday that while selectmen agree the town needs the project, they are also aware of the tax burdens and overrides town residents are already facing.

The expansion of the business district between Mill Village and Lafayette Drive and the revenues the town could gain from business taxes, have been limited by the size of the septic system, town officials have said. The failing system has also required costly repairs.

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MA-97

SUDBURY
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SEWAGE SYSTEM

Views mixed about system

By Kathy Uek
kuek@wickedlocal.com

The proposed wastewater treatment system to service the Boston Post Road commercial district has some proprietors happy with the prospect and others who worry that the high cost and disruption during construction will harm their businesses.

Brian Hendrix, who owns Starz Salon in Mill Village, pays $700 a month for a tank to store excess water, which has to be pumped out on a regular basis.

"It kills me to pay $8,400 a year for the tank," said Hendrix, who has owned the salon for 21 years. "Whatever additional fees we would pay would offset that cost. I'm all for advancement ... It would be nice to make Sudbury more of a Wellesley-type community with a nice downtown. I'm all for the project. I think it's a great idea"

Realizing the project would take about three years to complete, Hendrix would like to see a plan that outlines the costs and the period of construction.

Franco Bruno, who celebrates his second anniversary this week as the owner of Franco's Trattoria in Mill Village, has concerns about costs.

"It's a good, idea, but I have to worry about how much of the cost would come out of my pocket," he said.

"No matter what good it does us in 2015, if they wreck our business, it doesn't help us," said Jennifer Dey, manager of Majorie's in Mill Village. "A lot of businesses here are hanging on. Because of the economy, business is not

SEWER, PAGE 3

easy; it's a constant battle."

At Town Meeting, which begins May 2, members will vote on a debt exclusion of about $1 million for the designing, permitting and feasibility of a sewer system for the Rte. 20 business district. The $14 million balance, for bidding and construction, would be eligible for a State Revolving Fund (SRF) loan of between 0 and 2 percent.

Town officials are waiting for Weston & Sampson, project engineers hired by the town, to provide a more definite cost for the first phase, now estimated between $800,000 and $1 million.

Former selectmen candidate Mike Hullinger has more questions than an opinion about the project.

He said before a decision is made to move forward, a complete fiscal impact of the project on the town and its taxpayers should be conveyed to residents.

Some of the questions Hullinger would like answered include knowing the existing septic capacity and that of the proposed sewer system; what additional staff would be needed to administer and maintain the system; and would residential properties along Rte. 20 be eligible to tie into the system or would the properties be rezoned commercial, providing a windfall property value benefit to current owners. He also wonders how the treatment system would be monitored for toxic chemical discharges into the leach fields at the Curtis Middle School.

Curtis playing fields were chosen for the leaching fields after 86 sites were screened and initial testing was performed on some.

The treatment plant located on Rte. 20, would process the waste. The treated water would then be piped to the leaching field at Curtis, which could handle up to 350,000 gallons per day of effluent.

With the current septic system, businesses in the area are paying hundreds of thousands of dollars for repairs when it fails, said Selectmen Chairman John Drobinski.

"Sooner or later, we need a system like this so businesses don't move out of town, which will affect our tax base," he said. "The new system will also change the mix of businesses and attract more companies on Rte. 20."

Although there would be benefits, Bruno of Franco's Trattoria said if the costs were too high, he'd be forced to increase prices. "I'd have to generate more business to offset the cost," he said.

Addressing Bruno's concerns, Drobinski said the intent is to have both businesses and homeowners share the cost equally. He said residential taxpayers would mainly fund the first phase.

"After the first part, we need to figure out how the bonds get paid off," he said.

One idea, said the chairman, is to have businesses

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pay a betterment fee, a surcharge for having the sewer. Another suggestion is to have the companies pay by the number of gallons of raw sewage they discharge into the system.

"There are a whole series of different ways to pay for it," said Drobinski. "The engineers would help us determine that. We would also look at what other communities do. Again, when I say equitable, we want to make sure it's fair to business as well as residents in town."

Having a waste sewer system would change the face of the district by making it more green and walkable, said Drobinski.

Without the leaching fields around the area, he said it would make shoppers more accessible to the businesses such as they do in Wellesley and Concord and have parking behind the shops.

Because of the limits of the current septic system, Franco's Tratorria can't have a dishwasher making it necessary for diners at the restaurant to use paper plates and plastic cutlery.

"It would help because not all customers like to use paper and plastic," said Bruno. "But again, I would need to know how much it would cost us."

Pierre Weiss, manager of Duck Soup, doesn't agree with Drobinksi that it would make the area walkable.

"People aren't used to walking around here," he said. "It's not a downtown Lexington, Concord or Wellesley. "I would love to be able to open my front door out onto Rte. 20 and have customers come in it."

The Duck Soup manager also questions what happens when the state eventually widens Rte. 20.

"Anything to help our business district would be good, but it depends on the cost," said Dey of Marjorie's. "It would help enhance the shopping experience in Sudbury. There are a lot of good things here and anything to draw attention to that would help us all."

If the debt exclusion for the first phase passes, the project would be ready to bid.

Account: 31409B (5773)
MA-231

Business, Government

Sudbury Town Officials Promote Sewer Project to Business Leaders

The proposed plan calls for construction of a sewer system for Sudbury's commercial district along portions of Boston Post Road and Union Avenue

By Helen Young | Email the author | 6:00am

At a gathering of the Chamber of Commerce at the **Wayside Inn** on Tuesday evening, Sudbury Planning and Community Development Director Jody Kablack was on hand to explain the town's plan to build a sewer system for Sudbury's main business district

"We have taken the project to a point where we have a feasibility analysis completed and we know that we can build a sewer system," said Kablack, who explained that this milestone had been elusive ever since the town began considering the project 40 years ago. "So we are kind of in a rush education mode right now. We are trying to get a lot of information out in a short amount of time."

Specifically, the proposed project would include all business and residential properties that front Boston Post Road from approximately Massasoit Avenue to Lafayette Drive, as well as properties on the southern portion of Union Avenue. A treatment facility would be located at 641 Boston Post Road, and wastewater would be piped up Horse Pond Road to the field in front of **Curtis Middle School** for leaching

At the annual Town Meeting on May 2, an article will be considered requesting an initial $1 million from the town's taxpayers to complete a detailed design for the project. After that, an estimated $14 million would be needed to fund the actual construction, which would likely take place over a two-year period from 2013 to 2015. This larger sum could potentially be funded by all Sudbury taxpayers, by just the property owners who would use the system, or by some combination of both

In a letter sent to town business leaders by the Route 20 Sewer Technical Advisory Committee on April 7, Committee Chair Lisa Eggleston summarized the potential advantages a sewer system could have for them

"Installing a decentralized wastewater treatment system along the corridor would eliminate the costly financial burden of frequent septic system repairs, create opportunities for new tenants, allow property owners to reinvest and redevelop their properties knowing that potential increased wastewater would be managed effectively, and allow the corridor to better compete with surrounding commercial areas," she said

At Tuesday's meeting, Kablack added that another important goal of the project is to protect the water supply, given that 60 percent of the town's drinking water comes from wells behind **Shaw's market**, where ground water quality could become an issue long term

During a brief question and answer session at the end of the meeting, audience reaction was mixed, with some welcoming the initiative and others expressing concern about whether the benefits would truly outweigh the costs. One attendee, who worried that the proposed sewer system wouldn't extend far enough since the businesses on the eastern end of Boston Post Road would be excluded, asked whether the effort might entail a phase two

"I don't expect to work on this project for the next 40 years," joked Kablack, "so no, probably not."

She elaborated that feasibility studies had indicated that this portion of town was too topographically distinct and geographically distant from the rest of the target area to be reasonably included

Additional information on the sewer system project will be posted on Sudbury's town **website** as it becomes available.

Frequently Asked Questions:

ARTICLE 20 - ROUTE 20 SEWER SYSTEM DESIGN AND PERMITTING
2011 ANNUAL TOWN MEETING

The Town of Sudbury relies almost entirely on individual on-site septic systems for disposal and treatment of wastewater. On-site septic systems generally work well in the residential areas of the Town; however, relying on on-site septic systems in commercial areas poses significant environmental and economic challenges.

Since 1999 the Town has analyzed the wastewater treatment issue; based on this analysis the Town believes that the solution to the on-site septic challenges is the installation of a **Decentralized Wastewater Treatment System** for the commercial corridor along Boston Post Road. This project is at the core of the Sudbury Master Plan as the predominant means of long term protection of our water supply, and the creation of a sustainable economic development strategy to relieve our reliance on residential property taxes. The 2011 Annual Town Meeting Warrant Article 20 proposes raising approximately $1 million for the design and permitting of a wastewater treatment system which would serve all properties on Boston Post Road (Route 20) from approximately Massasoit Avenue to Lafayette Drive, as well as the commercial properties on Concord Road, Union Avenue and Station Road.

Why do we need to be concerned with wastewater treatment along the Route 20 corridor?

The Board of Selectmen, working with the Route 20 Sewer Technical Advisory Committee, has advanced this project over the last 10 years from feasibility to reality. The 1999 Wastewater Needs Assessment, developed by Weston & Sampson Engineers, clearly demonstrated that the commercial properties along Route 20 are experiencing difficulty in treating and disposing of wastewater due to poor soil conditions and shallow depth to groundwater. The physical inability to properly dispose of wastewater leads to costly repairs and replacement of systems and the inability to attract certain types of businesses, particularly food services. The severity of the problem may eventually require businesses to shut down or move as the naturally occurring soils required for septic treatment are depleted, leaving no options for on-site disposal. Years of testing by the property owners have found limited soil suitability, if any, to expand the existing commercial septic systems.

Advanced wastewater treatment is necessary to protect the adjacent aquifers which provide Sudbury's drinking water; to prevent businesses from moving out of Sudbury and the loss of commercial tax revenue; and to accommodate business growth and revitalization along the Route 20 corridor.

How much money has the Town spent to date to study this issue?

Over the past 12 years the Town has appropriated a total of $135,000 for this project, with an additional $60,000 contributed by the Route 20 businesses and the Sudbury Foundation. These funds produced a Needs Assessment in 1999 which tabulated the wastewater usage of the entire corridor's businesses, identified the seriousness of the problem and prioritized areas of critical need for alternative wastewater treatment. From 2001-2009 numerous properties were investigated for suitability as a groundwater recharge system (i.e., leaching field) for the project. In 2009, the Curtis Middle School field site became an apparent possibility, and hydrogeological investigation of this site was completed in 2010. Currently our consultants are working on an updated Needs Assessment and a Project Engineering Report which is needed to gain state-approved financing of the project.

What is a Decentralized Wastewater Treatment System?

Traditional sewer systems typically convey wastewater (and stormwater) from expansive areas, long distances to a centralized treatment plant. Centralized sewer systems usually serve an entire town, are very expensive to build and maintain, pose challenges for containing development, and can redirect treated wastewater outside of watersheds, which reduces the ability to replenish groundwater supplies. On-site septic systems, on the opposite end of the spectrum and what Sudbury relies completely on, require a large land area to treat wastewater, and as they age are very prone to failure, creating unsanitary conditions, impaired water quality, and the need for expensive repairs. Decentralized wastewater treatment systems occupy the middle ground between on-site septic systems and traditional sewer systems.

Decentralized wastewater treatment systems are located in closer proximity to the source of wastewater being managed. Wastewater from multiple buildings is conveyed to a treatment facility where it is treated and then flows or is pumped to a groundwater recharge system where it percolates through the soil back to the groundwater supply. Decentralized systems address the limitations of on-site septic systems as they provide a much higher level of treatment before wastewater leaches back into the groundwater supply, and are monitored, which makes them much less prone to failure. Likewise, decentralized systems address the limitations of centralized sewer systems. They are more affordable to build and maintain and they recycle cleaned wastewater back to the groundwater supply. Finally, unlike on-site septic systems, which require large areas for wastewater treatment, and centralized sewers, which promote sprawling development patterns, decentralized wastewater systems can play a critical role in supporting compact development and redevelopment.

What Would a Decentralized Wastewater Treatment System Look Like in Sudbury?

Sudbury's system would consist of pipes laid under the roads within the service area, pump stations to move the effluent properly, a treatment plant building and a groundwater recharge system. No land acquisition would be required for this project; the Town currently owns a suitable site for the treatment plant at 641 Boston Post Road, the former Bushey property. This site is located within the Route 20 corridor and is situated away from developed residential areas. The treatment processes and machinery would be sited on this parcel completely within a building designed to look either like a barn, or some other appropriate structure for the site. The facility would include an odor control system, so no odors are anticipated to be noticeable from outside the building. The building would not block the existing trail head parking or interfere with the existing use of the property for conservation access.

After several years of searching, it was determined that the closest appropriate site for the groundwater recharge system is located on the Curtis Middle School property, also endorsed by the Town. Cleaned and treated water would be pumped 1.7 miles from the treatment facility under Horse Pond Road to a groundwater recharge system located beneath the athletic fields at Curtis Middle School, where it would percolate into the ground and replenish the aquifer. While this would interrupt the use of the Curtis athletic field temporarily during construction, the field would be fully useable upon completion. The Sudbury Public School Committee supports this project and the use of Curtis as a means of creating a sustainable economic future for Sudbury.

How can a Decentralized Wastewater Treatment System Address Environmental Challenges?

Reliance on on-site septic systems in Sudbury's commercial corridor has created an environmental challenge for the Town. Continued on-site septic use will allow environmental risks to continue. These risks are linked to soils along the corridor and the groundwater underneath it. Soil plays a critical role in treating wastewater as it leaches back into the groundwater aquifer. Septic systems require sufficiently permeable soil for water to move through and back to the groundwater aquifer. Adequate depth of soil ensures the wastewater is in contact with soil material for a sufficient period of time for treatment to take place. Unfortunately, the soils along Boston Post Road generally have moderate to severe limitations for on-site septic treatment, which makes individual systems more prone to failure. Additionally, the water table is generally high in this area, which increases the chance of on-site septic system failure by effectively reducing the depth of soil needed for treatment to take place.

All of Sudbury receives its drinking water from underground aquifers situated in various locations throughout the Town. The majority of the Boston Post Road corridor identified to be serviced by a decentralized wastewater treatment system sits above the Raymond Road Aquifer. This area is approved by the state's Department of Environmental Protection as a Zone II wellhead protection area, which means that the aquifer provides water for wells in the Sudbury drinking water system. Almost 60% of Sudbury's drinking water comes from the Raymond Road Aquifer area. Existing failing and inadequate septic systems along the corridor pose a potential threat to public drinking water supplies in this area. Installing a decentralized wastewater treatment system to service the commercial properties along Boston Post Road will address environmental issues associated with the area's poor soils and the area's role in providing public drinking water. It will accomplish this by aggregating wastewater from multiple commercial properties, conveying it to a treatment facility where it is treated and then allowed to percolate back into the groundwater aquifer in an area of the Town that is not designated for wellhead protection.

What are the Potential Economic Benefits of Installing a Decentralized Wastewater Treatment System?

Currently, most commercial properties along Route 20 cannot expand due to septic system limitations. Reliance on on-site septic systems severely limits the ability for property owners along the corridor to attract new tenants, particularly restaurants and food services like grocery stores. Restaurants create significant amounts of wastewater but are a critical component of successful retail/commercial areas. Restaurants such as Panera Bread and Bertuccis have both expressed interest in locating in Sudbury, however without a sewer system there are no sites in Sudbury where they can be accommodated due to their wastewater needs. Additionally, due to the physical constraints along the corridor, septic systems fail more frequently resulting in costly repairs and maintenance, which hurts the bottom line of businesses and results in reduced property values. Commercial property owners in the Route 20 area have spent over $3 million repairing or replacing their septic systems over the past 10 years, and will be faced with similar costs over the next 10 years.

Installing a decentralized wastewater treatment system along the corridor would eliminate the costly financial burden of frequent septic system repairs, create opportunities for new tenants, allow property owners to reinvest and redevelop their properties knowing that potential increased wastewater will be managed effectively, and allow the corridor to better compete with surrounding commercial areas, particularly the new Wayland Town Center. Sudbury's commercial corridor is at a competitive disadvantage because of its wastewater treatment challenges.

What Does the Town Envision for Route 20 in the Future? Will Sudbury's Commercial Corridor be Able to Grow After Sewers are Installed?

Soon after Town Meeting concludes the Town will initiate a public process involving residents and businesses to begin planning for the future of Route 20 with decentralized wastewater. A Citizens Advisory Committee (CAC) will be formed, which will include subcommittees on creating a vision for Route 20, writing zoning bylaws, defining the sewer service area, preparing bylaws and regulations for the sewer district including its operation, planning for other Route 20 streetscape improvements to be executed during the construction period, and other issues. The CAC will be the catalyst for zoning changes directed by the residents and businesses. There are many good examples in Massachusetts of successful mixed use business districts and corridors, and studying these examples will be the cornerstone of this effort. Preserving the character of Sudbury and creating development opportunities without allowing overdevelopment is of utmost concern, therefore adopting proper zoning controls needs to be carefully studied and executed.

Even without any zoning changes at all, the proposed wastewater system would be designed and constructed to handle approximately 50% additional flow from the existing properties in the service area. This would allow additional restaurants to locate in the existing shopping plazas, accommodate the renovation of vacant 2nd floor office space into residential units and allow for expansion of existing properties where all other zoning bylaws are complied with.

It is possible that sewering Route 20 may provide wastewater options for more dense residential development in the form of multi-family housing (such as developments using 40B zoning), however state guidelines for 40Bs do not promote or advocate for densities above 12 units per acre for suburban sewered areas. Additionally only properties which directly front on the sewer line would be eligible to utilize it for wastewater disposal. Most of the Route 20 residential properties are small, with the majority being less than 1 acre in size. Even if aggregated, they would not support large-scale residential development. The cost to hook into the sewer for small multi-family housing development would generally cost more than constructing a conventional septic system, therefore the sewer may actually be a deterrent to this type of development. It is doubtful that commercially zoned properties would be redeveloped for residential use, as the value is higher for commercial use.

How will Sudbury Control Increased Development Pressure that will Result from the Installation of a Decentralized Wastewater Treatment System?

Sudbury has a long and successful history of using traditional land use controls to provide a regulatory landscape that promotes development that fits into and enhances Sudbury's traditional development patterns. Looking forward, the Town will identify enhanced regulatory mechanisms that may be employed to ensure accommodative growth along Boston Post Road after the installation of a decentralized wastewater treatment system, such as overlay districts and mixed use zoning. Mixed use zoning, where residential and commercial uses are developed together, is an effective method of creating vibrancy and critical mass in commercial districts.

What other alternatives has Sudbury explored for wastewater disposal?

Over the nine or so years that the Route 20 Sewer Technical Advisory Committee worked to find a suitable parcel for the groundwater recharge system, they also explored possible alternatives to constructing a decentralized plant in Sudbury. Framingham is a member of the Metropolitan Water Resource Authority (MWRA), and hooking into that system was one option investigated. However, there were more cons than pros – removing wastewater from Sudbury would be considered an out-of-basin transfer of water resources by DEP, and is highly discouraged, particularly for communities that rely on groundwater supplies for their drinking water. The historical high cost of MWRA services was also a deterrent. Framingham also does not have the capacity to incorporate Sudbury's needs into their system without costly upgrades.

Piping our wastewater to the City of Marlborough's Easterly Treatment Plant was also investigated, since that plant is located fairly close to the Sudbury town line. This alternative was rejected based on the high cost of pumping raw sewage, as well as for political reasons, since Sudbury and Marlborough have litigated over the exceedance of the EPA permit for discharge from this treatment plant into Hop Brook, which causes eutrophication of the ponds and streams in and through Sudbury. Adding additional wastewater to this system was thought to be an alternative that would not be popular with Sudbury residents.

Installation of large, community septic systems is sometimes a method of wastewater discharge for parcels of land with unsuitable soils. However, there is no land area within the Route 20 business area that has suitable soils, and most of the area is within the direct recharge zone to the town's water supply.

In addition to the Curtis Middle School a number of other parcels were investigated, and soil tests were conducted on several of them. The DPW property on Old Lancaster Road, and Haskell Field on Fairbank Road were among those tested but were rejected due to soil conditions and/or insufficient infiltration capacity. The Stone Farm on Horse Pond Road and Cavicchio's greenhouses on Union Avenue were logical properties to explore, however they are in private ownership and the owners of these properties are not interested in using their land for this purpose. Parcels located south of Route 20 were determined to be too close to the drinking water wells to meet DEP standards for travel time for the leachate. Many other parcels were explored and rejected. The Curtis Middle School parcel is not only the town's best option, but it may be the only one. The soils there have been determined to be highly suitable for infiltration, with a good depth to groundwater. The proposed leaching field location provides ample space to infiltrate the entire volume of wastewater needed, without impact on the school's septic system or neighboring properties.

What will happen if we don't install a sewer system for the commercial corridor?

If this project does not advance, the environmental challenges discussed above will continue, and will likely get worse. Businesses will find it increasingly difficult to discharge wastewater due to saturated soils and more stringent regulatory requirements, and may need to relocate to other Towns where the soils are better or sewers are available. The threat of contamination of the drinking water supply will also continue.

How is Sudbury Proposing to Pay for this Project, and what will be the Cost to the Average Taxpayer?

The project is broken down into 2 distinct phases - the design and permitting phase, and the construction phase. Design and permitting would involve designing the treatment plant (components, size, and type of treatment process), the piping in the roadway and the groundwater recharge system at the Curtis Middle School, as well as the Dept. of Environmental Protection groundwater discharge permit and the Mass. Environmental Protection Act (MEPA) permitting. This phase would be completed in approximately 18 months and is estimated to cost approximately $1 million. Currently this phase is being proposed to be apportioned between all taxpayers in Sudbury – residential and commercial. The cost would be borrowed over a 5 year period (as allowed by law), resulting in a total cost of $175 to the average residential taxpayer with a home assessed at $628,000 and $300 to the average commercial taxpayer with a business assessed at $810,000.

With Sudbury's current split tax rate, a heavier burden is being placed on the commercial taxpayers than the residential payers in this scheme. However, the entire burden is not being placed on the commercial taxpayers, as there would be a benefit to all Sudbury residents if and when the sewer is installed and the groundwater supply, which serves all Sudbury residents, is secured and protected. In addition, not all of the commercial properties in town would be served by the proposed sewer. It is anticipated that all residents would also benefit when the planned infrastructure improvements create the opportunity for Sudbury's commercial sector to expand and raise additional revenue. This first phase is viewed as an investment in Sudbury's future.

The second phase is the construction of the system, which would involve building the treatment plant at 641 Boston Post Road, laying the pipes in Route 20 and Horse Pond Road, and constructing the groundwater recharge system at the Curtis Middle School. This phase is currently estimated to cost approximately $14 million, however the Town would have much better information on the cost of the construction phase once the design is complete. A final decision has not been made on how the construction cost would be apportioned between taxpayers, however it is anticipated that a large share of the cost would be recovered through the assessment of betterment fees on the properties which are in the service area, since those properties would receive a "specific benefit" from the infrastructure improvement. A betterment is a onetime tax that can be paid in one lump sum or financed by the Town over a maximum period of 20 years. The amount of the betterment is typically calculated based on a property's usage of the wastewater treatment plant, so as an example, a single family home that fronts on Route 20 within the sewer service area would pay a fee based on their usage of approximately 330 gallons per day, while the Shaw's plaza would pay a betterment fee based on their usage of approximately 8,000 gallons per day. In many Massachusetts' communities, both betterment fees and taxation are used to pay for wastewater projects, since the vitality of the commercial district and the tax revenue it brings in is a "general benefit" to all residents. The Town is confident that a fair and equitable arrangement can be approved which does not overburden any one property owner or sector. The construction phase is anticipated to take approximately 24 months to complete. Ongoing operational costs of the treatment facilities would be paid completely by the users of the system.

Providing necessary infrastructure to shape a town's future has historically been a municipal function, and this project is no different. Just as the business community in Sudbury provides our local services and generously supports many school activities and local fundraising events, residents are now being asked to partner with the commercial property owners to help build a more sustainable business community. Much is on the line for Sudbury as we embark on this project. Now is the time to either commit to a long term project which has many attributes, including the protection of our drinking water supply and economic development opportunities that have been discussed for decades, or pass the opportunity by.

Town of Sudbury

Route 20 Sewer Technical Advisory Committee

sewertech@sudbury.ma.us

April 7, 2011

Dear Sudbury Business Leader,

Sudbury faces a significant challenge to continue providing and preserving drinking water from underground aquifers to all residents, and sustaining the viability of our commercial property. Sudbury relies almost entirely on individual on-site septic systems for the disposal and treatment of wastewater (both residential and commercial). This is generally not an issue in residential areas, but as you may know, it has become a major problem in the areas of commercial development, particularly along an approximately 2 mile stretch of Boston Post Road. The Town's majority of business establishments, with almost 1 million square feet of commercial real estate, are located along this stretch of Boston Post Road, as are the Town's water supply wells. The continued reliance on septic systems for wastewater disposal is severely limiting the growth of existing businesses, curtailing the types of businesses that are able to locate in Sudbury, eliminating the possibility of introducing mixed-use development along the corridor, and threatening the adjacent underground water supply.

Sudbury's commercial corridor is at a competitive disadvantage because of its wastewater treatment challenges. Due to the high water table and poor soils along the corridor, septic systems fail more frequently resulting in costly repairs and maintenance, which hurts the bottom line of businesses. Reliance on on-site septic systems severely limits the ability for property owners along the corridor to attract new tenants, particularly restaurants and food services like grocery stores. Installing a decentralized wastewater treatment system along the corridor would eliminate the costly financial burden of frequent septic system repairs, create opportunities for new tenants, allow property owners to reinvest and redevelop their properties knowing that potential increased wastewater would be managed effectively, and allow the corridor to better compete with surrounding commercial areas.

Since 2000, the Town has spent considerable time and resources analyzing this issue and identifying potential options. The most favorable solution is the installation of a decentralized wastewater treatment system for the commercial corridor. The Town has advanced this idea most recently by identifying suitable locations on existing Town properties for both the treatment plant and the leaching field. Wastewater would be collected from all properties fronting Route 20 from approximately Massasoit Avenue to Lafayette Drive. The wastewater would be treated at a plant located on Route 20, and would be piped up to the Curtis Middle School for leaching. Hydrogeological testing was completed in the late fall of 2010, confirming the locations.

The next step in this process is a proposal at May's upcoming Town Meeting to authorize the Town to contract for the design and permitting of the system. This phase of the project is estimated to cost approximately $1 million. Once designed, a final Town Meeting vote will be needed to authorize funds for construction of the system, currently estimated at $14 million.

These are significant sums to ask any property owner to contemplate, and we are working on funding scenarios which are fair and equitable to both the residential property owners, and the small commercial property owners. We don't have all the answers yet, and are open to suggestions, comments and considerations from all parties. However, we view this project as an investment in Sudbury's future, and are hoping all residents and property owners do as well.

A brief presentation will also be made on the wastewater project to the Sudbury Chamber of Commerce on Tuesday, April 12, 2011 at 5:30 pm at the Wayside Inn. The vote for design funding will be at the May 2 Annual Town Meeting, Article 20.

In the meantime, questions regarding this project can be sent to sewertech@sudbury.ma.us

Sincerely,

Lisa Eggleston, Chairman, Route 20 Sewer Technical Advisory Committee

C.R.I.

Cail Realty and Investments *106 Access Road* *Norwood, MA 02062* *781-769-5858* *Fax 781-769-4269*

April 25, 2011

Mr. John Drobinski
Mr. Lawrence O'Brien
Mr. Robert Haarde
Sudbury Board of Selectmen
Flynn Building
278 Old Sudbury Road
Sudbury, MA 01776

Re: Business Community's Support for Article 20

Gentlemen:

We write to express our support for the Town's efforts to design, permit and construct a sewer system along the Route 20 business corridor. We are hopeful that Sudbury's residents will act favorably on Article 20 at Town Meeting, and authorize appropriation of the $1 million dollars required to complete the design and permitting phase of the project.

The need to sewer the commercial district is acute as businesses are faced with costly septic system repairs and fewer options to discharge wastewater in an area of high groundwater and poor soils. Sudbury's commercial corridor is at a competitive disadvantage due to these challenges, and reliance on on-site septic systems severely limits our ability as property owners to attract new tenants, particularly restaurants and food services.

We understand that the design, permitting and construction of the sewer system is a costly endeavor. We are also cognizant of the costs we are likely to face in having to constantly repair and replace our septic systems over time. Therefore, we in the business community are amenable to discussing scenarios whereby a significant portion of the cost to design and construct the system will be paid by its users.

Mr. John Drobinski
Mr. Lawrence O'Brien
Mr. Robert Haarde
April 25, 2011
Page 2

Thank you for your efforts to move this important project forward.

Sincerely,

Richard B Cohen

Hal Garnick/Richard Cohen, Sudbury Crossing (TJ Maxx)

John Civilinski, Director of Real Estate, Gravestar Inc., Shaw's Plaza

Charles D. Katz, Manager

Charles D. Katz, Katz Irrevocable Trust, The Rugged Bear Plaza

Faith Kaplan, 1776 Plaza (Sudbury Farms Plaza)

Randy Goldberg, Intrum Corporation, Mill Village

Louis B. Stephan, Prudential Stephan REALTORS (Sudbury Chamber of Commerce)

SUDBURY TOWN CRIER

Date: Thursday, April 14, 2011
Location: SUDBURY, MA
Circulation (DMA): 3,376 (7)
Type (Frequency): Newspaper (W)
Page: 10,12
Keyword: Weston & Sampson

RTE. 20 SEWER

Now is the time to take action

By Lisa D. Eggleston
Guest Column

To follow up on the front-page article in the April 7 edition of the Town Crier, it is ironic that at the same time the article was being posted, a large public meeting was being held in the Town offices to discuss the Route 20 sewer project. Members from the Board of Selectmen, Finance Committee, Planning Board, Route 20 Sewer Technical Advisory Committee, Sudbury Water District, Board of Health and Conservation Commission were present, as well as representatives from all the retail plazas along Route 20, including Sudbury Farms, Gravestar, Sudbury Crossing, Rugged Bear, Mill Village, and the president of the Sudbury Chamber of Commerce. The meeting was convened to update all the groups on the progress of the project so that informed decisions can be made at the May 2 Town Meeting, where Article 20 will ask the residents to authorize a $1 million debt exclusion for the design and permitting of the sewer system.

The need to sewer the commercial district has not changed in the last 20 years. In fact, it has become more critical as businesses are faced with costly septic system repairs and fewer options to discharge wastewater in an area of high groundwater conditions and poor soils. Sudbury's commercial corridor is at a competitive disadvantage due to these challenges. Reliance on on-site septic systems severely limits the ability of property owners to attract new tenants, particularly restaurants and food services. Additionally, the discharge of wastewater along Route 20 has the potential to degrade Sudbury's drinking water supply. The wells that produce 60 percent of Sudbury's drinking water are located directly south of the Route 20 corridor.

Thursday's meeting focused on how to pay for the upcoming article, as well as how the full sewer system will be financed, and on whose shoulders the costs will fall. The Town's consultant, Weston & Sampson, provided options for financing the full project, estimated at $15 million. The Town will have the ability to assess betterments to the properties fronting the sewer system for the construction phase. No decisions were made regarding the cost apportionment between Sudbury taxpayers and the system users. However the plaza owners indicated that the costs that they are faced with to repair and replace their septic systems over the next 10 years is likely greater than what the cost for the sewer system will be, and conceptually they support moving forward with the expectation that a significant portion of the cost, if not the total cost, will be paid by the users.

The financing of the $1 million design portion to be voted on at Town Meeting also has options. Many at the meeting thought that this phase of the project should be paid for by all taxpayers, as the long term viability of the Route 20 business district, as well a protection of our water supply, benefits all residents. Costs for this phase, if apportioned to all taxpayers, would cost the average residential property (assessed at $628,000) approximately $35/year for 5

SEWERS, PAGE 12

years, or $175 total. The average commercial property (assessed at $810,357) would pay approximately $60/year for 5 years, or $300 total.

If design funding is approved this year, and construction funding is approved in 2013, the Town could see a sewer system along the Route 20 corridor by 2015. An 18-month design and permitting period, and a 2-year construction period, is anticipated. The system would be designed for both sustainability and growth in the commercial districts, and new zoning is envisioned to ensure that properties grow in locations that are preferable and appropriate, uses are compatible for our vision of Sudbury, and so that over-development does not occur. New growth will enhance the tax revenue from the commercial sector, and po-

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tentially relieve some of the residential tax burden, which is another town-wide benefit to sewering the area. Rezoning is an integral part of this project, and will be undertaken in a community process with wide input from residents and businesses.

The time is now to make this work. Delaying it could stop the project, as the momentum is high and the groundwork has been laid. We have completed our feasibility analyses, are in line for a low interest loan from DEP for the construction phase, and are garnering support from the business community. Protection of Sudbury's environment, economic sustainability, and quality of life is at stake. Additional information will be available as we get closer to Town Meeting on the potential economic impacts of the project.

Lisa D. Eggleston, P.E., is the chairman of the Wastewater Technical Advisory Committee

To the Editor,

To follow up on the front page article in the April 7^{th} edition of the Town Crier, it is ironic that at the same time the article was being posted, a large public meeting was being held in the Town offices to discuss the Route 20 sewer project. Members from the Board of Selectmen, Finance Committee, Planning Board, Route 20 Sewer Technical Advisory Committee, Sudbury Water District, Board of Health and Conservation Commission were present, as well as representatives from all the retail plazas along Route 20, including Sudbury Farms, Gravestar, Sudbury Crossing, Rugged Bear, Mill Village, and the president of the Sudbury Chamber of Commerce. The meeting was convened to update all the groups on the progress of the project so that informed decisions can be made at the May 2 Town Meeting, where Article 20 will ask the residents to authorize a $1 million debt exclusion for the design and permitting of the sewer system.

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If design funding is approved this year, and construction funding is approved in 2013, the Town could see a sewer system along the Route 20 corridor by 2015. An 18 month design and permitting period, and a 2 year construction period, is anticipated. The system would be designed for both sustainability and growth in the commercial districts, and new zoning is envisioned to ensure that properties grow in locations that are preferable and appropriate, uses are compatible for our vision of Sudbury, and so that over-development does not occur. New growth will enhance the tax revenue from the commercial sector, and potentially relieve some of the residential tax burden, which is another town-wide benefit to sewering the area. Rezoning is an integral part of this project, and will be undertaken in a community process with wide input from residents and businesses.

The time is now to make this work. Delaying it could stop the project, as the momentum is high and the groundwork has been laid. We have completed our feasibility, are in line for a low interest loan from DEP for the construction phase, and are garnering support from the business community. Protection of Sudbury's environment and quality of life is at stake. Additional information will be available as we get closer to Town Meeting on the potential economic impacts of the project.

Sincerely,

Lisa Eggleston, Chairman, Route 20 Sewer Technical Advisory Committee

Town of Sudbury, Massachusetts

Public Forum

November 7, 2001

Route 20 Business District

Wastewater Needs Assessment

Weston&Sampson

Since 1899

PROJECT GOALS

- Economic Sustainability
- Protection of Town's Water Supply

Weston&Sampson
Since 1899

Study Area

WASTEWATER MANAGEMENT NEEDS ASSESSMENT

Weston&Sampson
Since 1899

PROJECT SCOPE

- Assessment of Current Conditions
- Assessment of Future Conditions
- Wastewater Needs Identification
- Preliminary Evaluation of Potential Alternatives
- Report Preparation

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Since 1899

CURRENT CONDITIONS

- On-Site Wastewater Disposal Systems
- Soil Types – Moderate to Severe Limitations
- Town Drinking Water – Underground Aquifers (DEP Zone II)
- Hop Brook – List of Impaired Surface Waters

Weston&Sampson Since 1899

WASTEWATER NEEDS IDENTIFICATION

- System Age
- Condition of System
- Soils Classification
- Groundwater Levels
- Lot Size
- Environmental Concerns

Weston&Sampson Since 1899

WASTEWATER NEEDS MATRIX

- "Non-Priority" Parcels (28)
- "Priority" Parcels (45)
- "Critical" Parcels (30)

Weston&Sampson Since 1899

Ranked Parcels

SUMMARY OF BUILD-OUT WASTEWATER DESIGN FLOWS (gpd)

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

WASTEWATER MANAGEMENT ALTERNATIVES

- Repair/Upgrade Existing Septic Systems
- Shared Septic Systems
- Decentralized Wastewater Treatment

PRELIMINARY STUDY AREA RECOMMENDATIONS

- **East** – Repair/Upgrade Existing Septic Systems (For Now)
- **Center** – Consider Decentralized Options
- **West** – Repair/Upgrade Existing Septic Systems (For Now)

Weston&Sampson
Since 1899

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.

Weston&Sampson
Since 1899

WHAT NEXT?

1. Is there consensus to continue? If yes…
2. Find Site(s) for Decentralized Treatment Facility (2002)
3. Finish Planning Process (State Approval) (2002-2003)
4. Design (2004)
5. Build (2004-2005)

Weston&Sampson
Since 1899

SUDBURY TOWN CRIER & TAB
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126 6 CG

11-26-01

37 Route to: SKP FYI

Would business shoulder cost?

SEWER, from page 1

the impression the town would pay for it."

MacKinnon said he would "love" to see the decentralized waste management system built, saying "it would benefit everybody." Yet, he said he does not know whether it is in his business's best interest to pay for it.

"I could just put $10,000 of my own money into septic (improvements)," he said.

According to Sampson & Weston, each business would pay anywhere from $72,000 to $106,000 each depending on the number of businesses who use the system. These figures were arrived at assuming all lots pay the same regardless of size or volume of sewage.

Gravestar Property Manager John Williams said he was unaware of the cost of the study.

"I have to look into it and see what it would mean for Gravestar financially," he said.

The company owns Sudbury Plaza on Route 20, which houses Star Market. It recently finished installing a state-of-the-art septic system earlier this year.

"My personal thoughts (are) that it will benefit the entire community," he said. "But first, I want to see what it costs."

Selectmen Chairman John Drobinski said he would like to see a system where the town bonds the project and has the businesses pay it off through a special commercial tax.

That way, the town maintains control of the project," Drobinski said. He added he has not yet heard all the information and will, like the wastewater management committee, wait until it is the proper time to discuss the issue. He also said he is open to the possibility of residents paying for part of the costs.

Chamber of Commerce board member Nick Palermo said he would prefer businesses pay for the project, as they will benefit from it the most.

"It would make multimillionaires out of anyone who owns property on Route 20," he said.

Palermo said a decentralized sewer system would allow greater density on Route 20 lots, thus allowing for further expansion. This, he said, would then increase the property value tremendously.

He added federal and state funds may be easily obtained for the project, as it would stimulate the economy.

"Once you put the sewer line in, it's over," he said. "You never have to redo a septic system again."

He said $72,000 may seem like a lot, but once bonded, would only come to a few hundred dollars a month.

"Every business can afford a few hundred bucks a month to put in a sewer," he said.

Copies of the 100-page report are located at the Goodnow Library, the planning board office and the selectmen's office and are available to the public.

The study was included as a goal of the town's master plan.

Support for sewer system on Route 20

PAGE ONE

Business owners approve of the idea but not of paying for the new facility

1409

By Matthew Fisher
STAFF WRITER

Chamber of Commerce President Ron Stephan said he likes what he heard at Wednesday's wastewater management needs study open forum.

He said he would support the Sewer Assessments Technical Advisory Committee's study conclusions and, like the committee, would favor a decentralized waste management facility sewer system for the Route 20 business district.

But would he support the businesses paying for all of it?

"I don't think so," he said.

Stephan, like many members of the business community, supports the ideas of the committee but still has many questions to ask.

According to committee chairman Lisa Eggleston, questions like cost have not been thoroughly discussed yet and will be dealt with at a later planning stage. All the committee has done, she said, is a needs assessment study, and the study concluded that there is a need for a new wastewater management system, preferably a decentralized system.

A decentralized system would be like a city's sewer system, only on a smaller scale with multiple treatment plants instead of one large centralized facility.

Each business would pay anywhere from $72,000 to $106,000 each depending on the number of businesses who use the system.

She said the next step for the com mittee is to approach the selectmen t discuss appropriating funds for a fea sibility study.

A feasibility study would investi gate possible locations and costs, a well as conduct soil, water, traffi and other environmental studies.

The committee has already me with the Department of Environmen tal Protection to discus state revolving fun loans to help pay for th study.

At the public forur the issue of cost w raised by audien members, curious as who pays for this mul million-dollar project.

Weston & Samps Engineering Inc. repr sentatives said in many towns t business district would cover 1 percent of the costs. Eggleston quic ly added that was one option many, though the one preferred Wayland when it created a sim system for its Route 20 businesses

Some members of the busin community are alarmed by this proach and said they were not sur they would support it.

"I was under impression this for the town to use...to upgr Route 20," said MacKinn Liquors owner John MacKin who also owns the building houses his store. "I was also ur

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Route to: SKP, FYI

'People accept that we need economic development. They're aware that we're pretty much taxing ourselves out of town.'

MARIANNE D'ANGELO, *Sudbury Economic Development Committee*

Sudbury edges toward limited sewer system

1409

Panel will study possible locations for treatment plant

By Thanassis Cambanis
GLOBE STAFF CORRESPONDENT

SUDBURY — Old septic systems have choked downtown development in Sudbury and potentially threaten the environment, according to a study released this month, and now a town committee wants to take the next step toward a limited sewer system for the business district.

"We get numerous requests from small businesses interested in locating to Sudbury, but you're really stymied in what you can do if you don't have alternatives to on-site septic systems," said Marianne D'Angelo, a member of the Sudbury Economic Development Committee.

Like many suburbs, Sudbury began considering a sewer system in the 1960s, but plans fell victim to lack of funds or fears of runaway growth.

Two years ago, however, Town Meeting voted to fund a study of the commercial district along Route 20.

The engineering company Weston & Samson concluded that the business zone needed some sort of localized waste-water treatment plant, because most enterprises were severely constricted by aging septic systems.

Now, the Sewer Assessment Technical Advisory Committee wants to take the next step and look at possible systems and locations for a treatment plant in the central commercial district along Route 20.

"The town should investigate alternatives," said Lisa Eggleston, the committee chairwoman. "A lot of properties in the primary commercial area were assessed as having a critical need."

An engineering study — funded either by local businesses or by Town Meeting — would look at possible sites for a treatment plant.

Sudbury's economic development blueprint calls for a greater diversity of small businesses in the slice of town reserved for commercial activity.

Currently, about 10 percent of the town's tax revenue comes from commercial property.

According to the engineering study, many of Sudbury's small businesses need to upgrade their septic systems to comply with state law. Judging by the recent experiences of enterprises like Sudbury Farms or the Lotus Blossom Chinese Restaurant, new waste-water systems can cost hundreds of thousands of dollars.

"Some businesses have installed new systems, others are in complete failure," Selectman Larry O'Brien said. "If we're ever going to expand our revenue base from [the] commercial sector, we need to vary the type of businesses and services."

Sudbury might qualify for interest-free loans from the state to plan a sewer system, but the town might also ask business owners to foot the bill.

"The business community needs to stand up and say, 'Yes, we want to be a part of this,' " D'Angelo said. "It would be very appropriate for us to ask the business community to put up some money because basically they are the ones who would benefit."

Bill Cossart, another sewer committee member and a local business owner, said it could cost $7 million just to bring septic systems into compliance with state law.

"In the long run," he said, "it appears businesses would be better off" with a sewer system.

However, he warned, the costs of a system, even a small one, could be high. "Once we know the price, people will have to decide whether they want to go ahead with it," he said.

In the past, Eggleston said, residents have objected to sewer plans that included the entire town. This time, an inclusive process involving planners and business owners has won broad support.

"Lots of people who were previously concerned felt assured that the scope of this study was limited to the needy areas, and not on [installing sewers throughout] the entire town of Sudbury and triggering all sorts of growth," Eggleston said.

D'Angelo said Sudbury residents were more receptive to business now than a decade ago. "You don't hear the same arguments today," she said. "People accept that we need economic development. They're aware that we're pretty much taxing ourselves out of town."

Town of Sudbury, Massachusetts

School Committee Meeting
June 23, 2010

Route 20 Business District
Wastewater Management Plan

Introduction

- Wastewater Treatment and Disposal
- Route 20 Business District
  - Economic Sustainability
  - Water Supply Protection
- TAC/Needs Assessment
- Decentralized Wastewater Treatment

Route 20 Business District

On-Site Constraints

- Soil Types – Moderate to Severe Limitations
- Shallow Depth-To-Groundwater
- Town Drinking Water – Underground Aquifers (DEP Zone II)
- Hop Brook – List of Impaired Surface Waters

Wastewater Needs Matrix

- System Age
- Condition of System
- Soils Classification
- Groundwater Levels
- Lot Size
- Environmental Concerns

Ranked Parcels

- "Non-Priority Parcels (28)
- "Priority" Parcels (45)
- "Critical" Parcels (30)

SUMMARY OF BUILD-OUT WASTEWATER DESIGN FLOWS (gpd)

Area	"Non-Priority" Flows	"Priority" Flows	"Critical" Flows	Total Flows (2001 study)	Total Flows (2010 update)
West	37,313	18,428	17,708	73,449	102,767
Central	10,101	51,982	44,725	106,808	112,598
East	49,520	52,727	1,028	103,275	103,275
Totals	96,934	123,137	63,461	283,532	318,640

Weston&Sampson.

Disposal Site Evaluations

- Initiated evaluations for a disposal site of a minimum of 100,000 gpd
- Need:
  - 2-6 acres
  - Depth-to-groundwater
  - Permeable deposits
  - No impacts to human or ecological receptors

Weston&Sampson.

Site Screening

- 86 sites
- Subsurface work at DPW, etc.
- Narrowed down to 3 general possibilities

Weston&Sampson.

Screened Recharge Sites

Weston&Sampson.

2008 - 2009

- Preliminary hydrogeologic investigation at:
  - Haskell Field
  - Old Lancaster Road
  - Curtis Middle School

Weston&Sampson.

Sites Map

Weston&Sampson.

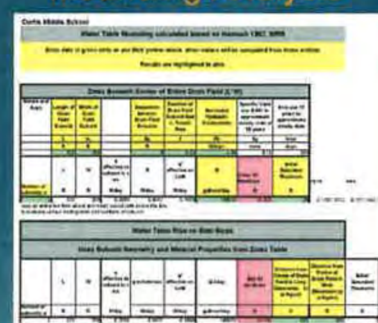
Curtis Middle School

- Depth-to-groundwater:
  - Approximately 29 feet
- Sand and gravel deposits
- Estimated capacity of 100,000 – 200,000 gpd

Boring Locations

Well Logs

Mounding Analysis



Potential Layout of Fields

Additional Hydrogeologic Investigations to Pursue

- Hydrogeo work plan to DEP
- Load scale test
- Groundwater modeling
- GWDP application

MA Groundwater Discharge Permits Schools and Recreational Facilities

TOWN	FACILITY NAME
BARNSTABLE	BARNSTABLE HORACE MANN SCHOOL
BOLTON	NASHOBA REG. HIGH SCHOOL
BOURNE	BOURNE MIDDLE SCHOOL
BYFIELD	TRITON REGIONAL HIGH
CARLISLE	CARLISLE PUBLIC SCHOOLS
CARVER	[illegible]
CHATHAM	[illegible]
CONCORD	CONCORD COUNTRY CLUB
DOVER	DOVER-SHERBORN HIGH
DUXBURY	DUXBURY SCHOOL COMPLEX
EASTON	EASTON SCHOOL DEPT
GREAT BARRINGTON	BERKSHIRE HILLS REG. SCHOOL
HARVARD	HARVARD PUBLIC SCHOOLS
HARWICH	MIDDLE & ELEM SCHOOLS
HOLLISTON	WOODLAND STREET SCHOOL
KINGSTON	SILVER LAKE REG. HIGH
LAKEVILLE	FREETOWN-LAKEVILLE REG. SCH
LITTLETON	LITTLETON PUBLIC SCHOOLS
LYNNFIELD	LYNNFIELD MIDDLE SCHOOL
LYNNFIELD	LYNNFIELD HIGH SCHOOL
MARSHFIELD	MARSHFIELD PUBLIC SCHOOLS
MT. WASHINGTON	[illegible]
NORTON	NORTON MIDDLE SCHOOL

TOWN	FACILITY NAME
NORWELL	NORWELL HIGH SCHOOL
OAK BLUFFS	[illegible]
PEMBROKE	PEMBROKE HIGH SCHOOL
PLYMOUTH	PLYMOUTH SOUTH HIGH SCHOOL
SANDWICH	SANDWICH HIGH SCHOOL
SANDWICH	FORESTDALE SCHOOL
SANDWICH	[illegible]
SHARON	SHARON PUBLIC SCHOOLS
SHEFFIELD	MT. EVERETT REG. SCHOOL
SHEFFIELD	BERKSHIRE SCHOOL
SOUTHBOROUGH	ST. MARK'S SCHOOL
SUDBURY	LINCOLN SUDBURY HIGH
SUTTON	SUTTON PUBLIC SCHOOLS
TOLLAND	TOLLAND STATE FOREST
TOPSFIELD	MASCONOMET REGIONAL HIGH SCHOOL
TOWNSEND	HAWTHORNE BROOK SCHOOL
WESTFORD	WESTFORD MIDDLE SCHOOL
WESTFORD	STONY BROOK SCHOOL
WESTFORD	ABBOTT SCHOOL
WESTON	WESTON PUBLIC SCHOOL
WESTON	RIVERS SCHOOL
WRENTHAM	WRENTHAM PUBLIC SCHOOLS
WRENTHAM	KING PHILIP REGIONAL SCHOOL
YARMOUTH	DENNIS YARMOUTH HIGH SCHOOL

Effluent Quality

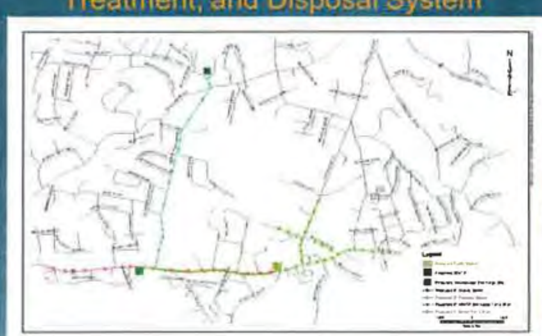
Parameter	Septic System Effluent	MBR Plant Effluent
BOD_5	100-250 mg/L	< 2 mg/l
Ammonia	25-40 mg/l	< 0.3 mg/l
Total Nitrogen	30-50 mg/l	< 3.0 mg/l
Phosphorous	7-20 mg/l	< 0.3 mg/l
TSS	20-140 mg/L	< 3.0 mg/l
Fecal Coliform	[illegible] CFU/100 ml	< 10 CFU/100 mL

Weston&Sampson

QUESTIONS AND DISCUSSION

Weston&Sampson

Conceptual Wastewater Collection, Treatment, and Disposal System



Weston&Sampson

WWTF Siting

- 641 Boston Post Road (Former Bushey Property)
  - Town owned parcel
  - Isolation from developed residential areas
  - Proximity to service area
  - Available land area

Weston&Sampson

Potential WWTF Footprint

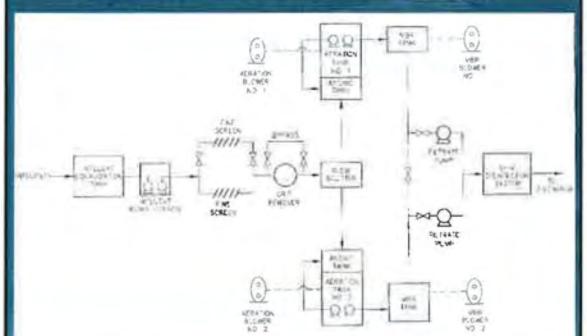
Weston&Sampson

WWTF Process

- Membrane Bioreactor (MBR)
  - High level of treatment
  - Smaller site requirements
  - Low-tech technologies for operational control

Weston&Sampson

System Conceptual Design



Weston&Sampson

Town of Sudbury, Massachusetts

Board of Selectmen Meeting
November 16, 2010

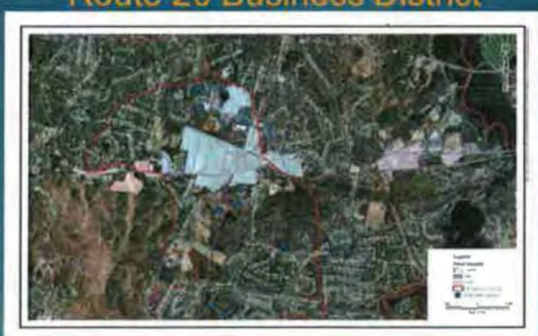
Route 20 Business District
Wastewater Management Plan

Introduction

- Wastewater Treatment and Disposal
  - On-site Systems/Underground Aquifers
- Route 20 Business District
  - Economic Sustainability
  - Water Supply Protection
- TAC/Needs Assessment
- Decentralized Wastewater Treatment

Weston&Sampson

Route 20 Business District



Weston&Sampson

On-Site Constraints

- Soil Types – Moderate to Severe Limitations
- Shallow Depth-To-Groundwater
- Town Drinking Water – Underground Aquifers (DEP Zone II)
- Hop Brook – List of Impaired Surface Waters

Weston&Sampson

Wastewater Needs Matrix

- System Age
- Condition of System
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- Groundwater Levels
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Weston&Sampson

Ranked Parcels

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Weston&Sampson

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Totals	96,934	123,137	63,461	283,532	318,640

Weston&Sampson.

Disposal Site Evaluations

- Initiated evaluations for a disposal site of a minimum of 100,000 gpd
- Need:
  - 2-6 acres
  - Depth-to-groundwater
  - Permeable deposits
  - No impacts to human or ecological receptors

Weston&Sampson.

Site Screening

- 86 Sites Screened
- Initial Testing Performed at Six Sites
  - Meader, Sykes, Bushey, Mahoney, Young, DPW
- Recent Testing (Fall 2009) at Three Sites
  - Haskell Field
  - Old Lancaster Road
  - Curtis Middle School

Weston&Sampson.

Screened Recharge Sites

Weston&Sampson.

Curtis Middle School

- Depth-to-groundwater:
  - Approximately 29 feet
- Sand and gravel deposits
- Estimated capacity of 100,000 – 200,000 gpd
- June 2010 Meeting with School Committee

Weston&Sampson.

Recent Activity

- PEF Application for SRF Funding Consideration
- Draft Citizens Advisory Committee Mission Statement
- Work Plan for Hydrogeological Testing at Curtis Middle School

Weston&Sampson.

Going Forward

- Phase 1 – Planning
- Phase 2 – Design & Permitting
- Phase 3 – Bidding & Construction
- Project Financing

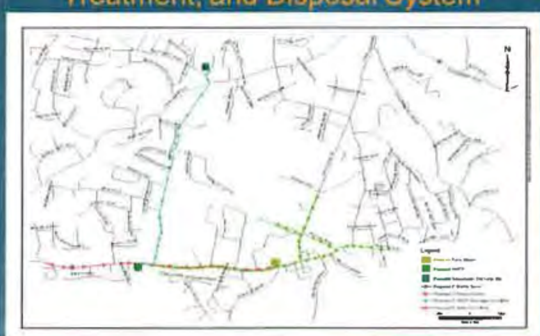
Weston&Sampson.

Phase 1 – Planning

- Hydrogeologic Investigations
  - Test Pits
  - Observation Wells
  - Load Scale Test
- Project Engineering Report (PER)
  - Conceptual System Design
  - Cost Allocation/Financing Alternatives
  - Regulatory Issues
  - Public Participation

Weston&Sampson.

Conceptual Wastewater Collection, Treatment, and Disposal System



Weston&Sampson.

Potential Layout of Fields

Weston&Sampson.

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Weston&Sampson.

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Weston&Sampson.

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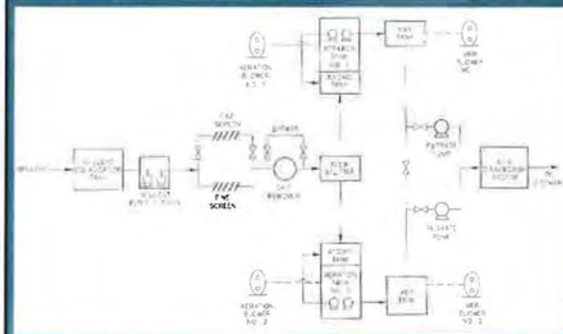
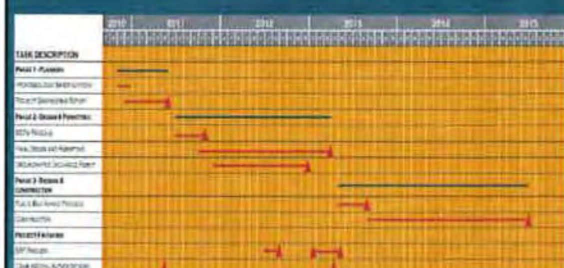
System Conceptual Design



Phase 2 – Design & Permitting

- MEPA/Expanded ENF
- Final Design
- Groundwater Discharge Permit
- Final Permitting and SRF Approval

Proposed Project Schedule



QUESTIONS AND DISCUSSION

Minutes
Joint meeting to discuss Route 20 Sewer
April 7, 2011
4:30 pm, Flynn Building

Present: Maureen Valente, Bob Leupold, Jody Kablack, Andrea Terkelsen, Larry O'Brien (BOS), Bob Haarde (BOS), Mike Fee (PB), Chris Morely (PB), Eric Poch (PB), Bob Stein (FC), Joan Carlton (FC), Lisa Eggleston (TAC), Parker Coddington (TAC and ConCom), Bill Cossart (TAC and SWD), Louis Stephan (Chamber of Commerce), Richard Cohen (Sudbury Crossing), Dave Stratos (Roche Brothers), Chuck Katz (Rugged Bear), Jerry Katz (Rugged Bear), Jeffrey Lyons (MillVillage), Michael Doherty (Shaw's Plaza), Steve Pedersen (W&S), Kent Nichols (W&S)

The meeting was convened to discuss the issue of the Route 20 sewer project and the upcoming article on the 2011 Annual Town Meeting warrant for $1 million for design and permitting of the system. Major policy boards and business people were invited, as well as Town staff and the town's consultant, Weston & Sampson. After introductions, Jody Kablack briefly explained the history of the project and updated the group on what was hoped to accomplish from the meeting. The business community has not been involved in the project for a number of years. The last extensive discussions with the businesses occurred in 2001/2002 regarding the establishment of a Business Improvement District. Those discussions terminated when it became apparent that without a sewer, the businesses were not willing or able to upgrade, renovate or grow in Sudbury to any great degree. The Town then proceeded to work diligently on finding a location for the sewer leach field. Many parcels were investigated, and most were eliminated for a variety of reasons. The Curtis Middle School property began to emerge as a possible site, despite its distance to Route 20. The soils on the site were preliminarily tested in 2009, and fully tested in 2010. The results have been favorable and have enabled the town to move forward with the project. Concurrently, a location for the treatment plant was also identified at 641 Boston Post Road. This property is owned by the town for general municipal use. Feasibility has been established.

Currently the Town and Weston & Sampson are working on an updated Needs Assessment to determine the capacity of the system. This will take into consideration the Title V wastewater design flows from all properties fronting on Route 20 in the "service area", including residential users. The "service area" is along Route 20 from approximately Massasoit Ave. to Lafayette Drive, and including the commercial properties along Union Ave and Station Road. The updated Needs Assessment and a project engineering report (which is needed to be approved for state revolving fund (SRF) loans for the construction of the system) will be completed by July 1, 2011. The next phase is the design of the system, and permitting through DEP and MEPA. The cost for the next phase is approximately $1 million. This will be a debt exclusion.

There are still many issues that need to be decided on, some of which are critical to the town meeting article, and others that will be important if we are successful in getting the funding for design and permitting:

- A Citizens Advisory Committee will be formed. This is a recommended course of action for the SRF funding, and will bring additional perspectives to the table on the political side of the project.

- The service area must be defined, and the authority of the sewer system must be decided – should a separate governmental agency be formed (similar to the Water District), or should the town be the owner/operator?
- How will the costs for construction of the system be apportioned? Should all taxpayers be assessed, or should betterments be considered, or a combination?
- Should hook up in the service area be mandatory or voluntary?
- What are the estimated betterment and user fees?
- What zoning changes are we considering?
- What will be the expected increase in commercial property taxes if the sewer is installed?
- What other streetscape amenities should be considered during construction, such as installation of utilities underground?

There are many issues to discuss, however the most important item is in regards to the cost of the warrant article, and how will this be apportioned.

After the introduction, the meeting members had questions. The issue of expansion of the sewer system in the future was discussed. The 1999 Needs Assessment identified the central and west business districts as having the most critical needs. That is where the service area is currently identified. DEP will require justification of need in order to expand the system once it is permitted. The east business district also has some critical needs, however the distance to the central district, and the geography and topography make it difficult (i.e., costly) to include in the system as envisioned. However, the Curtis site is capable of handling greater flows than what exist and there will be reserve capacity built into the system. The current need is for approximately 187,000 gallons/day. With potential growth (change in use of some properties and expansion), Weston & Sampson is designing for approximately 280,000 gpd. Initial testing indicates the Curtis site can handle up to 400,000 gpd (however additional testing to make sure no sensitive receptors are impacted will need to be completed). Approximately 21 residential properties are also included in those flow rates, and 18 properties that are zoned residential but are in commercial use.

The location of the plant was discussed next. The plant location was chosen based on available land, and it is beneficial that there are few direct and close abutters. The plant can be constructed to look like a residential structure, and all mechanical equipment can be inside the building. A membrane bioreactor with closed tankage is currently being investigated by Weston & Sampson, which produces very high quality effluent. Odors are controlled by enclosing the equipment, and treating any ventilation. W&S will provide pictures of similar structures for the Town Meeting presentation.

Possible zoning changes were discussed which would promote smart growth and compact development, and discourage sprawl. With sewers, more dense development patterns can occur in the central business area, including residential development. This alleviates the need to spread commercial development along the entire Route 20 corridor.

The sewer was also discussed as having a positive influence on the environment and water quality.

The Town of Weston has a small decentralized treatment system in its downtown, and Raytheon also has a small plant on its Sudbury campus.

The time frame for the project is to proceed to design and permitting, which if the article passes at Town Meeting, will be completed in approximately 18 months (January 2013). If construction funds are passed at the 2013 town meeting, construction could be completed by July 2015 (2 year construction period). The construction funds are anticipated to be funded through the state's revolving loan fund, which is at 2% interest. These rates have remained constant for many years, as this is a subsidized rate.

Joan Carlton suggested that the issue of capacity and ability for properties to expand must be made clearly. She also opined that it was beneficial to spread the cost of the design and permitting amongst all taxpayers as all of Sudbury benefits from the water quality aspect and the potential of raising higher taxes from the commercial sector. Bill Cossart added that 60% of the town's water supply comes from the wells located directly adjacent to the Route 20 area. The idea of shifting the commercial tax rate more towards the commercial properties to pay for the article was mentioned. This would need a Selectmen vote each year at the tax rate hearing, and would not be subject to town meeting vote. There are many scenarios for payment. The debt exclusion would be funded over a 5 year period. If shared equally among all taxpayers, the cost to a residential property at the average assessment ($628,000) would be $175 (or $35/year) and the cost to a commercial property at the average assessment ($810,000) would be $300 (or $60/year).

Lou Stephan noted that the businesses won't immediately see an increase in their property value, particularly office space. He thought that the $1 million should be shared amongst all taxpayers, as most of the town is also within the Sudbury Water District and would benefit from the protection of the water supply. It is likely that even businesses that can expand won't see a benefit for many years.

Mike Fee added that the allocation for the construction project can't be decided at this point. He urged the business community to publicly support the project and express a willingness to work with the town on the apportionment at the appropriate time.

Larry O'Brien noted that most business owners are not residents or voters. He also said that zoning is a very critical component of this project and will have a tremendous impact on property values in the service area if and when it is approved.

Discussion continued on what will be the issues and questions from residents at Town Meeting:

- Location of residential properties in proximity to the treatment plant – odor issues
- Water supply protection must be stressed
- A model of what the treatment plant will look like is important
- Impact on the Curtis field

The plaza owners were asked what their difficulties were with their current system of wastewater disposal.

Sudbury Farms is working on water conservation. They will need to replace their system at a future date, and currently spend considerable money monthly on septic repairs, maintenance and operation. The owner of the Sudbury Farms plaza is very receptive to the sewer project.

Sudbury Crossing stated that while they currently do not have a problem with their system, they run the risk of having serious problems in the future which will affect their ability to stay in Sudbury. They estimate that in 5-10 years they will have problems keeping their system functioning.

Mill Village replaced a portion of their system 3 years ago at a cost of $100,000. They own property in Weston Center and are hooked into that treatment system and it has been very beneficial for them.

Shaw's Plaza has recently replaced ½ of its system so they are managing currently, but there is no room to grow. They have turned several good businesses away due to septic system constraints, including Bertuccis and Panera Bread. Their opinion is that turning businesses away in this economy is very unusual.

One business owner stated that service industries are in high demand in Sudbury. Many of these do have high water use, such as hair salons. Some potential tenants don't even approach the business property owners because they know of the septic limitations in Sudbury.

Discussion moved to the topic of betterments as a means to pay for the project. Weston & Sampson led this discussion. Betterments are a fee on an individual property based on the assumption that the property being improved will have a higher value after the improvement. Many large infrastructure projects use a combination of betterments and raising taxes. It is a fairness and affordability issue. It looks at general benefits town wide versus specific benefits to a property. Betterments are usually in the 50 – 100% range of the cost of the project. W&S did some very preliminary calculations on betterments for the Route 20 sewer project. Many assumptions were made, but it was thought that some discussion on potential cost was appropriate for this meeting. One of the big assumptions was that Raytheon would be part of the service area, even though they have their own treatment plant.

A scenario was presented which included every property in the approximate service area participating. The betterment would be assessed on Title V wastewater design flows. There are 119 properties (98 commercial and 21 residential). Betterments are established using a base flow model, and then adding units based on the actual flows of the property. This makes large water users (and dischargers) pay more for the system than small water users. Based on the estimated flows, W&S calculated that an estimated betterment unit would be equivalent to a 3 bedroom house (or 330 gpd). There are an estimated 578 units in the service area currently, with an additional 218 calculated for growth, or 796 total units. Dividing the $14 million construction cost among the 796 units produces an average assessment unit cost at $17,600. A small system of 330 gpd or less would have to pay $17,600 for their portion of the sewer construction project. A system discharging 6,000 gpd would have to pay approximately $320,000. Betterments can be paid up front, or financed by the town over a 20-30 year period. They become liens on the property. This scenario again is made with many assumptions and decisions which would have to be made by the town at the appropriate time. Many decisions will require town meeting votes.

Several property owners opined that the betterment fees seem reasonable and are in line with their 10-20 year budgeting forecasts for wastewater disposal.

Preservation of the town's water supply has a cost, and Larry O'Brien asked if these sums are commensurate with the cost to find a new water supply if the existing supply became contaminated. The need for participation by the Sudbury Water District is apparent.

Bill Cossart stated that the SWD monitors their water supply at a very high rate. There are currently no indicators for contamination, and they have plenty of capacity. However, they also have no other properties in line for well development except for a property on Concord Road. They are supportive of this project, but they don't necessarily expect to see improvement in the water quality with sewers unless there is a major contamination threat.

There was a discussion on what would be the comparable cost of hooking into the MWRA system, or to develop new water supply wells, or the loss of commercial tax revenue if businesses have to close.

The group agreed that there are 3 components to the sewer issue: quality of life, protection of the water supply and economics (being the most important in order to persuade town meeting to vote to proceed). Business support is critical to passage of the article. The question was asked if the business owners would come forward and support a plan which places a majority of the financial burden of the construction costs on their shoulders. There was some agreement to this. The businesses agreed to write a letter in support for publication in the Town Crier, and to notify their customers of the importance of the project.

The meeting adjourned at 6:15 pm

May 3, 2011 Town Meeting Presentation

Lisa Eggleston, Chair of the Route 20 Sewer Assessment Technical Advisory Committee.

[SLIDE OF TAC MEMBERSHIP and W&S]

Good evening. The Sewer Assessment Technical Advisory Committee (TAC) was appointed by the Selectmen in 1999, and charged with investigating the potential for installation of a sewer system on Route 20.) Comprised of representatives of various town departments with technical expertise in engineering, hydrogeology and water systems, we have conducted this effort with the help of our Community Development Director, Jody Kablack, and the Town's consultants, Weston & Sampson Engineers, several of whom are here tonight to help answer questions. As the TAC chair, I am here before you tonight to update you on the status of our work, and to request your consideration for funding the next phase of the project; the design and permitting of the system. Before I go into more detail on that, however, let me briefly summarize how we got to this point.

Sudbury has been discussing wastewater treatment and disposal options for the Route 20 business corridor for over 40 years. Whereas on-site septic systems generally work for the residential areas of town, it has long been clear that it is not a sustainable strategy for our commercial sector, both environmentally and economically. This is due to a combination of factors, not the least of which is that the Route 20 area is plagued with low permeability soils and a high groundwater table, resulting in limited capacity for disposal, frequent system failures and costly upgrades. [SLIDE OF ONSITE CONSTRAINTS]

The proximity of one of Sudbury's major water supply wells to the Route 20 commercial area also poses a concern over possible contamination of the Town's drinking water supply, as much of the area sits above the Raymond Road Aquifer. The wellfield just south of Route 20 supplies nearly 70 percent of the Town's water.

Recent revisions to Title V septic requirements, as well as increasingly more stringent regulations governing protection of groundwater supplies, have compounded the already difficult task of wastewater disposal in the Route 20 area.

Finding an alternative to onsite septic systems for Route 20 was one of the primary objectives identified in Sudbury's 1999 Master Plan as a means of long term protection of our water supply, and the creation of a sustainable economic development strategy to relieve our reliance on residential property taxes.

In 1999, the ATM voted to fund a Needs Assessment for the Route 20 Business district, the first step in the State's Comprehensive Wastewater Management Planning process. [1st SLIDE OF NEEDS ASSESSMENT]

Using a matrix analysis, every commercial property along Route 20 and the Union Ave/Station Road area was evaluated to assess the adequacy of existing wastewater disposal systems to meet existing and projected demand.

[NA MATRIX SLIDE]The conclusion of the analysis was that significant need for an alternative to onsite septic systems did exist, particularly in the central portion of the study area, where 27 properties were deemed critical - either in categorical failure or imminent danger of being so, and another 29 properties were deemed priority in terms of wastewater needs. In terms of flow, this is more than two-thirds of the systems evaluated. It was further concluded that meeting these needs would be best accomplished through a decentralized treatment system (sewering this area) with localized treatment and groundwater discharge at a location to be determined in the vicinity of the service area.

The findings of the Needs Assessment were presented in several public forums during 2000 and 2001 and reviewed with representatives of DEP. With the allocation of $90K at the 2001 ATM (this amount supplementing $61K donated by the business community and the Sudbury Foundation), the Town voted to advance the project to the next step in the process; the evaluation and identification of potential disposal locations and the preparation of a Project Evaluation Report (PER) for submittal to the state permitting agencies.

Since that time, the TAC has been focused on locating a site that could accept the needed volume of treated wastewater while maintaining watershed health and minimizing ecological impacts. [SITE SCREENING SLIDE] The site screening process began by looking at parcels in the immediate Route 20 vicinity but, as these efforts proved unsuccessful, the search was systematically expanded, eventually including all large parcels within roughly three miles of Route 20. The DPW property on Old Lancaster Road, and Haskell Field on Fairbank Road were among those tested but rejected due to soil conditions and/or insufficient infiltration capacity, as were several privately own parcels. Many more were screened out before even getting to the testing phase. The option of a potential shared disposal system with Raytheon Corporation was also investigated and eliminated and, at some point in the process, we also looked at the possibility of discharging the wastewater through Framingham to the MWRA system or pumping it west to the Marlborough Easterly treatment plant. Both of these options have significant drawbacks.

Ultimately, subsurface borings conducted at the Curtis Middle School in August 2009 indicated soil conditions well suited for the development of a large-scale subsurface disposal system beneath the playing fields in front of the school.[CURTIS TESTING SLIDE] Subsequent load-scale testing, conducted by WSE this past winter under DEP oversight confirmed the suitability of the site to accommodate even more than the needed capacity.

Having finally cleared the hurdle of identifying a viable site for wastewater disposal, preparation of the PER is now underway and expected to be completed this spring. As part of this process, this conceptual layout of the proposed wastewater system was developed. [SLIDE OF SERVICE AREA]

The assumed service area would extend from Massasoit Ave to Lafayette Road on Route 20 and include Station Road and portions of Union Ave up to Codjer Lane. Currently the properties in the proposed service area discharge approximately 187,000 gpd, and our consultants have determined that an initial design flow of 270,000 gpd could be accommodated. The system would include a combination of gravity and pressure sewers laid under the roads within the service area, pump stations to move the effluent properly, and a treatment facility located at the Town owned "Bushey" property at 641 Boston Post Road. The treated wastewater would then be pumped up Horse Pond Road to the groundwater recharge system at Curtis.

The proposed treatment plant location is a 1.6 acre parcel that the town acquired in conjunction with the purchase of the Tippling Rock conservation land several years ago.[WWTP AERIAL SLIDE] Except for a small parking area for the trailhead it is currently vacant. It is also relatively isolated from developed residential areas and centrally located within the proposed service area, making it particularly well suited for this purpose. The treatment processes and associated equipment would be fully enclosed within a building designed to blend in to the neighborhood. The facility would include an odor control system, so no odors are anticipated to be noticeable from outside the building. The facility would accommodate the existing trail head parking and not interfere with the existing use of the property for conservation access. This is a streetscape view of what it might look like. [SLIDE OF TREATMENT PLANT]

As far as the groundwater recharge system, it would be very similar to the septic leach fields we all have in our own yards, or that Curtis currently has below the adjacent field, except that this one would be bigger and, rather than discharging untreated septage, the discharge would be highly treated and disinfected. The field would need to be disturbed during system installation, but would then be fully restored. [SLIDE OF CURTIS]

So now we get to the question on everyone' mind – how much is this going to cost me, and what benefits will I see as a taxpayer?

Going forward, the project is broken down into 2 distinct phases - the design and permitting phase, and the construction phase. [SLIDE w/ SCHEDULE] The first is the subject of this Article; it would entail detailed design of the collection, treatment and disposal systems, as well as obtaining a DEP groundwater discharge permit and environmental review through the Mass. Environmental Policy Act (MEPA) process. This phase would take approximately 18 months to complete and is estimated to cost approximately $1 million.

[RESIDENTIAL COST SLIDE] As proposed, the cost of this phase would be apportioned between all taxpayers in Sudbury – residential and commercial and would be borrowed over a 5-year period, resulting in a total cost of $175 to the average residential taxpayer with a home assessed at $628,000 and $300 to the average commercial taxpayer with a business assessed at $810,000. So for the average residential property owner, your taxes would increase approximately $35 each year for 5 years, then drop back down to their original level.

[COMMERCIAL COST SLIDE] With Sudbury's current split tax rate, a larger proportion of this article is being paid for by the commercial taxpayers. However, the entire burden is not being placed on the commercial sector, as all Sudbury residents will benefit once a sewer is installed and the groundwater supply is secured and protected. Also, not all of the commercial property owners in Sudbury would be served by the proposed sewer, yet they all pay taxes. This first phase is viewed as an investment in Sudbury's future, as the planned improvements will also create the opportunity for Sudbury's commercial sector to generate more revenue, thereby decreasing the residential tax burden.

We anticipate the design and permitting phase to be completed in early 2013, and would expect to request construction funding at either the 2013 or 2014 ATM. Construction of the system is currently estimated to cost approximately $14 million, however we will have a much better handle on the cost once the design is complete. The process is expected to take approximately 2 years. A final decision has not been made on how the construction cost would be apportioned between taxpayers, but it is anticipated that the majority of the cost would be recovered through the assessment of betterment fees on the properties which are in the service area, since those properties would be improved or "bettered" by construction of the sewer. [BETTERMENT SLIDE] A betterment is a onetime tax that can be paid in one lump sum or financed by the Town over a maximum period of 20 years. The amount of the betterment is typically calculated based on a property's usage of the wastewater treatment plant, in other words apportioned based on wastewater flow. The town could vote to use a combination of fees and taxation to pay for the project, since the vitality of the commercial district and the tax revenue it brings in is a general benefit to all residents; this will need to be decided after significant public discussion. We are confident that an equitable arrangement can be approved which does not overburden any one property owner or sector. Ongoing operational costs of the treatment facilities would be paid completely by the users of the system.

Prior to funding the construction phase, there will be ample time for the legal and political aspects of the project to be thoroughly studied, discussed and brought before the voters. These include identifying the organizational authority for the sewer district, determining when properties in the service area will need to tie into the system, establishing fee structures, and implementing any zoning changes needed to control growth in the area.

In the 10 years it's taken us to identify a feasible disposal site and come up with a conceptual plan, the need for sewers has only increased. According to BOH records at least ten commercial septic systems in the proposed service area failed within just the last three years. All entailed significant cost to replace the systems, with no ability to expand. Other properties are just getting by, pumping their systems on a monthly basis, and still others will need to be replaced in the near future. This hurts the bottom line of businesses and reduces property values. Property owners along the corridor are severely limited in their ability to attract new tenants, particularly food services, and existing tenants have no opportunity to expand. Restaurants like Bertuccis and Panera who've expressed interest in locating in Sudbury have had to be turned away due to the lack of sewer, as have dentists, doctors, hair salons, bakeries, dog groomers and the like. Several hair salons have recently had to move out of town. With Wayland and Marlborough both having sewers, Sudbury's commercial corridor is at a competitive disadvantage because of its wastewater treatment challenges.

[LETTER OF SUPPORT SLIDE] You have seen the Letter to the Editor from the Sudbury Crossing and Sudbury Farms plaza owners requesting your support of this project. Additionally, a joint letter from all the plaza owners – Sudbury Crossing, Sudbury Farms, Rugged Bear, and Shaw's Plaza as well as the Chamber of Commerce – was delivered to the Selectmen last week, indicating broad support and a willingness to shoulder a significant portion of the construction costs. We have met with representatives at Raytheon, who are also supportive. The Finance Committee supports the article, as does the Planning Board, Conservation Commission, Sudbury Water District, and the Sudbury School Committee.

Even with an affirmative vote tonight, we are still at least 3 to 4 years away from having a system in operation. Please, let us not delay any further.

Thank you.

ARTICLE 20

ROUTE 20 SEWER
DESIGN AND PERMITTING

Town of Sudbury

Sewer Assessment Technical Advisory Committee

http://www.sudbury.ma.us
email: [illegible]

Members:

Elizabeth D. Eggleston, Chair	Planning Board Representative
Parker L. Coddington	Conservation Commission Representative
William J. Cossart	Sudbury Water District Representative
John C. Drobinski	Selectmen Representative
Robert Leupold	Board of Health Director

Staff:
Jody Kablack, Director of Planning and Community Development

Consultants:
Weston & Sampson

Weston&Sampson
environmental/infrastructure consultants

Adam Ploetz, AICP

On-Site Constraints

- Soil Types – Moderate to Severe Limitations
- Shallow Depth-To-Groundwater
- Town Drinking Water – Underground Aquifers (DEP Zone II)
- Hop Brook – List of Impaired Surface Waters

Wastewater Needs Matrix

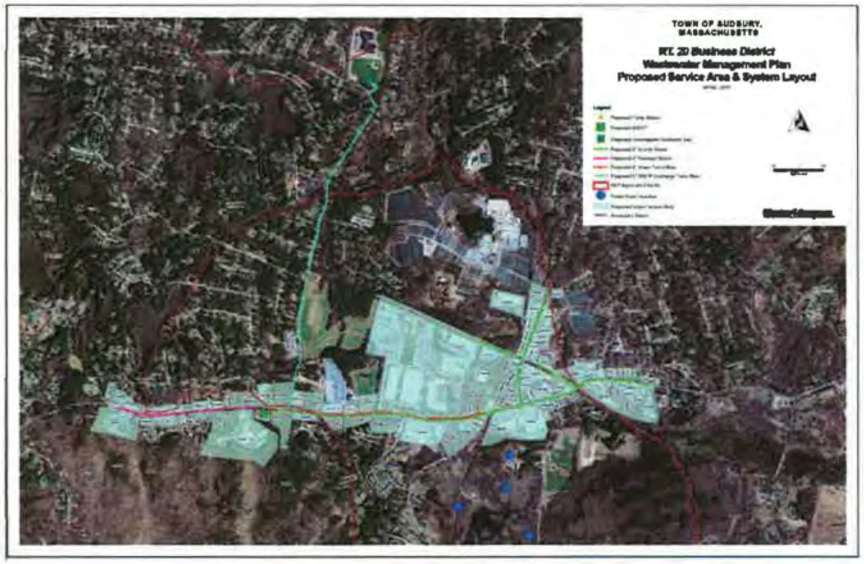
- System Age
- Condition of System
- Soils Classification
- Groundwater Levels
- Lot Size
- Environmental Concerns

Site Screening

- 86 Sites Screened
- Initial Testing/Investigation Performed at 6 Sites
  - Meader, Sykes, Bushey, Mahoney, Young, Shylovsky
- Hydrogeological Testing at 3 Sites
  - DPW
  - Haskell Field
  - Old Lancaster Road
  - Curtis Middle School

Curtis Middle School

- Depth-to-groundwater:
  - Approximately 29 feet
- Sand and gravel deposits
- Estimated capacity of 100,000 – 400,000 gpd
- June 2010 Meeting with School Committee



Phase 1 – Planning

- Hydrogeologic Investigations – November 2010 thru December 2010
- Project Engineering Report (PER) – December 2010 thru May 2011
- Town Meeting Authorization of Design Funding – May 2011

Phase 2 – Design, Permitting and Funding

- MEPA Process – July 2011 thru October 2011
- Final Design and Permitting – October 2011 thru March 2013
- Groundwater Discharge Permit – December 2011 thru December 2012
- Re-Submittal of Project Evaluation Form (PEF) – August 2012
- Submittal of State Revolving Fund (SRF) Loan Application – March 2013
- Town Meeting Authorization of Construction Funding – April 2013
- Permission to Advertise – May 2013

Phase 3 – Bidding and Construction

- Public Bid/Award Process – May 2013 thru August 2013
- Construction – September 2013 thru June 2015

Scenario Assumptions – Residential Taxpayers

Amount	1,000,000
Issuance Costs	20,000
Total Bonding	1,020,000
Term/years	5
Rate	2.500%
Average value	628,000
Res Value	3,999,570,656
Resid share	90.92%
Amortization	straight line

Year	Balance	Principal	Interest	Total	Residential Share	1,000 Tax Impact	100,000 Tax Impact	628,000 Prop Tax Impact
1	1,020,000	204,000	25,500	229,500	208,671	$0.06	$5.80	$36.41
2	816,000	204,000	20,400	224,400	204,033	$0.06	$5.67	$35.60
3	612,000	204,000	15,300	219,300	199,396	$0.06	$5.54	$34.79
4	408,000	204,000	10,200	214,200	194,758	$0.05	$5.41	$33.98
5	204,000	204,000	5,100	209,100	190,122	$0.05	$5.28	$33.17
Total		1,020,000	76,500	1,096,500	996,982	$0.28	$27.70	$173.94

Scenario Assumptions – Commercial Taxpayers

Amount	1,000,000	
Issuance Costs	20,000	
Total Bonding	1,020,000	
Term/years	5	
Rate	2.500%	
CIP share	9.076%	
Average value	$ 810,357	
C&I Value	274,711,172	strictly CIP
C&I Parcels	339	strictly CIP
Amortization	straight line	

Year	Balance	Principal	Interest	Total	Commercial Share	1,000 Tax Impact	131% 100,000 Tax Impact	shift 810,357 Prop Tax Impact
1	1,020,000	204,000	25,500	229,500	20,829	$0.08	$7.58	$61.44
2	816,000	204,000	20,400	224,400	20,367	$0.07	$7.41	$60.08
3	612,000	204,000	15,300	219,300	19,904	$0.07	$7.25	$58.71
4	408,000	204,000	10,200	214,200	19,441	$0.07	$7.08	$57.35
5	204,000	204,000	5,100	209,100	18,978	$0.07	$6.91	$55.98
Total		1,020,000	76,500	1,096,500	99,518	$0.36	$36.23	$293.56

April 25, 2011

Mr. John Drobinski
Mr. Lawrence O'Brien
Mr. Robert Haarde
Sudbury Board of Selectmen
Flynn Building
278 Old Sudbury Road
Sudbury, MA 01776

Re: Business Community's Support for Article 20

Gentlemen:

We write to express our support for the Town's efforts to design, permit and construct a sewer system along the Route 20 business corridor. We are hopeful that Sudbury's residents will act favorably on Article 20 at Town Meeting, and authorize appropriation of the $1 million dollars required to complete the design and permitting phase of the project.

The need for sewer in the commercial district is acute as businesses are faced with costly septic system repairs and fewer options to discharge wastewater in an area of high groundwater and poor soils. Sudbury's commercial corridor is at a competitive disadvantage due to these challenges, and reliance on on-site septic systems severely limits our ability as property owners to attract new tenants, particularly restaurants and food services.

We understand that the design, permitting and construction of the sewer system is a costly endeavor. We are also cognizant of the costs we are likely to face in having to constantly repair and replace our septic systems over time. Therefore, we in the business community are amenable to discussing scenarios whereby a significant portion of the cost to design and construct the system will be paid by its users.

Mr. John Drobinski
Mr. Lawrence O'Brien
Mr. Robert Haarde
April 25, 2011
Page 2

Thank you for your efforts to move this important project forward.

Sincerely,

[illegible]/Richard Cohen, Sudbury Crossing (TJ Maxx)

John C[illegible], Director of Real Estate, [illegible] Inc., Shaw's Plaza

Charles D. Katz, Katz Irrevocable Trust, The Rugged Bear Plaza

[illegible], 1776 Plaza (Sudbury Farms Plaza)

Randy Goldberg, [illegible] Corporation, Mill Village

[illegible], Prudential [illegible] REALTORS (Sudbury Chamber of Commerce)

May 3, 2011 Town Meeting Presentation

2011 ATM Article 20 – Route 20 Sewer, Planning Board Presentation

The Planning Board is enthusiastic in its support of this article. We have been working diligently with the Selectmen over the past decade to find solutions to the wastewater problems in the business district. This most recent effort to sewer Route 20 began in 1999 when the Planning Board was writing the master plan. It had been 37 years since the previous plan was written, and was long overdue. The master plan introduced the concept of sustainability, where issues are interconnected to provide long term solutions without burdening future generations. During the master plan public forums and surveys, residents expressed their ideas on what they wanted Sudbury to be and not to be. They wanted less reliance on residential property taxes, and more revenue from the commercial sector. They proposed getting there by creating a denser pedestrian village atmosphere where you could walk to stores and services. They wanted residential housing interspersed with the businesses. They also wanted to ensure the protection of the town's natural resources over the long term. These became the goals of the master plan. The objectives and strategies for how to accomplish those goals led us in the direction of moving forward with a Route 20 sewer system so that all of those issues could be addressed. And while we have tinkered in addressing economic development, streetscape improvements, vacancies and zoning along Route 20, we cannot create much more than what we have there now without the sewer. So that is what we have focused on over the past several years.

Lisa addressed the Needs Assessment, and the identification of critical needs of many of our businesses. This isn't just for show – without alternative wastewater disposal methods, the economic viability of some of our businesses, and the quality of our groundwater is at risk. We are at a turning point where we either commit to constructing a sewer system, or we don't. We can move forward with progressive planning and infrastructure development, or be faced with commercial vacancies and a failing business district.

SLIDES OF VACACNY SIGNS

Over the last week or so I have been engaged in conversations with many of my neighbors about the project. There have been criticisms that we should not proceed to design until residents know what the zoning will be, or what the development implications are. And while the desire to revise zoning along Route 20 has always been a part of the project, it is not the paramount issue. Protection of the town's drinking water is critical, and for that reason alone we should proceed in haste with the design.

But let's talk about zoning. Our current zoning is very protective of Sudbury's character, and is well suited for the present while we design the sewer system. We have strong zoning which supports the existing businesses and protects Sudbury against undesirable land uses, and have made some very important but small changes to zoning over the years to help reinforce the

Master Plan goals. In our business districts we prohibit fast food drive-throughs, we require parking behind buildings and the construction of buildings closer to the road, we have additional review processes for any commercial structure greater than 20,000 sq. ft., we have good landscaping standards. There is no immediate threat or risk that would require us to hastily make any changes. And installing sewers also will not dramatically increase developability of property. That will come with well thought out zoning changes, and a Route 20 master plan. We anticipate a parallel path to review zoning while the sewer system is being designed.

SLIDE of Zoning items

Soon after Town Meeting concludes the Selectmen will initiate a public process involving residents and businesses to begin planning for the future of Route 20 with decentralized wastewater. A Citizens Advisory Committee (CAC) will be formed, which will include subcommittees on creating a vision for Route 20, writing zoning bylaws, defining the sewer service area, preparing bylaws and regulations for the sewer district including its operation, planning for other Route 20 streetscape improvements to be executed during the construction period, and other issues.

The CAC will be the catalyst for zoning changes directed by the residents and businesses, and will be the primary opportunity for residents to take part in shaping the future of Route 20. The Planning Board will be very involved in this process. There are many good examples in Massachusetts of successful mixed use business districts and corridors, and studying these examples will be the cornerstone of this effort. Preserving the character of Sudbury and creating development opportunities without allowing overdevelopment is of utmost concern, therefore adopting proper zoning controls needs to be carefully studied and executed.

Even without any zoning changes at all, the proposed wastewater system is planned to be designed and constructed to handle approximately 40% additional flow from the existing properties in the service area. This would allow additional restaurants to locate in the existing shopping plazas, accommodate the renovation of vacant 2nd floor office space into residential units and allow for expansion of existing properties where all other zoning bylaws are complied with. So for the immediate future, we could see some redevelopment and change of use among the existing businesses.

But the longer term vision, of what we want and will need to address in zoning and regulations, is an important and exciting part of the sewer project. Our vision for Route 20 will be its future. We do have some older examples of Route 20 redevelopment scenarios produced after the Route 20 Visioning Sessions were conducted in 2001. The premise then, and it may still be favorable, was to move buildings closer to the street so that pedestrian access was easier. With a sewer system, the construction of these street-side buildings may be accomplished in the larger plazas without the need to tear down the existing buildings. Parking and stormwater would still need to be addressed, however shared situations are becoming much more popular with both of these. Redevelopment would open up tremendous opportunity for shared vehicle access and residential options as well. The following slides show redevelopment or new development options at Shaws, Sudbury Crossing and Sudbury Farms.

CECIL GROUP SKETCHES

Shaws (2 different views)

Corner of Nobscot and Route 20

Colonial Auto (Union and Route 20)

Sudbury Farms/Sudbury Crossing plazas

What you can tell from these images is that the scale and character of Sudbury remains. The goal here is not to reshape Route 20 into Route 9 in Framingham, or Route 20 in Marlborough. It is to create a denser central business area within the existing commercially zoned areas - more of a Sudbury main street – a place to go for services, a bite to eat, convenience shopping and leisure. Reducing corridor sprawl goes hand in hand with this vision as well, where outlying areas may be rezoned for less intense development, and incentives are given to relocate business in the central core. We think these goals are attainable.

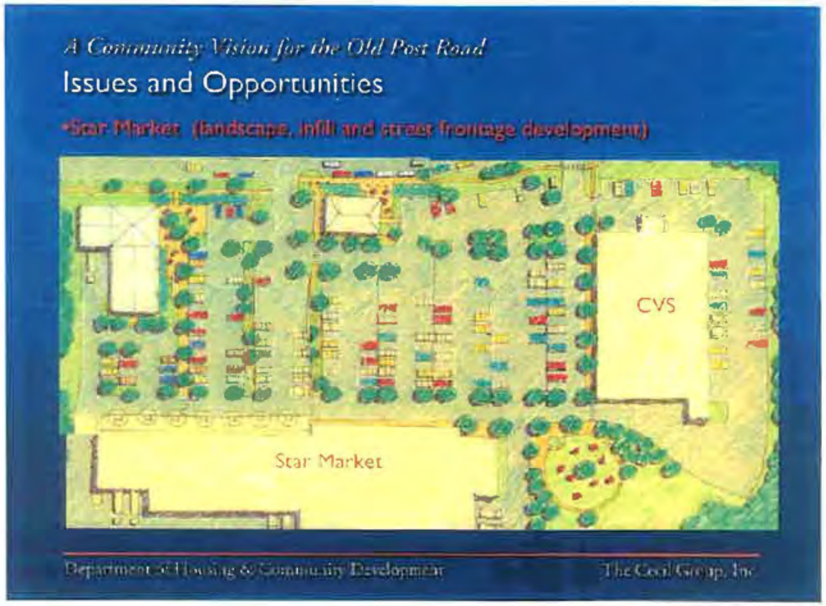
KEY CONCEPT SLIDE

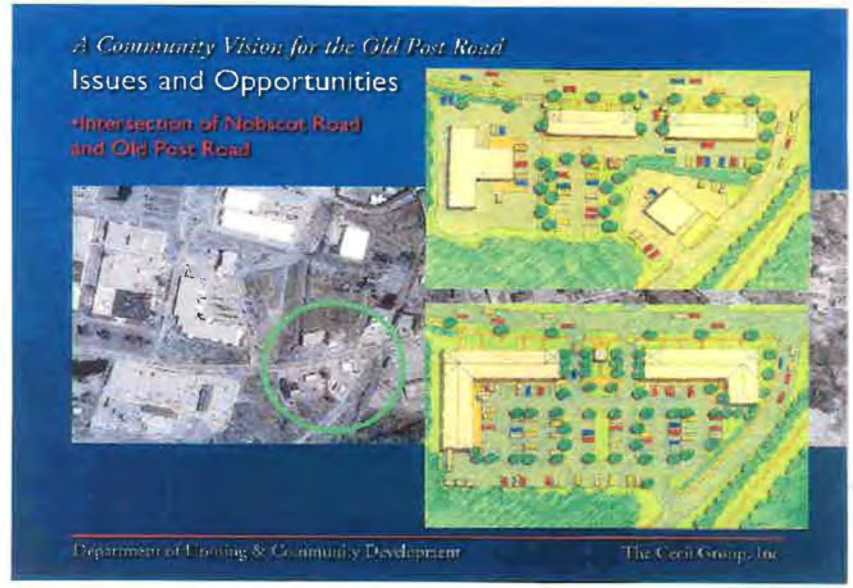
Let me also discuss how Zoning Happens, because this is really where the residents have an opportunity to have a say in the future of Route 20. We envision a year or longer process where options are presented, discussed, revised and advanced based on public meetings, design charettes and surveys, similar to how the town-wide Master Plan was developed. Then, once a zoning scheme is chosen, it would advance to Town Meeting, where a 2/3 vote is required. The Planning Board will direct this process, and we would likely be ready for Town Meeting in 2013. This analysis will take into account traffic impacts, fiscal impacts of new construction, and wetland and stormwater impacts.

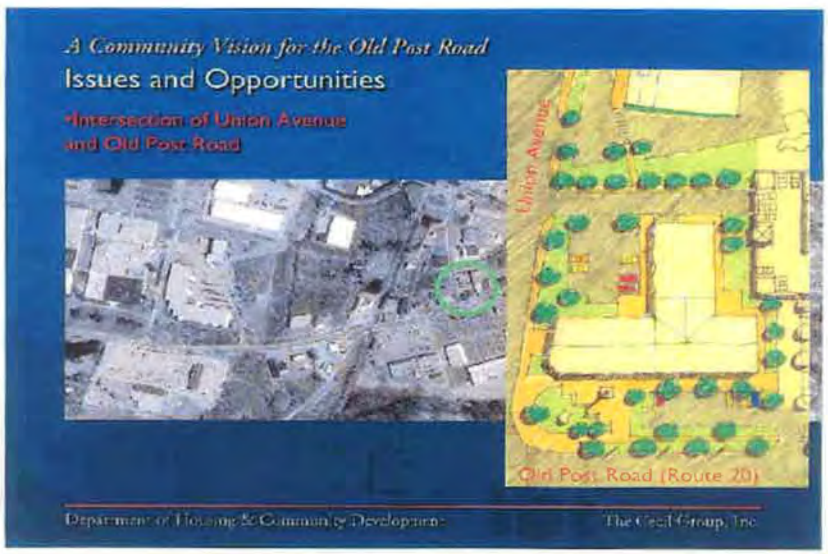
I want to end my presentation by going back to the need for the sewer system in the first place. It is about planning for the future - the future of our water supply, the future of our economy, the future of our community - and providing for basic infrastructure so that our future is sustainable. The need has been demonstrated. The benefits are for all residents and businesses. The time is now. The Planning Board urges your support of Article 20, and the ballot question at the Special Election in June.

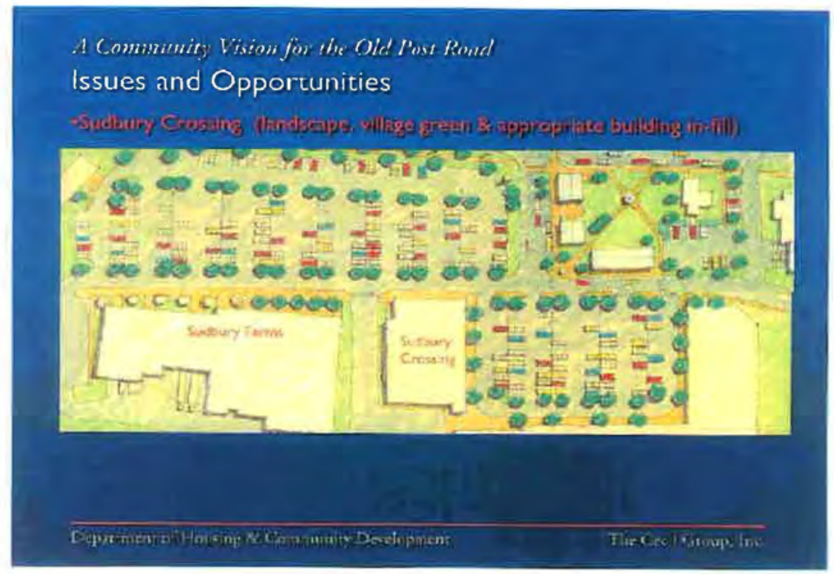
Zoning Protections In Place

- No fast food drive-through
- Parking located behind buildings
- Buildings moved closer to the street
- Review process for large buildings - >20,000 sf
- Landscaping standards


A Community Vision for the Old Post Road
Issues and Opportunities
•Star Market (landscape, infill and street frontage development)
CVS
Star Market
Department of Housing & Community Development
The Cecil Group, Inc


A Community Vision for the Old Post Road
Issues and Opportunities
•Intersection of Nobscot Road and Old Post Road
Department of Housing & Community Development
The Cecil Group, Inc


A Community Vision for the Old Post Road
Issues and Opportunities
•Intersection of Union Avenue and Old Post Road
Union Avenue
Old Post Road (Route 20)
Department of Housing & Community Development
The Cecil Group, Inc


A Community Vision for the Old Post Road
Issues and Opportunities
•Sudbury Crossing (landscape, village green & appropriate building in-fill)
Sudbury Farms
Sudbury Crossing
Department of Housing & Community Development
The Cecil Group, Inc

Key Concepts from Visioning Session:

- Regulations that enhance and ensure quality and provide incentives for high quality development is good for business, good for commercial development and good for the tax base
- Use public property or public infrastructure to spur appropriate redevelopment
- Private sector redevelopment initiatives help complete the vision

SUDBURY
TOWN CRIER

Date: Thursday, May 19, 2011
Location: SUDBURY, MA
Circulation (DMA): 3,376 (7)
Type (Frequency): Newspaper (W)
Page: 2A
Keyword: Weston & Sampson

BRIEFS

Route 20 sewer meeting

The Route 20 Sewer Assessment Technical Advisory Committee (TAC) will hold a public meeting at Town Hall on Wednesday, May 25, at 7:30 p.m. to discuss and answer questions related to the project and the upcoming ballot vote to appropriate $1 million for design and permitting of the project.

Panelists will include representatives from the Technical Advisory Committee, Planning Board, Board of Selectmen, Sudbury Water District, Board of Health and the Sudbury business community. The Town's consulting engineers, Weston & Sampson, will also be attending.

For more information, please visit the Technical Advisory Committee's website at: //sudbury.ma.us/departments/SewerTechCommittee/

Account: 31409B (5835)
MA-231

Route 20 Sewer Meeting

May 25, 2011

Town of Sudbury

Sewer Assessment Technical Advisory Committee

http://www.sudbury.ma.us
email: [illegible]

<u>Members:</u>

Elizabeth D. Eggleston, Chair	Planning Board Representative
Parker L. Coddington	Conservation Commission Representative
William J. Cossart	Sudbury Water District Representative
John C. Drobinski	Selectmen Representative
Robert Leupold	Board of Health Director

<u>Staff:</u>
Jody Kablack, Director of Planning and Community Development

<u>Consultants:</u>
Weston & Sampson

Weston&Sampson
environmental/infrastructure consultants

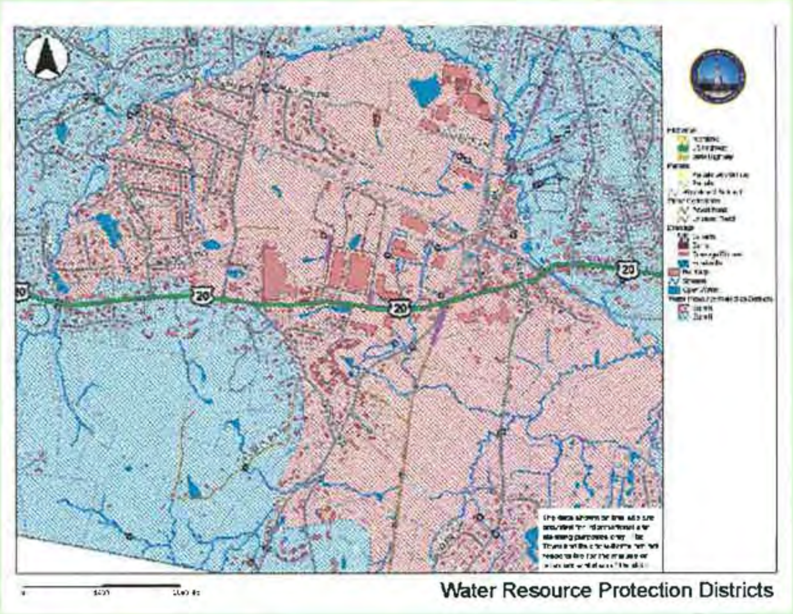
Adam Ploetz, AICP

Route 20 Sewer Meeting
Wednesday May 25, 2011
7:30 pm, Town Hall
AGENDA

- **Introduction** – Lisa Eggleston
- **History/Need** – Lisa Eggleston
- **Project Description** – Weston & Sampson
- **Elements of Cost Structure** - Eric Poch
- **Route 20 Vision/Zoning**– Jody Kablack
- **Citizen's Advisory Committee** - Eric Poch
- **Q&A** – All Panelists
- **Wrap Up** – Lisa Eggleston

On-Site Constraints

- Soil Types – Moderate to Severe Limitations
- Shallow Depth-To-Groundwater
- Town Drinking Water – Underground Aquifers (DEP Zone II)
- Hop Brook – List of Impaired Surface Waters



2001 Wastewater Needs Matrix

- System Age
- Condition of System – repair/pump rate
- Soils Classification
- Groundwater Levels
- Lot Size
- Environmental Concerns – Zone II, wetlands, flood plain

2001 Needs Assessment

- 84 parcels in total
- 36 PRIORITY - 43%
- 29 CRITICAL - 34%

Total 77%

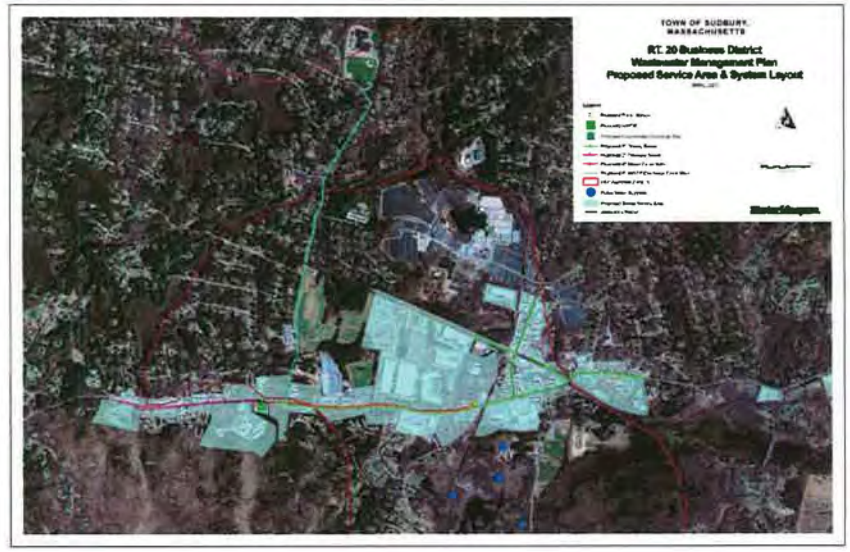
- 19 Non-Priority

Site Screening

- 86 Sites Screened
- Initial Testing/Investigation Performed at 6 Sites
  - Meader, Sykes, Bushey, Mahoney, Young, Shylovsky
- Hydrogeological Testing at 3 Sites
  - DPW
  - Haskell Field
  - Old Lancaster Road
  - Curtis Middle School

Curtis Middle School

- Depth-to-groundwater:
  - Approximately 29 feet
- Sand and gravel deposits
- Estimated capacity of 100,000 – 200,000 gpd
- June 2010 Meeting with School Committee



Potential Layout of Recharge Fields

Sewer Project

- Phase 1 – Planning: Soil Tests, PER – In Process
- Phase 2 – Design & Permitting
- Phase 3 – Bidding & Construction
- Project Financing

Phase 1 – Planning
(Project Engineering Report)

- Wastewater Needs Analysis
- Wastewater Management Alternatives
- Hydrogeologic Investigations/Analysis
- Recommended Plan/Implementation
- Public Participation

Phase 2 – Design and Permitting

- Massachusetts Environmental Policy Act (MEPA)
  - Expanded ENF
- Final Design
  - Wastewater Collection System
  - Wastewater Treatment Facility
  - Treated Effluent Subsurface Disposal Field
- Groundwater Discharge Permit (through DEP)
  - Initial Hydrogeological Investigations
  - Final Application with Treatment Process Design

Phase 3 – Bidding and Construction

- Two Projects
  - Collection System (Chapter 30)
  - Treatment and Recharge (Chapter 149)
- Simultaneous Construction Schedules
  - Certain Restrictions
  - Minimize Adverse Impacts

Ashfield, MA
Treatment Plant

Project Financing

- State Revolving Fund (SRF) Loan
  - Massachusetts Water Pollution Abatement Trust (MWPAT)
- Typically 2% Loan Financed over 20 Years
- Project Evaluation Form (PEF)
  - Intended Use Plan (IUP)
- Final Application and Approval Process

Preliminary Estimated Project Schedule

- MEPA Process – July 2011 thru October 2011
- Final Design and Permitting – October 2011 thru March 2013
- Groundwater Discharge Permit – Dec. 2011 thru Dec. 2012
- Re-Submittal of Project Evaluation Form (PEF) – Aug. 2012
- Submittal of State Revolving Fund (SRF) Loan Application – March 2013
- Town Meeting Authorization of Construction Funding – April 2013
- Permission to Advertise – May 2013
- Public Bid/Award Process – May 2013 thru Aug. 2013
- Construction – Sept. 2013 thru June 2015

Elements of Cost Structure

- Taxation – design and construction
- Betterments/Privilege Fees
- Hook Up Fees
- User Fees

DESIGN: $1 million Cost - Residential

Design Phase:
Residential Impact =
$35/year for 5 years

Scenario Assumptions	Residential
Amount	1,000,000
Issuance Costs	20,000
Total Bonding	1,020,000
Term/years	5
Rate	2.500%
Average value	628,000
Res Value	3,599,570,656
Resid share	90.92%
Amortization	straight line

Year	Balance	Principal	Interest	Total	Residential Share	1,000 Tax Impact	100,000 Tax Impact	628,000 Prop Tax Impact
1	1,020,000	204,000	25,500	229,500	208,671	$0.08	$5.80	$36.41
2	816,000	204,000	20,400	224,400	204,033	$0.08	$5.67	$35.60
3	612,000	204,000	15,300	219,300	199,396	$0.08	$5.54	$34.79
4	408,000	204,000	10,200	214,200	194,759	$0.05	$5.41	$33.98
5	204,000	204,000	5,100	209,100	190,122	$0.05	$5.28	$33.17
Total		1,020,000	76,500	1,096,500	996,982	$0.28	$27.70	$173.94

DESIGN: $1 million Cost - Commercial

Design Phase:
Commercial Impact =
$58/year for 5 years

Scenario Assumptions	Commercial	
Amount	1,000,000	
Issuance Costs	20,000	
Total Bonding	1,020,000	
Term/years	5	
Rate	2.500%	
CIP share	9.076%	
Average value	$ 810,357	
C&I Value	274,711,172	strictly CIP
C&I Parcels	339	strictly CIP
Amortization	straight line	

Year	Balance	Principal	Interest	Total	Commercial Share	1,000 Tax Impact	131% 100,000 Tax Impact	shift 810,357 Prop Tax Impact
1	1,020,000	204,000	25,500	229,500	20,829	$0.08	$7.58	$61.44
2	816,000	204,000	20,400	224,400	20,367	$0.07	$7.41	$60.09
3	612,000	204,000	15,300	219,300	19,904	$0.07	$7.25	$58.71
4	408,000	204,000	10,200	214,200	19,441	$0.07	$7.08	$57.35
5	204,000	204,000	5,100	209,100	18,978	$0.07	$6.91	$55.98
Total		1,020,000	76,500	1,096,500	99,518	$0.36	$36.23	$293.58

Construction Phase:
Residential Impact =
$40/year for 20 years

Scenario Assumptions	Residential
Amount	3,500,000
Issuance Costs	50,000
Total Bonding	3,550,000
Term/years	20
Rate	4.000%
Average value	628,000
Res Value	3,599,570,656
Resid share	90.92%
Amortization	straight line

Year	Balance	Principal	Interest	Total	Residential Share	1,000 Tax Impact	100,000 Tax Impact	628,000 Prop Tax Impact
1	3,550,000	177,500	142,000	319,500	290,502	$0.08	$8.07	$50.68
2	3,372,500	177,500	134,900	312,400	284,047	$0.08	$7.89	$49.56
3	3,195,000	177,500	127,800	305,300	277,591	$0.08	$7.71	$48.43
4	3,017,500	177,500	120,700	298,200	271,135	$0.08	$7.53	$47.30
5	2,840,000	177,500	113,600	291,100	264,680	$0.07	$7.35	$46.18
6	2,662,500	177,500	106,500	284,000	258,224	$0.07	$7.17	$45.05
7	2,485,000	177,500	99,400	276,900	251,769	$0.07	$6.99	$43.92
8	2,307,500	177,500	92,300	269,800	245,313	$0.07	$6.82	$42.80
9	2,130,000	177,500	85,200	262,700	238,857	$0.07	$6.64	$41.67
10	1,952,500	177,500	78,100	255,600	232,402	$0.06	$6.46	$40.55
11	1,775,000	177,500	71,000	248,500	225,946	$0.06	$6.28	$39.42
12	1,597,500	177,500	63,900	241,400	219,491	$0.06	$6.10	$38.29
13	1,420,000	177,500	56,800	234,300	213,035	$0.06	$5.92	$37.17
14	1,242,500	177,500	49,700	227,200	206,579	$0.06	$5.74	$36.04
15	1,065,000	177,500	42,600	220,100	200,124	$0.06	$5.56	$34.91
16	887,500	177,500	35,500	213,000	193,668	$0.05	$5.38	$33.79
17	710,000	177,500	28,400	205,900	187,213	$0.05	$5.20	$32.66
18	532,500	177,500	21,300	198,800	180,757	$0.05	$5.02	$31.54
19	355,000	177,500	14,200	191,700	174,301	$0.05	$4.84	$30.41
20	177,500	177,500	7,100	184,600	167,846	$0.05	$4.66	$29.29
Total		3,550,000	1,491,000	5,041,000	4,583,475	$1.27	$127.33	$799.86

Scenario Assumptions		Commercial
Amount	3,500,000	
Issuance Costs	50,000	
Total Bonding	3,550,000	
Term/years	20	
Rate	4.000%	
CIP share	9.079%	
Average value	$ 810,357	
C&I Value	274,711,172	strictly CIP
C&I Parcels	339	strictly CIP
Amortization	straight line	

Year	Balance	Principal	Interest	Total	Commercial Share	1,000 Tax Impact	100,000 Tax Impact	810,357 Prop Tax Impact
1	3,550,000	177,500	142,000	319,500	28,998	$0.11	$10.56	$85.54
2	3,372,500	177,500	134,900	312,400	28,353	$0.10	$10.32	$83.64
3	3,195,000	177,500	127,800	305,300	27,709	$0.10	$10.09	$81.74
4	3,017,500	177,500	120,700	298,200	27,065	$0.10	$9.85	$79.84
5	2,840,000	177,500	113,600	291,100	26,420	$0.10	$9.62	$77.94
6	2,662,500	177,500	106,500	284,000	258,224	$0.07	$7.17	$45.05
7	2,485,000	177,500	99,400	276,900	251,769	$0.07	$6.99	$43.92
8	2,307,500	177,500	92,300	269,800	245,313	$0.07	$6.82	$42.80
9	2,130,000	177,500	85,200	262,700	238,857	$0.07	$6.64	$41.67
10	1,952,500	177,500	78,100	255,600	232,402	$0.06	$6.46	$40.55
11	1,775,000	177,500	71,000	248,500	225,946	$0.06	$6.28	$39.42
12	1,597,500	177,500	63,900	241,400	219,491	$0.06	$6.10	$38.29
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16	887,500	177,500	35,500	213,000	193,668	$0.05	$5.38	$33.79
17	710,000	177,500	28,400	205,900	187,213	$0.05	$5.20	$32.66
18	532,500	177,500	21,300	198,800	180,757	$0.05	$5.02	$31.54
19	355,000	177,500	14,200	191,700	174,301	$0.05	$4.84	$30.41
20	177,500	177,500	7,100	184,600	167,846	$0.05	$4.66	$29.28
Total		3,550,000	1,491,000	5,041,000	3,334,066	$1.35	$120.29	$966.20

Construction Phase:
Commercial Impact =
$48/year for 20 years

How will the project be paid for?

Betterments vs. Raising Taxes

What is a Sewer Betterment?

- A tax assessed by Municipalities to properties "bettered" by construction of a public sewer (MGL C. 80 & C. 83)
- Public sewer is considered an improvement over on-site wastewater disposal
- Therefore the value of the those properties abutting the sewer line is improved or "bettered"
- Total costs recovered through Assessments (Betterments & Privilege Fees) cannot exceed the cost of the project

Property Taxes (within or outside Proposition 2 ½ tax limits)

- Raising taxes implies a General Benefit to entire community

Combination of Both

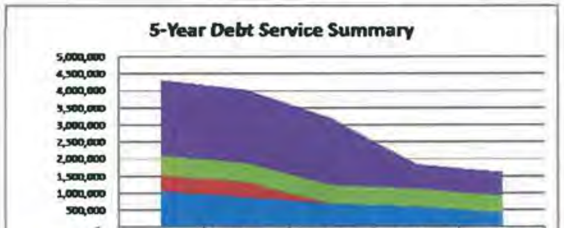
- Betterment Assessments - Only to serviced properties for a Specific Benefit
- Compensatory Sewer Privilege Fees - Additional Fee for future Change in use/expansion of serviced properties
- Hook up Fees – only to serviced properties
- User Charges (Annual Operation & Maintenance Costs) – only to serviced properties
- Some taxation

Route 20 Sewer Estimated Betterment

- Based on existing design flows of properties in the service area; Includes room for growth
- Estimated assumption of 75% betterment and 25% taxation
  - – $10.5 million raised from betterment charges
  - – $3.5 million raised from taxpayers
- Many different scenarios possible

1 Betterment unit = $15,000 to $20,000

Equivalent to a single family home (330 gal/day)



	FY12	FY13	FY14	FY15	FY16
LS	2,179,636	2,121,175	1,917,223	679,035	659,316
Land (non-CPA)	591,144	580,950	540,513	519,113	502,238
Town	455,898	440,449	-	-	-
SPS	1,073,573	893,204	706,022	621,578	430,978

	FY12	FY13	FY14	FY15	FY16	5-Year
Est. Tax Impact	$ 682.15	$ 637.03	$ 501.87	$ 288.66	$ 252.62	$ 2,109.71

	FY12	FY13	FY14	FY15	FY16	5-Year
SPS	1,073,573	893,204	706,022	621,578	430,978	3,725,355
Town	455,898	440,449	-	-	-	896,347
Land (non-CPA)	591,144	580,950	540,513	519,113	502,238	2,713,958
LS	2,179,636	2,121,175	1,917,223	679,035	659,316	7,556,385
Exempt Debt Service	4,300,251	4,015,778	3,163,757	1,819,725	1,592,531	14,892,042
	-	-	-	-	-	-

A Community Vision for the Old Post Road

Issues and Opportunities

•Star Market (landscape, infill and street frontage development)

Department of Housing & Community Development — The Cecil Group, Inc.

A Community Vision for the Old Post Road

Issues and Opportunities

•Intersection of Nobscot Road and Old Post Road

Department of Housing & Community Development — The Cecil Group, Inc.

A Community Vision for the Old Post Road

Issues and Opportunities

•Intersection of Union Avenue and Old Post Road

Department of Housing & Community Development — The Cecil Group, Inc.

A Community Vision for the Old Post Road

Issues and Opportunities

•Sudbury Crossing (landscape, village green & appropriate building in-fill)

Department of Housing & Community Development — The Cecil Group, Inc.

Key Concepts from Visioning Session:

- Regulations that provide incentives for high quality development is good for business, good for commercial development and good for the tax base
- Use public property or public infrastructure to spur appropriate redevelopment
- Private sector redevelopment initiatives help complete the vision

Zoning Protections In Place

- No fast food drive-through
- Parking located behind buildings
- Buildings moved closer to the street
- Review process for large buildings - >20,000 sf
- Landscaping standards
- Wetlands Bylaw
- Groundwater Protection Bylaw
- Stormwater Bylaw

Citizen's Advisory Committee (CAC)

- Public involvement and process
- Creating a vision for Route 20
- Writing zoning bylaws
- Defining the sewer service area
- Preparing bylaws and regulations for the sewer district including its operation
- Innovative technology
- Reviewing financing options and betterment charges
- Planning for other Route 20 streetscape improvements

Questions & Answers

Email:

sewertech@sudbury.ma.us

Ways to Get Involved

- TAC – environmental impacts, technical oversight
- CAC – financial, zoning, sewer district, public participation
- BOS – process, recommendations to Town Meeting
- Town Meeting – all votes (betterments, district set-up, bonding, zoning)

Next Steps

- June 7, 2011 Election
- Create CAC
- Email Board of Selectmen if interested

selectmen@sudbury.ma.us

Route 20 Sewer Citizens' Advisory Committee
Town of Sudbury
(Voted to establish July 5, 2011 by the Sudbury Board of Selectmen)

Mission Statement

The Citizens' Advisory Committee (CAC) is a committee appointed by the Board of Selectmen and reporting to the Steering Committee. Its role is to work with the Technical Advisory Committee (TAC) in the wastewater treatment planning process. The TAC will focus on those issues that are technical in nature such as a needs assessment, feasibility study, wastewater treatment alternatives, and facility siting options. The CAC will deal with issues that are political in nature, including but not limited to defining the structure and regulations of a sewer district, cost allocation between users, financing the project, operation and management of the wastewater treatment facility and community outreach and public education. The CAC may also assist the TAC in addressing questions that arise from the TAC's work that have a political component.

Membership and Officers

The CAC shall be appointed by the Board of Selectmen. Each member shall serve for a two-year term, expiring on June 30th of the second year. Membership shall be solicited from the business community, Chamber of Commerce, residents of Boston Post Road within the project area, commercial property owners, residents and members of relevant boards and committees and residents who possess the skills described below. Members will be chosen to represent the five (5) precincts of the Town to the extent feasible and depending on the applicant pool.

The Board of Selectmen shall seek members who possess skills necessary to accomplish the needed tasks, including but not limited to understanding the Sudbury business climate, knowledge of Federal and State grant funding, knowledge of wastewater treatment facilities, knowledge of financing and betterments, knowledge of municipal affairs, residents with strong analytical, presentation and/or graphic design skills, and/or property owners within the proposed sewer district area.

The CAC shall appoint a chair, co-chair and clerk. It is anticipated that sub-committees will be formed, and that CAC members will be expected to join at least one sub-committee so that progress can be made concurrently on several issues.

Responsibilities and Functions

The CAC will work with the Steering Committee to develop a list of political, governance, operational and financing issues that must be addressed, develop a list of options on each issue, set criteria for evaluating those options, and make recommendations to the Steering Committee regarding formation of a sewer district, cost allocation, project financing and operating a wastewater treatment system in Sudbury's Route 20 business district.

The CAC will provide the Steering Committee with a written report of its work including: all issues studied, all options examined, the process used for evaluation, the discussion on each option, and the committee's findings.

Further, the CAC will work with the Steering Committee to educate the public on the information gathered. Educating the public throughout the process will be critical to the success of the Route 20 sewer project, explaining what we are doing and why we are doing it. This shall be accomplished by posting articles on the Town's website, discussing the issues with the *Sudbury Town Crier* and *Sudbury Patch* journalists, posting minutes of public meetings, etc.

Compliance with State and Local Laws

The Citizens' Advisory Committee is responsible for conducting its activities in a manner which is in compliance with all relevant State and local laws and regulations including but not limited to the Open Meeting Law, Public Records Law, and Conflict of Interest Law. Committee members must limit their activities and scope to that described in this mission statement.

Open Session/Executive Session. Town staff will advise the Committee as to whether any part of their meetings should be held in executive session. Otherwise, all meetings of the Committee will be held in public sessions. One member of the Committee should be designated as Clerk of the Committee, and shall keep minutes of all meetings.

Route 20 Sewer Steering Committee
Town of Sudbury
(Voted to establish July 5, 2011 by the Sudbury Board of Selectmen)

Mission: The Steering Committee is an ad hoc entity established by and reporting to the Board of Selectmen in order to provide guidance and coordination to all committees and groups working on the Route 20 sewer issue, including the Technical Advisory Committee, Citizens' Advisory Committee, Route 20 Zoning Committee, and any sub-committees of those groups. It shall confine its efforts to the mission and responsibilities described herein, unless the Board of Selectmen subsequently increases the mission or responsibilities.

Membership: The Steering Committee shall be appointed by the Board of Selectmen and shall be comprised of one member of the Board of Selectmen, or their designee; one member of the Planning Board, or their designee; one member of the Board of Health, or their designee; one member of the Sudbury Water District; one member of the Sudbury Public School Committee and one member of the Finance Committee. Other organizations and residents who possess the skills described below will also be considered for appointment to the Steering Committee.

Member skills – The Board of Selectmen shall seek members who possess skills necessary to understand and analyze the Sudbury business climate, who have demonstrated knowledge of Federal and State grant funding, who have demonstrated knowledge of wastewater treatment facilities, who own property within the proposed sewer district, or who possess knowledge of municipal affairs.

Term of Appointment: Each voting member shall serve for a two-year term, expiring on June 30th of the second year.

The Steering Committee shall disband upon the appropriation of construction funds for the project, or June 30, 2014, whichever occurs first.

Responsibilities: The Steering Committee shall compile a working library of all materials produced by the various Route 20 sewer committees.

The Steering Committee shall recommend candidates for Citizens' Advisory Committee membership to the Board of Selectmen.

The Steering Committee shall investigate the experiences of other Massachusetts communities with regard to wastewater management planning and implementation.

The Steering Committee shall increase public awareness of the wastewater planning process by regularly presenting material and findings to various boards, committees and citizen groups.

The Steering Committee shall work with the Board of Selectmen on determining timing for any Town Meeting or ballot initiatives regarding the Route 20 sewer project.

The Steering Committee shall investigate any opportunities for grant or outside funding for the project.

The Steering Committee shall initiate and consistently meet with land owners in the proposed sewer district to better understand, weigh and make recommendations for resolution of the issues and concerns of the property owners.

The Steering Committee will report progress to the Board of Selectmen at least once per month.

Staffing: All staff time will be allocated by and through the Town Manager, who will endeavor to provide five hours per week for this effort, (excluding evening meeting time). For initial meetings of the Steering Committee, the Director of Planning and Community Development will attend and provide start up staffing assistance for the committee.

Compliance with State and Local Laws: The Steering Committee is responsible for conducting its activities in a manner which is in compliance with all relevant State and local laws and regulations including but not limited to the Open Meeting Law, Public Records Law, and Conflict of Interest Law. Committee members must limit their activities and scope to that described in this mission statement.

Open Session/Executive Session. Town staff will advise the Committee as to whether any part of their meetings should be held in executive session. Otherwise, all meetings of the Committee will be held in public sessions. One member of the committee should be designated as Clerk of the Committee, and shall keep minutes of all meetings.