Report

Comprehensive Wastewater Management Plan and Environmental Impact Report Phase II Screening of Alternatives Tyngsborough, Massachusetts

Prepared for:

Town of Tyngsborough
25 Bryants Lane
Tyngsborough, Massachusetts 01879

Prepared by:

Earth Tech, Inc.
196 Baker Avenue
Concord, Massachusetts 01742

June 2006

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Phase II – Screening of Alternatives
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Executive Summary

EXECUTIVE SUMMARY

The Town of Tyngsborough submitted an Environmental Notification Form (ENF) to MEPA in the fall of 1998. The comment period for the ENF ended on November 14, 1998 and on December 1, 1998 the Executive Office of Environmental Affairs (EOEA) determined that the project required an Environmental Impact Report (EIR) and established a Special Procedure for review of the required EIR. The Phase I "Needs and Growth Management" Report, was submitted March 1, 2003, and on May 15, 2003 the EOEA determined that the Phase I Report adequately and properly complies with the MEPA regulations and the special procedure.

The MEPA Certificate (EOEA No. 11788), issued by the Secretary of Environmental Affairs to the Town of Tyngsborough, requires the preparation of a Comprehensive Wastewater Management Plan/Environmental Impact Report (CWMP/EIR) for the Town and establishes a special procedure for review of this project. The special procedure is a phased review during which the scope for future phases is based in large part on the results of the preceding phase. A project description was included in the MEPA certificate. The Phase I is the" Needs and Growth Management". The Phase II scope is the "Screening of Alternatives". The Phase III scope is the "Draft CWMP and EIR" and will be finalized upon the completion of Phase II. The Phase IV scope is the "Final CWMP and EIR" and will be finalized upon the completion of Phase III. Each phase of this project will be distributed for review according to MEPA regulations.

The Town of Tyngsborough submitted Phase I, Needs Analysis to MEPA on April 30, 2002. The comment period for Phase I, Needs Analysis ended on June 24, 2002. On July 1, 2002, the Executive Office of Environmental Affairs (EOEA) issued the MEPA Certificate (EOEA No. 11788), which determined that the project adequately and properly complied with the Massachusetts Environmental policy Act (G.L. c. 30, ss. 61-62H) and with its implementing regulations (301 CMR 11.00). A copy of the Certificate as well as all comment letters and responses can be found in Appendix A.

This document contains the results of extensive efforts by Earth Tech, Inc. and the Town of Tyngsborough to evaluate the available options for improving the existing on-site wastewater disposal systems. This CWMP/EIR Phase II Document addresses issues from the Phase I Report, re-evaluates the identified Need Areas from the Phase I Report, screens alternatives, identifies preliminary sites for use as wastewater treatment facilities, groundwater discharge, analyzes the selected alternatives for wastewater disposal in accordance with the scope of work issued by the Secretary of EOEA, responds to comments received on the CWMP/EIR Phase I Document and presents short listed recommendations for wastewater management in the identified areas of the Town of Tyngsborough where existing on-site septic systems have been shown to be inadequate for wastewater disposal.

The CWMP/EIR Phase II Document presents numerous alternatives for local wastewater treatment. The treatment alternatives identified includes those technologies that will provide an appropriate level of wastewater treatment, which would allow treated effluent discharge within the borders of Tyngsborough. The treatment technologies described herein represent many of the available treatment processes necessary, which could potentially accomplish the treatment needed to meet proposed effluent limits mandated by the Massachusetts Department of Environmental Protection (DEP).

The CWMP/EIR Phase II Document evaluates the viability of the discharge of treated wastewater effluent to surface waters and to groundwater in Tyngsborough. Due to the stringent regulatory requirements and lack of suitable surface waters located within the Town's borders, surface water discharges were described herein but eliminated for further evaluation.

A preliminary investigation into the viability of siting wastewater treatment facility(s) and/or highly treated wastewater effluent disposal facilities in Tyngsborough resulted in 10 potential sites. The screening criteria used to evaluate these potential sites was based upon eleven environmental criteria as follows: (1) wetlands; (2) soils; (3) drinking water supply - wellhead protection areas (Zone I and Zone II); (4) fisheries; (5) waterbodies (distance from surface water); (6) floodplains; (7) sensitive habitats; (8) park lands; (9) recreational resources; (10) historical interests; and (11) ACEC. The criteria was developed with respect to whether or not there was an existing environmental "Opportunity" or "Constraint" for a site to be utilized for a wastewater treatment facility and/or disposal location. The application of the screening criteria resulted in the elimination of all ten sites for a variety of reasons. All of the identified sites within the Town presented constraints for wastewater usage due to current land use, environmental conditions present on the property, severe soil and/or groundwater conditions, and other factors. Chapter 3 addresses the screening of the sites in detail.

The scope of the CWMP/DEIR Phase III Document will analyze the selected alternatives in accordance with the revised scope that will be issued by the Secretary of EOEA and comments received on the Phase II CWMP/EIR Document. The CWMP/DEIR Phase III Document will present draft recommendations for wastewater management in the identified areas of the Town of Tyngsborough where existing on-site septic systems are shown to be inadequate for wastewater disposal. Specific recommendations by Study Area will take into account the appropriateness of utilizing: (1) innovative alternative systems; (2) communal systems; (3) local wastewater collection, treatment, and disposal facilities; and (4) regional wastewater collection treatment and disposal facilities. The CWMP/DEIR Phase III document will evaluate the environmental impacts, technical design, institutional factors, and project costs associated with each alternative and recommend the appropriate solution to the wastewater disposal problems in the Town of Tyngsborough on a long term basis.

Section 1.0

Information Update Request of the Phase I MEPA Certificate

1.0 INFORMATION UPDATE REQUEST OF THE PHASE I MEPA CERTIFICATE

A. NEEDS ANALYSIS DISCUSSION UPDATE

1. Review of Phase I MEPA Certificate

The Town of Tyngsborough submitted an Environmental Notification Form (ENF) to MEPA in the fall of 1998. The comment period for the ENF ended on November 14, 1998 and on December 1, 1998 the Executive Office of Environmental Affairs (EOEA) determined that the project required an Environmental Impact Report (EIR) and established a Special Procedure for review of the required EIR. The Phase I "Needs and Growth Management" Report, was submitted March 1, 2003, and on May 15, 2003 the EOEA determined that the Phase I Report adequately and properly complies with the MEPA regulations and the special procedure. Included in this section are the responses to the comments letter on the Phase I "Needs and Growth Management" Report.

The MEPA Certificate (EOEA No. 11788), issued by the Secretary of Environmental Affairs to the Town of Tyngsborough, requires the preparation of a Comprehensive Wastewater Management Plan/Environmental Impact Report (CWMP/EIR) and establishes a special procedure for review of this project. The special procedure is a phased review during which the scope for future phases is based in large part on the results of the preceding phase. A project description was included in the MEPA Certificate. The Phase I is the" Needs and Growth Management". The Phase II is the "Screening of Alternatives" and is being finalized herein. The Phase III is the "Draft CWMP and EIR" and will be finalized upon the completion of Phase II. The Phase IV is the "Final CWMP and EIR" and will be finalized upon the completion of Phase III. Each phase of this project will be distributed for review according to MEPA regulations. Therefore, there will be opportunity for the appropriate public comment period for all interested parties to contribute to the outcome of this project. The Response to Comment for the Phase I Document is included in Appendix B.

The Secretary requested that the following items be addressed in the Phase II Report.

1. Title 5 systems over 10,000 gallons per day (gpd)
2. Secondary growth impacts (Executive Order 385) as a result of sewering areas
3. Existing Intermunicipal Agreements’ ability to support increased growth
4. Additional information on Infiltration and Inflow (I//I)
5. Clarification of wastewater flow rate of 65 gpd per household
6. Inclusion of water conservation measures/demand measures

These have been addressed as follows:

1. According to Board of Health records, there is one operating Title 5 system over 10,000 gpd located within the Town located at the TJ Maxx Plaza, 440 Middlesex Road, Map11, Block 5, Lot 0. The other location questioned was the Tyngsborough Campground. According to Town records, the Campground was permanently closed April 2005.

2. Secondary growth impacts, Executive Order 385. The Phase II Document addresses this topic throughout the Alternatives Analysis for each Study Area recommended for an alternative solution to the current on-site wastewater disposal systems.

3. Summaries of the three existing Intermunicipal Agreements (Dracut, North Chelmsford, and Lowell) are included in Chapter 2. Copies of the three existing Intermunicipal Agreements are included in Appendix C.

4. A summary of the October 2002 Infiltration and Inflow (I/I) Report is included in Chapter 2. A copy of the Executive Summary for the October 2002 Infiltration and Inflow Report is included in Appendix D.

5. We found no clarification on why the previous consultant used 65 gpd per household to estimate wastewater flow. This Report utilized 8 years of actual water use records dating from 1992 to average water use per residential unit. Based on actual data, this amounted to 320 gpd. All estimates going forward utilize actual data.

6. Water conservation and demand measures undertaken by the Tyngsborough Water District, the Chelmsford Water District, and the Dracut Water District are included in Appendix E.

2. Phase I Needs and Growth Management Summary and Update

A Town wide Needs Analysis was performed to determine whether or not conventional Title 5 on-site systems will be effective in disposing of wastewater within a given study area throughout and beyond the 20 year planning period. A "Needs Area" is defined as a Study Area where a majority of the developed or developable properties located within the Study Area will not be able to utilize a conventional Title 5 septic system to effectively dispose of wastewater throughout and beyond the 20-year planning period. Data obtained from Board of Health records, Assessor's files, USGS and soil surveys of Tyngsborough performed by the U.S. Department of Agriculture were used to ascertain current land uses, associated soil and groundwater conditions, and to identify wastewater disposal problem areas. The objective of the Needs Analysis was to determine the specific Study Areas where conventional Title 5 wastewater disposal systems are inadequate or conversely, where existing on-site wastewater disposal systems can remain and be effective for wastewater disposal.

The Phase I Needs and Growth Management did not evaluate areas of Town where the Town's Master Plan has set goals and objectives for economic development. The Northern Middlesex Road area, Study Area 8, is the major route through Tyngsborough into Nashua, New Hampshire where the lack of public infrastructure has severely limited commercial/industrial growth. The Phase I Needs Analysis originally rated this Study Area with a "medium severity" for system malfunction representing local conditions versus area-wide, but did not take into consideration the economic development potential in this corridor.

The Town has its planning, as well as zoning, in place in this area in order to reach its full potential in bringing in warranted growth in the form of economic development. The 2004 Master Plan details this area a top priority for sewering and lists it as a specific action to be implemented in its final recommendations. The Town's vision is for Middlesex Road to be the gateway to the community that strengthens its commercial sector, while maintaining its scenic appeal and connection to the Merrimack River. As a result of this, Study Area 8 has been added as a Needs Area for further evaluation for alternative wastewater disposal. Excerpts from the Town's Master Plan are included in Appendix F.

The Needs and Growth Management identified two study areas with a rating of "high" for severity of system malfunction. A "high" degree of severity indicates that on-site wastewater disposal is not the long-term solution. The following will be evaluated for alternatives to on-site wastewater disposal in the Phase II Document:

- Study Area 2 – Merrimack East
- Study Area 11 – Flint Pond

There were seven Study Areas that rated "medium" for severity of system malfunction that will be the focus of this Phase II Alternatives Analysis and discussed in greater detail. A "medium" degree of severity indicates that conventional on-site wastewater disposal systems are adequate, but provisions should be made for long-term management. A detailed review of these areas will be completed in order to determine the most effective long-term solution for wastewater disposal. These include:

- Study Area 1 – Norris Road
- Study Area 3 – Coburn Road
- Study Area 6 –Althea Lake
- Study Area 17 – Bridge Meadow Brook
- Study Area 7 –Merrimack West
- Study Area 10 – Locust South
- Study Area 23 – Massapoag

An additional seven Study Areas, while rated a "medium" for severity of system malfunction, represent conditions for localized problems versus area wide. A "medium" degree of severity indicates that conventional on-site wastewater disposal systems are adequate, but provisions should be made for long-term management. The following Study Areas will be evaluated further in this Phase II Report:

- Study Area 5 – Sherburn South
- Study Area 8 – Middlesex North
- Study Area 9 – Locust North
- Study Area 15 – Canon Gate
- Study Area 19 – Scribner North
- Study Area 20 – Scribner South
- Study Area 21 – States Complex

The remaining seven Study Areas are recommended for long-term sustainability with current on-site wastewater disposal. These areas rated a low degree of severity for system malfunction in the Phase I Report. These areas will be included as part of a Septage Management Program (SMP) for continued operation and maintenance. Included in this area are:

- Study Area 4 – Sherburn North
- Study Area 14 – Tyngsborough Road
- Study Area 16 – Red Gate
- Study Area 18 – Westford Road
- Study Area 22 – Davis Road
- Study Area 12 – Industrial North
- Study Area 13 – Industrial South

Additional discussion updating the Needs Analysis completed as part of the Phase I centers on economic development for the Town. Tyngsborough completed a Master Plan in 2004, which was after the filing of the Phase I Report. This Phase II Alternatives Evaluation encompasses the Town's goals and objectives of establishing and expanding the economic base, particularly along Middlesex Road area. Most all business services are located west of the Merrimack River along this corridor, which lacks sufficient infrastructure services to support economic development. While the Town has an ample supply of commercially and industrially zoned land, sewer service has severely limited the commercial and industrial growth to date. Addressed under "Public Facilities" goals in the Master Plan is to support the extension of sewer lines along Middlesex Road. Based on these goals and objectives, as well as other defining criteria detailed under each Study Area's discussion, Study Areas 7, 8, 9, and 10 have been added as Needs Areas of the Town. Excerpts from the 2004 Master Plan are included in Appendix F.

3. Evaluation of Phase I Needs and Growth Management

All Study Areas were evaluated based on a number of criteria including soil types, lot size, evidence of natural resources, water resources, and Board of Health records detailing performance of on-site wastewater disposal systems.

During the first phase, each Study Area was reviewed and rated based on the afore-mentioned criteria. Each Study Area's ability to sustain long-term with on-site wastewater disposal systems. was rated with either a high, medium or low severity.

This Phase II Report is evaluating and considering alternative solutions for all Study Areas rated either medium or high severity that offer the most effective long-term solution for wastewater disposal. Figure 1-1, identifies the Study Areas as developed for the Phase I Needs and Growth Management Report. Figure 1-2, outlines the groundwater resources for the Town as depicted in the Phase I Report.

DEP commented on three specific Study Areas and their medium rating from the Phase I Report:

- Study Area 21 - States Complex
- Study Area 22 - Davis Road
- Study Area 23 - Massapoag

DEP's comment in the MEPA Certificate stated, "In the western part of town, the States area, Davis area and Massapoag area each have high septic system failure rates, tight soils and high groundwater and bedrock, yet the areas received a "medium" rating. The Phase II report should address this and also consider a decentralized solution in this area".

The data used to develop the rating in the Phase I for each of these Study Areas data was reviewed. The following explanation further details the findings:

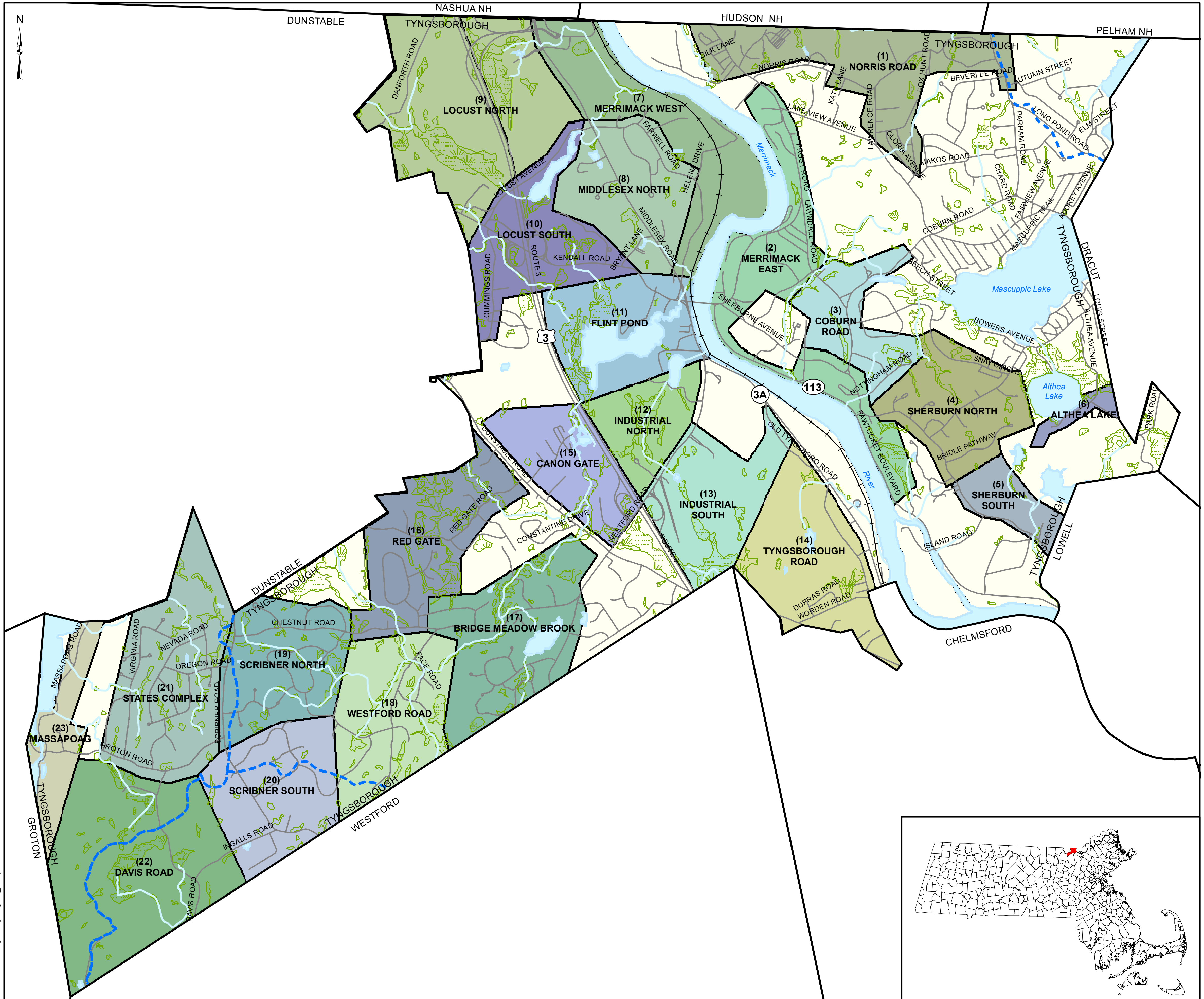
Study Area 21 - States Complex

States Area is located on Tyngsborough's western border abutting the Town of Dunstable, MA and is 48 percent residentially developed. Developed lots are over ½ acre and this Study Area is considered low-density development with individual lots generally one acre in size. Undeveloped land that is subject to environmental constraints accounts for 27 percent of the land area making this land generally undevelopable. Currently developable land accounts for 24 percent of the total land area and would be subject to current Title 5 Regulations for any future development. There are a total of 219 lots included in this Study Area. The State Land Use Codes, as detailed in the Assessor records, identify a total of 15 undeveloped parcels. This includes one residential developable lot, in excess of 32 acres, ten undevelopable residential lots, ten undevelopable residential lots, two municipal, one MIT and one the Commonwealth of Massachusetts.

FIGURE 1-1
STUDY AREAS

PHASE II
COMPREHENSIVE WASTEWATER
MANAGEMENT PLAN

TYNGSBOROUGH, MASSACHUSETTS



SCALE 1:36,000

0 1,500 3,000 Feet

Legend

- Rivers and Streams
- Road
- Sub-Basin Boundary
- Wetland
- Surface Water
- Town Boundary

EarthTech
A tyco International Ltd. Company

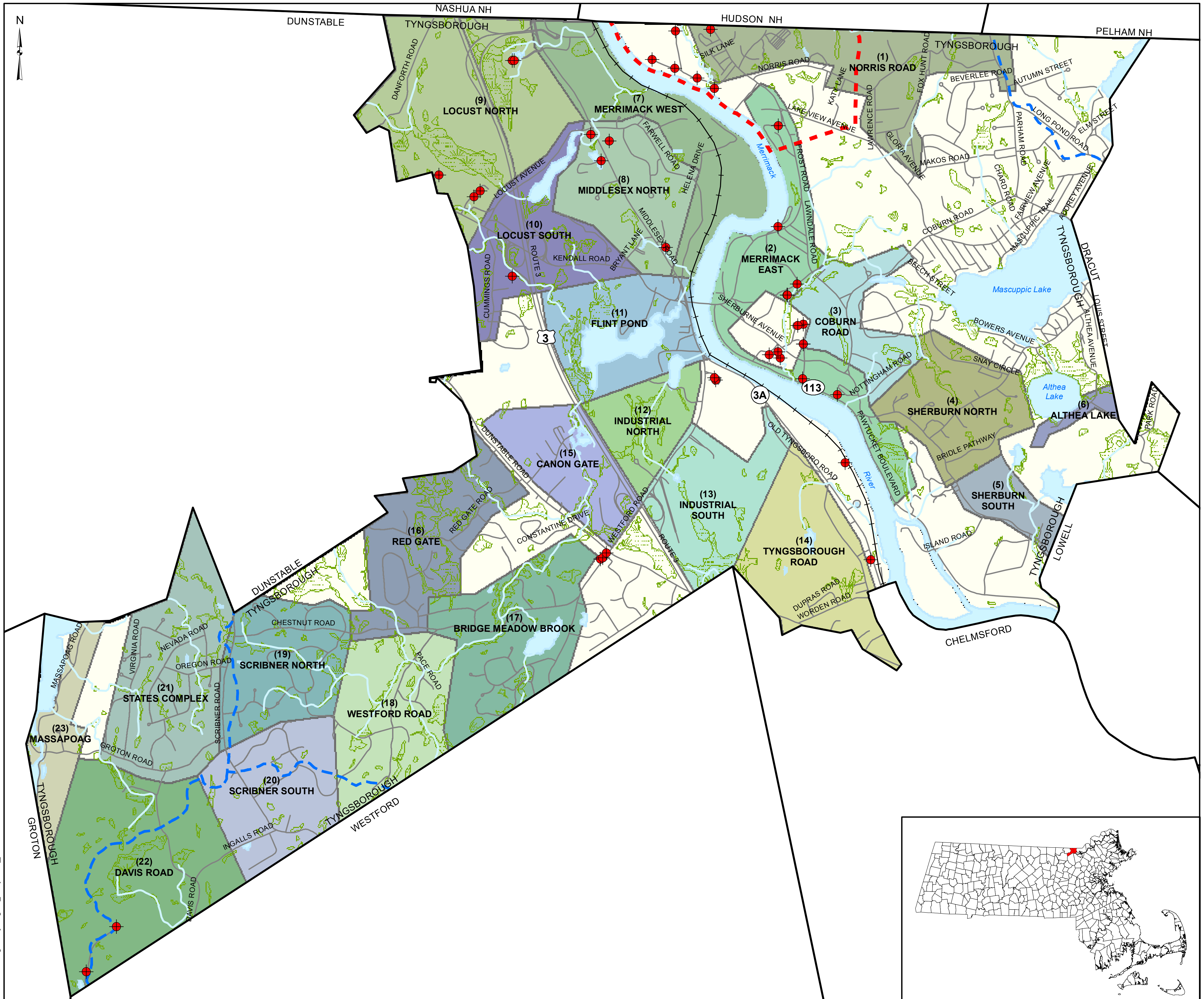
I:\work\80764\gis\maps\fig1-1_studyareas.mxd

MARCH 2006 SOURCE: Selected Datalayers from MassGIS.

FIGURE 1-2
STUDY AREAS AND PUBLIC WATER SUPPLIES

PHASE II COMPREHENSIVE WASTEWATER MANAGEMENT PLAN

TYNGSBOROUGH, MASSACHUSETTS



SCALE 1:36,000

0 1,500 3,000 Feet

Legend

- Public Water Supply
- Rivers and Streams
- Road
- Zone II Boundary
- Sub-Basin Boundary
- Wetland
- Surface Water
- Town Boundary

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MARCH 2006 SOURCE: Selected Datalayers from MassGIS.

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While the predominant soil mapped by NRCS and USGS is till, there are various areas of lesser constraining soils located throughout the area. Board of Health records further detail soils as mixed to loose with perc rates of 6 to 24 minutes per inch.

The existing development in this Study Area was built after the original Title 5 – late 1970s through 2000, with a large portion built after 1995 when Title 5 was revised, so most of the systems have been subject to the revised Regulations. In reviewing the Board of Health data, there are seven properties in this area with “tight soils”, none that were identified as failed inspections as all passed. There was one failure of a Title 5 inspection with a leach field having been replaced. The records did not indicate any difficulty with the replacement conforming to current Title 5 Regulations. All indications in this area are that the majority of the lots are large enough to support on-site wastewater disposal long-term. Problems with on-site systems appear to be remote and not area-wide. Smart growth policy would support a Septage Management Plan (SMP) as the long-term recommendation for this area.

Study Area 22 - Davis Road

Davis Road Area is located on Tyngsborough’s western border abutting the Towns of Westford, MA and Groton, MA and is 6 percent residentially developed. Developed lots are over ½ acre and this Study Area is considered low-density development with individual lots generally one acre in size. Undeveloped land that is subject to environmental constraints accounts for 25 percent of the land area, making this land generally undevelopable. Currently developable land accounts for 66 percent of the total land area and would be subject to current Title 5 Regulations for any future development. There are a total of 35 parcels included in this Study Area, with 11 undeveloped. The State Land Use Codes, as detailed in the Assessor records, identify the undeveloped as one multi-use parcel, one residential accessory, one developable residential, two agricultural, one municipal and five MIT, further confirming this Study Area as almost fully developed.

While the predominant soil mapped by NRCS and USGS is till, there are various areas of lesser constraining soils located throughout the area. Board of Health records further details soils as mixed to loose with moderate perc rates.

The high failure rate in this area, fourteen percent, was attributed to old system components and leach field replacement-most systems having been originally built in the 1960s. Boards of Health records indicate that failures included an overflowing cesspool, original systems installed in the 1960s and early 1970s (before Title 5), and that all were repaired with fully compliant Title 5 systems.

This area is largely undeveloped and smart growth policy would support on-site wastewater disposal systems. The lots are large and conducive to compliant Title 5 repairs. All new construction will be subject to Title 5 Regulations. Smart growth policy would support a Septage Management Plan (SMP) as the long-term recommendation for this area.

Study Area 23 – Massapoag

Massapoag Area is located on Tyngsborough's western border abutting the Towns of Dunstable and Groton and is 20 percent residentially developed. Developed lots are over ½ acre and this Study Area is considered low-density development. Undeveloped land that is subject to environmental constraints accounts for 39 percent of the land area. making this land generally undevelopable. Currently developable land accounts for 19 percent of the total land area and would be subject to current Title 5 Regulations for any future development. There are a total of 75 parcels included in this Study Area, with 23 undeveloped. The State Land Use Codes, as detailed in the Assessor records, identifies those undeveloped lots as 17 undevelopable residential lots, one municipal, one residential accessory, two recreational, and two developable residential, further confirming this Study Area as almost fully developed. Out of the 52 developed, 48 were built after 1978.

The predominant soil mapped by NRCS and USGS is sand and gravel deposits. Board of Health records indicate a high repair rate in this area due to old system components that have been replaced with fully compliant Title 5 systems. Although many of the lots in this general area are small and abut Lake Massapoag, the Board of Health felt that repairs/replacements were not difficult and those repaired and/or replaced all have compliant systems. Recorded perc rates are indicative of the loose sandy soils at or around 2 minutes per inch. The Towns of Groton and Dunstable also abut the Lake with properties, as well as a YMCA Camp beach area in Dunstable located directly across from the Tyngsborough properties. Information from the Greater Lowell YMCA, which operates the camp and beach on Massapoag in Dunstable, indicated that they do weekly water quality testing during the on-season. Over the last four years (records immediately available) they have not had any beach closings due to poor/degragraded water test results.

Based on the new, compliant systems in Tyngsborough and the number of properties abutting the Lake from other towns, this Study Area should maintain their current on-site systems under a Septage Management Plan. Any future planning in this area should include the towns of Groton and Dunstable.

The seven Study Areas that rated "medium" for severity of system malfunction are discussed in greater detail below. A "medium" degree of severity was an indication that conventional on-site wastewater disposal systems are adequate, but provisions should be made for long-term management. These include:

- Study Area 1 – Norris Road
- Study Area 3 – Coburn Road
- Study Area 6 –Althea Lake
- Study Area 17 – Bridge Meadow Brook
- Study Area 7 –Merrimack West
- Study Area 10 – Locust South
- Study Area 23 – Massapoag

Study Area 1 – Norris Road

This Study Area abuts the Hudson, New Hampshire border northeast of the Merrimack River. The area is 42 percent residentially developed, with 22 percent undeveloped due to environmental constraints and the remaining 36 percent is open to new development. There are a total of 50 parcels included in this Study Area, with 5 undeveloped. The State Land Use Codes, as detailed in the Assessor records, identifies those undeveloped lots as two undevelopable residential lots, and three municipal parcels. This Study Area is almost fully developed and will not add to unwarranted growth or sprawl if an off-site wastewater solution is implemented. Out of the 45 developed, 1 was built after 1995, 35 between 1976 and 1995, and 8 before 1976.

The most western portion of the Study Area is located within the Interim Well Protection Area (IWPA) for the Dracut Water Supply District (DWSD) with 96 percent of the lot sizes and densities greater than ½ acre. Soils are predominantly sand and gravel deposits, conducive to on-site systems. There are low incidences of recorded Title 5 failures in the Board of Health and while all new areas to be developed will be subject to Title 5 Rules and Regulations, there is concern with the areas within the IWPA. This Study Area, with its remote areas of medium severity is recommended for off-site solution for its long-term wastewater management due to protection of the groundwater resources located within the area.

Study Area 3 – Coburn Road

This Study Area is located in central Tyngsborough sandwiched between Masscuppic Lake and the Merrimack River. This Study Area is 39 percent residentially developed with 26 percent of the undeveloped land subject to environmental constraint and the remaining 35 percent open to residential development. The area intersects with both the DWSD and the Tyngsborough Water Supply District (TWSD). Soils are medium to loose, with perc rates in the 6 to 24 minutes per inch range with areas where groundwater is shallow. Lot sizes are mainly greater than ½ acre. There are a total of 105 parcels included in this Study Area, with 20 undeveloped. The State Land Use Codes, as detailed in the Assessor records, identifies those undeveloped lots as one residential accessory, five developable residential, two undevelopable residential, and 12 municipal lots. This Study Area is almost fully developed and will not add to unwarranted growth or sprawl if an off-site wastewater solution is implemented.

Board of Health records indicate no issues with Title 5 repairs. While the area appears to be functioning sufficiently with on-site wastewater disposal systems, the long-term wastewater management is recommended to be off-site due to protection of the groundwater resources in the area.

Study Area 6 –Althea Lake

This Study Area is located in the eastern portion of town abutting the Town of Dracut to the east. The area is 45 percent residentially developed, with 27 percent of the undeveloped area subject to environmental constraint. 28 percent is open to new residential development and subject to Title 5. There are a total of 13 parcels included in this Study Area, with nine undeveloped. The State Land Use Codes, as detailed in the Assessor records, identifies those undeveloped lots as one residential accessory, one developable residential, and seven undevelopable residential. This Study Area is almost fully developed and will not add to unwarranted growth or sprawl if an off-site wastewater solution is implemented.

This area is not proximate to groundwater resources. The soils are mixed, with areas of rock out-croppings, glacial till and floodplain alluvium. The lot sizes are small with densities greater than two per acre. This area relies on individual wells for its potable water supply. Due to lot size, severity of the soils and the location of private wells, the long-term wastewater management is recommended to be off-site.

Study Area 7 –Merrimack West

This Study Area is located on the northwest shoe of the Merrimack River abutting Nashua, New Hampshire. The area is 11 percent residentially developed, 28 percent commercially developed and 29 percent of the undeveloped land area subject to environmental constraint. Approximately 26 percent of the land area is open to new development, which is small scale considering the total lots. There are a total of 94 parcels included in this Study Area, with 19 undeveloped. The State Land Use Codes, as detailed in the Assessor records, identifies those undeveloped lots as 1 residential accessory, 4 developable residential, 6 undevelopable residential, 1 commercial accessory, 3 agricultural and 4 municipal lots. This Study Area is almost fully developed and will not add to unwarranted growth or sprawl if an off-site wastewater solution is implemented.

The area is proximate to the DWSD overlaying the Town’s aquifer. Soils consist of loose materials that have a fast perc rate, but very little groundwater issues. Board of Health records details a high Title 5 repair rate, mostly due to older systems in need of upgrade. This Study Area is also part of the Town designated in the Master Plan as economic development. Due to the severity of the soils, potable water supply, underlying aquifer area and economic development, the long-term wastewater management is recommended to be off-site.

Study Area 10 – Locust South

This Study Area is located east of the Merrimack River, south of Locust Pond abutting Dunstable to its west. The area is 14 percent residentially developed with 32 percent of the undeveloped land subject to environmental constraints. 22 percent of the area is dedicated to the Route 3 and Kendall Road interchange. There is 10 percent of the undeveloped land open to residential development and another 22 percent open to commercial development. The lost in this area are generally over ½ acre, but the predominant soils are severe with fast percs. There are a total of 62 parcels included in this Study Area, with 32 undeveloped. The State Land Use Codes, as detailed in the Assessor records, identifies those undeveloped lots as 1 developable residential, 10 undevelopable residential, 7 commercial/industrial accessory, 1 agricultural, 7 municipal lots, and 5 Massachusetts lots. This Study Area is almost fully residentially developed and will not add to unwarranted residential growth or sprawl if an off-site wastewater solution is implemented. There is, however, an opportunity for growth in the commercial/industrial areas as designated in the Town's Master Plan goals.

This area is reliant of private wells with a small area serviced by public water. Board of Health records detail a high rate of repair, with many systems having to upgrade to Title 5. Due to the severity of the soils, private wells and economic development, the long-term wastewater management is recommended to be off-site.

Study Area 17 – Bridge Meadow Brook

This Study Area is located in the southeastern portion of Town abutting the Town of Westford on its south. The area is 51 percent residentially developed, 28 percent of the undeveloped land is subject to environmental constraint and 19 percent is open to new development. Only 2 percent of the land area is non-residential. The majority of the lot sizes are greater than ½ acre, with approximately 1/5 of the land area comprised of new development. There are a total of 133 parcels included in this Study Area, with 9 undeveloped. The State Land Use Codes, as detailed in the Assessor records, identifies those undeveloped lots as two developable residential, six undevelopable residential, and one municipal lot.

While a portion of the area is reliant on private wells, the density of development is generally one acre per lot. The predominant soils are loose, groundwater depth is moderate and the Board of Health documents two repairs to upgrade systems. Due to suitable soil and groundwater conditions, large lots that support private wells and newer development that conforms to the current Title 5 Regulations, smart growth policy would support on-site wastewater disposal systems for long-term wastewater management. A Septage Management Plan (SMP) is the long-term recommendation for this area.

Study Area 23 – Massapoag

Previously discussed above, the long-term wastewater management is recommended to be on-site.

An additional seven Study Areas were rated a "medium" for severity of system malfunction in the Phase I Needs and Growth Management and represent conditions for localized problems versus area wide. The following Study Areas are evaluated further and discussed in greater detail below:

- Study Area 5 – Sherburn South
- Study Area 8 – Middlesex North
- Study Area 9 – Locust North
- Study Area 15 – Canon Gate
- Study Area 19 – Scribner North
- Study Area 20 – Scribner South
- Study Area 21 – States Complex

Study Area 5 – Sherburn South

This Study Area is located east of the Merrimack River abutting the City of Lowell, MA on Tyngsborough's southern border. The area is 18 percent residentially developed with 16 percent of the undeveloped land subject to environmental constraints. The remaining 62 percent of land area is open to residential development. There are a total of 39 parcels included in this Study Area, with 8 undeveloped. The State Land Use Codes, as detailed in the Assessor records, identifies those undeveloped lots as two developable residential, four undevelopable residential, one municipal lot, and two State of Massachusetts lots.

The soils are mixed with the majority loose and glacial till and some bedrock in the mix. Groundwater is moderate in the area. The lots sizes range from ¼ acre to greater than ½ acre, with densities generally rural with some lots over one acre. The area is serviced by public water. Due to suitable soil and groundwater conditions, lots and Title 5 repairs that conform to the current Title 5 Regulations and any new development conforming to Title 5, smart growth policy would support on-site wastewater disposal systems for long-term wastewater management. A Septage Management Plan (SMP) is the long-term recommendation for this area.

Study Area 8 – Middlesex North

This Study Area is located between Locust Pond and the Merrimack River. The area is 27 percent residentially developed and 12 percent is commercial development along Middlesex Road. 18 percent of the undeveloped land area is subject to environmental constraint, with an additional 15 percent open to residential development and 27 percent open to commercial/industrial development. There are a total of 149 parcels included in this Study Area, with 37 undeveloped. The State Land Use Codes, as detailed in the Assessor records, identifies those undeveloped lots as seven undevelopable residential, 17 commercial developable, four undevelopable commercial, three parcels devoted to electric transmission and six municipal lots. This Study Area is almost fully residentially developed and will not add to unwarranted residential growth or sprawl if an off-site wastewater solution is implemented. There is, however, an opportunity for growth in the commercial/industrial areas as designated in the Town's Master Plan goals.

The soils are mixed with some sand and gravels and till and rockiness in areas. Groundwater is moderate. The lots are generally larger than ½ acre. This Study Area encompasses five public water supplies, including both the DWSD and the TWSD. This area is proximate to the area designated by the Town's Master Plan for economic development. Due to the severity of the soils, public water supplies and economic development, the long-term wastewater management is recommended to be off-site.

Study Area 9 – Locust North

This Study Area is located in the northwest corner of town abutting both Nashua, New Hampshire and Dunstable, MA. The area is 4 percent residentially developed, 17 percent commercially developed with 29 percent of the undeveloped land subject to environmental constraints. There is 32 percent of the land area open to residential development and another 18 percent open to commercial/industrial development. There are a total of 24 parcels included in this Study Area, with 9 undeveloped. The State Land Use Codes, as detailed in the Assessor records, identifies those undeveloped lots as three developable residential, one undevelopable residential, and five state-owned parcels, three of which are devoted to Route 3. This Study Area is almost fully residentially developed and will not add to unwarranted residential growth or sprawl if an off-site wastewater solution is implemented. The majority of land in this Study Area is dedicated to Route 3.

There are two public water supply wells located within this Study Area, as well as areas dependent on private wells for their potable water. The soils are tight, poor percing and there are severe groundwater conditions present. This area is also proximate to the area designated by the Town's Master Plan for economic development. Due to the severity of the soils, public and private water supplies and economic development, the long-term wastewater management is recommended to be off-site.

Study Area 15 – Canon Gate

This Study Area is located west of the Merrimack River and Route 3 along Dunstable Road, just south of the Charles George Landfill. The area is 29 percent residentially developed, with approximately ¾ of the Study Area having lots greater than ½ acre. There is 22 percent of the undeveloped land subject to environmental constraints and the remaining 26 percent open to new residential development. There are a total of 128 parcels, many of which are condominiums.

Soils are generally sand and gravel deposits and groundwater is not an issue. The area is serviced by public water. Board of Health records indicate several repairs to leach fields. Due to suitable soil and groundwater conditions, large lots, smart growth strategy would support on-site wastewater disposal systems as the long-term wastewater management. A Septage Management Plan (SMP) is the long-term recommendation for this area.

Study Area 19 – Scribner North

This Study Area is located in the southeast corner of Town abutting the Town of Dunstable, MA. The area is 72 percent residentially developed with over 75 percent of the lot sizes greater than ½ acre. There is 13 percent of the undeveloped land area subject to environmental constraints and 15 percent open to new residential development. There are a total of 149 parcels included in this Study Area, with 28 undeveloped. The State Land Use Codes, as detailed in the Assessor records, identifies those undeveloped lots as 21 developable residential, three undevelopable residential, and four municipal lots.

The majority of the residential development was built in the mid 1990s and conforms to the most recent Title 5 Regulations. Soils are mixed, predominantly loose soils and tills and rock outcroppings in the mix. Groundwater is not an issue in the area. The area relies on private wells for potable water. Due to suitable soil and groundwater conditions, large lots that support private wells and newer development that conforms to the current Title 5 Regulations, smart growth strategy would support on-site wastewater disposal systems as the long-term wastewater management. A Septage Management Plan (SMP) is the long-term recommendation for this area.

Study Area 20 – Scribner South

This study Area is located in the southeast section of Town abutting the Town of Westford, MA. The area is 57 percent residentially developed with over 2/3 of the lots greater than ½ acre. Ten percent of the undeveloped land is subject to environmental constraints, with another 32 percent open to new residential development. There are a total of 126 parcels included in this Study Area, with 7 undeveloped. The State Land Use Codes, as detailed in the Assessor records, identifies those undeveloped lots as four developable residential, two potentially undevelopable residential, and one municipal lots.

The majority of the development in this area is new, with large lots. The soils are mixed, with some till and/or bedrock in the mix. Groundwater is moderate and not an issue. Board of Health records indicate all system repairs were for leach field replacement.

This area is reliant on private wells for its potable water source. Due to suitable soil and groundwater conditions, large lots that support private wells and newer development that conforms to the current Title 5 Regulations, smart growth strategy would support on-site wastewater disposal systems as the long-term wastewater management. A Septage Management Plan (SMP) is the long-term recommendation for this area.

Study Area 21 – States Complex

Previously discussed above, the long-term wastewater management is recommended to be on-site.

B. PHASE I WASTEWATER FLOW UPDATE

In the Phase I Report, wastewater flows were estimated for each study area based on 65 gpd per household. The estimates have been updated utilizing actual flow data of 320 gpd calculated using eight years of actual water usage. The estimates will go forward based on the number of developed lots and undeveloped parcels within each study area with the current zoning overlaid from records based on the Assessor's information. The design wastewater flow for each study area designated in Table 1-1 will be calculated from the undeveloped parcel and acreage data to determine the design number of developed lots. Table 1-1 details the long-term wastewater disposal based on the updated Needs Analysis.

This Phase II Alternatives Analysis will move forward to evaluate off-site wastewater solutions for those Study Areas, now deemed Needs Areas as designated in the above Table 1-1.

Figure 1-3 details the identified Need Areas in Town.

TABLE 1-1
STUDY AREA LONG TERM WASTEWATER DISPOSAL ALTERNATIVE

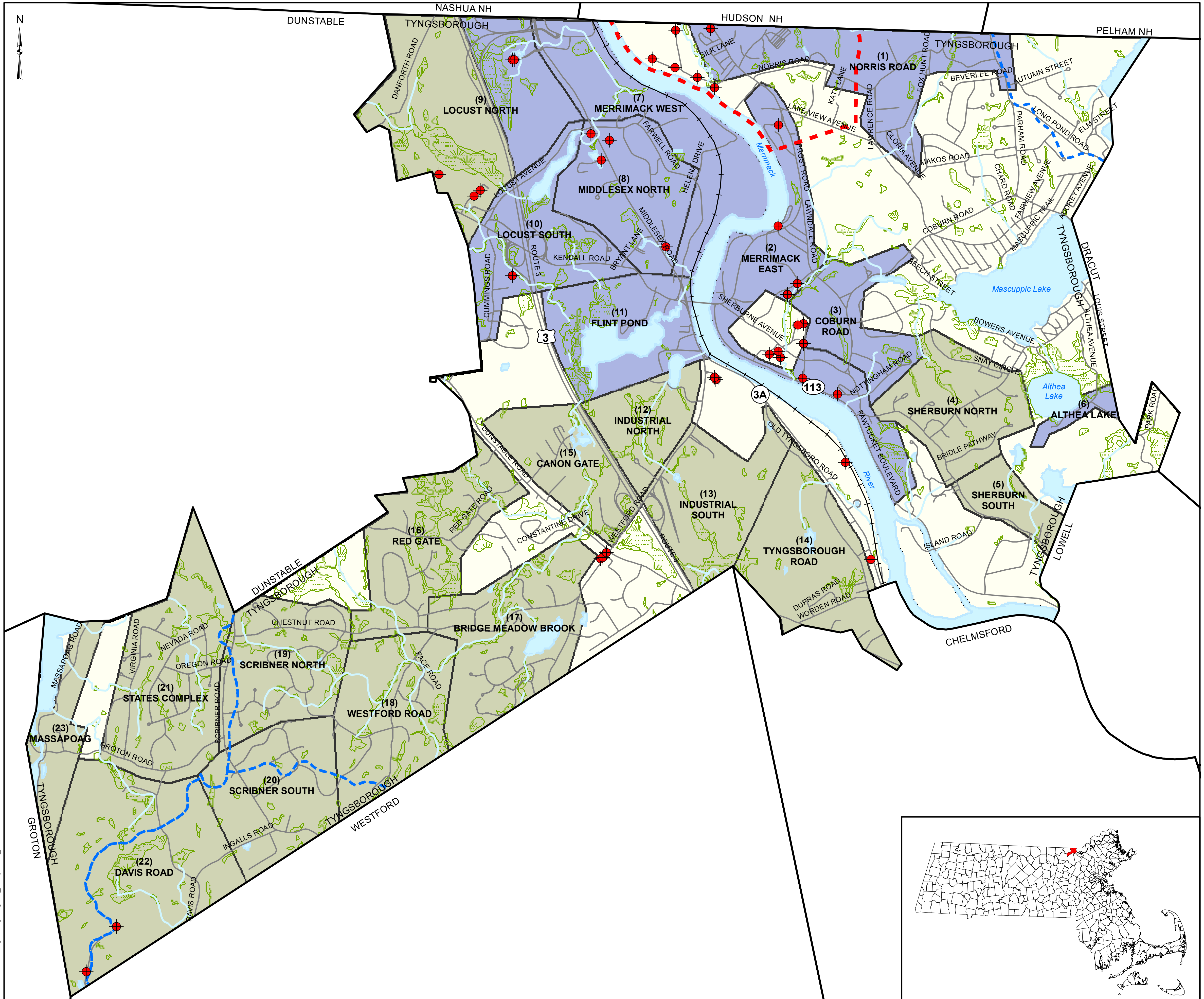
	Long Term Wastewater Disposal Alternative	
Study Area	On-site Innovative Alternative Systems, Local, Regional or Satellite WWTF	Septage Management Plan
1-Norris Road	**X**	
2-Merrimack East	**X**	
3-Coburn Road	**X**	
4-Sherburn North		X
5-Sherburn South		X
6-Althea Lake	**X**	
7-Merrimack West	**X**	
8-Middlesex North	**X**	
9-Locust North	**X**	
10-Locust South	**X**	
11-Flint Pond	**X**	
12-Industrial North		X
13-Industrial South		X
14-Tyngsborough Road		X
15-Canon Gate		X
16-Red Gate		X
17-Bridge Meadow Brook		X
18-Westford Road		X
19-Scribner North		X
20-Scribner South		X
21-States Complex		X
22-Davis Road		X
23-Masspoag		X

Note: Needs Areas shown in **Bold**.

FIGURE 1-3
AREAS OF WASTEWATER NEED

PHASE II
COMPREHENSIVE WASTEWATER MANAGEMENT PLAN

TYNGSBOROUGH, MASSACHUSETTS



SCALE 1:36,000

0 1,500 3,000 Feet

Legend

- Public Water Supply
- Rivers and Streams
- Road
- Zone II Boundary
- Sub-Basin Boundary
- Area of Wastewater Need
- Septage Management Plan
- Wetland
- Surface Water
- Town Boundary

EarthTech
A tyco International Ltd. Company

I:\work\80764\gis\maps\fig1-3_studyareas_wwneeds.mxd

MARCH 2006 SOURCE: Selected Datalayers from MassGIS.

C. INFILTRATION/INFLOW REPORT SUMMARY

In 1999, the Town of Tyngsborough submitted a Project Evaluation Form (PEF) requesting State Revolving Funds (SRF) to conduct an Infiltration/Inflow Study on the Town's wastewater collection system. The PEF was approved in 2000 and the study was initiated. The Town wastewater collection consists of four service areas:

- Dracut North / Lakeview
- Chelmsford / Worden
- Dracut South / Willowdale
- Lowell / Pawtucket

The Town competed the I/I Study in October 2002. Investigations were performed under the "DEP Guidelines for Performing Infiltration/Inflow Analyses". The I/I Study was in direct response to recurring high springtime wastewater flows recorded in the Town's two oldest sewered areas, both located east of the Merrimack River:

- Dracut North / Lakeview Service Area
- Dracut South / Willowdale Service Area

All wastewater flows from the Town are generated through three Intermunicipal Agreements (IMA) to the Lowell Regional Wastewater Utility (LRWWU):

- Dracut
- Chelmsford
- Lowell

Three continuous flow meters were installed using the existing four permanent metering stations to supplement data collection and monitor flow in the two oldest Service Areas. Flow meters were not installed in the Chelmsford / Worden Area or the Lowell / Pawtucket Service Areas. The Chelmsford / Worden Service Area is fairly new, with the oldest pipe in the system seven years old. This Service Area comprises approximately 15 percent of the total system. Make-up of the flow from this Area is also mostly from the Charles George Landfill and of groundwater and rainwater origin. Traditional I/I Analyses cannot identify quantities of this type of flow from this EPA site.

The Lowell / Pawtucket Service Area is very small in size, making up only two percent of the total system. Flow data from this Service Area does not reveal seasonal influence.

Based on the ages, sizes, and make-up of flows from these Service Areas, it was agreed by the Town and its consultant, as well as DEP, to preclude them from the I/I Study Analysis.

Due to the flows from the Chelmsford / Willowdale and Lowell / Pawtucket being excluded from the Study, the IMAs from Chelmsford and Lowell were also not included.

Inspections of the Town's wastewater system included: (a) Gravity sewers; (b) Sewer laterals; (c) Sewer manholes; (d) Force mains; (e) Pumping stations; and (f) Low-pressure sewers.

There were a total of three locations chosen for flow monitoring. The first meter was installed on Willowdale Avenue near the Dracut town line. This meter monitored flow from the Dracut South/Willowdale Service Area. A second meter was installed on Lakeview Avenue near the Dracut Town line, which monitored flow from the entire Dracut North / Lakeview Service Area. Due to the size of this Service Area, it was broken into sub-areas and another flow meter was installed upstream of the Lakeview meter. This third meter was located on Mascuppic Trail near the Mascuppic Trail pumping station. This meter monitored flow from the western portion of the Dracut North / Lakeview Service Area.

In addition to the metering data, which proved to be conflicting, possibly sue to sedimentation in the sewers, raw data monitoring was inspected. Groundwater and rainfall data was also collected and utilized in the analyses.

Data analyses identified the three flow streams of concern: (a) sanitary flow; (b) infiltration; and (c) inflow. The analysis made use of the wet and dry month flow monitoring data as well as rainfall data. Utilizing these together, the analysis attempted to quantify the total I/I volume for each of the metered service areas and develop a strategy for the Town to better manage flows.

Conclusions

The January 2002 monitoring period did not evidence much impact from I/I. The March through April 2001 monitoring period did evidence seasonal I/I impact. This was expected due to the noticeably wet season in comparison to historical records. The infiltration was not found to be excessive. Significant inflow was evidenced, but again, due to the significant rainfall experienced during this time, the inflow was likely inflated.

In total, the sanitary flow, infiltration and inflow were found to be roughly ten percent less than average daily flow rates monitored by the meters. Specific sources of direct and indirect inflow were not identified as part of this Study. Inflow was identified as appearing to be seasonal. Sources could include basement sump pumps and foundation drains, roof drains, leaky manhole covers and yard drains.

Based on the results of this Study, a Sewer System Evaluation Survey (SSES) was not warranted. Recommendations do include sewer system rehabilitation and an on-going operation and maintenance program to identify and correct sources of I/I. Routine preventative maintenance, as well as Town inspections of new sewer laterals, will serve to provide a proactive approach to preventing and eliminating future I/I. The Town was encouraged to update its Sewer Use Ordinance (rules and regulations) to proved enforcement for the Town.

A comprehensive public education program to help the typical homeowner understand the implications of sump pumps, yard drains and the like was recommended to be initiated along with the on-going efforts of the O & M Program.

The Study also encouraged the Town to explore storm water management planning in order to provide relief to those homeowners needing legal discharge of excessive water from their properties.

A copy of the Executive Summary is included in Appendix D.

Section 2.0

Alternatives for Wastewater Disposal

2.0 ALTERNATIVES FOR WASTEWATER DISPOSAL

A. OPTIMIZATION, OPERATION AND MAINTENANCE OF EXISTING ON-SITE SYSTEMS

A variety of wastewater alternatives were investigated to determine the appropriate wastewater facilities, which will meet the needs of Tyngsborough. The evaluation of alternatives accommodates the information compiled on recommended need areas, environmental screening ratings, and preliminary engineering and technical criteria. The CWMP/DEIR Phase III document will evaluate the environmental, technical design and institutional costs associated with each alternative and recommend the appropriate solution to the wastewater disposal problems in the Town of Tyngsborough on a long term basis. This chapter presents the following alternatives: (a) the optimization of existing wastewater disposal systems; (b) regional solutions to Tyngsborough’s wastewater disposal needs; (c) local wastewater collection, disposal and treatment alternatives; and (d) alternative technologies. A short list of alternatives, which will meet Tyngsborough’s long-term wastewater needs, will also be presented.

One alternative to be considered is optimizing the performance of the existing on-site wastewater disposal systems, which includes, optimizing septage management, maintenance, and repair and upgrade of on-site wastewater disposal systems. The Phase I Needs and Growth Management Report identified where conventional Title 5 systems will be effective in disposing of wastewater within a given Study Area throughout and beyond the 20 year planning period. The Needs Analysis completed in Phase I considered a majority of the developed or developable properties located within the Study Area that will not be able to utilize a conventional Title 5 septic system to effectively dispose of wastewater throughout and beyond the 20-year planning period. Data obtained from Board of Health records, Assessor’s files, USGS and soil surveys of Tyngsborough performed by the U.S. Department of Agriculture were used to ascertain current land uses, associated soil and groundwater conditions, and to identify wastewater disposal problem areas. The objective of the need evaluation was to determine the specific Study Areas where conventional Title 5 wastewater disposal systems are inadequate or conversely, where existing on-site wastewater disposal systems can remain and be effective for wastewater disposal.

If this alternative to maintain all Title 5 on-site systems were pursued, all developed lots in Tyngsborough would remain dependent on their existing on-site wastewater disposal systems. As previously shown, there are substantial documented failures, severe soil and groundwater conditions, and disposal systems with eminent problems in Tyngsborough.

At the present time, there is not a severe public health problem in Town; however there is a substantial amount of the Town's water supply from individual well sources near areas which are experiencing on-site disposal problems as well as abutting public water supply areas. There are many areas where the lot size is less than ½ acre and the potential exists for an increase in contamination of the groundwater supply and private wells.

The failing on-site systems may be contributing to the degradation of water quality in surface water bodies such as the Merrimack River, Mascuppic Lake, Flint Pond and Lake Massapoag. Each of these surface water bodies is located within close proximity of a need area. The water bodies which are within and/or downstream of the areas of wastewater disposal need are threatened by existing on-site disposal systems (both properly operating as well as malfunctioning systems) which discharge effluent into the groundwater.

It can be expected that as time passes, the on-site systems will only become less adequate and will continue to contribute to the degradation of water bodies and the aquifer. Even a properly installed and operating Title 5 system will still discharge high levels of pollutants, which will impact the quality of the groundwater and adjacent water bodies. These on-site wastewater disposal systems combined with severe soils with poor filterability and high groundwater levels are both a water quality and health hazard. If the water quality of surface water bodies continues to decline, Tyngsborough could potentially lose very important recreational resources.

As more on-site wastewater disposal systems fail within the Town, individual property owners will be required to upgrade their systems to conventional Title 5 or Innovative/Alternative (I/A) systems. If they are unable to do so, a tight tank would be required. The cost of frequently pumping these tight tanks will be a financial burden for those property owners. Property owners would not be able to expand their homes or even use their existing facilities to the fullest extent. Property values would decline. With the increased potential of the degradation of both the water quality in the surface water bodies and potentially the drinking water supply from the aquifer, Tyngsborough is obligated to provide acceptable wastewater disposal for the areas of need.

However, this alternative of optimizing existing on-site disposal systems is a viable option for those areas of Tyngsborough which are outside the areas of wastewater disposal need and where the Town should consider implementing a septage management plan. The purpose of a septage management plan is to maintain the operation of on-site disposal systems, which will protect the groundwater and reduce the expansion of the areas of wastewater disposal need, which require structural solutions. Such a plan should include such items as recommended septage pump-out frequencies and maintenance of on-site wastewater disposal systems. Public education concerning the importance of proper maintenance of on-site wastewater disposal systems is a beneficial means of prolonging the life of these systems.

B. REGIONAL SOLUTIONS

This section explores the regional solutions, which may be implemented in order to solve the Town's wastewater disposal needs. These out-of-town regional treatment and disposal solutions are: (a) Connection to the Lowell Regional Wastewater Utility (LRWWU) system through Dracut; (b) Connection to the LRWWU system through North Chelmsford; (c) Connection to the LRWWU system through Lowell; and (d) Connection to the Division of Public Works Wastewater Treatment Facility (NWTF) through the City of Nashua, New Hampshire. For each regional solution a brief description of the effects on land use, effects on streams and/or interbasin transfer, limitations on future expansion (no land), reliability and economic cost delays, legal and or municipal permitting is presented. Regional solutions are being researched as part of the CWMP/EIR process and are based on current Intermunicipal Agreements (IMA) the Town has under contract with available capacity, Town goals for economic development in designated areas, as well as the inability of the Town of Tyngsborough to find sufficient suitable land area for in-town groundwater discharge for flows over and above currently allotted capacities. Tyngsborough currently has three IMAs with the Town of Dracut, Town of North Chelmsford and the City of Lowell to collect, treat and dispose of wastewater through the LRWWU.

Summary of Intermunicipal Agreements

All wastewater flows from the Town are generated through three Intermunicipal Agreements (IMA) that all have individual agreements with the LRWWU to treat and dispose of the wastewater. The following are the current IMAs with Tyngsborough: (a) Town of Dracut; (b) Town of Chelmsford; and (c) City of Lowell.

The Chelmsford / Worden Service Area is fairly new, with the oldest pipe in the system seven years old. This Service Area comprises approximately 15 percent of the total system. Make-up of the flow from this Area is also mostly from the Charles George Landfill and of groundwater and rainwater origin.

The Lowell / Pawtucket Service Area is very small in size, making up only 2 percent of the total system.

The Dracut systems are the original Tyngsborough systems thus the oldest in Town.

The Town's collection system is comprised of approximately 21 miles of gravity sewer, 500 manholes, 12 major pumping stations with force mains, portions of low-pressure sewers and 4 wastewater metering stations. The metering stations are located at: (a) Dracut North / Parham; (b) Dracut South / Willowdale; (c) Chelmsford / Worden; and (d) Lowell / Pawtucket.

This section provides a summary of each IMA with calculations of Average Daily Flows over the most recent 180 day period.

Tyngsborough-Dracut IMA

The IMA with the Town of Dracut is comprised of Tyngsborough's two oldest original sections of the sewer infrastructure system, which was constructed in the late 1970s under Federal and State grant programs to provide sewer service to areas north and south of Mascuppic Lake in the Town's easterly section. This collection system is connected to the Town of Dracut's sewer system, which conveys the wastewater to the LRWWU for treatment and disposal. The system is conveyed through two sub-area locations; (a) Dracut North / Parham Sub-Area; and (b) Dracut South / Willowdale Sub-Area.

The Agreement is for the Town of Dracut to receive and transport for treatment to the LRWWU up to 1.6 million gallons per day (mgd) Average Peak Flow. The metering station located at the Parham Sub-Area is designed for 1.15 mgd Average Daily Flow with a Peak Flow of 4.0 mgd. The metering station at Willowdale is designed for 0.45 mgd Average Daily Flow, with a Peak Flow of 1.8 mgd.

A review of the Town's most recent 182 day Average Daily Flow from its Dracut IMA accounts for of 382,387 mgd of use. Table 2-1 details the calculated flows

TABLE 2-1
TYNGSBOROUGH-DRACUT FLOW TOTALS

Month/Year	Days	Parham Station	Willowdale Station	Total Flow
December 2004	31	7,564,100	1,831,759	9,395,859
January 2005	31	9,200,700	2,234,589	11,435,289
February 2005	28	7,745,300	1,852,595	9,597,895
March 2005	31	4,758,000	1,190,563	5,948,563
April 2005	30	15,901,900	4,868,304	20,770,204
May 2005	31	10,360,900	2,074,920	12,435,820
TOTALS	182	55,530,900	14,052,730	69,583,630

Using the 69,583,630 mgd over 182 days, that calculates to a current average daily flow of 382,387 gpd. With the 1.6 Average Daily Flow allotted in the IMA, that leaves Tyngsborough with capacity of approximately 1.2 mgd. This IMA is active for 30 years from the date of actual operation. The complete IMA as well as Tyngsborough's Flows and Flow Charges are included in Appendix C.

Tyngsborough-Chelmsford IMA

The IMA with the Town of Chelmsford was enacted in October of 1995. The primary reason for the agreement was to give the EPA Superfund site at the Charles George Landfill a location to discharge the industrial wastewater generated at the site. The flows from this site are the largest contributor to this IMA and have flow variations, which are controlled by the EPA. According to the IMA, these flows are counted towards the permitted allowance of 0.35 mgd Average Daily Flow This collection system is connected to the Town of Chelmsford's sewer system, which conveys the wastewater to the LRWWU for treatment and disposal. The system is conveyed through the Worden Road metering station.

The Agreement is for the Town of Chelmsford to receive, treat and discharge up to 0.35 mgd Average Daily Flow, with a Peak Flow of 1.3 mgd. A review of the Town's most recent 244 day Average Daily Flow from its Chelmsford IMA accounts for of 56,000 gpd of use. Table 2-2 details the calculated flows.

TABLE 2-2
TYNGSBOROUGH-CHELMSFORD FLOW TOTALS

Month/Year	Days	Worden Station	Total Flow
April 2005	30	2.071	2.071
May 2005	31	2.238	2.238
June 2005	30	1.488	1.488
July 2005	31	1.873	1.873
August 2005	31	1.923	1.923
September 2005	30	0.995	0.995
October 2005	31	1.746	1.746
November 2005	30	1.373	1.373
TOTALS	244	13.707	13.707

Using the 13.707 mgd over 244 days, that calculates to a current Average Daily Flow of 56,100 gpd. With the 0.35 Average Daily Flow allotted in the IMA, that leaves Tyngsborough with available capacity of approximately 294,000 gpd. This IMA runs until the year 2025. The complete IMA as well as Tyngsborough's Flows and Flow Charges are included in Appendix C.

Tyngsborough-Lowell IMA

The IMA with the City of Lowell was enacted in November of 1995. On May 11, 2000 an amendment to the original IMA was signed and approved. This system is relatively small, accounting for approximately 100 connections in the entire system in Tyngsborough. The Lowell Regional Vocational School generates a major portion of the wastewater served by the Pawtucket Boulevard Station. The flow from the Vocational School is deducted from the total flows for the Town. According to the IMA, the permitted allowance is 0.080 mgd Average Daily Flow This collection system conveys the wastewater to the LRWWU for treatment and disposal. The system is conveyed through the Pawtucket Boulevard metering station.

The Agreement is for the City of Lowell to receive, treat and discharge up to 0.080 mgd Average Daily Flow. A review of the Town's most recent 212 day Average Daily Flow from its Lowell IMA accounts for 0.0202 mgd of use. Table 2-3 details the calculated flows.

TABLE 2-3
TYNGSBOROUGH-LOWELL FLOW TOTALS

Month/Year	Days	Pawtucket Boulevard Station	Total Flow
December 2004	31	0.6183	0.6183
January 2005	31	0.53413	0.53413
February 2005	28	0.56947	0.56947
March 2005	31	0.59626	0.59626
April 2005	30	0.82078	0.82078
May 2005	31	0.5808	0.5808
June 2005	30	0.56611	0.56611
TOTALS	212	4.28585	4.28585

Using the 4.285 mgd over 212 days, that calculates to a current Average Daily Flow of 20,212 gpd. With the 80,000 Average Daily Flow allotted in the IMA, that leaves Tyngsborough with available capacity of approximately 60,000 gpd. This IMA runs for 20 years from the date of initial treatment, with rights to negotiate extensions. The complete IMA as well as Tyngsborough's Flows and Flow Charges are included in Appendix C.

Copies of and summaries of all three IMAs and available capacities are included in Appendix C. A map of the current municipal sewer system is shown on Figure 2-1.

Insert Figure 2-1

1. Dracut, Massachusetts

a. General

This solution involves connecting a portion of Tyngsborough's Needs Areas to the LRWWU sewer system through the Town of Dracut. Tyngsborough currently has two receiving metering stations with the Dracut system; (a) Parham Road; and (b) Willowdale Avenue. The Town of Dracut is a member of the LRWWU and currently has an agreement with the City of Lowell to transport up to 1.6 million gallons per day (mgd) of Tyngsborough's wastewater for treatment and disposal.

b. Effects on Land Use

Tyngsborough could potentially connect to the LRWWU thorough Dracut's interceptors, which are located on either Parham Road or Willowdale Avenue, both near the Dracut town line. It is technically feasible to connect to the LRWWU through Dracut, as the major infrastructure currently exists and there is available capacity in the IMA. For those Needs Areas located east of the Merrimack River that abut the current Dracut wastewater system infrastructure, this is the most cost-efficient option.

c. Effects on Streams and/or Interbasin Transfers

Connecting to the LRWWU through Dracut would not require Tyngsborough to negotiate any additional Intermunicipal Agreements. This solution would not entail transporting water out of the Merrimack Basin. State Agencies having jurisdiction over the watersheds are advocating wastewater collection, treatment and discharge into the watershed from which the water was taken from in the first place in order to replenish the aquifers and sustain stream flows and this alternative meets these goals.

d. Limitations on Future Expansion (No Land)

Once the allotted flow in the current IMA is reached, any additional flow would need to be approved and negotiated through Dracut and Lowell. Tyngsborough would be responsible for funding any improvements and/or upgrades to Dracut's sewer systems, which may be necessary to the existing interceptors. If this alternative is chosen, the Phase III Draft Environmental Impact Report will evaluate the current infrastructure capacity and identify additional upgrades and/or amendments to the IMA necessary to implement this option.

e. Reliability, Operation and Maintenance

The major advantage of this solution is that Tyngsborough is currently a part of the LRWWU system and can take advantage of its available capacity in its IMA with Dracut. Once Tyngsborough's wastewater enters the LRWWU collection system, the LRWWU becomes responsible for treating and disposing of the wastewater. Another advantage is that the Town would not have to own and operate one or more wastewater treatment facilities within Tyngsborough. Dracut, through the LRWWU would control costs or fees to Tyngsborough without input from the Town. The current IMA allows for annual reviews of costs to each community.

f. Environmental and Economic Costs of Delays

Under this option, there should be very little, if any, delay either to the environment or general economics as Tyngsborough has a current IMA with available capacity with the Town of Dracut. The Town of Tyngsborough may be required to upgrade portions of Dracut's interceptor system and, perhaps, install new interceptors to handle the additional capacity due to Tyngsborough's wastewater flow. In addition, the connection of Tyngsborough's collection system to Dracut may result in increase flow to the pump station and could potentially require that the pump station's capacity be increased in order to handle Tyngsborough's proposed average daily flow.

g. Legal or Municipal Agreements and Permitting

All entities involved have current IMAs. The Town of Dracut signed an IMA with Lowell on May 25, 1977, and Dracut signed an IMA with Tyngsborough also in 1977. Tyngsborough would work with Dracut to extend its flow from current use, but within its current permitted capacity. In addition to working with Dracut to extend its current flows under its on-going agreement, Tyngsborough would also need to file for permits under or for the following: (a) the Massachusetts Environmental Policy Act; and (b) a Massachusetts DEP, Sewer Extension or Connection Permit, G.L. c.21 s.43 and 314 CMR 7.00.

h. Summary

At this time, this regional solution is feasible due to technical, environmental, and political issues. This solution is a viable regional solution to be pursued by Tyngsborough. It is highly likely that Tyngsborough will get approval by the LRWWU under its current IMA to transport either all or part of its proposed average daily flow to the LRWWU system. The LRWWU will be responsible for determining that the following conditions are met: (a) the additional connection flows will not result in surcharging or other overflows in the LRWWU's transport system; (b) exceed treatment capacity; or (c) result in non-compliance with any NPDES permit limit.

2. Lowell, Massachusetts

a. General

This solution involves connecting a portion of Tyngsborough's Needs Areas to the LRWWU sewer system through the city of Lowell. Tyngsborough currently has a receiving metering station with the Lowell system located at Pawtucket Boulevard. The Town of Tyngsborough is a member of the LRWWU and currently has an agreement with the City of Lowell to transport up to 80,000 gallons per day (mgd) of Tyngsborough's wastewater for treatment and disposal at the Lowell facility through an amendment to its original IMA on May 11, 2000.

Assuming there is sufficient capacity in reserve at the plant to accept some or all of the proposed wastewater flows from Tyngsborough, and also assuming that there is sufficient capacity in the current IMA Tyngsborough has with Lowell, then this solution is technically feasible for the Town of Tyngsborough. The Town will also need to forge agreements through the private sections of this system in order to upgrade the flows. If there isn't enough capacity available in the current IMA, then this is still a possibility for Tyngsborough, provided that the necessary approvals required to upgrade the collection system could be obtained from private entities, and Lowell as well as the regulatory agencies.

b. Effects on Land Use

For this solution, Tyngsborough could utilize its current collection system to carry its flow to the LRWWU. In addition, service from Tyngsborough could potentially require additional infrastructure in order to connect and Needs Areas abutting the current system. The current receiving metering station on Pawtucket Avenue is located east of the Merrimack River on the southern border of the Tyngsborough town line with Lowell.

c. Effects on Streams and/or Interbasin Transfer

This solution would not entail transporting water out of the Merrimack Basin. State Agencies having jurisdiction over the watersheds are advocating wastewater collection, treatment and discharge into the watershed from which the water was taken from in the first place in order to replenish the aquifers and sustain stream flows. This alternative meets the state's goals.

d. Limitations on Future Expansion (No Land)

Once the allotted flow in the current IMA is reached, any additional flow would need to be approved and negotiated through Lowell. Tyngsborough would be responsible for funding any improvements and/or upgrades to Lowell's sewer systems, which may be necessary with the existing interceptors. If this alternative is chosen, the Phase III Draft Environmental Impact Report will evaluate the current infrastructure capacity and identify additional upgrades and or IMA amendments necessary to implement this option. Any further limitations will not be known until such time as Tyngsborough completes its CWMP and finds it necessary to negotiate additional flows from Lowell.

e. Reliability, Operation and Maintenance

The major advantage of this solution is that Tyngsborough is currently a part of the LRWWU system and can take advantage of its available capacity in its IMA. Once Tyngsborough's wastewater enters the LRWWU collection system, the LRWWU becomes responsible for treating and disposing of the wastewater. Another advantage is that the Town would not have to own and operate one or more wastewater treatment facilities within Tyngsborough. The LRWWU would control costs or fees to Tyngsborough without input from the Town. The current IMA allows for annual reviews of costs to each community.

f. Environmental and Economic Costs of Delays

Under this option, there should be very little, if any, delay either to the environment or general economics as Tyngsborough has a current IMA with the City of Lowell. The Town of Tyngsborough may be required to upgrade portions of Lowell's interceptor system and, perhaps, install new interceptors to handle the additional capacity due to Tyngsborough's wastewater flow. In addition, the connection of Tyngsborough's collection system to Lowell may result in increase flow to the pump station and could potentially require that the pump station's capacity be increased in order to handle Tyngsborough's proposed average daily flow.

g. Legal or Municipal Agreements and Permitting

On May 11, 2000, Tyngsborough and Lowell signed an amendment to the original IMA for Wastewater Collection, Treatment, and Disposal, which allows for Tyngsborough to discharge 80,000 gpd to the LRWWU. The Town of Tyngsborough currently discharges at Pawtucket Boulevard, which is in the southern portion of Town, east of the Merrimack River. The IMAs respective available capacities were previously discussed in this section. This solution may require the Town of Tyngsborough to work with the LRWWU to forge additional amendments to its current agreement. In addition, Tyngsborough would also need to file for permits under or for the following: (a) the Massachusetts Environmental Policy Act; and (b) a Massachusetts DEP, Sewer Extension or Connection Permit, G.L. c.21 s.43 and 314 CMR 7.00.

h. Summary

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At this time, this regional solution is feasible due to technical, environmental, and political issues. This solution is a viable regional solution to be pursued by Tyngsborough. It is highly likely that Tyngsborough could get approval by the LRWWU under its current IMA to transport either all or part of its proposed average daily flow to the LRWWU system. The LRWWU will be responsible for determining that the following conditions are met: (a) the additional connection flows will not result in surcharging or other overflows in the LRWWU's transport system; (b) exceed treatment capacity; or (c) result in non-compliance with any NPDES permit limit.

3. North Chelmsford, Massachusetts

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a. General

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This solution involves connecting a portion of Tyngsborough's Needs Areas to the LRWWU sewer system through the Town of Chelmsford. Tyngsborough currently has a receiving metering station with the North Chelmsford system located at Worden Road. The Town of Chelmsford is a member of the LRWWU and currently has an agreement with the City of Lowell to transport up to 350,000 gallons per day (mgd) of Tyngsborough's wastewater for treatment and disposal.

b. Effects on Land Use

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For this solution, Tyngsborough could utilize its current collection system with North Chelmsford to carry its flow to the LRWWU. In addition, service from Tyngsborough could potentially require additional infrastructure in order to connect and Needs Areas abutting the current system. The current receiving metering station on Worden Road is located west of the Merrimack River on the southern border of the Tyngsborough town line with Chelmsford. If this solution is utilized, the effects on land use would be minimal.

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c. Effects on Streams and/or Interbasin Transfer

The LRWWU is located in the Merrimack Basin and an interbasin would not be required. The advantage to this solution would be that Tyngsborough would be collecting and discharging into the watershed from which the water was taken in the first place in order to replenish the aquifer and sustain natural stream flow.

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d. Limitations on Future Expansion as Currently Utilized (No Land)

Once the allotted flow in the current IMA is reached, any additional flow would need to be approved and negotiated through Chelmsford and/or Lowell. Tyngsborough would be responsible for funding any improvements and/or upgrades to Chelmsford's sewer systems, which may be necessary with the existing interceptors. If this alternative is chosen, the Phase III Draft Environmental Impact Report will evaluate the current infrastructure capacity and identify additional upgrades and or IMA amendments necessary to implement this option. Any further limitations will not be known until such time as Tyngsborough completes its CWMP and finds it necessary to negotiate additional flows from Chelmsford.

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e. Reliability, Operation and Maintenance

The major advantage of this solution is that Tyngsborough is currently a part of the LRWWU system and can take advantage of its available capacity in its IMA. Once Tyngsborough's wastewater enters the LRWWU collection system, the LRWWU becomes responsible for treating and disposing of the wastewater. Another advantage is that the Town would not have to own and operate one or more wastewater treatment facilities within Tyngsborough. The LRWWU would control costs or fees to Tyngsborough without input from the Town. The current IMA allows for annual reviews of costs to each community.

f. Environmental and Economic Costs of Delays

Under this option, there should be very little, if any, delay either to the environment or general economics as Tyngsborough has a current IMA with Chelmsford. The Town of Tyngsborough may be required to upgrade portions of Chelmsford's interceptor system and, perhaps, install new interceptors to handle the additional capacity due to Tyngsborough's wastewater flow. In addition, the connection of Tyngsborough's collection system to North Chelmsford may result in increase flow to the pump station and could potentially require that the pump station's capacity be increased in order to handle Tyngsborough's proposed average daily flow.

g. Legal or Municipal Agreements and Permitting

On May 31, 1989 Tyngsborough and Chelmsford signed an IMA for wastewater collection, treatment, and disposal, which allows for Tyngsborough to discharge 350,000 gpd to the LRWWU. The Town of Tyngsborough currently discharges at Worden Road, which is in the southern portion of Town, west of the Merrimack River. Summaries of all IMAs and each's respective available capacities are included previously in this section. This solution may require the Town of Tyngsborough to work with the LRWWU to forge amendments to its original agreement. In addition, Tyngsborough would also need to file for permits under or for the following: (a) the Massachusetts Environmental Policy Act; and (b) a Massachusetts DEP, Sewer Extension or Connection Permit, G.L. c.21 s.43 and 314 CMR 7.00.

4. Lowell, Chelmsford and Dracut Intermunicipal Agreements

It is also important to note, that the Town of Tyngsborough may have the option to renegotiate any or all of the above IMAs amongst themselves. For example, there may be the potential to "trade" available capacity from one IMA to another without adding any additional flow to the sum of the overall agreements. There is also opportunity for Tyngsborough to sell back unused flow, as detailed in the Chelmsford IMA.

5. Nashua, New Hampshire

a. General

This solution involves connecting a portion of Tyngsborough's Needs Areas to the Division of Public Works Wastewater Treatment Facility (NWTF) located in Nashua, New Hampshire. Tyngsborough abuts the NWTF infrastructure at the town line where Middlesex Road meets the Daniel Webster Highway at Tyngsborough's northern border, west of the Merrimack River.

This option will require the Town of Tyngsborough to enter into negotiations with the NWTF in order to forge an agreement to collect, treat and dispose of Tyngsborough's wastewater from nearby Needs Areas.

b. Effects on Land Use

Under a potential IMA with the NWTF, Tyngsborough's wastewater would be pumped from a proposed new receiving station to be delivered to, treated by, and disposed of by the NWTF. The most feasible route for transporting the wastewater from Tyngsborough would be along Middlesex Road, which follows directly to the Nashua city line. Proposed infrastructure would be located within the roadway or previously disturbed land. If this solution is utilized the effects on land use would be minimal.

c. Effects on Streams and/or Interbasin Transfer

The NWTF is located in the Merrimack Basin and an interbasin would not be required. The advantage to this solution would be that Tyngsborough would be collecting and discharging into the watershed from which the water was taken in the first place in order to replenish the aquifer and sustain natural stream flow.

d. Limitations on Future Expansion as Currently Utilized (No Land)

Flow greater than that agreed to in any future negotiated IMA would need to be approved by the City of Nashua and an Intermunicipal Agreement would need to be signed. Any further limitations will not be known until Tyngsborough completes its on going CWMP.

e. Reliability, Operation and Maintenance

The major advantage of this solution is that Tyngsborough is adjacent to existing infrastructure located at the towns' borders. If an IMA is negotiated and approved, Tyngsborough would become part of the NWTF system and can take advantage of its available capacity in its agreed upon IMA. Once Tyngsborough's wastewater enters the NWTF collection system, the NWTF becomes responsible for treating and disposing of the wastewater.

Another advantage is that the Townwould not have to own and operate one or more wastewater treatment facilities within Tyngsborough. The NWTF would control costs or fees to Tyngsborough without input from the Town. Any future negotiated IMA should provide for annual reviews of costs to each community.

f. Environmental and Economic Costs of Delays

This alternative is feasible provided that both entities can come to an agreement. Included in this agreement could potentially be a buy-in cost, cost of upgrading the NWTF, cost of constructing Tyngsborough's collection system, annual user charges, and the amount of flow Nashua is capable of and willing to allocate to Tyngsborough. If this solution is delayed, the severe soil and groundwater conditions identified in the Phase I Needs and Growth Management Report located in this vicinity may continue to degrade the environment. Delays may also cost each entity economic benefits derived from a mutual agreement. Tyngsborough would be unable to develop this area as an economic development corridor and thus provide tax relief to the ratepayers of Town. Delays may limit Nashua from collecting revenue on available capacity in its WWTF and thus eliminating financial benefits to its community.

One additional advantage of this solution is that Tyngsborough would not need to build a WWTF capable of handling the proposed average daily flow within its Town limits for the Needs Areas located in this area.

g. Legal or Municipal Agreements and Permitting

Tyngsborough would need to enter into an IMA with the City of Nashua, which allows Tyngsborough to discharge future projected flows from the Needs Areas in the general vicinity of Middlesex Road.

In addition to the intermunicipal agreement, Tyngsborough could have the potential need to file for permits under or for the following: (a) the Massachusetts Environmental Policy Act; and (b) a Massachusetts DEP, Sewer Extension or Connection Permit, G.L. c.21 s.43 and 314 CMR 7.00. Additional permitting may also be required through the State of New Hampshire.

h. Summary

At this time, a regional solution with Nashua, New Hampshire is the most feasible due to technical, environmental, and political issues. As long as the NWTF has additional capacity to meet Tyngsborough's needs and both entities can reach a mutual agreement, this option affords each benefits.

6. Review of Regional Solutions

Connections to each of the regional solutions is feasible based on the locations of the Needs Areas to existing sewer infrastructure, the ability of Tyngsborough's additional flows to meet currently permitted levels, as well as the ability to negotiate a new IMA with Nashua, New Hampshire and possibly renegotiate amendments to existing IMAs.

Connection to the LRWWU either through receiving stations located in Dracut, North Chelmsford or Lowell are all feasible alternatives for Tyngsborough because each has a current IMA to service portions of Town.

Of the regional solutions presented, any of the options would be beneficial to the Town of Tyngsborough because the Town would not have to own and operate one or more wastewater treatment facilities within Tyngsborough. Because each of the communities is located within the Merrimack Basin there are no inter-basin transfers. While a significant portion of the Town relies on individual private wells for its potable water supply, its public water supply comes through supplies located in Dracut and Lowell, so there is no significant upset to the Town's water balance as the water leaving the Town is going to its place of origin.

All of the regional solutions considered above may have significant cost implications, potential environmental impacts, and require either new or amendments to intermunicipal agreements. The Phase III DEIR will further identify and evaluate these issues.

C. WASTEWATER COLLECTION, TREATMENT AND DISPOSAL ALTERNATIVES

1. Flow and Waste Reduction

a. General

The Town of Tyngsborough understands the significance of reducing its wastewater flows. One of the ways to ensure this minimization is to implement water conservation measures to reduce water use in the basin. While a major portion of the Town relies on private wells, the Town relies on three public sources of water supply for approximately 30 percent of its water. The first is the Tyngsborough Water Supply District (TWD), which is the only Town based water supplier. The system was required to serve a neighborhood impacted by the Charles George Landfill. The system was extended from the City of Lowell and came on line in 1998. The distribution lines from Lowell are maintained by the Lowell Water Treatment Facility (LWTF), which withdraws water from the Merrimack River.

The second is The Dracut water Supply and the third is the Chelmsford Water District.

The Tyngsborough Water District is proactive in its approach to water conservation. It adopted a by-law to protect public health and welfare and to implement its authority to regulate water use. There are four levels of restricted water use conditions enforced during a state of water supply conservation ranging from no restriction to no outdoor water use. The Tyngsborough Water District also provides public educational materials on a variety of sources including:

- Consumer Drinking Water Quality Reports
- Restrictions on Outdoor Water Use
- Maintaining Lawns Efficiently and Safely
- Protecting Drinking Water from Contamination
- Using water Efficiently

The Chelmsford Water District, which also supplies water to parts of Tyngsborough, implements a summer water Management Program from May 15th through September 15th.

Water is also supplied through the Dracut Water Supply to parts of Tyngsborough. Water conservation materials are disseminated for public education.

Copies of all water conservation materials are included in Appendix E.

b. Public Education

Public education involves the dissemination of information and getting public support by providing a basic understanding of sound water resources management. One of the three main areas of emphasis that should be included in an educational program is explaining to water users the various costs that are associated with providing water. These costs include planning, engineering, construction, operation, maintenance, treatment, wastewater facilities costs, piping, leak detection, compliance costs, salaries and benefits, protection costs, training, and public education. Other areas of emphasis include providing water system users with tangible evidence of the cost savings and environmental benefits that can be attained through water conservation. All three water suppliers to Tyngsborough are proactive in their public education approach as is evidenced by the samples included in Appendix E.

Additional materials for education programs may be sought from the Massachusetts Water Works Association, the New England Water Works Association and other organizations, and funded by local water and sewer revenues.

The “1992 Water Conservation Standards” makes the following suggestions for developing a successful public education program: (a) the largest users should be targeted early on to realize the greatest potential savings; (b) public education should reach to the schools; get the children involved; (c) water bills should include a worksheet to enable customers to track water use and conservation, and figure the dollar savings; (d) publicly advertise water conservation successes (and failures)/ public service announcements; (e) joint advertising with hardware stores to promote household conservation devices; and (f) provide information on landscaping, gardening, and lawn care practices that promote water conservation.

c. Leak Detection and Repair

Leak detection and repair is intended to reduce the amount of water lost via leaks in the water distribution system. This maintenance activity is considered most important in older water systems. Leak detection programs can vary but should be carried out regularly by the water suppliers. The full-cost pricing structure described below should include the costs for leak detection surveys and repairs.

d. Metering

Complete system metering lets customers know how much water they are using, provides Tyngsborough with valuable knowledge of customer use patterns, assists in demand management programs, and enables Tyngsborough to bill the customer accurately. With accurate knowledge about current demand, Tyngsborough can more effectively identify potential water savings, assist specific users to implement water saving measures, determine unaccounted for water, and thereby provide the opportunity to reduce overall system demand and plan efficiently for system growth. Metering costs should be recovered through water rates, and include not only the costs for the metering equipment, but also the costs associated with reading the meters regularly.

e. Pricing

Full-cost pricing refers to price levels, which recover all the direct and indirect costs associated with providing water. For all sectors of water use, knowing the costs associated with providing water and sewer services creates an appreciation of the importance of conserving water and promotes greater understanding of the direct relationship and environmental implications of individual water use and community water resources, especially during seasonal or drought shortages.

The pricing structure for water should include the complete cost to run the system. These costs include pumping, maintenance, electricity/fuel, treatment, distribution system operation and maintenance, watershed/well site purchase/protection, capital replacement fund, capital depreciation account, and debt service, purchase and installation of water conservation retrofit equipment, public education program, staff and benefits, and leak detection and repair

f. Residential Water Use

Residential water use from public water suppliers in Massachusetts amounts to approximately 450 million gallons per day (gpd). Increasing efficiency of use and implementing conservation measures can realize significant savings for consumers and suppliers, both in energy and water costs. Residential users should be encouraged to use the following water saving devices: low-flow showerheads, faucet aerators, toilet displacement devices and/or low-flow toilets, and toilet leak detection kits.

g. Public Sector Water Use

Public municipal and state buildings and facilities should serve as demonstrations of water saving techniques and concepts. The public should be aware that the state and municipalities are not only doing their part, but also leading the way. Government facilities (schools, hospitals, public offices, etc.) should be built or retrofitted with water conservation devices such as faucet aerators, low flow showerheads, toilet displacement devices or low-flow toilets, and self-closing faucets. Other public sector policies should include charging contractors for using fire hydrants for pipe flushing and other construction purposes.

h. Industrial, Commercial, and Institutional Water Use

The bulk of industrial, commercial, and institutional water use is for heating, cooling, and processing, but often includes an appreciable sanitary and landscaping component. Conservation measures must be tailored to reflect the type of water use and characteristics of individual facilities. The implementation of source reduction programs often is accompanied by a reduction in facility water uses as well as a reduction in pollutant discharge. Water conservation can be built into an industry's strategy to comply with sewer and discharge requirements and often results in monetary savings following short payback periods. All industrial, commercial, and institutional water users should be required to develop and implement a written water policy addressing at a minimum demand management, leak detection and repair, a program of preventive maintenance, and a program of employee education. They should also be required to perform water audits to determine the location and amount of water used for heating, cooling processing, sanitary use, and outdoor use. This information could then be used to determine areas to conserve water. Industrial, commercial, and institutional users should also be required to install water saving sanitary devices.

i. Water Supply System Management

Tyngsborough has many options for improving the efficiency of its operations and encouraging water conservation by consumers. The Local Water Resources Management Plan developed by the Water Resources Commission can provide a framework for implementing these standards and establishing long-term priorities and plans for system maintenance, source protection, and, as necessary, new source development.

The Tyngsborough water District has a by-law, which can be imposed in the event of a water supply emergency. These plans, adopted under Home Rule Petition, allows Tyngsborough to effectively use existing supplies during times of drought or emergency.

j. Summary

Adoption or compliance with many of these suggestions has already been undertaken in the Town. The Tyngsborough Water District has initiated and maintains an aggressive water conservation program. The goals set by the District are to promote the efficient use of water through education. The following are some of the accomplishments to date: (a) adopted a Water conservation By-Law; (b) reference materials readily available for public education; (c) aggressive leak detection program; and (d) mandatory lawn water restrictions.

Specific recommendations the Town has made to further reduce water consumption: (a) minimize the size of grass areas; (b) keep trees for shade; (c) use mulch to retain water; (d) xeroscape – plant drought tolerant grasses and shrubs; (e) fix or replace old toilets; (f) repair water leaks immediately; and (g) install water saving devices in faucets and toilets.

2. Decentralized Facilities

a. General

Decentralized approaches to wastewater management, when properly sited, designed and maintained, may provide a cost-effective, environmentally sound solution to all, or some, of a community’s wastewater disposal needs. Decentralized solutions promote groundwater recharge and may reduce infrastructure costs by eliminating the need for extensive collection systems. However, decentralized solutions may also carry a risk of ground and surface water contamination from the discharge of inadequately treated effluent to the subsurface environment. This concern is especially significant in areas defined as nutrient sensitive and in areas of high development density with failing or improperly sited systems. Additionally, in areas with poor soil conditions or high groundwater, the cost for new on-site disposal systems can greatly exceed the unit cost for construction of municipal treatment and disposal facilities.

Decentralized wastewater disposal alternatives include individual on-site sewage disposal systems (septic systems and alternative sewage treatment and disposal facilities), near-site sewage treatment and disposal facilities (shared septic systems and community treatment and disposal facilities using either Innovative/Alternative technologies or small wastewater treatment facilities (WWTF]), regional wastewater treatment and disposal facilities permitted under the State Groundwater Discharge Permit Program and remote effluent disposal facilities sited to promote groundwater recharge of effluent treated at a central municipal wastewater treatment facility.

Decentralized wastewater treatment and disposal alternatives can be segregated into the following general categories:

- Individual on-site conventional Title 5 tank/soil absorption systems or cluster (shared) subsurface sewage disposal facilities (septic systems).
- Innovative/Alternative (I/A) treatment and disposal facilities ranging in size from individual single family home units up to large systems with capacities approaching 10,000 gpd and permitted through the local Board of Health and the Massachusetts Department of Environmental Protection (MDEP) through Title 5 of the state Environmental Code 310 CMR 15.00. For these applications, I/A systems include aerobic treatment units, aerobic/anoxic treatment systems and composting toilets.
- Small public or private wastewater treatment and disposal facilities designed and sited to serve individual uses (schools, condominium or apartment communities, hospitals, etc.) or small areas of a town. These wastewater treatment facilities are designed and permitted through either the Massachusetts Groundwater Discharge Permit Program (314 CMR 5.00) or the Massachusetts Surface Water Discharge Permit Program (314 CMR 3.00).

Additionally, several other innovative approaches to wastewater treatment and/or disposal can be categorized as decentralized options. These include wastewater treatment and effluent reuse (typically for irrigation, gray water uses or aquifer recharge within a Zone II Area of Contribution for a public drinking water well), remote siting of groundwater discharge facilities (either open sand beds or subsurface leaching facilities) or use of artificial or constructed wetlands treatment and/or disposal facilities. Each of these categories is discussed more fully in the following sections.

b. Conventional Title 5 Systems

Title 5 of The Massachusetts Environmental Code, 310 CMR 15.000, effective March 31, 1995 governs the subsurface disposal of sanitary wastewater via the on-site tank/soil absorption system. Title 5 provides the standard requirements for the subsurface disposal of sanitary sewage as deemed necessary for the protection of public health, safety, welfare and the environment. The regulations include standards for the design, siting, construction, upgrade and maintenance of on-site sewage disposal systems and require appropriate means for the transport and disposal of septage. The standard components of an on-site Title 5 system are a building sewer, tank, distribution box, soil absorption system, and reserve area. Wastewater exits the building through its building sewer and enters a tank where solids are settled and retained. The tank effluent flows through the distribution box and to the soil absorption system where it is distributed and treated prior to discharge to appropriate subsurface soils.

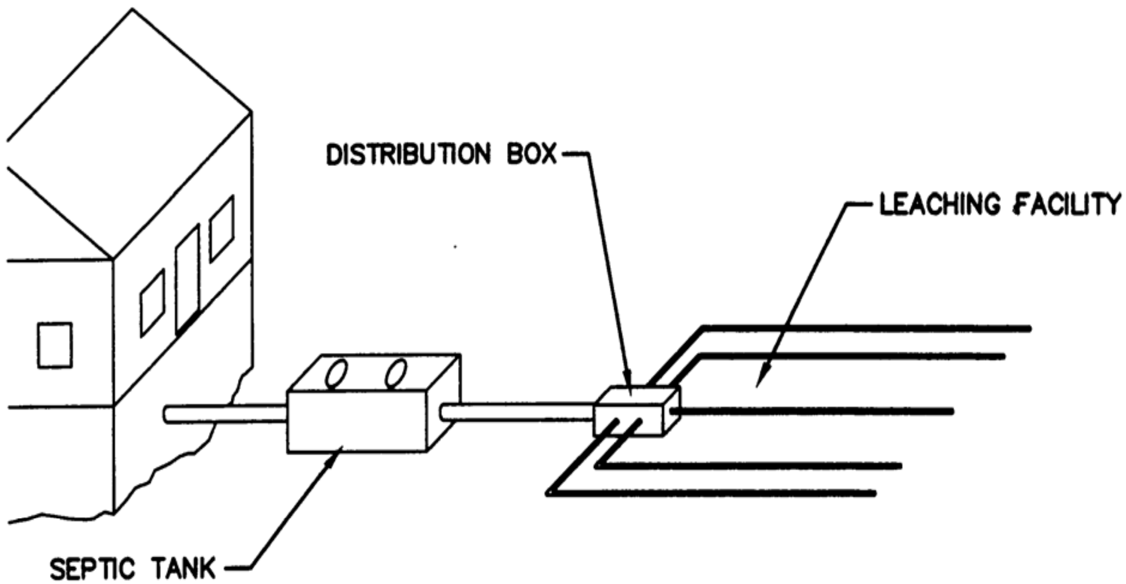
Typical Design Conditions

The conventional on-site tank/soil absorption system has two primary components, a water tank compartment (tank) and a provision for liquid effluent discharge to the subsurface (soil absorption) (Figure 2-2). The on-site tank serves simultaneously to separate the solids and liquid phases, to equalize flow peaks and to store and digest the retained scum and sludge. The solids storage and digestion functions dictate the tank's volume, dimensions and structure. The greater the depth, the less the velocity currents caused by the incoming and exiting wastewater disturb the sludge and scum. Baffling, and the use of multi-compartment tanks, can increase the detention times and improve scum and sludge retention.

A leaching system (soil absorption system) is used to dispense the liquid tank effluent into the soil, and therefore must be constructed in soils capable of accepting and dispersing the liquid. There are several types of leaching structures currently used including leaching pits, leaching galleries, leaching chambers, leaching trenches and leaching fields/beds. Some of these structures provide temporary detention for the liquid above the infiltrative surface, while others contribute minimal storage volume.

Once the tank effluent reaches the leaching structure, it percolates through a gravel (or coarse sand with some I/A leaching systems) layer into the surrounding soil. With time, a biological mat consisting of facultative (aerobic/anaerobic) bacteria and bacterial products forms at the soil-gravel interface. The mat serves to break down organic matter, to immobilize inorganic compounds and to effectively reduce the effluent infiltration rate thereby maintaining unsaturated soil conditions in the underlying soils. Pathogenic organisms and other pollutants are removed from the liquid as it passes through the mat and the unsaturated soil.

The viability and effectiveness of on-site systems are largely dependent on nearby resources and on-site soil and groundwater conditions. For instance, the minimum vertical separation distance from the bottom of the stone underlying the soil absorption system to the top of the seasonally high groundwater table is 4 feet in soils exhibiting a percolation rate greater than 2 minutes per inch (mpi) and 5 feet in soils where the percolation rate is less than or equal to 2 mpi. In addition, there must be at least 4 feet of naturally occurring pervious soil present below the entire area of the soil absorption system and the reserve area. The most difficult subsurface conditions to overcome include shallow depth to groundwater and insufficient depth of naturally occurring pervious soil.



Source: DEP, Alternative for On-Site Waste Water Treatment Systems
*Not to Scale

Figure 2-2: Conventional Title 5 Septic Systems

Systems sited in areas exhibiting these limitations oftentimes require construction of a raised or mounded soil absorption system that may require the use of pumps to provide groundwater separation. Additionally, soils with low permeability and a slow percolation rate require large soil absorption systems to properly accept the daily wastewater flows. Consequently, small lots with tight soil conditions and high groundwater may present significant limitations for the siting of conventional Title 5 on-site disposal systems.

Title 5 also dictates the minimum horizontal separation distance required between the components of the on-site system and points of possible human contact such as a drinking water well, property lines, surface waters and wetlands. Additionally, in areas deemed to be nutrient sensitive, Title 5 contains limitations on lot size (expressed as gpd per acre) to provide sufficient dilution to ensure that water quality criteria can be met. On-site disposal systems proposed for construction within Nitrogen Sensitive Areas are limited to a design flow of 440 gpd per acre. Generally, the specified separation distances and density limitations are intended to provide adequate detention time and dilution to overcome the viability and mobility of pathogenic bacteria and viruses in the saturated subsurface environment and to minimize the health or eutrophication effects instilled by the introduction of high concentrations of nitrates and phosphates. Older on-site disposal system Codes anticipated that the concentration of contaminants allowed to enter the groundwater would continue to be reduced by filtration, straining, physical-chemical processes, biological activity, dilution and dispersion as the groundwater passed through the saturated soil. However, extensive research conducted during the past decades has clearly demonstrated that contaminants (especially nitrate-nitrogen) allowed to enter the saturated groundwater environment can travel for great distances with very little attenuation or removal of pollutants actually occurring and although increasing the lateral separation distance to a sensitive receptor may theoretically aid in dilution, in practice little or no mixing occurs.

The majority of the concerns about on-site system contamination are related to failing and improperly sited "older" systems (including cesspools and failing or non-conforming Title 5 systems) that predate the 1995 Title 5 update and on-site systems constructed in densely populated areas or on sites that rely on private wells for drinking water. Additional concerns include the migration of nitrate-nitrogen within the aquifer and the potential for groundwater contamination from improper disposal of household chemicals and cleaners. As on-site systems are not only used for residential purposes, disposal of non-sanitary wastes must be strictly prohibited, and educational forums must be conducted to prevent a "flush it and forget it" mentality that can result in significant harm to groundwater resources.

The most common reasons for on-site system failure is due to overloading, poor siting, poor construction and poor maintenance. Assuming the systems are properly constructed and maintained, the remaining issue to address is overloading of the system. Several ways in which a soil absorption system can be overloaded include: (a) hydraulically overloading the soil; (b) pollutant clogging within the soil; and (c) insufficient depth of naturally occurring pervious soil that results in improper treatment of the effluent. These can be overcome through on-site disposal system designs that promote proper treatment in the unsaturated zone with low effluent loading rates to promote thin layer water formation at the soil-water and gas-water interface and through the maintenance of acceptable on-site system densities that allow for reasonable dilution of the effluent within the aquifer.

On-site systems require periodic maintenance including tank pumping to ensure proper function. Pumping is required whenever the top of the sludge or solids layer is within 12 inches of the bottom of the outlet tee, the top of the scum layer is within two inches of the top of the outlet tee or the bottom of the scum layer is within two inches of the bottom of the outlet tee. The required pumping frequency is a function of use, although pumping is typically necessary at least once every 3 years and is recommended on an annual basis for a system serving a dwelling equipped with a garbage grinder. Large systems and systems serving non-residential uses may require more frequent pumping. Additionally, since microorganisms in the tank and soil absorption system are responsible of providing treatment, use of harsh chemicals, grease cutters, cleaners and disinfectants that can harm or kill those organisms must be avoided.

A properly functioning Title 5 system can achieve an effective level of treatment as measured by Biochemical Oxygen Demand (BOD_5) and Total Suspended Solids (TSS) removal but are relatively ineffective at removing nitrogen from the wastewater. Based on compilation of various studies and DEP data, a conventional Title 5 on-site disposal tank typically discharges effluent with a BOD_5 concentration of approximately 170 mg/l, a TSS concentration of approximately 60 mg/l and a total nitrogen concentration of 42 mg/l with the majority of this total being ammonia-nitrogen. Thus, the conventional on-site disposal tank achieves 43 percent removal of BOD_5, 80 percent removal of TSS and only 6 percent removal of total nitrogen. The bacteria and unsaturated soil present in the soil absorption system further reduce the BOD_5 and TSS concentrations but only oxidize the nitrogen to the nitrate-nitrogen form with little removal actually occurring.

Title 5 limits the use of on-site systems to flows less than 10,000 gpd without a variance or requiring the issuance of a State Groundwater Discharge Permit. The land area required for a 10,000 gallon per day sewage disposal system (about 45 residential/commercial units) is approximately 17,800 square feet (approximately 0.4 acres), assuming an optimal percolation rate of less than 5 mpi with Class I soils (sands, loamy sands) and a long-term acceptance rate of 0.74 gpd per square foot of effective leaching area (based on Title 5 requirements). The required land area assumes the use of leaching trenches, each 2 feet wide by 2 feet deep and 100 feet long with 6 feet of separation provided between trenches. Title 5 also requires space to be set aside for a reserve area in the event of system failure; however, it allows the space between trenches to be used as the reserve area.

The overall area calculated above only includes the area needed for the subsurface disposal system itself, and does not include required setbacks from property lines, water bodies, buildings, slopes, etc. The land area required to satisfy setback limitations can only be determined when an appropriate disposal area has been identified and designated, but an additional 50 percent of the total would not be excessive. Hence a site of approximately 0.6 acres would be necessary for the disposal of 10,000 gpd of tank waste. Although the foregoing space requirements are needed to meet all of the setback limits of Title 5, it is quite common for on-site systems to be granted variances to allow them to be sited within smaller spaces and still function well.

As of this writing, the State is in the process of revising the Title 5 Regulations. The Town is advised to keep abreast of changes to the current law.

Variances to Conventional Title 5 Systems

Title 5 provides a variance procedure for review and evaluation of on-site systems that are unable to fully comply with all of the design and siting requirements of the Code. Depending on the scope of the variance, the process can be completed either through a local variance request issued by the Board of Health or through a variance issued by the DEP. When requesting a variance, the applicant is required to demonstrate that the proposed system will maintain a level of environmental protection that is at least equivalent to 310 CMR 15.000 without strict application of the specific provisions from which the variance is sought. The variance procedures and standards from which variances can be granted depend on many factors including system size and location and whether the proposed system is for new construction or a repair to an existing system. Title 5 also includes a variance from the system design flow criteria for schools and/or to allow an increase in flows to a large system serving a school with design flows between 10,000 and 15,000 gpd.

c. Shared Systems

Shared systems are defined in Title 5 as a system sited and designed in accordance with 310 CMR 15.100 through 15.293 which serves, or is proposing to serve, more than one facility or more than one dwelling in a single facility and which has been approved in accordance with 310 CMR 15.290 through 15.293. A system serving a condominium unit or units located on the same facility is not considered to be a shared system.

Title 5 allows the use of shared systems, subject to special conditions, for upgrade of existing systems, for new construction and for increased flow to an existing system. The application for use of a shared system must include a description of how the proposed shared system compares to systems constructed in full compliance with Title 5 in terms of its capacity to protect public health, safety, welfare and the environment; a proposed operation and maintenance plan for the shared system; a description of the form of ownership for all shared components of the system; a description of the financial assurance mechanism proposed to ensure effective long-term operation and maintenance of the system; and, a copy of a proposed Grant of Title 5 Covenant and Easement to be recorded and/or registered with the Registry of Deeds and/or Land Registration Office.

Shared systems for upgrades can be approved by the local Board of Health, either through a variance procedure or without a variance if there will be no increase in design flow from the facility or facilities to be served by the shared system and the system design satisfies all of the technical requirements of Title 5 with the exception of the setback from property lines between facilities to be served by the shared system. Shared systems must be reviewed by the Department of Environmental Protection after being approved by the local Board of Health.

The use of shared systems designed for new construction or for increased flow to existing systems can only be approved through a variance procedure. In addition to the requirements listed above for upgrades, the applicant for a shared system for new construction or for increased flow to existing systems must also demonstrate that the design flow from the facility or facilities to be served by the shared system does not exceed the design flow which could have been constructed in compliance with 310 CMR 15.100 without the use of the shared system.

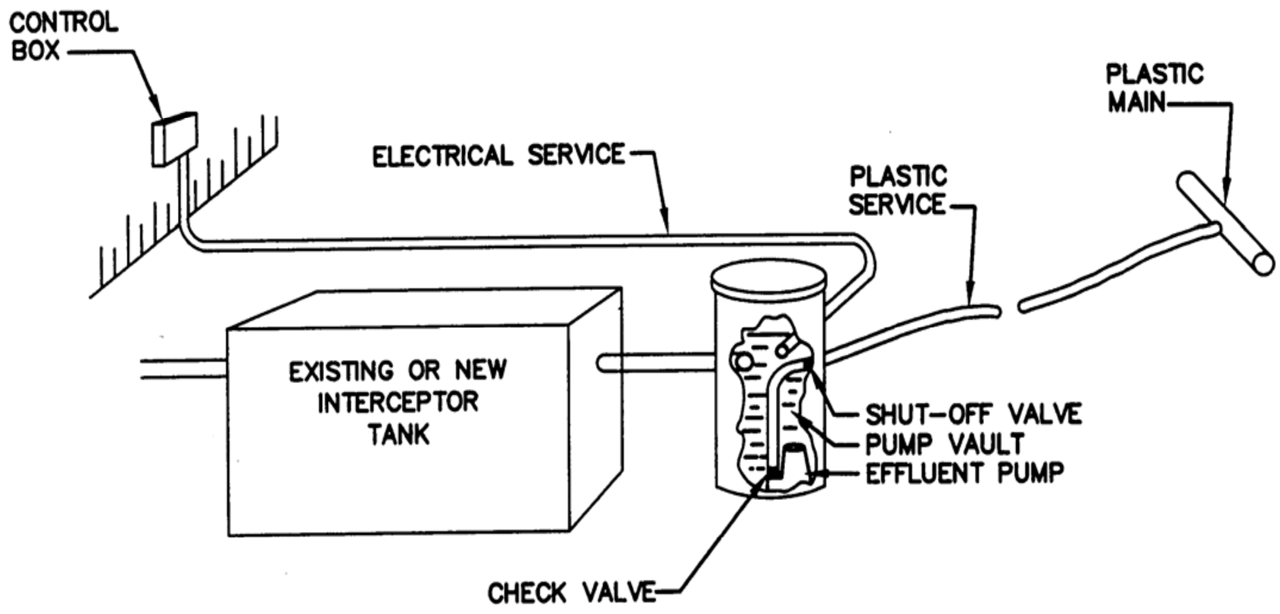
d. STEP/Cluster Systems

One decentralized treatment alternative to an individual Title 5 system is the Septic Tank Effluent Pump (STEP) System which pumps tank effluent through a pressurized sewer to a small-scale, off-site shared subsurface disposal system, Innovative/Alternative treatment system or wastewater treatment facility. The STEP system consists of a septic tank that concentrates and collects solids from the wastewater and a pump to transfer effluent to a remote location for treatment and disposal (Figure 2-3 and Figure 2-4).

The disposal system could be located either on an undeveloped parcel in the needs area, on an undeveloped parcel just outside of the needs area or on a portion of an existing developed parcel in the needs area. The system can be either private (permitted as a shared system) or municipal, with the property either purchased by the town or subject to an exclusive easement granted to the Town by the property owner.

e. Innovative Alternative (I/A) Systems

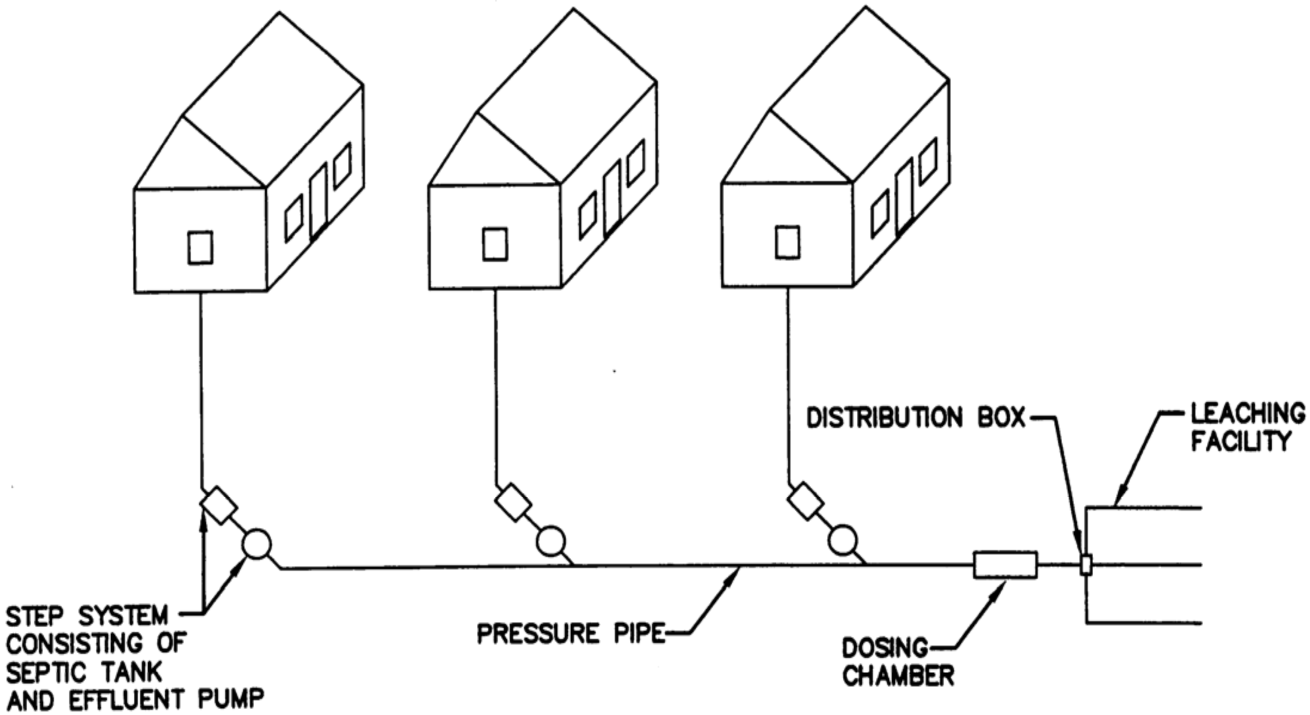
Title 5 allows the use of Innovative/Alternative (I/A) technologies for on-site wastewater treatment and disposal and periodically, the DEP issues an updated memorandum entitled: “Title 5 I/A Technologies Approved for use in 310 CMR 15.000 Massachusetts”. A number of these I/A technologies can safely and effectively treat wastewater providing enhanced wastewater treatment with improved nitrogen removal. Examples of I/A systems include the Recirculating Sand Filter, Amphidrome™ Process, Bioclere™ System, Cromaglass®, RUCK® System, and the Single Home FAST®.



Source: EPA Manual, Alternative Wastewater Treatment System

*Not to Scale

Figure 2-3: STEP System



*Not to Scale

Figure 2-4: Subsurface Cluster System

Like a conventional Title 5 system, these I/A systems require a soil absorption area. Use of an I/A system can potentially overcome site and environmental constraints but at a premium cost to the property owner.

In remedial situations, on-site disposal systems incorporating I/A technologies with nitrogen reduction may be allowed to use either a 50 percent reduction in leaching area; a two foot reduction in the groundwater separation requirement; or a two foot reduction in the depth of naturally occurring soil under the leach field. This may have advantages in areas displaying either severe soil limitations or high groundwater. Innovative/Alternative systems have been widely used to overcome flow restrictions in Nitrogen Sensitive Areas and have proven capable of overcoming site limitations and/or providing further resource protection especially in areas determined to be particularly sensitive to the discharge of pollutants from on-site sewage disposal systems. The Department has set loading limitations (310 CMR 15.214) in nitrogen sensitive areas, defined by Title 5 as an area of land and/or natural resource area so designated by the Department in accordance with 310 CMR 15.215, to promote increased treatment of pollutants and reduction of nutrients and pathogens discharged from on-site sewage disposal systems. Title 5 and the Bureau of Resource Protection, Interim Policy, "Nutrient Loading Approach to Wastewater Permitting and Disposal, August 20, 1999", have identified the following nitrogen sensitive areas:

- Interim Wellhead Protection Areas of public water supplies;
- Mapped Zone II's of public water supplies;
- Nitrogen Sensitive Embayments;
- Areas dependent on private wells;
- Zone A's for reservoirs;
- Site-specific ponds, lakes, rivers or wetlands deemed to be nitrogen sensitive by DEP after specific site assessments;
- Potentially productive aquifers that demonstrate hydrogeological characteristics and aerial extent that indicate feasibility for public water supply development;
- Sole source aquifers; and
- Other areas deemed sensitive to nutrients by DEP on a site-specific basis.

In nitrogen sensitive areas, on-site systems serving new construction are limited to a design flow of no more than 440 gpd per acre except as set forth at 310 CMR 15.216 (Aggregate Determinations of Flows and Nitrogen Loadings) and 310 CMR 15.217 (Systems with Enhanced Nitrogen Removal). These sections allow (a) the 440 gallon per day per acre nitrogen loading limitation to be calculated in the aggregate instead of on an individual lot basis and (b) the use of an approved alternative treatment system or wastewater treatment facility (WWTF) with a groundwater discharge permit issued pursuant to 314 CMR 5.00 (Groundwater Discharge Permit Program) capable of meeting the federal Safe Drinking Water nitrate nitrogen standard of 10 parts per million (ppm) or (c) for systems with design flows less than 2,000 gpd, a technology certified by the Department for enhanced nitrogen removal pursuant to 310 CMR 15.281–15.289. These systems with enhanced nitrogen removal are allowed to use an increased design flow per acre of land to reflect the nutrient removal performance of the approved technology compared to a conventional Title 5 on-site system. A system receiving a design flow credit for enhanced nutrient removal must still comply with the siting and design requirements of Title 5.

According to Title 5, “alternative systems, when properly designed, constructed, operated and maintained, may provide enhanced protection of public health, safety, welfare and the environment.” I/A systems are recommended for remedial use in areas where a conventional Title 5 system repair cannot be sited and in sensitive areas requiring an additional level of treatment. Title 5 details an approval process that proponents of each respective innovative/alternative technology must adhere to prior to gaining approval of their alternative system. DEP approves I/A technologies under four main categories: Approval for Piloting; Provisional Approval; Certification for General Use; and Approval for Remedial Use.

- Piloting Approval (310 CMR 15.285) allows for controlled field-testing and technical demonstration of I/A technologies. Pilot systems can only be built where the establishment to be serviced has access to a sewer system or a conventional Title 5 system to which it can be connected if the alternative system fails. If the I/A technology is approved for piloting it can be implemented at a maximum of fifteen locations. A minimum of 18 months of environmental monitoring must be performed at each facility. Piloting is considered successful when at least 75 percent of the systems perform satisfactorily over 12 months.

- Provisional Approval (310 CMR 15.286) provides for broader field-testing of the I/A technologies that appear to be technically capable of providing levels of environmental protection at least equivalent to a conventional Title 5 system. Under the provisional approval, testing will be performed to determine if the technology is technically capable of providing this level of treatment over a broader use than the pilot scale testing, and whether any further conditions regarding operation, maintenance, or monitoring are necessary to ensure such environmental protection. Provisional approval is contingent on successful completion of the piloting program. Systems that have completed 2 years of general use in another state will also be considered for provisional approval. A 3-year performance evaluation must be performed on the first 50 systems. As with piloting, establishments to be serviced by provisional systems must be capable of connecting to a sewer system or a conventional Title 5 system, if the alternative treatment system should fail.

- Certification for General Use (310 CMR 15.288) facilitates the use of I/A technologies that have shown that they provide the level of environmental protection at least equivalent to that offered by a conventional Title 5 on-site system. In order for an I/A technology to be certified for general use, it must have a success rate during the provisional process of 90 percent. The DEP also establishes nutrient removal credits for I/A technologies that are more effective than a conventional Title 5 system in removing nitrates.

- Remedial Approval (310 CMR 15.284) provides for rapid approval of I/A technologies needed to upgrade currently failing or non-conforming systems. In order for the technology to be considered for remedial approval, it must have at least 1 year of general use in a state with climate conditions similar to Massachusetts. Remedial approval is a “stopgap measure”. It is not intended that the data collected for a remedial use approval will be used to support an application for piloting, provisional or general certification.

Table 2-4 through Table 2-8, compiled from the most recent DEP I/A Technologies Memorandum, dated December 31, 2001, list the approval categories and technologies that have received each approval.

TABLE 2-4
SYSTEMS CERTIFIED FOR GENERAL USE

Technology and Model Numbers	Technology Proponent
Composting Toilets that comply with Title 5	(Generic)
Recirculating Sand Filter that complies with Title 5	(Generic)
BioDiffuser High Capacity, Standard, and Bio 2 Chambers Model Number: Standard	Advanced Drainage Systems
Bioclere 16, 22, 24, and 30 series units	AWT Environmental, Inc.
MicroFAST, High Strength FAST, NitriFAST	Bio-Microbics, Inc.
WWT System CA-5, CA-12, CA-25, CA-30, CA-50, CA-60, CA-100, CA-120, and CA-150	Cromaglass Corporation
Contactor 75, 100, 125 and EZ-24; and Recharger 180, 280, 330, and 400; Contactor Field Drain C1, C2, C3, and C4	Cultec, Inc.
Eljen In-Drain Systems: Model Number: Type B43	Eljen Corporation
High Capacity and Standard Chambers, Maximizer, 3050, and Equalizer 24	Infiltrator Systems, Inc.
RUCK System (less than 2000 gpd)	Innovative RUCK Systems, Inc.
Low-Rate Intermittent Sand Filter by Orenco Systems, Inc.	Saneco, Inc.
Modular FAST	Smith & Loveless, Inc.
Singulair Model 900 (Model 900 had been replaced by Model 960)	Seigmund Environmental Services, Inc.

TABLE 2-5
SYSTEMS CERTIFIED FOR PROVISIONAL USE

Technology and Model Numbers	Technology Proponent
Bioclere 16, 22, 24, and 30 series units	AWT Environmental, Inc.
Biolet XL Composting Toilet	Biolet, Inc.
MicroFAST	Bio-Microbics, Inc.
Single Home FAST and Modular FAST	Smith & Loveless, Inc.
ZenoGem/Cycle-Let	Zenon Municipal Systems

TABLE 2-6
SYSTEMS CERTIFIED FOR PILOTING

Technology and Model Numbers	Technology Proponent
WWT System CA-5D, CA-12D, CA-25D, CA-30D, CA-50D, CA-60D, CA-100D, CA-120D, and CA-150D	Cromaglass Corporation
Amphidrome Process	F.R. Mahony & Associates, Inc.
Krofta Compact Clarifier (KCC)	Lenox Institute of Water Technology
MicroSeptec EnviroServer 600, 1200, and 1500	MicroSeptec, Inc.
Norweco Singulair Model 960 DN	Siegmund Environmental Services, Inc.
Nitrex Filters and Nitrex Plus	Wastewater Science, Inc.
Waterloo Biofilter	Waterloo Biofilter System, Inc.

Innovative/Alternative treatment systems are more complex than conventional on-site systems and require a higher level of control of the operation and maintenance. For the Innovative/Alternative treatment and disposal system to operate properly, its various components need periodic inspection, maintenance and adjustment. Although a properly instructed homeowner can perform routine maintenance, a WWTF Operator, certified in accordance with the requirements of 257 CMR 2.00 and the Board of Certification of Operators of WWTFs, should be retained to perform quarterly inspections and system adjustments. The scope of services and schedule for operation and maintenance is system dependant but usually includes annual pumping of the tank to prevent solids carryover and regular inspection and adjustment of the fans, blowers, pumps, timers and alarms that may be present in the treatment system.

After system start-up and acclimation, these inspections are usually performed monthly or quarterly with adjustments performed as necessary in response to actual flow rates and treatment levels. Quarterly or annual effluent sampling with laboratory analysis and reporting to the Board of Health is often required to verify system performance.

TABLE 2-7
SYSTEMS CERTIFIED FOR REMEDIAL USE

Technology and Model Numbers	Technology Proponent
Composting Toilets that comply with Title 5	(Generic)
Recirculating Sand Filter that complies with Title 5	(Generic)
Bioclere 16, 22, 24, and 30 series units	AWT Environmental, Inc.
Biocycle 525	Biocycle, Inc.
Biolet XL Composting Toilet	Biolet, Inc.
MicroFAST, High Strength FAST, NitriFAST	Bio-Microbics, Inc.
WWT System CA-5, CA-12, CA-25, CA-30, CA-50, CA-60, CA-100, CA-120, and CA-150	Cromaglass Corporation
Jet Models J-335 Tertiary Sand Filter	Clearwater Recovery (Stephen B. Nelson)
Jet Models J-500*, J-750, J-1000, J-1250, and Jet J-1500 *Formerly J-353	Clearwater Recovery (Stephen B. Nelson)
Amphidrome Process	F.R. Mahony & Associates, Inc.
Ecoflo Biofilter	Premier Tech
High-Rate and Low-Rate Intermittent Sand Filter by Orenco Systems, Inc.	Saneco, Inc.
SeptiTech Models 300, 400, 500, 750, 1200, and 3000	SeptiTech, Inc.
Singulair Models 960N, 960/750, 960/1000, 960/1250, and 960/1500	Siegmund Environmental Services, Inc.
Modular FAST	Smith & Loveless, Inc.
Waterloo Biofilter	Waterloo Biofilter System, Inc.

TABLE 2-8
APPLICATIONS CURRENTLY UNDER REVIEW

Technology	Applicant	Type of Approval
Composting Toilet	Biolet USA, Inc.	General
FAST	Bio-Microbics, Inc.	General
Infiltrator	Infiltrator Systems, Inc.	General
Singulair	Norweco, Inc.	General
Waterloo Biofilter	Waterloo Biofilter System, Inc.	General
Amphidrome	F.R. Mahony and Associates, Inc.	Provisional
Waterloo Biofilter	Waterloo Biofilter System, Inc.	Provisional
RUCK CFT	Innovative RUCK Systems, Inc.	Piloting
SeptiTech	SeptiTech, Inc.	Piloting
Puraflow	Bord Na Mona	Remedial

f. Summary of I/A Technologies

Recirculating Sand Filter

The Recirculating Sand Filter (DEP approval March 1995) is an alternative treatment system that consists of a tank, a recirculation tank and pump, a sand filter with underdrains and a soil absorption system (Figure 2-5). The wastewater flows from the building through its building sewer to a tank where solids are settled and retained. Effluent from the tank flows by gravity and is collected in the recirculation pump chamber. The effluent from the tank and the effluent returned from the sand filter are mixed within the recirculation pump chamber. This mixture is then periodically pumped and evenly distributed over the sand filter bed surface. After percolating through the sand filter, underdrains collect effluent and either recirculated to the recirculation pump chamber or discharged to a soil absorption system.

The Recirculating Sand Filter was issued a Certification for General Use and Remedial Use Approval by DEP in March 1995 and its Remedial Use Approval was renewed by DEP in November 1998. The Recirculating Sand Filter must meet secondary treatment standards of 30 mg/l BOD_5 and 30 mg/l TSS with a minimum removal of 85 percent of the influent BOD_5 and TSS. The effluent total nitrogen concentration must not exceed 25 mg/l and the system is required to remove a minimum of 40 percent of the influent total nitrogen concentration.

Generally, the Recirculating Sand Filter achieves a higher level of treatment than provided by a conventional Title 5 system. A variety of papers and studies have been written on Recirculating Sand Filters showing very high levels of treatment. Some of these studies show that typical BOD_5 and TSS removals are greater than 90 and 85 percent, respectively with typical BOD_5 and TSS effluent concentrations less than 15 mg/l. These studies also show that the Recirculating Sand Filter is capable of obtaining high levels of total nitrogen removal of up to 75 percent. The effluent total nitrogen concentration has been recorded as low as 10 mg/l.

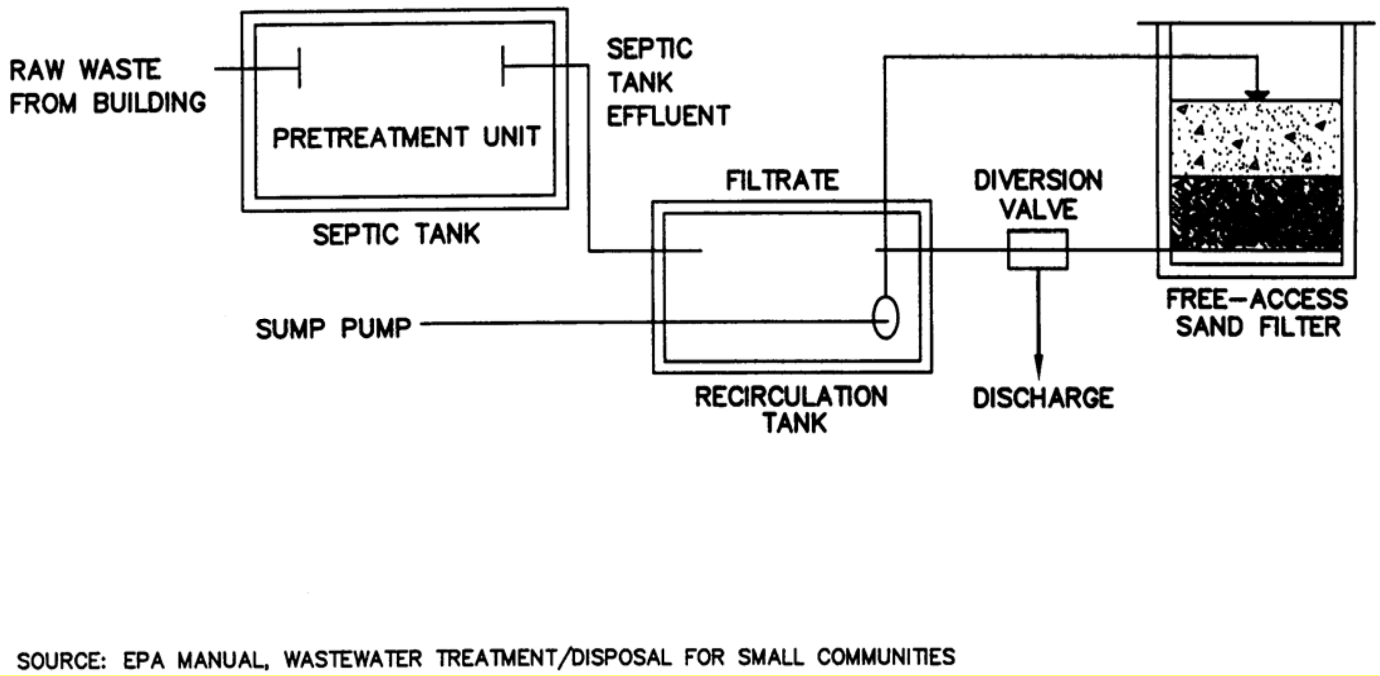


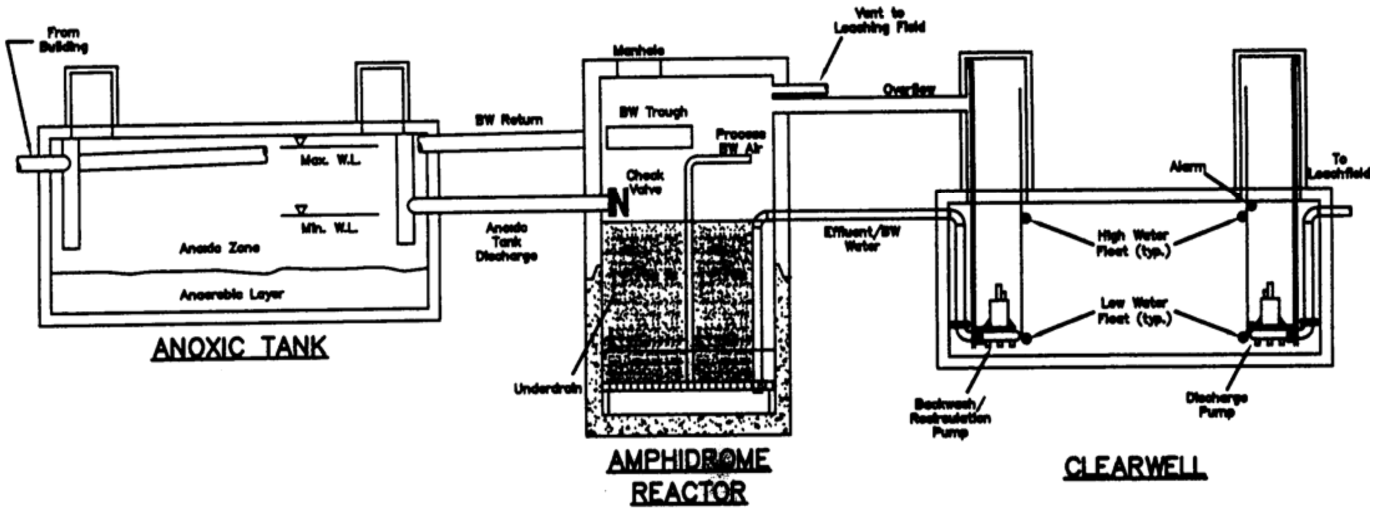
Figure 2-5: Recirculating Sand Filter

The Recirculating Sand Filter is the I/A technology that is specifically covered in Title 5 and the treatment capabilities of all I/A technologies are compared to the Recirculating Sand Filter. Although the Recirculating Sand Filter does not always meet the effluent standards, DEP is confident of the system's treatment capabilities and ability to protect public health and the environment. For a facility with a design flow less than 2,000 gpd located in a Nitrogen Sensitive Area, systems constructed with a Recirculating Sand Filter are allowed to increase the design flow rate to provide a density of 550 gpd per acre. For remedial use, Recirculating Sand Filters are allowed to be used with a percolation rate up to 90 minutes per inch and are allowed to provide either a 50 percent reduction in leaching area, a 2 foot reduction in the groundwater separation or a 2 foot reduction in the requirement for 4 feet of naturally occurring pervious material.

Amphidrome™ Process

The Amphidrome™ (DEP piloting approval June 1995) system is a fixed film, sequencing batch biological filter. The Amphidrome™ primarily consists of an anoxic equalization tank, the Amphidrome™ reactor/sand filter, and a clearwell (Figure 2-6). As with a conventional Title 5 system, a soil absorption system is also required. Wastewater flows from the building through its building sewer, combines with recycle flow from the clearwell and enters the anoxic pretreatment/equalization tank that stores flow prior to treatment through the biological filter. The anoxic pretreatment/equalization tank also promotes solids settling, provides sludge storage and digestion and promotes denitrification of the recycled flow using fresh wastewater flow as the carbon source.

The Amphidrome™ process works by sequences consisting of alternating flow directions within the Amphidrome™ reactor/sand filter. A batch of wastewater flow is sent by gravity from the anoxic equalization tank, down through the filter where it is collected by an underdrain system and directed to the clearwell. The wastewater flow direction is then reversed by pumping from the clearwell up through the filter, recycling partially treated wastewater to the equalization tank.



SOURCE: F.R. MAHONEY & ASSOCIATES, INC.

Figure 2-6: Amphidrome Process

This cycle is repeated several times, alternating between aerobic and anoxic modes, until the required level of treatment is achieved. Once the required degree of treatment is obtained, the effluent is pumped from the clear well for discharge in a soil absorption system.

The Amphidrome™ Process was issued Piloting Approval by DEP in June 1995 and was issued Remedial Use Approval in November 2000. It is approved for remedial situations where an existing system is failed, failing or nonconforming. With the remedial use approval, the soil absorption system can be constructed within two feet (or three feet for percolation rates less than two minutes an inch) of the seasonal high groundwater elevation; the size of the soil absorption system can be reduced in size up to 50 percent; or the soil absorption system can be built in areas where at least 2 feet of material is available beneath the system.

The Amphidrome™ Process is considered to be equivalent technology to a Recirculating Sand Filter and must meet secondary treatment standards of 30 mg/l BOD_5 and 30 mg/l TSS with a minimum of 85 percent removal of the influent BOD_5 and TSS. The system must also meet the nitrogen loading design standards as follows:

- For residential systems, the effluent total nitrogen concentration shall not exceed 19 mg/l and the system shall remove a minimum of 55 percent of the influent total nitrogen concentration.
- For non-residential systems, the effluent total nitrogen concentration shall not exceed 25 mg/l and the system shall remove a minimum of 40 percent of the influent total nitrogen concentration.

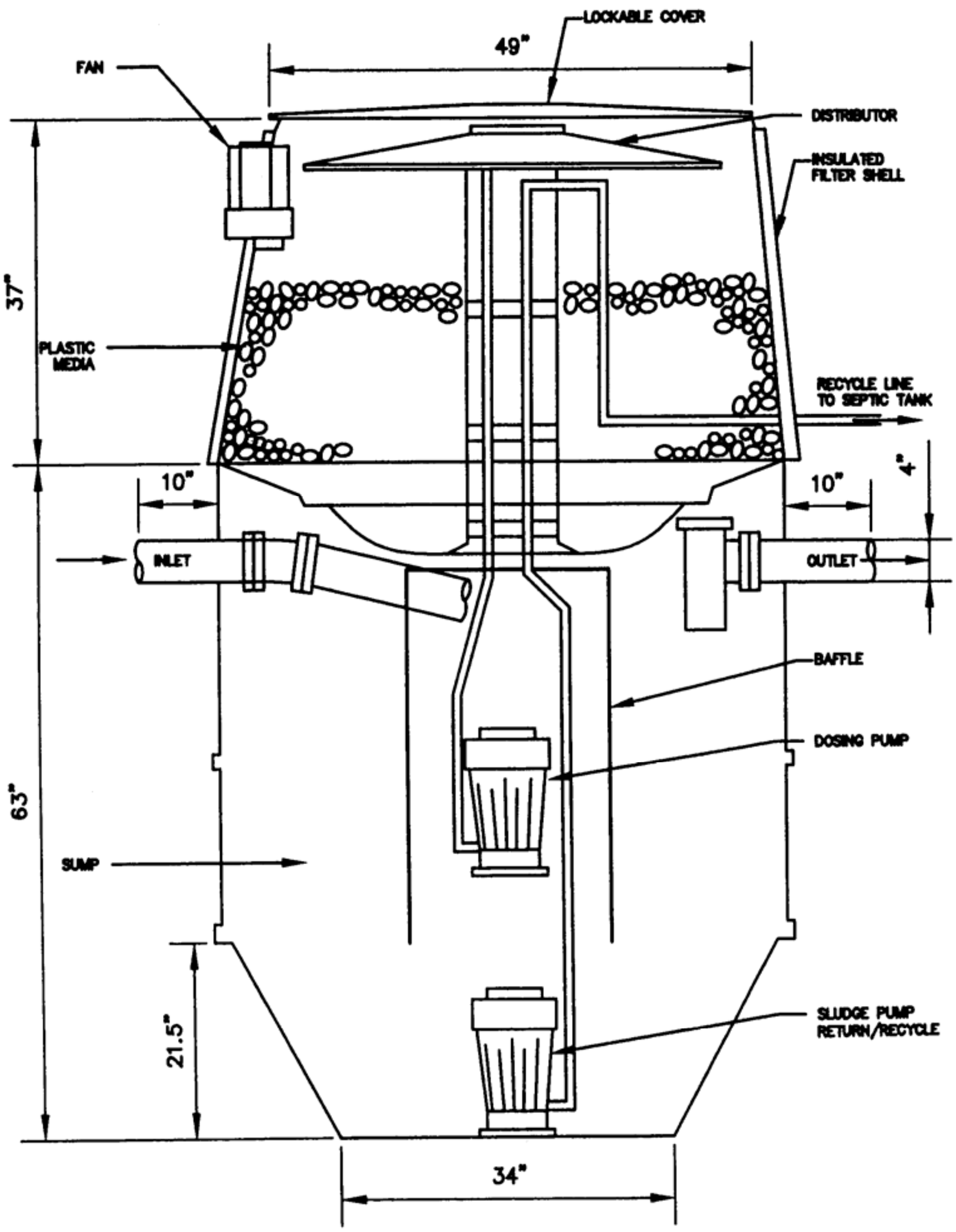
DEP requires that the influent and effluent parameters for this technology be monitored monthly for the first year of operation. The proponent of this system is seeking to show that the effluent total nitrogen concentration does not exceed 10 mg/l and that the system can remove a minimum of 76 percent of the influent total nitrogen. Therefore, the ultimate goal of the Amphidrome™ Process is to achieve an effluent with a total nitrogen concentration less than 10 mg/l. Test results from the Massachusetts Alternative Septic System Test Center have shown BOD_5 and TSS removals of 90 and 95 percent, respectively, at the distribution box. It was also shown that this system has removed approximately 65 percent of the total nitrogen as opposed to the 19 percent removal achieved by a Title 5 system during the same period.

The Amphidrome™ Process does not have General Use Approval or Provisional Use Approval but has a Piloting Use Approval that allows no more than 15 systems to be installed with an allowable loading of 660 gpd per acre for residential uses and 550 gpd per acre for non-residential uses located within Nitrogen Sensitive Areas. For remedial use, the Amphidrome™ Process is allowed to be used with a percolation rate up to 90 minutes per inch and is allowed to provide either a 50 percent reduction in leaching area, a 2 foot reduction in the groundwater separation or a 2 foot reduction in the requirement for four feet of naturally occurring pervious material.

Bioclere™ System

The Bioclere™ (DEP general approval renewed April 2000; remedial approval November 1998; and provisional approval renewed April 2000) is essentially a modified tricking filter that can be added to a Title 5 system between the tank and the soil absorption area (Figure 2-7). Wastewater flows from an establishment through its building sewer, into a standard Title 5 tank in which primary settling occurs. Effluent from the tank then flows by gravity to the baffled sump portion of the Bioclere™. A dosing pump within this sump intermittently pumps the wastewater up to the top of the media bed for distribution.

The wastewater trickles through this bed of highly permeable plastic media that serves as a site for attachment and growth of bacteria and then mixes with the raw wastewater fed to the bottom of the Bioclere™. This mixture is then recirculated to the top of the media bed in a continuous cycle. Sloughed biomass and particles not removed by the tank or the filter settle to the base of the Bioclere™ unit from where a portion of the effluent sludge is pumped back to the tank. The remaining portion of the Bioclere™ effluent is discharged to a conventional leaching area.



SOURCE: BIOCLERE – RHODE ISLAND ON-SITE WASTEWATER TRAINING PROGRAM

Figure 2-7: Bioclere System

The Bioclere™ was issued a Renewed Certification for General Use and Renewed Provisional Use Approval by DEP in April 2000 and Remedial Use Approval by DEP in November 1998. The Bioclere™ must meet secondary treatment standards of 30 mg/l BOD_5 and 30 mg/l TSS with a minimum removal of 85 percent of the influent BOD_5 and TSS. The system must also meet the nitrogen removal standards as follows:

- For residential systems, the effluent total nitrogen concentration shall not exceed 19 mg/l and the system shall remove a minimum of 55 percent of the influent total nitrogen concentration.
- For non-residential systems, the effluent total nitrogen concentration shall not exceed 25 mg/l and the system shall remove a minimum of 40 percent of the influent total nitrogen concentration.

A variety of papers and studies have addressed the Bioclere™ system that has been shown to provide high levels of treatment. Some of these studies indicate that typical BOD_5 and TSS removals are about 85 and 70 percent, respectively with typical BOD_5 and TSS concentrations of approximately 50 mg/l and 70 mg/l, respectively. The studies also show that the Bioclere™ system is capable of obtaining total nitrogen removal rates up to 25 percent greater than those provided by a conventional Title 5 system with effluent total nitrogen concentration recorded to be less than 30 mg/l.

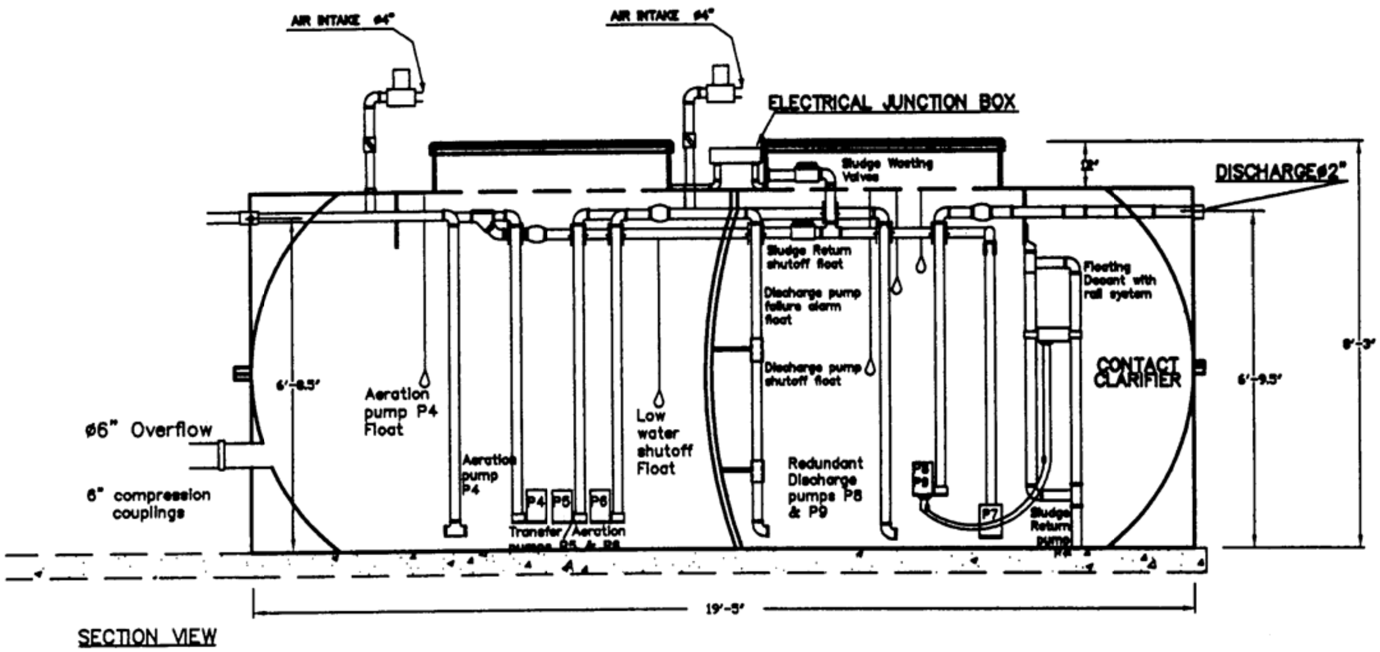
The General Use Approval allows the Bioclere™ to be used with an otherwise fully functional Title 5 system with an allowable loading of 440 gpd in a Nitrogen Sensitive Area. Bioclere™ has a Provisional Use Approval to increase the allowable loading to 660 gpd per acre for residential uses and 550 gpd per acre for non-residential uses located within Nitrogen Sensitive Areas. For existing systems located within Nitrogen Sensitive Areas, use of a Bioclere™ system can allow a two bedroom dwelling to be increased to three bedrooms if the lot is at least 10,000 square feet in size and to four bedrooms if the lot is at least 15,000 square feet. For remedial use, the Bioclere™ system is allowed to be used with a percolation rate up to 90 minutes per inch and is allowed to provide either a 50 percent reduction in leaching area, a 2 foot reduction in the groundwater separation or a 2 foot reduction in the requirement for four feet of naturally occurring pervious material.

Cromaglass®

The Cromaglass® (DEP general use approval September 1998; modified piloting use approval November 2000; remedial use approval August 2000) system is composed of a fiberglass tank that is separated into three chambers and operates as a Sequencing Batch Reactor (SBR) (Figure 2-8). Wastewater flows from the building through its building sewer and enters into the first chamber of the Cromaglass® unit, referred to as the "Solids Retention Section", that captures and retains large inorganic particles. Liquid with smaller particles and broken organic solids, flows through a grit screen into the second chamber, referred to as the "Aeration Section", where aeration and biological treatment occurs. New inflow is continuously mixed with the existing activated sludge retained in this chamber. The aeration phase lasts for several hours and is followed by an anoxic period to promote denitrification. After the anoxic period, a batch of treated wastewater is then transferred at preset intervals to the third chamber for clarification. This chamber, called the "Clarification Section", is filled until the mixed liquor overflows the weir and is returned to the Aeration Section.

The Clarification Section chamber is then isolated for about one hour allowing solids separation to occur by settling under quiescent conditions. The sludge, which collects at the bottom of the chamber, is either recycled by pump to the Aeration Section or transferred to a sludge collection tank. After clarification, a batch of treated wastewater effluent is discharged to the soil absorption system.

The Cromaglass® system was issued a Certificate for General Use in September 1998, a Modified Piloting Use Approval by DEP in November 2000 and a Remedial Use Approval in August 2000. Under the General Use category, the Cromaglass® system must meet the environmental protection requirements of a conventional Title 5 system.



SOURCE: CROMAGLASS CORPORATION

Figure 2-8: Chromaglass

The Cromaglass® is also approved for piloting as an equivalent technology to a Recirculating Sand Filter with requirements that it must meet secondary treatment standards of 30 mg/l BOD_5 and 30 mg/l TSS with a minimum of 85 percent removal of the influent BOD_5 and TSS. The system must also meet the following nitrogen removal standards:

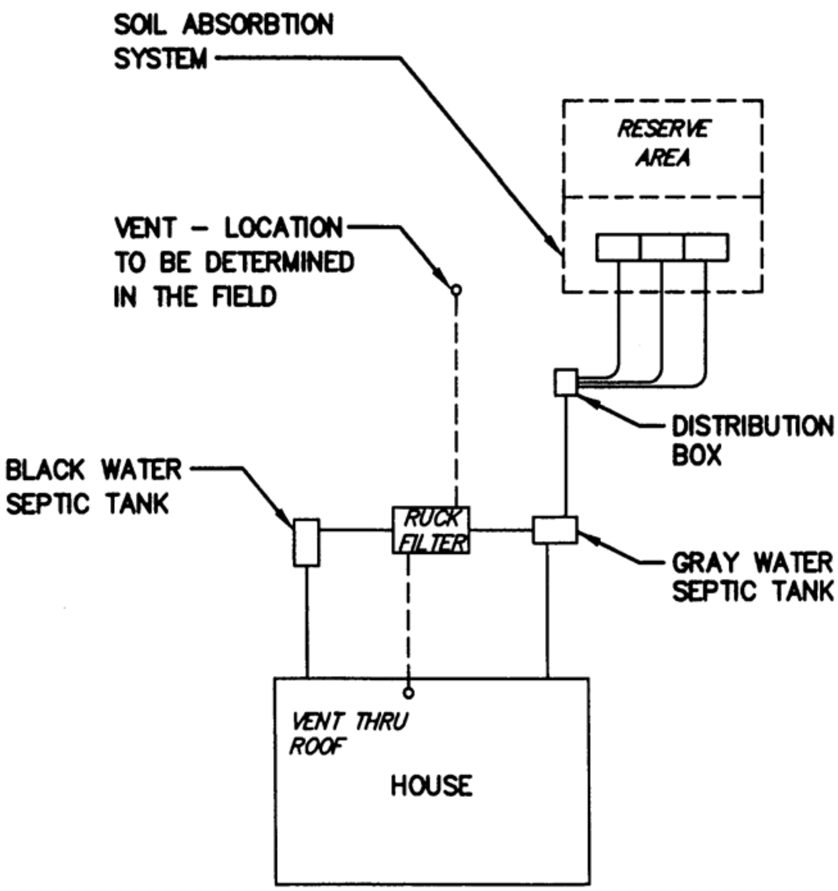
- For residential systems, the effluent total nitrogen concentration shall not exceed 19 mg/l and the system shall remove a minimum of 55 percent of the influent total nitrogen concentration.
- For non-residential systems, the effluent total nitrogen concentration shall not exceed 25 mg/l and the system shall remove a minimum of 40 percent of the influent total nitrogen concentration.

DEP requires that the influent and effluent parameters for this technology be monitored monthly for the first year of operation. As with the Amphidrome™ Process, the proponent of the Cromaglass® is seeking to show that the effluent total nitrogen concentration does not exceed 10 mg/l and that the system is capable of removing a minimum of 76 percent of the influent total nitrogen.

The General Use Approval allows the Cromaglass® system to be used with an otherwise fully functional Title 5 system with an allowable loading of 440 gpd per acre in a Nitrogen Sensitive Area. Cromaglass® does not have a Provisional Use Approval but has a Piloting Use Approval that allows no more than 15 systems to be installed. For remedial use, the Cromaglass® system is allowed to be used with a percolation rate up to 90 minutes per inch and is allowed to provide either a 50 percent reduction in leaching area, a 2 foot reduction in the groundwater separation or a 2 foot reduction in the requirement for four feet of naturally occurring pervious material.

RUCK® System

The RUCK® System (DEP renewed general use approval April 2000) is referred to as a passive nitrogen removal system. The components of the RUCK® system include two parallel septic tanks, the nitrifying RUCK® filter and a conventional subsurface leaching area (Figure 2-9).



SOURCE: INNOVATIVE RUCK SYSTEMS, INC.

Figure 2-9: Ruck System

One septic tank receives blackwater, consisting of the waste from toilets and drains equipped with garbage grinders such as a kitchen sink; the other tank receives graywater, also called washwater, from showers, washing machines, dishwashers and other sinks.

These wastes must be separated at the source, therefore an establishment will need to have the appropriate dual plumbing system or make plumbing changes to make this possible. Blackwater flows from the establishment through the blackwater designated building sewer to the blackwater septic tank where solids settle. The effluent from this blackwater tank is then passed through the single pass aerobic RUCK® sand filter.

An underdrain collects the liquid from the bottom of the bottom of the filter and transfers it to the graywater septic tank where it is combined with raw graywater from the establishment that provides a carbon source for denitrification. The denitrified effluent from this tank is then transferred to a conventional soil absorption system.

The RUCK® System was issued a Renewed Certification for General Use Approval by DEP in April 2000. The RUCK® System must meet secondary treatment standards of 30 mg/l BOD_5 and 30 mg/l TSS with a minimum removal of 85 percent of the influent BOD_5 and TSS. The effluent total nitrogen (TN) concentration must not exceed 19 mg/l and the system must remove a minimum of 55 percent of the influent total nitrogen. The proponent of the system has indicated that the RUCK® system has achieved between 60 and 85 percent removal of BOD_5 and TSS and has achieved better than 55 percent removal of total nitrogen. DEP requires sampling at three points in the process: the blackwater effluent (septic tank effluent); graywater influent; and the distribution box (final effluent) to the soil absorption system. The RUCK® System is just starting to be used in this area, and therefore, there is not much performance data currently available.

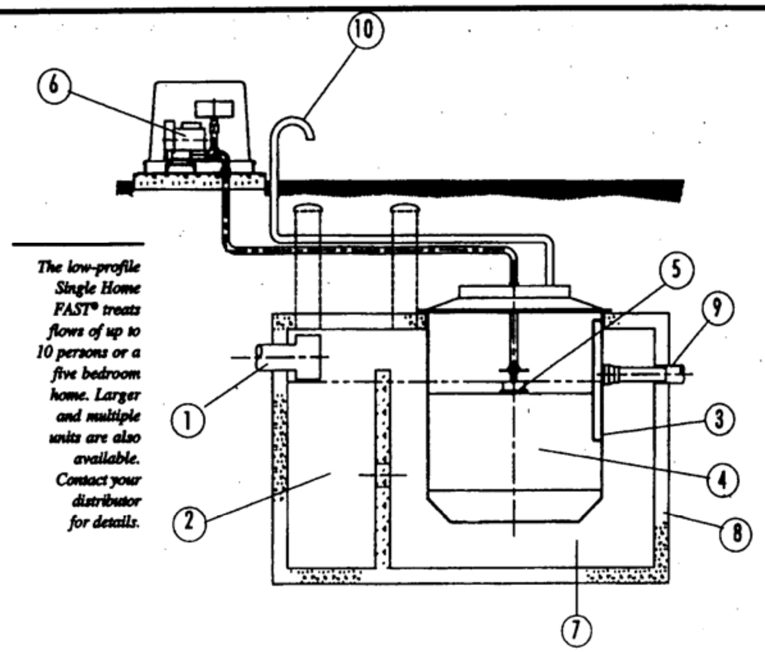
The General Use Approval for the RUCK® system allows the loading to be increased to 660 gpd per acre for residential uses and 550 gpd per acre for non-residential uses located within Nitrogen Sensitive Areas. For existing systems located within Nitrogen Sensitive Areas, use of a RUCK® system can allow a 2 bedroom dwelling to be increased to 3 bedrooms if the lot is at least 10,000 square feet in size and to 4 bedrooms if it is at least 15,000 square feet. The RUCK® system does not have Provisional Use Approval, Piloting Use Approval or Remedial Use Approval.

FAST®

The Smith & Loveless FAST® (DEP renewed general, provisional and remedial use approval August 2001) system is a Fixed Film Activated Sludge Treatment (FAST) system. The FAST® Process consists of two zones, a primary settling zone and an aerobic biological treatment zone. The single home FAST® unit is essentially a fixed film media bed that is inserted into a 1,500 to 2,000 gallon septic tank. Remote blowers provide aeration to the system (Figure 2-10).

The FAST® System was issued a Renewed Certification for General Use and Renewed Remedial Use Approval by DEP in August 2001, and Renewed Provisional Use Approval in September 1998. The FAST® System must meet secondary treatment standards of 30 mg/l BOD_5 and 30 mg/l TSS with a minimum removal of 85 percent of the influent BOD_5 and TSS. The system must also meet the following nitrogen removal standards.

- For residential systems, the effluent total nitrogen concentration shall not exceed 19 mg/l and the system shall remove a minimum of 55 percent of the influent total nitrogen concentration.
- For non-residential systems, the effluent total nitrogen concentration shall not exceed 25 mg/l and the system shall remove a minimum of 40 percent of the influent total nitrogen concentration.



Standard Features:

1. **Influent from House Sewer Line** - connects directly from the house sewer line pipe and can handle the equivalent of 10 persons or a five bedroom home

2. **Primary Settling Zone** - encourages rapid settling of large solids entering the unit and away from the Fast® media

3. **Treatment Insert** - packed with bacteria-laden media, the liquid circulating through the insert is essentially clear and free of suspended solids, unlike those in conventional activated sludge systems

4. **FAST® Media** - houses the "friendly bacteria" in an environment ideal for rapid bacterial growth. The high surface area-to-volume ratio ensures a continuous level of treated effluent

5. **Draft Tube** - disperses the liquid evenly over the upper surface of the media, providing continuous circulation of the wastewater

6. **Totally Enclosed Blower** - supplies air which provides oxygen for the bacteria to grow and multiply

7. **Solids Collection Zone** - holds the solids which have settled. Occasional solids removal is required

8. **System Tank** - houses the system. Available in concrete or fiberglass configurations

9. **Odorless Liquid Effluent** - discharges into the leach field or disposal well after being disinfected

10. **Vent** - ventilates treatment section

SOURCE: SMITH & LOVELESS, INC.

Figure 2-10: Single Home FAST

The proponent of this system is seeking to show that the effluent total nitrogen concentration does not exceed 15 mg/l and that the system removes a minimum of 64 percent of the influent total nitrogen. DEP has recognized that the FAST® unit is capable of a 90 to 95 percent reduction in BOD_5 and TSS with effluent concentrations less than 30 mg/l. It is also reported that the unit can reduce the total nitrogen to 19 mg/l.

The results of tests conducted at the Massachusetts Alternative Septic System Test Center have indicated BOD_5 and TSS removals of 90 and 92 percent, respectively, at the distribution box. It was also shown that this system removed approximately 60 percent of the total nitrogen as opposed to the 22 percent removal achieved by a conventional Title 5 system during the same period.

The General Use Approval allows the FAST® system to be used with an otherwise fully functional Title 5 system with an allowable loading of 440 gpd per acre in a Nitrogen Sensitive Area. The FAST® system has a Provisional Use Approval to increase the allowable loading to 660 gpd per acre for residential uses and 550 gpd per acre for non-residential uses located within a Nitrogen Sensitive Areas. For existing systems located within Nitrogen Sensitive Areas, use of a FAST® system can allow a 2 bedroom dwelling to be increased to 3 bedrooms if the lot is at least 10,000 square feet in size and to 4 bedrooms if it is at least 15,000 square feet. For remedial use, the FAST® system is allowed to be used with a percolation rate up to 90 minutes per inch and is allowed to provide either a 50 percent reduction in leaching area, a 2 foot reduction in the groundwater separation or a 2 foot reduction in the requirement for four feet of naturally occurring pervious material.

Waterloo Biofilter®

The Waterloo Biofilter® (DEP Piloting Use Approval February 1997, Remedial Use Approval November 1998) is a trickling filter system that uses plastic foam as a media to achieve aerobic bacterial oxidation of the organic matter and nitrification. The open-cell foam has a highly porous surface area that enables the flow of air to create an aerobic environment to promote nitrification. Septic tank effluent is sprayed over the top of the foam and allowed to flow by gravity to the bottom of the filter housing where it is collected and split to either the anoxic septic tank for denitrification or to the soil absorption system for discharge. Airflow through the filter can be maintained either by a small blower or through convection currents formed by the wastewater flowing through the filter.

The Waterloo Biofilter® system was issued a DEP Piloting Use Approval in February 1997 and a Remedial Use Approval in November 1998. The Waterloo Biofilter® System must meet secondary treatment standards of 30 mg/l BOD_5 and 30 mg/l TSS with a minimum removal of 85 percent of the influent BOD_5 and TSS. The system must also meet the following nitrogen removal standards:

- For residential systems, the effluent total nitrogen concentration shall not exceed 19 mg/l and the system shall remove a minimum of 55 percent of the influent total nitrogen concentration.
- For non-residential systems, the effluent total nitrogen concentration shall not exceed 25 mg/l and the system shall remove a minimum of 40 percent of the influent total nitrogen concentration.

The Waterloo Biofilter® system does not have General Use Approval or Provisional Use Approval but has a Piloting Use Approval that allows no more than 15 systems to be installed. For remedial use, the Waterloo Biofilter® system is allowed to be used with a percolation rate up to 90 minutes per inch and is allowed to provide either a 50 percent reduction in leaching area, a 2 foot reduction in the groundwater separation or a 2 foot reduction in the requirement for four feet of naturally occurring pervious material.

Innovative/Alternative System Testing

The Massachusetts Alternative Septic System Test Center has an on-going project that tests the operation and performance of various innovative/alternative treatment systems. The goal of this project is “to evaluate the performance and operation costs of new and innovative wastewater disposal technologies in a carefully controlled and unbiased manner, and provide this information to regulators and consumers." In July and October 2001, the Test Center released Interim Findings on the various technologies being tested at their site to present the performance of each system after at least 1 year of system testing.

Additional monitoring results for six of the Innovative/Alternative (I/A) Technologies discussed above were compiled and are summarized in Table 2-9. This Table shows the average effluent concentrations and percent removals for several systems in operation for each I/A technology. Also, shown on this Table are the DEP requirements and goals set for each system. The monitoring results are variable, as not all technologies were sampled and tested under the same conditions or using the same sampling and testing methodology. Although the monitoring methods and results were different for each system and cannot be used to rank the technologies, the results may be helpful in evaluating the ability of the technologies to achieve the effluent requirements set by DEP.

In summary, the monitoring results indicate that all of the technologies have the capability of achieving enhanced treatment over that provided by a conventional Title 5 system. Of the systems and monitoring results analyzed, the Recirculating Sand Filter, the Amphidrome™ Process, the Cromaglass®, FAST® system, and the Waterloo Biofilter® achieved their respective DEP effluent and removal requirements more frequently than the other technologies and consistently achieved a higher degree of wastewater treatment than provided by a Conventional Title 5 system.

Composting Toilets

All of the systems discussed in the previous section are used to treat the entire wastewater flow from a residence or commercial establishment. Composting toilets are systems that are designed to treat only the human-toilet portion of wastewater, called "blackwater", with the "greywater" that comes from sinks, showers, bathtubs, dishwashers, and washing machines directed to a conventional on-site system. Although greywater does not contain as much human waste as blackwater, it is important to realize that greywater may still contain dangerous

TABLE 2-9
SUMMARY OF MONITORING RESULTS VERSUS TREATMENT REQUIREMENTS

	Average Monitoring Results						DEP Treatment Requirements					
	BOD_5		TSS		Total Nitrogen		BOD_5		TSS		Total Nitrogen	
I/A Technology	Effluent Concentration (mg/l)	Percent Removal (%)	Effluent Concentration (mg/l)	Percent Removal (%)	Effluent Concentration (mg/l)	Percent Removal (%)	Effluent Concentration (mg/l)	Percent Removal (%)	Effluent Concentration (mg/l)	Percent Removal (%)	Effluent Concentration (mg/l)	Percent Removal (%)
Recirculating Sand Filter							30	85	30	85	25	40
Colburn Street	7.0	96.5	12.0	82.3	60.8	39.2						
Gloucester, MA												
Langsford Street	11.0	93.3	15.0	77.0	78.6	44.6						
Gloucester, MA												
Anne Arudel County – Maryland												
System A	4.0	98.1	8.0	88.9	22.0	59.3						
System B	2.0	98.4	5.0	91.1	17.0	62.2						
System C	8.0	97.8	10.0	89.7	21.0	70.4						
Chart House Restaurant	4.0	99.1	7.0	96.5	11.9	73.5						
Chester, CT												
Amphidrome Process							30	85	30	85	Resident -- 19	55
Stuart's Mall	9.2	95.0	9.9	68.5	14.5	67.5					Nonresident – 25	40
Swansea, MA												
											Goal – 10	76

TABLE 2-9 (Continued)
SUMMARY OF MONITORING RESULTS VERSUS TREATMENT REQUIREMENTS

	Average Monitoring Results						DEP Treatment Requirements					
	BOD_5		TSS		Total Nitrogen		BOD_5		TSS		Total Nitrogen	
I/A Technology	Effluent Concentration (mg/l)	Percent Removal (%)	Effluent Concentration (mg/l)	Percent Removal (%)	Effluent Concentration (mg/l)	Percent Removal (%)	Effluent Concentration (mg/l)	Percent Removal (%)	Effluent Concentration (mg/l)	Percent Removal (%)	Effluent Concentration (mg/l)	Percent Removal (%)
Bioclere							30	85	30	85	Resident -- 19	55
High Street	29.0	78.4	33.0	62.3	26.9	39.8					Nonresident – 25	40
Gloucester, MA												
Vale Court	51.0	83.6	42.0	66.3	29.3	47.4						
Gloucester, MA												
NSF Testing	13.0	82.4	17.0	63.8	22.3	20.5						
391 Atlantic Avenue	7.3	87.6	8.9	64.0	12.3	11.1						
Cohasset. MA												
Stop & Shop	112.0	81.1	86.0	50.4	43.7	35.3						
Yarmouth, MA												
Mercury Drive	50.0	63.9	79.0	63.5	24.0	21.7						
South Yarmouth, MA												
Cromaglass							30	85	30	85	Residential – 19	55
Meadowbrook Christian School -- Milton, PA											Nonresident – 25	40
Phase I	11.1	92.1	19.2	86.2	12.9	29.7					Goal – 10	76
Phase II	7.5	95.8	11.9	93.1	4.7	78.7						
NSF Testing	42.0	82.3	39.0	84.2	--	--						

TABLE 2-9 (Continued)
SUMMARY OF MONITORING RESULTS VERSUS TREATMENT REQUIREMENTS

	Average Monitoring Results						DEP Treatment Requirements					
	BOD_5		TSS		Total Nitrogen		BOD_5		TSS		Total Nitrogen	
I/A Technology	Effluent Concentration (mg/l)	Percent Removal (%)	Effluent Concentration (mg/l)	Percent Removal (%)	Effluent Concentration (mg/l)	Percent Removal (%)	Effluent Concentration (mg/l)	Percent Removal (%)	Effluent Concentration (mg/l)	Percent Removal (%)	Effluent Concentration (mg/l)	Percent Removal (%)
RUCK							30	85	30	85	Resident -- 19	55
Highway Inspection Facility	9.7	80.9	--	--	60.3	57.0						
Truckee, CA												
Porter's Orchard Lot No. 5	51.2	75.7	156.0	48.2	142.7	27.5						
Colchester, VT												
Porter's Orchard 8 Home Composite	47.8	--	63.1	--	5.7	--						
Single Home FAST							30	85	30	85	Residential -- 19	55
NSF Testing	9.0	93.8	7.0	96.4	9.3	73.2					Nonresidential -- 25	40
Florida Keys	4.6	95.7	8.0	92.2	13.0	64.5					Goal – 15	64
Owners Demonstration												
140 Beach Street	20.1	--	6.2	--	12.2	--						
Cohasset, MA												

pathogens as well as many of the nutrients that blackwater contains. Therefore, adequate treatment and disposal is still required for all greywater that is produced on a property considering use of composting toilets. Greywater constitutes approximately 70 percent of the total wastewater flow from a residence. The characteristics of greywater are actually very similar to the characteristics of blackwater, with one major exception, the chemical oxygen demand or COD. Because of the high organic solids content of blackwater, the COD, a measure of the total oxidizable organic matter in the wastewater, is usually much higher in blackwater than in greywater. Other constituents that are used to characterize the strength of a wastewater, including the BOD_5 and pathogenic bacteria and virus counts, are present in similar concentrations in both waste streams. Most commonly, conventional and innovative/alternative on-site systems are designed to treat wastewater consisting of a combination of blackwater and greywater. It is very uncommon to design a system to just treat the greywater from a residence.

In a composting toilet, moisture is evaporated from the effluent and the human waste is decomposed via a composting process using nature's own microorganisms. A variety of different biologic media are used as a starter in the composting toilet to begin the decomposition process. The decomposition of the human waste is an aerobic process needing a controlled amount of air to be added to the human waste. The waste is also provided with periodic mixing to speed up the composting process resulting in a harmless humus-like end product. Any liquid that is included in the human waste can be evaporated via the use of a heater, which supplies the toilet with a controlled amount of heat and also helps in the decomposition process.

There are two general types of composting toilets: (a) small self-contained toilets that can be used for small dwellings and seasonal cottages, and (b) larger, centrally located systems that often have multiple inlets and can be used for larger homes and commercial establishments. The small, self-contained units consist of a single unit that includes both the toilet itself and a small holding tank located directly under the toilet. The larger, centrally located systems have a larger holding tank (where the decomposition takes place) usually located in a basement. This tank could have several inlets based on the number of toilets located throughout the dwelling. Regardless of the type of system, regular disposal of the decomposed human waste is required. Additionally, Composting toilets that are not equipped with evaporators have been shown to provide limited nutrient removal capabilities as the majority of the nitrogen remains in the liquid phase that subsequently requires disposal.

Many factors reduce the general acceptability of composting toilets. These systems require a large amount of maintenance, including removal of the composted material on a quarterly basis, in order to keep them functioning properly. This composted material must then be disposed in accordance with State and local Board of Health regulations. Any liquid waste that is still present in the composter also has to be properly disposed. Additionally, a bulking agent that can consist of a variety of different biologic media such as peat moss must be added to the composter on a daily or weekly basis.

In addition to routine maintenance, composting toilets have a risk of the growth of flies or insects within the composter, which could affect the aesthetics of the bathroom. The design of the toilet itself may also affect the aesthetic quality of the bathroom in which it is located. Although many of these toilets are very similar to airplane toilets, there are other systems that allow the user to see directly into the composter. This may not be a very acceptable aesthetic quality for many families or businesses.

Another negative associated with this system is social acceptance. Since many people are opposed to having such a system in their home, this could lead to decreased property resale value. This factor along with the other aesthetic and operational factors makes composting toilets less desirable than many of the other options.

Composting toilets only present a viable option if the site can still support a fully compliant conventional on-site disposal system. The General Use Approval allows the composting toilets to be used with an otherwise fully functional Title 5 system with an allowable loading of 440 gpd per acre in a Nitrogen Sensitive

Area. Composting toilets do not have Provisional Use Approval or Piloting Use Approval. The Remedial Use Approval for composting toilets allows a 40 percent reduction in the size of the leaching facility.

3. Configurations and Alternative Sewer Systems

a. Gravity Sewer Systems

Conventional Systems

Most New England communities utilize a conventional gravity sewer system comprised of a network of gravity collection sewers, force mains and pumping stations. The system includes 4 to 6 inch diameter gravity service connections that allow residential, commercial, and industrial customers to discharge directly into a gravity collection system comprised of continuously sloped pipe, typically eight inches minimum diameter and normally constructed of PVC or concrete pipe materials.

The gravity collection system directs wastewater downhill to a pumping station or treatment facility. Concrete manholes are provided at 300 to 400 foot intervals, at all roadway intersections, and at all changes in pipe slope or direction.

The design of a gravity sewer system is dictated by the volume and velocity of the wastewater within the pipes. Minimum velocities are set to assure that suspended matter does not settle out in the conduit, while maximum velocities are set to prevent erosion of pipe material. Extremely flat or hilly terrain and sites displaying high groundwater or minimal depths to bedrock may pose problems to gravity sewer installation. These conditions often result in increasingly deep excavations or the need for intermediate pump stations. Sewage pumping stations are typically constructed with concrete wet wells, alarms and emergency generators and are located at all low points in the system to collect and pump the wastewater to the next high point in the collection system or to the wastewater treatment facility.

Small Diameter Gravity Systems

Small diameter gravity collection systems include the installation of a septic tank in the building service connection prior to discharge to the sewer main. The septic tank eliminates the solids inherent to raw wastewater allowing the collection system to be constructed with smaller pipe sizes. Other than pipe size, these systems are configured similar to conventional gravity systems requiring straight runs between manholes to convey wastewater to a low point where a pumping station is typically sited. Solids settlement is not as worrisome as in a conventional gravity system, but periodic pumping of the individual septic tanks to remove sludge, scum and grease is required.

b. Low Pressure Sewer Systems

Low-pressure sewage collection systems have proven to be viable alternatives to conventional gravity sewer systems especially in low-lying areas exhibiting high groundwater where the installation of conventional gravity sewers and pumping stations is impractical or not cost effective. Low-pressure sewer systems work especially well in extremely hilly areas and have also proven advantageous in waterfront areas surrounding lakes where deep excavations and extensive dewatering could cause environmental harm. Additionally, low-pressure systems are well suited to installation in coastal areas subject to periodic flooding as well as for areas where sprawl is an issue and a flow-based system is needed.

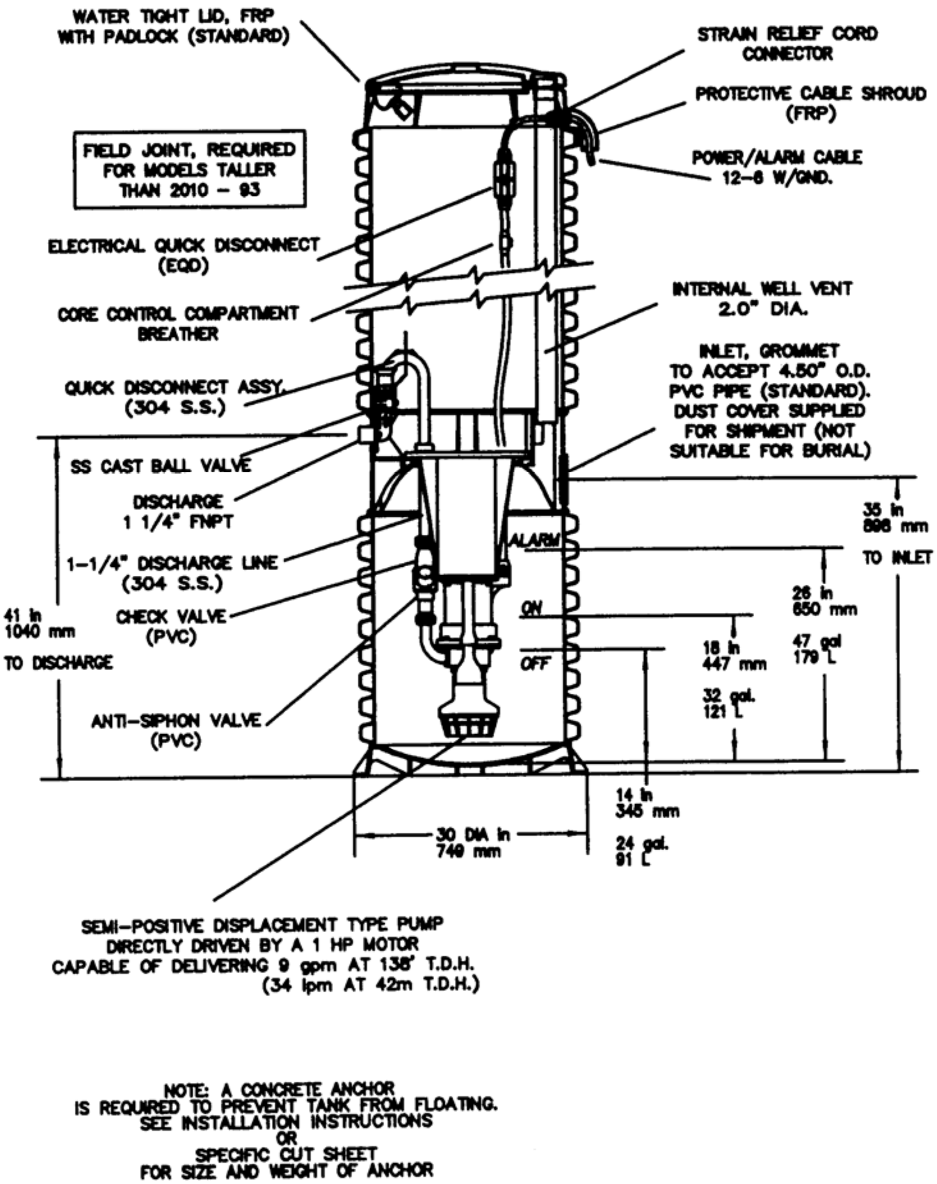
A low-pressure sewer system includes pressure sewers fed either by individual grinder pumps installed at each source or configured so that the pumping system serves multiple sources. Simplex and duplex pumping systems are available and are installed within a variety of wet well sizes and configurations. A low-pressure sewer system makes use of small diameter mains and laterals with pipe sizes ranging from 1-¼ to 4 inches in diameter, that follow the profile of the ground and are buried at a shallow depth usually just below the depth of frost penetration. The pressure main and service pipe are generally manufactured from polyvinyl chloride (PVC) or high-density polyethylene (HDPE).

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 and drain manholes are installed at the end of branches and where major changes in direction or size of pipe occurs. Air relief/vacuum valve manholes are installed at all high points in the system to allow trapped air to escape with terminal flushing drain manholes installed at all low points. In addition, cleanouts are required to be installed every 1,000 feet.

Each pumping unit is equipped with a simplex or duplex pump, check valves to prevent backflow of wastewater, a tank and all necessary controls. Although the grinder pumps can be installed indoors, they are generally located outside, close to each customer's existing tank or cesspool so that the service connection can be easily made with minimal alterations to the indoor plumbing required. The grinder pump (Figure 2-11) macerates the solids present in the wastewater into slurry in a manner that is similar to a kitchen sink garbage disposal and discharges wastewater to the low-pressure sewer collection pipes. If a malfunction occurs, a high liquid level alarm is activated.

This alarm may be a light mounted on the outside of the building or an audible alarm that alerts the user. Installations may also include automatic telephone dialers or radio controlled telemetry, and provisions for connecting the pump to an emergency generator to provide service during power failures.

Low-pressure pumping systems are generally divided into three categories that differ primarily by the types of pumping system employed. The three available configurations include progressing cavity (semi-positive displacement) pumping systems, centrifugal grinder pumping systems and pneumatic ejector pumping systems that use a cycle of vacuum and compressed air to impart a force on the fluid. Progressing cavity pumping systems offer high head capabilities and can transport sewage slurries and sludge without clogging. They have steep operating curves and exhibit very little change in flow as the number of system users and total dynamic head changes. Alternately, centrifugal grinder pumps are self-limiting with respect to both flow and pressure. They offer a higher flow rate at low pressure than is possible with progressing cavity pumps but may exhibit a dramatic decrease in flow as multiple systems come on line and system-operating pressure increases. Low-pressure sewage collection systems present a unique set of concerns both for the system users and for the municipality. These concerns include ownership of the system, the potential need for easements, limitations on system expansion, pumping system compatibility and delineation of operation and maintenance responsibilities. If the Town wishes to own the pumping system, easements will be required to permit system installation and to enable periodic and emergency maintenance to be performed.



SOURCE: ENVIRONMENT ONE CORPORATION

Figure 2-11: Typical Grinder Pump Unit

Alternately, each user could own the pumping system and schedule maintenance as needed. In this case, the Town may need to adopt regulations prohibiting users from modifying the system to use incompatible pumps. In either case, the Town should require that the user be responsible for arranging service and that all "damage" that may occur due to broken or inoperable pumps remain with the user. Low-pressure pumping systems typically provide little emergency storage capacity and require electricity to operate. Therefore, user knowledge of the system limitations is essential. This is particularly important when the pumps serve commercial establishments or have multiple users.

c. Vacuum Sewer Systems

Like the low-pressure sewer system, a vacuum sewer system can be used where gravity sewer systems are impractical and/or not economically feasible. Although not prevalent in New England, vacuum sewer systems have been installed in other parts of the country. Vacuum sewers employ a central vacuum source that is maintained at 15 to 25 inches Hg vacuum. Vacuum sewers are limited by the available lift and are, therefore, most suited to flat terrain.

The vacuum collection system consists of three main components: (a) building services; (b) wastewater collection mains; and (c) the vacuum station. As with pressure sewers, the materials used for the collection mains and service pipe are typically PVC or HDPE. The collection main pipe diameter usually ranges from 4 inches to 10 inches with service lines having a minimum diameter of 3 inches. The service lines include a vacuum valve and controller, auxiliary vents and a valve pit/sump or buffer tank that accepts the waste from the customer.

The gravity vacuum interface valve provides the interface between the vacuum in the collection piping and the atmospheric air in the building sewer with the controller regulating vacuum cycle frequency. When the vacuum valve is closed, system vacuum within the collection piping is maintained; when it opens, the system vacuum evacuates the contents of the sump. After a preset interval, the valve closes and the slug of liquid is propelled into the collection system main.

Numerous cycles eventually propel the wastewater to a collection tank located at the central vacuum station. Installation of an auxiliary vent on the customer's service lateral is necessary to provide the volume of air that follows the wastewater into the main. Buffer tanks are also used as holding tanks to collect and regulate large flows such as those flows from apartment buildings, schools and other large users.

Vacuum systems can be buried at a shallow depth as the high velocities (15 to 18 feet per second) attained by the system keeps the lines from freezing. The collection mains can follow the profile of the ground provided that; modest elevation changes are maintained. The collection lines need to maintain a minimum downward slope of 0.2 percent toward the vacuum station. Uphill liquid transport or temporary increases in elevation can be accomplished by the insertion of lifts (vertical profile changes) along the sloped route to the station. These lifts can consist of two 45-degree elbows connected by a straight piece of pipe and are each limited to a rise of 3 feet.

The collection mains are all connected to a vacuum station located in the center of the service area. The vacuum station includes a vacuum tank, a collection tank, vacuum pumps to create the vacuum for wastewater transport; wastewater pumps to transfer the wastewater from the collection tank to the disposal point in the downstream collection system; controls; a motor control center; a flow meter and chart recorder; and a fault monitoring system to alert the operator of irregularities such as low vacuum levels. A standby generator is required at the vacuum station so that the system can continue to operate in the event of a power failure. The vacuum station requires an electrical service connection. Although, electrical controls are not necessary for each user, individual high water alarms may be beneficial, as failure of a vacuum collection system will result in accumulation at the service connection.

There are various proprietary vacuum collection systems in use, differing mainly in the handling of gray and black water, the location of the gravity/vacuum interface and the design of the pumps and vacuum valves. Collection piping is generally 3 to 6 inches in diameter, unless a system employing separate 1-½ to 3 inch diameter black and gray water collection systems is used. Common modifications include vacuum reserve tanks installed to reduce vacuum pump cycling.

d. Septic Tank Effluent Pumping Systems

Septic Tank Effluent Pumping (STEP) systems are a variation of the low-pressure collection system that incorporates an intermediate septic tank installed upstream of the pumping system to remove primary sludge, scum and grease from the waste stream. STEP systems can be used either to convey wastewater to a treatment facility or more commonly, to a common subsurface leaching system. Periodic removal of the sludge and grease collected within the septic tank by a licensed septage hauler is essential to the long-term performance of the system.

4. Wastewater Treatment, Disposal, Reuse, and Land Applications

a. Wastewater Treatment Levels and Technologies

Wastewater treatment levels are generally classified as preliminary, primary, secondary, tertiary, and advanced. The nature of each level of treatment is discussed in the following sections.

Primary Treatment

The first step in treatment, sometimes referred to as preliminary treatment, generally consists of the physical processes of screening, or comminution, and grit removal. Past this initial screening, primary treatment consists of physical processes to remove settleable organic and inorganic solids by sedimentation and floating materials by skimming. These also remove some of the organic nitrogen, organic phosphorus, and heavy metals. Primary treatment, together with preliminary treatment, typically removes 50 to 60 percent of the suspended solids and 30 to 40 percent of the organic matter. Primary treatment does not remove the soluble constituents of the wastewater.

Primary treatment has little effect on the removal of most biological species present in wastewater. However, some protozoa and parasite ova and cysts will settle out during primary treatment, and some particulate-associated microorganisms may be removed with settleable matter. Primary treatment does not reduce the level of viruses in municipal wastewater. While primary treatment by itself generally is not considered adequate for ground water recharge applications, primary effluent has been successfully used in soil-aquifer treatment systems at some spreading sites where the extracted water is to be used for non-potable purposes.

A disadvantage of using primary effluent is that infiltration basin hydraulic loading rates may be lower because of higher suspended solids and weaker biological activity on and in the soil of the infiltration system. Also; too much organic carbon in the recharge water can have adverse effects on processes that occur in the soil and aquifer systems. In most cases, wastewater receives at least secondary treatment and disinfection, and often tertiary treatment by filtration, prior to augmentation of non-potable aquifers by surface spreading.

Secondary Treatment

Secondary treatment is intended to remove soluble and colloidal biodegradable organic matter and suspended solids (SS). In some cases, nitrogen and phosphorus also are removed. Treatment consists of an aerobic biological process whereby microorganisms oxidize organic matter in the wastewater. Several types of aerobic biological processes are used for secondary treatment, including activated sludge, trickling filters, rotating biological contactors (RBCs), and stabilization ponds. Generally, primary treatment precedes the biological process; however, some secondary processes are designed to operate without sedimentation; e.g., stabilization ponds and aerated lagoons.

Tertiary Treatment

The treatment of wastewater beyond the secondary or biological stage is sometimes called tertiary treatment. The term normally implies the removal of nutrients such as phosphorus and nitrogen, and a high percentage of suspended solids. However, the term tertiary treatment is now being replaced in most cases by the term advanced wastewater treatment, which refers to any physical, chemical, or biological treatment used to accomplish a degree of treatment greater than that achieved by secondary treatment.

Advanced Wastewater Treatment

Advanced wastewater treatment processes are designed to remove suspended solids and dissolved substances, either organic or inorganic in nature. Advanced wastewater treatment processes generally are used when high-quality reclaimed water is necessary, such as for direct injection into potable aquifers. The major advanced wastewater treatment processes associated with ground water recharge are coagulation-sedimentation, filtration, nitrification-denitrification, phosphorus removal, carbon adsorption, and reverse osmosis.

- Coagulation-Sedimentation - Chemical coagulation with lime, alum, or ferric chloride followed by sedimentation removes suspended solids, heavy metals, trace substances, phosphorus, and turbidity. Viral inactivation under alkaline pH conditions can be accomplished using lime as a coagulant, but pH values of 11 to 12 are required before significant inactivation is obtained.

- Filtration - Filtration is a common treatment process used to remove particulate matter prior to disinfection. Filtration involves the passing of wastewater through a bed of granular media, which retain the solids. Treatment of biologically treated secondary effluent by chemical coagulation, sedimentation, and filtration has been demonstrated to remove more than 99 percent of seeded poliovirus. This treatment chain reduces the turbidity of the wastewater to very low levels, thereby enhancing the efficiency of the subsequent disinfection process. The primary purpose of the filtration step is not to remove viruses, but to remove protozoa and helminth eggs and other suspended matter that may contain adsorbed or enmeshed microorganisms, thereby making the disinfection process more effective.

- Chemical coagulation and filtration, followed by disinfection, can remove or inactivate five logs (99.999 percent) of seeded polio virus and bacteria through these processes alone; and subsequent to conventional biological secondary treatment, can produce effluent essentially free of measurable levels of bacterial and viral pathogens.

- Nitrification - Nitrification is the biological conversion of ammonia nitrogen sequentially to nitrite nitrogen and nitrate nitrogen. Nitrification does not remove significant amounts of nitrogen from the effluent: it merely converts it to another form.

- Denitrification - Denitrification removes nitrate nitrogen from the wastewater. As with ammonia removal, denitrification is usually done biologically for most municipal applications. In biological denitrification, nitrate nitrogen is used by a variety of heterotrophic bacteria as the terminal electron acceptor in the absence of dissolved oxygen (anaerobic conditions). In the process, nitrate nitrogen is converted to nitrogen gas, which escapes to the atmosphere. A carbonaceous food source (e.g., carbonaceous BOD, methanol) is required by the bacteria in these processes.

- Phosphorus Removal - Phosphorus can be removed from wastewater by either chemical or biological methods, or a combination of the two.

- Carbon Adsorption - One of the most effective advanced wastewater treatment processes for removing biodegradable and refractory organic constituents is the use of granular activated carbon (GAC). GAC can reduce the levels of synthetic organic chemicals in wastewater by 75 to 85 percent. The basic mechanism of removal is by adsorption of the organic compounds onto the carbon. Carbon adsorption preceded by conventional secondary treatment and filtration can produce an effluent with a BOD of 0.1 to 5.0 mg/l, Chemical Oxygen Demand (COD) of 3 to 25 mg/l, and Total Organic Compound (TOC) of 1 to 6 mg/l.

- Reverse Osmosis - Reverse Osmosis (RO) is used mainly as a wastewater treatment process to remove suspended and dissolved solids (including microorganisms), either organic or inorganic. Removal is accomplished by the passage of wastewater through a semi-permeable membrane. The size, shape, chemical characteristics, and concentration of the chemical species, as well as the physical and chemical characteristics of the feed wastewater and type of RO unit employed influence constituent removal. Because of the nature of the RO process, feed wastewater must be of a fairly high-quality (low suspended solids content) to prevent membrane clogging and deterioration.

- Emerging Hybrid Technology - Membrane bioreactor (MBR) is an emerging technology that combines an activated sludge reactor with a membrane filtration unit. The end-result is an effluent that is similar to the one that is produced, by a process train, consisting of a secondary treatment followed by tertiary treatment and advanced treatment. MBR process essentially eliminates the tertiary treatment step. The MBR effluent is considered suitable for aquifer recharge.

- Disinfection - The most important process for the destruction of microorganisms is disinfection. Although the most common disinfectant is chlorine, ozone (O_3) and ultraviolet (UV) radiation are other prominent disinfectants used at WWTFs. Other disinfectants, such as gamma radiation, bromine, iodine, and hydrogen peroxide, have been considered for the disinfection of wastewater, but are not generally used because of economical, technical, operational, or disinfection efficiency considerations. Membrane processes (e.g., micro-filtration, ultra-filtration, and RO) have been shown to be effective in removing microorganisms, including viruses, from municipal wastewater, but again are not commonly used. The strategy in the selection and use of disinfectants for source waters prior to recharge should recognize the possibility that the nature and quantities of the disinfection by-products (DBPs) that may be formed are different from those in conventional water treatment. For example, both chlorine and ozone react in wastewater with organic precursors, which are likely to be greater in number and concentration than in freshwater sources of drinking water, to form DBPs. Accordingly, treatment of water for potable purposes is being modified to minimize the use of oxidizing disinfectants. However, in the treatment of wastewater for non-potable purposes, the numbers and concentration of DBPs are of less concern because long-term ingestion is not an issue.

- Chlorine - The efficiency of disinfection with chlorine depends on the water temperature, pH, degree of mixing, time of contact, presence of interfering substances, concentration and form of chlorinating species, and the nature and concentration of the organisms to be destroyed. In general, bacteria are less resistant to chlorine than viruses, which in turn are less resistant than parasite ova and cysts. The chlorine dosage required to disinfect a wastewater to any desired level is greatly influenced by the constituents present in the wastewater. Secondary effluent can be disinfected with chlorine to achieve very low levels of coliform bacteria, although complete destruction of pathogenic bacteria and viruses is unlikely to occur. Chlorination of secondary effluent that has received further treatment to remove suspended matter can produce wastewater that is essentially free of bacteria and viruses. Chlorine, at the normal concentrations used in wastewater treatment, may not destroy helminth eggs, *Giardia lamblia*, and *Crypto sporidium* species.

- Ozone - Ozone is a powerful disinfecting agent and a powerful chemical oxidant in both organic and inorganic reactions. Due to the instability of ozone, it must be generated on site from air or oxygen carrier gas. Ozone destroys bacteria and viruses by means of rapid oxidation of the protein mass, and disinfection is achieved in a matter of minutes. Some disadvantages are that the use of ozone is relatively expensive and energy intensive, ozone systems are more complex to operate and maintain than chlorine systems, and ozone does not maintain a residual in water. Ozone is a highly effective disinfectant for advanced WWTF effluent, and it removes color and contributes dissolved oxygen. It also breaks down recalcitrant organic compounds into more biodegradable compounds, which is advantageous for ground water recharge and soil-aquifer treatment.

- Ultraviolet Radiation - Irradiation of wastewater with ultraviolet radiation for disinfection is potentially a desirable alternative to chemical disinfection, owing to its inactivating power for bacteria and viruses, affordable cost, and the absence of chemical disinfection by-products. Exposure of microorganisms to the appropriate amount of electromagnetic (EM) radiation disrupts the cells' genetic material and interferes with the reproduction process. Some bacteria have repair enzyme systems that are activated by similar EM energies, and thus disinfected waters may be repopulated by these particular bacteria after disinfection when exposed to light. UV disinfection for water and wastewater is the newest of the disinfection technologies and therefore, valuable large-scale field applications are still under study. However, the trend is toward more use of UV disinfection.

b. Private/Small Wastewater Treatment Facilities (WWTFs)

General

Decentralized wastewater treatment facilities typically employ aerobic biological processes to accomplish waste treatment and are therefore capable of removing substantially greater amounts of Biochemical Oxygen Demand (BOD) and Total Suspended Solid (TSS) than accomplished by conventional sewage disposal systems. Additionally, these treatment facilities are also capable of nitrifying the ammonia-nitrogen present in the wastewater to nitrate-nitrogen, which can subsequently be removed through an anoxic denitrification process. Disinfection at such facilities provides significant reductions in the number of pathogenic organisms in the wastewater prior to discharge to the environment.

Sewage collection with advanced wastewater treatment and careful effluent disposal system siting helps to ensure that sensitive receptors such as public water supplies, surface water bodies and nitrogen sensitive resources are not adversely impacted. A review of available data on the operation of wastewater treatment facilities demonstrates that they are extremely effective and reliable in consistently providing a high quality effluent. Standard process monitoring parameters such as 5-day BOD_5 and Total Suspended Solids (TSS) demonstrate removal rates generally in excess of eighty-five percent. Treatment facilities equipped with anoxic process units such as submerged denitrification filters have proven capable of further treating the oxidized wastewater, performing a treatment step referred to as denitrification. This process releases nitrogen to the atmosphere as nitrogen gas, enabling the treatment facilities to comply with the stringent total nitrogen and nitrate-nitrogen limitations typically included in their Groundwater Discharge Permits.

Typical nitrogen removal rates in excess of eighty percent and total nitrogen effluent concentrations less than 5 or 10 mg/l allow higher density development that promotes groundwater recharge while still greatly reducing the environmental impact of the Project.

Regulations

Regulation of sewage treatment facilities is jointly vested in the MDEP under its Bureau of Resource Protection's Division of Water Pollution Control and the local Board of Health. There is a detailed body of requirements at the state level, which apply stringent standards for siting, designing, permitting, constructing, operating and maintaining wastewater facilities with ground discharges in excess of 10,000 gpd. While some of the requirements are found in regulations, most notably the Massachusetts Groundwater Discharge Permit Program (314 CMR 5.00) and the Massachusetts Ground Water Quality Standards (314 CMR 6.00), many of the technical standards are found in guidelines in "draft" form -- commonly referred to as the *Draft Guidelines*. In practice, these guidelines are applied with the full force of regulations. In addition, the DEP has adopted various policies over the years.

Decentralized wastewater treatment facilities can also be permitted via the Surface Water Discharge Permit Program through a National Pollutant Discharge Elimination System (NPDES) Permit from Region I Environmental Protection Agency (EPA) and a water quality certification permit from the MDEP.

The Board of Health derives its authority primarily through its own set of regulations promulgated pursuant to Massachusetts General Laws, chapter 111. Title 5 of the State Environmental Code (310 CMR 15.000) although intended to regulate discharges less 10,000 gpd, is also used as a guideline for certain aspects relating to effluent disposal system design and permitting.

The permitted sewage treatment facility must be operated by a Certified WWTF Operator in accordance with the "Rules and Regulations for Certification of Operators of Wastewater Treatment Facilities" (257 CMR 2.00). The permittee bears the ultimate responsibility of providing for the proper operation and maintenance of the facilities in accordance with "Operation and Maintenance and Pretreatment Standards for Wastewater Treatment Works and Indirect Discharges" (314 CMR 12.00).

Interim Policies

The DEP, Bureau of Resource Protection has developed two Interim Policies governing wastewater treatment design and permitting. These two interim policies, *"Private Sewage Treatment Facilities for Multiple Lot Residential Developments"* and the *"Nutrient Loading Approach to Wastewater Permitting and Disposal"* allow private wastewater treatment facilities to be utilized at single family residential developments and provide an alternate approach to permitting wastewater treatment facilities and to protecting groundwater supplies. The DEP has also adopted the *"Interim Guidelines on Reclaimed Water (Revised)"*, effective January 3, 2000, to establish an interim approach for regulating the use of reclaimed water.

PSTF Policy

The interim policy for "*Private Sewage Treatment Facilities for Multiple Lot Residential Developments"*, dated August 20, 1999 (PSTF Policy) reflects a modification of the DEP permitting policy to allow Groundwater Discharge Permits for new Private Sewage Treatment Facilities (PSTFs) serving multiple lot residential developments. The Policy does not apply to residential condominiums or to multiple lot commercial developments except at the election of the Project proponent. According to the PSTF Policy, condominium developments and multiple lot commercial developments may choose, but are not required, to use the Nutrient Loading Approach to permitting. The Department intends to continue its practice of permitting these discharges according to 314 CMR 5.00 without requiring a demonstration that the Willis Hill Permit Decision

(1988) objectives are satisfied, or that applicants employ the Nutrient Loading Approach to Wastewater Permitting. Therefore, these discharges may be permitted by two different methods:

Option 1: Use nutrient loading approach to meet 5 mg/l nitrogen at the property line

-or-

Option 2: Build a treatment plant that treats to 10 mg/l.

Multiple lot residential developments and mixed use developments with a residential component must employ the nutrient loading approach to their discharge and must demonstrate their ability to meet the six permitting objectives identified in the Willis Hill Permit Decision. These six objectives are intended to ensure that a single entity, fundamentally identical to the user of the facility, is fully responsible for the operation, maintenance, repair and replacement of the facility; that all users share the financial and operational responsibilities the above obligations entail; that the entity has the authority both to institute a user-charge system sufficient to generate adequate revenues and to enforce such assessments against users in a manner equivalent to municipal fee, tax and betterment assessments; that the entity maintains a source of immediate emergency repair and replacement funding and a capital reserve facility replacement account; that there be no unapproved change in the entities organizational arrangements; and, that the entity owns the land used for the sewage treatment and disposal facilities and owns the land or has easements for the land ten feet either side of all sewer lines and appurtenances. Additionally, the Policy contains special conditions applicable to PSTF's serving multiple lot residential developments that include provisions that through the application of the Nutrient Loading Approach and open space preservation requirements, the PSTF permittees can account for and mitigate any potential environmental and/or growth impacts resulting from the use of a PSTF serving multiple lot residential developments. Where application of the Nutrient Loading Policy would result in higher wastewater flows than would otherwise be allowable on the site pursuant to Title 5, 310 CMR 15.000, proponents of PSTFs must demonstrate that at least 50 percent of the site will be preserved as open space.

Nutrient Loading Approach

The MDEP has developed an Interim Policy entitled *"Nutrient Loading Approach to Wastewater Permitting and Disposal"* dated August 20, 1999. This policy is intended to provide a performance-based approach for use in evaluating groundwater discharges subject to the Massachusetts Groundwater Discharge Permit Program. The approach is a simple dilution model that sums all nitrogen inputs from a particular site and dilutes that nitrogen load (measured in pounds) by the volume of rainwater falling on the site that annually percolates down to the water table. The goal is to maintain an ambient groundwater concentration of 5 mg/l nitrogen or less for sites located within Nitrogen Sensitive Areas. Regulated sites that are not located in areas deemed to be nitrogen sensitive may use 10 mg/l nitrate-nitrogen as the regulatory criteria for the overall groundwater concentration.

The Interim Policy identifies the following nutrient sensitive areas:

- Interim Wellhead Protection Areas (IWPAs);
- Zone IIs;
- Nitrogen Sensitive Embayments;
- Areas dependent of private wells;
- Zone A's for reservoirs;
- Site specific ponds, lakes, rivers or wetlands deemed to be nitrogen sensitive by DEP after specific site assessments;
- Potentially productive aquifers that demonstrate hydrogeological characteristics and aerial extent that indicate feasibility for public water supply development;
- Sole source aquifers; and
- Other areas deemed sensitive to nutrients by DEP on a site-specific basis.

The Nutrient Loading Approach is intended to determine how a proposed development will impact *overall* groundwater quality. It enables a developer to "foster a distribution of the discharge in order to make full use of the site's land area" (i.e. spread the effluent around throughout the site) but is not designed to identify specific impacts to potential receptors. The nutrient loading approach requires calculating the total number of pounds of nitrogen derived over a 1-year period from all on-site sources including sanitary wastewater, fertilizer use and storm water runoff and dividing that total by the volume of recharge from precipitation that leaches into the ground over the site. In order to avoid an extensive site-specific analysis of nitrogen loading, the Policy relies on certain generic assumptions derived from DEP's Nitrogen Loading Model. The simple formula that describes this concept is: Load divided by volume equals concentration, where:

- LOAD means the nitrogen that percolates downward to the groundwater table, derived from several site-specific sources. The number of pounds contributed by each source must be determined and added together to establish a total load.
- VOLUME is the quantity of water allowed to be used in the nutrient loading approach to dilute all of the nitrogen inputs. The volume is dependent on local historical rainfall, the percentage of rainfall recharging the substrate, the mechanism for recharge and the size of the site.

The Nutrient Loading Approach also contains provisions that allow nitrogen trading to be used as part of the permitting processes to offset site loading. The Policy includes examples such as Nitrogen Trading in a Zone II, Nitrogen Loading in a Built-out Zone II and Nitrogen Trading in an Overloaded Nitrogen Sensitive Embayment. In each of these examples, the developer is given "credits" for removing or treating existing nutrient loads from nitrogen sensitive areas. These credits enable the developer to reallocate the existing load to allow for new development.

Private WWTF Treatment Alternatives

A number of biological treatment alternatives have been utilized to satisfy the wastewater treatment and disposal needs of small private commercial or residential developments. These include a variety of generic processes such as trickling filters, oxidation ditches, conventional activated sludge, extended aeration activated sludge, rotating biological contactors (RBCs), and sequencing batch reactors (SBRs). It also includes numerous proprietary processes such as the Fixed Film Activated Sludge (FAST) system, the Amphidrome treatment system, the Solar Aquatics™ treatment system and the Zenon membrane ultra-filtration system.

Treatment facilities utilizing RBCs, SBRs or modified versions of Innovative/Alternative treatment systems such as Amphidrome, Bioclere or FAST treatment systems that provide additional filtration, disinfection and nitrogen removal treatment units added to comply with Groundwater Discharge Permit standards, have generally been shown to be the most cost-effective processes for flow rates between 10,000 and 40,000 gpd. These facilities are generally considered “small” wastewater treatment facilities. For treatment facilities with flows above 40,000 gpd, RBCs and SBRs are almost exclusively used. All of these biological treatment systems are capable of meeting the Groundwater Discharge Permit standards when used in combination with other unit processes. The basic issues in determining which of these systems is the most appropriate for a particular site include: (a) the relative acceptance of the system by the regulatory community, primarily the MDEP; (b) the projected capital and operation and maintenance expenses associated with each system; and, (c) the aesthetic acceptability of the proposed facility.

Rotating Biological Contactors

Rotating biological contactor (RBC) treatment devices employ a series of polyethylene discs, mounted on a steel shaft. These shafts are rotated to achieve a peripheral velocity of approximately 60 feet per minute with approximately 40 percent media submergence in the wastewater. Microorganisms naturally present in the environment, (primarily bacteria, but also other simple life forms such as algae, protozoa, and rotifers), adhere to the discs forming a biological slime layer. This biological layer utilizes the soluble organic compounds in the wastewater as a source of energy and as a supply of the basic elements necessary to produce new cell material. Rotation of the media alternately exposes the organisms to their food, the soluble organic matter, and to the atmosphere which provides the oxygen needed for respiration.

Shearing forces exerted on the organisms during rotation through the wastewater cause excess growth to slough from the media into the wastewater solution (referred to as mixed liquor). The mixing action of the rotating media keeps the sloughed solids suspended in the mixed liquor. Subsequent processes of clarification and filtration separate the phases, producing a clarified liquid effluent and a waste sludge.

During the biological treatment of sewage, a series of biochemical reactions known collectively as nitrification, convert the nitrogenous compounds present within the wastewater to the completely oxidized nitrate-nitrogen (NO_3-N) form. In recent years, denitrification filters have proven extremely successful in providing an additional treatment phase known as denitrification. This process utilizes submerged sand filters designed to starve the organisms of free oxygen. Bacteria functioning in the anoxic (devoid of free dissolved oxygen) environment utilize combined forms of oxygen for respiration thereby converting the NO_3-N present in the wastewater to nitrogen gas.

RBCs have historically been the preferred biological treatment process for private and small public wastewater treatment facilities. Development of a varied biological population enables the RBC treatment process to operate more efficiently than most other treatment processes. Furthermore, RBCs are capable of producing a uniformly high quality effluent while operating over a wide range of hydraulic and organic loading. The biological growth providing waste treatment develops in response to the imparted load. During periods of low hydraulic or organic loading, the biological growth is concentrated on the front portion of the treatment unit. The remainder of the disk media will be available as excess capacity. As the flow (or organic load) is increased, the organisms begin to populate the entire surface area of the RBC media. Thus, the system is quickly able to adjust to the strength and volume of the influent wastewater stream.

Although the majority of rotating biological contactor treatment systems in Massachusetts have been constructed within a building, exterior installations using fiberglass covers have proven effective and are the norm in other areas of the country. Installing RBCs within a building offers the advantages of enabling the operator to readily view the process to assess the condition of the biological population and provides a fairly constant, warm temperature to promote treatment. Although, exterior installations may require larger RBC units to compensate for reduced bacterial treatment levels during winter months, the potential for decreased capital costs may make this an attractive option particularly if the facility is permitted with a seasonal nitrogen limitation.

Sequencing Batch Reactors

Over the past few years, as computer control technology advances have been made, sequencing batch reactor (SBR) treatment systems have become more feasible and cost effective for small-scale wastewater treatment. The SBR process is a modified activated sludge treatment process, which utilizes a batch treatment system to perform the required steps of wastewater treatment. For small facilities, this allows multiple treatment units to be combined into one basin, decreasing capital costs, minimizing facility footprint, and reducing treatment complexity. The historical drawback to utilizing this technology has been the intense operator control required to properly operate the system and achieve the required levels of treatment. The advent of reliable Programmable Logic Controllers (PLCs) and computer controlled operation systems has reduced the level of operator input required, and as such, has made the technology more attractive for small wastewater treatment applications. Furthermore, SBRs are capable of producing a uniformly high quality effluent while operating over a wide range of hydraulic and organic loadings. The biological growth providing waste treatment develops in response to the imparted load. During periods of low hydraulic or organic loading, the biological growth can be concentrated and maintained within the reactor by reducing the frequency of sludge wasting. However, as the flow (or organic load) is increased, the organisms begin to proliferate and a larger percent can be removed from the system for disposal by increasing sludge wasting, while maintaining the same level of treatment. Thus, the system is quickly able to adjust to the strength and volume of the influent wastewater stream.

Sequencing batch reactor systems are a very simple, and yet sophisticated, variation of the activated sludge process system that has been successfully used in industrial and municipal applications. A simplified description of the “Fill and Draw” mode of operation of an SBR system is characterized by wastewater being added to a reactor, treated to remove undesirable components and subsequently discharged. The SBR incorporates equalization, aeration and clarification within the confines of a single reactor. There are five steps in the SBR process, all of which take place in the same tank, including: fill, react (aeration), settle (clarification), draw (decant) and idle (sludge wasting). A SBR consists of tanks with inlets for raw wastewater; air diffusers with associated compressors and piping; a sludge draw off mechanism at the bottom to waste sludge; a decant mechanism to remove the supernatant after settling; and a control mechanism to time and sequence the processes. A treatment plant using the SBR process would also have to include grit and screening removal, flow equalization, filtration, disinfection and sludge storage.

One of the primary attributes of the SBR wastewater treatment system is that this variation of the activated sludge process provides an enormous degree of flexibility in the design variations available to meet the requirements of specific waste treatment applications. Due to this flexibility and other inherent advantages, SBR systems are being employed in a variety of process design variations with increased frequency in both municipal and industrial wastewater treatment applications.

In addition to removing organic matter, SBR treatment systems are also capable of oxidizing influent nitrogen typically present in the reduced ammonia-nitrogen and organic nitrogen forms. Treatment facilities equipped with SBRs have proven capable of further treating the oxidized wastewater, performing a treatment step referred to as denitrification. This process releases nitrogen to the atmosphere as nitrogen gas, enabling the treatment facilities to comply with the stringent total nitrogen and nitrate-nitrogen limitations typically included in their Groundwater Discharge Permits.

SBR systems operate on a very simple concept of introducing a quantity of waste to a reactor, providing an adequate time period for the treatment of the waste, and subsequently discharging a volume of effluent plus waste sludge that is essentially equal to the original volume of waste introduced to the reactor. The general phases of reactor operation are the introduction of wastewater, the discharge of effluent and/or waste sludge and the various mixing and aeration steps in-between. The inclusion or deletion of individual phases of operation is typically based upon process considerations related to the influent characteristics and the effluent quality requirements of a specific wastewater treatment application.

Prior to beginning the first phase of operation, the Mixed Fill phase, the reactor environment has been “conditioned” by events that occurred during the prior cycle. This conditioning is initially accomplished by the termination of flow and associated organic loading to the reactor as the React Fill phase was completed. It is continued by the completion of a React phase that provided an opportunity to “polish off” waste contaminants. Lastly, it is completed by the absence of mixing and aeration for a time period during the Settle, Decant, Sludge Waste and Idle phases of operation.

Typically, the settled sludge mass will contain the majority of the microbial life, which continues a certain level of respiration and effectively depletes the settled sludge zone of the reactor of any dissolved oxygen. It also reduces forms of oxidized nitrogen to minimal levels through denitrification and exhibits some degree of phosphorus release from the cell mass to the liquid medium in a soluble form. Reasonably good quality can be expected in the supernatant. This quality can be further improved through the use of tertiary filtration.

Since the majority of the microbial life has settled to the bottom of the reactor, the relative effect of microbial respiration in the supernatant layer, as compared to the sludge mass layer, is substantially reduced. Consequently, dissolved oxygen levels of 0.50–1.5 mg/l will exist in the supernatant of the reactor. Since the system has been designed to accomplish nitrification and denitrification, the supernatant layer will contain ammonia-nitrogen (NH_3-N) and NO_3-N at or below the levels of the design effluent objectives. Residual soluble levels of organic material, as determined by a BOD_5 or COD measurement, will also be present in concentrations at, or near, the design effluent concentration values.

During the biological treatment of sewage that occurs in the aerated React phase of the SBR process, a series of biochemical reactions known collectively as nitrification, convert the nitrogenous compounds present within the wastewater to the completely NO_3-N form. The anoxic Mixed Fill and anoxic Mixed React phases of the SBR process create an anoxic (devoid of dissolved oxygen) environment to utilize combined forms of oxygen for respiration thereby converting the nitrate-nitrogen present in the wastewater to nitrogen gas.
The denitrifying bacteria require the presence of biodegradable organic material (carbon) as a food source. The addition of raw sewage during the Anoxic Mixed Fill stages acts as the requisite supplemental carbon source that sustains the life processes of the denitrifying bacteria thereby ensures the completion of the denitrification reactions. Effluent nitrate-nitrogen concentrations well below the primary drinking water standard of 10 mg/l and total nitrogen removals in excess of 80 percent can be consistently achieved at SBR equipped treatment facilities.

Fixed Film Activated Sludge

The Fixed Film Activated Sludge Treatment (FAST) System manufactured by Smith & Loveless, Inc., utilizes a honeycomb type plastic media submerged in the wastewater to promote both fixed and suspended biological growth. Constant aeration and circulation of wastewater is accomplished by the release of air in a draft tube located near the bottom of the media block. The air causes the wastewater to rise through the tube to a deflector baffle that distributes the wastewater over the media. Nitrification occurs in the system as the wastewater is distributed through the media. Denitrification occurs in a mixed anoxic reactor, where anaerobic bacteria convert the nitrate-nitrogen to free nitrogen gas that is released to the atmosphere.

The FAST® wastewater treatment system is a fixed film, packed bed reactor that combines elements of trickling filter and activated sludge technologies. The honeycomb type media in the system, which is 100 percent submerged in the wastewater, provides a high surface area to volume ratio. The packing material is similar to the media used in trickling filter towers and has discrete channel flow paths throughout resulting in high liquid velocities and a self-cleaning action. Air is released inside the draft tube, creating a standard airlift pump that circulates wastewater through the media and completely mixes the tank.

As the system is operated, bacteria grow and flourish on the media and reach a point where they slough from the media in a similar manner as the RBC slime growth sloughs from the RBC media. The solids from a FAST® unit are large, dense solids which settle rapidly. These sloughed solids are removed through sedimentation using a conventional secondary clarifier.
There are several configurations for the FAST® system depending on the waste characteristics and environment where the treatment takes place. In situations with stringent nitrogen limitations for nitrogen, the FAST® system is partitioned into a series of aerobic and anoxic zones with a supplemental carbon source added to the anoxic zone to promote denitrification. Tertiary filtration and disinfection can also be added to the treatment system.

Amphidrome

The *Amphidrome* Process makes use of an innovative configuration of Tetra Technologies' *Colox* and *Denite* processes. *Colox* is an upflow, packed bed, aerobic biological treatment process. It utilizes fixed-film bacteria attached to the surface of a granular media. The media has a high specific surface area for the attachment of the bacteria. This allows the development of a high density of biomass in a very small space.

As a result, the hydraulic detention time is significantly reduced and the solids retention time is quite long. The *Denite* filter system is a columnar biological denitrification process that employs microorganisms growing on the fixed surfaces of the filter media to convert oxidized nitrogen in the wastewater to gaseous nitrogen under anoxic conditions. In order to accelerate the denitrification reaction, a carbon source may be added to the nitrified wastewater.

Amphidrome Reactor

The Amphidrome Reactor serves as combination fixed-film reactor and denitrification filter to provide aerobic and anoxic treatment of wastewater. The Amphidrome Reactor consists of submerged granular media that is alternately supplied with air and deprived of air during multiple computer controlled aerobic and anoxic cycles.

Wastewater flow is initially collected in an anoxic/flow equalization tank that serves as a primary clarifier, sludge storage tank, anoxic reactor and flow equalization tank. Effluent from the anoxic/flow equalization tank is directed to the Amphidrome Reactor that is equipped with granular media to remove suspended organic matter and provide a location for the attachment and growth of bacteria needed to treat the wastewater. The microorganisms that provide treatment are naturally present in the environment, consisting primarily of bacteria, but also simple life forms such as algae, protozoa and rotifers.

The Amphidrome Reactor operates similar to a sequencing batch reactor, with alternating aerobic and anoxic cycles. The aerobic biological treatment cycle is utilized for the removal of dissolved organic matter, measured as BOD_5 and to accomplish oxidation of reduced forms of nitrogen (nitrification). During the aerobic cycle, an oxygen rich environment is maintained through the introduction of air through the Amphidrome Reactor underdrain. This air supply encourages microorganism respiration using the soluble organic compounds in the wastewater as a source of energy and as a supply of the basic elements necessary in the production in new cellular material. In addition to removing the carbonaceous BOD, additional aerobic bacteria perform a series of biochemical reactions known collectively as nitrification convert the reduced nitrogenous compounds present within the wastewater to the completely NO_3-N form.

After completion of the aerobic cycle, the oxygen feed is discontinued to provide anoxic conditions necessary for the denitrification cycle. The denitrification cycle uses bacteria functioning in the anoxic (devoid of free dissolved oxygen) environment that are capable of using combined forms of oxygen for respiration thereby, converting the nitrate-nitrogen present in the wastewater to nitrogen gas.

The typical Amphidrome Reactor process cycle consists of three to five minutes of aeration followed by ten to fifteen minutes without aeration. Cycle times and sequences depend on the volume and strength of the wastewater.

As the granular media collects organic matter and microorganisms, the flow rate through the media will slow, and the Amphidrome Reactor will need to be backwashed. An initial air scour is performed to separate the solids and move them into suspension within the wastewater. After the air scour is complete, a quick settling period is completed to allow the filter media to settle out of suspension. The final step is a liquid backwash that involves pumping effluent wastewater stored in the clearwell/final effluent pump chamber through the media to remove the dirty wastewater and accumulated solids from the filter.
The backwash is returned to the anoxic/flow equalization tank via the backwash return line. The entire process is initiated and controlled using timers and float switch overrides. Additional backwash cycles are scheduled every hour regardless of the aeration sequence.

Amphidrome Plus Reactor

The Amphidrome Plus Reactor provides an additional anoxic zone to promote denitrification and also serves as a polishing filter designed to remove solids not removed in the Amphidrome Reactor. The silica sand media in the Amphidrome Plus Reactor is completely submerged in the wastewater and operates in an anoxic environment that allows the predomination of denitrifying organisms.

The denitrifying bacteria in the Amphidrome Plus Reactor require biodegradable organic material (carbon) as a source of food. As the aerobic bacteria in the preceding processes (oxidation of carbonaceous matter and nitrification) have consumed most of the organic matter in the wastewater, a supplemental carbon source must be provided to sustain the life processes of the denitrifying bacteria thereby ensuring completion of the denitrification reactions. Methanol (wood alcohol) is a highly soluble source of carbon and therefore is generally used as a supplemental carbon source. Methanol contributes to high denitrification rates and produces less excess biological cell growth than most other alternate carbon sources.

The Amphidrome Plus Reactor also includes a backwash cycle incorporating an initial air scour, a quick settling period and a liquid backwash that involves pumping the effluent wastewater stored in the clearwell/final effluent pump chamber through the media to remove the dirty wastewater from the filter. The backwash is returned to the anoxic/flow equalization tank via the backwash return line. The entire process is initiated and controlled using timers and float switch overrides.

Solar Aquatics™

The Solar Aquatics™ treatment process, developed by Ecological Engineering Associates, is characterized as a natural system consisting of elements of natural wetland systems, such as plants, subsurface wetland media and sand filtration combined with more conventional treatment elements such as diffused aeration and settling tanks. The Solar Aquatics™ process is housed in a greenhouse structure that provides light for photosynthesis of its plant life, giving the system the ability to grow plants year-round as well as providing an attractive appearance. Several Solar Aquatics™ facilities are currently operating within the state and have been proven capable of reducing BOD_5 and TSS to secondary treatment standards (30 mg/l). Designs are available which are reported to reduce BOD_5, TSS and total nitrogen to 10 mg/l. Phosphorus removals are also reported to be feasible.

The Solar Aquatics® treatment system combines several conventional unit processes in an aquaculture/constructed wetlands treatment system. The facility uses screening and grit removal followed by flow equalization and blending. A diffused air mixing system helps keep the primary solids in suspension for aerobic biodegradation and nitrification within the greenhouse treatment system that includes solar tanks and solar ponds. The translucent cylindrical solar tanks and solar ponds contain bacterial and algal biomass and are planted with water hyacinth, willow, duckweed and azole. Additional non-floating plants are suspended from the tank walls. The plant roots and Solar Aquatics® tank surface provide a fixed film media for development of a diverse combination of biological components including bacteria, algae, zooplankton, aquatic and non-aquatic plants, snails and other aquatic animals that mimic natural environmental pollutant removals processes and facilitate the removal of organic material and nutrients. This complete ecosystem approach provides a higher degree of biodiversity than conventional technologies and may be capable of treating a wide range of contaminants while providing a stable and resilient system. The greenhouse and the floating macrophytes used in the process provide a very pleasing aesthetic environment that is not typically found with conventional wastewater treatment processes.

The system also incorporates elements similar to a conventional activated sludge process. Secondary clarifiers recycle sludge to the blending tank for microbial reseeding. Excess sludge is transferred to an aerobic digester for gravity thickening (to 2 to 3 percent solids). This sludge can be either disposed off-site, dewatering using covered sand drying beds or composted with excess vegetative material.

The liquid effluent is typically further polished, disinfected and disposed via conventional subsurface leaching chamber trenches. This polishing stage of the Solar Aquatics® system includes manually cleaned sand filters and a constructed wetlands marsh. Each marsh is constructed with a crushed stone substrata and is planted with bulrush, *Scirpus*, cattail, iris and reeds. The submerged marshes provide an anaerobic treatment zone for denitrification, with phosphorus absorption into the root mass.

A pilot scale Solar Aquatics® septage treatment system was constructed in the town of Harwich, Massachusetts at the Town landfill adjacent to the septage lagoons. Construction of the facility began in December 1989, with start-up operations commencing on March 26, 1990. Routine operations proceeded from June 1, 1991, until December 1, 1991, with a final report on pilot plant results submitted to the MDEP on June 30, 1992. This pilot test resulted in conditional approval of the system by the DEP.

Ecological Engineering Associates also operates a 7,000 gallon per day Solar Aquatics® System serving the downtown business area of the town of Weston.

This wastewater treatment system is permitted through a Groundwater Discharge Permit and has operated effectively for the past several years, consistently attaining compliance with Permit effluent limitations and requirements.

Living Machine

The Advanced Ecologically Engineered System (AEES) Living Machine® wastewater treatment technology was conceived by Dr. John Todd, the President of Ocean Arks International, one of the developers of the Solar Aquatics® treatment system. Although the process holds promise for being capable of meeting Groundwater Discharge Permit standards, the Living Machine® technology is still very much in the development stage. For purposes of this study, it was assumed that the Living Machine® technology does not provide any advantage over the Solar Aquatics® system in terms of treatment efficiency or costs.

The EPA recently completed an assessment of the Living Machine® wastewater treatment technology. Their findings were summarized in a report entitled *Response to Congress on the AEES "Living Machine" Wastewater Treatment Technology*, EPA 832-R-97-002, April 1997. In terms of system costs, EPA concluded – "The life cycle costs (construction plus operation and maintenance) of the 'Living Machine' are comparable to conventional technologies capable of achieving the same treatment performance at flow rates less than 100,000 gpd …".

Private/Small WWTF Facility Components

Decentralized wastewater treatment facilities approved under the Massachusetts Groundwater Discharge Permit Program are usually designed based on the criteria established in the *"Draft Guidelines for the Design, Construction, Operation and Maintenance of Small Sewage Treatment Facilities with Land Disposal"* published in January 1988 by the MDEP. These treatment facilities utilize a combination of treatment units generally consisting of primary settling followed by aerobic treatment, secondary settling, tertiary filtration and disinfection with effluent disposal usually accomplished through subsurface disposal. Additional anoxic treatment units are often appended to the facility to accomplish nitrogen removal.

Primary Treatment

A primary treatment step is typically provided to remove coarse solids and debris that may hinder the performance of subsequent treatment units and pumping equipment. The primary treatment process can be accomplished by primaryclarifiers, fine screens or below ground pretreatment tanks configured with inlet and outlet tees similar to a septic tank. The pretreatment tank is designed to retain both floating and heavy solids. Waste sludge produced by the various treatment processes is often returned to the pretreatment tank for storage and ultimate removal for off-site treatment.

Sludge Storage Tank

The waste solids generated during the treatment cycle and the backwashing of the tertiary filtration system are collected and then returned to the sludge storage tank. As solids and scum accumulate, a licensed septage hauler must be retained to clean the tank and deliver the waste to a treatment facility licensed to receive treatment plant waste.

Flow Equalization

Sewage flows typically occur over a twelve to sixteen hour period, with the majority produced during morning and early evening hours. Flow equalization tanks are typically provided to decentralized wastewater treatment facilities to modulate the flow ensuring a constant feed rate to the treatment system and enabling the subsequent unit processes to be designed to accommodate average daily flow instead of peak hourly rates. Wastewater is generally pumped to the biological treatment units from the equalization tank. The facility's operator is able to adjust the feed rate to maximize treatment efficiency. The MDEP generally requires flow equalization tanks to be sized to retain at least fifty percent of the calculated average daily flow.

Biological Treatment

There are two basic methods of biological treatment available – fixed film reactors and suspended growth systems. Both of these treatment processes employ biological growth to effect aerobic decomposition or oxidation of organic material into more stable compounds and provide for a higher degree of treatment than that accomplished by primary sedimentation alone. In the fixed film reactor, the biological growth is attached to a fixed medium and the organic material must be brought to them. With suspended growth systems, the organisms are migrant and are carried to the organic matter in the wastewater. In either case, successful operation involves maintaining aerobic environmental conditions favorable for the life cycle of the organisms, and control over the amount of organic matter that they decompose. The organic matter is the food upon which these organisms live. If they are either over-fed or under-fed their efficiency is reduced. The treatment processes used in decentralized wastewater treatment facilities include RBCs and Amphidrome (fixed film reactors), SBRs (a suspended growth system) and FAST (a combination fixed film – suspended growth system).

Secondary Clarifier

A secondary clarifier is typically placed in the treatment train following the aerobic and anoxic treatment processes. This tank provides a quiescent zone for the settling of biological solids generated during the biological treatment. The settled solids are typically directed to a hopper by rotating sludge rakes and returned to the pretreatment tank or sludge storage tank at regular intervals (usually hourly), via an air lift system. The secondary clarifier also captures floating matter that is also returned for temporary storage prior to removal from the system.

Denitrification Filter

Denitrification filters are used to enhance wastewater quality by providing nitrate removal as well as filtration of suspended solids. The filtering medium captures the suspended solids, which escape the secondary clarifier and provide a site for the development of denitrifying bacteria. A head-loss controlled automatic scour and backwash cycle cleanses each filter cell, directing the accumulated solids to the sludge holding tanks.

During the aerobic biological treatment of sewage that occurs in the aerobic treatment phase, a series of biochemical reactions known collectively as nitrification, convert the nitrogenous compounds present within the wastewater to the completely NO_3-N form. In recent years, the use of deep bed submerged denitrification filters has proven extremely successful in providing a subsequent treatment phase known as denitrification. By submerging the filter media, bacteria functioning in an anoxic (devoid of dissolved oxygen) environment to utilize combined forms of oxygen for respiration thereby converting the nitrate-nitrogen present in the wastewater to nitrogen gas.

The denitrifying bacteria require the presence of biodegradable organic material (carbon) as a food source. As the aerobic bacteria in the preceding treatment stages (oxidation of organic matter and nitrification) have consumed most of the available organic matter in the wastewater, a supplemental carbon source must be provided to sustain the life processes of the denitrifying bacteria thereby ensuring the completion of the denitrification reactions.

Methanol (wood alcohol) is a highly soluble source of carbon and therefore, is generally used as a supplemental carbon source. Methanol contributes to high denitrification rates and produces less excess biological growth than most alternate carbon sources. It is also readily available as a market product at a reasonable cost.

Effluent nitrate-nitrogen concentrations less than the primary drinking water standard of 10 mg/l and total nitrogen removals in excess of 80 percent can be consistently achieved at treatment facilities equipped with denitrifying filters and properly monitored methanol feed systems. The efficiency of the nitrogen removal process is, however, directly dependent upon the operator’s ability to monitor the system and make the appropriate process adjustments. An insufficient supply of methanol inhibits the growth of the denitrifying bacteria, thus reducing the overall efficiency of the nitrogen removal process. Alternately, excess methanol contributes to elevated BOD_5 levels.

Wastewater treatment facilities usually are equipped with automatic, flow proportional, chemical feed units designed to regulate the rate of methanol addition based upon the influent flow. These systems usually rely on a self-priming peristaltic feed pump will to deliver the methanol solution from a 55-gallon storage reservoir. As a precaution, the methanol supply is stored in a totally enclosed, fully ventilated room accessed from the exterior of the building and equipped with Class I, Division I explosion-proof electrical fixtures.

Cloth Filters

Tertiary cloth filters can be used to enhance wastewater quality by providing additional removal of suspended solids and organic material. These filters are comprised of cloth covered plastic disk filtering media that captures the suspended solids that escape the secondary treatment system. A head-loss controlled automatic backwash cycle cleanses the filter disk, directing the accumulated solids-laden backwash to a sludge storage tank.

Disinfection

Disinfection of treatment facility effluent allows for the destruction of pathogenic bacteria and viruses to further protect the environment. The most common disinfectants used at WWTFs include chlorine, ozone (O_3) and ultraviolet (UV) radiation. Other disinfectants, such as gamma radiation, bromine, iodine, and hydrogen peroxide, have been considered for the disinfection of wastewater, but are not generally used because of economical, technical, operational, or disinfection efficiency considerations. Membrane processes (e.g., micro-filtration, ultra-filtration, and RO) have also been shown to be effective in removing microorganisms, including viruses, from municipal wastewater, but are not commonly used except in facilities that need additional treatment for beneficial reuse of the reclaimed water.

Irradiation of wastewater with ultraviolet radiation for disinfection is potentially a desirable alternative to chemical disinfection, owing to its inactivating power for bacteria and viruses, affordable cost, and the absence of chemical disinfection by-products. Exposure of microorganisms to the appropriate amount of electromagnetic (EM) radiation disrupts the cells' genetic material and interferes with the reproduction process. Some bacteria have repair enzyme systems that are activated by similar EM energies, and thus these particular bacteria may repopulate disinfected waters after disinfection when exposed to light.

Effluent Disposal/Permitting of Private/Small WWTFs

Small wastewater treatment facilities can be permitted either through the Groundwater Discharge Permit Program or the Surface Water Discharge Permit Program through a NPDES Permit from Region I EPA and a water quality certification permit from the DEP. The vast majority of small wastewater treatment facilities use effluent disposal facilities permitted through the Groundwater Discharge Permit Program. Table 2-10 illustrates typical influent and effluent characteristics as well as required contaminant removal and typical permit effluent limitations for wastewater treatment facilities permitted under the Groundwater Discharge Permit Program.

TABLE 2-10
TYPICAL WASTEWATER CHARACTERISTICS

Parameter	Typical Influent Values	Typical Effluent Values	Typical Percent Reduction	Expected Permit Requirements
Total Biochemical Oxygen Demand	300 mg/l	10 mg/l	97 %	30 mg/l
Total Suspended Solids	300 mg/l	10 mg/l	97 %	30 mg/l
Total Nitrogen (as Nitrogen)	45 mg/l	5 mg/l	90 %	1 mg/l
Ammonia-Nitrogen (as Nitrogen)	25 mg/l	1 mg/l	96 %	N/A
pH (standard units)	6.5–8.5	6.5-8.5	N/A	6.5–8.5
Dissolved Oxygen	N/A	5.0 mg/l	N/A	N/A
Fecal Coliform Bacteria	N/A	100/100 ml	N/A	< 200/100 ml
Temperature	55°F	N/A	N/A	N/A
Alkalinity	275 mg/l	N/A	N/A	N/A

Groundwater disposal of effluent provides an additional degree of unsaturated effluent filtration, further enhancing the capture and inactivation of bacterial and viral contaminants. Since the effluent entering the leaching facilities is superior in quality to that of an on-site disposal system, significantly higher hydraulic loads are typically used in the design of these systems. The installation of monitoring wells, both up gradient and down gradient of the leaching facilities, allows routine sampling and analysis of the groundwater. Groundwater disposal facilities include the use of open sand beds and subsurface disposal systems incorporating leaching chambers, leaching pits, leaching trenches or leaching beds. The size of the facilities is based on the percolation rate of the soils and the hydrogeologic properties of the site as determined through completion of a hydrogeologic assessment that includes groundwater modeling to identify potential sensitive receptors, evaluate contaminant fate and transport and to estimate the amount of groundwater mounding that will develop beneath the system. The criteria for completing hydrogeologic assessments is outlined in the Massachusetts Department of Environmental Protection *"Guidelines for Hydrogeologic Assessments at Proposed WWTF Sites"*, dated September 1993.

The two general categories of groundwater effluent disposal systems are open sand beds and subsurface leaching systems. Both practices are widely used for groundwater discharge of treatment plant effluent in Massachusetts and throughout the Northeast.

Open sand beds, or rapid infiltration basins, are sand lined open excavations or diked areas where treatment plant effluent is discharged onto the ground surface and allowed to percolate into the soil. For sandy soils with a percolation rate less than 5 minutes per inch, open beds may be designed with a hydraulic loading rate of 5 gpd per square foot. A typical design should include multiple alternating beds facilitate routine maintenance with an equivalent sized reserve area provided. The entire disposal site is usually fenced to prevent accidental contact by the public.

Open sand beds are allowed to use higher loading rates than subsurface leaching systems and therefore require less land area. They are also less expensive to construct and are easily monitored and repaired. Open sand beds will prevent the use of the effluent disposal area for other purposes such as recreation. Additionally, open sand beds could have a potential for causing odors and for attracting wildlife and may need to have weed growth controlled during warm months.

Subsurface leaching systems include leaching trenches, leaching pits and plastic or concrete leaching chamber systems. Leaching trenches are covered, shallow, level excavations that are usually not more than 3 to 4 feet deep, 3 feet wide and 100 feet in length. The bottom of the trench is filled with washed stone supporting a perforated distribution pipe. Plastic or concrete chambers can be used to reduce or completely eliminate the need for washed stone and to provide storage volume. The total leaching area provided by trenches includes the pervious bottom and sidewall areas of the excavation below the invert of the distribution pipe. Where more than one leaching trench is installed, the space between trenches may be used as the reserve area provided the distance between excavation sidewalls is no less than three times the effective width effective depth of the trench, whichever is greater.

For sandy soils, the DEP allows leaching trenches constructed with chambers use a hydraulic loading rate of 3.0 gpd per square foot. Stone leaching trenches that do not incorporate chambers are limited to a maximum loading rate of 2.5 gpd per square foot. Advantages of subsurface leaching systems include increased safety, a minimal need for routine maintenance, an improved visual appearance since no structures other than vent pipes are visible at the ground surface, and the ability to use the land for other purposes such as ball fields. Disadvantages include the large land areas that are required, the cost of construction, the inability to easily monitor performance and condition of the system and the need to completely reconstruct the system should the leaching system fail. Table 2-11 shows the application rates for effluent disposal.

TABLE 2-11
APPLICATION RATES FOR EFFLUENT DISPOSAL (GPD PER SQUARE FOOT)

Percolation Rate	Less than 5 Minutes per Inch	5 to 10 Minutes Per Inch	10 to 20 Minutes per Inch
Open Sand Beds	5.0	4.0	2.0
Leaching Pits	3.0	2.5	1.5
Leaching Chambers	3.0	2.5	1.5
Leaching Trenches	2.5	1.5	1.0

Operation and Maintenance of Private/Small WWTFs

The permitted sewage treatment facility must be operated by a Certified WWTF Operator in accordance with the "Rules and Regulations for Certification of Operators of Wastewater Treatment Facilities" (257 CMR 2.00). The permittee bears the ultimate responsibility of providing for the proper operation and maintenance of the facilities in accordance with "Operation and Maintenance and Pretreatment Standards for Wastewater Treatment Works and Indirect Discharges" (314 CMR 12.00).

Treatment plant operations require regular supervision and maintenance from trained and skilled personnel. The DEP usually dictates that a licensed operator be present at the treatment facility at least two hours per day to perform operational supervision and routine maintenance. The DEP also requires that a Massachusetts Registered Professional Engineer inspect the treatment facility at least once per month to monitor the operation and collect samples to determine facility compliance with the Groundwater Discharge Permit. A monthly inspection report must be submitted by the engineer to the DEP and the local Board of Health. An annual compliance fee is submitted to the DEP to cover the expense of the Department's independent compliance inspection.

A number of safety factors must be incorporated into the design of wastewater treatment facilities. First, design calculations for the size of each unit operation should include design safety factors. High water level switches activating both audible and visual alarms must be provided to alert the operator of a potential problem. Additionally, an electronic auto-dial telephone paging system should be installed in the plant to provide the operator with notice of an unanswered alarm.

All pumps in the system must have a duplicate unit plumbed and wired to automatically start should the primary pump malfunction. Any pump malfunction should also activate the alarm system. A spare parts inventory should be maintained to minimize the downtime of any unit due to a malfunction.

Wastewater treatment facilities are required to be equipped with a permanently mounted emergency generator of sufficient size to provide enough electricity to operate the entire facility including all pumps, treatment processes and lighting. The treatment plant must be equipped with an automatic transfer switch to activate the emergency generator in the event of a prolonged power outage with the main control panel equipped with a sequential starter to prevent an overload of the circuitry upon transfer to the alternate electric source.

Wastewater treatment facilities produce waste solids and, since small facilities typically do not incorporate on-site sludge dewatering, these solids are usually removed from sludge holding tanks by a waste hauler at least once per year. This material has characteristics similar to a mixture of primary and secondary sludge and is usually delivered to a regional WWTF equipped for septage receiving by a licensed septage hauler for further processing and disposal.

Decentralized Effluent Disposal for Municipal WWTFs

Decentralized disposal of effluent treated at a municipal wastewater treatment facility may offer an attractive option to the construction of on-site WWTFs. The decentralized disposal option would enable the existing infrastructure to be retained while still promoting groundwater recharge.

Permitting Requirements

Decentralized disposal facilities would be permitted through the Groundwater Discharge Permit Program or potentially, in the case of constructed wetlands treatment systems, through a NPDES Permit issued by Region I of the EPA and a water quality certification permit from the Massachusetts Department of Environmental Protection. Additionally, depending on location and proximity to sensitive receptors, including potentially productive aquifers, these effluent disposal systems may also need to comply with the *Interim Guidelines on Reclaimed Water* for Urban Reuse or Indirect Aquifer Recharge. This may necessitate that additional treatment processes be added to the existing municipal wastewater treatment facilities to polish the effluent and to produce an effluent quality consistent with the environmental setting of the discharge site.

A groundwater effluent disposal site will require that the effluent be treated to levels in compliance with the Groundwater Discharge Permit Program (314 CMR 5.00) and the Groundwater Quality Standards (314 CMR 6.00). For Class I and Class II groundwater, this requires that the facility attain at least secondary treatment levels for BOD and Total SS and a maximum nitrate nitrogen concentration of 10 mg/l. Additional standards for pathogenic organisms and coliform bacteria, metals, chlorides, toxic pollutants and organic contaminants will also apply. The discharge limits will be established by the DEP on an individual site basis to ensure that the quality standards of the receiving waters will be maintained or attained. In establishing effluent limitations, the Department will consider natural background conditions, protection of existing adjacent and downgradient uses, and the maintenance and attainment of beneficial uses in adjacent and downgradient waters.

The Department requires regular monitoring of the groundwater at, and around, the effluent disposal site. Monitoring wells are required upgradient and downgradient of the effluent disposal site to measure groundwater quality and to assure compliance with the groundwater quality standards. Sampling and analysis is usually required on a quarterly, and occasionally more frequent, basis.

Groundwater reclassification is also possible, but not probable.

General Siting and Sizing Criteria

Discharges into aquifer recharge areas defined by Zone II boundaries and groundwater discharges that recharge reservoirs or tributaries to reservoirs are classified as reclaimed water through Indirect Aquifer Recharge. This type of reuse requires the treatment facility to provide at least secondary treatment, disinfection and possibly filtration. The required reclaimed water quality limitations include a pH range of 6 to 9 standard units, a BOD_5 less than or equal to 30 mg/l, turbidity less than or equal to 5 NTU, TSS less than or equal to 10 mg/l, total nitrogen less than 10 mg/l and a fecal coliform count with a 7-day median limit of no detectable colonies per 100 ml and a maximum of 200 colonies per 100 ml. If the discharge is located in an approved Zone II at a site with less than a 2 year groundwater travel time to the public water supply well, the treatment plant must treat to more rigorous standards with effluent limitations of 10 mg/l BOD_5, 2 NTU for turbidity, 5 mg/l TSS and a maximum fecal coliform count of 14 colonies per 100 ml.

Decentralized groundwater disposal facilities can use either open sand beds or subsurface disposal systems consisting of leaching chambers, leaching trenches or leaching beds, which have been previously discussed. The size of the facilities is based on the percolation rate of the soils and the hydrogeologic properties of the site as determined through completion of a hydrogeologic assessment including groundwater modeling to identify potential sensitive receptors, evaluate contaminant fate and transport and to estimate the amount of groundwater mounding that will develop beneath the system. The criteria for completing hydrogeologic assessments is outlined in the Massachusetts Department of Environmental Protection *"Guidelines for Hydrogeologic Assessments at Proposed WWTF Sites"*, dated September 1993.

Advantages of subsurface leaching systems include increased safety, a minimal need for routine maintenance an improved visual appearance and the ability to use the land for other purposes such as ball fields. Disadvantages include the requirement for a large land area, the cost of construction, the inability to easily monitor the performance and condition of the system, and the need to completely reconstruct the system should the leaching system fail. Table 2-12 shows the minimum acceptable separation distance.

TABLE 2-12
MINIMUM ACCEPTABLE SEPARATION DISTANCES

Component	Leaching Facility (feet)
Public Well	400
Private Well	100
Water Supply Line	25
Dwelling Unit	25
Subsurface Drain	25
Property Boundary	25
Surface Water	100
Downhill Slope	50

Constructed Wetland Treatment or Disposal Facilities

Natural wetlands are areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to maintain saturated conditions. Natural wetlands support a large and diverse population of bacteria that grow on the submerged roots and stems of aquatic plants and promote BOD_5 removal. Although wetlands have been shown to provide significant pollutant attenuation properties, natural wetlands are considered to be waters of the United States and thus, use of wetlands and discharge to wetlands is strictly regulated. Constructing a new wetland where one did not previously exist avoids many of the regulatory entanglements associated with the use of natural wetlands. Constructed aquatic wastewater treatment systems provide a controlled treatment system designed to mimic the pollutant attenuation processes provided by natural aquatic plant systems while providing a buffering zone to preserve and enhance the natural environment.

A recent trend in wastewater treatment is the inclusion of artificial ecosystems as a functional part of a comprehensive wastewater treatment system. These artificial ecosystems seek to mimic many of the treatment processes that occur in natural environments while allowing the design of the wetland to be optimized to maximize the efficiency of the wastewater treatment process. Constructed wetland systems can range in scope from the creation of a marsh in a natural setting where one did not previously exist to intensive construction involving grading, the installation of impermeable barriers or the construction of tanks or trenches. Constructed wetlands can be used prior to discharge to natural wetlands or surface waters or can be designed as zero discharge systems that disperse effluent solely through evapotranspiration and groundwater recharge. Constructed wetlands that discharge to surface water require 4 to 10 times more land area than a conventional wastewater treatment facility. Zero discharge, constructed wetlands require 10 to 100 times the area.

Constructed wetlands have been used for treating primary effluent, or more commonly for polishing secondary effluent and for enhancing the quality of effluent discharged to existing natural wetlands. Constructed wetlands provide a relatively low cost, low maintenance advanced treatment phase which can dampen spikes in effluent characteristics, resulting in a more stable and consistent discharge that exhibits reduced suspended solids concentration and fecal coliform counts thereby creating a more predictable effluent discharge to re-supply the natural wetland or surface water system.

Types of Constructed Wetland Treatment Systems

Constructed wetlands are typically divided into two general categories; free water system (FWS) and subsurface flow system (SFS) wetlands. Free water systems are ponded wetlands similar to shallow ponds and oxidation ditches that typically consist of long narrow basins or channels with a subsurface barrier of clay or impervious geotechnical material to prevent seepage, soil or another suitable medium to support emergent vegetation and water at a relatively shallow depth. FWS wetlands have water depths ranging between six inches and five feet and may use a combination of free floating, fixed and submerged vegetation. They are usually constructed using relatively long narrow channels to minimize flow channelization and short-circuiting and to ensure plug-flow conditions.

The major sources of oxygen in FWS wetlands are reaeration at the water surface and plant translocation of oxygen from the leaves to the rhizosphere. The organic loading should be distributed over a significant portion of the area, not applied to a single point. The design water depth should be 6 inches to 5 feet with an average of 24 inches or less to ensure adequate oxygen distribution. Partial effluent recirculation should be considered in the summer months to overcome evapotranspiration losses and to maintain design flow rates and oxygen levels.

FWS wetlands are very sensitive to temperature and typically require that water levels be increased during the winter to allow for ice formation and to increase the detention time to compensate for the reduced biological activity associated with lower water temperature.

FWS wetlands typically use an average organic loading rate of approximately 100 pounds BOD_5 per acre per day with a hydraulic loading rate of 20,000 gpd per acre and a detention time of 6 to 7 days. Shorter detention times do not provide adequate time for pollutant degradation to occur whereas longer detention times can lead to stagnant, anaerobic conditions. During the summertime, evapotranspiration can significantly increase the detention time, while ice formation in the winter can significantly decrease the detention time. Adjustable effluent weirs and effluent recirculation systems are therefore needed to control water depth, detention time and treatment efficiency.

SFS are essentially horizontal trickling filters using emergent plants with extensive root systems that develop within the filter media. The specific surface area of SFS wetlands is not as critical as the media porosity for predicting the required treatment unit size. SFS wetlands are usually configured as a trench or bed underlain with an impermeable layer of clay or a synthetic liner. The bed contains gravel or sand media that supports the growth of the emergent vegetation. The system is built with a slight (1 to 3 percent) grade using an inlet flow distributor and a variable height outlet structure. As the wastewater flows through the rhizosphere of the wetland plants, it is treated by filtration, sorption, microbial degradation and precipitation processes within the soil. Gravel planted emergent plant systems are able to remove significant levels of suspended solids, BOD_5 and nitrogen. Metals and phosphorus removal is limited by the adsorption sites provided by the soil media.

Oxygen is transmitted by the vegetation in SFS wetlands to the root treatment zone. In most cases the subsurface flow system is designed to maintain flow below the surface of the bed, so there can be very little direct atmospheric reaeration. Selection of plant species is therefore very important. Cattail roots are usually limited to the top 12 inches of the profile, while the roots of reeds and bulrushes can extend to depths of 24 to 30 inches.

Design Constraints

Constructed wetlands systems have potentially more points of contact with the environment and the public than conventional treatment and disposal facilities. Effluent monitoring is difficult and public access must be controlled with fencing. Constructed wetlands may also provide breeding grounds for insects and disease producing organisms and may generate odors. These are much greater concerns for FWS wetlands than for submerged systems.

The application of wastewater to a wetland system is controlled by the hydrology and ecosystem characteristics. Important factors that control the chemical and physical properties of the wetland substrate include the source and the quality of the influent water, velocity, flow rate, renewal rate and frequency of inundation. Constructed wetland treatment systems should be designed with long narrow channels with a manifold pipe and gate valves installed at the head of each channel to allow distribution to the preferred channels and wetland segments. Systems with recycle should be equipped with a pump station to return flow to the distribution system. Outlet structure controls must be able to control the depth of water in the wetlands especially for winter ice conditions where deeper wetland conditions are required to maintain treatment levels. An overflow should be installed for dispersion of excess flows and emergency diversions.

Precipitation, infiltration, evapotranspiration, hydraulic loading rate and water depth can all affect the removal of organics, nutrients and trace elements by altering the detention time within the wetland system and by diluting or concentrating the wastewater. Since changes in detention time or water volume can significantly affect the treatment performance, a seasonal hydrologic budget needs to be prepared prior to system design.

There are many geographic limitations of wetlands plant species. Aquatic plants such as water hyacinth (*Eichhornia crassipes*) have an extensive root system and rapid growth rate and are the most common wetland plant used in southern climates. Water hyacinths are sensitive to temperature and are rapidly killed by frost, thereby eliminating them from use in uncovered constructed wetland systems in northern states. Duckweed exhibits a lower sensitivity to cold climates but has a shallow root system and a sensitivity to wind. Emergent aquatic vegetation such as cattails (*Typha*), rushes (*Juncus*), bulrushes (*Scirpus*), reeds (*Phragmites*), and sedges (*Carex*) can tolerate freezing much better than aquatic plant systems and are thus more suited to use in northern climates.

Treatment Processes in Constructed Wetlands Systems

The basic functions that wetland treatment systems perform are the physical entrapment of pollutants through sorption in the surface soils and organic litter and utilization and transformation of elements by microorganisms. The basic treatment mechanisms include sedimentation, chemical precipitation and adsorption, and microbial interactions with BOD_5, suspended solids and nitrogen as well as some limited uptake by the vegetation. Very little of the actual treatment of the wastewater is completed by the aquatic plants. Their function is primarily to support bacterial components of the aquatic environment that provide treatment and to improve the capability and/or reliability of the microorganism environment through the transfer of oxygen to the root treatment zone.

Plant roots and stems in the water column provide surface on which bacteria grow and media for filtration and adsorption of solids. Bacteria attached to the plant stems and the humic deposits are the major factor for BOD_5 removal. Stems and leaves at or above the water surface attenuate sunlight and thus help to control the growth of algae and the formation of odors. Additionally, they reduce the effect of wind on the water and transfer gases to and from the submerged parts of the plant.

Nitrogen removal is accomplished in pond systems via plant or algal uptake, biological nitrification and denitrification and loss of ammonia gas to the atmosphere via evaporative stripping. Harvesting plant biomass is not generally regarded as a practical means of nutrient removal as it would need to be done early in the growing season and repeated often to prevent nutrient return. For free water systems, dry grasses are sometimes burned off annually to help maintain the hydraulic profile of the wetland and to avoid the formation of grassy hillocks which encourage channelization. Harvesting wetland vegetation is generally not needed for subsurface flow systems.

Phosphorus removal in wetlands and aquatic plant systems is not very effective and is limited by the contact opportunities with the soil. Dormant plants may release phosphorus during the winter. The principal mechanisms for phosphorus removal are plant uptake and retention in the soil. The exception is the submerged bed design using soils with significant amounts of clay and the presence of iron and aluminum that enhance the potential for phosphorus and metals removal. Use of these types of soils reduces the hydraulic conductivity and greatly increases the area needed for treatment.

Metals removal in constructed wetlands system is attributed to precipitation and adsorption. Chemical precipitation is enhanced by wetland metabolism, especially algal cells, which deplete dissolved carbon dioxide (CO_2) levels and raise the pH. There is limited opportunity for metals removal in FWS wetlands, with much greater opportunity for contact and sorption provided by SFS wetlands. The overall extent of phosphorus and metals removal in SFS wetlands will likely be finite due to exhaustion of exchange sites.

Pathogenic bacteria and viruses are removed through bacterial predation, sedimentation, absorption and die-off from unfavorable conditions including UV in sunlight and temperatures unfavorable for cell reproduction.

Use of Constructed Wetlands

Constructed wetlands may present a viable treatment alternative for the polishing of secondary WWTF effluent prior to discharge to a natural wetland system. A constructed wetland with a subsurface flow configuration would probably be the preferred arrangement, accomplishing a limited degree of metals removal while requiring the least amount of maintenance and exhibiting the greatest resiliency to temperature changes. This type of system should be capable of removing approximately 60 to 90 percent of the BOD_5 and suspended solids and 40 to 80 percent of the nitrogen typically contained in secondary treatment plant effluent. Although heavy metal removal rates in excess of 90 percent have been recorded through chemical precipitation and adsorption enhanced by biological metabolism in SFS wetlands, the overall extent of the metals removal will be limited by the adsorptive capacity of the soils. This adsorptive site limitation may ultimately require that the wetlands be periodically reconstructed with the metals laden soils disposed via landfill.

The major benefit of constructed wetlands is that they provide an additional cost effective treatment step, acting as a nutrient sink, reducing pathogens and providing a buffering zone to preserve and enhance the natural environment.

Providing this additional level of wastewater polishing may safely enable the treatment plant effluent to be ultimately discharged to natural wetlands or surface water systems. Table 2-13 shows the design assumptions for a medium sand, subsurface flow system wetland.

TABLE 2-13
DESIGN ASSUMPTIONS OF A MEDIUM SAND, SUBSURFACE FLOW SYSTEM WETLAND

Design Assumptions	
Flow Rate	200,000 gpd (757 m^3/d)
Influent BOD (C_o)	10 mg/l
Effluent BOD (C_o)	5 mg/l
Winter Temperature	3 degrees C
Summer Temperature	15 degrees C

The sizing of a constructed wetland filter is based on the reaction rate constant, the temperature and the degree of organic removal required by the system. Metals removal does not enter into the equation. Thus, a 200,000 gpd system intended to lower the BOD_5 from 10 mg/l to 5 mg/l will require a wetland system approximately 600 meters wide and 30 meters long (approximately 200,000 square feet: 2,000 feet wide by 100 feet long). Raising the influent BOD_5 to 20 mg/l or increasing the detention time to 5.5 days to promote more effective metals capture, will double the required size to approximately 400,000 square feet.

Metals removal is through adsorption onto the soil particles within the wetland system. These soils will need to be periodically excavated and disposed to rejuvenate the metals removal capabilities of the system and to prevent captured metals from being redissolved into the wastewater effluent. This maintenance process will most likely not be required more than once every 5 to 10 years. Table 2-14 shows the pros and cons of constructed wetland treatment systems.

TABLE 2-14
PROS AND CONS OF CONSTRUCTED WETLANDS TREATMENT SYSTEMS

Pros

In the right setting, constructed wetlands provide effective effluent polishing
Good for solids removal, BOD_5 reduction, pH neutralization and adsorption of metals
Can be relatively maintenance free
Environmentally appealing
Best suited as polishing prior to discharge to natural wetland or water body
Low energy requirements
Subsurface Flow System best suited for northern climates

Cons

Temperature sensitive
Very little experience in northern climates
More suited to warmer, drier climates
Requires extensive land area (approximately 20,000 gpd per acre)
Limited experience with metals removal
Maintenance requirements not well documented
Possibility of attracting mosquitoes and developing nuisance conditions

c. Wastewater Disposal Alternatives

As previously discussed, alternatives were presented for discharge of Tyngsborough's sewage to various facilities. In this section, the alternative of treating Tyngsborough's sewage at a local wastewater treatment facility rather than pumping it to a regional facility will be explored. The alternative will require a detailed look at process requirements, cost impacts, land requirements, structure sizing, treatment ability, etc.

In general, the treatment alternative consists of providing an appropriate level of sewerage treatment, which would allow treated effluent discharge within the borders of Tyngsborough. As such, the treatment technologies analyzed must be capable of producing an effluent, which meets DEP criteria. The following issues will be discussed in this section: (a) Effluent discharge options;

(b) Proposed effluent limitations; (c) Four general treatment categories: suspended growth biological process, fixed film biological processes, physical/chemical processes and natural systems processes; (d) Evaluation criteria; and (e) Potential Reuse Opportunities.

The treatment categories and technologies described in this section do not represent all of the treatment processes necessary, only the central processes, which accomplish most of the treatment needed to meet, proposed effluent limitations. It is assumed that all treatment technologies will need preliminary screening of large objects, grit removal and disinfection. The need for primary clarification will depend on the specific technology involved, but it is assumed that many will require it. These issues will be addressed in detail once the treatment technologies have been screened.

d. Effluent Discharge Options

Surface Water Discharges

The discharge of treated wastewater to surface waters was evaluated and rejected as an option for disposal in Tyngsborough due to not only stringent regulatory requirements but also, the lack of suitable surface waters within the Town of Tyngsborough boundaries. Surface waters also include wetland areas adjacent to streams and waterbodies. It is being presented in the following paragraphs only to address the opportunities and constraints associated with wastewater disposal.

This disposal option would involve the discharge of highly treated effluent from a treatment facility directly to a stream or wetland system. 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 along a pipeline.

The Merrimack River, Lake Massapoag, Mascuppic and Althea Lakes, Flint Pond, and Long Pond are the largest waterbodies in Town, which comprise approximately seven percent of Town. These waterbodies are primarily utilized for passive recreation and wildlife habitats. The portion of the Merrimack River that cuts through Tyngsborough is designated as a Class B waterway, which allows for the protection of aquatic life and wildlife, and for primary and secondary recreational use. Class B waters are designated as habitat for fish, other aquatic life, and wildlife, and for primary and secondary contact recreation. These waters are considered suitable as a source of public water supply if properly treated. Other uses of Class B waters include irrigation and agriculture, and for compatible industrial cooling and process uses. Several brooks transverse the Town including the Lawrence, Scarlet and Bridge Meadow. Flint Pond, Massapoag Pond and Lawrence Brook are listed in the State's 303 (d) list of impaired water bodies. In addition, Lawrence Brook was once stocked with trout and is now dead as a fish habitat.

The discharges of pollutants to surface waters is regulated by DEP under the Surface Water Discharge Permit Program (314 CMR 3.00) and the Massachusetts Clean Water Act (MGL c. 21, s. 26-53). The point source discharge of pollutants is regulated by the NPDES permit program administered by the EPA under Section 402 of the Clean Water Act. EPA is the lead agency in NPDES permitting using compliance with water quality standards set under the DEP state Surface Water Discharge Permit Program (314 CMR 3.00). The DEP cosigns the issued permit, if it is determined that water quality standards will be met, a 401 Water Quality Certificate is issued.

The Surface Water Discharge and NPDES Permit Program have been established to, limit or prohibit, discharges of pollutants to surface waters to assure that surface water quality standards of receiving waters are protected, maintained or attained. The antidegradation provision of the Surface Water Quality Standards (314 CMR 4.04) requires that in all cases existing uses shall be maintained and protected.

The effluent parameter of concern for a surface water discharge is phosphorus, which, even at relatively low concentrations, can increase the growth of aquatic plants, and produce algal blooms. Such conditions reduce the aesthetic and recreational utility of receiving waters. Lakes, ponds, and small or slow moving streams are most sensitive to increases in phosphorus and other nutrient loadings, due to their low flow through rates. Table 2-15 outlines the minimum criteria for Class B waters, the anticipated designation of receiving waters, as well as additional minimum criteria for surface waters.

One option that could potentially enable a city or town to successfully permit a surface water discharge is the use of "watershed-based trading". This concept, which is detailed in EPA publication entitled "Draft Framework for Watershed-Based Trading" (May 1996) allows for the introduction of pollutants and/or nutrients into a water basin provided that an equal or larger amount of the same parameters are removed by another means. For example an increase of 100 pounds per year in the phosphorus discharge into a river from a WWTF may be allowed if more than 100 pounds can be removed by means of improvements in the storm drainage system which discharges into the same river, or a reduction of the use of fertilizers within the drainage area. There are several criteria; that must be met for approval of this concept.

Due to their uses and classifications, none of the surface waters in Town are considered usable for a surface water discharge.

Groundwater Discharges

The discharge of treated wastewater to groundwater is being evaluated as an option for disposal in Tyngsborough. This disposal option would involve the discharge of highly treated effluent from a wastewater treatment facility into an infiltration bed designed to handle the estimated discharge. 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 along a pipeline to the infiltration 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. Potential sites for use as a groundwater disposal site must be comprised of sandy or gravely soils that exhibit medium

TABLE 2-15
SUMMARY OF WATER QUALITY CRITERIA FOR CLASS B WATERS

Class B Waters (Minimum Criteria)	Description
Dissolved Oxygen	Shall not be less than 6.0 mg/l in cold water fisheries and 5.0 mg/l in warm water fisheries
Temperature	Shall not exceed 68 degree F in cold water fisheries and 83 degree F in warm water fisheries
pH	Shall be in a range of 6.5 to 8.3 standard units and not more than 0.5 units outside of the background range
Fecal Coliform Bacteria	Shall not exceed the geometric mean of 200 organisms per 100 ml, not shall mare than 10 percent of samples exceed 400 organisms per 100 ml
Solids	Free from floating, suspended and settleable solids
Color and Turbidity	Free from color and turbidity in concentrations or combinations that are objectionable
Oil and Grease	Free from oil, grease and petrochemicals that produce a visible film on the surface of the water, impart an oily taste
Taste and Odor	None in such concentrations or combinations that are aesthetically objectionable
Additional Minimum Criteria for All Surface Waters	All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits, float as debris, scum or other matter to form nuisances
Bottom Pollutants or Alterations	All surface waters shall be free from pollutants in concentrations or combinations, or from alterations that adversely effect the physical or chemical nature of the bottom
Nutrients	Shall not exceed site-specific limits necessary to control accelerated growth of algae and other plants.
Radioactivity	Free from radio-active substances in concentration or combinations that would be harmful
Toxic Pollutants	Free from pollutants in concentrations or combinations toxic to humans, aquatic life or wildlife

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 or mounding the infiltration beds. This approach may be infeasible for larger systems designed for large wastewater flows but may be appropriate for small systems.

The most difficult of these physical constraints to overcome is the shallow depth to bedrock. Title 5 requires that 4 feet of naturally occurring pervious material be located beneath the bottom of the leaching facility. In areas where bedrock is 4 feet or less from the natural ground surface, a system cannot be installed in accordance with Title 5. Soils with slight or moderate limitations for wastewater disposal are considered acceptable for effluent beds. The groundwater discharge options within Tyngsborough are also restricted by discharge standards that prohibit anti-degradation.

The soils of Tyngsborough are generally sloping, thin and rocky, with parts west of the Merrimack River having higher elevations and steeper slopes. This is clearly shown on the soils maps contained in the Middlesex County Soil Survey Report by the U.S. Department of Agriculture. The most predominant types of soils found in Tyngsborough fall into the Charlton/Hollis Rock, Hinkley, Merrimac, Windsor, Paxton, Canton and Scituate associations. Freetown Mucks are found in wetlands and along waterways. Generally, Tyngsborough's soil is composed of rocky unsorted loam deposited on top of hardpan. The soils are poorly sorted and are not agriculturally significant due to their rocky nature. Hardpan is firmly packed fine loamy sand, and the soil above the hardpan has good drainage characteristics, but the underlying hardpan is much less permeable. Due to the thickness of the soil the amount of water it can contain is limited. Drainage and absorption problems can arise from saturation of the soil layer due to the topography and the amount of precipitation.

Soils that drain poorly and/or have a high water table may restrict future development options for a parcel of land due to an inability to provide on-site wastewater disposal or support structures, or due to other environmental constraints such as wetland resources. Soils will continue to be a development constraint for those areas of Tyngsborough without suitable soils for a conventional Title 5 system.

Soil types with restraints on their use for on-site subsurface wastewater disposal systems are located throughout the general Town border. The bulk of the soils in Tyngsborough are very conducive for on-site wastewater disposal based on areas where zoning requires over ½ acre, using standards in the Middlesex County Soil Survey Report by the U.S. Department of Agriculture. This is particularly true for most of the western portion of Town where lot sizes are over ½ acre and development is less dense.

Proposed Effluent Limitations

Effluent limitations are dependent upon the method and location of treated effluent discharge. As discussed above, there are two ultimate effluent discharge options: surface water and groundwater discharge. A surface water discharge would involve discharging treated effluent to a stream, pond, lake or wetland area. A groundwater discharge would involve the discharge of treated effluent to the ground and percolation through the soil to the groundwater. Groundwater discharge can be accomplished by discharging the treated effluent to rapid infiltration sand basins; using spray irrigation or overland discharge; or to subsurface disposal beds similar to Title 5 on-site disposal systems. Another groundwater discharge method would be to utilize subsurface injection through wells.

The requirements for groundwater discharges can be found in 314 CMR 5.00. According to these regulations, the minimum effluent limitations for a Tyngsborough treatment facility are shown in Table 2-16.

TABLE 2-16
PROPOSED EFFLUENT LIMITATIONS

Parameter	Open Beds Proposed Limits[1]	Subsurface/Spray Irrigation Proposed Limits[2]
Biochemical Oxygen Demand (BOD_5)	30 mg/l	10 mg/l
Total Suspended solids (TSS)	30 mg/l	10 mg/l
Total Nitrogen	10 mg/l	<10 mg/l
Fecal Coliform	200 mpn/100 ml	200 mpn/100 ml
Oil and Grease	15 mg/l	15 mg/l

[1] 314 CMR 5.00

[2] Proposed limits for subsurface disposal to prevent plugging of disposal area and to eliminate the need for a reserve area.

Note: mg/l = milligrams per liter; mpn/100 ml = most probable number per 100 milliliters

Although DEP supports the discharge of highly treated wastewater to the groundwater, it prefers that this type of discharge only be located within a Zone II of a public water supply well if no other suitable site is available. However, the DEP's opinion is that a properly planned and sited discharge that has received a high level of treatment can be sited in a Zone II and still be protective of the environment and public health.

Based on the Interim Guidance on Reclaimed Water Use issued by DEP (Draft, September 1, 1998), new discharges from WWTFs within aquifer recharge areas (Zone IIs) must meet the discharge and treatment standards as shown in Table 2-17. These standards apply to the reclaimed water at the point of discharge from the treatment facility, unless otherwise noted. Siting a wastewater disposal site within a Zone II is normally a prohibited use unless all other feasible alternatives have been explored.

TABLE 2-17
GROUNDWATER PERMIT STANDARDS

Parameter	Standard
pH	6 to 9
BOD	≤ 10 mg/l or ≤ 30 mg/l
Turbidity	≤ 2 NTU or ≤ 5 NTU
Fecal Coliform	Median of 0 colonies/100 ml over continuous, running 7 day sampling periods, not to exceed 14/100 ml or 200 colonies/100 ml
TSS	5 mg/l or 10 mg/l
Total Nitrogen	< 10 mg/l

e. Beneficial Reuse

Beneficial reuse of wastewater typically is associated with the application and reuse of water for irrigation. In this context, reuse also applies to discharging treated wastewater into the ground to recharge the aquifer used for supplying drinking water. The technology exists; through the use of, micro-filtration and membrane technologies, if necessary, to produce very clean effluent to meet most reuse needs.

Reuse of the wastewater effluent as seasonal irrigation at the municipal golf course could reduce water use at the course and as well as, minimize the summer loadings to adjacent waterbodies during the critical spring-to-fall growing season. This irrigation reuse is considered a secondary disposal option since a permanent effluent disposal solution will still be required in the off months when the golf course is not operating.

The Massachusetts DEP has developed interim guidance describing how the use of reclaimed water will initially be regulated. The DEP has initially limited the use of reclaimed water to spray irrigating golf courses, landscaping, artificially recharging aquifers and toilet flushing. The artificial recharging of aquifers shall be permitted only in basins, sub-basins and watersheds acknowledged to be stressed water resource areas where it is necessary to replenish stream flow, enhance the productivity and capacity of an aquifer, and/or improve upon or mitigate water quality problems. The water quality criteria for the treated wastewater is extremely rigorous, requiring that reclaimed water be virtually pathogen and contaminant free.

WWTFs constructed to deliver reclaimed water must not only demonstrate the ability to consistently meet the rigorous water quality standards, but are also required to have an alternate effluent disposal option available that can be employed immediately if the reclaimed water criteria are not met. Best management practices aimed at minimizing direct human exposure are also required for all projects employing reclaimed water.

The technology exists, through the use of, micro-filtration (Zenon Process) and membrane technologies (Membrane Bioreactor), an emerging technology that combines an activated sludge reactor with a membrane filtration unit, to produce very clean effluent to meet most reuse needs. The end result is; an effluent that is similar to the one that is produced by a process train consisting of secondary treatment followed by tertiary treatment and advanced treatment with disinfection. The MBR process essentially eliminates the tertiary treatment step and produces an effluent considered suitable for aquifer recharge and beneficial reuse applications.

The level of wastewater treatment required, and the institutional management practices to be employed, is dependent on the level of public exposure and environmental sensitivity. The *Interim Guidelines on Reclaimed Water (Revised)*, dated January 2, 2000, are intended to be a dynamic working guidance for reclaimed water projects and provide the water quality criteria, sampling frequency and public awareness requirements for these types of projects.

Reuse projects that involve the use of reclaimed water for drip or spray irrigation, injection into the subsurface or spreading on the land surface are required to obtain a Groundwater Discharge Permit. Until the Groundwater Discharge

Permit regulations are updated, all permits issued for reclaimed water projects are required to contain conditions incorporating the applicable standards for Urban Reuse, Discharge of Treated Wastewater into a Zone II of a Community Water System or Toilet Flushing as set forth in the Interim Guidance.

The reclaimed water can be used either by the WWTF that generates the reclaimed water, or by another party that contracts with the WWTF for a supply of reclaimed water. If it is to be used by another party, there must be binding agreements incorporated by reference into the Permit to ensure that construction, operation, maintenance and monitoring of the reclaimed water use meet the requirements of the Groundwater Discharge Permit and the Interim Guidance. As the Permittee, the WWTF owner remains accountable to the DEP for all violations of the permit or binding agreement including failure of the wastewater reuser to comply with the binding agreement.

As discussed previously, typically treated effluent is discharged either to a surface water body or to the ground with percolation through the soil to the groundwater. A third option, discussed in this section, is to reuse the wastewater for non-potable needs. Some communities, throughout the United States, have adopted policies on wastewater reuse in an effort to conserve valuable water resources and provide a means for the disposal of treated effluent.

A properly developed wastewater reclamation program can provide valuable benefits to both the municipality and the water/wastewater system users. Fee structures can be developed whereby consumers pay a flat fee or no fee at all for unlimited use of reclaimed wastewater for lawn irrigation and other non-potable uses. If such a structure includes fees based on usage for potable water, consumers can realize an economic benefit by using reclaimed wastewater for irrigation purposes rather than potable water. Such a pricing scheme would also encourage water conservation. The agricultural, industrial, and commercial consumers can realize similar economic benefits. With proper treatment, reclaimed wastewater demonstrates few health risks, while providing the community with a solution to their wastewater disposal problem.

The Water Environment Federation explored water reuse issues at their Annual Conference and Exposition in October 1998. Specifically, water reuse innovations and alternatives were presented as they applied to numerous Florida communities. Such technologies include water reuse for landscaping, agricultural uses, and fire protection. Following is a discussion of these alternatives, and commercial/industrial water reuse applications as they may be applied to the town of Tyngsborough.

Landscaping

Reclaimed wastewater has been successfully used as irrigation water for residential, commercial, and industrial applications. Reclaimed water has several advantages over the use of potable water for irrigation. In St. Petersburg, Florida, it was shown that the application of 1½ inches of reclaimed water per week provided approximately 50 percent of the nitrogen, phosphorus, and potassium requirements for horticultural and agricultural purposes. This resulted in reduced fertilizing costs to the consumer. A study completed by St. Petersburg indicated that when chloride levels in the reclaimed wastewater were kept below 400 mg/l, plants being irrigated with reclaimed water showed significantly more growth than those plants irrigated with water from the city's potable water system.

Agricultural Uses

The City of Orlando, Florida has achieved success in wastewater reuse through the implementation of Water Conserv II, a comprehensive program whereby water is reused in agricultural irrigation systems and aquifer recharge. In areas with a significant agricultural industry, wastewater reuse can substantially reduce the amount of wastewater to be disposed of by traditional surface or subsurface application procedures. Depending on demand, reclaimed wastewater can be given to agricultural consumers free of charge or for a nominal fee, thereby providing an incentive to farmers by decreasing costs and providing an alternative for wastewater disposal. Benefits from the nutrient enriched reclaimed wastewater are similar to those cited for wastewater reuse for landscaping purposes.

Fire Protection

The use of reclaimed wastewater for fire protection involves unique construction, permitting, and regulatory limitations. For such a system to be developed, the town of Tyngsborough would have to work closely with local, state, and federal environmental and regulatory groups to develop a policy for the design of a facility utilizing reclaimed wastewater in its fire protection system. Initial design considerations would include delineating the potential uses of the facility for which the fire protection system is being designed (food preparation, retail outlet, industrial, etc.), examining construction constraints, and addressing regulatory concerns (for example, would building occupants be required to sign an agreement prohibiting them from salvaging certain items in the event of a fire). Development of this alternative could require substantial investment of time and resources, as this technology is relatively new.

Commercial/Industrial Uses

Commercial/Industrial consumers can use reclaimed wastewater for process water and other non-potable applications within their facilities and for irrigation outside their facilities as described above. Commercial/Industrial consumers could also prove instrumental in the implementation of reclaimed wastewater in fire protection systems. The specific nature of any given industrial application would require that the industrial water reuse program be tailored to meet the specific needs of each facility.

Health concerns of the public will need to be addressed to promote acceptance of a reclaimed wastewater system. St. Petersburg, Florida, has had no reported cases of illness or disease resulting from the use of reclaimed water since the inception of their reuse program in the 1970s. This fact is significant in that homeowners have control over their use of reclaimed water, and many of the residents of St. Petersburg are elderly and thus more susceptible to disease. The specific health risks associated with the wastewater produced in the Town of Tyngsborough would have to be studied and addressed as part of the development of a wastewater reclamation program.

The drawbacks of reclaimed water use can be mitigated through careful planning. If demand is anticipated to exceed supply, the Town may consider installing metering devices and developing a rate structure so that usage can be monitored and controlled. The Town would need to develop the rate structure in conjunction with the potable water rate structure to ensure that incentives are still present to encourage consumers to use reclaimed wastewater for their non-potable water needs. Should the supply of reusable water exceed the demand, the Town would have to implement other wastewater disposal alternatives to supplement reuse activities. Consumers would have to be educated as to the benefits and proper use of a reclaimed wastewater system. For example, use of reclaimed water is not recommended for car washing, as the high mineral content in the wastewater will leave a mineral deposit on vehicles. Such educational objectives could be included in the water conservation plan. Finally, construction costs must be minimized. Installing a new reclaimed wastewater distribution system in an area can be quite costly due to restoration costs associated with installing the necessary piping. However, if construction is coordinated with other projects, such as the construction of a wastewater collection system, economic benefits could be realized. If such construction activities can be coordinated, it may make economic sense to install dry lines in areas of new development to accommodate the reclaimed water supply when it becomes available.

Required Land Areas

The land area required for each alternative is the sum of the area required for the actual treatment facility and the area required for effluent disposal. The land area required for the actual facility is dependent upon the size of the treatment facility as well as the treatment technology chosen. As this is a highly variable parameter, it will be discussed in general in the following subsection (Treatment Technologies and Evaluation Criteria) as it relates to the specific technologies and will be defined more precisely in the screening process and subsequent detailed analyses of the prospective alternatives.

Land areas required for effluent disposal are dependent upon the soil characteristics of the site and the method of disposal. Effluent disposal can be achieved through surface or subsurface application. Table 2-18 and Table 2-19 include approximate land area requirements for surface and subsurface disposal assuming a percolation rate of 5 to 10 minutes per inch and an application rate of 4 and 2.5 gpd per square feet, respectively.

These areas will have to be tailored to the specific facility and site once screening is complete and soil characteristics have been determined.

TABLE 2-18
AREA REQUIRED FOR SURFACE APPLICATION OF TREATED EFFLUENT

Surface Application (Open Sand Beds) Application Rate: 4 gpd/ft^2*						
Average Daily Flow	Leaching Area		Reserve Area		Total Area	
gpd	ft^2	Acres	ft^2	Acres	ft^2	Acres
200,000	50,000	1.15	50,000	1.15	100,000	2.30
400,000	100,000	2.30	100,000	2.30	200,000	4.59
600,000	150,000	3.44	150,000	3.44	300,000	6.89
800,000	200,000	4.59	200,000	4.59	400,000	9.18
1,000,000	250,000	5.74	250,000	5.74	500,000	11.48

* Based on recommendations in the “Guidelines for the Design, Construction, Operation, and Maintenance of Small Sewage Treatment Facilities with Land Disposal.”

TABLE 2-19
AREA REQUIRED FOR SUBSURFACE APPLICATION OF TREATED EFFLUENT

Subsurface Application (Leaching Trenches) Application Rate: 2.5 gpd/ft² [1]						
Average Daily Flow	Leaching Area		Reserve Area[2]		Total Area	
gpd	ft^2	Acres	ft^2	Acres	ft^2	Acres
200,000	44,600	1.02	133,200	3.06	177,800	4.08
400,000	89,000	2.04	266,400	6.12	355,400	8.16
600,000	133,400	3.06	399,600	9.17	533,000	12.23
800,000	177,800	4.08	532,800	12.23	710,600	16.31
1,000,000	222,400	5.11	666,600	15.30	889,000	20.41

[1] Based on recommendations in the "Guidelines for the Design, Construction, Operation, and Maintenance of Small Sewage Treatment Facilities with Land Disposal.

[2] According to the "Guidelines," the area between the leaching facilities can be used as the reserve area.

f. Wastewater Treatment Alternatives

Selection of a wastewater treatment technology is based on technical, environmental, institutional and economic factors. The 14 wastewater treatment technologies being considered for the town of Tyngsborough are discussed herein. In order to determine which technologies are best suited to the needs of this project, the technologies have been screened. Screening is defined as applying on the technical, environmental, institutional and economic factors certain criteria to eliminate less feasible treatment technologies. The overall purpose of screening is to reduce the total number of alternatives to a short list of the best treatment options. The best treatment options will have the most favorable impacts applying the following general criteria listed below.

Technical Factors

Technical factors are related to physical and engineering issues. Such issues considered under this criterion are:

- Flow and Loading: In order to provide greater flexibility in the operation of the facility, treatment technologies which cannot deal with variable flow and loading are screened out;

- Land/Site Requirements: Land/Site requirements for the treatment technologies are compared against land available;

- Suitability for groundwater Discharge: Due to the fact that Zone IIs are where the suitable soil limitations are located, the treatment technologies must be able to produce an effluent suitable for groundwater discharge into a Zone II;

- Climate: The treatment technology must be able to function in Tyngsborough's climate;

- Sludge Disposal: The treatment technology must be capable of producing a sludge which can be incorporated into long-term sludge disposal plan; and

- Ease of Operation: The treatment technology must not require specialized staff.

Environmental Factors

The treatment technologies under consideration all require a discharge of treated wastewater effluent which can not adversely impact the environment and permit process. The principal environmental factors are associated with the treated wastewater discharge to the environment. The evaluation centers on the impact the discharge will have on surface and/or groundwater quality, aquifer recharge/stream flow maintenance, and habitat.

Institutional Factors

Institutional factors are those related to community acceptance, regulatory and legal issues. These issues are further described as follows:

- Community Acceptance Issues: Human environmental issues which may be a concern. The potential for objectionable odors must be considered when siting a facility;

- Regulatory Issues: The treatment technology must be able to meet requirements imposed by federal, state and local regulatory agencies such as groundwater discharge permit, surface water discharge permit, environmental permits, and other requirements; and

- Legal Issues: The treatment technology must comply with all applicable laws.

Economic factors

The last screening criterion evaluated is economic factors. Economic factors consist of the cost to design, construct, and operate the treatment technology, and the ability of the Town to pay for it. Because of aesthetics and odor control concerns, satellite facilities may have to be covered or enclosed in a building. Therefore a technology, which will allow for a compact process and a small footprint would be required which may eliminate certain other technologies.

Summary

Based on the above, the following four wastewater treatment technologies are considered the most favorable: (a) Anaerobic/Anoxic Systems; (b) Constructed Wetlands; (c) Rotating Biological Contactors; and (d) Sequencing Batch Reactors. Refer to Table 2-20.

TABLE 2-20
WASTEWATER TREATMENT TECHNOLOGIES SCREENING MATRIX

Treatment Technology	Technical Factors						Environmental Factors		Institutional Factors			Economic Factors		Total Favorable Impacts
	Flow and Loading	Land/Site Requirements	Land Disposal	Climate	Sludge Disposal	Ease of Operation	Groundwater	Permitting	Acceptance	Regulatory	Legal	Construction	Operation	
Suspended Growth Biological Processes														
CAS/Extended Aeration		X		X		X			X			X		5
Pure Oxygen Activated Sludge		X		X						X	X	X	X	6
Sequencing Batch Reactors	X	X	X	X	X	X	X			X	X	X	X	11
Oxidation Ditch					X	X								2
A/O Systems		X	X	X	X		X	X	X	X	X	X		10
Fixed Film Biological Processes														
Rotating Biological Contactors	X	X	X	X	X	X	X	X		X	X	X	X	12
Trickling Filters	X	X			X	X							X	5
Activated Biofilters	X	X			X	X							X	5
Physical/Chemical Processes														
Chemical Coagulation		X		X					X					3
Granular Activated Carbon		X		X					X					3
Zimpro PACT		X		X					X					3
Natural System Processes														
Aquaculture	X				X	X			X		X		X	6
Constructed Wetlands	X				X	X		X	X	X	X		X	8
Solar Aquatics	X				X	X			X		X		X	6

5. Residuals Disposal and Reuse

a. General

In this section, technologies are reviewed for possible application in meeting the town of Tyngsborough's sludge management needs if a local wastewater treatment facility is constructed within the borders of Tyngsborough. A description of each technology option is presented, focusing on the process, products and/or sidestreams, relative advantages and disadvantages. Some of these, such as dewatered sludge landfilling, are, considered to be, "disposal" technologies because sludge, as a waste material, is being disposed. Others are often referred to as "beneficial-use" technologies because they result in a product form of sludge that can be recycled for beneficial purposes. For example, composting processes sludge into humus-like material that contains plant nutrients and is an excellent soil conditioner. Some technologies, such as incineration, have both disposal and beneficial aspects. Ash, the end product of incineration, is usually disposed in a landfill. However, heat produced during combustion can also be recovered and is sometimes used to generate electricity. Methane recovery from sludge digestion will not be considered since it would only be provided with anaerobic digestion facilities. These facilities are typically not economical for smaller wastewater treatment facilities with flows less than 5.0 mgd.

b. Incineration with Ash Landfilling

Incineration reduces sludge to ash and gases, decreasing the volume for disposal by approximately 95 percent. Sludge ash is a sterile, inorganic, non-odorous powdery material that is typically conditioned with water to minimize blow-away during handling and landfilling. Incineration exhaust gas contains pollutants that must be treated with emissions control equipment prior to release to the atmosphere.

Federal and state regulations govern both ash handling and air pollution controls. The ash must meet the standards set forth in the Resource Conservation and Recovery Act (RCRA) toxicity characteristic leaching procedure (TCLP) prior to landfilling. Exhaust gases must meet federal New Source Performance Standards (NSPS), National Emissions Standards for Hazardous Air Pollutants (NESHAP) and the 40 CFR Part 503 regulations with respect to emissions of hazardous air pollutants, plume capacity and flue gas temperature and oxygen content.

Advantages of incineration as a sludge management technology are that it is a well-established and proven technology; the resultant ash is sterile and odor-free and requires minimal landfill volume; large quantities can be processed and disposed of on a continuous basis; and storage and transport requirements are minimal.

Disadvantages are that: it is a relatively complex technology requiring skilled operators; capital and operating costs, including costs for emission control, are high; and two sidestreams are produced, ash and emissions, which require additional treatment and handling. Odor production is often associated with the use of this technology due to the relatively low temperature combustion practiced at many existing incinerator facilities. However, combustion at high temperatures will be required to comply with future emissions standards that should largely eliminate odor releases.

c. Heat-Drying with Distribution and Marketing

Heat-drying is a beneficial-use technology, which uses heat from either flue gases or steam heat exchangers to evaporate moisture from dewatered sludge and produce an organic fertilizer/soil conditioner for distribution and marketing. A sidestream of exhaust gases is also produced which must be treated by emissions control equipment before discharge to the atmosphere.

Both the heat-dried product and the emissions resulting from the process are subject to Federal and State regulations relating to land application of sludge. The federal NSPS, the NESHAP, 40 CRF Part 503 regulations, and state regulations would regulate the release of exhaust gases from heat-drying.

The main advantage of heat-drying is that it produces a beneficial, marketable product, which is less bulky and potentially more valuable than compost because of its higher nutrient content. Thus, transportation to more distant markets is sometimes practical. In addition to local marketing of the product, it can be distributed through brokers to large users such as citrus growers and tree farmers. Heat-dried product can be used as a substitute for chemical fertilizers and has numerous landscaping and horticultural applications.

Disadvantages are that it is a relatively complex and expensive technology that requires skilled operators, strict emissions/odor control, and efficient storage/handling/and marketing of a product with primarily a seasonal demand. Another factor to consider is competition from heat-dried products produced outside of the town of Tyngsborough (e.g. Boston, New York City and possibly some other communities that formerly relied on ocean dumping).

d. Composting with Distribution and Marketing

Composting is a beneficial-use technology that accelerates the biological decomposition of dewatered sludge through aeration and the addition of volatile organic material to produce a humus-like soil conditioner for distribution and marketing. The composting process generates two sidestreams that require treatment: a liquid sidestream consisting of condensate and leachate and an exhaust air sidestream, which must be treated with odor control equipment.

Compost can be marketed to various industries and users. Compost can be used for the following:

- Greenhouse, Nursery, and Turfgrass Use: To provide a growing medium and soil amendment in a mix with other media for potting non-food chain plants, for growing and transplanting nursery stock, and for soil enhancement prior to new seeding and maintenance.

- Golf Courses and Landscaping: To provide organic matter during maintenance and fertilizing of the grasses, and as a soil amendment.

- Landfills: As an amendment to soil used for final cover material and for subsequent slope management.

- Topsoil and Land Reclamation: As a soil amendment to improve the growing ability, nutrient content, and water retention of poor, sandy, gravel type soils.

The main advantages of composting are the relative simplicity of the technology, the fact that it produces a beneficial and marketable product from sludge waste, and that it can aid in meeting solid waste management needs by utilizing tree trimmings and other yard wastes in the sludge composting process.

Disadvantages include potential difficulties with odor control, dependence on a successful marketing and distribution program, and substantial storage/handling requirements for a bulky product with a primarily seasonal demand. Additional factors to consider in the town of Tyngsborough area include availability of suitable land for compost application and competition for a limited market.

e. Alkaline Stabilization

Alkaline stabilization is a beneficial-use technology which uses exothermic (heat producing) reactions resulting from mixing alkaline materials with dewatered sludge to evaporate moisture and kill pathogens and odor-causing bacteria, while fixating (chemically binding) metals to produce an organic soil conditioner/soil substitute. Alkaline-stabilized sludge can be used for agricultural, landscaping, and land reclamation purposes. Alkaline stabilized sludge is different than compost. The chief difference is that it has much higher inert solids content due to the chemicals added during processing.

The main advantages of alkaline stabilization are that it is a relatively simple technology and that it produces a usable material without generating sidestreams. Disadvantages are the need for a continuous supply of alkaline material, substantial storage and handling requirements, and reliance on dependable outlets for product distribution.

f. Agricultural or Non-Agricultural Land Application

Land application is a beneficial-use technology in which liquid or dewatered sludge is applied directly to the land to promote agricultural or non-agricultural plant growth. Land application can also be a sludge disposal technology, when sludge is applied at higher than agronomic rates to dedicated sites. Land-applied sludge is usually pretreated for pathogen reduction and stabilized by lime conditioning or aerobic or anaerobic digestion. If the sludge is applied properly, potential sidestream problems (i.e. odors, surface run-off, leachate) can be averted.

Advantages of land application are that it is a simple technology based on beneficial-use and little capital investment is required. Disadvantages are that: large usable land areas must be available; operation is weather- and season-dependent, necessitating provisions for sludge storage; and careful application and monitoring are required to control problems with odors, surface runoff, and leachate.

g. Dewatered Sludge Landfilling (Monofilling)

Monofilling is the disposal of sludge by burial in a dedicated sanitary landfill. Preprocessing typically consists of dewatering and may include anaerobic digestion or chemical treatment for stabilization. Proper design and operation is required to control leachate, volatile organics emissions, and methane gas seepage.

The RCRA TCLP regulates landfilling of dewatered sludge, 40 CFR Part 257 requirements for landfills, and by state regulations governing landfilling. Sludges rarely fail the TCLP test and so are usually classified as non-hazardous.

Advantages of monofilling include simple operation, minimal processing, and low costs. The overwhelming disadvantage is the need for suitable landfill sites to place the dewatered sludge.

h. Co-Disposal

Co-disposal is the treatment and/or disposal of sludge in conjunction with municipal solid waste (MSW). Possibilities include co-incineration, co-composting, and landfill co-disposal.

While co-incineration has been successfully practiced in other countries, there are only two large-scale operations in the United States – one located in the Western Connecticut region at Stamford, the other in Duluth, Minnesota. Western Connecticut also has a very small co-incinerator located in New Canaan. Typically, dry sludge solids are burned at a rate of 1 dry pound for every 5 to 8 pounds of MSW; the Stamford facility operates at a 1 to 20 ratio.

Advantages of co-incineration are the reduction in combined costs of incinerating Sludge and MSW separately and the process efficiency that allows complete burning of both materials without the use of auxiliary fossil fuels (and provides an excess of heat for steam generation if desired). Disadvantages are the dependence on a supply of MSW and coordination of sludge quantities with MSW quantities during the co-incineration process.

Co-composting sewage sludge with MSW is a co-treatment technology which has had limited acceptance in the United States in the past, but is beginning to receive interest. The process requires presorting and pulverization of MSW before mixing it with liquid sludge containing 5 to 12 percent solids. A 2 to 1 ratio of solid wastes to sludge is the recommended minimum. Although beneficial product results, the quality of the compost is inconsistent and generally inferior to compost made from sewage sludge alone.

The most common co-disposal practice is sanitary landfilling, which is advantageous because of the complimentary absorption characteristics of the solid waste and the soil conditioning characteristics of the sludge.

Co-disposal costs are typically lower than the costs of a dedicated sludge landfill due to the economy of scale. Disadvantages of utilizing a co-disposal site include operational problems associated with mixing refuse and sludge, increased leachate and odor potential, and site capacity concerns.

i. Contract Disposal Alternatives

An alternative to the town of Tyngsborough disposing of its own sludge is to have the material transported to a private contract disposal facility. The sludge could be transported in cake form, with a dump truck or a container truck using watertight bodies. Dump trucks typically have a normal capacity of approximately 12 cubic yards, though smaller and larger sizes are available. Container capacities typically average approximately 30 cubic yards, though smaller and larger sizes are also available. Containers can be custom made in different sizes, shapes, and dumping configurations to suit the needs of a specific location.

The sludge could also be thickened and pumped into a tank truck in liquid form for disposal at a facility that accepts liquid sludge. The liquid sludge is transported in tank trucks that typically hold approximately 6,500 gallons (though smaller and larger capacities are available).

Various facilities are available throughout the New England area. Wastestream Environmental (WSE), with facilities located in Fitchburg, Upper Blackstone, Mattabassett, and Hartford; New England Treatment Company (NETCO), located in Woonsocket, Rhode Island; Waste Management, Inc. in Rochester, New Hampshire; and Naugatuck Treatment Company in Naugatuck, Connecticut are all contract disposal facilities in the New England region. Costs at these facilities depend on how the sludge is transported (in liquid or solid form), and the sludge has to meet various criteria established by each facility. The cost will be dependent on the specific characteristics of the sludge, but typically range from $0.10 to $0.20 per gallon for liquid sludge and $90 to $100 per wet ton for dewatered sludge. This fee typically covers the tipping fee at the facility and the transportation costs.

j. Innovative Technologies

"Innovative technologies" is the generic term applied to a range of unconventional sludge disposal technologies. In general, these technologies have been demonstrated on a pilot scale or small facility basis, but have not seen widespread use. End products range from a compost-like material to a concrete aggregate substitute.

The following technologies are some of the more widely known, if not widely practiced, innovative technologies.

Aggregate Production

This type of process is available in various forms and is generally similar to conventional incineration in that sludge volatiles are burned, leaving only the inert fraction. In one of the process variations, sludge is burned in a special furnace at very high temperatures to induce slag formation. Instead of ash, liquid slag is removed from the bottom of the furnace and dropped into a quenching medium, such as water, forming a stable, fused, glassy solid, suitable for reuse as aggregate. This process is being marketed by World Envirotech, and is used at a wastewater facility in Monticello, New York.

Earthworm Conversion, or Vermiculture

This is a stabilization process by which earthworms consume the organic material in municipal wastewater sludge. The product of vermiculture (i.e., the worm castings) may be used as a soil conditioner, similar to compost. This technology is still in the experimental stage. There are no significant facilities in the United States.

Fuel from Sludge

The conversion of sludge solids to oil and char under pressure has been proven technically feasible under laboratory conditions. However, commercialization and scale-up have been estimated to be prohibitively expensive.

Deep Well Oxidation

This process uses conventional oil well drilling technology to position an annular reactor in a vertical position up to one mile below grade. The process takes advantage of the great hydraulic head generated by the liquid column, along with the application of head and oxygen, to oxidize the sludge organics. A small prototype facility was constructed and operated with mixed results in Longmont, Colorado early in the 1980s. Privatized facilities using modifications to the original concept are under evaluation in Houston and Detroit. Chief disadvantages of the process are corrosion or scaling of the reactor surfaces and generation of a side stream with a high soluble organics content that requires additional treatment. The main advantages are the generation of a relatively inert ash-like product, and low land area requirement.

As with the conventional technologies described previously, any innovative technology would also be subject to corresponding federal and state regulations governing processing and distribution. For example, the aggregate production process would be regulated in a manner similar to incineration, focusing on air quality impacts.

Each of the innovative technologies described above has its unique advantages. For example, the aggregate production process solves the problem of ash disposal resulting from conventional incineration, assuming a market for the aggregate material is found.

The major disadvantage of all innovative technologies is that they are untried and unproven on a large scale in the United States. High costs and operational problems are generally incurred in operating a facility based upon a new unproven process. A prime example of this is the difficulties experienced by the city of Los Angeles with its innovative oil-based sludge drying system used at the Hyperion treatment plant, which represented the first large-scale adaptation of this technology for wastewater sludge in the United States.

Summary

Based on the previous discussion of alternatives for wastewater disposal and after the completion of the next section, *Screening of Sites for Treatment and/or Disposal*, the appropriate alternatives for wastewater disposal will be applied accordingly. Section 3.0 will identify and screen sites within the Town as potential wastewater disposal facility sites.

Section 3.0

Screening of Sites for Treatment and/or Disposal

3.0 SCREENING OF SITES FOR TREATMENT AND/OR DISPOSAL

A. CRITERIA DEVELOPMENT

1. General

The screening criteria presented in this section were developed to assess the viability of 10 sites identified within Tyngsborough as potential wastewater disposal facility sites. The screening criteria used to evaluate these potential project sites was based upon eleven environmental criteria. The environmental screening criteria were chosen based upon review by the Project Proponent and upon comments received by the Proponent in the Secretary of the Executive Office of Environmental Affairs Certificate on the ENF. It was determined that by applying the screening criteria to the 10 identified sites a short list of selective potential sites would be established for additional evaluation through field testing. The screening criteria chosen to evaluate the potential project sites are: (1) wetlands; (2) soils; (3) drinking water supply - wellhead protection areas (Zone I and Zone II); (4) fisheries; (5) waterbodies (distance from surface water); (6) floodplains; (7) sensitive habitats; (8) park lands; (9) recreational resources; (10) historical interests and (11) in or adjacent to an Area of Critical Environmental Concern. A description of each screening criteria is given below and presented on Table 3-1.

The criteria were also developed with respect as to whether or not there was an existing "Opportunity" or environmental "Constraint" for the site to be utilized as a disposal facility for Tyngsborough's wastewater. Although "Surface Water Discharge" is defined, any surface water discharges have been eliminated from consideration due to stringent regulatory requirements and for lack of suitable surface waters located within the Town's borders.

The designation of an "Opportunity" within the screening criteria reflects the positive aspects of the environment that could be used in a beneficial manner in siting these facilities. Similarly, the designation of environmental "Constraints" within the screening criteria reflects aspects of the site and environment that would not be beneficial in siting the disposal facilities. All sites were potentially located to avoid directly impacting any of the screening criteria.

TABLE 3-1
TOWN OF TYNGSBOROUGH
CWMP/EIR
SCREENING CRITERIA

Screening Criteria	Facility	Surface water Discharge	Groundwater Discharge
Wetlands [a]	**Opportunity**-N/A **No Constraint**-if greater than 200 feet from wetlands **Minimal Constraint**-if within 200 feet of wetlands **Moderate Constraint**-if within 100 feet of wetlands **Severe Constraint**-if within wetland	**Opportunity** if wetlands present adjacent to Site **No constraint** if within 200 feet of wetlands **Minimal constraint** if between 200 and 400 feet from wetlands **Moderate constraint** if between 400 and 1000 feet from wetlands **Severe constraint** if greater than 1000 feet from wetlands	**Opportunity** - N/A **No constraint** if greater than 1000 feet from wetland **Minimal constraint** if between 400 and 1000 feet from wetlands **Moderate constraint** if between 100 and 400 feet from wetland **Severe constraint** if within 100 ft of wetland
Soils	**Opportunity**-N/A **No Constraint**-based on mapped soil type **Minimal Constraint**- based on mapped soil type **Moderate Constraint**- based on mapped soil type **Severe Constraint**-if within known documented hazardous soil area	**No opportunity, minimal, or moderate constraint** based on mapped soil type **Severe constraint** if within known hazardous area	**Opportunity** if mapped within sand/gravel deposits **No constraint** - N/A **Minimal constraint** - N/A **Moderate constraint** - if mapped within till/bedrock **Severe constraint** if mapped within known hazardous area
Drinking Water Supply	**Opportunity** - N/A **No constraint** if outside Zone II **Minimal constraint** if within Zone II **Moderate constraint** - N/A **Severe constraint** - N/A	**Opportunity** - N/A **No constraint** if greater than 1000 feet from Zone II **Minimal constraint** - N/A **Moderate constraint** if within Zone II and greater than 1000 feet from public well **Severe constraint** if within Zone II and within 1000 feet from public well	**Opportunity** - N/A **No constraint** if greater than 1000 feet from Zone II **Minimal constraint** - N/A **Moderate constraint** if within Zone II and greater than 1000 feet from public well **Severe constraint** if within Zone II and within 1000 feet from public well
Fisheries	**Opportunity**-N/A **No constraint** if facility is downstream or greater than 1000 feet of fish stocking area **Minimal constraint** if facility is located within 400 feet from fish stocking area **Moderate constraint** if facility is located within 200 feet fish stocking area **Severe constraint** if facility is located directly in fish stocking area	**Opportunity** - N/A **No constraint** if discharge is downstream or greater than 1000 feet of fish stocking area **Minimal constraint** if discharge within 400 feet from fish stocking area **Moderate constraint** if discharge within 200 feet fish stocking area **Severe constraint** if discharge directly into fish stocking area	**Opportunity** - N/A **No constraint** if discharge downstream or greater than 1000 feet of fish stocking area **Minimal constraint** if discharge within 400 feet from fish stocking area **Moderate constraint** if discharge within 200 feet fish stocking area **Severe constraint** -N/A
Waterbodies [a]	**Opportunity**-N/A **No Constraint**-if greater than 200 feet from water body **Minimal Constraint**-if within 200 feet of water body **Moderate Constraint**-if within 100 feet of water body **Severe Constraint**-if within wetland	**Opportunity** if adjacent waterbody present **No constraint** if within 200 feet of waterbody **Minimal constraint** if between 200 and 400 feet from waterbody **Moderate constraint** if greater than 400 feet from waterbody **Severe constraint** if greater than 1000 feet from waterbody	**Opportunity** - N/A **No constraint** if greater than 1000 feet from waterbody **Minimal constraint** if between 200 and 1000 feet from waterbody **Moderate constraint** if within 200 feet from waterbody **Severe constraint** - N/A
Floodplains [a]	**Opportunity** - N/A **No constraint** if outside of floodplain **Minimal constraint** -N/A **Moderate constraint** - if within floodplain **Severe constraint** N/A	**Opportunity** - N/A **No constraint** if outside of floodplain **Minimal constraint** -N/A **Moderate constraint** - N/A **Severe constraint** if within floodplain	**Opportunity** - N/A **No constraint** if outside of floodplain **Minimal constraint** -N/A **Moderate constraint** - N/A **Severe constraint** if within floodplain
Sensitive Habitat [a]	**Opportunity** - N/A **No constraint** if outside of sensitive habitat **Minimal constraint** - N/A **Moderate constraint** if within sensitive habitat and greater than 100 feet from wetland **Severe constraint** if within sensitive habitat and within 100 feet from wetland	**Opportunity** - N/A **No constraint** if greater than 200 feet from sensitive habitat **Minimal constraint** if within 200 feet of sensitive habitat **Moderate constraint** if within sensitive habitat and greater than 100 feet from wetland **Severe constraint** if within sensitive habitat and within 100 feet from wetland	**Opportunity**- N/A **No constraint** if greater than 200 feet from sensitive habitat **Minimal constraint** if within 200 feet of sensitive habitat **Moderate constraint** if within sensitive habitat and greater than 100 feet from wetland **Severe constraint** if within sensitive habitat and within 100 feet from wetland
Park Lands	**Opportunity** - N/A **No constraint** if greater than 200 feet from park lands **Minimal constraint** if abutting park lands **Moderate constraint** - N/A **Severe constraint** if within park lands	**Opportunity** - N/A **No constraint** if greater than 200 feet from park lands **Minimal constraint** if abutting park lands **Moderate constraint** if within park lands **Severe constraint** - N/A	**Opportunity**- N/A **No constraint** if greater than 200 feet from park lands **Minimal constraint** if within 200 feet of park lands **Moderate constraint** if within park lands **Severe constraint** - N/A
Recreation Resources	**Opportunity** - N/A **No constraint** if greater than 200 feet from recreation resource **Minimal constraint** if within 200 feet of recreation resource **Moderate constraint** if within recreation resource area **Severe constraint** - N/A	**Opportunity** - N/A **No constraint** if greater than 200 feet from recreation resource[b] **Minimal constraint** if within 200 feet of recreation resource **Moderate constraint** if within recreation resource **Severe constraint** - N/A	**Opportunity** - N/A **No constraint** if greater than 200 feet from recreation resource **Minimal constraint** if within 200 feet of recreation resource **Moderate constraint** if within recreation resource **Severe constraint** - N/A
Historic Interests	**Opportunity** - N/A **No constraint** if greater than 200 feet from historic interest **Minimal constraint** if within 200 feet of historic interest **Moderate constraint** if directly abutting historic interest **Severe constraint** if within historic interest	**Opportunity** - N/A **No constraint** if greater than 200 feet from historic interest **Minimal constraint** if within 200 feet of historic interest **Moderate constraint** if directly abutting historic interest **Severe constraint** if within historic interest	**Opportunity** - N/A **No constraint** if greater than 200 feet from historic interest **Minimal constraint** if within 200 feet of historic interest **Moderate constraint** if directly abutting historic interest **Severe constraint** if within historic interest
ACEC [a]	**Opportunity** - N/A **No constraint** if outside of ACEC **Minimal constraint** -N/A **Moderate constraint** - N/A **Severe constraint** if within ACEC	**Opportunity** - N/A **No constraint** if outside of ACEC **Minimal constraint** -N/A **Moderate constraint** – N/A **Severe constraint** if within ACEC [a]	**Opportunity** - N/A **No constraint** if outside of ACEC **Minimal constraint** -N/A **Moderate constraint** – N/A[a] **Severe constraint** if within ACEC [a]

(a) Based on available information, potential sites were located to avoid directly impacting wetlands, floodplains, ACEC (Site specific), sensitive habitat (Site specific) and waterbodies and are at least 100 feet removed.
(b) Assumes that receiving waters are not a recreational resource.

The "Constraints" are identified as "Minimal", "Moderate", and "Severe" depending on the extent and nature of the obstacles to developing each site and defined below.

- "Opportunity": the positive attributes associated with the criteria that could be a benefit to siting the facility (positive).
- "Constraint": the nature of the obstacles associated with the criteria that could negatively affect the siting of the facility.
    1. "No Constraint": the criteria do not have any positive attributes or impose any obstacles to the siting of the facility (neutral).
    2. "Minimal Constraint": the criteria impose the lowest degree of obstacles in the siting the facility.
    3. "Moderate Constraint": the criteria impose average obstacles to the siting the facility.
    4. "Severe Constraint": the criteria impose extremely difficult obstacles to overcome in the siting the facility.

2. Wetlands

The wetlands screening criteria is considered an important factor in siting both treatment facilities and effluent disposal facilities. It was determined that "No Opportunities" exist for constructing treatment facilities or effluent disposal facilities in wetlands. These facilities would need to be constructed in upland areas to avoid filling or alternation of wetlands. The wetland related "Constraints" are based on distances from the wetland. The wetland screening criteria is developed with the assumption that the potential facilities will be greater than 100 feet away from wetland areas.

The wetlands criteria for surface water discharge facilities is considered more constrained the further removed from the wetland, since the discharge of the treated effluent ideally should be directly into the receiving waterbody. Those sites located within 100 feet of a wetland are considered to present "Minimal Development Constraints" because the proximity of the treatment facility and the length of the treated wastewater effluent discharge piping is minimized. Sites located distant (greater than 400 feet) from the wetland/surface water would pose "Moderate" and "Severe Constraints" since access to the discharge point is restricted.

3. Soils

Soil type is considered to have a greater influence on the selection of an effluent disposal/groundwater discharge site than on the selection of a treatment facility site due to the variable infiltration properties of soils. However, soil type is not as critical in selecting a treatment facility or surface water disposal site since construction is predominantly above ground. The only "Constraint" associated with soil type for the construction of treatment facilities or surface water discharge facilities is the presence of known hazardous materials on site. The soil properties and the presence of hazardous material on site is considered primary to the selection of potential groundwater discharge sites.

The Phase I Needs and Growth Management Report identified 77 soil units in Tyngsborough with varying degrees of limitations including poor filter, slow percs, depth to bedrock, slope, wetness, ponding, large stones, and flooding. Additionally, the Town was mapped according to subsurface geological features that identified areas encompassed with large surface waters, high yield aquifers, medium yield aquifers, floodplain alluvium, sand and gravel deposits and till and/or bedrock that were all based on the NRCS Soil Survey. Soils are classified as slight, moderate or severe according to its engineering properties for sanitary facilities capabilities.

Sites located within areas which are comprised of slight soil types are considered to provide the greatest "Opportunity", followed by sites located with moderate classifications. The last classification, severe, is not considered suitable for effluent disposal, therefore, sites with these soil types are considered to have "Severe Constraints".

4. Floodplains

Construction within 100-year floodplains is constrained by regulatory restrictions on development within floodplain areas for protection of flood storage and for protection of the constructed facility to flood hazards. This criterion was considered to present "Moderate Developmental Constraints" with regard to siting of treatment facilities if located within a floodplain, and "No Constraint" if located outside of a floodplain.

Potential groundwater discharge sites located within the 100-year floodplain are restricted from being located in velocity zones and floodways in accordance with DEP regulations (310 CMR 15.213(2)). Therefore, the floodplain site selection criterion was considered to present “Severe Developmental Constraints for groundwater disposal facilities if the potential site is located within the floodplain. If the disposal site is outside the floodplain then “No Constraints” are present to development of a groundwater discharge facility.

Surface water discharge facilities located within a floodplain is a concern since the discharge flow would represent additional flow, which would have to be accommodated during the 100-year flood event. However, surface water discharges must be to a surface water. Most of the primary streams in Hopkinton are associated with a floodplain. Therefore, potential flooding impacts could be buffered by the capability of the stream to handle slight increases in flow. Therefore, surface water discharges within a floodplain is considered to present a “Moderate Development Constraints”. If the disposal site is outside the floodplain then “No Constraints” are present to development of a discharge site.

5. Waterbodies (Distance from Surface Water)

Proximity to waterbodies is considered a factor in the siting of surface water and groundwater discharge locations. The location and construction of treatment facilities should not impact waterbodies if the facility is located greater than 100 feet from the waterbodies. The screening criteria for waterbodies is not considered to present “Developmental Constraints” on treatment facility sites regardless of the location outside the resource.

Surface water discharge sites are required to be located proximate to a surface waterbody. Therefore, this site selection criteria is accorded substantial weight in the surface water discharge site selection process. Those sites located proximate to surface waterbodies are considered to present an “Opportunity” for development as long as other environmental constraints are not present. Those sites that are not located proximate to a waterbody are considered to present extensive “Developmental Constraints” regarding the surface water discharge site selection process.

Groundwater discharge sites should be located a sufficient distance from a surface water to ensure the facility does not affect the water quality of the surface water. The proposed subsurface disposal of effluent may result in the creation of a groundwater “mound” beneath the disposal field. The system should be sited such that the outer edges of the mound do not significantly influence the hydrology or water quality of the adjacent surface water body. Therefore, it was conservatively assumed that a groundwater discharge effluent bed should be at least 500 feet from a surface water body to provide an adequate margin of safety to ensure preservation of surface water quality. Potential groundwater discharge sites located at least 500 feet from a surface water body are considered to present an “Opportunity” for development. If within 500 feet, the site is considered to present “Moderate Constraints” for groundwater disposal.

6. Drinking Water Supply - Wellhead Protection Areas (Zone I and II)

Treatment facility sites, without an associated discharge on site, located in Zone II areas are not scrutinized the same as groundwater discharge since the potential impacts to drinking water quality are minimal. Due to the importance of the Zone II resource areas, treatment facility sites located in Zone II areas are considered to present “Minimal Developmental Constraints” while those located outside these areas are considered to present “No Constraints”. Treatment facility sites located in Interim Wellhead protection Areas areas are considered to present “Severe Developmental Constraints” while those located outside these areas are considered to present “No Constraints”.

The proximity of surface water and groundwater discharge sites to public drinking water supplies is a significant criteria in the screening process due to the stringent regulatory restrictions which apply to siting these facilities within Zone I and II areas. This criteria is not given the same significance with respect to the siting of the treatment facilities since construction a treatment facility does not necessarily include a discharge of wastewater. The screening criteria was developed to coincide with the requirements of the Massachusetts Drinking Water Regulations and the designation of Zone I (400 feet > 100,000 gpd) and Zone II (contributes to the well under severe pumping and recharge conditions).

Siting an effluent discharge is prohibited within a Zone I area. The location of surface water or groundwater discharge within a Zone II area and greater than 1,000 feet from a public well is considered a "Moderate Constraint". In order to conservatively protect the Zone II areas, which are nitrogen sensitive, more stringent nitrogen discharge limitations have been established by DEP. Discussions with regulatory agencies regarding this matter suggests that an effluent discharge should not be located within a Zone II area unless all alternative options have been exhausted and a risk/benefit analysis has been performed. DEP is currently developing policy that will identify the specific criteria for consideration of a wastewater discharge within Zone IIs. Due to the numerous restrictions placed on siting wastewater discharge facilities within Zone IIs, a "Severe Constraint" is identified for a discharge within 1,000 feet of a drinking water supply well within the Zone II. Location of a facility outside of the Zone II is viewed as having "No Constraint" for either a treatment facility or a discharge facility.

7. Fisheries

The proximity of the potential facility site to fisheries resources and adjacent waterbodies is a factor in siting surface water and groundwater discharge facilities. It was assumed that the location and construction of treatment facilities would not impact fisheries, if the facility is located greater than 100 feet from the waterbodies supporting the fisheries. The screening criteria for fisheries is considered to present "No Constraints" to development on treatment facility sites regardless of the location outside the resource.

Surface water discharge facilities pose the greatest threat to the fishery resources since the discharge of treated wastewater is directly into the waterbodies which support the fisheries. Therefore, this criteria is considered to present a "Moderate Developmental Constraints" for a facility if it is located within 100 feet of a fish stocking area. If a site is located downstream or greater than 1,000 feet from a fish stocking area the site is considered to present "No Constraint" for the facility.

While groundwater discharges may impact fisheries, there is less risk of impact because the discharge is not directly into the surface waterbody, which contains the fisheries. Therefore, the criteria is only considered to present a “Minimal Constraint” for sites located within 400 feet of the fish stocking areas, and “No Constraint” for sites located greater than 1,000 feet from fish stocking areas. It was considered to be a “Moderate Constraint” if the facility site was located within 200 feet of the fisheries.

8. Sensitive Habitats

Sensitive habitats considered in the screening criteria include Estimated Habitats of Rare Wildlife, Certified Vernal Pools, Priority Sites of Rare Species Habitats and Exemplary Natural Communities, and Areas of Critical Environmental Concern. These habitats are sensitive to changes in the environment and are protected in both DEP Wetland Protection and Surface Water Quality Regulations. These regulations impose restrictions on development of any kind within the boundaries of these mapped habitats, and thus, for sites located within sensitive habitats, there is a “Severe Constraint” to development. Therefore, the “Constraints” to treatment facilities, surface water and groundwater disposal facilities is viewed to be equally restricted. The criteria identifies a “Severe Constraint” for those sites located within a sensitive habitat area, a “Minimal Constraint” if outside of, but abutting a sensitive habitat area, and “No Constraint” for those sites located a sufficient distance outside of a sensitive habitat area. Other sensitive habitats include park lands, recreational resources, and historical interests.

9. Park Lands and Recreational Resources

Land developed for recreational use or as park lands should be avoided in siting treatment facilities and disposal facilities (groundwater or surface water). If the existing land use of the potential site involves park or conservation lands or other recreational resources, construction of a treatment facility and/or disposal facility would represent an incompatible use conflict. Therefore, the presence of a park, conservation, or recreation land poses a “Severe Constraint” to development of a treatment facility. If the potential treatment facility site is located on property directly abutting the resources, then a “Minimal Development Constraint” exists on the site. If located greater than 200 feet from theses resource areas, the criteria is considered to present “No “Constraints” to development.

Groundwater and surface water discharge facilities do not impact these resources to the same extent the buildings and above ground structures associated with a treatment facility would, however certain deed restrictions may eliminate other uses entirely. Therefore, these wastewater disposal facilities are only considered to present "Moderate Developmental Constraints" for sites located within the resource areas, and "Minimal Constraints" if the sites are located outside the resource areas and "No Constraints" to development if located greater than 200 feet from these resource areas.

10. Historical Interests

Historic interests include historic structures and/or properties and archaeological resources. *The National Register of Historic Places* lists one property located at 10 Kendal Road, The Old Town Hall, *The Massachusetts Cultural Resource Information System* of the Massachusetts Historical Commission lists 162 properties of historical interest in Tyngsborough.

In screening the potential project sites, it was considered desirable to select sites, which do not impact these resources. The Massachusetts Historical Commission (MHC) must be notified of details of proposed projects in designated historic areas. The MHC will then determine whether State Register properties exist within a project's area of potential impact. If it is determined that the proposed project will have an adverse effect, the applicant will be required to present a comprehensive analysis of alternatives. By eliminating these sites, the project will preserve the resources and avoid potential administrative and regulatory burdens associated with development in these areas. Since the developmental regulatory "Constraints" associated with these resources apply with equal force to either treatment facilities or disposal facilities, independent of any specific characteristics associated with the facilities, this site selection criteria is considered to present the same "Constraints" for either facility. The criteria presents a "Severe Constraint" for those sites located within a historic resource area, a "Moderate Constraint" if directly abutting the site, a "Minimal Constraint" if within 200 feet a historic resource area, and "No Constraint" for those sites located greater than 200 feet outside of these resource areas.

11. Areas of Critical Environmental Concern (ACEC)

Construction within the ACEC is constrained by regulatory restrictions, specifically 301 CMR 12.00, 301 CMR 21.00, 310 CMR 9.00, 310 CMR 10.00, 310 CMR 16.00 and further addressed in the MEPA regulations at 301 CMR 11.03 (11). Any construction within the ACEC is subject to MEPA review as has been noted in the Environmental Notification Form filed November 30, 2001 on behalf of this project. Construction within the ACEC was considered to present "Moderate Developmental Constraints" with regard to siting of treatment facilities if located within a designated ACEC and "No Constraint" if located outside of the ACEC.

Potential groundwater discharge sites located within the ACEC are restricted through 301 CMR 12.00, 301 CMR 21.00, 310 CMR 9.00, 310 CMR 10.00, 310 CMR 16.00 and further addressed in the MEPA regulations at 301 CMR 11.03 (11). Therefore, the ACEC site selection criteria was considered to present "Moderate to Severe Developmental Constraints" for groundwater disposal facilities, dependent on site specific details, if the potential site is located within the ACEC. If the disposal site is outside the ACEC then "No Constraints" are present to development of a groundwater discharge facility.

Surface water discharge facilities located within an ACEC is a concern since the discharge flow could potentially alter the unique natural, cultural ecosystem. Although there could potentially be a significant alteration the opposite could also be true. Therefore, surface water discharges within an ACEC is site specific and considered to present a "Moderate to Severe Development Constraints", dependent on site specific details. If the disposal site is outside the floodplain then "No Constraints" are present to development of a discharge site.

In screening the potential project sites, it was considered desirable to select sites, which do not impact these resources. The ENF filed on behalf of this CWMP serves as notice to all interested parties proposed projects details in designated ACEC areas. The ENF process will then determine whether ACEC properties exist within a project's area of potential impact. If it is determined that the proposed project will have an adverse effect, the applicant will be required to present a comprehensive analysis of alternatives. The criteria presents a “Moderate to Severe Constraint” for those sites located within an ACEC area and “No Constraint” for those sites outside of these resource areas.

B. PRELIMINARY SITE IDENTIFICATION

The following section provides a description of the 10 sites identified as potential locations for local or centralized treatment facilities and/or groundwater treated effluent disposal locations. Refer to Table 3-2. Again, surface water discharges have been eliminated from consideration due to not only stringent regulatory requirements but also, the lack of suitable surface waters within the Town of Tyngsborough boundaries. Major waterbodies located within the Town are either classified as Class B Waters or designated from Mass Wildlife for fish stocking. The identification of sites in this section includes both properties and sites within larger parcels, as is the case with the River Road parcels.

The discussion describes the sites in terms of their location, the primary land use associated with the sites, and the significant site features and conditions. Existing conditions and site features for each site are presented in Table 3-2, with respect to the screening criteria. Information used in the description of the sites was obtained from MassGIS data layers, Tyngsborough Master Plan, Mass Wildlife-Fish and Game, Mass Historic Commission, local planning and Conservation Departments and USGS topographic maps. The information used to characterize the environmental conditions of these sites is viewed as conservative and appropriate for planning and screening purposes. Most of the sites screened in this analysis have been visited in the field and information gathered during these inspections is reflected in the details of the site. The information was supplemented by a field reconnaissance of the potential site locations. The existing conditions for all 10 potential project sites were characterized based on the screening criteria previously outlined. Refer to Table 3-2 for the site descriptions.

1. Locust Avenue – 12-18-0

This site is located west of Middlesex Road in the northwest quadrant of Town. The site consists of approximately 5.5 acres and is owned by the Town of Tyngsborough. There are wetlands located on site as well as soils consisting of till or bedrock. Other screening criteria include proximate to stream and to public water supplies.

TABLE 3-2
TOWN OF TYNGSBOROUGH
CWMP/EIR
SITE DESCRIPTIONS

Site	Wetlands	Soils	Drinking Water Supply	Fisheries	Waterbodies	Floodplains	Sensitive Habitat	Park Lands	Recreation Resources	Historic Interests	ACEC
1. Locust Avenue 12-18-0	Wetlands Onsite	Till or Bedrock	Outside of Zone II Area	No Fish Stocking Nearby	Proximate to Stream	Outside of 100-yr Floodplain	No Sensitive Habitat Nearby	No Parkland within or Proximate to Site	None located within Site or proximate to Site	None located within Site or proximate to Site	None Located within or Proximate to Site
2. Frost Road 20-93-0	Wetlands Onsite	Till or Bedrock	Proximate to Public Water Supply	No Fish Stocking Nearby	Proximate Merrimack River	Outside of 100-yr Floodplain	Sensitive Habitat Nearby	No Parkland within or Proximate to Site	None located within Site or proximate to Site	None located within Site or proximate to Site	None Located within or Proximate to Site
3.River Road 19-35-0	Wetlands Onsite	Mix of Till or Bedrock, Muck, Sand and Gravel	Proximate to IWPA Main Aquifer Area	No Fish Stocking Nearby	Proximate to Merrimack River	Inside of 100-yr Floodplain	Sensitive Habitat Nearby	Site in the 100' Rivers Protection Act Buffer. Conservation Land	Proximate to Site	None located within Site or proximate to Site	Located within or Proximate to Site
4. River Road 19-50-0	Wetlands on Site	Mix of Till or Bedrock, Muck, Sand and Gravel	Proximate to IWPA Main Aquifer Area	No Fish Stocking Nearby	Proximate to Merrimack River	Inside of 100-yr Floodplain	Sensitive Habitat Nearby	Site in the 100' Rivers Protection Act Buffer. Conservation Land	Proximate to Site	None located within Site or proximate to Site	Located within or Proximate to Site
5.River Road 19-51-0	Wetlands Onsite	Mix of Till or Bedrock, Muck, Sand and Gravel	Proximate to IWPA Main Aquifer Area	No Fish Stocking Nearby	Proximate to Merrimack River	Inside of 100-yr Floodplain	Sensitive Habitat Nearby	Site in the 100' Rivers Protection Act Buffer. Conservation Land	Proximate to Site	None located within Site or proximate to Site	Located within or Proximate to Site
6. 17 Wicasse Road 20-104A-0	No Wetlands Onsite	Till , Bedrock and Rock Outcrop	Outside of Zone II Area	No Fish Stocking Nearby	Proximate to Merrimack River	Outside of 100-yr Floodplain	No Sensitive Habitat Nearby	Site Devoted to Recreation Land	Site Devoted to Recreation Land	None located within Site or proximate to Site	None Located within or Proximate to Site
7. Route 3 12-7-0	Wetlands Onsite	Till or Bedrock	Proximate to Public Water Supply	No Fish Stocking Nearby	Proximate to Stream	Outside of 100-yr Floodplain	No Sensitive Habitat Nearby	Land Devoted to State Highway	None located within Site or proximate to Site	None located within Site or proximate to Site	None Located within or Proximate to Site
8.4 Bryants Lane 20-21-0	Wetlands Onsite	Sand & Gravel Deposits and Till or Bedrock	Proximate to Public Water Supply	No Fish Stocking Nearby	Proximate to Stream	Outside of 100-yr Floodplain	No Sensitive Habitat Nearby	Site Under Conservation Restriction	None located within Site or proximate to Site	None located within Site or proximate to Site	None Located within or Proximate to Site
9. 170 Frost Road 18-7-0	Wetlands Onsite	Sand & Gravel Deposits	Within Dracut IWPA Area	No Fish Stocking Nearby	Proximate to Merrimack River	Outside of 100-yr Floodplain	No Sensitive Habitat Nearby	Site Under Conservation Restriction	None located within Site or proximate to Site	None located within Site or proximate to Site	Located within or Proximate to Site
10. Coburn Road 26-33A-0	Wetlands Onsite	Till or Bedrock & Sand & Gravel Deposits	Outside of Zone II Area	Fishing Stocking Nearby at Mascuppic Lake	Proximate to Streams	Outside of 100-yr Floodplain	No Sensitive Habitat Nearby	Site Under Conservation Restriction	None located within Site or proximate to Site	None located within Site or proximate to Site	None Located within or Proximate to Site

2. Frost Road – 20-93-0

This site is located east of the Merrimack River in the center of Town. The site consists of approximately 7 acres and is owned by the Town of Tyngsborough There are wetlands on site as well as soils consisting of till or bedrock. Other screening criteria include proximate to the Merrimack River and public water supplies.

3. River Road – 19-35-0

This site is located just east of Middlesex Road and west of the Merrimack River. The site consists of approximately 7.4 acres of land and is owned by the Town of Tyngsborough under a conservation restriction. There are wetlands on site and contains various soil types including sand and gravels, mucks and till or bedrock. Other screening criteria include proximate to the Merrimack River, within the 100-year flood plain, located within a conservation restriction, within the NHESP 2005 Estimated Priority Habitat for Rare Wildlife, and high groundwater.

4. River Road – 19-50-0

This site is located just east of Middlesex Road and west of the Merrimack River. The site consists of approximately 15 acres of land and is owned by the Town of Tyngsborough under a conservation restriction. There are wetlands on the site and does contain soils consisting of sand and gravel deposits as well as till or bedrock. Other screening criteria include proximate to the Merrimack River, within the 100-year flood plain, located within a conservation restriction, within the NHESP 2005 Estimated Priority Habitat for Rare Wildlife, and high groundwater.

5. River Road – 19-51-0

This site is located just east of Middlesex Road and west of the Merrimack River. The site consists of approximately 17.25 acres of land and is owned by the Town of Tyngsborough under a conservation restriction. There are wetlands on the site and contains soils consisting of sand and gravel deposits as well as till or bedrock and mucks. Other screening criteria include proximate to the Merrimack River, within the 100-year flood plain, located within a conservation restriction, within the NHESP 2005 Estimated Priority Habitat for Rare Wildlife, and high groundwater.

6. 17 Wicasse Road – 20-104A-0

This site is located just east of the Merrimack River near Lawndale Road. The site consists of approximately 9 acres of land and is owned by the Town of Tyngsborough. There are no wetlands on site and the site does contain severe rock outcrops as well as soils consisting of till or bedrock. Other screening criteria include proximate to public water supplies and currently devoted to recreational us.

7. Route 3 – 12-7-0

This site is located in the northwestern quadrant of Town east of State Route 3. The site consists of approximately 8 acres of land and is owned by the Town of Tyngsborough. There are wetlands on site and does contain soils consisting of till or bedrock. Other screening criteria include proximate to a stream with a majority of the land area devoted to the Route 3 Highway.

8. 4 Bryants Lane – 20-21-0

This site is located adjacent to the Tyngsborough Town Hall Office on Bryants Lane. The site consists of approximately 15 acres of land and is owned by the Town under a conservation restriction. There are wetlands on site and the parcel contain soils consisting of till or bedrock as well as sand and gravel deposits. Other screening criteria include proximate to a stream.

9. 170 Frost Road – 18-7-0

This site is located on the eastern side of the Merrimack River in the northeastern quadrant of Town. The site consists of approximately 72 acres of land and is owned by the Town of Dracut. There are wetlands on site and contains soils consisting of sand and gravel deposits. Other screening criteria include proximate to the Merrimack River and is located within the Interim Well Protection Area (IWPA) for the Town of Dracut Water supply.

10. Coburn Road – 26-33A-0

This site is located east of the Merrimack River and south of Lakeview Avenue in the center of the Town. The site consists of approximately 79 acres of land and is owned by the Town of Tyngsborough under a conservation restriction. There are numerous wetlands on site and contain soils consisting of till or bedrock as well as sand and gravel deposits. Other screening criteria include proximate to several streams, adjacent to a river body, fish stocking is located nearby at Mascuppic Lake.

C. PRELIMINARY SITE SCREENING

1. Environmentally Sensitive Areas

Environmentally sensitive areas such as wetlands, flood plains, depth to groundwater, wellhead recharge/Zone Is/Zone IIs, surface waters, sensitive habitats and existing land use on each of the above sites was assessed. Any wetland/flood plains on site will be delineated according to appropriate federal and state guidelines. The functional value of the wetland as well as the potential to avoid or minimize impacts on, wetlands was determined. Wellhead recharge/Zone I/Zone II areas were delineated. The proximity of each site to these areas and the impacts of siting wastewater facilities was assessed.

2. Archaeological and Historical Resources

A review of existing information and the potential for significant historic and archaeological resources has been evaluated. The Massachusetts Historical Atlas/Register was reviewed for pertinent information on each identified site. At this time, a Step 1 archaeological survey has not been included.

3. MCP Phase I Site Assessment

A review of the Massachusetts Bureau of Waste Site Cleanup has been performed in order to determine the location of any hazardous materials on any of the identified sites. A complete listing can be found in Appendix G and at http://www.state.ma.us/cgi-bin/dep/wscreport.cgi.

4. Soil Suitability and Geologic Evaluation

Soil permeability and geologic conditions have been assessed at each site using existing data and maps such as the USDA Soil Conservation Services surficial geology maps and soil survey reports. Local Board of Health records were also used where applicable.

5. Sensitive Receptors

Sensitive receptors, which include the location of developed residential areas, schools, hospitals, nursing homes and commercial/industrial parcels within 500 feet of each site will be evaluated. The potential impacts of odors, noise, traffic and visual aesthetics of construction and operation of any wastewater facilities to be located on each identified site in relation to the identified sensitive receptors is also included as part of Phase III, CWMP/DEIR.

D. IDENTIFICATION OF FEASIBLE SITES BASED ON SCREENING ANALYSIS

1. General

The preliminary screening criteria previously presented was applied to the 10 sites identified above. The preliminary screening of sites involved applying the 11 environmental criteria: (1) wetlands; (2) soils; (3) drinking water supply; (4) fisheries; (5) waterbodies (6) floodplains; (7) sensitive habitat; (8) park lands; (9) recreation resources; (10) historic interests and (11) ACEC. Each site was screened with respect to the potential for construction of a treatment facility and location of a groundwater discharge site.

As previously mentioned, the designation of an "Opportunity" within the screening criteria reflects the positive aspects of the environment that could be viewed as a benefit in siting these facilities. Similarly, the designation of environmental "Constraints" within the screening criteria reflects aspects of the site and environment that would pose limitations in siting the treatment and/or disposal facilities. The "Constraints" are identified as "Minimal", "Moderate", and "Severe" depending on the extent and nature of the obstacles to developing each site.

The feasible site or sites to accommodate the recommended wastewater facilities were identified upon the completion of the preliminary screening described in the previous tasks. The results of this preliminary screening are presented in Table 3-3. This Table presents a rating of each site based on the application of the screening criteria. The sum of the opportunities and various "Constraints" are reflected in a rating of low, moderate or high potential for siting of a facility or disposal site.

The rationale for the ratings is as follows:

○ High Potential = predominately “Opportunities” and “No Constraints”; may have a “Minimal” or “Moderate Constraint”.

◒ Moderate Potential = characterized by more than 1 “Moderate” and 1 “Minimal Constraint”.

● Low Potential = presence of a least one “Severe Constraint” plus a minimal, “Moderate” or additional “Severe Constraint”.

2. Summary

Based on the evaluation and screening of sites, none of the sites proved to be an opportunity for the Town to consider. All of the sites were constrained with major factors that influenced their use for wastewater facilities within the Town. Conducive soils were present on some of the sites, but these sites were also the major land areas for the public water supplies for not only Tyngsborough, but the Town of Dracut as well. Other sites were hampered with riverfront impacts, floodplain, ACEC, NHESP limitations, severely limiting conservation restrictions, recreational use, and/or severe soil and groundwater conditions present throughout the site. Each site screened presented severe constraints for use outside its present land use. Refer to Figure 3-1 for site locations.

TABLE 3-3
TOWN OF TYNGSBOROUGH
CWMP/EIR
RESULTS OF PRELIMINARY SCREENING

Site No.	Site Name	Wetlands	Soils	Drinking Water Supply	Fisheries	Waterbodies	Floodplains	Sensitive Habitat	Park Lands	Recreation Resources	Historic Interests	ACEC	Rating
1	**Locust Avenue, 12-18-0**												
	Groundwater Discharge	Severe	Severe	No Constraint	No Constraint	Minimal	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	●
2	**Frost Road, 20-93-0**												
	Groundwater Discharge	Moderate	Moderate	Moderate	No Constraint	Moderate	No Constraint	Moderate	No Constraint	No Constraint	No Constraint	No Constraint	●
3	**River Road, 19-35-0**												
	Groundwater Discharge	Severe	Severe	Severe	No Constraint	Severe	Severe	Severe	Severe	Severe	No Constraint	No Constraint	●
4	**River Road, 19-50-0**												
	Groundwater Discharge	Severe	Severe	Severe	No Constraint	Severe	Severe	Severe	Severe	Severe	No Constraint	No Constraint	●
5	**River Road, 19-51-0**												
	Groundwater Discharge	Severe	Severe	Severe	No Constraint	Severe	Severe	Severe	Severe	Severe	No Constraint	No Constraint	●
6	**17 Wicasse Road, 20-104A-0**												
	Groundwater Discharge	No Constraint	Severe	No Constraint	No Constraint	Minimal	No Constraint	No Constraint	Severe	Severe	No Constraint	No Constraint	●
7	**Route 3, 12-7-0**												
	Groundwater Discharge	Severe	Severe	Severe	No Constraint	Moderate	No Constraint	No Constraint	Severe	No Constraint	No Constraint	No Constraint	●
8	**4 Bryants Lane, 20-21-0**												
	Groundwater Discharge	Moderate	Opportunity	Severe	No Constraint	Minimal	No Constraint	No Constraint	Severe	No Constraint	No Constraint	No Constraint	●
9	**170 Frost Road, 18-7-0**												
	Groundwater Discharge	Moderate	Opportunity	Severe	No Constraint	Moderate	No Constraint	Minimal	Severe	No Constraint	No Constraint	No Constraint	●
10	**Coburn Road, 26-33A-0**												
	Groundwater Discharge	Moderate	Moderate	No Constraint	Minimal	Minimal	No Constraint	No Constraint	Severe	No Constraint	No Constraint	No Constraint	●

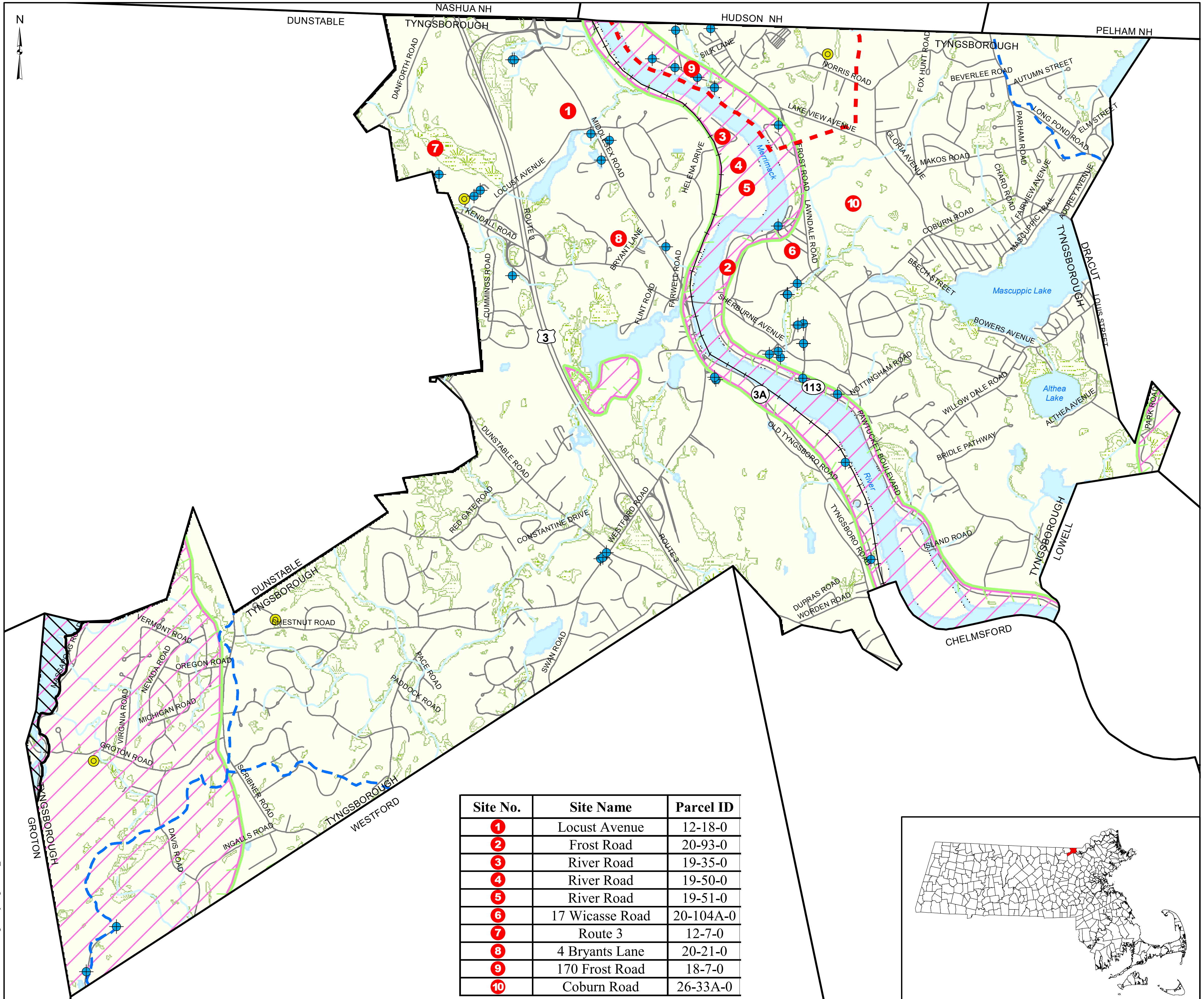
FIGURE 3-1
ALTERNATIVE EVALUATION SITES

PHASE II
COMPREHENSIVE WASTEWATER
MANAGEMENT PLAN

TYNGSBOROUGH, MASSACHUSETTS

SCALE 1:36,000

0 1,500 3,000 Feet



Site No.	Site Name	Parcel ID
1	Locust Avenue	12-18-0
2	Frost Road	20-93-0
3	River Road	19-35-0
4	River Road	19-50-0
5	River Road	19-51-0
6	17 Wicasse Road	20-104A-0
7	Route 3	12-7-0
8	4 Bryants Lane	20-21-0
9	170 Frost Road	18-7-0
10	Coburn Road	26-33A-0

Legend

- Alternative Site
- Public Water Supply
- NHESP 2003 Massachusetts Certified Vernal Pools
- Rivers and Streams
- Road
- Zone II Boundary
- Sub-Basin Boundary
- Areas of Critical Environmental Concern
- NHESP 2005 Estimated Habitats for Rare Wildlife: For Use with the MA Wetlands Protection Act Regulations (310 CMR 10)
- NHESP 2005 Priority Habitats for State-Protected Rare Species
- Wetland
- Surface Water
- Town Boundary

EarthTech
A tyco International Ltd. Company

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MARCH 2006 SOURCE: Selected Datalayers from MassGIS.

Section 4.0

Public Participation

4.0 PUBLIC PARTICIPATION

A. GENERAL

As part of the scope of this Comprehensive Wastewater Management Plan/Environmental Impact Report (CWMP/EIR), the Town of Tyngsborough will conduct an extensive public education program. The purpose of this public education/participation program will be to inform the public of the scope and progress of the planning study, to describe the results of the wastewater needs analysis and siting alternatives selection process, and to encourage public input throughout the entire planning process.

B. PUBLIC MEETINGS AND EDUCATION

The Town of Tyngsborough distributed pamphlets and flyers on the results of the CWMP/EIR Phase I Document through the Town Hall in the Town Clerk's Office, Sewer Office and Public Library. A copy of the information provided can be found in Appendix H. Also included in Appendix H is public education materials distributed by the Sewer Commission in sewer bills on infiltration and inflow issues.

A Public Informational Meeting will be held during the MEPA public comment period for this Phase II Report. The Phase II Report includes a comprehensive update of the Phase I Report, so the public will be apprised of the Phase I results as well as the Phase II. As each successive phase of this CWMP/EIR is completed, a public informational meeting will be held. At the conclusion of the Draft Environmental Impact Report, Phase III, Draft CWMP/DEIR, a public hearing will be held in order to solicit public input before finalizing the draft recommended plan in the Phase IV Final Environmental impact Report (CWMP/FEIR).

Additional public meetings include Sewer Commission meetings and other departmental meetings as deemed necessary. Any meetings held with Town officials will be posted as required in Town Hall.

C. RESPONSIVENESS SUMMARIES

Earth Tech will prepare and distribute responsiveness summaries after the public meetings. These responsiveness summaries will identify the public participation activities and document significant questions, comments, concerns and suggestions by the public and responses by Town staff and Earth Tech, including justification for rejection or incorporation of any comments into the document. The responsiveness summaries will be distributed to the depositories, active participants and the mailing list. In successive phases of this CWMP/EIR, any documented Responsiveness Summaries will be included.

D. DEPOSITORIES

As part of the Public Participation Plan, three Depositories have been set up and located throughout the Town for public access. At each location is a three-ring binder containing the following information on the CWMP/EIR:

- Mailing List (for <u>any</u> interested party or parties)
- Public Participation Work Plan
- Exhibit A CWMP/EIR Scope of Work
- Exhibit B Tyngsborough CWMP/EIR Projected Schedule
- MADEP SRF Loan Project Approval Certificate (PAC)
- Reference Materials
- Media Coverage
- Public Meeting(s) Record
- Responsiveness Summaries
- List of Appendices
- Meeting Minutes
- MEPA

Copies of all Reports filed to date are also included as part of the permanent Depository Record.

E. SUMMARY OF PUBLIC COMMENTS RECEIVED DURING THE MEPA PROCESS

The Town of Tyngsborough submitted an Environmental Notification Form (ENF) to MEPA in the fall of 1998. The comment period for the ENF ended on November 14, 1998 and on December 1, 1998 the Executive Office of Environmental Affairs (EOEA) determined that the project required an Environmental Impact Report (EIR) and established a Special Procedure for review of the required EIR. The Phase I "Needs and Growth Management" Report, was submitted March 1, 2003. On May 15, 2004, the Executive Office of Environmental Affairs (EOEA) issued the MEPA Certificate (EOEA No. 12654), which determined that the project adequately and properly complied with the Massachusetts Environmental policy Act (G.L. c. 30, ss. 61-62H) and with its implementing regulations (301 CMR 11.00). A copy of the MEPA Certificate is included in Appendix A and all comment letters and responses are in Appendix B.

This Phase II scope is the "Screening of Alternatives. The Phase III scope is the "Draft CWMP and EIR" and Phase IV is the "Final CWMP and EIR". Copies of these successive scopes can be found in Appendix I. Each successive phase builds on the previous and will be finalized upon the completions of the former. Each phase of this project will be distributed for review according to MEPA regulations. Therefore, there will be opportunity for the appropriate public comment period for all interested parties to contribute to the outcome of this project.

F. CIRCULATION LIST

MEPA Unit
Executive Office of Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114
(three copies)

Mr. Ron Lyberger
Department of Environmental Protection
One Winter Street, 5th Floor
Boston, MA 02108
(three copies)

Ms.Margo Webber
Department of Environmental Protection
627 Main Street
Worcester, MA 01603

Northern Middlesex Council of Governments
Gallagher Terminal, Floor 3B
115 Thorndike Street
Lowell, MA 01852-3308

Ms. Brona Simon
Massachusetts Historical Commission
The Massachusetts Archives Building
220 Morrissey Boulevard
Boston, MA 02125

Massachusetts Highway Department
District No. 4
519 Appleton Street
Arlington, MA 02476
Attn: Environmental Reviewer

Mr. David Pincumbe
U.S. EPA - N.E. Region
1 Congress Street, Suite 1100
Boston, MA 02114-2023

Town of Tyngsborough
Board of Selectmen
Town Hall
25 Bryants Lane
Tyngsborough, MA 01879

Mr. Allen Curseaden
Town of Tyngsborough
Sewer Commission
83 Wood Street
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Office of Water Resources
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MEPA Reviewer
Department of Food and Agriculture
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Tyngsborough Water District
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City of Lowell Regional Wastewater Utility
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Sewer Commission
Town of Dracut Sewer Department
1196 Lakeview Avenue
Dracut, MA 01826-4791

Sewer Commission
Town of Chelmsford
50 Billerica Road
Chelmsford, MA 01821

Mario Leclerc, Superintendent
Division of Public Works NWTF
City of Nashua New Hampshire
Sawmill Road
Nashua, New Hampshire 03060

Doug Fainelli
The Gutierrez Company
One Wall St
Burlington, MA 01803

Section 5.0

SRF Grant Loan Administration

5.0 STATE REVOLVING FUND LOAN ADMINISTRATION

A. GENERAL

The Town of Tyngsborough began preparation of a draft Comprehensive Wastewater Management Plan in August 1997. December 1, 1998, the Secretary of Environmental Affairs issued MEPA Certificate No. 11788 stating that the draft Comprehensive Wastewater Management Plan (CWMP), pursuant to the Massachusetts Environmental Policy Act (G.L.c.30, ss. 61-62H) and Sections 11.03 of the MEPA regulations (301 CMR 11.00), requires the preparation of an Environmental Impact Report (EIR). The EIR process called for a Special Procedure with the filing of four phases; Phase I, Needs and Growth Management; Phase II Screening of Alternatives; Phase III Draft Environmental impact Report; and Phase IV Final Environmental Impact Report. The Certificate also approved a waiver for Phase I sewers in the northeastern portion of Town to proceed prior to the completion of the EIR.

On August 15, 2002 a Project Evaluation Form (PEF) was filed by the Town to secure State Revolving Funds (SRF) for the successive phases of the CWMP/EIR. The PEF was included in the Department of Environmental Protection's (DEP) Intended Use Plan (IUP) for CY2003. On December 31, 2003 the DEP issued a restricted Project Approval certificate (PAC) No. CW-03-27 for $90,000.00. The DEP determined and certified to the Massachusetts Water Pollution Abatement Trust (WPAT) in accordance with M.G.L. c. 21, s.27A, M.G.L. c. 29C (the "enabling Act") and 310 CMR 44.00 (the "Regulations") that the PAC was issued by the DEP in accordance with all rules and regulations.

The Phase I, Needs and Growth Management Report was completed and submitted to MEPA in March of 2003. Notice was published in the *Environmental Monitor* on March 25, 2003. After the public comment period, the Secretary of Executive Office of Environmental Affairs issued the MEPA Certificate on May 15, 200 stating the Phase I Needs Analysis and Growth Management submitted on this project adequately and properly complies with the Massachusetts Environmental Policy Act (G.L. c. 30, ss. 61-62H) and with its implementing regulations (301 CMR 11.00). The Certificate also gave permission for the Town to proceed with the Phase II Screening of Alternatives document.

On September 23, 2004 the Town requested a Revised PAC and Project Regulatory Agreement (PRA) from DEP based on the fact the Town had undertaken a competitive procurement process to select a consultant to perform the Phase II Screening of Alternatives. Additional information that was provided to the DEP with this request included:

- Request for Proposal
- Cost Proposal Summary
- Service Agreement with Earth Tech, Inc. (includes Scope of Work)

On February 8, 2005, the Department approved the Phase II Scope of Work and the Scope was submitted to MEPA for publication as a Notice of Availability in the *Environmental Monitor*. The Notice appeared in the *Monitor* dated March 9, 2005.

On behalf of the Town of Tyngsborough, Earth Tech submitted a PEF for the EIR on August 15, 2004 and again on August 15, 2005. While the 2004 PEF was included in the CY2005 IUP, the Town did not move forward with Town Meeting approval due to financial reasons. The CY2006 PEF was included in the final IUP and will proceed as usual in securing the necessary Town appropriation before June 30, 2006.

B. GRANT/LOAN ADMINISTRATION

Grant/Loan administration services are being provided in accordance with DEP financial assistance guidelines and procedures. Liaison among the Town, DEP officials and Earth Tech, and contract administration, are being carried out. Earth Tech is assisting the Town in submitting (on average) monthly SRF drawdown requests to the DEP for reimbursement for costs incurred to undertake the study. Upon completion of the project, the Town and Earth Tech will prepare and submit the required loan closeout documents.

The Town will then be responsible to budget for debt service payments to the Water Pollution Abatement Trust over the 20-year payoff period for this loan.

APPENDIX A

CWMP/EIR Phase I MEPA Certificate

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
251 Causeway Street, Suite 900
Boston, MA 02114-2119

MITT ROMNEY
GOVERNOR
KERRY HEALEY
LIEUTENANT GOVERNOR
ELLEN ROY HERZFELDER
SECRETARY

Tel. (617) 626-1000
Fax (617) 626-1181
http://www.mass.gov/envir

May 15, 2003

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS

ON THE SPECIAL REVIEW PROCEDURE

PHASE I: NEEDS AND GROWTH MANAGEMENT ANALYSIS

PROJECT NAME	: Comprehensive Wastewater Management Plan
PROJECT MUNICIPALITY	: Tyngsborough
PROJECT WATERSHED	: Merrimack
EOEA NUMBER	: 11788
PROJECT PROPONENT	: Town of Tyngsborough
DATE NOTICED IN MONITOR	: March 25, 2003

As Secretary of Environmental Affairs, I hereby determine that the Phase I: Needs Analysis and Growth Management submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (G. L. c. 30, ss. 61-62H) and with its implementing regulations (301 CMR 11.00). The proponent may begin to prepare the Phase II: Screening of Alternatives document.

Project Description

This project involves the development of a town-wide Comprehensive Wastewater Management Plan (CWMP) for Tyngsborough. The goal of the CWMP is to examine the full range of wastewater management needs and identify environmentally sustainable treatment and disposal alternatives that respond to the community's needs while meeting water quality and public health standards. The result will be a comprehensive plan outlining how the Town of Tyngsborough will treat and dispose of its wastewater for the next 20 years.

In the fall of 1998, the Town of Tyngsborough filed an ENF for the CWMP. In December of that year, a Certificate on the ENF was issued defining a Special Review Procedure for the CWMP and allowing a portion of the proposed plan, east of the Merrimack River, to proceed as Phase I prior to completion of the EIR for the overall project. On April 6, 2001, a Certificate was issued on a Notice of Project Change (NPC) granting the proponent's request to add a section of sewers to the Phase I project to support the development of Sycamore Networks, a campus style office park off Potash Hill Road.

The Special Review Procedure required the Town of Tyngsborough to file four documents: Phase I: Needs and Growth Management Analysis includes an assessment of existing conditions and an analysis of wastewater management needs; Phase II: Screening of Alternatives includes the development and screening of water resources and wastewater management alternatives to address the needs defined in the Phase I document; Phase III: DEIR/Facilities Plan will build on the Phase II analysis and present a draft plan that includes evaluation of the most feasible options; and Phase IV: FEIR/Facilities Plan will present the final proposed plan and incorporate and respond to any outstanding comments and issues.

Permits and Jurisdiction

This project is subject to the Mandatory EIR provisions of the MEPA regulations because it will likely involve construction of more than ten miles of new sewers and may exceed other Mandatory EIR thresholds. It will likely require permits from the Department of Environmental Protection (DEP) for sewer extensions and connections, National Pollutant Discharge Elimination System (NPDES) permits issued by the U.S. Environmental Protection Agency (EPA) and an Order of Conditions from the Tyngsborough Conservation Commission. It may also include work in state roads and require a permit from the Massachusetts Highway Department (MHD). Because the project will receive funding or financial assistance from DEP under the State Revolving Fund, this project is subject to broad scope jurisdiction under MEPA.

Summary of Phase I: Needs Analysis and Growth Management

The scope for Phase I called for identifying existing wastewater problems, their causes and the geographic area over which they occur; identification of service areas where additional wastewater disposal measures will be required; and, an initial analysis of potential reduction in wastewater volumes including a draft water demand management and conservation plan.

The Needs Analysis identifies alleviating non point source pollution, protecting water quality and promoting groundwater recharge as important goals. It includes an assessment of existing environmental conditions, water demand projections and supply sources, an overview of existing stormwater management systems and areas that have been identified for additional analysis and development of stormwater Best Management Practices (BMPs), a description of the existing wastewater management systems and identification of areas that will be addressed in the alternatives analysis.

The Needs Analysis is responsive to the scope and sets the stage for the next phase of work; however, some additional analysis on existing conditions is necessary and should be incorporated into the Phase II document.

The Needs Analysis notes that one third of the community's wastewater management needs are met through existing sewers in the areas of Mascuppic Lake, Dunstable Road and the southern end of Pawtucket Boulevard. The Tyngsborough Sewer Commission is responsible for administering, maintaining, and operating these sewage collection systems. Sewage is conveyed from Tyngsborough to the Lowell Regional Wastewater Utility (LRWU) for treatment via sewage collection systems in the towns of Dracut, Chelmsford and Lowell. Wastewater flow limits are established through intermunicipal agreements (IMAs) with each of these communities. The remaining 2/3 of the wastewater management needs are met through on-site systems located throughout the town. The report describes existing stormwater systems and includes a draft stormwater management plan that includes recommendations for development of Best Management Practices (BMPs), removal of illegal connections and public education. In addition, it describes the town's water supply system and projects growth in water demands based on historical trends. Seventy percent of the Town's water needs are met through local aquifers and, as noted previously, protection of groundwater resources is an important goal of the CWMP.

The Needs Analysis identified 15 areas throughout the town where identification of alternatives to on-site septic systems will be important. These areas were identified based on a number of criteria including soil types, lot size, natural resources, water resources and performance of existing on site systems. Two areas, the Merrimack East Study Area and the Flint Pond Study Area, have been identified as a high priority.

The report includes a good overview of the extent and performance of Title 5 systems and identifies areas where these systems can adequately provide environmental protection and where they should be substituted with alternatives. DEP has indicated that information on large Title 5 systems (greater than 15,000 gallons per day) is not included and should be provided in the Phase II document and these needs should be included within the screening process.

Executive Order #385 requires that state and local agencies engage in proactive and coordinated planning oriented towards both resource protection and sustainable economic development. Public infrastructure should be carefully targeted toward those areas for which a clear existing need has been established and for areas where denser development is appropriate, thereby relieving development pressures on open space, agricultural lands, and other valuable natural resources. While the Phase I report provides useful and detailed information on land use (Tyngsborough is expected to reach build out within the 20 year planning period), amount of protected open space, and amount of developable land town-wide and within each study area, it does not address the potential secondary growth impacts that may be induced by public sewers. These impacts should be discussed within the context of local and regional growth management plans and policies and efforts to address inconsistencies should be described in the Phase II report. In addition, the report should describe the extent to which existing intermunicipal agreements can accommodate growth and to what extent the sewage collection systems and LRWU can support increases in wastewater generation.

DEP has also highlighted the need for additional information on Infiltration/Inflow (I/I). I understand that an I/I study is underway. In addition, while the Town developed an estimate of wastewater flow rates for typical homes (65 gpd per household), it is unclear how that number was derived and whether it is an accurate estimate. The Phase II report should include a summary of the I/I report and additional analysis on household sewer flows. The Phase I report identifies some measures with the potential for reducing wastewater volumes as required but a draft demand management and conservation plan was not included. I expect the proponent will explore this in much more depth in the Phase II report.

Scope of Phase II

As noted earlier, Phase II will evaluate and screen all potential alternatives that can address the needs and problems identified by the Phase I report. Alternatives should include the full range of options available under Title 5, shared septic systems, package treatment plants, extension of town sewers, and measures to ensure the effectiveness of on-site systems. DEP has indicated a couple of areas where decentralized solutions should be given strong consideration. An appropriate set of screening criteria should be developed and applied addressing the areas of cost, technical feasibility, environmental and public health protection, institutional and management issues, and other relevant concerns. In addition, any potential impact to environmental resources and resource areas such as wetlands, drinking water supplies, fisheries, water bodies, sensitive habitats, parklands, recreational resources and historic interest should be identified on a plan of reasonable scale. The identification of environmental resources should build upon the growth management analysis.

The Phase I report contains a proposed scope for the Phase II document. The Town of Tyngsborough should carefully address the issues raised by DEP in the attached comment letter and continue to work with DEP to refine and finalize the Scope of Work for the Phase II document. The proponent should file the revised Scope of Work for the Phase II document with the MEPA Office for publication of a Notice of Availability in the *Environmental Monitor*, and it should distribute copies of the revised Scope of Work to all commenters to the Phase II document.

May 15, 2003
Date

Ellen Roy Herzfelder

Comments received:

05/12/03	Department of Environmental Protection/CERO
04/23/03	Northern Middlesex Council of Governments

ERH/CDB/cdb

NMCOG

Northern Middlesex Council of Governments

A Multi-Purpose Regional Planning District Serving:

Billerica
Chelmsford
Dracut
Dunstable
Lowell
Pepperell
Tewksbury
Tyngsborough
W   ord

Ellen D. Rawlings
Chair

Robert W. Flynn
Executive Director

Gallagher Terminal
Floor 3B
115 Thorndike Street
Lowell, MA
01852-3308

TEL.#(978) 454-3021

FAX #(978) 454-8023

www.nmcog.org

RECEIVED
APR 25 2003
MEPA

April 23, 2003

Ellen Roy Herzfelder, Secretary
Executive Office of Environmental Affairs
251 Causeway Street, Suite 900
ATTN: Deirdre Buckley
Boston, MA 02114

RE: Phase 1 EIR- Tyngsborough Comprehensive Water Resources Management Plan, EOEA # 11788, NMCOG # 512

Dear Secretary Herzfelder:

The staff of the Northern Middlesex Council of Governments has reviewed the EIR for the Tyngsborough Comprehensive Water Resources Management Plan – Phase 1 Needs and Growth Assessment. This document represents the first of four phases as outlined in a Special Review Procedure per the Secretary's October 25, 1998 certificate.

The Phase 1 document includes documentation of existing environmental conditions, and an assessment of current and future water demand and wastewater disposal needs. It is the opinion of the Council staff that the Phase 1 needs assessment provides a thorough analysis of the issues prescribed in the Secretary's certificate. Furthermore, the Council staff has reviewed the proposed scope for the Phase 2 EIR-Screening of Alternatives, and finds it to be comprehensive and inclusive of those issues detailed in the certificate.

Should you have any questions regarding the NMCOG staff comments please contact myself or Beverly Woods, Assistant Director.

Very truly yours,

Robert W. Flynn
Executive Director

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sewering. The proponent must determine whether sewering these additional areas, plus the existing area, might cause flow exceedences to the Chelmsford sewer line.

- The report does not identify any large Title 5 systems (>15,000 gallons per day). These systems would need either groundwater permits or some other solution. The Tyngsborough Campground is one of these systems and has been under an Order to upgrade its septic facility. Also, Figure 4.5 identifies the locations of community wells and Figure 4.3 identifies lot sizes with multi-family systems, many of which may be large Title 5 systems, and which may not meet DEP requirements. The Town must identify all large Title 5 systems and the Phase II report should consider alternatives for them during the screening process.

- In the western part of town, the States area, Davis area and Massapoag area each have high septic system failure rates, tight soils and high groundwater and bedrock, yet the areas receive a "Medium" rating. The Phase II report should address this and also consider a decentralized solution in this area.

- Massapoag Lake is very eutrophic and surrounded by many small lots and failing Title 5 systems. The soils in the area are good, and a decentralized system should be investigated for this location.

- The town has an Inter-municipal Agreement with the city of Lowell for 0.02 mgd. This IMA should be increased to 0.04 MGD. The report agrees that the Town should increase the IMA to 0.04 mgd. When Stonehedge Inn recently increased its flow, the Department required the larger IMA amount in the sewer connection permit: therefore this increase should already be in place. The Phase II report should update the status of the IMA.

The DEP Central Regional Office appreciates the opportunity to comment on this proposed project. If you have any questions regarding these comments, please do not hesitate to contact me at (508) 792-2802.

Sincerely,

Paul Anderson

Paul Anderson
Municipal Services Coordinator

Cc. Martin Suuberg, Regional Director, CERO
Commissioner's Office, DEP, Boston
Ron Lyberger, BRP-Boston

APPENDIX B

Phase I CWMP/EIR MEPA Certificate Response to Comments

SUMMARY OF PUBLIC COMMENTS RECEIVED DURING THE MEPA PROCESS

The Town of Tyngsborough submitted an Environmental Notification Form (ENF) to MEPA in the fall of 1998. The comment period for the ENF ended on November 14, 1998 and on December 1, 1998 the Executive Office of Environmental Affairs (EOEA) determined that the project required an Environmental Impact Report (EIR) and established a Special Procedure for review of the required EIR. The Phase I "Needs and Growth Management" Report, was submitted March 1, 2003, and on May 15, 2003 the EOEA determined that the Phase I Report adequately and properly complies with the MEPA regulations and the special procedure. Included in this section are the responses to the comments letter on the Phase I "Needs and Growth Management" Report.

The MEPA Certificate (EOEA No. 11788), issued by the Secretary of Environmental Affairs to the Town of Tyngsborough, requires the preparation of a Comprehensive Wastewater Management Plan/Environmental Impact Report (CWMP/EIR) for the Town and establishes a special procedure for review of this project. The special procedure is a phased review during which the scope for future phases is based in large part on the results of the preceding phase. A project description was included in the MEPA certificate. The Phase I is the" Needs and Growth Management". The Phase II scope is the "Screening of Alternatives". The Phase III scope is the "Draft CWMP and EIR" and will be finalized upon the completion of Phase II. The Phase IV scope is the "Final CWMP and EIR" and will be finalized upon the completion of Phase III. Each phase of this project will be distributed for review according to MEPA regulations. Therefore, there will be opportunity for the appropriate public comment period for all interested parties to contribute to the outcome of this project. The Secretary requested that the following items be addressed in the Phase II Report:

1. Title 5 systems over 10,000 gallons per day
2. Secondary growth impacts (Executive Order 385) as a result of sewering areas
3. Existing Intermunicipal Agreements' ability to support increased growth
4. Additional information on I/I*
5. Clarification of wastewater flow rate of 65 gpd per household
6. Inclusion of water conservation measures/demand measures

* I/I Report was completed In October 2002. Copies were forwarded to DEP-Boston on January 31, 2005 and DEP-CERO on February 9, 2005.

SUMMARY OF PUBLIC COMMENTS RECEIVED DURING THE MEPA PROCESS

Below is a list of letters received by the MEPA Office during the public comment period for the Phase I "Needs and Growth Management" Report:

1. Department of Environmental Protection – Central Regional Office
2. The Northern Middlesex Council of Governments.

Each letter includes a variety of issues and concerns, which are summarized in the paragraphs that follow. A response to the comments and issues immediately follow each item. The complete MEPA certificate with the comment letters is provided in Appendices A and B.

1. April 23, 2003 letter from Robert W. Flynn, Executive Director, the Northern Middlesex Council of Governments (NMCOG). The staff of NMCOG reviewed the Phase I "Needs and Growth Management" Report and had the following comments.

    - *It is the opinion of the Council staff that the Phase I needs assessment provides a thorough analysis of the issues prescribed in the Secretary's certificate.*

2. May 12, 2003 letter from Paul Anderson, Municipal Services Coordinator, Department of Environmental Protection, Central Region Office (DEP-CERO). The staff of DEP-CERO reviewed the Phase I "Needs and Growth Management" Report and had the following comments.

    - *Page 4-7 has an estimate based on 65-gpd person and the report references that there is an Infiltration/Inflow (I/I) study underway. The Department has information from previous reports that indicates that flow and I/I may be higher than stated. The Phase II report should include more on sewer flows and I/I.*

      The Phase II Report will summarize the completed I/I Report as well as review the 65-gpd estimate included in the Phase I Report.

SUMMARY OF PUBLIC COMMENTS RECEIVED DURING THE MEPA PROCESS

- *There were two primary "high needs" areas that are discussed. One area is east of the Merrimack River, which would connect to the Dracut sewer line, and one is west of the Merrimack River, which would connect to the Chelmsford sewer line. Sewering the high needs on the west of the river would open up sewers to three other areas. Also installing sewers for the Flint Pond area would open up four other areas for sewering. The proponent must determine whether sewering these additional areas plus the existing area, might cause flow exceedances to the Chelmsford sewer line.*

  The Phase II Report will identify and complete an alternatives analysis for all of the areas identified in the Phase I report as unsustainable with on-site wastewater disposal systems. A complete review of all IMAs that Tyngsborough is currently under agreement with will be reviewed as part of the scope of Phase II.

- *The report does not identify any large Title 5 systems (>15,000 gallons per day)*. These systems would need either groundwater permits or some other solution. The Tyngsborough Campground is one of these systems and has been under an Order to upgrade its septic facility. Also, Figure 4.5 identifies the locations of community wells and figure 4.3 identifies lot sizes with multi-family systems, many of which may be large Title 5 systems, and which may not meet DEP requirements. The town must identify all large Title 5 systems and the Phase II report should consider alternatives for them during the screening process.*

  The Phase II Report will identify and evaluate alternative options all Title 5 systems > 10,000 gallons per day.

- *In the western part of Town, the States area, Davis area and Massapoag area each have high septic system failure rates, tight soils and high groundwater and bedrock, yet the areas receive a "medium" rating. The Phase II report should address this and also consider a decentralized solution in this area.*

  The Phase II Report will review each study area as presented in the Phase I Report. Each area will be fully evaluated in the alternatives analysis.

**Note: The correct number should read "10,000 gallons per day".*

- *Massapoag Lake is very eutrophic and surrounded by many small lots and failing Title 5 systems. The soils in the area are good, and a decentralized system should be investigated for this location*

  Massapoag Lake will be included in the alternatives analysis in the Phase II Report.

- *The town has an Inter-municipal Agreement with the city of Lowell for 0.02 mgd. This IMA should be increased to 0.04MGD. The report agrees that the Town should increase the IMA to 0.04 mgd. When Stonehedge Inn recently increased its flow, the Department required the larder IMA amount in the sewer connection permit; therefore this increase should already be in place. The Phase II report should update the status of the IMA.*

  The Phase II Report will contain a review of Tyngsborough's IMA with the City of Lowell as well as the IMAs with the Towns of Dracut and Chelmsford.

SUMMARY OF PUBLIC COMMENTS RECEIVED DURING THE MEPA PROCESS

CIRCULATION LIST

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Executive Office of Environmental Affairs
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Department of Environmental Protection
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Ms. Brona Simon
Massachusetts Historical Commission
The Massachusetts Archives Building
220 Morrissey Boulevard
Boston, MA 02125

Mr. David Pincumbe
U.S. EPA - N.E. Region
1 Congress Street, Suite 1100
Boston, MA 02114-2023

Mr. Allen Curseaden
Town of Tyngsborough
Sewer Commission
83 Wood Street
Hopkinton, MA 01748
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Town of Tyngsborough
Planning Board
Town Hall
25 Bryants Lane
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MassWildlife
Natural Heritage and Endangered
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Mr. Jack Hamm
Department of Environmental Protection
One Winter Street, 5th Floor
Boston, MA 02108
(four copies)

Northern Middlesex Council of
Governments
Gallagher Terminal, Floor 3B
115 Thorndike Street
Lowell, MA 01852-3308

Massachusetts Highway Department
District No. 4
519 Appleton Street
Arlington, MA 02476
Attn: Environmental Reviewer

Town of Tyngsborough
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Town of Tyngsborough
Board of Health
Town Hall
25 Bryants Lane
Tyngsborough, MA 01879

Town of Tyngsborough
Conservation Commission
Town Hall
25 Bryants Lane
Tyngsborough, MA 01879

Massachusetts Audubon Society
208 South Great Road
Lincoln, MA 01773

SUMMARY OF PUBLIC COMMENTS RECEIVED DURING THE MEPA PROCESS

Ms. Michele Drury
Department of Conservation and Recreation
Office of Water Resources
251 Causeway Street, Suite 700
Boston, MA 02114

Ms. Kathleen Baskin, P.E.
Executive Office of Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

Mark A. Young
City of Lowell Regional Wastewater Utility
451 First St. Blvd. (Rte 100)
Lowell, MA 01850

Sewer Commission
Town of Chelmsford
50 Billerica Road
Chelmsford, MA 01821

Ms. Marcia Starkey
Department of Food and Agriculture
Lancaster Field Office
142 Old Common Road
Lancaster, MA 01523

Mr. David Denommee
Tyngsborough Water District
87 Progress Avenue
Tyngsborough, MA 01879

Sewer Commission
Town of Dracut Sewer Department
1196 Lakeview Avenue
Dracut, MA 01826-4791

Division of Public Works NWTF
City of Nashua New Hampshire
Sawmill Road
Nashua, New Hampshire 03060

APPENDIX C

Intermunicipal Agreements and Flow Capacities

COPY

Amendment to the Agreement dated November 13, 1995, between the City of Lowell, a Massachusetts municipal corporation within the County of Middlesex and the Commonwealth of Massachusetts, hereinafter referred to as the "City" and the Town of Tyngsborough, an incorporated township within the County of Middlesex and the Commonwealth of Massachusetts, hereinafter referred to as the "Town", acting by and through its Sewer Commission.

WHEREAS, the Town wishes to increase its capacity by an additional 60,000 gallons per day; and

WHEREAS, the City agrees to provide such increase capacity; and

WHEREAS, the Town agrees to pay any and all capital cost apportionment due under Article VI of the November 13, 1995 Agreement.

NOW THEREFORE, for mutual consideration, the parties agree as follows:

The Town's capacity is increased from 20,000 gallons per day to 80,000 per day upon the same conditions and terms as set forth in the November 13, 1995 agreement.

The schedule for this increase shall be:

20,000 Gallons upon execution of this Agreement;

20,000 Gallons on July 1, 2002; and

20,000 Gallons on July 1, 2005.

IN WITNESS WHEREOF, the City and the Town have caused their proper representatives to execute this Amendment.

Dated: 5/11/00

APPROVED AS TO FORM:

Asst. City. Solicitor

CITY OF LOWELL

By: Brian J. Martin
City Manager

APPROVED AS TO FORM:

Charles J. Zaroulis, Esq.
Tyngsborough Town Counsel

TOWN OF TYNGSBOROUGH

5-9-00

BY: CHAIR

Its Sewer Commission

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COPY

LOWELL-TYNGSBOROUGH AGREEMENT

AGREEMENT

THIS AGREEMENT, made and entered into this _____day of _____, 19__ by nd between the CITY OF LOWELL, a municipal corporation within the County of Middlesex and the Commonwealth of Massachusetts, hereinafter referred to as the "CITY", and the TOWN of TYNGSBOROUGH, an incorporated township within the County of Middlesex and the Commonwealth of Massachusetts, hereinafter referred to as the "TOWN".

WITNESSETH:

WHEREAS, the Water Resources Commission, Commonwealth of Massachusetts, acting through the Office of the Director of the Division of Water Pollution Control, has found the TOWN to be discharging wastewaters into the surface waters of the Commonwealth in contravention of the water quality standards of the Division of Water Pollution Control, and

WHEREAS, the CITY is authorized by law to enter into contracts and agreements with the TOWN for the purpose of aiding in the abatement of water pollution, and

WHEREAS, the TOWN has petitioned the CITY to purchase ~~ten~~ TWENTY thousand ~~five hundred~~ (~~10,500~~ 20,000) gallons of capacity from the CITY's wastewater treatment facility, and

WHEREAS the flow shall enter the CITY through a metering station to be placed on Pawtucket Blvd, and

WHEREAS, the CITY deems it to be in the public interest to enter into an Agreement with the TOWN whereby the CITY would receive, treat and dispose of the TOWN'S wastes through the CITY'S sewage system.

NOW, THEREFORE, in consideration of these premises and mutual benefits to be derived by the parties hereto, it is agreed as follows:

ARTICLE 1. DEFINITIONS

1.1 For the purposes of this Agreement, the following terms are defined:

1.1.1 "Average Daily Flow" shall mean the total annual flow as measured in gallons at metering stations plus agreed - to unmetered direct discharges to the CITY sewage system divided by the number of days in the year.

1.1.2 "Biochemical Oxygen Demand" (BOD_5) shall mean the quantity of oxygen utilized in the biochemical oxidation of organic matter under standard laboratory procedure in five(5) days at 20 degrees Centigrade(68 degrees Fahrenheit) expressed in milligrams per liter (mg/1) by weight.

1.1.3 "CITY" shall mean the City of Lowell, a municipal corporation of the Commonwealth of Massachusetts.

1.1.4 "Chloride Demand" shall mean the amount of chlorine expressed in mg/1 required to be added to water, sewage or other liquid to achieve a combined chlorine residual after fifteen (15) minutes contact of one (1) mg/1.

1.1.5 "Combined Sewer" shall mean a sewer receiving both surface runoff and wastewater.

1.1.6 "Industrial User" shall mean any a source of indirect discharge.

1.1.7 "Industrial wastewater" shall mean all water-carried wastes and wastewater excluding domestic wastewater and unpolluted water. Includes all wastewater from any producing, manufacturing, processing, testing, institutional, commercial, agricultural, or other operations where the wastewater discharged includes nondomestic wastes.

1.1.8 "Maximum Daily Flow" shall mean the maximum gallons recorded at metering stations plus agreed-to allowances for direct discharges to the CITY sewage system during a 24-hour period during any calendar year.

1.1.9 "Operating Cost" shall mean the cost incurred by the CITY necessary for the proper and efficient operation and maintenance of the sewage works.

1.1.10 "Peak Rate of Flow" shall mean the maximum instantaneous rate of flow in gallons recorded at metering stations or measured in the direct discharges to the CITY sewage system during any calendar year.

1.1.11 "pH" shall mean a measure of the alkalinity or acidity of a substance, expressed in standard units.

1.1.12 Publicly owned treatment works or POTW shall mean the city-owned treatment works, as defined in Section 212 of the Act (33 U.S.C. 1292). This definition includes any sewers that covey wastewater to the POTW treatment plant, but does not include pipes, sewers, or other conveyances not connected to a facility providing treatment. For the purpose of this agreement, "POTW" shall also include any sewers that convey wastewater to the POTW from persons outside the city who are, by agreement with the Utility, users of the POTW.

1.1.13 "Replacement Costs" shall mean expenditures for obtaining and installing equipment, accessories or appurtenances which are necessary during the service life of the sewage works to maintain the capacity and performance for which said works were designed and constructed. Replacement costs shall be apportioned in accordance with ARTICLE VI.

1.1.14 "Sanitary sewer" shall mean a sewer which carries sewage and to which stormwater, surface water and groundwater are not intentionally admitted.

1.1.15 "Service Life" shall mean the period of time during which the sewage works or a component of a waste treatment management program will be capable of performing a function.

1.1.16 "Sewage System or Sewage Works" shall mean all facilities for collecting, conveying, pumping, treating and disposing of sewage.

1.1.17 "Suspended Solids" (TSS) shall mean solids that either float on the surface of, or are in suspension in, water, sewage, wastewater or other liquids and which are removable by laboratory filtering.

1.1.18 "Total Capitol Cost" shall mean construction costs, engineering and legal fees, capitalized interest costs during construction, amortization costs and land costs.

1.1.19 "TOWN" shall mean the Town of Tyngsborough, an incorporated township of the Commonwealth of Massachusetts.

1.1.20 "User Charge" shall mean a charge levied on a user of a sewage works for the cost of operation and maintenance, including replacement costs, of such works.

1.1.21 "Wastes" shall mean substances in liquid, solid or gaseous form that can be carried in water.

ARTICLE II. OBLIGATIONS AND RESPONSIBILITIES

2.1 The CITY shall receive, treat and dispose of the TOWN'S wastes, in accordance with all existing or future laws, regulations, existing or future CITY Sewer Ordinance, water quality standards, and orders and decrees of any governmental authority having jurisdiction over the treatment and disposal of said wastes; provided, however, that the treatment of the TOWN'S wastes to be provided by the CITY shall be of such a type and degree as may be necessary to provide for the application of Best Practicable Waste Treatment Technology. The TOWN shall conform to all appropriate industrial wastewater pretreatment rules and regulations as established by the appropriate State and Federal regulatory agencies.

The TOWN, in regard to any violation in the TOWN, shall assist the CITY in meeting its obligations of adhering to and enforcing all existing and future laws, regulations, water quality standards, and orders and decrees of any governmental authority having jurisdiction over the treatment and disposal of said wastewaters.

2.2 The TOWN will not connect any combined sewer or separate drains into the CITY'S sewage system and will not discharge into said sewage system any volume of sewage, substances or wastewater containing the following characteristics in excess of that agreed to herein:

2.2.1 Any Waters or wastes containing fats, wax, grease or oils, whether emulsified or not, in excess of one hundred (100) mg/l or containing substances which may solidify or become viscous at temperatures between zero (0) and sixty-five(65) degrees Centigrade, (32 and 150 degrees Fahrenheit).

2.2.2 Any gasoline, benzene, naptha, fuel oil, or other liquid, solid or gas in sufficient concentration to be flammable or explosive.

2.2.3 Heat in the amounts which will inhibit biological activity in the POTW resulting in interference but in no case heat in such amounts that the temperature of the wastewater entering the POTW treatment plant exceeds 40_0C (104^0 F);

2.2.4 Solid or viscous substances in quantities or of such size capable of causing obstruction to the flow in sewers, or other interference with the proper operation of the sewage works such as, but not limited to, ashes, cinders, sand, mud, straw, unground garbage, whole blood, paunch manure, hair and fleshings, entrails, paper dishes, cups, milk containers, etc., either whole or ground by garbage grinders.

2.2.5 Any garbage not properly shredded.

2.2.6 Any wastes having a ph lower than 6.0 or higher than 9.5 or having any corrosive property capable of causing damage or hazards to structures, equipment or personnel at the sewage works.

2.2.7 Any pollutant that results in the presence of toxic gases, vapors or fumes within the POTW in any quantity that may result in worker health and safety problems.

2.2.8 Waters or wastes containing substances which are not amendable to treatment or reduction by the sewage treatment processes employed, or are amendable to treatment only to such degree that the sewage treatment plant effluent cannot meet the requirements of other agencies having jurisdiction over discharge to the receiving waters.

2.2.9 Pollutants which create a fire or explosive hazard in the POTW, including but not limited to, wastestreams with a closed cup flashpoint of less than 140 degrees Fahrenheit or 60 degrees Celsius using the test methods specified in 40 CFR 261.21;

2.2.10 Any pollutant, including oxygen demanding pollutants(BOD_5, etc.) released in a discharge at a flow rate and/or pollutant concentration which will cause Interference with the POTW;

2.2.11 Any trucked or hauled pollutants, except at discharge points designated by the Executive Director.

2.3 All Measurements of volume and characteristics of the TOWN'S wastes shall be made at metering stations constructed, operated and maintained by the TOWN at all mutually agreed upon locations.

All flow measurements made at the metering stations will be submitted to the Lowell Regional Wastewater Utility. For small individual areas in the TOWN, which will be discharging wastewater directly into the CITY sewage system, measurements shall be based on either water consumption readings or some other mutually acceptable method. Industrial wastewater from the TOWN, as measured at metering stations, shall be judged by the same standards as are in effect within the CITY'S sewage system, notwithstanding the provisions of Paragraph 2.2 of this ARTICLE.

ARTICLE III. AGREEMENT TERM

3.1 The provisions of this Agreement shall run for a minimum period of Twenty(20) years from the date of initial treatment of the TOWN'S wastewater subject to the provisions of ARTICLE X.

ARTIClE IV. IMPLEMENTATION

4.1 The CITY agrees to provide a system for the collection and treatment, with a portion of the capacity allocated to handle wastewater from the TOWN.

ARTICLE V. USER CHARGES

5.1 User charges:

5.1.1 The TOWN shall develop, in accordance with the provisions of federal regulations ("Code of Federal Regulations, subpart I, 40 CFR 35.2122 and 35.2140, et seq."), an equitable User Charge System to assure that each recipient of waste treatment services within the TOWN'S service area will pay its proportionate share of the costs of operation and maintenance (including replacement) of all waste treatment services provided by the CITY.

5.1.2 The TOWN must obtain approval of the Massachusetts Water Resources Commission, Division of Water Pollution Control, and the Region 1 Office of the U.S. Environmental Protection Agency for its User Charge System for the above costs.

5.1.3 The TOWN, upon approval of its User Charge System, must incorporate said System in one or more municipal legislative regulations.

5.1.4 The regulation(s) must include provisions whereby the maintenance of said System and the collection of the revenues can be reviewed by any governmental authority having jurisdiction and/or the CITY.

ARTICLE VI. CAPITAL COST APPORTIONMENT

6.1 The TOWN shall pay to the CITY a sum which represents its full obligation of the Total Cost to the CITY for the capacity purchased, after deduction of all government grants for all sewage works in the CITY, required to receive, transmit and treat the TOWN'S wastewater.

The TOWN and CITY acknowledge that certain construction has previously been completed by the CITY to facilities which are and shall be used by the TOWN pursuant to this AGREEMENT and the TOWN agrees to pay to the CITY the TOWN'S proportionate share of said construction in one(1) payment which shall be due before there is a connection of any sewer line from within the boundaries of the TOWN to the CITY'S sewage system.

6.2 Records of the CITY's Total Cost are public information and will be on file with the CITY and available for review at any time during normal business hours by all responsible agencies. Copies of pertinent information and other requested information will be forwarded to the TOWN during the course of the projects.

6.3 Whereas, metering stations are solely for flows generated by the TOWN, all capital costs for these facilities will be borne by the TOWN.

Where other sewage works are constructed solely for flows generated by the TOWN, all capital costs for said works will be borne by the TOWN. The basis of payments by the TOWN for sewage works constructed by the CITY shall be established as follows:

6.4.1 Treatment Facilities (including EPA/State Project No. 1 C250251 01, Preparation of Treatment Facilities Site and Sewers and Raw Sewage Pumping Station):

TOWN Payment = C2 d/e

Where:

C2 = Total Cost including all interest accrued as of 9/30/95.

d = Average Daily Flow Rate requested by TOWN

e = Total Average Daily Flow Rate minus capacity allotted to the other Contributing Towns

$$\text{Town Payment} = 27{,}114{,}998.45 \times \frac{20{,}000 \text{ gals}}{21{,}130{,}500 \text{ gals}} = \$25{,}664.43$$

6.5 The CITY shall provide capacities in its sewage works for the wastewater from the TOWN. Capacities for the TOWN shall be as follows:

6.5.1 Treatment Facilities and Raw Sewage Pumping

Station: Design Term	20 years
Transmission Facilities:	
Design Term	50 years
Average Daily Flow	0.0200 mgd
BOD_5	41.7 lbs/day
TSS	41.7 lbs/day

6.6 The CITY has designed the sewage works to meet the present day Division of Water Pollution Control requirements and to provide for Best Practicable Wastewater Treatment Technology, defined by said Division as secondary treatment.

6.7 Should it be required by the appropriate State and/or Federal agencies to provide additional wastewater treatment, or in any way modify the POTW to conform to Federal and State mandates, the TOWN shall pay its proportionate share of the required sewage works based on the flows established under Paragraph 6.5 of this ARTICLE.

If the CITY'S sewage works require enlargement or other modifications because the total flows or total strength of the flow to the treatment facilities exceed the design, then the TOWN shall contribute only in so far as its wastewater have exceeded the limits called for under the above referenced Paragraph 6.5.

ARTICLE VII. OPERATING COST APPORTIONMENT

7.1 The CITY shall maintain an adequate cost accounting system which shall be the basis for the determination and allocation of operating costs. This accounting system shall be subject to review by the TOWN.

The CITY shall maintain separate cost accounting records for the operation of those portions of their sewage works that are shared by the CITY and the TOWN and any other participants. Connection to the sewage works by the TOWN and any other participants will be made only at those points mutually agreed upon by the CITY and the TOWN. The annual cost of operating these sewage works shall be apportioned between the CITY, the TOWN and any other participants on the basis of their actual, annual flows, as determined from records at the respective metering stations.

7.2 The operating costs shall be apportioned against participants on the basis of average daily flows, providing that the established parameters from any participant are not exceeded. If either the average BOD_5 or TSS from any metering station exceeds 250 mg/l, then the TOWN shall pay a surcharge to the CITY for treatment of its wastewater. The surcharges will be based on the proportional extra cost incurred for the complete treatment of wastewater in excess of 250 mg/l for the period of time in violation.

7.3 Measured annual flows shall be determined for the TOWN from records at metering stations. Estimated flows from nonmetered, individual areas shall also be included, if not charged separately. Actual, annual flows shall be determined for the CITY from records at the treatment facilities.

7.4 The individual areas discharging directly into the sewer system, as described in paragraph 7.3, shall be assessed fees on the same basis as the users of the CITY. This amount shall then be assessed to the TOWN for payment. It is the responsibility of the TOWN, not the CITY to collect such fees and to submit payment to the CITY as required in Section 7.8.

7.5 The waste strengths, BOD_5 and TSS, for each of the participants shall be determined from proportional, composite 24-hour samples obtained at the metering stations. The Average daily BOD_5 and TSS in pounds per day shall be determined from the average of the composite samples taken on a random basis.

7.6 When determining surcharges, the unit cost per pound of BOD_5 and TSS used shall be based on the previous year's treatment facility operational costs divided by the total annual BOD_5 or TSS loadings. If the average of the concentration is over the established thresholds, the formula to determine the additional costs to the TOWN(over the operating cost) for that month will be as follows:

$$\text{Lbs } BOD_5 \text{ or TSS} = \text{Total Flow(MG) for month} \times (\text{Actual } BOD_5 \text{ or TSS} - 250 \text{ mg/l}) \times 8.34 \text{ lbs/gal}$$

$$\text{Surcharge amount \$} = \text{Lbs } BOD_5 \text{ or TSS} \times \text{price per lb } BOD_5 \text{ or TSS}$$

7.7 Operating costs for the treatment facilities shall include the cost of sampling and analyzing wastewater discharged by the participants. It shall also include the cost accounting related to the distribution and invoicing of operating costs and any other applicable costs.

7.8 Operating costs shall be payable monthly, on a fiscal year basis, upon receipt by the TOWN of the CITY's invoice. Bills shall be paid within thirty(30) days. Any bills not received within this time frame shall be assessed a five percent(5%) late fee. It will be the TOWN's responsibility to pay all costs and expenses, including but not limited to, all attorney's fees paid or incurred by the CITY in the enforcing of this agreement.

Operating costs for the first eleven (11) months shall be determined by using the CITY'S approved yearly operation budget (reduced to a monthly cost) and apportioning the TOWN'S share on the basis of actual total monthly flow, as measured.

The final monthly invoice for the fiscal year shall be rendered by the CITY within fifteen (15) days or the end of the fiscal year and shall be determined on the basis of actual flows and expenditures. All previous monthly invoices shall be subject to adjustment and correction at the time of this final billing for the fiscal year. The CITY shall forward to the TOWN, on or before March first, the projected estimate of operating cost and other costs for such fiscal year, so that the TOWN may make necessary preparations for the final monthly invoice for the fiscal year.

ARTICLE VIII. ANNUAL COST REVIEW

8.1 The CITY and TOWN both agree that the apportionment of costs set forth in ARTICLE VII, shall be subject to review annually. After a review of the annual costs, if an adjustment to the costs appears to be necessary, said adjustment shall be made by the CITY in the forthcoming billing for services. The adjustment will be to both the CITY'S and TOWN'S mutual satisfaction.

Should arbitration be necessary, unless otherwise provided by law, both parties shall mutually agree as to the arbitration procedure.

ARTICLE IX. ADJUSTMENT CLAUSE

9.1 The TOWN reserves the right at any time to pretreat and/or to reduce the BOD_5 and TSS concentrations of its wastewater, or to otherwise give preliminary treatment to its wastewater prior to discharge to the CITY sewage system. The TOWN agrees to notify the CITY as far in advance as possible of any significant increase or decrease in the quantity and/or quality of the wastewater to be discharged to the CITY sewage system.

9.2 Any separate agreement between the TOWN and adjacent communities must be reviewed by the CITY, but such separate agreements shall not be unreasonably disapproved by the CITY. The CITY's signature of approval will be required on any agreement of such nature. In any event, the TOWN shall in the aggregate be restricted to the waste parameters established under ARTICLE VI. Any increase in the allotted flow must be formally contracted for between the TOWN and the CITY.

<u>ARTICLE X. TERMINATION CLAUSE</u>

10.1 Any obligations under this Agreement are conditioned upon both the receipt and acceptance by the TOWN of construction grant funds from federal and/or state government agencies for sewage works necessary within the TOWN to transmit waste flows to the CITY sewage system and the receipt and acceptance by the CITY of construction grant funds from said agencies for the sewage works necessary within the CITY to convey and treat the TOWN'S wastewater.

10.2 Either party may terminate this Agreement by giving notice thereof to the other party in writing three(3) years prior to the termination date. Upon receipt of said notice, both parties will enter into discussion within thirty (30) days to assure proper termination of the Agreement.

Should the TOWN initiate the termination proceedings, it shall not have any right to the return of any of its initial capital investment under ARTICLE VI.

Should the CITY initiate the termination proceedings, it shall be obliged to return to the TOWN the unused proportionate share of the TOWN'S capital investment under ARTICLE VI.

10.3 The TOWN shall have the right to negotiate an extension of this agreement for the continued use of the CITY'S sewage works provided for, in part, by the TOWN'S capital investment under ARTICLE VI, beyond the twenty(20) years provided for in ARTICLE III, for as long as those sewage works remain in active use. The right shall be limited to the waste parameters established under ARTICLE VI.

ARTICLE XI. WASTEWATER ANALYSIS

11.1 The CITY and the TOWN both agree that the determination of character and concentration of wastewater will be in accordance with 40 CFR 136, or where there is no equivalent procedure, the latest edition of "Standard Methods for the Examination of Water and Wastewater", as proposed, approved and published jointly by the American Public Health Association, the American Water Works Association and the Water Pollution Control Federation, or any other method mutually agreed upon by the CITY and the TOWN, and subject further to the following:

11.1.1 Sampling at metering stations will be performed by the CITY. Determination of the character and concentration of the TOWN'S wastewater, for the purpose of checking waste parameters, shall be the responsibility of the CITY or its authorized agent. The TOWN shall be furnished copies of all such determinations.

11.1.2 Samples shall be collected by the CITY at metering stations in such a manner so as to be representative of the actual quality of the wastewater. The CITY shall have access to said Stations, as required, to conduct intermittent or continuous waste sampling. Access will be provided at all times as long as a one hour notice is given to the TOWN.

11.1.3 Portions of waste samples collected by the CITY, as part of a sampling and analytical program, will be made available to the TOWN at no cost and in adequate quantities for analysis by the TOWN for Characteristics and concentrations. In the event of discrepancy which cannot be satisfactorily resolved, the parties will submit the samples to a mutually acceptable, disinterested, qualified third party for determination of the waste characteristics and concentrations.

11.1.4 The metering station must be constructed so as to minimize the hazards of confined space entry.

ARTICLE XII. FLOW MEASUREMENTS

12.1 The CITY and the TOWN agree that flow measurements shall be made as follows:

12.1.1 The volume of flow used in computing the TOWN'S share of the operating costs shall be based upon readings obtained by suitable metering equipment of a type mutually acceptable to both the TOWN and the CITY. Such metering equipment shall be installed and maintained by the TOWN. The TOWN will provide the CITY with waste flow data for the preceding month, based upon meter readings, The CITY shall have access to said meters during normal business hours.

12.1.2 In the event the metering equipment is temporarily out of order or service for any reason, the TOWN'S estimated flow will be based on the average daily flow of the previous three months.

ARTICLE XIII RE-OPENER CLAUSE

13.1 In the event that Tyngsboro requests a greater flow allotment than provided in herein this contract, then the contract shall be re-opened and renegotiated. All negotiations and agreements must be finalized prior to the connection of any new sewer lines to the CITY's sewer system.

13.2 In the event that the City finds it necessary to modify its treatment facility, or in any other way adjust or improve either its treatment facility or collection system, resulting from Federal or State intervention, this contract shall be reopened for negotiation in regards to capitol costs and any other costs associated with said activities.

IN WITNESS WHEREOF, the CITY and the TOWN have caused their proper representatives on the day and year first above written.

FOR THE CITY OF LOWELL, MASSACHUSETTS

By____________________________

By____________________________

Approved as to form:

By____________________________ Asst. City Solicitor

FOR THE TOWN OF TYNGSBORO, MASSACHUSETTS

By Its Sewer Commissioners

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Approved as to form:

By ____________________________

Town Counsel

ARTICLE XIV INDUSTRIAL SEWER USE ADDENDUM

This Agreement is entered into this ____ day of _____, 19__, between the City of Lowell(City) and the Town of Tyngsborough(Town)(hereinafter jointly referred to as the "Parties").

RECITALS

1. The City owns and operates a wastewater treatment system.

2. The Town currently utilizes this wastewater treatment system.

3. Facilities located in The Town currently contribute wastewater which includes industrial waste. These facilities are hereinafter referred to as industrial users.

4. The City must implement and enforce a pretreatment program to control discharges from all industrial users of its wastewater treatment system pursuant to the requirements set out in 40 CFR Part 403. In this Agreement the Town agrees to adopt an industrial sewer user rules and regulations that subjects the industrial users within its boundaries to the necessary pretreatment controls, and the City is authorized to implement and enforce that industrial sewer use rules and regulations.

AGREEMENT

1A. The Town will adopt a local industrial sewer use rules and regulations which is no less stringent and is as broad in scope as the City Sewer Use Ordinance, Chapter 18 Article III. The Town will forward to the City for review a draft of its proposed industrial sewer use rules and regulations within sixty(60) days of the date of this Agreement. The Town will adopt its industrial sewer use rules and regulations within thirty(30) days of receiving approval from the City of its contents. Until such time as the Town's industrial sewer use rules and regulations have been adopted, the Town must abide by the City Sewer Use Ordinance, Chapter 18 Article III.

B. Whenever the City revises its industrial sewer use ordinance, it will forward a copy of the revisions to the Town. The Town will adopt revisions to its industrial sewer use rules and regulations which are at least as stringent as those adopted by the City. The Town will forward its proposed revisions within sixty(60) days of receipt of the City's revisions. The Town will adopt its revisions within thirty(30) days of receiving approval from the City of the content thereof. Until the Town's revisions have been adopted, the Town must abide by the revisions to the City's sewer use ordinance.

C. The Town will adopt pollutant specific local limits which address at least the same pollutant parameters and are as stringent as the local limits enacted by the City within thirty(30) days of the date of this Agreement. If the City makes any revisions to its local limits, the City will forward to the Town a copy of such revisions or additions within thirty(30) days of enactment thereof. The Town will adopt any such revisions or additions within sixty(60) days of receipt thereof. Until such time as the Town adopts its local limits or any revision to the local limits, the Town must abide by the City's local limits.

2A. The Town designates the City as the agent of the Town for the purposes of implementation and enforcement of the Town's industrial sewer use rules and regulations for industrial users located in the Town. The City may take any action under the Town's industrial sewer use rules and regulations that could have been taken by the Town, including the enforcement of the rules and regulations in courts of law.

B. The City, on behalf of and as agent for the Town, will perform technical and administrative duties necessary to implement and enforce the Town's industrial sewer use rules and regulations. The City will:

(1) update the industrial waste survey;

(2) issue permits to all industrial users required to obtain a permit;

(3) conduct inspections, sampling and analysis;

(4) take all appropriate enforcement actions as outlined in the Town's industrial sewer use rules and regulations;

(5) perform any other technical or administrative duties deemed appropriate.

In addition, the City may, as agent of the Town, take emergency action to stop or prevent any discharge which presents or may present an imminent danger to the health and welfare of humans, which reasonably appears to threaten the environment, or which threatens to cause interference, pass through or sludge contamination.

3. Before an industrial user located outside the jurisdictional boundaries of the Town discharges into the Town's sewer system, the Town and the City will enter into an agreement with the jurisdiction in which such industrial user is located. Such agreement will be substantially equivalent to this Agreement and must be entered into prior to a discharge from any such user.

4. The City will be responsible for all costs incurred by it in implementing and enforcing the Town's industrial sewer use rules and regulations. The City will bill the industrial users directly for sampling and related costs in accordance with Chapter 18 Article III of the Lowell City Code of Ordinances.

5A. If any term of this Agreement is held to be invalid in any judicial action, the remaining terms will be unaffected.

B. The Parties will review and revise this Agreement to ensure compliance with the Federal Clean Water Act(42 U.S.C.1251 <u>et seq</u>.) and rules and regulations(see 40 CFR Part 403) issued thereunder, as necessary, but at least once every five(5) years on a date to be determined by the Parties.

C. The Town will indemnify the City of Lowell for any costs incurred due to the failure of the Town to uphold any changes or modifications as required within this Agreement.

6. If the Authority of the City to act as agent for the Town is questioned by the industrial user, court of law, or otherwise, the Town will take whatever action is necessary to ensure the implementation and enforcement of its industrial sewer use rules and regulations, including, but not limited to, implementing and enforcing its industrial sewer use rules and regulations on its own behalf and/or amending this Agreement to clarify the City's authority.

FOR THE CITY OF LOWELL, MASSACHUSETTS

By________________________

By________________________

Approved as to form:

By________________________ Asst. City Solicitor

FOR THE TOWN OF TYNGSBORO, MASSACHUSETTS

By Its Sewer Commissioners

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Approved as to form:

By ________________________

Town Counsel

Tyngsboro through Lowell Flow & Flow Charges

	*calculated	(flow in millions)					Surcharges				(Flow in millions)	
Month/Year	Total Flo	Tyng Flow	*Factor	Expenses	*Total Costs	*Charge	BOD	TSS	*Total Charg	Year Total	Yr Flow	Ave Yr
Dec-04	1010.4	0.6183	0.00061194	$681,395.25	$681,395.25	$416.97	$853.58	$462.43	$1,732.98			
Jan-05	1097.3	0.53413	0.00048677	$681,395.25	$681,395.25	$331.68	$154.20	$25.34	$511.22			
Feb-05	974.6	0.56947	0.00058431	$681,395.25	$681,395.25	$398.15	$187.36	$61.41	$646.92			
Mar-05	1141.4	0.59626	0.00052239	$681,395.25	$681,395.25	$355.96	$605.35	$245.86	$1,207.17			
Apr-05	1285.3	0.82078	0.00063859	$681,395.25	$681,395.25	$435.13	$294.53	$0.00	$729.66			
May-05	1135.5	0.5808	0.00051149	$681,395.25	$681,395.25	$348.53	$301.62	$221.95	$872.10			
Jun-05	911.6	0.56611	0.00062101	$681,395.25	$681,395.25	$423.15	$380.72	$292.03	$1,095.90			
Jul-05	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!			#DIV/0!			
Aug-05	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!			#DIV/0!			
Sep-05	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!			#DIV/0!	#DIV/0!	4.28585	0.428585
Oct-05	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!			#DIV/0!			
Nov-05	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!			#DIV/0!			
Dec-05	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!			#DIV/0!			
Jan-06	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!			#DIV/0!			
Feb-06	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!			#DIV/0!			
Mar-06	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!			#DIV/0!			
Apr-06	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!			#DIV/0!			
May-06	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!			#DIV/0!			
Jun-06	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!			#DIV/0!			
Jul-06	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!			#DIV/0!			
Aug-06	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!			#DIV/0!			
Sep-05	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!			#DIV/0!	#DIV/0!	0	0
Oct-06	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!			#DIV/0!			
Nov-06	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!			#DIV/0!			
Dec-06	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!			#DIV/0!			
Jan-07	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!			#DIV/0!			
Feb-07	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!			#DIV/0!			
Mar-07	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!			#DIV/0!			
Apr-07	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!			#DIV/0!			
May-07	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!			#DIV/0!			
Jun-07	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!			#DIV/0!			
Jul-07	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!	$0.00	$0.00	#DIV/0!			
Aug-07	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!	$0.00	$0.00	#DIV/0!			
Sep-07	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!	$0.00	$0.00	#DIV/0!	#DIV/0!	0	0
Oct-07	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!	$0.00	$0.00	#DIV/0!			
Nov-07	0	0	#DIV/0!	$0.00	$0.00	#DIV/0!	$0.00	$0.00	#DIV/0!	#DIV/0!	0	0
Totals to date	7556.1	4.28585				#######	#######	$1,309.02	$6,795.95			
Average		0.11905							$188.78			

Pd this
3/10/05

LOWELL, MA February 17, 2005

Code #: 600005

TY OF LOWELL

COPY

epartment of Public Works

ite #:

count #:

vice #:

TO: Town of Tyngsboro
Board of Sewer Commissioners
25 Bryant Lane
Tyngsboro, Massachusetts 01879-1042

UE DATE: MARCH 17, 2005

MISC	INFORMATION	AMOUNT
	Tyngsboro sewer bill for December 2004 and January 2005 as per cntract. See attached.	$416.97
		$1,316.01
	December 2004	$331.68
	BOD & TSS for December 2004	$179.54
	January 2005	
	BOD & TSS for January 2005	$483.22
	UNPAID BALANCE	$2,727.42
	TOTAL DUE	
	Please make check payable to the: CITY OF LOWELL Flow only	748.65
	and mail: c/o Edward J. Walsh Commissioner of Public Works 1365 Middlesex Street Lowell, Massachusetts 01851	

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Pd this
3/10/05

ct Code #: 600005

LOWELL, MA February 17, 2005

ITY OF LOWELL

Department of Public Works

oute #:

ccount #:

ervice #:

TO: Town of Tyngsboro
Board of Sewer Commissioners
25 Bryant Lane
Tyngsboro, Massachusetts 01879-1042

DUE DATE: MARCH 17, 2005

MISC	INFORMATION	AMOUNT
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	January 2005	$331.68
	BOD & TSS for January 2005	$179.54
	UNPAID BALANCE	$483.22
	TOTAL DUE	$2,727.42

Please make check payable to the: CITY OF LOWELL
and mail: c/o Edward J. Walsh
Commissioner of Public Works
1365 Middlesex Street
Lowell, Massachusetts 01851

Town of Tyngsboro
Board of Sewer Commissioners
PO Box 11
Tyngsboro, Massachusetts 01879

Tyngsboro
Monthly Sewer Bill
for
Wastewater Transport and Treatment

Billing Period January-05

Standard Charge

Tyngsboro Monthly Flow (Million Gallons - see page 2)		0.53413
Wastewater Utility Monthly Flow (Million Gallons)		1,097.30
Proportioning Multiplier = Tyngsboro Flow / Utility Flow		0.0004868
Wastewater Utility Monthly Operating Costs (see page 2)	$	681,395.25
Standard Monthly Charge = Utility Monthly Costs x Multiplier	**$**	**331.68**

BOD / TSS Surcharges

Excess BOD Loading (lbs BOD) = Flow x [Actual - Threshold] BOD Conc x 8.34 (see page 2)		797.38
Excess TSS Loading (lbs TSS) = Flow x [Actual - Threshold] TSS Conc x 8.34 (see page 2)		122.50
BOD Unit Cost ($/lb BOD - see page 2)		0.1934
TSS Unit Cost ($/lb TSS - see page 2)		0.2069
BOD Surcharge = BOD Unit Cost x Excess BOD Loading	**$**	**154.20**
TSS Surcharge = TSS Unit Cost x TSS Excess Loading	**$**	**25.34**

Total Monthly Charge Summary

Standard Monthly Charge = Utility Monthly Costs x Multiplier	$	331.68
BOD Surcharge = BOD Unit Cost x BOD Excess Loading	$	154.20
TSS Surcharge = TSS Unit Cost x TSS Excess Loading	$	25.34
Total January-05 Monthly Charges	**$**	**511.22**

Wastewater Utility Monthly Operating Costs

Annual Utility Operating Costs = Operations + Overhead + Debt	$	**8,176,743.05**
Utility Monthly Operating Costs = Annual Costs / 12 Months	$	**681,395.25**

BOD / TSS Unit Costs

Utility BOD Costs = 38% of Annual Operating Costs	$	3,107,162
Utility TSS Costs = 35% of Annual Operating Costs	$	2,861,860
Annual Utility BOD Loading (lbs BOD / year)		16,067,819
Annual Utility TSS Loading (lbs TSS / year)		13,834,373
BOD Unit Cost ($ / lb BOD) = BOD Costs / BOD Loading		**0.1934**
TSS Unit Cost ($ / lb TSS) = TSS Costs / TSS Loading		**0.2069**

Excess Monthly BOD Loading

Pawtucket Boulevard Station = 0.53413 MGD x (429.00 - 250.00) mg/L x 8.34 : 797.38 lbs BOD

Excess Monthly BOD Loading = Flow x [Actual - Threshold] BOD Conc x 8.34 = **797.38** lbs BOD

Excess Monthly TSS Loading

Pawtucket Boulevard Station = 0.53413 MGD x (277.50 - 250.00) mg/L x 8.34 : 122.50 lbs TSS

Excess Monthly TSS Loading = Flow x [Actual - Threshold] TSS Conc x 8.34 = **122.50** lbs TSS

Monthly Monitoring Results

Pawtucket Boulevard Station

Date	Flow (MG)	BOD (mg/L)	TSS (mg/L)
01/07/05	16,413	618	416
01/21/05	39,077	240	139
Monthly Total/Average	27,745	429.00	277.50

Excess Threshold BOD/TSS Concentration (mg/L)	250.00
Tyngsboro Monthly Flow (MG)	**0.5341**

MONTHLY MONITORING RESULTS DETAIL

Pawtucket Boulevard Station						Lowell Vocational School				
Date	Sample #	Monthly Flow (MG)	Average Flow (GPD)	BOD (mg/L)	TSS (mg/L)	Date	Sample #	Average (GPD)	BOD (mg/L)	TSS (mg/L)
1/7/2005	01-07-05-015		16,413	618	416					
1/21/2005	01-21-05-017		39,077	240	139					
otal/Average		0.53413	27,745	429	277.5			10,412		

January-05

leter Readings	Vesper	Pawt. Blvd	Voke Flow	Net Tyngsboro Flow (MG)	
1/3/2005	-	75,725,504	Water Consu	Average Daily Flow	
2/1/2005	636,920.00	76,540,873	10,412	0.018418	
nterval Volume		815,369	281,242	0.53413	

lote: Spoke to Allan Curseaden regarding the Vesper totalizer meter. Will input readings next month

Wastewater Utility Monthly Operating Costs

Annual Utility Operating Costs = Operations + Overhead + Debt	$	**8,176,743.05**
Utility Monthly Operating Costs = Annual Costs / 12 Months	$	**681,395.25**

BOD / TSS Unit Costs

Utility BOD Costs = 38% of Annual Operating Costs	$	3,107,162
Utility TSS Costs = 35% of Annual Operating Costs	$	2,861,860
Annual Utility BOD Loading (lbs BOD / year)		16,067,819
Annual Utility TSS Loading (lbs TSS / year)		13,834,373
BOD Unit Cost ($ / lb BOD) = BOD Costs / BOD Loading		**0.1934**
TSS Unit Cost ($ / lb TSS) = TSS Costs / TSS Loading		**0.2069**

Excess Monthly BOD Loading

Pawtucket Boulevard Station = 0.61830 MGD x (1,106.00 - 250.00) mg/L x 8.34 = 4,414.07 lbs BOD

Excess Monthly BOD Loading = Flow x [Actual - Threshold] BOD Conc x 8.34 = **4,414.07** lbs BOD

Excess Monthly TSS Loading

Pawtucket Boulevard Station = 0.61830 MGD x (683.50 - 250.00) mg/L x 8.34 = 2,235.40 lbs TSS

Excess Monthly TSS Loading = Flow x [Actual - Threshold] TSS Conc x 8.34 = **2,235.40** lbs TSS

Monthly Monitoring Results

Pawtucket Boulevard Station

Date	Flow (MG)	BOD (mg/L)	TSS (mg/L)
12/03/04	25,856	1121	638
12/17/04	41,301	1091	729
Monthly Total/Average	33,579	1,106.00	683.50

Excess Threshold BOD/TSS Concentration (mg/L)	250.00
Tyngsboro Monthly Flow (MG)	**0.6183**

MONTHLY MONITORING RESULTS DETAIL

Pawtucket Boulevard Station						Lowell Vocational Schoc			
Date	Sample #	Monthly Flow (MG)	Average Flow (GPD)	BOD (mg/L)	TSS (mg/L)	Date	Sample #	Average (GPD)	BOD (mg/L)
12/3/2004	12-03-017		25,856	1121	638				
12/17/2004	12-17-016		41,301	1091	729				
Total/Average		0.618300	33,579	1106	684			10,412	#DIV/0!

December-04

Meter Readings	Vesper	Pawt. Blvd	Voke Flow	Net Tyngsboro Flow (MG)		
11/30/2004	~~9,921,268~~	74,753,196	Water Consump	Average Daily Flow		
1/3/2005	~~10,197,840~~	75,725,504	10,412	0.0181853		
Interval Volume	~~276,572~~	972,308	354,008	0.618300		

ıwn of Tyngsboro
ıard of Sewer Commissioners
) Box 11
ngsboro, Massachusetts 01879

Tyngsboro
Monthly Sewer Bill
for
Wastewater Transport and Treatment

illing Period		December-04

Standard Charge

yngsboro Monthly Flow (Million Gallons - see page 2)		0.61830
Vastewater Utility Monthly Flow (Million Gallons)		1,010.40
'roportioning Multiplier = Tyngsboro Flow / Utility Flow		0.0006119
Vastewater Utility Monthly Operating Costs (see page 2)	$	681,395.25
;tandard Monthly Charge = Utility Monthly Costs x Multiplier	**$**	**416.97**

BOD / TSS Surcharges

:xcess BOD Loading (lbs BOD) = Flow x [Actual - Threshold] BOD Conc x 8.34 (see page 2)		4,414.07
:xcess TSS Loading (lbs TSS) = Flow x [Actual - Threshold] TSS Conc x 8.34 (see page 2)		2,235.40
3OD Unit Cost ($/lb BOD - see page 2)		0.1934
TSS Unit Cost ($/lb TSS - see page 2)		0.2069
3OD Surcharge = BOD Unit Cost x Excess BOD Loading	**$**	**853.58**
TSS Surcharge = TSS Unit Cost x TSS Excess Loading	**$**	**462.43**

Total Monthly Charge Summary

Standard Monthly Charge = Utility Monthly Costs x Multiplier	$	416.97
BOD Surcharge = BOD Unit Cost x BOD Excess Loading	$	853.58
TSS Surcharge = TSS Unit Cost x TSS Excess Loading	$	462.43
Total December-04 Monthly Charges	**$**	**1,732.98**

Town of Tyngsboro
Board of Sewer Commissioners
PO Box 11
Tyngsboro, Massachusetts 01879

Tyngsboro
Monthly Sewer Bill
for
Wastewater Transport and Treatment

Billing Period		February-05

<u>Standard Charge</u>

Tyngsboro Monthly Flow (Million Gallons - see page 2)		0.56947
Wastewater Utility Monthly Flow (Million Gallons)		974.60
Proportioning Multiplier = Tyngsboro Flow / Utility Flow		0.0005843
Wastewater Utility Monthly Operating Costs (see page 2)	$	681,395.25
Standard Monthly Charge = Utility Monthly Costs x Multiplier — Flow?	$	**398.15**

<u>BOD / TSS Surcharges</u>

Excess BOD Loading (lbs BOD) = Flow x [Actual - Threshold] BOD Conc x 8.34 (see page 2)		968.88
Excess TSS Loading (lbs TSS) = Flow x [Actual - Threshold] TSS Conc x 8.34 (see page 2)		296.84
BOD Unit Cost ($/lb BOD - see page 2)		0.1934
TSS Unit Cost ($/lb TSS - see page 2)		0.2069
BOD Surcharge = BOD Unit Cost x Excess BOD Loading	$	**187.36**
TSS Surcharge = TSS Unit Cost x TSS Excess Loading	$	**61.41**

BOD/TSS — 248.77

<u>Total Monthly Charge Summary</u>

Standard Monthly Charge = Utility Monthly Costs x Multiplier	$	398.15
BOD Surcharge = BOD Unit Cost x BOD Excess Loading	$	187.36
TSS Surcharge = TSS Unit Cost x TSS Excess Loading	$	61.41
Total February-05 Monthly Charges	**$**	**646.9~~1~~2**

398.15
Feb. 05

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total
1189.24
Flow only.

Wastewater Utility Monthly Operating Costs

Annual Utility Operating Costs = Operations + Overhead + Debt	$	**8,176,743.05**
Utility Monthly Operating Costs = Annual Costs / 12 Months	$	**681,395.25**

BOD / TSS Unit Costs

Utility BOD Costs = 38% of Annual Operating Costs	$	3,107,162
Utility TSS Costs = 35% of Annual Operating Costs	$	2,861,860
Annual Utility BOD Loading (lbs BOD / year)		16,067,819
Annual Utility TSS Loading (lbs TSS / year)		13,834,373
BOD Unit Cost ($ / lb BOD) = BOD Costs / BOD Loading		**0.1934**
TSS Unit Cost ($ / lb TSS) = TSS Costs / TSS Loading		**0.2069**

Excess Monthly BOD Loading

Pawtucket Boulevard Station = 0.56947 MGD x (454.00 - 250.00) mg/L x 8.34 = 968.88 lbs BOD

Excess Monthly BOD Loading = Flow x [Actual - Threshold] BOD Conc x 8.34 = **968.88** lbs BOD

Excess Monthly TSS Loading

Pawtucket Boulevard Station = 0.56947 MGD x (312.50 - 250.00) mg/L x 8.34 = 296.84 lbs TSS

Excess Monthly TSS Loading = Flow x [Actual - Threshold] TSS Conc x 8.34 = **296.84** lbs TSS

Monthly Monitoring Results

Pawtucket Boulevard Station

Date	Flow (MG)	BOD (mg/L)	TSS (mg/L)
02/11/05	40,136	570	259
02/25/05	21,926	338	366
Monthly Total/Average	31,031	454.00	312.50

Excess Threshold BOD/TSS Concentration (mg/L)	250.00
Tyngsboro Monthly Flow (MG)	**0.5695**

MONTHLY MONITORING RESULTS DETAIL

Pawtucket Boulevard Station						Lowell Vocational School				
Date	Sample #	Monthly Flow (MG)	Average Flow (GPD)	BOD (mg/L)	TSS (mg/L)	Date	Sample #	Average (GPD)	BOD (mg/L)	TSS (mg/L)
2/11/2005	02-11-05-018		40,136	570	259					
2/25/2005	02-25-05-017		21,926	338	366					
Total/Average		[redacted]	31,031	454	313			10,412		

February-05

Meter Readings	Vesper	Pawt. Blvd	Voke Flow	Net Tyngsboro Flow (MG)		
			Water Consum	Average Daily Flow		
2/1/2005	636,920.000	76,540,873	10,412	0.01964		
3/2/2005	963,326.000	77,391,586	281,242	[redacted]		
Interval Volume	326,406.000	850,713				

Town of Tyngsboro
Board of Sewer Commissioners
PO Box 11
Tyngsboro, Massachusetts 01879

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Tyngsboro
Monthly Sewer Bill
for
Wastewater Transport and Treatment

Billing Period — March-05

Standard Charge

Tyngsboro Monthly Flow (Million Gallons - see page 2)		0.59626
Wastewater Utility Monthly Flow (Million Gallons)		1,141.40
Proportioning Multiplier = Tyngsboro Flow / Utility Flow		0.0005224
Wastewater Utility Monthly Operating Costs (see page 2)	$	681,395.25
Standard Monthly Charge = Utility Monthly Costs x Multiplier — Flow	$	**355.96**

BOD / TSS Surcharges

Excess BOD Loading (lbs BOD) = Flow x [Actual - Threshold] BOD Conc x 8.34 (see page 2)		3,130.40
Excess TSS Loading (lbs TSS) = Flow x [Actual - Threshold] TSS Conc x 8.34 (see page 2)		1,188.51
BOD Unit Cost ($/lb BOD - see page 2)		0.1934
TSS Unit Cost ($/lb TSS - see page 2)		0.2069
BOD Surcharge = BOD Unit Cost x Excess BOD Loading	$	**605.35**
TSS Surcharge = TSS Unit Cost x TSS Excess Loading — BOD/TSS — 851.21	$	**245.86**

Total Monthly Charge Summary

Standard Monthly Charge = Utility Monthly Costs x Multiplier	$	355.96
BOD Surcharge = BOD Unit Cost x BOD Excess Loading	$	605.35
TSS Surcharge = TSS Unit Cost x TSS Excess Loading	$	245.86
Total March-05 Monthly Charges	**$**	**1,207.17**

355.96
Mar. 05

Wastewater Utility Monthly Operating Costs

Annual Utility Operating Costs = Operations + Overhead + Debt	$	**8,176,743.05**
Utility Monthly Operating Costs = Annual Costs / 12 Months	$	**681,395.25**

BOD / TSS Unit Costs

Utility BOD Costs = 38% of Annual Operating Costs	$	3,107,162
Utility TSS Costs = 35% of Annual Operating Costs	$	2,861,860
Annual Utility BOD Loading (lbs BOD / year)		16,067,819
Annual Utility TSS Loading (lbs TSS / year)		13,834,373
BOD Unit Cost ($ / lb BOD) = BOD Costs / BOD Loading		**0.1934**
TSS Unit Cost ($ / lb TSS) = TSS Costs / TSS Loading		**0.2069**

Excess Monthly BOD Loading

Pawtucket Boulevard Station = 0.59626 MGD x (879.50 - 250.00) mg/L x 8.34 : 3,130.40 lbs BOD

Excess Monthly BOD Loading = Flow x [Actual - Threshold] BOD Conc x 8.34 = **3,130.40** lbs BOD

Excess Monthly TSS Loading

Pawtucket Boulevard Station = 0.59626 MGD x (489.00 - 250.00) mg/L x 8.34 : 1,188.51 lbs TSS

Excess Monthly TSS Loading = Flow x [Actual - Threshold] TSS Conc x 8.34 = **1,188.51** lbs TSS

Monthly Monitoring Results
Pawtucket Boulevard Station

Date	Flow (MG)	BOD (mg/L)	TSS (mg/L)
03/11/05 03/25/05	40,622 34,654	669 1090	210 768
Monthly Total/Average	37,638	879.50	489.00

Excess Threshold BOD/TSS Concentration (mg/L)	250.00
Tyngsboro Monthly Flow (MG)	**0.5963**

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own of Tyngsboro
oard of Sewer Commissioners
O Box 11
yngsboro, Massachusetts 01879

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Tyngsboro
Monthly Sewer Bill
for
Wastewater Transport and Treatment

illing Period — April-05

Standard Charge

yngsboro Monthly Flow (Million Gallons - see page 2)		0.82078
'astewater Utility Monthly Flow (Million Gallons)		1,285.30
roportioning Multiplier = Tyngsboro Flow / Utility Flow		0.0006386
'astewater Utility Monthly Operating Costs (see page 2)	$	681,395.25
tandard Monthly Charge = Utility Monthly Costs x Multiplier — Flow	$	**435.13**

BOD / TSS Surcharges

xcess BOD Loading (lbs BOD) = Flow x [Actual - Threshold] BOD Conc x 8.34 (see page 2)		1,523.08
xcess TSS Loading (lbs TSS) = Flow x [Actual - Threshold] TSS Conc x 8.34 (see page 2)		0.00
OD Unit Cost ($/lb BOD - see page 2)		0.1934
SS Unit Cost ($/lb TSS - see page 2)		0.2069
OD Surcharge = BOD Unit Cost x Excess BOD Loading	$	**294.53**
SS Surcharge = TSS Unit Cost x TSS Excess Loading — BOD/TSS — 294.53	$	? -

Total Monthly Charge Summary

andard Monthly Charge = Utility Monthly Costs x Multiplier	$	435.13
OD Surcharge = BOD Unit Cost x BOD Excess Loading	$	294.53
SS Surcharge = TSS Unit Cost x TSS Excess Loading	$	-
Total April-05 Monthly Charges	**$**	**729.66**

435.13
apr. 05

Total Flow Only - Feb, Mar, April 05 = 1,190.00

Wastewater Utility Monthly Operating Costs

ɿnual Utility Operating Costs = Operations + Overhead + Debt	$	**8,176,743.05**
tility Monthly Operating Costs = Annual Costs / 12 Months	$	**681,395.25**

BOD / TSS Unit Costs

tility BOD Costs = 38% of Annual Operating Costs	$	3,107,162
tility TSS Costs = 35% of Annual Operating Costs	$	2,861,860
ɿnual Utility BOD Loading (lbs BOD / year)		16,067,819
ɿnual Utility TSS Loading (lbs TSS / year)		13,834,373
OD Unit Cost ($ / lb BOD) = BOD Costs / BOD Loading		**0.1934**
SS Unit Cost ($ / lb TSS) = TSS Costs / TSS Loading		**0.2069**

Excess Monthly BOD Loading

Pawtucket Boulevard Station = 0.82078 MGD x (472.50 - 250.00) mg/L x 8.34 = 1,523.08 lbs BOD

xcess Monthly BOD Loading = Flow x [Actual - Threshold] BOD Conc x 8.34 = **1,523.08** lbs BOD

Excess Monthly TSS Loading

Pawtucket Boulevard Station = 0.82078 MGD x (203.50 - 250.00) mg/L x 8.34 = 0.00 lbs TSS

xcess Monthly TSS Loading = Flow x [Actual - Threshold] TSS Conc x 8.34 = **0.00** lbs TSS

Monthly Monitoring Results
Pawtucket Boulevard Station

Date	Flow (MG)	BOD (mg/L)	TSS (mg/L)
04/08/05	44,727	385	90
04/29/05	42,430	560	317
Monthly Total/Average	43,579	472.50	203.50

Excess Threshold BOD/TSS Concentration (mg/L)	250.00
Tyngsboro Monthly Flow (MG)	**0.8208**

MONTHLY MONITORING RESULTS DETAIL

Pawtucket Boulevard Station						Lowell Vocational School				
Date	Sample #	Monthly Flow (MG)	Average Flow (GPD)	BOD (mg/L)	TSS (mg/L)	Date	Sample #	Average (GPD)	BOD (mg/L)	TSS (mg/L)
4/8/2005	04-08-05-013		44,727	385.0	90.0					
4/29/2005	04-29-05-017		42,430	560.0	317.0					
otal/Average		0.82078	43,579	472.5	203.5			10,412	#DIV/0!	#DIV/0!

April-05

leter Readings	Vesper	Pawt. Blvd	Voke Flow	Net Tyngsboro Flow (MG)	
4/1/2005	1,290,073.000	78,278,790	Water Consui	Average Daily Flow	
5/2/2005	1,682,326.000	79,400,207	10,412	0	
iterval Volume	392,253.000	1,121,417	300,638	0.82078	

Acct Code #: 600005 **LOWELL, MA** July 13, 2005

CITY OF LOWELL

Department of Public Works

Route #: TO: Town of Tyngsboro
Account #: Board of Sewer Commissioners
Service #: 25 Bryant Lane
Tyngsboro, Massachusetts 01879-1042

DUE DATE: AUGUST 13, 2005

MISC	INFORMATION	AMOUNT
	Tyngsboro sewer bill for June 2005 as per contract. See attqched.	
	June 2005	$423.15
	BOD & TSS for June 2005	$672.75
	UNPAID BALANCE	$4,245.38
	TOTAL DUE	$5,341.28

Acct Code #: 600005 **LOWELL, MA** July 11, 2005

CITY OF LOWELL

Department of Public Works

Route #: TO: Town of Tyngsboro
Account #: Board of Sewer Commissioners
Service #: 25 Bryant Lane
Tyngsboro, Massachusetts 01879-1042

DUE DATE: AUGUST 11, 2005

MISC	INFORMATION	AMOUNT
	Tyngsboro sewer bill for May 2005 as per contract. See attqched.	
	May 2005	$348.53
	BOD & TSS for May 2005	$523.57
	UNPAID BALANCE	$3,373.28
	TOTAL DUE	$4,245.38
	Please make check payable to the: CITY OF LOWELL and mail: c/o Edward J. Walsh Commissioner of Public Works 1365 Middlesex Street Lowell, Massachusetts 01851	

RECEIVED JUL 12 2005

Acct Code #: 600005 LOWELL, MA July 11, 2005

CITY OF LOWELL

Department of Public Works

Route #: ______ TO: Town of Tyngsboro

Account #: ______ Board of Sewer Commissioners

Service #: ______ 25 Bryant Lane

Tyngsboro, Massachusetts 01879-1042

DUE DATE: AUGUST 11, 2005

MISC	INFORMATION	AMOUNT
	Tyngsboro sewer bill for May 2005 as per contract. See attqched.	
	May 2005	$348.53
	BOD & TSS for May 2005	$523.57
	UNPAID BALANCE	$3,373.28
	TOTAL DUE	$4,245.38
	Please make check payable to the: CITY OF LOWELL and mail: c/o Edward J. Walsh Commissioner of Public Works 1365 Middlesex Street Lowell, Massachusetts 01851	

Copied Prepd.

Town of Tyngsboro
Board of Sewer Commissioners
PO Box 11
Tyngsboro, Massachusetts 01879

Tyngsboro
Monthly Sewer Bill
for
Wastewater Transport and Treatment

Billing Period May-05

Standard Charge

Tyngsboro Monthly Flow (Million Gallons - see page 2)		0.58080
Wastewater Utility Monthly Flow (Million Gallons)		1,135.50
Proportioning Multiplier = Tyngsboro Flow / Utility Flow		0.0005115
Wastewater Utility Monthly Operating Costs (see page 2)	$	681,395.25
Standard Monthly Charge = Utility Monthly Costs x Multiplier	**$**	**348.53**

BOD / TSS Surcharges

Excess BOD Loading (lbs BOD) = Flow x [Actual - Threshold] BOD Conc x 8.34 (see page 2)		1,559.73
Excess TSS Loading (lbs TSS) = Flow x [Actual - Threshold] TSS Conc x 8.34 (see page 2)		1,072.92
?D Unit Cost ($/lb BOD - see page 2)		0.1934
. SS Unit Cost ($/lb TSS - see page 2)		0.2069
BOD Surcharge = BOD Unit Cost x Excess BOD Loading	**$**	**301.62**
TSS Surcharge = TSS Unit Cost x TSS Excess Loading	**$**	**221.95**

Total Monthly Charge Summary

Standard Monthly Charge = Utility Monthly Costs x Multiplier	$	348.53
BOD Surcharge = BOD Unit Cost x BOD Excess Loading	$	301.62
TSS Surcharge = TSS Unit Cost x TSS Excess Loading	$	221.95
Total May-05 Monthly Charges	**$**	**872.10**

Wastewater Utility Monthly Operating Costs

Annual Utility Operating Costs = Operations + Overhead + Debt	$	8,176,743.05
ility Monthly Operating Costs = Annual Costs / 12 Months	$	681,395.25

BOD / TSS Unit Costs

Utility BOD Costs = 38% of Annual Operating Costs	$	3,107,162
Utility TSS Costs = 35% of Annual Operating Costs	$	2,861,860
Annual Utility BOD Loading (lbs BOD / year)		16,067,819
Annual Utility TSS Loading (lbs TSS / year)		13,834,373
BOD Unit Cost ($ / lb BOD) = BOD Costs / BOD Loading		**0.1934**
TSS Unit Cost ($ / lb TSS) = TSS Costs / TSS Loading		**0.2069**

Excess Monthly BOD Loading

Pawtucket Boulevard Station = 0.58080 MGD x (572.00 - 250.00) mg/L x 8.34 = 1,559.73 lbs BOD

Excess Monthly BOD Loading = Flow x [Actual - Threshold] BOD Conc x 8.34 = **1,559.73** lbs BOD

Excess Monthly TSS Loading

Pawtucket Boulevard Station = 0.58080 MGD x (471.50 - 250.00) mg/L x 8.34 = 1,072.92 lbs TSS

Excess Monthly TSS Loading = Flow x [Actual - Threshold] TSS Conc x 8.34 = **1,072.92** lbs TSS

Monthly Monitoring Results
Pawtucket Boulevard Station

Date	Flow (MG)	BOD (mg/L)	TSS (mg/L)
05/13/05 05/27/05	38,141 38,716	520 624	543 400
Monthly Total/Average	38,429	572.00	471.50

Excess Threshold BOD/TSS Concentration (mg/L)	250.00
Tyngsboro Monthly Flow (MG)	**0.5808**

MONTHLY MONITORING RESULTS DETAIL

Pawtucket Boulevard Station						Lowell Vocational School				
Date	Sample #	Monthly Flow (MG)	Average Flow (GPD)	BOD (mg/L)	TSS (mg/L)	Date	Sample #	Average (GPD)	BOD (mg/L)	TSS (mg/L)
5/13/2005	05-13-05-015		38,141	520.0	543.0					
5/27/2005	05-27-05-014		38,716	624.0	400.0					
Total/Average		0.58080	38,429	572.0	471.5			10,412	#DIV/0!	#DIV/0!

May-05

Meter Readings	Vesper	Pawt. Blvd	Voke Flow	Net Tyngsboro Flow (MG)		
Meter Readings	Vesper	Pawtucket Bl	Voke Flow	Net Tyngsboro Flow (MG)		
5/2/2005	1,682,326.000	79,400,207	Water Consu	Average Daily Flow		
5/31/2005	1,973,276.000	80,262,251	10,412	0.02003		
Interval Volume	290,950.000	862,044	281,242	[illegible]		

Acct Code #: 600005

LOWELL, MA July 13, 2005

CITY OF LOWELL

Department of Public Works

Route #:

Account #:

Service #:

TO: Town of Tyngsboro
Board of Sewer Commissioners
25 Bryant Lane
Tyngsboro, Massachusetts 01879-1042

DUE DATE: AUGUST 13, 2005

MISC	INFORMATION	AMOUNT
	Tyngsboro sewer bill for June 2005 as per contract. See attqched.	
	June 2005	$423.15
	BOD & TSS for June 2005	$672.75
	UNPAID BALANCE	$4,245.38
	TOTAL DUE	$5,341.28
	Please make check payable to the: CITY OF LOWELL and mail: c/o Edward J. Walsh Commissioner of Public Works 1365 Middlesex Street Lowell, Massachusetts 01851	

Town of Tyngsboro
Board of Sewer Commissioners
PO Box 11
T[illegible]sboro, Massachusetts 01879

Tyngsboro
Monthly Sewer Bill
for
Wastewater Transport and Treatment

Billing Period		June-05
Standard Charge		
Tyngsboro Monthly Flow (Million Gallons - see page 2)		0.56611
Wastewater Utility Monthly Flow (Million Gallons)		911.60
Proportioning Multiplier = Tyngsboro Flow / Utility Flow		0.0006210
Wastewater Utility Monthly Operating Costs (see page 2)	$	681,395.25
Standard Monthly Charge = Utility Monthly Costs x Multiplier	**$**	**423.15**
BOD / TSS Surcharges		
Excess BOD Loading (lbs BOD) = Flow x [Actual - Threshold] BOD Conc x 8.34 (see page 2)		1,968.79
E[illegible]ess TSS Loading (lbs TSS) = Flow x [Actual - Threshold] TSS Conc x 8.34 (see page 2)		1,411.67
[illegible] Unit Cost ($/lb BOD - see page 2)		0.1934
TSS Unit Cost ($/lb TSS - see page 2)		0.2069
BOD Surcharge = BOD Unit Cost x Excess BOD Loading	**$**	**380.72**
TSS Surcharge = TSS Unit Cost x TSS Excess Loading	**$**	**292.03**
Total Monthly Charge Summary		
Standard Monthly Charge = Utility Monthly Costs x Multiplier	$	423.15
BOD Surcharge = BOD Unit Cost x BOD Excess Loading	$	380.72
TSS Surcharge = TSS Unit Cost x TSS Excess Loading	$	292.03
		.90
Total June-05 Monthly Charges	**$**	**1,095.~~89~~**

ty Monthly Operating Costs

Annual Utility Operating Costs = Operations + Overhead + Debt	$	8,176,743.05
L...ty Monthly Operating Costs = Annual Costs / 12 Months	$	681,395.25

BOD / TSS Unit Costs

Utility BOD Costs = 38% of Annual Operating Costs	$	3,107,162
Utility TSS Costs = 35% of Annual Operating Costs	$	2,861,860
Annual Utility BOD Loading (lbs BOD / year)		16,067,819
Annual Utility TSS Loading (lbs TSS / year)		13,834,373
BOD Unit Cost ($ / lb BOD) = BOD Costs / BOD Loading		**0.1934**
TSS Unit Cost ($ / lb TSS) = TSS Costs / TSS Loading		**0.2069**

Excess Monthly BOD Loading

Pawtucket Boulevard Station = 0.56611 MGD x (667.00 - 250.00) mg/L x 8.34 = 1,968.79 lbs BOD

Excess Monthly BOD Loading = Flow x [Actual - Threshold] BOD Conc x 8.34 = **1,968.79** lbs BOD

Excess Monthly TSS Loading

Pawtucket Boulevard Station = 0.56611 MGD x (549.00 - 250.00) mg/L x 8.34 = 1,411.67 lbs TSS

Excess Monthly TSS Loading = Flow x [Actual - Threshold] TSS Conc x 8.34 = **1,411.67** lbs TSS

Monthly Monitoring Results
Pawtucket Boulevard Station

Date	Flow (MG)	BOD (mg/L)	TSS (mg/L)
06/02/05	40,207	816	521
06/30/05	24,417	518	577
Monthly Total/Average	32,312	667.00	549.00

Excess Threshold BOD/TSS Concentration (mg/L)	250.00
Tyngsboro Monthly Flow (MG)	**0.5661**

MONTHLY MONITORING RESULTS DETAIL

Pawtucket Boulevard Station						Lowell Vocational Scho			
Date	Sample #	Monthly Flow (MG)	Average Flow (GPD)	BOD (mg/L)	TSS (mg/L)	Date	Sample #	Average (GPD)	BOD (mg/L)
6/2/2005	06-02-05-023		40,207	816	521				
6/30/2005	06-30-05-025		24,417	518	577				
Total/Average		0.5661	32,312	667	549			10,412	#DIV/0!

June-05

Meter Readings	Vesper	Pawt. Blvd	Voke Flow	Net Tyngsboro Flow (MG)		
5/31/2005	1,973,276.000	80,262,251	Water Consu	Average Daily Flow		
7/1/2005	2,321,938.000	81,128,994	10,412	0.01826		
Interval Volume	348,662.000	866,743	300,638	0.5661		

COPY

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CHELMSFORD - TYNGSBOROUGH AGREEMENT

AGREEMENT

THIS AGREEMENT, made and entered into this 31st day of May, 1989 by and between the TOWN OF CHELMSFORD, a municipal corporation within the County of Middlesex and the Commonwealth of Massachusetts, hereinafter referred to as CHELMSFORD, and the TOWN OF TYNGSBOROUGH, an incorporated township within the County of Middlesex and the Commonwealth of Massachusetts, hereinafter referred to as TYNGSBOROUGH.

WITNESSETH:

WHEREAS, CHELMSFORD is authorized by law to enter into contracts and agreement with TYNGSBOROUGH for the purpose of aiding in the abatement of water pollution; and

WHEREAS, CHELMSFORD deems it to be in the public interest to enter into an Agreement with TYNGSBOROUGH whereby CHELMSFORD would receive and transport TYNGSBOROUGH'S wastes through CHELMSFORD'S Sewerage System to the CITY OF LOWELL Sewerage System; and whereby the CITY OF LOWELL would receive, treat and dispose of the waste; and

WHEREAS, CHELMSFORD entered into an agreement with the CITY OF LOWELL on June 26, 1985, whereby LOWELL would receive, treat and dispose of CHELMSFORD'S wastes through the CITY OF LOWELL'S Sewerage System; and

WHEREAS, CHELMSFORD has designed and constructed or will design and construct a wastewater collection system with capacity to receive flow from TYNGSBOROUGH as outlined in this agreement; and

WHEREAS, the federal government is empowered under a Public Law 95-217, as amended, to make federal grants for the construction of public treatment works, and to impose conditions on the award of said grants;

WHEREAS, THE CITY OF LOWELL has accepted federal grants for the construction of public treatment works, and must abide by the applicable federal laws, rules and regulations; and

WHEREAS, THE CITY OF LOWELL, CHELMSFORD, AND TYNGSBOROUGH all intend to comply with the applicable federal laws, rules and regulations, including but not limited to user charge, and sewer use ordinance requirements; and

WHEREAS, the provision for wastewater treatment and disposal service is necessary to protect the public health, safety, and welfare; and

WHEREAS, CHELMSFORD AND TYNGSBOROUGH have determined to enter into this Agreement for aforesaid reasons.

NOW THEREFORE, in consideration of these premises and mutual benefits to be derived by this parties hereto, it is agreed as follows:

<u>ARTICLE 1. DEFINITIONS</u>

1.1 For the purpose of this Agreement, the following terms are defined:

1.1.1 "LOWELL" shall mean the City of Lowell, a municipal corporation of the Commonwealth of Massachusetts.

1.1.2 "CHELMSFORD" shall mean the Town of Chelmsford, an incorporated township of the Commonwealth of Massachusetts.

1.1.3 "TYNGSBOROUGH" shall mean the Town of Tyngsborough, an incorporated township of the Commonwealth of Massachusetts.

1.1.4 "Industrial Wastes" shall mean liquid wastes, other than sanitary sewage, resulting from commercial, manufacturing or industrial operations of processes.

1.1.5 "Sanitary Sewage" shall mean sewage discharging from sanitary conveniences such as toilets, washrooms, urinals, sinks, showers, drinking fountains, small laundries, kitchens, cafeterias and floor drains essentially free of industrial wastes or toxic materials.

1.1.6 "Biochemical Oxygen Demand" (BOD) shall mean the quantity of oxygen utilized in the biochemical oxidation of organic matter under standard laboratory procedure in five (5) days at 20 degrees Centigrade (68 degrees Fahrenheit) expressed in milligrams per liter (mg/l) by weight.

1.1.7 "Suspended Soils" (SS) shall mean solids that either float on the surface of, or are in suspension in, water, sewage, wastewater or other liquids and which are removable by laboratory filtering.

1.1.8 "pH" shall mean the logarithm of the reciprocal of the weight of hydrogen ions in grams per liter of solution.

1.1.9 "Chloride Demand" shall mean the amount of chloride expressed in mg/l required to be added to water, sewage or other liquid to achieve a combined chloride residual after fifteen (15) minutes contact of one (1) mg/l.

1.1.10 "Sewage System or Sewage Works" shall mean all facilities for collecting, conveying, pumping, treating and disposing of sanitary sewage and/or industrial wastes.

1.1.11 "Combined Sewer" shall mean a sewer receiving both surface runoff and sanitary sewage and/or industrial wastes.

1.1.12 "Wastes" shall mean the sanitary sewage, industrial wastes and infiltration from TYNGSBOROUGH'S sewerage system.

1.1.13 "Average Daily Flow" shall mean the total annual flow as measured in gallons at Metering Stations plus agreed-to direct discharges to CHELMSFORD'S sewerage system divided by the number of days in the year.

1.1.14 "Maximum Daily Flow" shall mean the maximum gallons recorded at Metering Stations plus agreed-to allowances for direct discharges to CHELMSFORD sewerage system during a 24-hour period during any calendar year.

1.1.15 "Peak Rate of Flow" shall mean the maximum rate of flow in gallons recorded at Metering Stations or measured in the direct discharges to CHELMSFORD'S sewerage system during any calendar year.

1.1.16 "User Charges" shall mean charges levied in proportion to the use of sewage works. As required by Section 204 (b) (1) (A) of Public Law 95-217, as amended, and by regulations promulgated by the U.S. Environmental Protection Agency, such charges must, to the extend possible, distribute operation and maintenance (including replacement) cost to each user in proportion to its contribution to the total loading of the sewage works, where construction of such works has been financed in part by a federal grant.

1.1.17 "Replacement Costs" shall mean expenditures for obtaining and installing equipment, accessories or appurtenances which are necessary during the service life of the sewage works to maintain the capacity and performance for which said works were designed and constructed.

1.1.18 "Service Life" shall mean the period of time during which the sewage works or component of a waste treatment management program will be capable of performing a function.

1.1.19 "Industrial User" shall mean any non-governmental user of CHELMSFORD'S sewage works, which contributes industrial wastes, identified in the <u>Standard Industrial Classification Manual</u>, 1972 Edition, Office of Management and Budget, as amended and supplemented, under the following divisions:

Division A. Agriculture, Forrestry, and Fishing.
Division B. Mining.
Division D. Manufacturing.
Division E. Transportation, Communications, Electric, Gas, and Sanitary Services.
Division I. Services.

1.1.20 "Total Cost" shall mean construction costs, engineering and legal fees, capatilized interest costs during construction, amortization costs and land costs.

1.1.21 "Operation Costs" shall mean the cost incurred by CHELMSFORD necessary for the proper and efficient operation and maintenance of the sewage works.

ARTICLE II. GENERAL PROVISIONS

2.1 TYNGSBOROUGH understands and agrees to the following obligations, limitations, and commitments, made in return for CHELMSFORD'S agreement to permit connection by TYNGSBOROUGH to CHELMSFORD'S sewage works.

2.1.1 "Limitations of Rights." Nothing in this Agreement shall be construed as a grant by CHELMSFORD of any exclusive right of privilege. TYNGSBOROUGH agrees to comply in all respects with "the TOWN OF CHELMSFORD Sewer Use Regulations," as amended.

2.1.2 "Charges and Fees." TYNGSBOROUGH agrees to make prompt payment of all charges described in and pursuant to this agreement.

2.1.3 "Sewer Use By-Law." TYNGSBOROUGH agrees to adopt and enforce a by-law that embodies rules related to use of TYNGSBOROUGH'S sewage works. Said rules shall include the Town of Tyngsborough Sewer Rules and Regulations adopted August 1981 and any amendments thereto that be required to be acceptable to federal and state authorities, to CHELMSFORD and to LOWELL. As a minimum, such rules shall prescribe conditions and requirements for use of TYNGSBOROUGH'S sewage works so as to comply with the limitations set forth in "TOWN OF CHELMSFORD Sewer Use Regulations," as amended.

2.1.4 "Interceptor Responsibilities." TYNGSBOROUGH shall be responsible for the design, construction, operation, maintenance, and costs incurred for its sewer program. A complete metering/sampling station shall be constructed by TYNGSBOROUGH, installed adjacent to the CHELMSFORD town line, to determine and to allocate CHELMSFORD'S costs for operation and maintenance to TYNGSBOROUGH for its wastewater volume and strengths.

ARTICLE III. OBLIGATIONS AND RESPONSIBILITIES

3.1 CHELMSFORD shall receive and transport TYNGSBOROUGH'S wastes, in accordance with all existing or future laws, regulations, existing or future CHELMSFORD Sewer Ordinance, water quality standards, and orders and decrees of any governmental authority having jurisdiction over the transmission of said wastes; provided, however, that the treatment of TYNGSBOROUGH'S wastes shall be of such a type and degrees as may be necessary to provide for the application of Best Practicable Waste Treatment Technology. TYNGSBOROUGH shall conform to all appropriate industrial wastewater pretreatment rules and regulations as established by the appropriate state and federal regulatory agencies.

3.2 TYNGSBOROUGH will not connect any combined sewer or separate drains into CHELMSFORD'S sewerage system and will not discharge into said sewerage system any volume of sewage, substances or wastes containing the following characteristics in excess of that agreed to herein.

3.2.1 Any waters or wastes contaminating fats, wax, grease or oils, whether emulsified or not, in excess of one hundred (100) mg/l or containing substances which may solidify or become viscous at temperature between zero (0) and sixty-five (65) degrees Centrigrade, (32 and 150 degrees Fahrenheit).

3.2.2 Any gasoline, benzene, naptha, fuel oil, or other liquid, solid or gas in sufficient concentration to be flammable or explosive.

3.2.3 A temperature higher than 65 degrees Centrigrade (150 degrees Fahrenheit).

3.2.4 Any garbage not properly shredded.

3.2.5 Any ashes, cinders, sand, mud, straw, shavings, metal, glass, rags, feathers, tar, wood, paunch manure, or other solid or viscous substances capable of causing interference with the proper operation of the sewerage system.

3.2.6 Any wastes having a pH lower than 5.5 or higher than 9.5 or having any corrosive property capable of causing damage or hazards to structures, equipment and personnel at the sewage works.

3.2.7 Any wastes containing a toxic or poisonous substances which constitute a hazard to humans or animals or to create any hazard in the receiving waters of the sewage works.

3.2.8 Waters or wastes containing substances which are amendable to treatment only to a degree such that the sewage treatment plant effluent cannot meet the requirements of any governmental authority having jurisdiction over discharge to the receiving waters.

3.2.9 Any noxious or malodorous gas or substance capable of creating a public nuisance.

3.2.10 Plastics, except those materials which have undergone complete reaction and whose size does not exceed 2.5 inches in its largest dimension.

3.2.11 Wastes character or concentration, as sampled at Metering Stations, in accordance with the provisions of ARTICLE VIII.

3.3 All measurements of volume and characteristics of TYNGSBOROUGH'S wastes shall be made at Metering Stations constructed, and maintained by TYNGSBOROUGH at locations acceptable to CHELMSFORD pursuant to this Agreement. <u>Said acceptance by CHELMSFORD shall not be unreasonably withheld.</u> All flow measurements made at the metering stations will be transmitted to Southwellfield Pump Station in North Chelmsford and to the Duck Island Wastewater Treatment Plant in Lowell. For small individual areas in TYNGSBOROUGH'S sewerage system, measurements shall be based on a method acceptable to CHELMSFORD and TYNGSBOROUGH.

3.4 Industrial wastes from TYNGSBOROUGH, as measured at Metering Stations, shall be judged by the same standards as are in effect within CHELMSFORD'S Sewerage System, notwithstanding the provisions of Paragraph 3.2 of this ARTICLE.

ARTICLE IV. AGREEMENT TERM

4.1 The provisions of this Agreement shall run for a minimum period of thirty (30) years from the date of initial transport of TYNGSBOROUGH'S wastes subject to the provisions of ARTICLE XI.

ARTICLE V. IMPLEMENTATION

5.1 CHELMSFORD agrees to provide a sewerage system with a portion of the capacity allocated to handle wastes from TYNGSBOROUGH. Construction commencement and completion of said sewerage system shall be in accordance with the implementation schedule established by the Massachusetts Water Resources Commission, Division of Water Pollution Control. In the event TYNGSBOROUGH determines that it shall not use its entire capacity, CHELMSFORD shall have the right to purchase the unused flow. Unused flow will be based on capacities, described in Paragraph 7.3.1 of ARTICLE VII less actual meter readings at metering stations.

ARTICLE VI. USER CHARGES

6.1 User Charges:

6.1.1 TYNGSBOROUGH shall develop, in accordance with the provisions of federal regulations ("Code of Federal Regulations, Subpart I, 40 CFR 35.2122 and 35.2140, et seq."), as amended, an equitable User Charge System to assure that each recipient of waste treatment services within TYNGSBOROUGH'S service area will pay its proportionate share of the costs of operation and maintenance (including replacement) of all waste transmission services provided by CHELMSFORD and all waste treatment services provided by LOWELL.

6.1.2 TYNGSBOROUGH shall obtain approval of the Massachusetts Water Resource Commission, Division of Water Pollution Control, and the Region 1 Office of the U.S. Environmental Protection Agency for its User Charge System for the above costs.

6.1.3 TYNGSBOROUGH, upon approval of its User Charge System, must incorporate said system in one or more municipal legislative by-laws.

ARTICLE VII. PAYMENT OF CAPITAL COSTS

7.1 TYNGSBOROUGH shall, periodically, as set forth herein, pay to CHELMSFORD sums which in total represent its full obligation of the Total Cost to CHELMSFORD, after deduction of all government grants for all sewage works in CHELMSFORD, required to receive and transport TYNGSBOROUGH'S wastes.

CHELMSFORD and TYNGSBOROUGH acknowledge that certain construction has previously been completed by CHELMSFORD and LOWELL of facilities which are and shall be used by TYNGSBOROUGH pursuant to this AGREEMENT and TYNGSBOROUGH agrees to pay to CHELMSFORD, TYNGSBOROUGH'S share as determined by this agreement.

Payments of the full obligation, as determined by this agreement, by TYNGSBOROUGH to CHELMSFORD shall be due <u>immediately upon notification from TYNGSBOROUGH of the commencement of transmission of sewerage from TYNGSBOROUGH to the Town of CHELMSFORD Sewerage System provided that no flow shall be accepted from TYNGSBOROUGH until payment is made.</u>

7.2 The basis of payments by TYNGSBOROUGH for sewage works construction by CHELMSFORD shall be established as follows:

7.2.1 <u>Lowell Facilities</u>:

7.2.1.1 Duck Island Regional Treatment

$$\text{TYNGSBOROUGH payment} = C_1\ a/b$$

Where:

C_1 = Total Local Share for North Chelmsford Regional Treatment

a = Average daily design flow rate requested by TYNGSBOROUGH

b = Total average daily design flow rate for the North Chelmsford Regional Area. This regional flow represents flows from TYNGSBOROUGH, WESTFORD, and NORTH CHELMSFORD.

7.2.1.2 Lowell Transmission Facilities

$$\text{TYNGSBOROUGH payment} = C_2\ d/e$$

Where:

C_2 = Total Local Share of Lowell Transmission Facilities built to receive North Chelmsford Regional Flow.

d = Peak daily design flow requested by TYNGSBOROUGH

e = Total peak daily design flow rate of the North Chelmsford Regional Area.

7.2.2 Chelmsford Facilities:

7.2.2.1 Southwell Field Pump Station

$$\text{TYNGSBOROUGH Payment} = C_3\ a/f$$

Where:

C_3 = Total local share of Southwell Field Pump Station

f = Total Average regional design flow for Southwell Field Pump Station

7.2.2.2 North Chelmsford Interceptor Sewer Project

$$\text{TYNGSBOROUGH Payment} = C_4\ d/g + C_5\ d/h$$

Where:

C_4 = Total Local Share of the 16" Force Main

C_5 = Total Local Share of the 24" Gravity Sewer

g = Peak daily regional design flow in the 16" Force Main

h = Peak daily regional design flow in the 24" Gravity Sewer

7.2.2.3 North Chelmsford Lateral Sewers - Tyngsborough Road

$$\text{TYNGSBOROUGH Payment} = C_6\ d/i$$

Where:

C_6 = Total Local Share of the 15" Gravity Sewer

i = Peak daily regional design flow in the 15" Gravity Sewer

7.3 CHELMSFORD shall provide capabilities in its sewage works for the wastes from TYNGSBOROUGH'S service area, as defined by a boundary created by the CHELMSFORD Town Line, then northerly along the Merrimack River, then Southwesterly along Westford Road, then Southeasterly along Route 3 to the CHELMSFORD Town Line. Capacities for TYNGSBOROUGH shall be as follows:

7.3.1	Average Daily Flow	0.35 million gallons per day (mgd)
	Peak Flow	1.3 mgd
	BOD	740 lbs/day
	SS	800 lbs/day

7.4 Should it be required by the appropriate State and/or Federal agencies to provide additional waste treatment at Duck Island Regional Facilities, TYNGSBOROUGH shall pay its proportionate share of the required sewage works based on the flows established under Paragraph 7.3 of this ARTICLE. If LOWELL'S sewage works required enlargement because the total flows or total strength of the flow to the treatment facilities exceed the design, then TYNGSBOROUGH shall contribute only insofar as its wastes have exceed the limits called for under the above-referenced Paragraph 7.3 and the provisions of 7.3.

ARTICLE VIII. OPERATING COST APPORTIONMENT

8.1 CHELMSFORD and LOWELL shall maintain an adequate cost accounting system which shall be the basis for the determination and allocation of operating costs.

CHELMSFORD shall maintain separate cost accounting records for the operation of those portions of their sewage works that are shared by CHELMSFORD and TYNGSBOROUGH and any other participants. The annual cost of operating these sewage works shall be apportioned between CHELMSFORD, TYNGSBOROUGH and any other participants on the basis of their actual, annual flows, as determined from records at the respective Metering Stations.

8.2 The operating costs shall be apportioned against participants on the basis of the average daily flows, providing that the established parameters from any participant are not exceeded. If either the average BOD or SS from any participants exceeds 300 mg/l; then the participant shall pay a surcharge to CHELMSFORD and/or LOWELL for transport and/or treatment of its wastes. The surcharges will be based on the proportional extra cost incurred for the complete transport and/or treatment of wastes in excess of 300 mg/l for the period of time in violation.

8.3 Actual flows shall be determined for TYNGSBOROUGH from records of Metering Stations. Actual annual flow for CHELMSFORD, will be determined at Southwell Field Pump Station. Estimated flows from non-metered, individual areas shall also be included, if not charged separately. Actual, annual flows shall be determined for LOWELL from records at the treatment facilities.

8.4 The waste strengths, BOD and SS, for each of the participants shall be determined from proportional, composite 24-hour samples obtained at the participants Metering Stations. The average daily BOD and SS in pounds per day shall be determined from the average of not less than twelve (12) samples taken on weekdays at monthly intervals.

8.5 When determining surcharges, the unit cost per pound of BOD and SS used shall be based on the previous year's treatment facility operational costs divided by the total annual BOD or SS loadings.

8.6 Operating costs for the treatment facilities shall include the cost of sampling and analyzing wastes discharged. It shall also include the cost accounting related to the distribution and invoicing of operating costs.

8.7 Operating costs shall be payable monthly, on a fiscal year basis, upon receipt by TYNGSBOROUGH of CHELMSFORD'S invoice. Bills shall be paid within forty-five (45) days. Operating costs for the first eleven (11) months shall be determined by using CHELMSFORD and LOWELL'S approved yearly operation budget (reduced to a monthly cost) and approportioning TYNGSBOROUGH'S share on the basis of actual total monthly flow, as measured.

The final monthly invoice for the fiscal year shall be rendered by CHELMSFORD within thirty (30) days of the end of the fiscal year and shall be determined on the basis of actual flows and expenditures. All previous monthly invoices shall be subject to adjustment and correction at the time of this final billing for the fiscal year.

CHELMSFORD shall forward to TYNGSBOROUGH, on or before March first, the projected estimate of operating cost and other costs <u>attributable to TYNGSBOROUGH</u> for such fiscal year, so that TYNGSBOROUGH may make necessary preparations for the final monthly invoice for the fiscal year.

ARTICLE IX. ANNUAL COST REVIEW

9.1 CHELMSFORD and TYNGSBOROUGH both agree that the apportionment of costs set forth in ARTICLE VIII, shall be subject to review annually. After a review of the annual costs, if an adjustment to the costs appears to be necessary, said adjustment shall be made by CHELMSFORD in the forthcoming billing for services.

ARTICLE X. ADJUSTMENT CLAUSE

10.1 TYNGSBOROUGH reserves the right at any time to pretreat and/or reduce the BOD and SS concentrations of its wastes, or to otherwise give preliminary treatment to its wastes prior to discharge to CHELMSFORD'S sewerage system. TYNGSBOROUGH agrees to notify CHELMSFORD as far in advance as possible of any significant increase or decrease in the quantity and/or quality of the wastes to be discharged to CHELMSFORD'S sewerage system.

ARTICLE XI. TERMINATION CLAUSE

11.1 Either party may terminate this Agreement by giving the notice thereof to the other party in writing three (3) years prior to the termination date. Upon receipt of said notice, both parties will enter into discussion within thirty (30) days to assure proper termination of the Agreement.

Should TYNGSBOROUGH initiate the termination proceedings, it shall not have any right to the return of any of its initial capital investment under ARTICLE VII.

Should CHELMSFORD initiate the termination proceedings, it shall be obliged to return to TYNGSBOROUGH the unused proportionate share of TYNGSBOROUGH'S capital investment under ARTICLE VIII.

11.2 TYNGSBOROUGH shall have the right to the continued use of CHELMSFORD sewerage works provided for, in part, by TYNGSBOROUGH'S capital investment under ARTICLE VII, beyond the thirty (30) years provided for in ARTICLE IV, for as long as those sewerage works remain in active use. The right shall be limited to the waste parameters established under ARTICLE VII.

11.3 Each party shall truly and faithfully perform its duties, all the undertakings covenants, terms and conditions of this agreement during the term of this agreement, and any extension thereof which may be granted by CHELMSFORD; and subject further to the following:

11.3.1 TYNGSBOROUGH shall assume the defense of and indemnify and hold harmless CHELMSFORD, including CHELMSFORD'S Sewer Commission, agents, servants, employees, and/or elected officials from and against all liability, damage, loss, claim, demands, and actions of any nature whatsoever which arise out of or are connected with, or are claimed to arise out of or be connected with any provisions, terms, and condition, etc. of this agreement, including, without limiting the generality of the foregoing thereto, all liability, damage, loss, claims, demands and action on account of personal injury, death or property loss occasioned by CHELMSFORD, its Sewer Commission, its agents, servants, employees and/or elected officials, or any other persons, whether or not caused or claimed to have caused by active, or inactive negligence, or other breach of duty by the Town of TYNGSBOROUGH its agents, Sewer Commission elected officials and/or employees or any other person. TYNGSBOROUGH shall as its own expense investigate all such claims and demands against it, its Sewer Commission, agents and or employees, attend to claim settlement or other disposition, defend all actions based thereon and pay all charges or attorney's fees and all other costs and expenses of any kind arising from any such liability loss claims, demands, and actions.

11.3.2 CHELMSFORD shall assume the defense of and indemnify and hold harmless TYNGSBOROUGH, including TYNGSBOROUGH'S Sewer Commission, agents, servants, employees, and/or elected officials from and against all liability, damage, loss, claim, demands, and actions of any nature whatsoever which arise out of or are connected with, or are claimed to arise out of or be connected with any provision, term, and condition, etc. ~~of this agreement~~, including, without limiting the generality of the foregoing thereto, all liability, damage, loss, claims, demands and action of account of personal injury, death or property loss occasioned by TYNGSBOROUGH, its Sewer Commission, its agents, servants, employees and/or elected officials, or any other persons, whether or not caused or claimed to have caused by active or inactive negligence, or other breach of duty by the Town of CHELMSFORD its agents, Sewer Commission, elected officials and/or employees or any other person. CHELMSFORD shall at its own expense investigate all such claims and demands against it, its Sewer Commission, agents and/or employees, attend to claim settlement or other disposition, defend all actions based thereon and pay all charges or attorney's fees and all other costs and expenses of any kind arising from any such liability, loss, claims, demands, and actions.

11.4 TYNGSBOROUGH and CHELMSFORD shall, at all times be obligated to comply with the terms and conditions of this agreement. Any party in default and/or in breach of this agreement shall reimburse and repay to the non-breaching and/or non-defaulting party, its Sewer Commission, its agents, servants, employees and/or elected officials all expenses and other sums incurred by said non-breaching party and/or non-defaulting party for curing such default and/or breach. In the event TYNGSBOROUGH fails to make any payments as required in this agreement, CHELMSFORD may, but is not obligated to cure TYNGSBOROUGH default, and any sums incurred by the Town of CHELMSFORD in regard to the same, shall be paid by TYNGSBOROUGH to CHELMSFORD within thirty (30) days from the expenditure by the Town of CHELMSFORD, its Sewer Commission, agents, agent servants, employees and/or elected officials.

11.5 This agreement will become null and void if within three (3) years of the date of this agreement CHELMSFORD does not receive notification from TYNGSBOROUGH of the commencement of transmission of sewerage and payment of TYNGSBOROUGH'S full obligation as required in Section VII.

ARTICLE XII. WASTES ANALYSIS

12.1 CHELMSFORD and TYNGSBOROUGH both agree that the determination of character and concentration of wastes will be in accordance with the latest edition of "Standard Methods for the Examination of Water and Sewage," as proposed, approved and published by the American Public Health Association and the Water Pollution Control Federation, or any other method established by CHELMSFORD, and subject further the following:

12.1.1 Sampling at Metering Stations will be performed by CHELMSFORD. Determination of the character and concentration of TYNGSBOROUGH'S wastes, for the purpose of checking waste parameters, shall be the responsibility of CHELMSFORD or its authorized agent. TYNGSBOROUGH shall be furnished copies of all such determinations.

12.1.2 Samples shall be collected by CHELMSFORD at Metering Stations in such a manner so as to be representative of the actual quality of the wastes. TYNGSBOROUGH shall have the access to said Stations, as required, to conduct intermittent or continuous waste sampling.

12.1.3 Portions of waste samples collected by CHELMSFORD, as part of a sampling and analytical program, will be made available to TYNGSBOROUGH at no cost in adequate quantities for analysis by TYNGSBOROUGH for characteristics and concentrations. In the event of discrepancy which cannot be satisfactorily resolved, the parties will submit the samples to a mutually acceptable, disinterested, qualified third party for determination of the waste characteristics and concentrations.

ARTICLE XIII. FLOW MEASUREMENTS

13.1 CHELMSFORD and TYNGSBOROUGH agrees that flow measurements shall be made as follows:

13.1.1 The volume of flow used in computing TYNGSBOROUGH'S share of the operating costs shall be based upon readings obtained by suitable metering equipment acceptable to CHELMSFORD. Such metering equipment shall be installed and maintained by TYNGSBOROUGH. TYNGSBOROUGH will provide CHELMSFORD with waste flow data for the preceding week, based upon meter readings. CHELMSFORD shall have access to said meters during normal business hours.

13.1.2 In the event the metering equipment is temporary out of order or service for any reason, TYNGSBOROUGH estimated flow will be based on the average daily flow of the previous three months.

ARTICLE XIV. CONFORMANCE TO LAW

14.1 TYNGSBOROUGH agrees to abide by, and conform to, all applicable laws of the United States and the Commonwealth of Massachusetts, together, with such rules and regulations as CHELMSFORD may promulgate from time to time with regard to its sewerage works.

IN WITNESS WHEREOF, CHELMSFORD and TYNGSBOROUGH have caused their proper representatives on the day and year first above written.

FOR THE TOWN OF TYNSBOROUGH, MASSACHUSETTS

By Its Sewer Commissioners

Approved as to Form

Town Counsel

FOR THE TOWN OF CHELMSFORD, MASSACHUSETTS

By ~~Its Sewer~~ Commissi~~oners~~

Approved as to Form

Town Counsel

(C-1000)

Tyngsboro through Chelmsford Flow & Flow Charges

Month/Year	Total Flow	Tyng Flow	*Factor	Expenses	Chemicals	*Total Costs	*Tyngsboro's Cost
	*calculated	(flow in million gallons)					
Apr-05	25.914	2.071	0.07991819	$18,539.55		$18,539.55	$1,481.65
May-05	24.951	2.238	0.0896958	$20,457.43		$20,457.43	$1,834.95
Jun-05	21.071	1.488	0.07061839	$18,539.55		$18,539.55	$1,309.23
Jul-05	20.225	1.873	0.09260816	$19,818.14		$19,818.14	$1,835.32
Aug-05	19.425	1.923	0.09899614	$19,818.14		$19,818.14	$1,961.92
Sep-05	18.92	0.995	0.05258985	$19,178.84		$19,178.84	$1,008.61
Oct-05	25.141	1.746	0.06944831	$19,181.14		$19,181.14	$1,332.10
Nov-05	22.791	1.373	0.06024308	$19,178.84		$19,178.84	$1,155.39
Dec-05	0	0	#DIV/0!	$0.00		$0.00	#DIV/0!
Jan-06	0	0	#DIV/0!	$0.00		$0.00	#DIV/0!
Feb-06	0	0	#DIV/0!	$0.00		$0.00	#DIV/0!
Mar-06	0	0	#DIV/0!	$0.00		$0.00	#DIV/0!
Apr-06	0	0	#DIV/0!	$0.00		$0.00	#DIV/0!
May-06	0	0	#DIV/0!	$0.00		$0.00	#DIV/0!
Jun-06	0	0	#DIV/0!	$0.00		$0.00	#DIV/0!
Jul-06	0	0	#DIV/0!	$0.00		$0.00	#DIV/0!
Aug-06	0	0	#DIV/0!	$0.00		$0.00	#DIV/0!
Sep-06	0	0	#DIV/0!	$0.00		$0.00	#DIV/0!
Totals to date		13.707					#DIV/0!
Average Monthly Flow		**1.1265556**					**$64.19**

TOWN OF TYNGSBOROUGH SEWER BILL

1. Period		4/1/05 - 4/29/05
2. Number of Days in Period		29
3. Total Flow @ Southwell Pump Station (MG)		25.914
4 Total Flow from Town of Tyngsborough (MG)		2.071
5. Multiplier Factor (Line 4/Line 3)		0.080
6. Personnel Expenses	$	6,533.41
7. Expenses & Supplies	$	9,196.77
8. Overhead ((Line 6x 43%)	$	2,809.37
9. Subtotal (Lines 6,7 and 8)	$	18,539.55
10. Town of Tyngsborough share (Line 5 x Line 9)	$	1,481.65
11. Total Tyngsborough Bill for Period	$	1,481.65

TOWN OF TYNGSBOROUGH SEWER BILL

1. Period		4/30/05 - 6/1/05
2. Number of Days in Period		32
3. Total Flow @ Southwell Pump Station (MG)		24.951
4 Total Flow from Town of Tyngsborough (MG)		2.238
5. Multiplier Factor (Line 4/Line 3)		0.090
6. Personnel Expenses	$	7,209.28
7. Expenses & Supplies	$	10,148.16
8. Overhead ((Line 6x 43%)	$	3,099.99
9. Subtotal (Lines 6,7 and 8)	$	20,457.43
10. Town of Tyngsborough share (Line 5 x Line 9)	$	1,834.95
11. Total Tyngsborough Bill for Period	$	1,834.95

TOWN OF TYNGSBOROUGH SEWER BILL

1. Period		6/2/05-6/30/05
2. Number of Days in Period		29
3. Total Flow @ Southwell Pump Station (MG)		21.071
4 Total Flow from Town of Tyngsborough (MG)		1.488
5. Multiplier Factor (Line 4/Line 3)		0.071
6. Personnel Expenses	$	6,533.41
7. Expenses & Supplies	$	9,196.77
8. Overhead ((Line 6x 43%)	$	2,809.37
9. Subtotal (Lines 6,7 and 8)	$	18,539.55
10. Town of Tyngsborough share (Line 5 x Line 9)	$	1,309.23
11. Total Tyngsborough Bill for Period	$	1,309.23

TOWN OF TYNGSBOROUGH SEWER BILL

1. Period		7/1-7/31
2. Number of Days in Period		31
3. Total Flow @ Southwell Pump Station (MG)		20.225
4 Total Flow from Town of Tyngsborough (MG)		1.873
5. Multiplier Factor (Line 4/Line 3)		0.093
6. Personnel Expenses	$	6,983.99
7. Expenses & Supplies	$	9,831.03
8. Overhead ((Line 6x 43%)	$	3,003.12
9. Subtotal (Lines 6,7 and 8)	$	19,818.14
10. Town of Tyngsborough share (Line 5 x Line 9)	$	1,835.03
11. Total Tyngsborough Bill for Period	$	1,835.03

TOWN OF TYNGSBOROUGH SEWER BILL

1. Period		8/1 - 8/31
2. Number of Days in Period		31
3. Total Flow @ Southwell Pump Station (MG)		19.425
4 Total Flow from Town of Tyngsborough (MG)		1.923
5. Multiplier Factor (Line 4/Line 3)		0.099
6. Personnel Expenses	$	6,983.99
7. Expenses & Supplies	$	9,831.03
8. Overhead ((Line 6x 43%)	$	3,003.12
9. Subtotal (Lines 6,7 and 8)	$	19,818.14
10. Town of Tyngsborough share (Line 5 x Line 9)	$	1,961.92
11. Total Tyngsborough Bill for Period	$	1,961.92

TOWN OF TYNGSBOROUGH SEWER BILL

1. Period		9/1 - 9/30
2. Number of Days in Period		30
3. Total Flow @ Southwell Pump Station (MG)		18.92
4 Total Flow from Town of Tyngsborough (MG)		0.995
5. Multiplier Factor (Line 4/Line 3)		0.053
6. Personnel Expenses	$	6,758.70
7. Expenses & Supplies	$	9,513.90
8. Overhead ((Line 6x 43%)	$	2,906.24
9. Subtotal (Lines 6,7 and 8)	$	19,178.84
10. Town of Tyngsborough share (Line 5 x Line 9)	$	1,008.82
11. Total Tyngsborough Bill for Period	$	1,008.82

TOWN OF TYNGSBOROUGH SEWER BILL

1. Period		10/1 - 10/31
2. Number of Days in Period		31
3. Total Flow @ Southwell Pump Station (MG)		25.141
4 Total Flow from Town of Tyngsborough (MG)		1.746
5. Multiplier Factor (Line 4/Line 3)		0.069
6. Personnel Expenses	$	6,983.99
7. Expenses & Supplies	$	9,831.03
8. Overhead ((Line 6x 43%)	$	3,003.12
9. Subtotal (Lines 6,7 and 8)	$	19,818.14
10. Town of Tyngsborough share (Line 5 x Line 9)	$	1,376.34
11. Total Tyngsborough Bill for Period	$	1,376.34

TOWN OF TYNGSBOROUGH SEWER BILL

1. Period		11/1-11/30
2. Number of Days in Period		30
3. Total Flow @ Southwell Pump Station (MG)		22.791
4 Total Flow from Town of Tyngsborough (MG)		1.373
5. Multiplier Factor (Line 4/Line 3)		0.060
6. Personnel Expenses	$	6,758.70
7. Expenses & Supplies	$	9,513.90
8. Overhead ((Line 6x 43%)	$	2,906.24
9. Subtotal (Lines 6,7 and 8)	$	19,178.84
10. Town of Tyngsborough share (Line 5 x Line 9)	$	1,155.39
11. Total Tyngsborough Bill for Period	$	1,155.39

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CHELMSFORD - TYNGSBOROUGH AGREEMENT

AGREEMENT

THIS AGREEMENT, made and entered into this 31st day of May, 1989 by and between the TOWN OF CHELMSFORD, a municipal corporation within the County of Middlesex and the Commonwealth of Massachusetts, hereinafter referred to as CHELMSFORD, and the TOWN OF TYNGSBOROUGH, an incorporated township within the County of Middlesex and the Commonwealth of Massachusetts, hereinafter referred to as TYNGSBOROUGH.

WITNESSETH:

WHEREAS, CHELMSFORD is authorized by law to enter into contracts and agreement with TYNGSBOROUGH for the purpose of aiding in the abatement of water pollution; and

WHEREAS, CHELMSFORD deems it to be in the public interest to enter into an Agreement with TYNGSBOROUGH whereby CHELMSFORD would receive and transport TYNGSBOROUGH'S wastes through CHELMSFORD'S Sewerage System to the CITY OF LOWELL Sewerage System; and whereby the CITY OF LOWELL would receive, treat and dispose of the waste; and

WHEREAS, CHELMSFORD entered into an agreement with the CITY OF LOWELL on June 26, 1985, whereby LOWELL would receive, treat and dispose of CHELMSFORD'S wastes through the CITY OF LOWELL'S Sewerage System; and

WHEREAS, CHELMSFORD has designed and constructed or will design and construct a wastewater collection system with capacity to receive flow from TYNGSBOROUGH as outlined in this agreement; and

WHEREAS, the federal government is empowered under a Public Law 95-217, as amended, to make federal grants for the construction of public treatment works, and to impose conditions on the award of said grants;

WHEREAS, THE CITY OF LOWELL has accepted federal grants for the construction of public treatment works, and must abide by the applicable federal laws, rules and regulations; and

WHEREAS, THE CITY OF LOWELL, CHELMSFORD, AND TYNGSBOROUGH all intend to comply with the applicable federal laws, rules and regulations, including but not limited to user charge, and sewer use ordinance requirements; and

WHEREAS, the provision for wastewater treatment and disposal service is necessary to protect the public health, safety, and welfare; and

WHEREAS, CHELMSFORD AND TYNGSBOROUGH have determined to enter into this Agreement for aforesaid reasons.

NOW THEREFORE, in consideration of these premises and mutual benefits to be derived by this parties hereto, it is agreed as follows:

ARTICLE 1. DEFINITIONS

1.1 For the purpose of this Agreement, the following terms are defined:

1.1.1 "LOWELL" shall mean the City of Lowell, a municipal corporation of the Commonwealth of Massachusetts.

1.1.2 "CHELMSFORD" shall mean the Town of Chelmsford, an incorporated township of the Commonwealth of Massachusetts.

1.1.3 "TYNGSBOROUGH" shall mean the Town of Tyngsborough, an incorporated township of the Commonwealth of Massachusetts.

1.1.4 "Industrial Wastes" shall mean liquid wastes, other than sanitary sewage, resulting from commercial, manufacturing or industrial operations of processes.

1.1.5 "Sanitary Sewage" shall mean sewage discharging from sanitary conveniences such as toilets, washrooms, urinals, sinks, showers, drinking fountains, small laundries, kitchens, cafeterias and floor drains essentially free of industrial wastes or toxic materials.

1.1.6 "Biochemical Oxygen Demand" (BOD) shall mean the quantity of oxygen utilized in the biochemical oxidation of organic matter under standard laboratory procedure in five (5) days at 20 degrees Centigrade (68 degrees Fahrenheit) expressed in milligrams per liter (mg/l) by weight.

1.1.7 "Suspended Soils" (SS) shall mean solids that either float on the surface of, or are in suspension in, water, sewage, wastewater or other liquids and which are removable by laboratory filtering.

1.1.8 "pH" shall mean the logarithm of the reciprocal of the weight of hydrogen ions in grams per liter of solution.

1.1.9 "Chloride Demand" shall mean the amount of chloride expressed in mg/l required to be added to water, sewage or other liquid to achieve a combined chloride residual after fifteen (15) minutes contact of one (1) mg/l.

1.1.10 "Sewage System or Sewage Works" shall mean all facilities for collecting, conveying, pumping, treating and disposing of sanitary sewage and/or industrial wastes.

1.1.11 "Combined Sewer" shall mean a sewer receiving both surface runoff and sanitary sewage and/or industrial wastes.

1.1.12 "Wastes" shall mean the sanitary sewage, industrial wastes and infiltration from TYNGSBOROUGH'S sewerage system.

1.1.13 "Average Daily Flow" shall mean the total annual flow as measured in gallons at Metering Stations plus agreed-to direct discharges to CHELMSFORD'S sewerage system divided by the number of days in the year.

1.1.14 "Maximum Daily Flow" shall mean the maximum gallons recorded at Metering Stations plus agreed-to allowances for direct discharges to CHELMSFORD sewerage system during a 24-hour period during any calendar year.

1.1.15 "Peak Rate of Flow" shall mean the maximum rate of flow in gallons recorded at Metering Stations or measured in the direct discharges to CHELMSFORD'S sewerage system during any calendar year.

1.1.16 "User Charges" shall mean charges levied in proportion to the use of sewage works. As required by Section 204 (b) (1) (A) of Public Law 95-217, as amended, and by regulations promulgated by the U.S. Environmental Protection Agency, such charges must, to the extend possible, distribute operation and maintenance (including replacement) cost to each user in proportion to its contribution to the total loading of the sewage works, where construction of such works has been financed in part by a federal grant.

1.1.17 "Replacement Costs" shall mean expenditures for obtaining and installing equipment, accessories or appurtenances which are necessary during the service life of the sewage works to maintain the capacity and performance for which said works were designed and constructed.

1.1.18 "Service Life" shall mean the period of time during which the sewage works or component of a waste treatment management program will be capable of performing a function.

1.1.19 "Industrial User" shall mean any non-governmental user of CHELMSFORD'S sewage works, which contributes industrial wastes, identified in the <u>Standard Industrial Classification Manual</u>, 1972 Edition, Office of Management and Budget, as amended and supplemented, under the following divisions:

Division A. Agriculture, Forrestry, and Fishing.
Division B. Mining.
Division D. Manufacturing.
Division E. Transportation, Communications, Electric, Gas, and Sanitary Services.
Division I. Services.

1.1.20 "Total Cost" shall mean construction costs, engineering and legal fees, capatilized interest costs during construction, amortization costs and land costs.

1.1.21 "Operation Costs" shall mean the cost incurred by CHELMSFORD necessary for the proper and efficient operation and maintenance of the sewage works.

ARTICLE II. GENERAL PROVISIONS

2.1 TYNGSBOROUGH understands and agrees to the following obligations, limitations, and commitments, made in return for CHELMSFORD'S agreement to permit connection by TYNGSBOROUGH to CHELMSFORD'S sewage works.

2.1.1 "Limitations of Rights." Nothing in this Agreement shall be construed as a grant by CHELMSFORD of any exclusive right of privilege. TYNGSBOROUGH agrees to comply in all respects with "the TOWN OF CHELMSFORD Sewer Use Regulations," as amended.

2.1.2 "Charges and Fees." TYNGSBOROUGH agrees to make prompt payment of all charges described in and pursuant to this agreement.

2.1.3 "Sewer Use By-Law." TYNGSBOROUGH agrees to adopt and enforce a by-law that embodies rules related to use of TYNGSBOROUGH'S sewage works. Said rules shall include the Town of Tyngsborough Sewer Rules and Regulations adopted August 1981 and any amendments thereto that be required to be acceptable to federal and state authorities, to CHELMSFORD and to LOWELL. As a minimum, such rules shall prescribe conditions and requirements for use of TYNGSBOROUGH'S sewage works so as to comply with the limitations set forth in "TOWN OF CHELMSFORD Sewer Use Regulations," as amended.

2.1.4 "Interceptor Responsibilities." TYNGSBOROUGH shall be responsible for the design, construction, operation, maintenance, and costs incurred for its sewer program. A complete metering/sampling station shall be constructed by TYNGSBOROUGH, installed adjacent to the CHELMSFORD town line, to determine and to allocate CHELMSFORD'S costs for operation and maintenance to TYNGSBOROUGH for its wastewater volume and strengths.

ARTICLE III. OBLIGATIONS AND RESPONSIBILITIES

3.1 CHELMSFORD shall receive and transport TYNGSBOROUGH'S wastes, in accordance with all existing or future laws, regulations, existing or future CHELMSFORD Sewer Ordinance, water quality standards, and orders and decrees of any governmental authority having jurisdiction over the transmission of said wastes; provided, however, that the treatment of TYNGSBOROUGH'S wastes shall be of such a type and degrees as may be necessary to provide for the application of Best Practicable Waste Treatment Technology. TYNGSBOROUGH shall conform to all appropriate industrial wastewater pretreatment rules and regulations as established by the appropriate state and federal regulatory agencies.

3.2 TYNGSBOROUGH will not connect any combined sewer or separate drains into CHELMSFORD'S sewerage system and will not discharge into said sewerage system any volume of sewage, substances or wastes containing the following characteristics in excess of that agreed to herein.

3.2.1 Any waters or wastes contaminating fats, wax, grease or oils, whether emulsified or not, in excess of one hundred (100) mg/l or containing substances which may solidify or become viscous at temperature between zero (0) and sixty-five (65) degrees Centrigrade, (32 and 150 degrees Fahrenheit).

3.2.2 Any gasoline, benzene, naptha, fuel oil, or other liquid, solid or gas in sufficient concentration to be flammable or explosive.

3.2.3 A temperature higher than 65 degrees Centrigrade (150 degrees Fahrenheit).

3.2.4 Any garbage not properly shredded.

3.2.5 Any ashes, cinders, sand, mud, straw, shavings, metal, glass, rags, feathers, tar, wood, paunch manure, or other solid or viscous substances capable of causing interference with the proper operation of the sewerage system.

3.2.6 Any wastes having a pH lower than 5.5 or higher than 9.5 or having any corrosive property capable of causing damage or hazards to structures, equipment and personnel at the sewage works.

3.2.7 Any wastes containing a toxic or poisonous substances which constitute a hazard to humans or animals or to create any hazard in the receiving waters of the sewage works.

3.2.8 Waters or wastes containing substances which are amendable to treatment only to a degree such that the sewage treatment plant effluent cannot meet the requirements of any governmental authority having jurisdiction over discharge to the receiving waters.

3.2.9 Any noxious or malodorous gas or substance capable of creating a public nuisance.

3.2.10 Plastics, except those materials which have undergone complete reaction and whose size does not exceed 2.5 inches in its largest dimension.

3.2.11 Wastes character or concentration, as sampled at Metering Stations, in accordance with the provisions of ARTICLE VIII.

3.3 All measurements of volume and characteristics of TYNGSBOROUGH'S wastes shall be made at Metering Stations constructed, and maintained by TYNGSBOROUGH at locations acceptable to CHELMSFORD pursuant to this Agreement. <u>Said acceptance by CHELMSFORD shall not be unreasonably withheld.</u> All flow measurements made at the metering stations will be transmitted to Southwellfield Pump Station in North Chelmsford and to the Duck Island Wastewater Treatment Plant in Lowell. For small individual areas in TYNGSBOROUGH'S sewerage system, measurements shall be based on a method acceptable to CHELMSFORD and TYNGSBOROUGH.

3.4 Industrial wastes from TYNGSBOROUGH, as measured at Metering Stations, shall be judged by the same standards as are in effect within CHELMSFORD'S Sewerage System, notwithstanding the provisions of Paragraph 3.2 of this ARTICLE.

ARTICLE IV. AGREEMENT TERM

4.1 The provisions of this Agreement shall run for a minimum period of thirty (30) years from the date of initial transport of TYNGSBOROUGH'S wastes subject to the provisions of ARTICLE XI.

ARTICLE V. IMPLEMENTATION

5.1 CHELMSFORD agrees to provide a sewerage system with a portion of the capacity allocated to handle wastes from TYNGSBOROUGH. Construction commencement and completion of said sewerage system shall be in accordance with the implementation schedule established by the Massachusetts Water Resources Commission, Division of Water Pollution Control. In the event TYNGSBOROUGH determines that it shall not use its entire capacity, CHELMSFORD shall have the right to purchase the unused flow. Unused flow will be based on capacities, described in Paragraph 7.3.1 of ARTICLE VII less actual meter readings at metering stations.

ARTICLE VI. USER CHARGES

6.1 User Charges:

6.1.1 TYNGSBOROUGH shall develop, in accordance with the provisions of federal regulations ("Code of Federal Regulations, Subpart I, 40 CFR 35.2122 and 35.2140, et seq."), as amended, an equitable User Charge System to assure that each recipient of waste treatment services within TYNGSBOROUGH'S service area will pay its proportionate share of the costs of operation and maintenance (including replacement) of all waste transmission services provided by CHELMSFORD and all waste treatment services provided by LOWELL.

6.1.2 TYNGSBOROUGH shall obtain approval of the Massachusetts Water Resource Commission, Division of Water Pollution Control, and the Region 1 Office of the U.S. Environmental Protection Agency for its User Charge System for the above costs.

6.1.3 TYNGSBOROUGH, upon approval of its User Charge System, must incorporate said system in one or more municipal legislative by-laws.

ARTICLE VII. PAYMENT OF CAPITAL COSTS

7.1 TYNGSBOROUGH shall, periodically, as set forth herein, pay to CHELMSFORD sums which in total represent its full obligation of the Total Cost to CHELMSFORD, after deduction of all government grants for all sewage works in CHELMSFORD, required to receive and transport TYNGSBOROUGH'S wastes.

CHELMSFORD and TYNGSBOROUGH acknowledge that certain construction has previously been completed by CHELMSFORD and LOWELL of facilities which are and shall be used by TYNGSBOROUGH pursuant to this AGREEMENT and TYNGSBOROUGH agrees to pay to CHELMSFORD, TYNGSBOROUGH'S share as determined by this agreement.

Payments of the full obligation, as determined by this agreement, by TYNGSBOROUGH to CHELMSFORD shall be due <u>immediately upon notification from TYNGSBOROUGH of the commencement of transmission of sewerage from TYNGSBOROUGH to the Town of CHELMSFORD Sewerage System provided that no flow shall be accepted from TYNGSBOROUGH until payment is made.</u>

7.2 The basis of payments by TYNGSBOROUGH for sewage works construction by CHELMSFORD shall be established as follows:

7.2.1 <u>Lowell Facilities</u>:

7.2.1.1 Duck Island Regional Treatment

$$\text{TYNGSBOROUGH payment} = C_1\ a/b$$

Where:

C_1 = Total Local Share for North Chelmsford Regional Treatment

a = Average daily design flow rate requested by TYNGSBOROUGH

b = Total average daily design flow rate for the North Chelmsford Regional Area. This regional flow represents flows from TYNGSBOROUGH, WESTFORD, and NORTH CHELMSFORD.

7.2.1.2 Lowell Transmission Facilities

TYNGSBOROUGH payment = C_2 d/e

Where:

C_2 = Total Local Share of Lowell Transmission Facilities built to receive North Chelmsford Regional Flow.

d = Peak daily design flow requested by TYNGSBOROUGH

e = Total peak daily design flow rate of the North Chelmsford Regional Area.

7.2.2 Chelmsford Facilities:

7.2.2.1 Southwell Field Pump Station

TYNGSBOROUGH Payment = C_3 a/f

Where:

C_3 = Total local share of Southwell Field Pump Station

f = Total Average regional design flow for Southwell Field Pump Station

7.2.2.2 North Chelmsford Interceptor Sewer Project

$$\text{TYNGSBOROUGH Payment} = C_4\ d/g + C_5\ d/h$$

Where:

C_4 = Total Local Share of the 16" Force Main

C_5 = Total Local Share of the 24" Gravity Sewer

g = Peak daily regional design flow in the 16" Force Main

h = Peak daily regional design flow in the 24" Gravity Sewer

7.2.2.3 North Chelmsford Lateral Sewers - Tyngsborough Road

$$\text{TYNGSBOROUGH Payment} = C_6\ d/i$$

Where:

C_6 = Total Local Share of the 15" Gravity Sewer

i = Peak daily regional design flow in the 15" Gravity Sewer

7.3 CHELMSFORD shall provide capabilities in its sewage works for the wastes from TYNGSBOROUGH'S service area, as defined by a boundary created by the CHELMSFORD Town Line, then northerly along the Merrimack River, then Southwesterly along Westford Road, then Southeasterly along Route 3 to the CHELMSFORD Town Line. Capacities for TYNGSBOROUGH shall be as follows:

7.3.1	Average Daily Flow	0.35 million gallons per day (mgd)
	Peak Flow	1.3 mgd
	BOD	740 lbs/day
	SS	800 lbs/day

7.4 Should it be required by the appropriate State and/or Federal agencies to provide additional waste treatment at Duck Island Regional Facilities, TYNGSBOROUGH shall pay its proportionate share of the required sewage works based on the flows established under Paragraph 7.3 of this ARTICLE. If LOWELL'S sewage works required enlargement because the total flows or total strength of the flow to the treatment facilities exceed the design, then TYNGSBOROUGH shall contribute only insofar as its wastes have exceed the limits called for under the above-referenced Paragraph 7.3 and the provisions of 7.3.

ARTICLE VIII. OPERATING COST APPORTIONMENT

8.1 CHELMSFORD and LOWELL shall maintain an adequate cost accounting system which shall be the basis for the determination and allocation of operating costs.

CHELMSFORD shall maintain separate cost accounting records for the operation of those portions of their sewage works that are shared by CHELMSFORD and TYNGSBOROUGH and any other participants. The annual cost of operating these sewage works shall be apportioned between CHELMSFORD, TYNGSBOROUGH and any other participants on the basis of their actual, annual flows, as determined from records at the respective Metering Stations.

8.2 The operating costs shall be apportioned against participants on the basis of the average daily flows, providing that the established parameters from any participant are not exceeded. If either the average BOD or SS from any participants exceeds 300 mg/l; then the participant shall pay a surcharge to CHELMSFORD and/or LOWELL for transport and/or treatment of its wastes. The surcharges will be based on the proportional extra cost incurred for the complete transport and/or treatment of wastes in excess of 300 mg/l for the period of time in violation.

8.3 Actual flows shall be determined for TYNGSBOROUGH from records of Metering Stations. Actual annual flow for CHELMSFORD, will be determined at Southwell Field Pump Station. Estimated flows from non-metered, individual areas shall also be included, if not charged separately. Actual, annual flows shall be determined for LOWELL from records at the treatment facilities.

8.4 The waste strengths, BOD and SS, for each of the participants shall be determined from proportional, composite 24-hour samples obtained at the participants Metering Stations. The average daily BOD and SS in pounds per day shall be determined from the average of not less than twelve (12) samples taken on weekdays at monthly intervals.

8.5 When determining surcharges, the unit cost per pound of BOD and SS used shall be based on the previous year's treatment facility operational costs divided by the total annual BOD or SS loadings.

8.6 Operating costs for the treatment facilities shall include the cost of sampling and analyzing wastes discharged. It shall also include the cost accounting related to the distribution and invoicing of operating costs.

8.7 Operating costs shall be payable monthly, on a fiscal year basis, upon receipt by TYNGSBOROUGH of CHELMSFORD'S invoice. Bills shall be paid within forty-five (45) days. Operating costs for the first eleven (11) months shall be determined by using CHELMSFORD and LOWELL'S approved yearly operation budget (reduced to a monthly cost) and approportioning TYNGSBOROUGH'S share on the basis of actual total monthly flow, as measured.

The final monthly invoice for the fiscal year shall be rendered by CHELMSFORD within thirty (30) days of the end of the fiscal year and shall be determined on the basis of actual flows and expenditures. All previous monthly invoices shall be subject to adjustment and correction at the time of this final billing for the fiscal year.

CHELMSFORD shall forward to TYNGSBOROUGH, on or before March first, the projected estimate of operating cost and other costs <u>attributable to TYNGSBOROUGH</u> for such fiscal year, so that TYNGSBOROUGH may make necessary preparations for the final monthly invoice for the fiscal year.

ARTICLE IX. ANNUAL COST REVIEW

9.1 CHELMSFORD and TYNGSBOROUGH both agree that the apportionment of costs set forth in ARTICLE VIII, shall be subject to review annually. After a review of the annual costs, if an adjustment to the costs appears to be necessary, said adjustment shall be made by CHELMSFORD in the forthcoming billing for services.

ARTICLE X. ADJUSTMENT CLAUSE

10.1 TYNGSBOROUGH reserves the right at any time to pretreat and/or reduce the BOD and SS concentrations of its wastes, or to otherwise give preliminary treatment to its wastes prior to discharge to CHELMSFORD'S sewerage system. TYNGSBOROUGH agrees to notify CHELMSFORD as far in advance as possible of any significant increase or decrease in the quantity and/or quality of the wastes to be discharged to CHELMSFORD'S sewerage system.

ARTICLE XI. TERMINATION CLAUSE

11.1 Either party may terminate this Agreement by giving the notice thereof to the other party in writing three (3) years prior to the termination date. Upon receipt of said notice, both parties will enter into discussion within thirty (30) days to assure proper termination of the Agreement.

Should TYNGSBOROUGH initiate the termination proceedings, it shall not have any right to the return of any of its initial capital investment under ARTICLE VII.

Should CHELMSFORD initiate the termination proceedings, it shall be obliged to return to TYNGSBOROUGH the unused proportionate share of TYNGSBOROUGH'S capital investment under ARTICLE VIII.

11.2 TYNGSBOROUGH shall have the right to the continued use of CHELMSFORD sewerage works provided for, in part, by TYNGSBOROUGH'S capital investment under ARTICLE VII, beyond the thirty (30) years provided for in ARTICLE IV, for as long as those sewerage works remain in active use. The right shall be limited to the waste parameters established under ARTICLE VII.

11.3 Each party shall truly and faithfully perform its duties, all the undertakings covenants, terms and conditions of this agreement during the term of this agreement, and any extension thereof which may be granted by CHELMSFORD; and subject further to the following:

11.3.1 TYNGSBOROUGH shall assume the defense of and indemnify and hold harmless CHELMSFORD, including CHELMSFORD'S Sewer Commission, agents, servants, employees, and/or elected officials from and against all liability, damage, loss, claim, demands, and actions of any nature whatsoever which arise out of or are connected with, or are claimed to arise out of or be connected with any provisions, terms, and condition, etc. of this agreement, including, without limiting the generality of the foregoing thereto, all liability, damage, loss, claims, demands and action on account of personal injury, death or property loss occasioned by CHELMSFORD, its Sewer Commission, its agents, servants, employees and/or elected officials, or any other persons, whether or not caused or claimed to have caused by active, or inactive negligence, or other breach of duty by the Town of TYNGSBOROUGH its agents, Sewer Commission elected officials and/or employees or any other person. TYNGSBOROUGH shall as its own expense investigate all such claims and demands against it, its Sewer Commission, agents and or employees, attend to claim settlement or other disposition, defend all actions based thereon and pay all charges or attorney's fees and all other costs and expenses of any kind arising from any such liability loss claims, demands, and actions.

11.3.2 CHELMSFORD shall assume the defense of and indemnify and hold harmless TYNGSBOROUGH, including TYNGSBOROUGH'S Sewer Commission, agents, servants, employees, and/or elected officials from and against all liability, damage, loss, claim, demands, and actions of any nature whatsoever which arise out of or are connected with, or are claimed to arise out of or be connected with any provision, term, and condition, etc. of this agreement, including, without limiting the generality of the foregoing thereto, all liability, damage, loss, claims, demands and action of account of personal injury, death or property loss occasioned by TYNGSBOROUGH, its Sewer Commission, its agents, servants, employees and/or elected officials, or any other persons, whether or not caused or claimed to have caused by active or inactive negligence, or other breach of duty by the Town of CHELMSFORD its agents, Sewer Commission, elected officials and/or employees or any other person. CHELMSFORD shall at its own expense investigate all such claims and demands against it, its Sewer Commission, agents and/or employees, attend to claim settlement or other disposition, defend all actions based thereon and pay all charges or attorney's fees and all other costs and expenses of any kind arising from any such liability, loss, claims, demands, and actions.

11.4 TYNGSBOROUGH and CHELMSFORD shall, at all times be obligated to comply with the terms and conditions of this agreement. Any party in default and/or in breach of this agreement shall reimburse and repay to the non-breaching and/or non-defaulting party, its Sewer Commission, its agents, servants, employees and/or elected officials all expenses and other sums incurred by said non-breaching party and/or non-defaulting party for curing such default and/or breach. In the event TYNGSBOROUGH fails to make any payments as required in this agreement, CHELMSFORD may, but is not obligated to cure TYNGSBOROUGH default, and any sums incurred by the Town of CHELMSFORD in regard to the same, shall be paid by TYNGSBOROUGH to CHELMSFORD within thirty (30) days from the expenditure by the Town of CHELMSFORD, its Sewer Commission, agents, agent servants, employees and/or elected officials.

11.5 This agreement will become null and void if within three (3) years of the date of this agreement CHELMSFORD does not receive notification from TYNGSBOROUGH of the commencement of transmission of sewerage and payment of TYNGSBOROUGH'S full obligation as required in Section VII.

ARTICLE XII. WASTES ANALYSIS

12.1 CHELMSFORD and TYNGSBOROUGH both agree that the determination of character and concentration of wastes will be in accordance with the latest edition of "Standard Methods for the Examination of Water and Sewage," as proposed, approved and published by the American Public Health Association and the Water Pollution Control Federation, or any other method established by CHELMSFORD, and subject further the following:

12.1.1 Sampling at Metering Stations will be performed by CHELMSFORD. Determination of the character and concentration of TYNGSBOROUGH'S wastes, for the purpose of checking waste parameters, shall be the responsibility of CHELMSFORD or its authorized agent. TYNGSBOROUGH shall be furnished copies of all such determinations.

12.1.2 Samples shall be collected by CHELMSFORD at Metering Stations in such a manner so as to be representative of the actual quality of the wastes. TYNGSBOROUGH shall have the access to said Stations, as required, to conduct intermittent or continuous waste sampling.

12.1.3 Portions of waste samples collected by CHELMSFORD, as part of a sampling and analytical program, will be made available to TYNGSBOROUGH at no cost in adequate quantities for analysis by TYNGSBOROUGH for characteristics and concentrations. In the event of discrepancy which cannot be satisfactorily resolved, the parties will submit the samples to a mutually acceptable, disinterested, qualified third party for determination of the waste characteristics and concentrations.

ARTICLE XIII. FLOW MEASUREMENTS

13.1 CHELMSFORD and TYNGSBOROUGH agrees that flow measurements shall be made as follows:

13.1.1 The volume of flow used in computing TYNGSBOROUGH'S share of the operating costs shall be based upon readings obtained by suitable metering equipment acceptable to CHELMSFORD. Such metering equipment shall be installed and maintained by TYNGSBOROUGH. TYNGSBOROUGH will provide CHELMSFORD with waste flow data for the preceding week, based upon meter readings. CHELMSFORD shall have access to said meters during normal business hours.

13.1.2 In the event the metering equipment is temporary out of order or service for any reason, TYNGSBOROUGH estimated flow will be based on the average daily flow of the previous three months.

ARTICLE XIV. CONFORMANCE TO LAW

14.1 TYNGSBOROUGH agrees to abide by, and conform to, all applicable laws of the United States and the Commonwealth of Massachusetts, together, with such rules and regulations as CHELMSFORD may promulgate from time to time with regard to its sewerage works.

IN WITNESS WHEREOF, CHELMSFORD and TYNGSBOROUGH have caused their proper representatives on the day and year first above written.

FOR THE TOWN OF TYNSBOROUGH, MASSACHUSETTS

By Its Sewer Commissioners

Approved as to Form

Town Counsel

FOR THE TOWN OF CHELMSFORD, MASSACHUSETTS

By ~~Its Sewer~~ Commissi~~oners~~

Approved as to Form

Town Counsel

(C-1000)

COPY

DRACUT-TYNGSBOROUGH AGREEMENT

AGREEMENT

THIS AGREEMENT, made and entered into this ________________ day of ________________________, 1977, by and between the Town of Dracut, an incorporated Township within the County of Middlesex and the Commonwealth of Massachusetts, hereinafter referred to as "Dracut", and the Town of Tyngsborough, an incorporated township within the County of Middlesex and the Commonwealth of Massachusetts, hereinafter referred to as "Tyngsborough".

WITNESSETH

WHEREAS, the Water Resources Commission, Commonwealth of Massachusetts, acting through the Office of the Director of the Division of Water Pollution Control, has found both Dracut and Tyngsborough to be discharging untreated wastewaters into the surface waters of the Commonwealth in contravention of the water quality standards of the Division of Water Pollution Control; and

WHEREAS, Dracut is authorized by law to enter into contracts and agreements with Tyngsborough for the purpose of aiding in the abatement of water pollution; and

WHEREAS, Dracut deems it to be in the public interest to enter into an AGREEMENT with Tyngsborough whereby Dracut would receive and transmit Tyngsborough's wastes through Dracut's sewerage system to the City of Lowell where the City of Lowell would receive, treat, and dispose of Tyngsborough's wastes.

NOW, THEREFORE, in consideration of these premises and mutual benefits to be derived by the parties hereto, IT IS AGREED, as follows;

ARTICLE 1. DEFINITIONS

1.1 For the purposes of this AGREEMENT the following terms are defined:

1.1.1 "Dracut" shall mean the Town of Dracut, an incorporated township of the Commonwealth of Massachusetts.

1.1.2 "Tyngsborough" shall mean the Town of Tyngsborough, an incorporated township of the Commonwealth of Massachusetts.

1.1.3 "City " shall mean the City of Lowell, a municipal corporation of the Commonwealth of Massachusetts.

1.1.4 "Industrial Wastes" shall mean liquid wastes, other than sanitary sewage, resulting from commercial, manufacturing or industrial operations or processes.

1.1.5 "Sanitary Sewage" shall mean sewage discharging from sanitary conveniences such as toilets, washrooms, urinals, sinks, showers, drinking fountains, small laundries, kitchens, cafeterias and floor drains essentially free of industrial wastes or toxic materials.

1.1.6 "Biochemical Oxygen Demand" (BOD) shall mean the quantity of oxygen utilized in the biochemical oxidation of organic matter under standard laboratory procedure in five (5) days at 20 degrees (°) Centigrade (68° Fahrenheit) expressed in milligrams per liter (mg/l) by weight.

1.1.7 "Suspended Solids" (SS) shall mean solids that either float on the surface of, or are in suspension in, water, sewage, wastewater or other liquids and which are removable by laboratory filtering.

1.1.8 "pH" shall mean the logarithm of the reciprocal of the weight of hydrogen ions in grams per liter of solution.

1.1.9 "Chlorine Demand" shall mean the amount of chlorine expressed in mg/l required to be added to water, sewage or other liquid to achieve a combined chlorine residual after fifteen (15) minutes contact of one (1) mg/l.

1.1.10 "Sewerage System or Sewage Works" shall mean all facilities for collecting, conveying, and pumping of sanitary sewage and/or industrial wastes within the Town of Dracut.

1.1.11 "Treatment Facilities" shall mean all facilities for conveying, treating, and disposing of sanitary sewage and/or industrial wastes within the City of Lowell.

1.1.12 "Combined Sewer" shall mean a sewer receiving both surface runoff and sanitary sewage and/or industrial wastes.

1.1.13 "Wastes" shall mean the sanitary sewage, industrial wastes and infiltration from Tyngsborough's and/or Dracut's sewerage system(s).

1.1.14 "Average Daily Flow" shall mean the total annual flow as measured at Metering Stations plus agreed-to direct discharges to Dracut's sewerage system divided by the number of days in the year.

1.1.15 "Maximum Daily Flow" shall mean the maximum gallons recorded at Metering Stations plus agreed-to allowances for direct discharges to Dracut's sewerage system during a 24-hour period during any calendar day.

1.1.16 "Peak Rate of Flow" shall mean the maximum rate of flow recorded at Metering Stations or measured in the direct discharges to Dracut's sewerage system during any calendar year.

1.1.17 "User Charge" shall mean a charge levied on a user of sewage works for the cost of operation and maintenance, including replacement costs, of such works (Environmental Protection Agency definition).

1.1.18 "Replacement" shall mean expenditures for obtaining and installing equipment, accessories or appurtenances which are necessary during the service life of the sewage works to maintain the capacity and performance for which said works were designed and constructed. Replacement costs shall be apportioned in accordance with ARTICLE VI. (Environmental Protection Agency definition).

1.1.19 "Service Life" shall mean the period of time during which the sewage works or a component of a waste treatment management program will be capable of performing a function (Environmental Protection Agency definition).

1.1.20 "Industrial Cost Recovery" shall mean the recovery by Dracut of that portion of a federal grant allocable to the collection, transmission and treatment of discharges from industrial users (Environmental Protection Agency definition).

1.1.21 "Industrial User" shall mean any non-governmental user of Dracut's sewage works, which contributes industrial wastes, identified in the Standard Industrial Classification Manual, 1972 Edition, Office of Management and Budget, as amended and supplemented, under the following divisions (Environmental Protection Agency definition):

Division A. Agriculture, Forestry and Fishing

Division B. Mining

Division D. Manufacturing

Division E. Transportation, Communications, Electric, Gas and Sanitary Services

Division I. Services

1.1.22 "Total Cost" shall mean construction costs, engineering and legal fees, capitalized interest costs during construction, amortization costs, land costs, etc.

1.1.23 "Operating Cost" shall mean the cost incurred by Dracut necessary for the proper and efficient operation and maintenance of the sewage works.

ARTICLE II OBLIGATIONS AND RESPONSIBILITIES

2.1 Dracut shall receive and transmit Tyngsborough's wastes in accordance with all existing or future laws, regulations, Dracut Sewer Ordinances, water quality standards, and orders and decrees of any governmental authority having jurisdiction over the reception and transmission.

Tyngsborough shall assist Dracut in meeting its obligations of adhering to and enforcing all existing and future laws, regulations, Dracut Sewer Ordinances, water quality standards, and orders and decrees of any governmental authority having jurisdiction over the reception and transmission of said wastes.

Dracut shall enter into a separate agreement with the City, wherein the City will agree to receive, treat and dispose of the wastes from Dracut (which will include Tyngsborough's wastes) in accordance with all existing or future laws, regulations, City Sewer Ordinances, water quality standards, and orders and decrees of any governmental authority having jurisdiction over the treatment and disposal of said wastes; provided,however, that the treatment to be provided by the City of Dracut's wastes shall be of such a'type and degree as may be necessary to provide for the application of Best Practicable Waste Treatment Technology.

Tyngsborough shall assist Dracut in assisting the City in meeting its obligations of adhering to and enforcing all existing and future laws, regulations, City Sewer Ordinances, water quality standards, and orders and decrees of any governmental authority having jurisdiction over the treatment and disposal of said wastes.

2.1.1Sewer pipe inverts at the connection points of Tyngsborough's sewer lines into Dracut's sewer system at the Town Line shall be at or above the following elevations:

a) Tyngsboro Road at Tyngsborough-Dracut Town line 150.60 USGS Datum
b) Willowdale Avenue at Tyngsborough-Dracut Town line 151.50 USGS Datum

2.2 Tyngsborough will not connect any combined sewer or separate drain into Dracut's sewerage system and will not discharge into said sewerage system any volume of sewage, substances or wastes containing the following characteristics in excess of that agreed to herein:

2.2.1 Any waters or wastes containing fats, wax, grease or oils, whether emulsified or not, in excess of one hundred (100) mg/l or containing substances which may solidfy or become viscous at temperatures between zero (0) and sixty-five (65) degrees Centigrade (32 and 150 degrees Fahrenheit).

2.2.2 Any gasoline, benzene, naptha, fuel oil, or other liquid, solid or gas in sufficient concentration to be flammable or explosive.

2.2.3 A temperature higher than 65 degrees Centigrade (150 degrees Fahrenheit).

2.2.4 Any garbage not properly shredded.

2.2.5 Any ashes, cinders, sand, mud, straw, shavings, metal, glass, rags, feathers, tar, wood, paunch manure or other solid or viscous substances capable of causing interference with the proper operation of the sewerage system and/or treatment facilities.

2.2.6 Any wastes having a pH lower than 5.5 or higher than 9.5 or having any other corrosive property capable of causing damage or hazards to structures, equipment and personnel at the sewage works and or treatment works

2.2.7 Any wastes containing a toxic or poisonous substance in sufficient quantity to injure or interfere with the sewerage system, and/or treatment facilities to consititute a hazard to humans or animals or to create any hazard in the receiving waters of the treatment facilities.

2.2.8 Waters or wastes containing substances which are amenable to treatment only to a degree such that the treatment facilities effluent cannot meet the requirements of any governmental authority having jurisdiction over discharge to the receiving waters.

2.2.9 Any noxious or malodorous gas or substance capable of creating a public nuisance.

2.2.10 Plastics, except those materils which have undergone complete reaction and whose size does not exceed 2.5 inches in its largest dimension.

2.2.11 Waste character or concentration, as sampled at Metering Stations, in accordance with the provisions of ARTICLE VII.

2.3 All measurements of volume and characteristics of Tyngsborough's wastes shall be made at Metering Stations constructed, operated and maintained by Dracut at the following locations:

Metering Station No. 1 - Located on Tyngsboro Road at the Dracut-Tyngsborough Town boundary

Metering Station Number 2 - Located on Willowdale Avenue at the Dracut-Tyngsborough Town boundary.

2.4 Industrial wastes from Tyngsborough as measured at Metering Stations, shall be judged by the same standards as are in effect within Dracut's sewerage system; notwithstanding the provisions of Paragraph 2.2 of this Article.

ARTICLE III AGREEMENT TERM

3.1 The provisions of this AGREEMENT shall run for a minimum period of thirty (30) years from the date of initial treatment of Tyngsborough's wastes subject to the provisions of ARTICLE X.

ARTICLE IV IMPLEMENTATION

4.1 Dracut agrees to provide a sewerage system with a portion of the capacity allocated to receive and transmit wastes from Tyngsborough. Construction commencement and completion of said sewerage system shall be in accordance with the Implementation Schedule established by the Massachusetts Water Resources Commission, Division of Water Pollution Control.

ARTICLE V USER CHARGES AND INDUSTRIAL COST RECOVERY

5.1 User Charges:

5.1.1 Tyngsborough shall develop, in accordance with the provision of federal regulations ("Code of Federal Regulations, 40 CFR 35.925-11 and 35.935-13, et seq."), an equitable User Charge System to assure that each recipient of waste treatment services within Tyngsborough's service area will pay its proportionate share of the costs of operation and maintenance (including replacement) of all waste treatment services provided by Dracut.

5.1.2 Tyngsborough must obtain approval of the Massachusetts Water Resources Commission, Division of Water Pollution Control, and the Region 1 Office of the U.S. Environmental Protection Agency for its User Charge System for the above costs.

5.1.3 Tyngsborough, upon approval of its User Charge System, must incorporate said System in one or more municipal, legislative enactments.

5.1.4 The enactment(s) must include provisions whereby the maintenance of said System and the collection of the revenues can be reviewed by any governmental authority having jurisdiction and/or Dracut.

5.2 Industrial Cost Recovery:

5.2.1 Tyngsborough shall annually inventory and survey all the industries in its service area. The survey should produce all pertinent information so that a determination can be made by Dracut and Tyngsborough as to which is an industrial user as defined in ARTICLE I.

5.2.2 Dracut shall develop in accordance with the provisions of federal regulation ("Code of Federal Regulations, 40 CFR 35.925-12, 35.928 and 35.935-13, et seq."),an equitable Industrial Cost Recovery System for all industrial users in its service area for the recovery of their portion of a federal grant amount allocable to sewage works constructed in Dracut.

5.2.3 Dracut must obtain the approval of the Massachusetts Water Resources Commission, Division of Water Pollution Control, and the Region I Office of the U.S. Environmental Protection Agency for its Industrial Cost Recovery System.

5.2.4 Dracut and Tyngsborough, upon approval of the Industrial Cost Recovery System, must incorporate said System in one or more municipal, legislative enactments as being their Industrial Cost Recovery System.

5.2.5 Dracut shall annually bill Tyngsborough for Industrial Cost Recovery for all industries within Tyngsborough's service area as determined by Dracut's System. Tyngsborough shall collect all revenues for Industrial Cost Recovery from industries within Tyngsborough's service area.

5.2.6 Tyngsborough shall annually pay to Dracut the invoiced billings for Industrial Cost Recovery plus the interest earned thereon on the collected revenues at the time that the final payment for operating costs for each fiscal year is made in accordance with ARTICLE VII.

5.2.7 Tyngsborough shall provide Dracut with copies of all invoices and records pertinent to the assessing and collection of revenue for Industrial Cost Recovery.

5.2.8 Dracut shall review the Industrial Cost Recovery System annually, using Tyngsborough's annual industrial inventory and survey report.

5.2.9 Dracut shall keep a permanent file of all reports, invoices, and records relative to Industrial Cost Recovery subject to review by any governmental authority having jurisdiction.

5.2.10 Dracut shall retain, as presently permitted by federal regulation, 50 percent of the amounts recovered from industrial users. Accurate records of the retained revenues, including acknowledgement of the source as well as detailed cost accounts of expenditures of these funds, will be maintained so that Dracut and Tyngsborough will receive full credit and benefit in accordance with the terms of this AGREEMENT. All of the retained amounts recovered from industrial users in Tyngsborough's service area shall be used in accordance with federal regulation for sewage works in Dracut which will directly benefit Tyngsborough.

ARTICLE VI CAPITAL COST APPORTIONMENT

6.1 Tyngsborough shall, periodically, pay to Dracut sums which in total represent its full obligation of the Total Cost to Dracut, after deduction of all government grants for all sewage works in Dracut, of sewage works required to receive and transmit Tyngsborough's wastes to the City where the City would receive, treat and dispose of Tyngsborough's wastes.

Payments of the full obligation by Tyngsborough to Dracut for each applicable construction contract within the Town of Dracut shall be established and processed as follows:

> For each construction contract four (4) payments shall be made. The initial payment, equal to forty (40) percent of the estimated Total Cost of the contract, shall be made within sixty (60) days after notification by Dracut that the contract has been awarded and the government grant offers have been accepted by Dracut. Two (2) additional payments, based on the initial estimated Total Cost of the contract, shall be made at six (6) month intervals. A final payment, based on the adjusted Total Cost of the contract, when accepted by Dracut, shall be made by Tyngsborough. In no case shall the total payments by Tyngsborough to Dracut exceed the full obligation of Tyngsborough as computed under Paragraph 6.4 of this ARTICLE.

Payments of the full obligation by Tyngsborough to Dracut for each applicable construction contract with the City of Lowell shall be established and processed as follows:

For each construction contract six (6) payments shall be made. The intitial payment, equal to twenty (20) percent of the estimated Total Cost of the contract, shall be madw within sixty (60) days after notification by the City and Dracut that the contract has been awarded and the governmeng grant offers have been accepted by the City. Four (4) additional payments, based on the initial estimated Total Cost of the contract, shall be made at six (6) month intervals. A final payment, based on the adjusted Total Cost of the contract, when accepted by the City, shall be made to Dracut. In no case shall the total payments by Tyngsborough to Dracut exceed the full obligation of Tyngsborough as computed under Paragraph 6.4 of the ARTICLE.

6.2 Records of the Total Cost are public information and will be on file with Dracut and available for review during normal business hours by all responsible agencies. Copies of pertinent information will be forwarded to Tyngsborough, as required.

6.3 Whereas, the Metering Stations listed in Section 2.1, are being constructed solely for flows generated by Tyngsborough, all capital costs for these facilities will be borne by Tyngsborough.

Whereas, other sewage works are constructed solely for flows generated by Tyngsborough, all cpaital costs for said works will be borne by Tyngsborough.

6.4 The basis of payments by Tyngsborough for sewage works constructed by Dracut and the City shall be established as follows:

6.4.1 Gravity Sewer, Force Mains, Stewart St. Pumping Station, City Metering Station No. 1, and Raw Sewage Pumping Station:

Tyngsborough Payment = $C_1 \cdot \frac{a}{b}$

Where:

C_1 = Total Cost

a = Peak Rate of Flow requested by Tyngsborough

b = Design Peak Rate of FLow for facility as approved by the Massachusetts Water Resources Commission, Division of Water Pollution Control, and the Region I Office of the

6.4.2 Treatment Facilities at the Duck Island Regional Wastewater Treatment Plant (including EPA/State Project No. C250251 01, Preparation of Treatment Facilities Site):

Tyngsborough Payment = $C_2 \frac{d}{e}$

Where:

C_2 = Total Cost of the Duck Island Regional Wastewater Treatment Plant Upon Completion

d = Average Daily Flow rate requested by Tyngsborough

e = Total Average Daily Flow rate used for design of facility as defined in the approved "Interim Basin Plan"

6.5 Dracut shall provide capacities in its sewage works and in its Agreement with the City for the wastes from Tyngsborough's service area as defined in the approved "Interim Basin Plan". Capacities for Tyngsborough shall be as follows:

6.5.1 Treatment Facilities, Stewart Street Pumping Station, and Raw Sewage Pumping Station:

Design Year	2000
Average Daily Flow	1.0 million gallons per day (mgd)
Maximum Daily Flow	2.1 mgd
Peak Flow	3.5 mgd
BOD	2100 lbs/day
SS	2500 lbs/day

6.5.2 Transmission Facilities:

Design Year 2025

	Average Daily Flow	Peak Flow
At Metering Station No. 1	1.15 mgd	4.0 mgd
At Metering Station No. 2	.45 mgd	1.8 mgd
At City Metering Station No. 1	1.60 mgd	5.2 mgd

6.6 Dracut shall design its sewage works to meet the present day Division of Water Pollution Control requirements.

As above, Dracut shall enter into a separate agreement with the City, wherein the City shall design its treatment facilities to meet the present day Division of Water Pollution Control requirements, and to provide for Best Practicable Wastewater Treatment technology, defined by said Division as secondary treatment.

6.7 Should it be required by any governmental authority having jurisdiction to provide additional treatment, Tyngsborough shall pay its proportionate share of the required sewage works based on the flows established under Paragraph 6.5 of this ARTICLE. If the City's treatment facilitities and/or Dracut's sewage works require enlargement because the parameters of the flow to the treatment facilities and/or sewage works exceed the design, then Tyngsborough shall contribute only insofar as its wastes have exceeded the limits called for under the above-referenced Paragraph 6.5.

ARTICLE VII OPERATING COST APPORTIONMENT

7.1 Dracut shall maintain an adequate cost accounting system which shall be the basis for the determination and allocation of operating costs. This accounting system shall be subject to review by Tyngsborough.

Dracut shall maintain separate cost accounting records for the operation of the following portions of the sewage works and treatment facilities:

7.1.1 Double Brook Interceptor, Beaver Brook Interceptor, and Connecting Mains - The annual cost of operating these facilities shall be apportioned between Dracut, Tyngsborough, and any other participants on the the basis of their actual, annual flows, as determined from records obtained at the respective Metering Stations.

7.1.2 The Stewart Street Pumping Station - The annual cost of operating this facility shall be apportioned between Dracut, Tyngsborough, and any other participants on the basis of their actual, annual average daily flows, taken on a yearly basis and determined from records obtained at the respective Metering Stations.

7.1.3 North Bank Interceptor from the Point of Connect at Beaver Brook to the Raw Sewage Pumping Station - The annual cost of operating this sewage works shall be apportioned between the City, Dracut, Tyngsborough, and any other participants on the basis of their actual, annual flows, as determined from records at the respective Metering Stations. The costs of operating and maintaining the diversion chambers and other stormwater facilities shall be borne by the City.

7.1.4 Raw Sewage Pumping Station and Treatment Facilities (The Duck Island Regional Wastewater Treatment Plant) - The annual cost of operating these facilities shall be apportioned between the City, Dracut, Tyngsborough, and any other participants, on the basis of their actual, annual average daily flows, taken on a yearly basis, and determined from records obtained at the respective Metering Stations. Dracut and Tyngsborough shall bear no costs associated with the collection and treatment of stormwater.

7.2 The operating costs shall be apportioned against participants on the basis of average daily flows, providing that the established parameters from any participant are not exceeded.

In the above mentioned separate agreement between Dracut and the City, if either the average BOD or SS from Dracut exceeds 300 mg/l, then Dracut shall pay a surcharge to the City for treatment of its wastes. The surcharges will be based on the proportional extra cost incurred for the complete treatment of wastes in excess of 300 mg/l for the period of time in violation. If it is ever determined that Dracut has exceeded the above limits and is, in fact, levied a surcharge, and if it is further determined that the excessive BOD or SS is in whole due to an excessive loading from Tyngsborough, then Tyngsborough shall totally reimburse Dracut. If the excessive loading is only in part from Tyngsborough, then Tyngsborough shall reimburse Dracut using a weighted average formula.

7.3 Actual, annual flows shall be determined for Tyngsborough from records at the Metering Stations within Dracut. Estimated flows from non-metered, individual areas shall also be included, if not charged separately. Actual, annual flows shall be determined for Dracut from records at the Metering Stations within the City.

7.4 The waste strengths, BOD and SS, for each of the participants shall be determined from proportional, composite 24-hour samples obtained at the participant's Metering Stations. The average daily BOD and SS in pounds per day shall be determined from the average of not less than twelve (12) samples taken on weekdays at monthly intervals.

7.5 When determining surcharges, the unit cost per pound of BOD and SS used shall be based on the previous year's treatment facility operational costs divided by the total annual BOD or SS loadings.

7.6 Operating costs shall include the cost of sampling and analyzing wastes discharged by the participants. It shall also include the cost accounting related to the distribution and invoicing of operating costs.

7.7 Operating costs shall be payable monthly, on a fiscal year basis, upon receipt by Tyngsborough of Dracut's invoice. Bills shall be paid within fifty-five (55) days after which a surcharge of 1½ percent per month shall be assessed.

Operating costs for the first eleven (11) months shall be determined by using Dracut's approved yearly operation budget including money from Lowell (reduced to a monthly cost) and apportioning Tyngsborough's share on the basis of actual, total, monthly flow, as measured.

The final monthly invoice for the fiscal year shall be rendered by Dracut within thirty (30) days of the end of the fiscal year and shall be determined on the basis of actual flows and expenditures. All previous monthly invoices shall be subject to adjustment and correction at the time of this final billing for the year.

ARTICLE VIII ANNUAL COST REVIEW

8.1 Dracut and Tyngsborough both agree that the apportionment of costs set forth in ARTICLE VII shall be subject to review annually. After a review of the annual costs, if an adjustment to the costs appears to be necessary, said adjustment shall be made by Dracut in the forthcoming billing for services. The adjustment will be to both Dracut's and Tyngsborough's mutual satisfaction. Should arbitration be necessary, unless otherwise provided by law, both parties shall mutually agree as to the arbitrator and the arbitration procedure.

ARTICLE IX ADJUSTMENT CLAUSE

9.1 Tyngsborough reserves the right at any time to pretreat and/or to reduce either or both the quantity and quality of its wastes, or to otherwise give preliminary treatment to its wastes prior to discharge to Dracut's sewerage system. Tyngsborough agrees to notify Dracut as far in advance as possible of any significant increase or decrease in the quantity and/or quality of the wastes to be discharged to Dracut's sewerage system.

9.2 Any separate agreement between Tyngsborough and adjacent communities must be reviewed by Dracut. In any event, Tyngsborough shall in the aggregate be restricted to the waste parameters established under ARTICLE VI. Any increase must be formally contracted for between Tyngsborough and Dracut.

ARTICLE X TERMINATION CLAUSE

10.1 Any obligations under this AGREEMENT are conditioned upon both the receipt and acceptance by Tyngsborough of construction grant funds from federal and/or state government agencies for sewage works necessary within Tyngsborough to transmit waste flows to Dracut's sewerage system and the receipt and acceptance by Dracut of construction grant funds from said agencies for the sewage works necessary within Dracut to receive and transmit Tyngsborough's wastes for treatment and disposal at the Duck Island Regional Wastewater Treatment Plant.

10.2 Either party may terminate this AGREEMENT by giving notice thereof to the other party in writing three (3) years prior to the termination date. Upon receipt of said notice, both parties will enter into discussion within thirty (30) days to assure proper termination of the AGREEMENT.

Should Tyngsborough initiate the termination proceedings, it shall not have any right to the return of any of its original capital investments under ARTICLE VI.

Should Dracut initiate the termination proceedings, it shall be obligated to return to Tyngsborough the unusued proportionate share of Tyngsborough's capital investment under ARTICLE VI.

ARTICLE XI WASTES ANALYSIS

11.1 Dracut and Tyngsborough both agree that the determination of character and concentration of wastes will be in accordance with the latest edition of "Standard Methods for the Examination of Water and Sewage", as proposed, approved and published jointly by the American Public Health Association, the American Water Works Association and the Water Pollution Control Federation, or any other method mutually agreed upon by Dracut and Tyngsborough and subject further to the following:

11.1.1 Sampling at Metering Stations within Dracut will be performed by Dracut. Determination of the character and concentration of Tyngsborough's wastes, for the purpose of checking waste parameters, shall be the responsibility of Dracut or its authorized agent. Tyngsborough shall be furnished copies of all such determinations.

11.1.2 Samples shall be collected by Dracut at Metering Stations within Dracut in such a manner so as to be representative of the actual quality of the wastes. Tyngsborough shall have access to said Stations, as required, to conduct intermittent or continuous waste sampling.

11.1.3 Portions of waste samples collected by Dracut, as part of a sampling and analytical program, will be made available to Tyngsborough at no cost and in adequate quantities for analysis by Tyngsborough for characteristics and concentrations. In the event of discrepancy which cannot be satisfactorily resolved, the parties will submit the samples to a mutually acceptable, disinterested, qualified third party for determination of the waste characteristics and concentrations.

ARTICLE XII FLOW MEASUREMENTS

12.1 Dracut and Tyngsborough agree that flow measurements shall be made as follows:

12.1.1 The volume of flow used in computing Tyngsborough's share of the operating costs shall be based upon readings obtained by suitable metering equipment of a type mutually acceptable to both Tyngsborough and Dracut. Such metering equipment shall be installed and maintained by Dracut. Dracut will provide Tyngsborough with waste flow data for the preceeding month, based upon meter readings. Tyngsborough shall have access to said meters during business hours.

12.1.2 In the event the metering equipment is temporarily out of order or service for any reason, Tyngsborough's estimated flow will be based upon the average daily flow of the previous three months.

IN WITNESS WHEREOF, Dracut and Tyngsborough have caused their proper representatives on the day and year first written above:

For the Town of Dracut, Massachusetts

By Its Board of Sewer Commissioners

Ellis M. DePolito

Nicholas Lambros

Frederick B. Genault

Approved as to Form

By: Edward J. Owens

Town Counsel

For the Town of Tyngsborough, Massachusetts

By Its Board of Selectmen

Richard E. Forman

Richard E. Fay

Roland A. Thurville

Approved as to Form:

By: J M [illegible]

Town Counsel

ADDENDUM

Addendum to Intermunicipal Agreement between the Town of Tyngsborough Middlesex County, Massachusetts, a municipal corporation, by and through its Board of Sewer Commissioners ("Tyngsborough") and the Town of Dracut Middlesex County, Massachusetts, a municipal corporation, by and through its Town Manager and Highway Surveyor ("Dracut") and by and through the Sewer Commission for the Town of Dracut ("Commission") dated May 18, 1988.

NOW, THEREFORE, the parties agree as follows:

1. The Intermunicipal Agreement between Tyngsborough, Dracut and Commission dated May 18, 1988, shall expire on May 18, 2018.

Witness our hands and seals this 13 day of September, 1988.

APPROVED AS TO FORM:

By: ______________________
Edward Owens
Town Counsel
Town of Dracut

APPROVED AS TO FORM:

By: ______________________
Charles J. Zaroulis
Town Counsel
Town of Tyngsborough

APPROVED AS TO FORM:

By: ______________________
Legal Counsel
Dracut Board of
Sewer Commissioners

TOWN OF DRACUT

By: ______________________

Town Manager
Town of Dracut

By: ______________________

Highway Surveyor

BOARD OF SEWER COMMISSIONERS
FOR THE TOWN OF DRACUT

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TOWN OF TYNGSBOROUGH
By its BOARD OF SEWER
COMMISSIONERS

____

____

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C/Adden4

AGREEMENT entered into this 18 day of May, 1988, by and among the Town of Tyngsborough, Middlesex County, Massachusetts, a municipal corporation, by and through its Board of Sewer Commissioners ("Tyngsborough"), the Town of Dracut, Middlesex County, Massachusetts, a municipal corporation, by and through its Town Manager and Highway Surveyor ("Dracut") and by and through the Sewer Commission for the Town of Dracut ("Commission").

WHEREAS, a Tyngsborough sewer main will be constructed through land situated in Dracut, being shown as Elm Street (also known as Elm Avenue) and to the property situated at 857 Nashua Road on Sheet 2 of 10 of Plans entitled "Proposed Lateral Sewers, Force Main, and Pumping Station, Tyngsborough, Mass.", MASS-WPC-Collection Systems Project No. 557-CS-213, Contract No. 87-1, dated August, 1987 and prepared by Whitman and Howard, Inc. of Wellesley, Massachusetts, and the plan is incorporated with this agreement and, further, the plan is to be recorded in Middlesex North District Registry of Deeds; and

WHEREAS, Tyngsborough, Dracut and the Commission wish to provide sewerage services to the properties situated on Elm Street in Dracut and to the property situated at 857 Nashua Road in Dracut; and

WHEREAS, Tyngsborough has requested and Dracut and Commission have granted permission to Tyngsborough to open said way and install, operate and maintain in perpetuity such sewer mains, lines and other appurtenances thereto and connections for said premises in Dracut and said Dracut and Commission have granted permission for the connection of said sewer project and mains into the Lowell Sanitary Sewer System through Dracut.

NOW, THEREFORE, the parties agree as follows:

1. The Commission agrees that it shall be responsible to Tyngsborough for payment of sewer use charges by Tyngsborough to said lots and associated user charges and user assessments.

2. Tyngsborough agrees that sewer use charges to the respective lots in Dracut shall be computed in the manner in effect at the time by Tyngsborough and consistent with the rates charged to Tyngsborough users. Said amount shall be paid semi-annually. The rate of payment hereunder is fixed only until such time as Tyngsborough deems an adjustment necessary. Such adjustment, if any, shall require a thirty (30) day advance written notice to the Commission and such new rates shall be constant with other similarly existing agreements.

3. The collection of the sewer use charges from the owners of the respective lots shall be the responsibility of the Commission.

4. This Agreement is intended to establish the rate of sewer use charges and collection procedures between the parties, but not to establish or restrict the sewer use charges between the owners of the respective lots and the Commission.

5. Tyngsborough shall collect from the owners of each lot a betterment fee presently estimated to be in the amount of eight thousand ($8,000.00) dollars and a connection fee in the amount of two hundred and fifty ($250.00) dollars.

6. The use and connection of said premises to the Tyngsborough Sewer System shall be in accordance with the rules and regulations of Tyngsborough.

7. This Agreement contains the entire agreement between the parties and cannot be changed, modified, waived or cancelled except by an agreement in writing executed by all parties.

APPROVED AS TO FORM:

By: Edward Owens
Edward Owens
Town Counsel
Town of Dracut

APPROVED AS TO FORM:

By: ______________________
Charles J. Zaroulis
Town Counsel
Town of Tyngsborough

APPROVED AS TO FORM:

By: Edward Owens
Legal Counsel
Dracut Board of
Sewer Commissioners

TOWN OF DRACUT

By: ______________________

Town Manager
Town of Dracut

By: Paul G. Dillon

Highway Surveyor

BOARD OF SEWER COMMISSIONERS
FOR THE TOWN OF DRACUT

____

Frederick J. Renault

____

____

____

TOWN OF TYNGSBOROUGH
By its BOARD OF SEWER COMMISSIONERS

Ronald V. Corm

Doreen Stannard

____

____

____

C/GEDDES/1-3

Tyngsboro through Dracut Flow & Flow Charges

Dracut charges us per MG and also passes along Lowell's charges per MG

There are two metering stations: Meter#1 on Tyngsboro Rd and Meter#2 on Willowdale Rd+3/15/05 Bridge st. station

	*calculated	(flow in millions)			
Month/Year	Meter#1	Meter#2	*Total MG	Total Charged	
Dec-04	7,564,100	1,831,759	9,395,859	$7,286.85	
Jan-05	9,200,700	2,234,589	11,435,289	$8,166.17	
Feb-05	7,745,300	1,852,595	9,597,895	$7,716.97	
Mar-05	4,758,000	1,190,563	5,948,563	$4,342.51	
Apr-05	15,901,900	4,868,304	20,770,204	$12,662.91	
May-05	10,360,900	2,074,920	12,435,820	$8,581.92	
Jun-05	0	0	0	$0.00	
Jul-05	0	0	0	$0.00	
Aug-05	0	0	0	$0.00	
Sep-05	0	0	0	$0.00	
Oct-05	0	0	0		
Nov-05	0	0	0	$0.00	
Dec-05	0	0	0		
Jan-06	0	0	0	$0.00	
Feb-06	0	0	0		
Mar-06		0	0		
Apr-06	0	0	0	$0.00	
May-05	0	0	0		
Jun-06		0	0		
Jul-06	0	0	0	$0.00	
Aug-06	0	0	0	$0.00	
Sep-06	0	0	0	$0.00	
Oct-06	0	0	0	$0.00	
Nov-06	0	0	0	$0.00	
Dec-06	0	0	0		
Jan-07		0	0		
Feb-07		0	0		
Mar-07		0	0		
Apr-07	0	0	0	$0.00	
May-07		0	0		
Jun-07	0	0	0	$0.00	
Totals to date	55530900	14052730	69583630	$48,757.33	
**Average Mo	1791319.4	453313.87	2244633.23	$1,572.82	**edit formula after each addition

Town of Dracut Sewer Department
1196 Lakeview Avenue
Dracut, Massachusetts 01826-4791
Telephone: (978) 957-0371
FAX: 978-957-9308

13-Apr-05

Town of Tyngsborough
Sewer Commission
25 Bryant Lane
Tyngsborough MA 01879

Sewer Account: O29935
Sewer Usage Bill for: December-2004

Meter 1, Tyngsboro Road

	Date	Reading	Gallons Used
Current:	12/31/04	188,313,900	
Previous:	11/30/04	180,749,800	7,564,100

Meter 2, Willowdale Avenue

	Date	Reading	Gallons Used
Current:	12/31/04	36,465,909	
Previous:	11/30/04	34,634,150	1,831,759

Total Usage Meters 1 and 2: 9,395,859

City of Lowell bill to Dracut for the period: Dec. 2004

Amount	$	40,280.87	
Million Gallons		59,730,100	
Per Million Gal.	$	674.38	
Charge per Million Gal.			
Lowell	$	674.38	
Dracut	$	101.16	
Total Per MG	$	775.54	
Multiplied by		9.40	MG
Current Charge	$	7,286.85	
Previous Balance	$	2,558.75	
Total Due	**$**	**9,845.60**	
Due Date:		**6/6/05**	

The Town of Dracut is an Equal Opportunity/ Affirmative Action Employer

Town of Dracut
Board of Sewer Commissioners
1196 Lakeview Avenue
Dracut, Massachusetts 01826

Dracut
Monthly Sewer Bill
for
Wastewater Transport and Treatment

Billing Period		December-04

<u>Standard Charge</u>

Dracut Monthly Flow (Million Gallons - see page 2)		59.7301
Wastewater Utility Monthly Flow (Million Gallons)		1,010.40
Proportioning Multiplier = Dracut Flow / Utility Flow		0.0591153
Wastewater Utility Monthly Operating Costs (see page 2)	$	681,395
Standard Monthly Charge = Utility Monthly Costs x Multiplier	**$**	**40,280.87**

<u>BOD / TSS Surcharges</u>

Excess BOD Loading (lbs BOD) = Flow x [Actual - Threshold] BOD Conc x 8.34 (see page 2)		-
Excess TSS Loading (lbs TSS) = Flow x [Actual - Threshold] TSS Conc x 8.34 (see page 2)		-
BOD Unit Cost ($ / lb BOD - see page 2)		0.1934
TSS Unit Cost ($ / lb TSS - see page 2)		0.2069
BOD Surcharge = BOD Unit Cost x Excess BOD Loading	**$**	**-**
TSS Surcharge = TSS Unit Cost x TSS Excess Loading	**$**	**-**

<u>Total Monthly Charge Summary</u>

Standard Monthly Charge = Utility Monthly Costs x Multiplier	$	40,280.87
BOD Surcharge = BOD Unit Cost x BOD Excess Loading	$	-
TSS Surcharge = TSS Unit Cost x TSS Excess Loading	$	-
Total December-04 Monthly Charges	**$**	**40,280.87**

RECEIVED
FEB 22 2005
TOWN OF DRACUT
SEWER DEPT

Wastewater Utility Monthly Operating Costs

Annual Utility Operating Costs = Operations + Overhead + Debt	$	**8,176,743.05**
Utility Monthly Operating Costs = Annual Costs / 12 Months	$	**681,395.25**

BOD / TSS Unit Costs

Utility BOD Costs = 38% of Annual Operating Costs	$	3,107,162
Utility TSS Costs = 35% of Annual Operating Costs	$	2,861,860
Annual Utility BOD Loading (lbs BOD / year)		16,067,819
Annual Utility TSS Loading (lbs TSS / year)		13,834,373
BOD Unit Cost ($ / lb BOD) = BOD Costs / BOD Loading		**0.1934**
TSS Unit Cost ($ / lb TSS) = TSS Costs / TSS Loading		**0.2069**

Excess Monthly BOD Loading

Bachman Street Station = 38.6907 MGD x (250.00 - 300.00) mg/L x 8.34 = 0 lbs BOD
Willard Street Station = 13.9295 MGD x (205.00 - 300.00) mg/L x 8.34 = 0 lbs BOD
First Street Station = 7.1099 MGD x (241.00 - 300.00) mg/L x 8.34 = 0 lbs BOD

Excess Monthly BOD Loading = Flow x [Actual - Threshold] BOD Conc x 8.34 = **0.00** lbs BOD

Excess Monthly TSS Loading

Bachman Street Station = 38.6907 MGD x (175.00 - 300.00) mg/L x 8.34 = 0 lbs TSS
Willard Street Station = 13.9295 MGD x (130.00 - 300.00) mg/L x 8.34 = 0 lbs TSS
First Street Station = 7.1099 MGD x (236.00 - 300.00) mg/L x 8.34 = 0 lbs TSS

Excess Monthly TSS Loading = Flow x [Actual - Threshold] TSS Conc x 8.34 = **0.00** lbs TSS

Monthly Monitoring Results

Date	*Bachman St. Station*			*Willard St. Station*			*First St. Station*		
	Flow (MG)	BOD (mg/L)	TSS (mg/L)	Flow (MG)	BOD (mg/L)	TSS (mg/L)	Flow (MG)	BOD (mg/L)	TSS (mg/L)
		300	204		268.00	147.00		204	95
		200	146		142.00	113.00		278	377
Monthly Total/Average	38.6907	250.00	175.00	13.9295	205.00	130.00	7.1099	241.00	236.00

Excess Threshold BOD/TSS Concentration (mg/L)	300.00
Dracut Monthly Flow (MG)	**59.7301**

MONTHLY MONITORING RESULTS DETAIL

Bachman		Monthly (MG)	Average (GPD)	BOD (mg/L)	TSS (mg/L)
		December-04			
12/10/2004	12-10-012		1,286,810	300	204
12/14/2004	12-14-015		1,027,518	200	146
Average/Total		38.6907	1,157,164	250.00	175.00

First Street		Monthly (MG)	Average (GPD)	BOD (mg/L)	TSS (mg/L)
		December-04			
12/10/2004	12-10-013		218,300	204	95
12/14/2004	12-14-017		202,600	278	377
Average/Total		7.1099	210,450	241.00	236.00

Willard		Monthly (MG)	Average (GPD)	BOD (mg/L)	TSS (mg/L)
		December-04			
12/7/2004	12-07-012		426,100	268	147
12/14/2004	12-14-018		340,200	142	113
Average/Total		13.9295	383,150	205.00	130.00

Town of Dracut Sewer Department
1196 Lakeview Avenue
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FAX: 978-957-9308

13-Apr-05

Town of Tyngsborough
Sewer Commission
25 Bryant Lane
Tyngsborough MA 01879

Sewer Account: O29935
Sewer Usage Bill for: January-2005

Meter 1, Tyngsboro Road

	Date	Reading	Gallons Used
Current:	1/31/05	197,514,600	
Previous:	12/31/04	188,313,900	9,200,700

Meter 2, Willowdale Avenue

	Date	Reading	Gallons Used
Current:	1/31/05	38,700,498	
Previous:	12/31/04	36,465,909	2,234,589

Total Usage Meters 1 and 2: 11,435,289

City of Lowell bill to Dracut for the period: Jan. 2005

Amount	$	29,508.75	
Million Gallons		47,520,100	
Per Million Gal.	$	620.97	
Charge per Million Gal.			
Lowell	$	620.97	
Dracut	$	93.15	
Total Per MG	$	714.12	
Multiplied by		11.44	MG
Current Charge	$	8,166.17	
Dec.'04, Previous Balance	$	9,845.60	
Total Due	**$**	**18,011.77**	
Due Date:		**6/6/05**	

The Town of Dracut is an Equal Opportunity/ Affirmative Action Employer

Town of Dracut
Board of Sewer Commissioners
1196 Lakeview Avenue
Dracut, Massachusetts 01826

Dracut
Monthly Sewer Bill
for
Wastewater Transport and Treatment

Billing Period		January-05

Standard Charge

Dracut Monthly Flow (Million Gallons - see page 2)		47.5201
Wastewater Utility Monthly Flow (Million Gallons)		1,097.30
Proportioning Multiplier = Dracut Flow / Utility Flow		0.0433064
Wastewater Utility Monthly Operating Costs (see page 2)	$	681,395
Standard Monthly Charge = Utility Monthly Costs x Multiplier	**$**	**29,508.75**

BOD / TSS Surcharges

Excess BOD Loading (lbs BOD) = Flow x [Actual - Threshold] BOD Conc x 8.34 (see page 2)		-
Excess TSS Loading (lbs TSS) = Flow x [Actual - Threshold] TSS Conc x 8.34 (see page 2)		-
BOD Unit Cost ($ / lb BOD - see page 2)		0.1934
TSS Unit Cost ($ / lb TSS - see page 2)		0.2069
BOD Surcharge = BOD Unit Cost x Excess BOD Loading	$	-
TSS Surcharge = TSS Unit Cost x TSS Excess Loading	$	-

Total Monthly Charge Summary

Standard Monthly Charge = Utility Monthly Costs x Multiplier	$	29,508.75
BOD Surcharge = BOD Unit Cost x BOD Excess Loading	$	-
TSS Surcharge = TSS Unit Cost x TSS Excess Loading	$	-
Total January-05 Monthly Charges	**$**	**29,508.75**

Wastewater Utility Monthly Operating Costs

Annual Utility Operating Costs = Operations + Overhead + Debt	$	**8,176,743.05**
Utility Monthly Operating Costs = Annual Costs / 12 Months	$	**681,395.25**

BOD / TSS Unit Costs

Utility BOD Costs = 38% of Annual Operating Costs	$	3,107,162
Utility TSS Costs = 35% of Annual Operating Costs	$	2,861,860
Annual Utility BOD Loading (lbs BOD / year)		16,067,819
Annual Utility TSS Loading (lbs TSS / year)		13,834,373
BOD Unit Cost ($ / lb BOD) = BOD Costs / BOD Loading		**0.1934**
TSS Unit Cost ($ / lb TSS) = TSS Costs / TSS Loading		**0.2069**

Excess Monthly BOD Loading

Bachman Street Station =	30.7836 MGD x (	273.00	-	300.00) mg/L x 8.34 =	0 lbs BOD
Willard Street Station =	10.2285 MGD x (	192.50	-	300.00) mg/L x 8.34 =	0 lbs BOD
First Street Station =	6.5080 MGD x (	215.00	-	300.00) mg/L x 8.34 =	0 lbs BOD

Excess Monthly BOD Loading = Flow x [Actual - Threshold] BOD Conc x 8.34 = **0.00** lbs BOD

Excess Monthly TSS Loading

Bachman Street Station =	30.7836 MGD x (	148.00	-	300.00) mg/L x 8.34 =	0 lbs TSS
Willard Street Station =	10.2285 MGD x (	137.00	-	300.00) mg/L x 8.34 =	0 lbs TSS
First Street Station =	6.5080 MGD x (	174.00	-	300.00) mg/L x 8.34 =	0 lbs TSS

Excess Monthly TSS Loading = Flow x [Actual - Threshold] TSS Conc x 8.34 = **0.00** lbs TSS

Monthly Monitoring Results

Date	*Bachman St. Station*			*Willard St. Station*			*First St. Station*		
	Flow (MG)	BOD (mg/L)	TSS (mg/L)	Flow (MG)	BOD (mg/L)	TSS (mg/L)	Flow (MG)	BOD (mg/L)	TSS (mg/L)
		330	160		205.00	141.00		265	226
		216	136		180.00	133.00		165	122
Monthly Total/Average	30.7836	273.00	148.00	10.2285	192.50	137.00	6.5080	215.00	174.00

Excess Threshold BOD/TSS Concentration (mg/L)	300.00
Dracut Monthly Flow (MG)	**47.5201**

MONTHLY MONITORING RESULTS DETAIL

Bachman		Monthly (MG)	Average (GPD)	BOD (mg/L)	TSS (mg/L)
January-05					
1/11/2005	01-11-05-015		91,505	330	160
1/28/2005	01-28-05-015			216	136
Average/Total		30.78357	91,505	273.00	148.00

First Street		Monthly (MG)	Average (GPD)	BOD (mg/L)	TSS (mg/L)
January-05					
1/11/2005	01-11-05-016		196,600	265	226
1/25/2005	01-25-05-015		251,700	165	122
Average/Total		6.5080	224,150	215.00	174.00

Willard		Monthly (MG)	Average (GPD)	BOD (mg/L)	TSS (mg/L)
January-05					
1/4/2005	01-04-05-015		339,050	205	141
1/19/2005	01-19-05-015		374,250	180	133
Average/Total		10.2285	356,650	192.50	137.00

LOWELL REGIONAL WASTEWATER UTILITY

WASTEWATER COLLECTION AND TREATMENT

MARK A. YOUNG
EXECUTIVE DIRECTOR

SERVING
LOWELL
CHELMSFORD
DRACUT
TEWKSBURY
TYNGSBORO

RECEIVED
TOWN OF DRACUT
SEWER DEPT.

MAR 23 REC'D

Mr. Michael Buxton
Dracut DPW Chairman
Town of Dracut Sewer Commission
1196 Lakeview Avenue
Dracut, MA 01826

March 15, 2005

Reference: The Bridge Street Station flow on Monthly Billings

Mr. Buxton:

Please be informed that Dracut's monthly sewer bills now include the Bridge Street Station flow. Pages two and three of the enclosed bill reflect this billing change.

In the event that the station has an increased flow, the Lowell Regional Wastewater Treatment Utility (LRWWU) will analyze the strength of the waste stream and add only the concentrations to the bill.

If you have any questions or concerns, please contact me at (978) 970-4248.

Sincerely,

Christopher J. Crowley

Christopher Crowley
Pretreatment Coordinator / Engineer

cc: John Turpin, Dracut Superintendent
Michael Stuer, LRWWU Engineer Supervisor

Town of Dracut Sewer Department
1196 Lakeview Avenue
Dracut, Massachusetts 01826-4791
Telephone: (978) 957-0371
FAX: 978-957-9308

RECEIVED APR 19 2005

13-Apr-05

Town of Tyngsborough
Sewer Commission
25 Bryant Lane
Tyngsborough MA 01879

Sewer Account: O29935
Sewer Usage Bill for: February-2005

Meter 1, Tyngsboro Road

	Date	Reading	Gallons Used
Current:	2/28/05	205,259,900	
Previous:	1/31/05	197,514,600	7,745,300

Meter 2, Willowdale Avenue

	Date	Reading	Gallons Used
Current:	2/28/05	40,553,093	
Previous:	1/31/05	38,700,498	1,852,595

Total Usage Meters 1 and 2: 9,597,895

City of Lowell bill to Dracut for the period: Feb. 2005

Amount	$	30,087.90
Million Gallons		43,034,700
Per Million Gal.	$	699.15

Charge per Million Gal.

Lowell	$	699.15
Dracut	$	104.87
Total Per MG	$	804.03
Multiplied by		~~9.60~~ MG
Current Charge	$	7,716.97
Dec.'04, Jan.'05, Previous Balance	$	18,011.77
Total Due	**$**	**25,728.74**
Due Date:		**6/6/05**

Pd
aug, Sept, Oct
04 Flow only
19,618.75
12/2/04

The Town of Dracut is an Equal Opportunity/ Affirmative Action Employer

Town of Dracut
Board of Sewer Commissioners
1196 Lakeview Avenue
Dracut, Massachusetts 01826

Dracut
Monthly Sewer Bill
for
Wastewater Transport and Treatment

Billing Period		February-05

Standard Charge

Dracut Monthly Flow (Million Gallons - see page 2)		43.0347
Wastewater Utility Monthly Flow (Million Gallons)		974.60
Proportioning Multiplier = Dracut Flow / Utility Flow		0.0441563
Wastewater Utility Monthly Operating Costs (see page 2)	$	681,395
Standard Monthly Charge = Utility Monthly Costs x Multiplier	**$**	**30,087.90**

BOD / TSS Surcharges

Excess BOD Loading (lbs BOD) = Flow x [Actual - Threshold] BOD Conc x 8.34 (see page 2)		-
Excess TSS Loading (lbs TSS) = Flow x [Actual - Threshold] TSS Conc x 8.34 (see page 2)		-
BOD Unit Cost ($ / lb BOD - see page 2)		0.1934
TSS Unit Cost ($ / lb TSS - see page 2)		0.2069
BOD Surcharge = BOD Unit Cost x Excess BOD Loading	$	-
TSS Surcharge = TSS Unit Cost x TSS Excess Loading	$	-

Total Monthly Charge Summary

Standard Monthly Charge = Utility Monthly Costs x Multiplier	$	30,087.90
BOD Surcharge = BOD Unit Cost x BOD Excess Loading	$	-
TSS Surcharge = TSS Unit Cost x TSS Excess Loading	$	-
Total February-05 Monthly Charges	**$**	**30,087.90**

Wastewater Utility Monthly Operating Costs

Annual Utility Operating Costs = Operations + Overhead + Debt	$	8,176,743.05
Utility Monthly Operating Costs = Annual Costs / 12 Months	$	681,395.25

BOD / TSS Unit Costs

Utility BOD Costs = 38% of Annual Operating Costs	$	3,107,162
Utility TSS Costs = 35% of Annual Operating Costs	$	2,861,860
Annual Utility BOD Loading (lbs BOD / year)		16,067,819
Annual Utility TSS Loading (lbs TSS / year)		13,834,373
BOD Unit Cost ($ / lb BOD) = BOD Costs / BOD Loading		**0.1934**
TSS Unit Cost ($ / lb TSS) = TSS Costs / TSS Loading		**0.2069**

Excess Monthly BOD Loading

achman Street Station = 29.7307 MGD x (174.00 - 300.00) mg/L x 8.34 = 0 lbs BOD
Willard Street Station = 6.7467 MGD x (218.00 - 300.00) mg/L x 8.34 = 0 lbs BOD
First Street Station = 6.4468 MGD x (69.00 - 300.00) mg/L x 8.34 = 0 lbs BOD
Bridge Street Station = 0.1105 MGD x (0.00 - 300.00) mg/L x 8.34 = 0 lbs BOD

Excess Monthly BOD Loading = Flow x [Actual - Threshold] BOD Conc x 8.34 = **0.00** lbs BOD

Excess Monthly TSS Loading

achman Street Station = 29.7307 MGD x (129.00 - 300.00) mg/L x 8.34 = 0 lbs TSS
Willard Street Station = 6.7467 MGD x (170.00 - 300.00) mg/L x 8.34 = 0 lbs TSS
First Street Station = 6.4468 MGD x (122.00 - 300.00) mg/L x 8.34 = 0 lbs TSS
Bridge Street Station = 0.1105 MGD x (0.00 - 300.00) mg/L x 8.34 = 0 lbs TSS

Excess Monthly TSS Loading = Flow x [Actual - Threshold] TSS Conc x 8.34 = **0.00** lbs TSS

Monthly Monitoring Results

Date	*Bachman St. Station*			*Willard St. Station*			*First St. Station*		
	Flow (MG)	BOD (mg/L)	TSS (mg/L)	Flow (MG)	BOD (mg/L)	TSS (mg/L)	Flow (MG)	BOD (mg/L)	TSS (mg/L)
	84313.0	212	166	281710.0	268.00	232.00	0.0	138	132
	136610.0	136	92	300700.0	168.00	108.00	209600.0	0	112
Monthly Total/Average	29.7307	174.00	129.00	6.7467	218.00	170.00	6.4468	69.00	122.00

Date	*Bridge St. Station*		
	Flow (MG)	BOD (mg/L)	TSS (mg/L)
Monthly Total/Average	0.1105		

Excess Threshold BOD/TSS Concentration (mg/L)	300.00
Dracut Monthly Flow (MG)	**43.0347**

MONTHLY MONITORING RESULTS DETAIL

Bachman		Monthly (MG)	Average (GPD)		BOD (mg/L)		TSS (mg/L)
		February-05					
2/2/2005	02-02-05-015		84,313		212		166
2/18/2005	02-18-05-011		136,610		136		92
Average/Total		29.731	110,462		174.00		129.00

First Street		Monthly (MG)	Average (GPD)		BOD (mg/L)		TSS (mg/L)
		February-05					
2/2/2005	02-02-05-016				138		132
2/10/2005	02-10-05-022		209,600				112
Average/Total		6.4468	209,600		138.00		122.00

Willard		Monthly (MG)	Average (GPD)		BOD (mg/L)		TSS (mg/L)
		February-05					
2/1/2005	02-01-05-015		281,710		268		232
2/18/2005	02-18-05-012		300,700		168		108
Average/Total		**6.7467**	291,205		218.00		170.00

Bridge Street		Monthly (MG)	Average (GPD)		BOD (mg/L)		TSS (mg/L)
		February-05					
2/2/2005		0.0041820					
3/1/2005		0.1146620					
Average/Total		0.11048	#DIV/0!		#DIV/0!		#DIV/0!

pd Tris 7/14/05

Town of Dracut Sewer Department
1196 Lakeview Avenue
Dracut, Massachusetts 01826-4791
Telephone: (978) 957-0371
FAX: 978-957-9308

12-Jul-05

Town of Tyngsborough
Sewer Commission
25 Bryant Lane
Tyngsborough MA 01879

Sewer Account: O29935
Sewer Usage Bill for: March-2005

Meter 1, Tyngsboro Road

	Date	Reading	Gallons Used
Current:	3/31/05	210,017,900	
Previous:	2/28/05	205,259,900	4,758,000

Meter 2, Willowdale Avenue

	Date	Reading	Gallons Used
Current:	3/31/05	41,743,656	
Previous:	2/28/05	40,553,093	1,190,563

Total Usage Meters 1 and 2: 5,948,563

City of Lowell bill to Dracut for the period: March 2005

Amount	$	31,020.96
Million Gallons		48,868,000
Per Million Gal.	$	634.79

Charge per Million Gal.

Lowell	$	634.79
Dracut	$	95.22
Total Per MG	$	730.01
Multiplied by		5.95 MG
Current Charge	$	4,342.51
Previous Balance	$	2,637.66 — Projected out to due date
Total Due	**$**	**6,980.17**
Due Date:		**9/5/05**

July 11, 05

The Town of Dracut is an Equal Opportunity/ Affirmative Action Employer

COPY

Town of Dracut
Board of Sewer Commissioners
1196 Lakeview Avenue
Dracut, Massachusetts 01826

Dracut
Monthly Sewer Bill
for
Wastewater Transport and Treatment

Billing Period March-05

Standard Charge

Dracut Monthly Flow (Million Gallons - see page 2)		48.8680
Wastewater Utility Monthly Flow (Million Gallons)		1,141.40
Proportioning Multiplier = Dracut Flow / Utility Flow		0.0428141
Wastewater Utility Monthly Operating Costs (see page 2)	$	681,396
Standard Monthly Charge = Utility Monthly Costs x Multiplier	**$**	**29,173.33**

BOD / TSS Surcharges

Excess BOD Loading (lbs BOD) = Flow x [Actual - Threshold] BOD Conc x 8.34 (see page 2)		9,554.45
Excess TSS Loading (lbs TSS) = Flow x [Actual - Threshold] TSS Conc x 8.34 (see page 2)		-
BOD Unit Cost ($ / lb BOD - see page 2)		0.1934
TSS Unit Cost ($ / lb TSS - see page 2)		0.2069
BOD Surcharge = BOD Unit Cost x Excess BOD Loading	**$**	**1,847.62**
TSS Surcharge = TSS Unit Cost x TSS Excess Loading	**$**	-

Total Monthly Charge Summary

Standard Monthly Charge = Utility Monthly Costs x Multiplier	$	29,173.33
BOD Surcharge = BOD Unit Cost x BOD Excess Loading	$	1,847.62
TSS Surcharge = TSS Unit Cost x TSS Excess Loading	$	-
Total March-05 Monthly Charges	**$**	**31,020.96**

Wastewater Utility Monthly Operating Costs

Annual Utility Operating Costs = Operations + Overhead + Debt	$	**8,176,743.05**
Utility Monthly Operating Costs = Annual Costs / 12 Months	$	**681,395.25**

BOD / TSS Unit Costs

Utility BOD Costs = 38% of Annual Operating Costs	$	3,107,162
Utility TSS Costs = 35% of Annual Operating Costs	$	2,861,860
Annual Utility BOD Loading (lbs BOD / year)		16,067,819
Annual Utility TSS Loading (lbs TSS / year)		13,834,373
BOD Unit Cost ($ / lb BOD) = BOD Costs / BOD Loading		**0.1934**
TSS Unit Cost ($ / lb TSS) = TSS Costs / TSS Loading		**0.2069**

Excess Monthly BOD Loading

Bachman St. Station =	37.0801 MGD x (140.00 - 300.00) mg/L x 8.34 =	0 lbs BOD
Willard St. Station =	3.6519 MGD x (227.00 - 300.00) mg/L x 8.34 =	0 lbs BOD
First St. Station =	7.9834 MGD x (443.50 - 300.00) mg/L x 8.34 =	9,554 lbs BOD
Bridge St. Station =	0.1526 MGD x (0.00 - 300.00) mg/L x 8.34 =	0 lbs BOD

Excess Monthly BOD Loading = Flow x [Actual - Threshold] BOD Conc x 8.34 = **9,554.45** lbs BOD

Excess Monthly TSS Loading

Bachman St. Station =	37.0801 MGD x (90.00 - 300.00) mg/L x 8.34 =	0 lbs TSS
Willard St. Station =	3.6519 MGD x (215.00 - 300.00) mg/L x 8.34 =	0 lbs TSS
First St. Station =	7.9834 MGD x (142.50 - 300.00) mg/L x 8.34 =	0 lbs TSS
Bridge St. Station =	0.1526 MGD x (0.00 - 300.00) mg/L x 8.34 =	0 lbs TSS

Excess Monthly TSS Loading = Flow x [Actual - Threshold] TSS Conc x 8.34 = **0.00** lbs TSS

Monthly Monitoring Results

Date	*Bachman St. Station*			*Willard St. Station*			*First St. Station*		
	Flow (MG)	BOD (mg/L)	TSS (mg/L)	Flow (MG)	BOD (mg/L)	TSS (mg/L)	Flow (MG)	BOD (mg/L)	TSS (mg/L)
	1067840.0	200.00	116.00	511300.0	206.00	89.00	223500.0	162.00	94.00
	2709330.0	80.00	64.00	149151.0	248.00	341.00	247900.0	725.00	191.00
Monthly Total/Average	37.0801	140.00	90.00	3.6519	227.00	215.00	7.9834	443.50	142.50

Date	*Bridge St. Station*		
	Flow (MG)	BOD (mg/L)	TSS (mg/L)
	0.004182		
	0.114662		
Monthly Total/Average	0.1526		

Excess Threshold BOD/TSS Concentration (mg/L)	300.00
Dracut Monthly Flow (MG)	**48.8680**

MONTHLY MONITORING RESULTS DETAIL

Bachman		Monthly (MG)	Average (GPD)		BOD (mg/L)		TSS (mg/L)
		March-05					
3/23/2005	03-23-05-015		1,067,840		200		116
3/30/2005	03-30-05-015		2,709,330		80		64
Average/Total		3.70801	1,888,585		140.00		90.00

First Street		Monthly (MG)	Average (GPD)		BOD (mg/L)		TSS (mg/L)
		March-05					
3/8/2005	03-08-05-016		223,500		162		94
3/22/2005	03-22-05-015		247,900		725		191
Average/Total		7.9834	235,700		443.50		142.50

Willard		Monthly (MG)	Average (GPD)		BOD (mg/L)		TSS (mg/L)
		March-05					
3/8/2005	03-08-05-015		511,300		206		89
3/22/2005	03-22-05-016		149,151		248		341
Average/Total		0.6519	330,226		227.00		215.00

Bridge Street		Monthly (MG)	Average (GPD)		BOD (mg/L)		TSS (mg/L)
		March-05					
3/1/2005		0.004182					
4/1/2005		0.114662					
Average/Total		0.1526300	#DIV/0!		#DIV/0!		#DIV/0!

Town of Dracut Sewer Department
1196 Lakeview Avenue
Dracut, Massachusetts 01826-4791
Telephone: (978) 957-0371
FAX: 978-957-9308

12-Jul-05

Town of Tyngsborough
Sewer Commission
25 Bryant Lane
Tyngsborough MA 01879

Sewer Account: O29935
Sewer Usage Bill for: April-2005

Meter 1, Tyngsboro Road

	Date	Reading	Gallons Used
Current:	4/30/05	225,919,800	
Previous:	3/31/05	210,017,900	15,901,900

Meter 2, Willowdale Avenue

	Date	Reading	Gallons Used
Current:	4/30/05	46,611,960	
Previous:	3/31/05	41,743,656	4,868,304

Total Usage Meters 1 and 2: 20,770,204

City of Lowell bill to Dracut for the period: April 2005

Amount	$	27,932.19
Million Gallons		52,687,800
Per Million Gal.	$	530.15

Charge per Million Gal.

Lowell	$	530.15	
Dracut	$	79.52	
Total Per MG	$	609.67	
Multiplied by		20.77	MG
Current Charge	$	12,662.91	
March & Previous Balance	$	6,980.17	
Total Due	**$**	**19,643.08**	
Due Date:		**9/5/05**	

The Town of Dracut is an Equal Opportunity/ Affirmative Action Employer

Town of Dracut
Board of Sewer Commissioners
1196 Lakeview Avenue
Dracut, Massachusetts 01826

Dracut
Monthly Sewer Bill
for
Wastewater Transport and Treatment

Billing Period

April-05

Standard Charge

Dracut Monthly Flow (Million Gallons - see page 2)		52.6878
Wastewater Utility Monthly Flow (Million Gallons)		1,285.30
Proportioning Multiplier = Dracut Flow / Utility Flow		0.0409926
Wastewater Utility Monthly Operating Costs (see page 2)	$	681,395
Standard Monthly Charge = Utility Monthly Costs x Multiplier	$	**27,932.19**

BOD / TSS Surcharges

Excess BOD Loading (lbs BOD) = Flow x [Actual - Threshold] BOD Conc x 8.34 (see page 2)		-
Excess TSS Loading (lbs TSS) = Flow x [Actual - Threshold] TSS Conc x 8.34 (see page 2)		-
BOD Unit Cost ($ / lb BOD - see page 2)		0.1934
TSS Unit Cost ($ / lb TSS - see page 2)		0.2069
BOD Surcharge = BOD Unit Cost x Excess BOD Loading	$	-
TSS Surcharge = TSS Unit Cost x TSS Excess Loading	$	-

Total Monthly Charge Summary

Standard Monthly Charge = Utility Monthly Costs x Multiplier	$	27,932.19
BOD Surcharge = BOD Unit Cost x BOD Excess Loading	$	-
TSS Surcharge = TSS Unit Cost x TSS Excess Loading	$	-
Total April-05 Monthly Charges	**$**	**27,932.19**

Wastewater Utility Monthly Operating Costs

Annual Utility Operating Costs = Operations + Overhead + Debt	$	8,176,743.05
Utility Monthly Operating Costs = Annual Costs / 12 Months	$	681,395.25

BOD / TSS Unit Costs

Utility BOD Costs = 38% of Annual Operating Costs	$	3,107,162
Utility TSS Costs = 35% of Annual Operating Costs	$	2,861,860
Annual Utility BOD Loading (lbs BOD / year)		16,067,819
Annual Utility TSS Loading (lbs TSS / year)		13,834,373
BOD Unit Cost ($ / lb BOD) = BOD Costs / BOD Loading		**0.1934**
TSS Unit Cost ($ / lb TSS) = TSS Costs / TSS Loading		**0.2069**

Excess Monthly BOD Loading

Bachman St. Station =	38.5207 MGD x (	158.00	-	300.00) mg/L x 8.34 =	0 lbs BOD
Willard St. Station =	3.6519 MGD x (	227.00	-	300.00) mg/L x 8.34 =	0 lbs BOD
First St.Station =	10.3512 MGD x (	155.00	-	300.00) mg/L x 8.34 =	0 lbs BOD
Bridge St. Station =	0.1641 MGD x (	0.00	-	300.00) mg/L x 8.34 =	0 lbs BOD

Excess Monthly BOD Loading = Flow x [Actual - Threshold] BOD Conc x 8.34 = **0.00** lbs BOD

Excess Monthly TSS Loading

Bachman St. Station =	38.5207 MGD x (	253.50	-	300.00) mg/L x 8.34 =	0 lbs TSS
Willard St. Station =	3.6519 MGD x (	215.00	-	300.00) mg/L x 8.34 =	0 lbs TSS
First St.Station =	10.3512 MGD x (	121.50	-	300.00) mg/L x 8.34 =	0 lbs TSS
Bridge St. Station =	0.1641 MGD x (	0.00	-	300.00) mg/L x 8.34 =	0 lbs TSS

Excess Monthly TSS Loading = Flow x [Actual - Threshold] TSS Conc x 8.34 = **0.00** lbs TSS

Monthly Monitoring Results

Date	*Bachman St. Station*			*Willard St. Station*			*First St. Station*		
	Flow (MG)	BOD (mg/L)	TSS (mg/L)	Flow (MG)	BOD (mg/L)	TSS (mg/L)	Flow (MG)	BOD (mg/L)	TSS (mg/L)
	133100.0	124.00	335.00	511300.0	206.00	89.00	0.0	102.00	116.00
	931520.0	192.00	172.00	149151.0	248.00	341.00	321200.0	208.00	127.00
Monthly Total/Average	38.5207	158.00	253.50	3.6519	227.00	215.00	10.3512	155.00	121.50

Date	*Bridge St. Station*		
	Flow (MG)	BOD (mg/L)	TSS (mg/L)
	0.004182		
	0.114662		
Monthly Total/Average	0.1641		

Excess Threshold BOD/TSS Concentration (mg/L)	300.00
Dracut Monthly Flow (MG)	**52.6878**

MONTHLY MONITORING RESULTS DETAIL

Bachman		Monthly (MG)	Average (GPD)		BOD (mg/L)		TSS (mg/L)
		April-05					
4/6/2005	04-06-05-016		133,100		124		335
4/26/2005	04-26-05-011		931,520		192		172
Average/Total		38.5207	532,310		158.00		253.50

First Street		Monthly (MG)	Average (GPD)		BOD (mg/L)		TSS (mg/L)
		April-05					
4/12/2005	04-12-05-012				102		116
4/26/2005	04-26-05-012		321,200		208		127
Average/Total		10.3512	321,200		155.00		121.50

Willard		Monthly (MG)	Average (GPD)		BOD (mg/L)		TSS (mg/L)
		April-05					
3/8/2005	03-08-05-015		511,300		206		89
3/22/2005	03-22-05-016		149,151		248		341
Average/Total		3.6519	330,226		227.00		215.00

Bridge Street		Monthly (MG)	Average (GPD)		BOD (mg/L)		TSS (mg/L)
		April-05					
4/1/2005		0.114662					
5/2/2005		0.431362					
Average/Total		0.16407	#DIV/0!		#DIV/0!		#DIV/0!

Town of Dracut Sewer Department
1196 Lakeview Avenue
Dracut, Massachusetts 01826-4791
Telephone: (978) 957-0371
FAX: 978-957-9308

12-Jul-05

Town of Tyngsborough
Sewer Commission
25 Bryant Lane
Tyngsborough MA 01879

Sewer Account: O29935
Sewer Usage Bill for: May-2005

Meter 1, Tyngsboro Road

	Date	Reading	Gallons Used
Current:	5/31/05	236,280,700	
Previous:	4/30/05	225,919,800	10,360,900

Meter 2, Willowdale Avenue

	Date	Reading	Gallons Used
Current:	5/31/05	48,686,880	
Previous:	4/30/05	46,611,960	2,074,920

Total Usage Meters 1 and 2: 12,435,820

City of Lowell bill to Dracut for the period: May 2005

Amount	$	34,968.87	
Million Gallons		58,273,300	
Per Million Gal.	$	600.08	
Charge per Million Gal.			
Lowell	$	600.08	
Dracut	$	90.01	
Total Per MG	$	690.10	
Multiplied by		12.44	MG
Current Charge	$	8,581.92	
March, April, & Previous Balance	$	19,643.08	
Total Due	**$**	**28,225.00**	
Due Date:		**9/5/05**	

The Town of Dracut is an Equal Opportunity/ Affirmative Action Employer

MONTHLY MONITORING RESULTS DETAIL

Bachman		Monthly (MG)	Average (GPD)		BOD (mg/L)		TSS (mg/L)
April-05							
4/6/2005	04-06-05-016		133,100		124		335
4/26/2005	04-26-05-011		931,520		192		172
Average/Total		38.5207	532,310		158.00		253.50

First Street		Monthly (MG)	Average (GPD)		BOD (mg/L)		TSS (mg/L)
April-05							
4/12/2005	04-12-05-012				102		116
4/26/2005	04-26-05-012		321,200		208		127
Average/Total		10.3512	321,200		155.00		121.50

Willard		Monthly (MG)	Average (GPD)		BOD (mg/L)		TSS (mg/L)
April-05							
3/8/2005	03-08-05-015		511,300		206		89
3/22/2005	03-22-05-016		149,151		248		341
Average/Total		3.6519	330,226		227.00		215.00

Bridge Street		Monthly (MG)	Average (GPD)		BOD (mg/L)		TSS (mg/L)
April-05							
4/1/2005		0.114662					
5/2/2005		0.431362					
Average/Total		0.16407	#DIV/0!		#DIV/0!		#DIV/0!

Town of Dracut
Board of Sewer Commissioners
1196 Lakeview Avenue
Dracut, Massachusetts 01826

Dracut
Monthly Sewer Bill
for
Wastewater Transport and Treatment

Billing Period May-05

Standard Charge

Dracut Monthly Flow (Million Gallons - see page 2)		58.2733
Wastewater Utility Monthly Flow (Million Gallons)		1,135.50
Proportioning Multiplier = Dracut Flow / Utility Flow		0.0513195
Wastewater Utility Monthly Operating Costs (see page 2)	$	681,395
Standard Monthly Charge = Utility Monthly Costs x Multiplier	**$**	**34,968.87**

BOD / TSS Surcharges

Excess BOD Loading (lbs BOD) = Flow x [Actual - Threshold] BOD Conc x 8.34 (see page 2)		-
Excess TSS Loading (lbs TSS) = Flow x [Actual - Threshold] TSS Conc x 8.34 (see page 2)		-
BOD Unit Cost ($ / lb BOD - see page 2)		0.1934
TSS Unit Cost ($ / lb TSS - see page 2)		0.2069
BOD Surcharge = BOD Unit Cost x Excess BOD Loading	$	-
TSS Surcharge = TSS Unit Cost x TSS Excess Loading	$	-

Total Monthly Charge Summary

Standard Monthly Charge = Utility Monthly Costs x Multiplier	$	34,968.87
BOD Surcharge = BOD Unit Cost x BOD Excess Loading	$	-
TSS Surcharge = TSS Unit Cost x TSS Excess Loading	$	-
Total May-05 Monthly Charges	**$**	**34,968.87**

MONTHLY MONITORING RESULTS DETAIL

Bachman		Monthly (MG)	Average (GPD)		BOD (mg/L)		TSS (mg/L)
May-05							
5/3/2005	05-03-05-011		1,176,350		210		142
5/24/2005	05-24-05-015		1,284,100		158		84
Average/Total		39.5083	1,230,225		184.00		113.00

First Street		Monthly (MG)	Average (GPD)		BOD (mg/L)		TSS (mg/L)
May-05							
5/3/2005	05-03-05-012		310,400		220		150
5/17/2005	05-17-05-011		295,400		320		180
Average/Total		8.5501	302,900		270.00		165.00

Willard		Monthly (MG)	Average (GPD)		BOD (mg/L)		TSS (mg/L)
May-05							
5/17/2005	05-17-05-012		284,470		240		162
Average/Total		10.1332	284,470		240.00		162.00

Bridge Street		Monthly (MG)	Average (GPD)		BOD (mg/L)		TSS (mg/L)
May-05							
5/2/2005		0.43136					
5/31/2005		0.51309					
Average/Total		[illegible]	#DIV/0!		#DIV/0!		#DIV/0!

Wastewater Utility Monthly Operating Costs

Annual Utility Operating Costs = Operations + Overhead + Debt	$	8,176,743.05
Utility Monthly Operating Costs = Annual Costs / 12 Months	$	681,395.25

BOD / TSS Unit Costs

Utility BOD Costs = 38% of Annual Operating Costs	$	3,107,162
Utility TSS Costs = 35% of Annual Operating Costs	$	2,861,860
Annual Utility BOD Loading (lbs BOD / year)		16,067,819
Annual Utility TSS Loading (lbs TSS / year)		13,834,373
BOD Unit Cost ($ / lb BOD) = BOD Costs / BOD Loading		**0.1934**
TSS Unit Cost ($ / lb TSS) = TSS Costs / TSS Loading		**0.2069**

Excess Monthly BOD Loading

Bachman St. Station =	39.5083 MGD x (	184.00	-	300.00) mg/L x 8.34 =	0 lbs BOD
Willard St. Station =	10.1332 MGD x (	120.00	-	300.00) mg/L x 8.34 =	0 lbs BOD
First St.Station =	8.5501 MGD x (	270.00	-	300.00) mg/L x 8.34 =	0 lbs BOD
Bridge St. Station =	0.0817 MGD x (	0.00	-	300.00) mg/L x 8.34 =	0 lbs BOD

Excess Monthly BOD Loading = Flow x [Actual - Threshold] BOD Conc x 8.34 = **0.00** lbs BOD

Excess Monthly TSS Loading

Bachman St. Station =	39.5083 MGD x (	113.00	-	300.00) mg/L x 8.34 =	0 lbs TSS
Willard St. Station =	10.1332 MGD x (	81.00	-	300.00) mg/L x 8.34 =	0 lbs TSS
First St.Station =	8.5501 MGD x (	165.00	-	300.00) mg/L x 8.34 =	0 lbs TSS
Bridge St. Station =	0.0817 MGD x (	0.00	-	300.00) mg/L x 8.34 =	0 lbs TSS

Excess Monthly TSS Loading = Flow x [Actual - Threshold] TSS Conc x 8.34 = **0.00** lbs TSS

Monthly Monitoring Results

Date	*Bachman St. Station*			*Willard St. Station*			*First St. Station*		
	Flow (MG)	BOD (mg/L)	TSS (mg/L)	Flow (MG)	BOD (mg/L)	TSS (mg/L)	Flow (MG)	BOD (mg/L)	TSS (mg/L)
	1176350.0	210.00	142.00	284470.0	240.00	162.00	310400.0	220.00	150.00
	1284100.0	158.00	84.00	0.0	0.00	0.00	295400.0	320.00	180.00
Monthly Total/Average	39.5083	184.00	113.00	10.1332	120.00	81.00	8.5501	270.00	165.00

Date	*Bridge St. Station*		
	Flow (MG)	BOD (mg/L)	TSS (mg/L)
Monthly Total/Average	0.0817		

Excess Threshold BOD/TSS Concentration (mg/L)	300.00
Dracut Monthly Flow (MG)	**58.2733**

9#1-
Agreements with
City of Lowell
& Town of
Dracut

COPY

L-DRACUT AGREEMENT

AGREEMENT

THIS AGREEMENT, made and entered into this 25th day of May, 1977 by and between the CITY OF LOWELL, a municipal corporation within the County of Middlesex and the Commonwealth of Massachusetts, hereinafter referred to as the "CITY", and the TOWN OF DRACUT, an incorporated township within the County of Middlesex and the Commonwealth of Massachusetts, hereinafter referred to as the "TOWN"; WITNESSETH: That

WHEREAS, the Water Resources Commission, Commonwealth of Massachusetts, acting through the Office of the Director of the Division of Water Pollution Control, has found the CITY to be discharging untreated wastewaters into the surface waters of the Commonwealth in contravention of the water quality standards of the Division of Water Pollution Control; and

WHEREAS, the CITY is authorized by law to enter into contracts and agreements with the TOWN for the purpose of aiding in the abatement of water pollution; and

WHEREAS, the CITY deems it to be in the public interest to enter into an Agreement with the TOWN whereby the CITY would receive, treat and dispose of the TOWN'S wastes through the CITY'S sewerage system.

NOW, THEREFORE, in consideration of these premises and mutual benefits to be derived by the parties hereto, it is agreed as follows:

ARTICLE 1. DEFINITIONS

1.1 For the purposes of this Agreement, the following terms are defined:

1.1.1 "CITY" shall mean the City of Lowell, a municipal corporation of the Commonwealth of Massachusetts.

1.1.2 "TOWN" shall mean the Town of Dracut, an incorporated township of the Commonwealth of Massachusetts.

1.1.3 "Industrial Wastes" shall mean liquid wastes, other than sanitary sewage, resulting from commercial, manufacturing or industrial operations or processes.

1.1.4 "Sanitary Sewage" shall mean sewage discharging from sanitary conveniences such as toilets, washrooms, urinals, sinks, showers, drinking fountains, small laundries, kitchens, cafeterias and floor drains essentially free of industrial wastes or toxic materials.

1.1.5 "Biochemical Oxygen Demand" (BOD) shall mean the quantity of oxygen utilized in the biochemical oxidation of organic matter under standard laboratory procedure in five (5) days at 20 degrees (°) Centigrade (68° Fahrenheit) expressed in milligrams per liter (mg/l) by weight.

1.1.6 "Suspended Solids" (SS) shall mean solids that either float on the surface of, or are in suspension in, water, sewage, wastewater or other liquids and which are removable by laboratory filtering.

1.1.7 "pH" shall mean the logarithm of the reciprocal of the weight of hydrogen ions in grams per liter of solution.

1.1.8 "Chlorine Demand" shall mean the amount of chlorine expressed in mg/l required to be added to water, sewage or other liquid to achieve a combined chlorine residual after fifteen (15) minutes contact of one (1) mg/l.

1.1.9 "Sewerage System or Sewage Works" shall mean all facilities for collecting, conveying, pumping, treating and disposing of sanitary sewage and/or industrial wastes.

1.1.10 "Combined Sewer" shall mean a sewer receiving both surface runoff and sanitary sewage and/or industrial wastes.

1.1.11 "Wastes" shall mean the sanitary sewage, industrial wastes and infiltration from the TOWN'S sewerage system.

1.1.12 "Average Daily Flow" shall mean the total annual flow as measured at Metering Stations plus agreed-to direct discharges to the CITY sewerage system divided by the number of days in the year.

1.1.13 "Maximum Daily Flow" shall mean the maximum gallons recorded at Metering Stations plus agreed-to allowances for direct discharges to the CITY sewerage system during a 24-hour period during any calendar year.

1.1.14 "Peak Rate of Flow" shall mean the maximum rate of flow recorded at Metering Stations or measured in the direct discharges to the CITY sewerage system during any calendar year.

1.1.15 "User Charge" shall mean a charge levied on a user of a sewage works for the cost of operation and maintenance, including replacement costs, of such works (Environmental Protection Agency definition).

1.1.16 "Replacement" shall mean expenditures for obtaining and installing equipment, accessories or appurtenances which are necessary during the service life of the sewage works to maintain the capacity and performance for which said works were designed and constructed. Replacement costs shall be apportioned in accordance with ARTICLE VI. (Environmental Protection Agency definition).

1.1.17 "Service Life" shall mean the period of time during which the sewage works or a component of a waste treatment management program will be capable of performing a function (Environmental Protection Agency definition).

1.1.18 "Industrial Cost Recovery" shall mean the recovery by the CITY of that portion of a federal grant allocable to the collection, transmission, and treatment of discharges from industrial users (Environmental Protection Agency definition).

1.1.19 "Industrial User" shall mean any non-governmental user of the CITY'S sewage works, which contributes industrial wastes, identified in the Standard Industrial Classification Manual, 1972 Edition, Office of Management and Budget, as amended and supplemented, under the following divisions (Environmental Protection Agency definition):

Division A.	Agriculture, Forestry, and Fishing.
Division B.	Mining.
Division D.	Manufacturing.
Division E.	Transportation, Communications, Electric, Gas and Sanitary Services.
Division I.	Services.

1.1.20 "Total Cost" shall mean construction costs, engineering and legal fees, capitalized interest costs during construction, amortization costs, land costs, etc.

1.1.21 "Operating Cost" shall mean the cost incurred by the CITY necessary for the proper and efficient operation and maintenance of the sewage works.

ARTICLE 11. OBLIGATIONS AND RESPONSIBILITIES

2.1 The CITY shall receive, treat and dispose of the TOWN'S wastes in accordance with all existing or future laws, regulations, CITY Sewer Ordinance, water quality standards, and orders and decrees of any governmental authority having jurisdiction over the treatment and disposal of said wastes; provided, however, that the treatment to be provided by the CITY of the TOWN'S wastes shall be of such a type and degree as may be necessary to provide for the application of Best Practicable Waste Treatment Technology.

The TOWN shall assist the CITY in meeting its obligations of adhering to and enforcing all existing and future laws, regulations, CITY Sewer Ordinances, water quality standards, and orders and decrees of any governmental authority having jurisdiction over the treatment and disposal of said wastes.

2.2 The TOWN will not connect any combined sewer or separate drains into the CITY'S Sewerage System and will not discharge into said sewerage system any volume of sewage, substances or wastes containing the following characteristics in excess of that agreed to herein:

2.2.1 Any waters or wastes containing fats, wax, grease or oils, whether emulsified or not, in excess of one hundred (100) mg/l or containing substances which may solidify or become viscous at temperatures between zero (0) and sixty-five (65) degrees (°) Centigrade (32 and 150° Fahrenheit).

2.2.2 Any gasoline, benzene, naptha, fuel oil, or other liquid, solid or gas in sufficient concentration to be flammable or explosive.

2.2.3 A temperature higher than 65° Centigrade (150° Fahrenheit).

2.2.4 Any garbage not properly shredded.

2.2.5 Any ashes, cinders, sand, mud, straw, shavings, metal, glass, rags, feathers, tar, wood, paunch manure, or other solid or viscous substances capable of causing interference with the proper operation of the sewerage system.

2.2.6 Any wastes having a pH lower than 5.5 or higher than 9.5 or having any other corrosive property capable of causing damage or hazards to structures, equipment and personnel at the sewage works.

2.2.7 Any wastes containing a toxic or poisonous substance in sufficient quantity to injure or interfere with the sewerage system, to constitute a hazard to humans or animals or to create any hazard in the receiving waters of the sewage works.

2.2.8 Waters or wastes containing substances which are amenable to treatment only to a degree such that the sewage works effluent cannot meet the requirements of any governmental authority having jurisdiction over discharge to the receiving waters.

2.2.9 Any noxious or malodorous gas or substance capable of creating a public nuisance.

2.2.10 Plastics, except those materials which have undergone complete reaction and whose size does not exceed 2.5 inches in its largest dimension.

2.2.11 Waste character or concentration, as sampled at Metering Stations, in accordance with the provisions of ARTICLE VII.

2.3 All measurements of volume and characteristics of the TOWN'S wastes shall be made at Metering Stations constructed, operated and maintained by the CITY at the following locations:

Station No. 1	-	Beaver Brook Interceptor at the CITY boundary.
Station No. 2	-	CITY boundary near intersection of Arlington Avenue and Willard Street.
Station No. 3	-	Merrimack Avenue at the CITY boundary.

For small individual areas in the TOWN, which will be discharging wastes directly into the CITY sewerage system, measurements shall be based on either water consumption readings or some other mutually acceptable method.

2.4 Industrial wastes from the TOWN, as measured at Metering Stations, shall be judged by the same standards as are in effect within the CITY'S sewerage system, notwithstanding the provisions of Paragraph 2.2 of this ARTICLE.

ARTICLE III. AGREEMENT TERM.

3.1 The provisions of this Agreement shall run for a minimum period of thirty (30) years from the date of initial treatment of the TOWN'S wastes subject to the provisions of ARTICLE X.

ARTICLE IV. IMPLEMENTATION

4.1 The CITY agrees to provide a sewerage system with a portion of the capacity allocated to handle wastes from the TOWN. Construction commencement and completion of said sewerage system shall be in accordance with the implementation Schedule established by the Massachusetts Water Resources Commission, Division of Water Pollution Control.

ARTICLE V. USER CHARGES AND INDUSTRIAL COST RECOVERY

5.1 User Charges:

5.1.1 The TOWN shall develop, in accordance with the provisions of federal regulations ("Code of Federal Regulations, 40 CFR 35.925-11 and 35.935-13, et seq."), an equitable User Charge System to assure that each recipient of waste treatment services within the TOWN'S service area will pay its proportionate share of the costs of operation and maintenance (including replacement) of all waste treatment services provided by the CITY.

5.1.2 The TOWN must obtain approval of the Massachusetts Water Resources Commission, Division of Water Pollution Control, and the Region 1 Office of the Environmental Protection Agency for its User Charge System for the above costs.

5.1.3 The TOWN, upon approval of its User Charge System, must incorporate said System in one or more municipal legislative enactments.

5.1.4 The enactment(s) must include provisions whereby the maintenance of said System and the collection of the revenues can be reviewed by any governmental authority having jurisdiction and/or the CITY.

5.2 Industrial Cost Recovery:

5.2.1 The TOWN shall annually inventory and survey all the industries in its service area. The survey should produce all pertinent information so that a determination can be made by the CITY and TOWN as to which is an industrial user as defined in ARTICLE I.

5.2.2 The CITY shall develop in accordance with the provisions of federal regulation ("Code of Federal Regulations, 40 CFR 35.925-12, 35.928 and 35.935-13, et seq.") an equitable Industrial Cost Recovery System for all industrial users in its service area for the recovery of their portion of a federal grant amount allocable to sewage works constructed in the CITY.

5.2.3 The CITY must obtain the approval of the Massachusetts Water Resources Commission, Division of Water Pollution Control, and the Region 1 Office of the Environmental Protection Agency for its Industrial Cost Recovery System.

5.2.4 The CITY and the TOWN, upon approval of the Industrial Cost Recovery System, must incorporate said system in one or more municipal, legislative enactments as being their Industrial Cost Recovery System.

5.2.5 The CITY shall annually bill the TOWN for Industrial Cost Recovery for all industries within the TOWN'S service area as determined by the CITY'S System. The TOWN shall collect all revenues for Industrial Cost Recovery from industries within the TOWN'S service area.

5.2.6 The TOWN shall pay to the CITY all revenue collected for Industrial Cost Recovery plus the interest earned thereon at the time that the final payment for operating costs for each fiscal year is made in accordance with ARTICLE VII.

5.2.7 The TOWN shall provide the CITY with copies of all invoices and records pertinent to the assessing and collection of revenue for Industrial Cost Recovery.

5.2.8 The CITY shall review the Industrial Cost Recovery System annually, using the TOWN'S annual industrial inventory and survey report.

5.2.9 The CITY shall keep a permanent file of all reports, invoices, and records relative to Industrial Cost Recovery subject to review by any governmental authority having jurisdiction.

5.2.10 The CITY shall retain, as presently permitted by federal regulation, 50 per cent of the amounts recovered from industrial users. Accurate records of the retained revenues, including acknowledgement of the sources as well as detailed cost accounts of expenditures of these funds, will be maintained so that the CITY and the TOWN will receive full credit and benefit in accordance with the terms of this Agreement. All of the retained amounts recovered from industrial users in the TOWN'S service area shall be used in accordance with federal regulation for sewage works in the CITY which will directly benefit the TOWN.

ARTICLE VI. CAPITAL COST APPORTIONMENT.

6.1 The TOWN shall, periodically, pay to the CITY sums which in total represent its full obligation of the Total Cost to the CITY, after deduction of all government grants for all sewage works in the CITY, of sewage works required to receive, transmit and treat the TOWN'S wastes.

Payments of the full obligation by the TOWN ~~to the CITY for~~ each applicable construction contract shall be established and processed as follows:

1 For each construction contract six (6) payments shall be made. The initial payment, equal to twenty (20) per cent of the estimated total cost of the contract, shall be made within sixty (60)

days after notification by the CITY that the contract has been awarded and the government grant offers have been accepted by the CITY. Four (4) additional payments, based on the initial estimated Total Cost of the contract, shall be made at six (6) month intervals. A final payment, based on the adjusted Total Cost of the contract, when accepted by the CITY, shall be made by the TOWN. In no case shall the total payments by the TOWN to the CITY exceed the full obligation of the TOWN as computed under Paragraph 6.4 of this ARTICLE.

6.2 Records of the Total Cost are public information and will be on file with the CITY and available for review during normal business hours by all responsible agencies. Copies of pertinent information will be forwarded to the TOWN, as required.

6.3 Whereas, all diversion chambers and other stormwater facilities are being constructed solely for the peak rate of flow generated by the CITY, all capital costs for these facilities will be borne by the CITY.

Whereas, Metering Stations are being constructed solely for flows generated by the TOWN, all capital costs for these facilities will be borne by the TOWN.

Where other sewage works are constructed solely for flows generated by the TOWN, all capital costs for said works will be borne by the TOWN.

6.4 The basis of payments by the TOWN for sewage works constructed by the CITY shall be established as follows:

6.4.1 Sewers and Raw Sewage Pumping Station:

$$\text{TOWN Payment} = C_1 \frac{a}{b}$$

Where:

C_1 = Total Cost
a = Peak Rate of Flow requested by TOWN
b = Design Peak Rate of Flow for facility as approved by the Massachusetts Water Resources Commission, Division of Water Pollution Control, and the Region 1 Office of the Environmental Protection Agency

6.4.2 Treatment Facilities (including EPA/State Project No. C250251 01, Preparation of Treatment Facilities Site):

$$\text{TOWN Payment} = C_2 \frac{d}{e}$$

Where:

C_2 = Total Cost
d = Average Daily Flow Rate requested by TOWN
e = Total Average Daily Flow Rate used for design of facility as defined in the approved "Interim Basin Plan"

6.5 The CITY shall provide capacities in its sewage works for the wastes from the TOWN'S service area, which will include the Town of Tyngsborough and wastes from said town, as defined in the approved "Interim Basin Plan". Capacities for the TOWN shall be as follows:

6.5.1 Treatment Facilities and Raw Sewage Pumping Station:

Design Year	2000
Average Daily Flow	3.6 million gallons per day (mgd)
Maximum Daily Flow	6.5 mgd
Peak Flow	8.0 mgd
BOD	8000 lbs/day
SS	9500 lbs/day

6.5.2 Transmission Facilities:

Design Year 2025

	Average Daily Flow	Peak Flow
At Metering Station No. 1	8.0 mgd	17.0 mgd
At Metering Station No. 2	0.4 mgd	1.3 mgd
At Metering Station No. 3	2.5 mgd	6.1 mgd
Into the Pawtucketville Area (Unmetered)	0.03 mgd	0.15 mgd
Into the Hovey Field Area (Unmetered)	0.05 mgd	0.30 mgd
Into the Gate Park Area (Unmetered)	0.1 mgd	0.55 mgd

6.6 The CITY shall design sewage works to meet the present-day Division of Water Pollution Control requirements and to provide for Best Practicable Wastewater Treatment Technology, defined by said Division as secondary treatment.

6.7 Should it be required by any governmental authority having jurisdiction to provide additional treatment, the TOWN shall pay its proportionate share of the required sewage works based on the flows established under Paragraph 6.5 of this ARTICLE. If the CITY'S sewage works require enlargement because the parameters of the flow to the treatment facilities exceed the design, then the TOWN shall contribute only insofar as its wastes have exceeded the limits called for under the above-referenced Paragraph 6.5.

ARTICLE VII. OPERATING COST APPORTIONMENT

7.1 The CITY shall maintain an adequate cost accounting system which shall be the basis for the determination and allocation of operating costs. This accounting system shall be subject to review by the TOWN.

The CITY shall maintain separate cost accounting records for the operation of the following portions of the sewage works:

7.1.1 North Bank Interceptor from the Point of Connection at Beaver Brook to the Raw Sewage Pumping Station - The annual cost of operating this sewage works shall be apportioned between the CITY, the TOWN and any other participants on the basis of their actual, annual flows, as determined from records at the respective Metering Stations. The costs of operating and maintaining the diversion chambers and other stormwater facilities shall be borne by the CITY.

The annual cost of operating these sewage works shall be apportioned between the CITY and TOWN and any other participants on the basis of their actual, annual flows, as determined from records at the respective Metering Stations. The TOWN shall bear no costs associated with the collection and treatment of stormwater.

7.2 The operating costs shall be apportioned against participants on the basis of average daily flows, providing that the established parameters from any participant are not exceeded. If either the average BOD or SS from any participant exceeds 300 mg/1, then the participant shall pay a surcharge to the CITY for treatment of its wastes. The surcharges will be based on the proportional extra cost incurred for the complete treatment of wastes in excess of 300 mg/1 for the period of time in violation.

7.3 Actual, annual flows shall be determined for the TOWN from records at Metering Stations. Estimated flows from non-metered, individual areas shall also be included, if not charged separately. Actual, annual flows shall be determined for the CITY from records at the treatment facilities.

7.4 The waste strengths, BOD and SS, for each of the participants shall be determined from proportional, composite 24-hour samples obtained at the participants Metering Stations. The average daily BOD and SS in pounds per day shall be determined from the average of not less than twelve (12) samples taken on weekdays at monthly intervals.

7.5 When determining surcharges, the unit cost per pound of BOD and SS used shall be based on the previous year's treatment facility operational costs divided by the total annual BOD or SS loadings.

7.6 Operating costs for the treatment facilities shall include the cost of sampling and analyzing wastes discharged by the participants. It shall also include the cost accounting related to the distribution and invoicing of operating costs.

7.7 Operating costs shall be payable monthly, on a fiscal year basis, upon receipt by the TOWN of the CITY'S invoice. Bills shall be paid within sixty (60) days after which a surcharge of 1 1/2 per cent per month shall be assessed.

Operating costs for the first eleven (11) months shall be determined by using the CITY'S approved yearly operation budget (reduced to a monthly cost) and apportioning the TOWN'S share on the basis of actual, total, monthly flow, as measured.

The final monthly invoice for the fiscal year shall be rendered by the CITY within fifteen (15) days of the end of the fiscal year and shall be determined on the basis of actual flows and expenditures. All previous monthly invoices shall be subject to adjustment and correction at the time of this final billing for the fiscal year.

ARTICLE VIII. ANNUAL COST REVIEW

8.1 The CITY and TOWN both agree that the apportionment of costs set forth in ARTICLE VII, shall be subject to review annually.

After a review of the annual costs, if an adjustment to the costs appears to be necessary, said adjustment shall be made by the CITY in the forthcoming billing for services. The adjustment will be to both the CITY'S and TOWN'S mutual satisfaction. Should arbitration be necessary, unless otherwise provided by law, both parties shall mutually agree as to the arbitrator and the arbitration procedure.

ARTICLE IX. ADJUSTMENT CLAUSE

9.1 The TOWN reserves the right at any time to pretreat and/or to reduce either or both the quantity and quality of its wastes, or to otherwise give preliminary treatment to its wastes prior to discharge to the CITY sewerage system. The TOWN agrees to notify the CITY as far in advance as possible of any significant increase or decrease in the quantity and/or quality of the wastes to be discharged to the CITY sewerage system.

9.2 Any separate agreement between the TOWN and adjacent communities, excluding Tyngsborough, must be reviewed by the CITY. In any event, the TOWN shall in the aggregate be restricted to the waste parameters established under ARTICLE VI. Any increase must be formally contracted for between the TOWN and the CITY.

ARTICLE X. TERMINATION CLAUSE

10.1 Any obligations under this Agreement are conditioned upon both the receipt and acceptance by the TOWN of construction grant funds from federal and/or state government agencies for sewage works necessary within the TOWN to transmit waste flows to the CITY sewerage system and the receipt and acceptance by the CITY of construction grant funds from said agencies for the sewage works necessary within the CITY to convey and treat the TOWN'S wastes.

10.2 Either party may terminate this Agreement by giving notice thereof to the other party in writing three (3) years prior to the termination date. Upon receipt of said notice, both parties will enter into discussion within thirty (30) days to assure proper termination of the Agreement.

Should the TOWN initiate the termination proceedings, it shall not have any right to the return of any of its initial capital investments under ARTICLE VI.

Should the CITY initiate the termination proceedings, it shall be obliged to return to the TOWN the unused proportionate share of the TOWN'S capital investment under ARTICLE VI.

10.3 The TOWN shall have the right to the continued use of the CITY'S sewage provided for in part by the TOWN'S capital investment under ARTICLE VI, beyond the thirty (30) years provided for in ARTICLE III, for as long as those sewage works remain in active use. The right shall be limited to the waste parameters established under ARTICLE VI.

ARTICLE XI. WASTES ANALYSIS

11.1 The CITY and the TOWN both agree that the determination of character and concentration of wastes will be in accordance with the latest edition of "Standard Methods for the Examination of Water and Sewage", as proposed, approved and published jointly by the American Public Health Association, the American Water Works Assocition and the Water Pollution Control Federation, or any other method mutually agreed upon by the CITY and the TOWN, and subject further to the following:

11.1.1 Sampling at Metering Stations will be performed by the CITY. Determination of the character and concentration of the TOWN'S wastes, for the purpose of checking waste parameters, shall be the responsibility of the CITY or its authorized agent. The TOWN shall be furnished copies of all such determinations.

11.1.2 Samples shall be collected by the CITY at Metering Stations in such a manner so as to be representative of the actual quality of the wastes. The TOWN shall have access to said Stations, as required, to conduct intermittent or continuous waste sampling.

11.1.3 Portions of waste samples collected by the CITY, as part of a sampling and analytical program, will be made available to the TOWN at no cost and in adequate quantities for analysis by the TOWN for characteristics and concentrations. In the event of discrepancy which cannot be satisfactorily resolved, the parties will submit the samples to a mutually acceptable, disinterested, qualified third party for determination of the waste characteristics and concentrations.

ARTICLE XII. FLOW MEASUREMENTS.

12.1 The CITY and the TOWN agree that flow measurements shall be made as follows:

12.1.1 The volume of flow used in computing the TOWN'S share of the operating costs shall be based upon readings obtained by suitable metering equipment of a type mutually acceptable to both the TOWN and the CITY. Such metering equipment shall be installed and maintained by the CITY. The CITY will provide the TOWN with waste flow data for the preceding week, based upon meter readings. The TOWN shall have access to said meters during normal business hours.

12.1.2 In the event the metering equipment is temporarily out of order or service for any reason, the TOWN'S estimated flow will be based on the average daily flow of the previous three months.

IN WITNESS WHEREOF, the CITY and the TOWN have caused their proper representatives on the day and year first above written.

FOR THE CITY OF LOWELL, MASSACHUSETTS

By
City Manager

By
Commissioner of Public Works

Approved as to form:

By
City Solicitor

FOR THE TOWN OF DRACUT, MASSACHUSETTS

By Its Board of Sewer Commissioners

, Chairman

Approved as to form:

By
Town Counsel

APPENDIX D

Table of Contents and Executive Summary October 2002 I/I Report

INFLOW / INFILTRATION STUDY

TOWN OF TYNGSBOROUGH, MA

OCTOBER 2002

COMMONWEALTH OF MASSACHUSETTS
STEPHEN
H.
GERIBO
No. 28174
REGISTERED
PROFESSIONAL ENGINEER

S E A Consultants Inc.
Science/Engineering/Architecture
Cambridge, Massachusetts
Rocky Hill, Connecticut
Concord, New Hampshire
Rochester, New York

1999100.10A

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EXECUTIVE SUMMARY

This study was developed to determine the levels of infiltration and inflow (I/I) in the town of Tyngsborough's wastewater collection system. I/I is a condition common to most every wastewater system and represents unintended groundwater, storm water, and or snowmelt entering the wastewater collection system. Infiltration into a wastewater collection system is a result of flaws in the sewer pipes, manholes, and other system components that allow groundwater to enter the sanitary sewer. Inflow is derived from direct connections to the collection system that allow groundwater and/or storm water into the system. The extraneous water in the collection system represents an additional hydraulic load on the transport and treatment facilities installed for sewage treatment. If this influx of extraneous water becomes too great (i.e. excessive I/I), the protection of the environment becomes jeopardized from sewage back-ups, sewer system overflows or from discharges of partially treated wastewater. Besides the potential for environmental degradation, excessive I/I also poses an economic burden on communities by needing to pump and treat extraneous flows and by robbing sewers of capacity needed to handle sanitary wastes.

The Tyngsborough wastewater management system is comprised of 21.9 miles of sewers including twelve (12) major pumping stations that convey an average daily flow of 380,000 gallons per day (gpd) to the Lowell Regional Wastewater Utility (LRWU). Wastewater is conveyed from the Town of Tyngsborough to the LRWU via three intermunicipal connections with flow metering stations located at the Town's borders with Chelmsford, Dracut and the City of Lowell. The origins of the system were constructed around Mascuppic Lake in the early 1970s in response to water pollution from failing residential on-site wastewater systems. These areas were constructed of asbestos cement pipe and discharge to the Town of Dracut. Two other extensions were constructed from the Lowell and Chelmsford wastewater systems to service the Lowell Vocational High School and Charles George Landfill site, respectively, in the 1990s. Following the initial development of these portions of the system, private developers constructed a number of sewer extensions to service new and existing residential developments. More recently, the Town initiated construction of Phase I Sewers consisting of 30,000 linear ft. of gravity sewer. The more recent parts of the system are constructed of ductile iron and polyvinyl chloride pipe.

The Tyngsborough wastewater collection system has experienced a wide variation in wastewater flows peaking seasonally in the late winter and early spring seasons. These conditions are indicative of infiltration and inflow (I/I). I/I is typically an accepted component of wastewater flow when groundwater

APPENDIX E

Water Conservation Efforts

Note:
No water restriction is in effect for the month of June; we may institute water **restriction** on outdoor water use to between the hours of 7PM to 7AM for the months of July, August and September
We will advertise any water restrictions on the Comcast local access channel and the Neighbor to Neighbor Newsletter
Please adjust your timers, also note that rain sensors are required as well as backflow preventers and plumbing permits for all lawn irrigation systems.

Water Facts:
Our water rate is $3.50 per 750 gallons of water or $0.0046 per gallon
One gallon of water costs $0.0046, a gallon of milk costs $2.25,
and a gallon of soda would cost $1.29
Water is still an excellent value for the product delivered to your tap.
A 5/8" garden hose delivers about 1000 gallons in one hour,
A ¾" garden hose delivers about 1900 gallons in one hour,
The average home uses approximately 65 gallons of water per person, for inside use per day
75% of a home's total water use during the summer is for outdoor use
The average home uses approximately 150 gallons of water per person, for outside use per day
A small leak in a water line 1/32" in diameter, at 40 PSI would waste 6000 gallons per month
A single dripping faucet can waste 75-1000 gallons of water per week
A normal automatic lawn sprinkler system uses 600 gallons per head per hour of use
Our average daily use of water increases by more than 70% for the summer months

Water conservation tips:
Repair leaking faucets, pipes and toilets, Install water saving devices in faucets and toilets
Wash only full loads of laundry and dishes, Take shorter showers, install water saving shower heads
When washing hands, shaving and brushing teeth, use only as much water as needed
Use mulch around plants and shrubs to retain moisture, Minimize the size of your lawn.
Use water in a bucket to wash your vehicle, use the hose only to rinse off.

2004 Consumer Drinking Water Quality Report

Tyngsborough Water District

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Commissioners:
Warren Allgrove Jr.
David Reault
Edgar Gordon
George Dupras
Thomas Ives

Superintendent:
David Denommee

Office Manager / Secretary
Elizabeth Choate

Meter Reader / Maintenance:
Robert Pelletier Sr.

Secretary / Clerk:
Patsy Corcoran

We are pleased to provide our Annual Water Quality Report. It is our intention to keep you informed about our excellent services and water. The Tyngsborough Water District has continued to supply safe, clean, quality water, meeting all State and Federal requirements. Our licensed operators and staff attend numerous training sessions ensuring compliance with current State and Federal Regulations. Your health, safety and satisfaction are our main objectives

If you have any questions please call our Superintendent at (978)649-4577. Meetings are held at 7PM on the first and third Tuesday of every month at our office located at 87 Progress Ave., and are open to the public.

The Tyngsborough Water District is proud of its accomplishments and is committed to serving the needs of the community.

Thank You for Your support.

Our water is purchased from:

The City of Lowell, water treatment facility which treats and filters water from the Merrimack River

The Dracut Water Supply District, that furnishes water from the Frost Rd. well field in Tyngsborough

Pennichuck Water, water treatment facility that treats and filters water from the Merrimack River & Pennichuck Brook

The Tyngsborough Water District routinely monitors for constituents in your drinking water according to Federal and State Laws. The enclosed tables show the results for the monitoring period of January 1st to December 31st 2004.

All drinking water, including bottled drinking water, may be reasonably expected to contain at least small amounts of some constituents. It's important to remember that the presence of these constituents does not necessarily pose a health risk. Sources of drinking water **(both tap water and bottled water)** include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals, and in some cases, radioactive material. It can pick up substances resulting from the presence of animals or from human activity. Contaminants that may be present in source water include:

Microbial contaminants -such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife

.**Inorganic contaminants** -such as salts and metals, which can be naturally-occurring or result from urban stormwater runoff, industrial, or domestic wastewater discharges, oil and gas production, mining, or farming

.**Pesticides and herbicides** -which may come from a variety of sources such as agricultural, urban stormwater runoff, and residential uses.

Organic chemical contaminants - including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, and septic systems

Radioactive contaminants -which can be naturally occurring or be the result of oil and gas production and mining activities.

In order to ensure that tap water is safe to drink, the U.S. Environmental Protection Agency (EPA) prescribes regulations that limit the amount of certain contaminants in water provided by public water systems. The Food and Drug Administration (FDA) regulations establish limits for contaminants in bottled water that must provide the same protection for public health. All drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline at 800.426.4791.

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and some infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/Centers for Disease Control and Prevention (CDC) guidelines on lowering the risk of infection by *Cryptosporidium* and other microbial contaminants are available from the Safe Drinking Water Hotline at 800-426-4791

We're proud that your drinking water meets Federal and State requirements. We have learned through our monitoring and testing that some constituents have been detected. The system did have detectable levels of lead and copper in some of the homes tested. These levels reflect the copper and lead that is picked up from the plumbing system. These levels drop if the water lines in the house are flushed (run for approximately 5 minutes before use). Both the City of Lowell Water Dept. and The Dracut Water Supply District have up-graded their treatment process to control the pH, recent tests for lead and copper have been below action levels, all supplies contain fluoride now.

Copies of the Consumer Confidence Reports from the City of Lowell , Pennichuck and the Dracut Water Supply District will be available at the Tyngsborough Library, Town Hall and the Water District Office, for review. All sources of drinking water are subject to potential contamination by substances that are naturally occurring or man made. These substances can be microbes, inorganic or organic chemicals and radioactive substances. All drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that the water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the :

Environmental Protection Agency's Safe Drinking Water Hotline at 1-800-426-4791 MCL's are set at very stringent levels.

To understand the possible health effects described for many regulated constituents, a person would have to drink 2 liters of water every day at the MCL level for a lifetime to have a one-in-a-million chance of having the described health effects.

Health Effects

Nitrate: Nitrate in drinking water at levels above 10 ppm is a health risk for infants of less than six months of age. High nitrate levels in drinking water can cause blue baby syndrome. Nitrate levels may rise quickly for short periods of time because of rainfall or agricultural activity. If you are caring for an infant, you should ask for advice from your health care provider.

Total Coliform: Coliforms are bacteria that are naturally present in the environment and are used as an indicator that other, potentially harmful, bacteria may be present. The Total Coliform Rule requires water systems to meet a stricter limit for coliform bacteria. Coliform bacteria are usually harmless, but their presence in water can be an indication of disease-causing bacteria. When coliform bacteria are found, special follow-up tests are done to determine if harmful bacteria are present in the water supply. If this limit is exceeded, the water supplier must notify the public by newspaper, television or radio. To comply with the stricter regulation, we have increased our sampling for coliform and raised the average amount of chlorine in the distribution system.

Lead: Infants and children who drink water-containing lead in excess of the action level could experience delays in their physical or mental development. Children could show slight deficits in attention span and learning abilities. Adults who drink this water over many years could develop kidney problems or high blood pressure.

Infants and young children are typically more vulnerable to lead in drinking water than the general population. It is possible that lead levels at your home may be higher than at other homes in the community as a result of materials used in your home's plumbing. If you are concerned about elevated lead levels in your home's water, you may wish to have your water tested and flush your tap for 30 seconds to 2 minutes before using tap water. Additional information is available from the Safe Drinking Water Hotline (1-800-426-4791). Lead in drinking water is rarely the sole cause of lead poisoning, but it can add to a person's total lead exposure. All potential sources of lead in the household should be identified and removed, replaced or reduced.

Copper is a naturally occurring element. It is essential to humans in low concentrations but can be harmful at high doses. A deficiency of copper can lead to anemia. Acute exposure to elevated levels of copper in a normal population can result in gastrointestinal, liver, and kidney effects. Nausea and vomiting have been observed in humans exposed to drinking water containing 5.3 mg/l of copper. High concentrations of copper in water can discolor plumbing fixtures and clothing after washing. Flushing the copper water lines in your home, before use will lower the amount of copper in the water, as the water has little copper in it until it reaches your home.

Rate Effective 10/4/2004

$3.50 / 750 gallons	0 -20,000 gallons
$3.75 / 750 gallons	20,001 –55,000 gallons
$4.00 / 750 gallons	55,001 –80,000 gallons
$4.25 / 750 gallons	80,001-180,000 gallons
$4.50 / 750 gallons	180,001-400,000 gallons

The minimum water bill is $50.00 per quarter

At the water rate of $3.50 / 750 gallons; 40,000 gallons of water would cost $186.66

How to Prevent Contamination of Your Drinking Water

Protect your drinking water by taking the following precautions:

Don't:

* Submerge hoses in buckets, pools, tubs, sinks, ponds, etc.
* Use spray attachments without a backflow prevention device.
* Connect waste pipes from water softeners or other treatment systems to the sewer, submerged drain pipe, etc.
* Use a hose to unplug blocked toilets, sewers, etc.

Do:

* Keep the ends of hoses clear of all possible contaminants.
* If not already equipped with an integral (built-in) vacuum breaker, buy and install hose bibb type vacuum breakers on all threaded faucets around your home. These devices are inexpensive and are available at hardware stores and home improvement centers.
* Install an approved backflow prevention assembly on all underground lawn irrigation systems.
* Remember, a plumbing permit is required for the connection of an underground lawn irrigation system to your plumbing system.

In the tables you will find many terms and abbreviations you might not be familiar with. To help you better understand these terms we've provided the following definitions:

Non-Detects (ND) - laboratory analysis indicates that the constituent is not present.
Parts per million (ppm) or Milligrams per liter (mg/l) - one part per million corresponds to one minute in two years or a single penny in $10,000.
Parts per billion (ppb) or Micrograms per liter - one part per billion corresponds to one minute in 2,000 years, or a single penny in $10,000,000.
Parts per trillion (ppt) or Nanograms per liter (nanograms/l) - one part per trillion corresponds to one minute in 2,000,000 years, or a single penny in $10,000,000,000.
Parts per quadrillion (ppq) or Picograms per liter (picograms/l) - one part per quadrillion corresponds to one minute in 2,000,000,000 years or one penny in $10,000,000,000,000.
Picocuries per liter (pCi/L) - picocuries per liter is a measure of the radioactivity in water.
Millirems per year (mrem/yr) - measure of radiation absorbed by the body.
Nephelometric Turbidity Unit (NTU) - nephelometric turbidity unit is a measure of the clarity of water. Turbidity in excess of 5 NTU is just noticeable to the average person.
Action Level - the concentration of a contaminant, which, if exceeded, triggers treatment or other requirements, which a water system must follow.
Maximum Contaminant Level - The "Maximum Allowed" (MCL) is the highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.
Maximum Contaminant Level Goal - The "Goal"(MCLG) is the level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety

Daniel J. Lahiff
Executive Director

Lowell Regional Water Utility

815 PAWTUCKET BLVD. • LOWELL, MASSACHUSETTS 01854
PHONE (978) 970-4242 • FAX (978) 970-4235

2004 Water Quality Data Table

Contaminant Detected	Unit	MCL	MCLG	Level Detected	Range of Detection	Major Sources	Violation
Regulated Contaminants							
Nitrate	ppm	10	10	0.25	N/A	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion from natural deposits.	NO
Fluoride * (see below)				1.49	0 to 1.49	Erosion of natural deposits, water additive that promotes strong teeth. Discharge from fertilizer and aluminum factories.	NO
* State (MCL)	ppm	2	none				
* EPA (MCL)	ppm	4	none				
Sodium	ppm	none	none	35.0	N/A	Erosion of natural deposits; road salt, and water treatment chemicals.	NO
Chlorite	ppm	1.0	0.8	0.88	0.14 to 0.88	By-product of drinking water disinfection.	NO
Turbidity (see note)	NTU	1.0	TT= 96%	1.27	0.04 to 1.27	Soil runoff.	NO

TT= lowest percentage of monthly samples <0.3 NTU

Note: Turbidity is a measure of the cloudiness of the water. We monitor it because it is a good indicator of the effectiveness of our filtration system.

Contaminant Detected	Unit	MCL	MCLG	Level Detected	Range of Detection	Major Sources	Violation
Disinfectant residual	ppm	(MRDL) 4	(MRDLG) 4	1.20	0.35 to 1.60	By-product of drinking water disinfection.	NO
Volatile Organic Contaminants							
(TTHM) [Total Trihalomethanes]	ppb	80	0	(21.1) (Highest Running Annual Average)	6.0 to 31.0	By-product of drinking water chlorination.	NO
Disinfection By-Product Contaminants							
(HAA) [Halo-acetic Acids]	ppb	60	0	(7.14) (Highest Running Annual Average)	0 to 14.7	By-product of drinking water chlorination.	NO
Unregulated Contaminants							
MTBE	ppb	none	none	1.1	N/D<0.05 to 1.1	Gasoline Additive.	NO
Chloroform	ppb	none	none	14	3 to 14	By-product of drinking water chlorination.	NO
Bromodichloromethane	ppb	none	none	4.8	1.0 to 4.8	By-product of drinking water chlorination.	NO
Chlorodibromomethane	ppb	none	none	0.7	N/D<0.05 to 0.7	By-product of drinking water chlorination	NO
Sulfate	ppm	none	none	6.0	N/A	Mineral and nutrient	NO

Unregulated contaminants are those for which EPA has not established drinking water standards. The purpose of un-regulated contaminant monitoring is to assist EPA in determining their occurrence in drinking water and whether future regulation is warranted.

Contaminant Detected	Unit	MCL	MCLG	Level Detected	Range of Detection	Major Sources	Violation
Radionuclides							
Gross Alpha	pCi/l	15	0	0.5 (+-1.1)	N/A	Erosion of natural deposits	NO
Radium 228	pCi/l	5	0	0.1 (+-0.6)	N/A	Erosion of natural deposits	NO

Contaminant	Unit	AL	MCLG	90th % Value	# of Samples Above AL	Major Sources	Violation
Lead	ppb	15	0	10.30	1 of 50	Corrosion of household plumbing Systems. Erosion of natural deposits;	NO
Copper	ppm	1.3	1.3	0.06	0 of 50	Corrosion of household plumbing Systems. Erosion of natural deposits; Leaching from wood preservatives.	NO

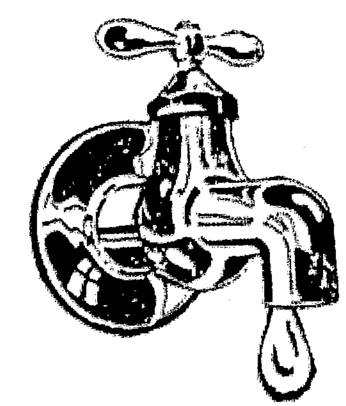
Finished water pH ranged from 7.4 to 8.5

TEST RESULTS: Tyngsborough Water District 2004

Contaminant	Violation Y/N	Level Detected	Unit Measurement	MCLG	MCL	Likely Source of Contamination
Microbiological Contaminants						
Total Coliform Bacteria Tyngsborough Water District	N	0		0	presence of coliform bacteria in 5% of monthly samples	Naturally present in the environment

Inorganic contaminants

	Violation	Level detected	Unit	90 % value above action level	Action level	Likely Source of Contamination
Copper	N	0.001	ppm	90th% value 0.001= 1 of 48 samples taken	AL=1.3ppm	Corrosion of household plumbing systems; erosion of natural deposits; leaching from wood preservatives
Lead	N	0.267	ppm	90th% value 0.267 =1 of 48 samples taken	AL=0.015ppm	Corrosion of household plumbing systems, erosion of natural deposits
Volatile Organic Compounds						
(THHM) Total Triholamethanes	N	17.56	ppb	Running annual adverage	MCL 80 ppb	By product of drinking water chlorination
Disinfection By-Product Contaminants						
(HAA5) Halo-acetic Acids	N	8.04	ppb	Running annual adverage	MCL 60 ppb	By product of drinking water chlorination



2004 DRACUT WATER SUPPLY DISTRICT
TREATED WATER QUALITY SUMMARY

SUBSTANCE	HIGHEST LEVEL DETECTED	HIGHEST LEVEL ALLOWED (EPA's MCL)*	IDEAL GOALS (EPA's MCLG)*	RANGE	VIOLATION	DATE	MAJOR SOURCES
Radium 228	2.1 pCi/L *	5 pCi/L	0 pCi/L	n.d. * to 0.7	NO	Sep-04	Erosion of natural deposits
Radium 226	0.9 pCi/L *	5 pCi/L	0 pCi/L	n.d. * to 0.9	NO	Sep-04	Erosion of natural deposits
Gross Alpha	1.1 pCi/L	15 pCi/L	0 pCi/L	n.d. * to 1.1	NO	Sep-04	Erosion of natural deposits
Fluoride	2.0	4 ppm	4 ppm	n.d. to 2.0	NO	Feb-04	Water additive which promotes strong teeth; Erosion of natural deposits; Discharge from fertilizer and aluminum factories
Copper	0 of 60 [D] 364 ppb * [F]	1,300 ppb (Action Level)	1,300 ppb	n.d. to 364	NO	Aug-04	Corrosion of household plumbing systems; Erosion of natural deposits; Leaching from wood preservatives.
Lead	0 of 60 [D] 7.7 ppb [F]	15 ppb (Action Level)	0	n.d. to 7.7	NO	Aug-04	Corrosion of household plumbing systems; Erosion of natural deposits
Nitrate	1.8 ppm [B]	10 ppm	10 ppm	n.d. to 1.8	NO	09/28/04	Runoff from fertilizer use; Leaching from septic tanks sewage; Erosion of natural deposits
Total Trihalomethanes (TTHM)	21.1 ppb [F]	80 ppb	0	6.0 to 31.0 [F]	NO	2004	By-product of drinking water chlorination
Haloacetic Acids (HAA5)	7.14 ppb [F]	60 ppb	0	n.d. to 14.7 [F]	NO	2004	By-product of drinking water chlorination
Chlorine Residual	1.2	4 ppm	4	0.35 to 1.6	NO	2004	By-product of drinking water disinfection
Chlorite	0.88 ppm	1.0 ppm	0.8 ppm	0.14 to 0.88	NO	2004	By-product of drinking water disinfection
Methyl Tertiary Butyl Ether (MtBE)	1.1 ppb	no MCL	none set	n.d. to 1.1	NO	2003	Discharge from leaking UST or gasoline spill
Sulfate	6.0 ppm	no MCL	none set	n.d. to 6.0	NO	2004	Erosion of natural sources
Chloroform	14 ppb	no MCL	none set	3.0 to 14.0	NO	2004	By-product of drinking water chlorination
Bromodichloromethane	4.8 ppb	no MCL	none set	1.0 to 4.8	NO	2004	By-product of drinking water chlorination
Chlorodibromomethane	0.7 ppb	no MCL	none set	n.d. to 0.7	NO	2004	By-product of drinking water chlorination
Sodium	35 ppm	no MCL	none set	n.d. to 35.0	NO	2004	Erosion of natural deposits; Runoff from orchards; Waste from electric and glass production.

(Listed above are 17 regulated & unregulated contaminants for which monitoring was required and detected in Dracut's drinking water. Not listed are over 100 other contaminants monitored but not detected.)

* DEFINITIONS:

Maximum Contaminant Level (MCL) - The highest level of a contaminant that is allowed in drinking water.

Maximum Contaminant Level Goal (MCLG) - The level of a contaminant in drinking water below which there is no known or expected risk to health.

ppm - One part per million.

ppb - One part per billion.

n.d. - none detected

Action Level - The concentration of a contaminant which triggers a treatment or other requirement that a water system must follow.

Treatment Technique (TT) - A required process intended to reduce the level of a contaminant in drinking water. The City is required under the Surface Water Treatment Rule to filter the source of the City's drinking water, the Merrimack River, to reduce contaminant levels such as turbidity.

NTU - Nephelometric Turbidity Unit measures the characteristic or propety of water that causes it to scatter or absorb light. This is usaully caused by very small particulate matter suspended in the water.

SPECIAL EXPLANATIONS:

[A] Results represent water pumped from Dracut Water Supply District (DWSD) wells.

[B] Results represent water purchased from City of Lowell.

[C] Turbidity is a measure of the cloudiness of the water. It is monitored because it is a good indicator of the effectiveness of the Water Treatment Plant filtration system.

[D] This is the number of sites above the action level.

[E] This is the most recent test result required by EPA Regulations.

[F] Highest Level Detected & Range are not always the same because results are averages or 90^{th} percentile.

[G] Results represent blended water from DWSD wells and City of Lowell water.

Pennichuck Water Co. Nashua-Tyngsborough Data Table 2004

NASHUA

EPA # 1621010

Inorganic Contaminants	Units	MCLG	MCL	Level Detected	Range	Sample Date	Violation Yes/No	Typical Source of Contaminant
Turbidity*	NTU	0	TT=1	0.52 NTU	n/a	4/26/2004	NO	Soil Runoff
			TT=% of samples <0.3	98.82%	n/a	April 2004	NO	

Inorganic Contaminants	Units	MCLG	MCL	Level Detected	Range	Year	Violation Yes No	Typical Source of Contaminant
Fluoride	ppm	4	4	0.2	n/a	2004	NO	Water additive which promotes strong teeth. Erosion of natural deposits

Volatile Organic Contaminants	Units	MCLG	MCL	Yearly Running Average	Range	Year	Violation Yes/No	Typical Source of Contaminant
Total Trihalomethanes (THMs)	ppb	0	80	21.7	7.5 to 39.4	2004	NO	By-product of drinking water chlorination
Haloacetic Acids	ppb	0	60	7.8	nd to 17.0	2004	NO	By-product of drinking water chlorination
Total Organic Carbon	ppm	n/a	TT	1.1	0.9 - 1.3	2004	NO	Naturally present in the environment

Volatile Organic Contaminants	Units	MRDLG	MRDL	Yearly Running Average	Range	Year	Violation Yes/No	Typical Source of Contaminant
Chlorine	ppm	4	4	0.42	0.1 to 1.34	2004	NO	Water additive used to control microbes

Inorganic Contaminants	Units	MCLG	AL	90th percentile sample value	# sites above AL	Year	Violation Yes/No	Typical Source of Contaminant
Lead	ppb	0	15	5	1	2002	NO	Corrosion of household plumbing system
Copper	ppm	1.3	1.3	0.15	0	2002	NO	Corrosion of household plumbing system

Source Assessment Information

Source Name	Date	Summary of Susceptibility Factors: Low	Med	High
Harris Pond/Penn. Brk.	5/15/02	6	3	2
Supply Pond	5/15/02	6	3	2
Merrimack River	5/15/02	2	4	5
Bon Terrain Well	1/31/01	8	1	3

The complete Assessment Report is available for inspection at Pennichuck Water Works Treatment Plant. For more information, call Gary Telley at 913-2378 or DES at 271-3303, or visit NH DES's Drinking Water Source Assessment Program web site at www.des.state.nh.us/dwspp/dwsap.htm.

Our water is purchased from the City of Lowell, water treatment facility which treats and filters the Merrimack River water and the Dracut Water Supply District which is well water from the well fields off Frost Rd. in Tyngsborough. We have over 755 services on the east and west sides of Tyngsborough. The water purchased from Dracut Water Supply is pumped at the Birchmont St. pump station and supplied to our customers; there is no storage facility at that location. The water purchased from the City of Lowell is pumped from the Pautuckett pump station across the Merrimack River to the storage tank on Oak Hill (behind Flint's Corner) and supplied to the customers on the west side.
This year we have increased our pumping capacity at the Pawtuckett station and installed an emergency generator and control system. The Pennachuck meter station was completed and will connect to the Middlesex Road water main this fall
The Tyngsborough Water District routinely monitors for constituents in your drinking water according to Federal and State laws. This table shows the results of our monitoring for the period of January 1st to December 31st 2002.
All drinking water, including bottled drinking water, may be reasonably expected to contain at least small amounts of some constituents. It's important to remember that the presence of these constituents does not necessarily pose a health risk.
Sources of drinking water **(both tap water and bottled water)** include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals, and in some cases, radioactive material. It can pick up substances resulting from the presence of animals or from human activity. Contaminants that may be present in source water include:

Microbial contaminants -such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.

Inorganic contaminants -such as salts and metals, which can be naturally-occurring or result from urban stormwater runoff, industrial, or domestic wastewater discharges, oil and gas production, mining, or farming.

Pesticides and herbicides -which may come from a variety of sources such as agricultural, urban stormwater runoff, and residential uses.

Organic chemical contaminants -including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, and septic systems.

Radioactive contaminants -which can be naturally occurring or be the result of oil and gas production and mining activities.

In order to ensure that tap water is safe to drink, the U.S. Environmental Protection Agency (EPA) prescribes regulations that limit the amount of certain contaminants in water provided by public water systems. The Food and Drug Administration (FDA) regulations establish limits for contaminants in bottled water that must provide the same protection for public health. All drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline at 800.426.4791.

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and some infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/Centers for Disease Control and Prevention (CDC) guidelines on lowering the risk of infection by *Cryptosporidium* and other microbial contaminants are available from the Safe Drinking Water Hotline at 800-426-4791

We're proud that your drinking water meets Federal and State requirements. We have learned through our monitoring and testing that some constituents have been detected. The system did have detectable levels of lead and copper in some of the homes tested. These levels reflect the copper and lead that is picked up from the plumbing system. These levels drop if the water lines in the house are flushed (run for approximately 5 minutes before use). Both the City of Lowell Water Dept. and The Dracut Water Supply District have up-graded their treatment process to control the pH, recent tests for lead and copper have been below detectable levels, both supplies contain fluoride now. Copies of the Consumer Confidence Reports from the City of Lowell and the Dracut Water Supply District will be available at the Tyngsborough Library, Town Hall and the Water District Office, for review. All sources of drinking water are subject to potential contamination by substances that are naturally occurring or man made. These substances can be microbes, inorganic or organic chemicals and radioactive substances. All drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that the water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the Environmental Protection Agency's Safe Drinking Water Hotline at 1-800-426-4791 MCL's are set at very stringent levels.

To understand the possible health effects described for many regulated constituents, a person would have to drink 2 liters of water every day at the MCL level for a lifetime to have a one-in-a-million chance of having the described health effects.

Nitrate: Nitrate in drinking water at levels above 10 ppm is a health risk for infants of less than six months of age. High nitrate levels in drinking water can cause blue baby syndrome. Nitrate levels may rise quickly for short periods of time because of rainfall or agricultural activity. If you are caring for an infant, you should ask for advice from your health care provider.
Total Coliform:Coliforms are bacteria that are naturally present in the environment and are used as an indicator that other, potentially harmful, bacteria may be present. The Total Coliform Rule requires water systems to meet a stricter limit for coliform bacteria. Coliform bacteria are usually harmless, but their presence in water can be an indication of disease-causing bacteria. When coliform bacteria are found, special follow-up tests are done to determine if harmful bacteria are present in the water supply. If this limit is exceeded, the water supplier must notify the public by newspaper, television or radio. To comply with the stricter regulation, we have increased our sampling for coliform and raised the average amount of chlorine in the distribution system.
Lead: Infants and children who drink water-containing lead in excess of the action level could experience delays in their physical or mental development. Children could show slight deficits in attention span and learning abilities. Adults who drink this water over many years could develop kidney problems or high blood pressure.
Infants and young children are typically more vulnerable to lead in drinking water than the general population. It is possible that lead levels at your home may be higher than at other homes in the community as a result of materials used in your home's plumbing. If you are concerned

about elevated lead levels in your home's water, you may wish to have your water tested and flush your tap for 30 seconds to 2 minutes before using tap water.
Additional information is available from the Safe Drinking Water Hotline (1-800-426-4791).
Lead in drinking water is rarely the sole cause of lead poisoning, but it can add to a person's total lead exposure. All potential sources of lead in the household should be identified and removed, replaced or reduced.
Copper: is an essential nutrient, but some people who drink water-containing copper in excess of the action level over a relatively short amount of time could experience gastrointestinal distress. Some people who drink water-containing copper in excess of the action level over many years could suffer liver or kidney damage.
Copper is a naturally occurring element. It is essential to humans in low concentrations but can be harmful at high doses. A deficiency of copper can lead to anemia. Acute exposure to elevated levels of copper in a normal population can result in gastrointestinal, liver, and kidney effects. Nausea and vomiting have been observed in humans exposed to drinking water containing 5.3 mg/l of copper. High concentrations of copper in water can discolor plumbing fixtures and clothing after washing. Flushing the copper water lines in your home, before use will lower the amount of copper in the water, as the water has little copper in it until it reaches your home.

In this table you will find many terms and abbreviations you might not be familiar with. To help you better understand these terms we've provided the following definitions:

Non-Detects (ND) - laboratory analysis indicates that the constituent is not present.
Parts per million (ppm) or Milligrams per liter (mg/l) - one part per million corresponds to one minute in two years or a single penny in $10,000.
Parts per billion (ppb) or Micrograms per liter - one part per billion corresponds to one minute in 2,000 years, or a single penny in $10,000,000.
Parts per trillion (ppt) or Nanograms per liter (nanograms/l) - one part per trillion corresponds to one minute in 2,000,000 years, or a single penny in $10,000,000,000.
Parts per quadrillion (ppq) or Picograms per liter (picograms/l) - one part per quadrillion corresponds to one minute in 2,000,000,000 years or one penny in $10,000,000,000,000.
Picocuries per liter (pCi/L) - picocuries per liter is a measure of the radioactivity in water.
Millirems per year (mrem/yr) - measure of radiation absorbed by the body.
Nephelometric Turbidity Unit (NTU) - nephelometric turbidity unit is a measure of the clarity of water. Turbidity in excess of 5 NTU is just noticeable to the average person.
Action Level - the concentration of a contaminant, which, if exceeded, triggers treatment or other requirements, which a water system must follow.
Maximum Contaminant Level - The "Maximum Allowed" (MCL) is the highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.
Maximum Contaminant Level Goal - The "Goal"(MCLG) is the level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety

TEST RESULTS

Contaminant	Violation Y/N	Level Detected	Unit Measurement	MCLG	MCL	Likely Source of Contamination
Microbiological Contaminants						
Total Coliform Bacteria Tyngsborough Water District	N	0		0	presence of coliform bacteria in 5% of monthly samples	Naturally present in the environment
City of Lowell	N	0		0		Naturally present in the environment
Dracut Water Supply Dist.	N	0		0		Naturally present in the environment
Nitrate						
City of Lowell	N	0.49	ppm	10.0	10.0	Run off from fertilizer use: Leaching from septic tanks, sewage: Erosion of natural deposits
Dracut Water Supply Dist.	N	2.2	ppm	10.0	10.0	Run off from fertilizer use: Leaching from septic tanks, sewage: Erosion of natural deposits
Inorganic contaminants						
	Violation	**Level detected**	**Unit**	**90 % value above action level**	**Action level**	Likely Source of Contamination
Copper Tyngsborough Water Dist.	N	0.08	ppm	90th% value 0 of 50 samples taken	AL=1.3	Corrosion of household plumbing systems; erosion of natural deposits; leaching from wood preservatives
City of Lowell	N	0.07	ppm	90th% value 0 of 50 samples taken	AL=1.3	Corrosion of household plumbing systems; erosion of natural deposits; leaching from wood preservatives
Dracut Water Supply Dist.	N	.17	ppm	90th% value 0 of 67 samples taken	AL=1.3	Corrosion of household plumbing systems; erosion of natural deposits; leaching from wood preservatives
Lead Tyngsborough Water Dist.	N	0-.004	ppb	90th% value 0.004 =1 of 50 samples taken	AL=15	Corrosion of household plumbing systems, erosion of natural deposits
City of Lowell	N	0-6.30	ppb	90th%value 6.30 =2 of 50 samples taken	Al=15	Corrosion of household plumbing systems, erosion of natural deposits
Dracut Water Supply Dist.	N	0-12.0	ppb	90th% value 12.0 =1 of 67 samples taken	AL=15	Corrosion of household plumbing systems, erosion of natural deposits

Thank you, for allowing us to continue providing your family with clean, quality water this year. In order to maintain a safe and dependable water supply we sometimes need to make improvements that will benefit all of our customers. These improvements are sometimes reflected as rate increases; as of this date our water rate has remained the same for over 17 years while our suppliers have raised theirs, we have maintained our rate through tight fiscal management, conservation, proper system development and improvements.
Our operators and staff are licensed and attend numerous training sessions to guarantee compliance with the current State and Federal Regulations. Ensuring your health, safety and satisfaction is our mandate.
Please call our office if you have questions or concerns. We ask that all our customers help us protect and conserve our water resources, which are the heart of our community, our way of life and our children's future. People waste water all too often because they assume that their water supply is virtually limitless. Natural resources can be conserved only when they are fully understood and appreciated. Water conservation has to begin in the home and only **YOU** can make that happen. We at The Tyngsborough Water District sincerely hope that you will make every effort to make water conservation a way of life.

Note:

No water restriction is in effect for the month of June; we may institute water **restriction** on outdoor water use to between the hours of 7PM to7AM for the months of July, August and September
We will advertise any water restrictions on the Comcast local access channel and the Neighbor to Neighbor Newsletter
Please adjust your timers, also note that rain sensors are required as well as backflow preventers and plumbing permits for all lawn irrigation systems.

Water Facts:

Our water rate is $3.25 per 750 gallons of water or $0.004 per gallon
One gallon of water costs $0.004, a gallon of milk costs $2.25,
and a gallon of soda would cost $1.29
Water is still an excellent value for the product delivered to your tap.
A 5/8" garden hose delivers about 1000 gallons in one hour,
A ¾" garden hose delivers about 1900 gallons in one hour,
The average home uses approximately 65 gallons of water per person, for inside use per day
75% of a home's total water use during the summer is for outdoor use
The average home uses approximately 150 gallons of water per person, for outside use per day
A small leak in a water line 1/32" in diameter, at 40 PSI would waste 6000 gallons per month
A single dripping faucet can waste 75-1000 gallons of water per week
A normal automatic lawn sprinkler system uses 600 gallons per head per hour of use
Our average daily use of water increases by more than 70% for the summer months

Water conservation tips:

Repair leaking faucets, pipes and toilets, Install water saving devices in faucets and toilets
Wash only full loads of laundry and dishes, Take shorter showers, install water saving shower heads
When washing hands, shaving and brushing teeth, use only as much water as needed
Use mulch around plants and shrubs to retain moisture, Minimize the size of your lawn.
Use water in a bucket to wash your vehicle, use the hose only to rinse off.

Tyngsborough Water District Water Conservation By-law

Section 1 Authority

This by-law is adopted by the Tyngsborough Water District under its police powers pursuant to the Home Rule Amendment of the Massachusetts Constitution, Article LXXXIX, to protect public health and welfare and its powers pursuant to M.G.L. c.40, §§21 et seq. and implements the District's authority to regulate water use pursuant to M.G.L. c. 41, §69B. This by-law also implements the District's authority under M.G.L. c. 40, §41A, conditioned upon a declaration of water supply emergency issued by the Department of Environmental Protection.

Section 2 Purpose

The purpose of this by-law is to protect, preserve and maintain the public health, safety and welfare whenever there is in force a State of Water Supply Conservation or State of Water Supply Emergency by providing for enforcement of any duly imposed restrictions, requirements, provisions or conditions imposed by the District or by the Department of Environmental Protection.

Section 3 Definitions

Agriculture shall mean farming in all its branches and agriculture, as defined at M.G.L. c. 128, § 1A.

Outdoor watering shall mean any residential, municipal, industrial, or commercial watering of decorative lawns, trees or shrubbery.

Person shall mean any individual, corporation trust, partnership, association, agency or authority, or other entity and any officer, employee, group or agent of such persons.

State of Water Supply Emergency shall mean a State of Water Supply Emergency declared by the Department of Environmental Protection under M.G.L. c.21G, §15-17.

State of Water Supply Conservation shall mean a State of Water Supply Conservation declared by the District pursuant to Section 4 of this by-law.

Water Users or Water Consumers shall mean all persons using water from the District's public water source irrespective of that person's responsibility for billing purposes for use of the water.

Section 4 Declaration of a State of Water Supply Conservation

The District, through its Board of Water Commissioners authorized to act as such, may declare a State of Water Supply Conservation upon a determination by a majority vote of the Board that a shortage of water exists of such a degree that conservation measures are appropriate to ensure an adequate supply of water to all water consumers. Public notice of a State of Water Conservation shall be given under Section 6 of this by-law before it may be enforced.

Section 5 Restricted Water Uses

A declaration of a State of Water Supply Conservation shall include one or more of the following restrictions, conditions, or requirements limiting the use of water as necessary to protect the water supply except as provided in Section 11. The applicable restrictions, conditions or requirements shall be included in the public notice required under section 6.

a) Lawn sprinkler systems must have rain sensors, proper backflow prevention devices, plumbing permits, and timers set to comply with the outdoor water restrictions in effect.

Level #1	no restriction
Level #2	outdoor water use between the hours of 7PM to 7AM
Level #3	outdoor water use between the hours of 7PM to 7AM + odd / even day use restriction
Level#4	NO outdoor water use

b) <u>Outdoor Watering Method Restriction</u>: Outdoor watering is restricted to bucket, can or hand held hose watering with automatic shutoff nozzle.

c) <u>Outdoor Watering Ban</u>: Outdoor watering is prohibited.

d) Outdoor Watering Hours: Outdoor watering is permitted only during daily periods of low demand, to be specified in the declaration of a State of Water Supply Conservation and public notice thereof.

e) Swimming Pools: Filling and topping off of swimming pools is prohibited.

f) Automatic Sprinkler Use: The use of automatic sprinkler systems is prohibited.

g) Car washing: Car or vehicle washing is prohibited.

Section 6 Public Notification of a State of Water Supply Conservation and State of Water Supply Emergency; Notification of the Department of Environmental Protection

Notification of any provision, including any restriction, requirement or condition imposed by the District as part of a State of Water Supply Conservation shall be published in a newspaper of general circulation within the District, or by such other means reasonably calculated to reach and inform all users of water of the State of Water Supply Conservation. Notification of a State of Water Supply Emergency declared by the Department shall be provided by furnishing a copy of the Notice to radio and television stations serving the area served by the public water system as soon as possible, but no later than 48 hours after the public water system receives notice of the Department's declaration. Any restriction imposed under section 5 or in the Department declaration of emergency or Order shall not be effective until such notification is provided. Notification of the State of Water Supply Conservation shall also be provided to the Massachusetts Department of Environmental Protection at the same time that notification is given.

Section 7 Termination of a State of Water Supply Conservation; Notice

A State of Water Supply Conservation may be terminated by a majority vote of the Board of Water Commissioners upon a determination that the water supply shortage no longer exists. Public notification of the termination of a State of Water Supply Conservation shall be given in the same manner as is required for notice of the Districts's declaration of its State of Water Supply Conservation.

Section 8 State of Water Supply Emergency; Compliance with DEP Orders

Upon notification to the public that a declaration of a State of Water Supply Emergency has been issued by the Department of Environmental Protection, no person shall violate any provision, restriction, requirement, condition of any order approved or issued by the Department for the purpose of bringing about an end to the State of Water Supply Emergency. The notice prescribed by this section shall be in writing and shall be published once in a newspaper of general circulation within the town where it is to be effective. Such notice shall summarize the provisions of the Declaration of Water Supply Emergency and the requirements and conditions thereof. Notice as prescribed by this section shall be sufficient for enforcement of the requirements of such Declaration on and after the date following newspaper publication.

Section 9 Penalties

The District, through its Water Commissioner, water superintendent, building inspector or local police may enforce this by-law. Any person violating this by-law shall be liable to the District in the amount of $ 25.00 for the first violation and $100.00 for each subsequent violation. Fines shall be recovered by indictment, or on complaint before the District Court, or by non-criminal disposition in accordance with section 21D of chapter 40 of the general laws.

Section 10 Severability

The invalidity of any portion or provision of this by-law shall not invalidate any other portion or provision thereof.

Section 11 Exemptions

The water use restrictions adopted under this by-law shall not apply to the specific uses outlined below.

a. Commercial agriculture;
b. Water to sustain animal life;
c. Swimming pools used as a primary means of exercise, therapy or rehabilitation located at a medical or rehabilitation facility;
d. Commercial car or vehicle washing facilities;

TYNGSBOROUGH WATER DISTRICT

THE TYNGSBOROUGH WATER DISTRICT IS REQUESTING A VOLUNTARY RESTRICTION ON OUTDOOR WATER USE. PLEASE ONLY WATER WHEN NEEDED. WATER IN EARLY MORNING OR AT NIGHT, 7PM-7AM. ADJUST YOUR SPRINKLER HEADS TO WATER THE LAWN AND NOT THE STREET.

IF VOLUNTARY COMPLIANCE DOES NOT LOWER WATER USE, A MANDATORY WATER BAN WILL BE INSTITUTED. TO ENSURE ADEQUATE PRESSURE AND FIRE PROTECTION, OUR STORAGE TANK MUST BE ¾ FULL. IF THIS CANNOT BE MAINTAINED MORE RESTRICTIVE HOURS WILL BE ESTABLISHED.

THE DISTRICT REQUIRES ALL AUTOMATIC SPRINKLER SYSTEMS HAVE RAIN SENSORS, BACKFLOW DEVICES AND PLUMBING PERMITS. THEY MUST ALSO HAVE TIMERS IN COMPLIANCE WITH NOTED HOURS. 7PM-7AM.

2-13-02

This New Year started with a notice from the Massachusetts Department of Environment with a warning of a drought for the state this spring and summer. Rain and snow have been well below normal, at present many shallow wells are going dry. We are asking our water users to conserve water. The District will be enforcing a **mandatory outdoor water** ban to ensure that adequate pressure and fire protection is available to all. The ban will start May 1-2002 and continue until October 31, 2002, outdoor watering will only be allowed from 7PM until 7AM. With your help further more restrictive hours will not have to be established to maintain adequate pressure and storage in the system.
The District requires that all automatic sprinkler systems have rain sensors, backflow devices, and plumbing permits. They must have timers in compliance with the noted hours of 7PM to 7AM

Thank you for your cooperation.
For more information call our office at 978-649-4577

Tyngsborough Water District

Fees adopted 5/30/02, amended 11/1/2005

Domestic water connections

Size	capacity ratio	fee	Meter Costs:	Total
1"	1.0	$4,188.00	$327.00	$ 4,515.00
1.5"	3.1	$12,983.00	$689.00	$13,787.00
2"	6.2	$25,966.00	$729.00	$26,814.00
3"	17	$71,196.00		
4"	38	$159,144.00		
6"	113	$473,244.00		

Water meter costs will be determined at the time of application to reflect current meter price.

Fire sprinkler line connections

3"	$5,365.00
4"	$6,600.00
6"	$8,250.00
8"	$11,550.00
10"	$16,500.00
12"	$23,100.00

In some locations a separate fee may also be due to the original installer of the water main in the street, some areas are: Swan Rd., Upper Westford Rd., Red gate Rd., Middlesex Rd., and a portion of Dunstable Rd.

A plumbing permit is necessary, a backflow preventer- dual check valve (Watts #7), pressure reducing valve (Watts UB-5) and thermal expansion tank must be installed on all **domestic water services to residences.**
Commercial connections will require testable backflow prevention devices, (Watts 909,009,709,007), pressure reducing valve, and thermal expansion tank.
Note: before any testable device is installed a plumbing permit and a completed DEP design data application (permit) must be obtained.
Backflow prevention device installation permits are $100.00 device
Commercial, Industrial, Multi-Unit and Multi – Family Dwellings will be assessed $4,188.00 per unit or the meter size; which ever is the greater amount
Main line extensions will be charged for all water used for filling, flushing and testing.
Inspections are $30.00 / Hr. **No work is to be covered without an inspection, all valves are to be operated by District personnel only**
Backflow prevention device tests are $50.00 each
Service to: repair–replace meters, turn on water, shut off water, will be $30.00 Hr.,
Final meter reads are $30.00
Water theft fine $1,000.00 per offense (each day is a separate offence)
Lawn sprinkler systems must have rain sensors, proper backflow prevention devices, plumbing permits, and timers set to comply with the outdoor water restrictions in effect.

Level #1	no restriction
Level #2	outdoor water use between the hours of 7PM to 7AM
Level #3	outdoor water use between the hours of 7PM to 7AM + odd / even day use restriction
Level#4	NO outdoor water use

6 THINGS YOU CAN DO TO SAVE WATER IN THE KITCHEN AND LAUNDRY

1 **Use your automatic dishwasher only for full loads.**

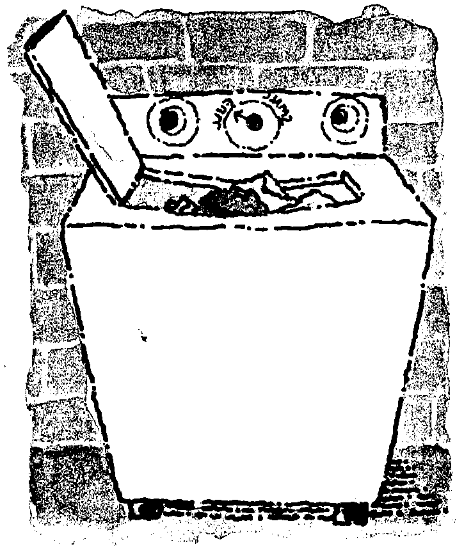
2 **Use your automatic washing machine only for full loads.**

3 **If you wash dishes by hand, don't leave the water running for rinsing.** If you have two sinks, fill one with soapy water and one with rinse water. If you have only one sink, gather washed dishes in a dish rack and rinse them with a spray device or a panful of hot water.

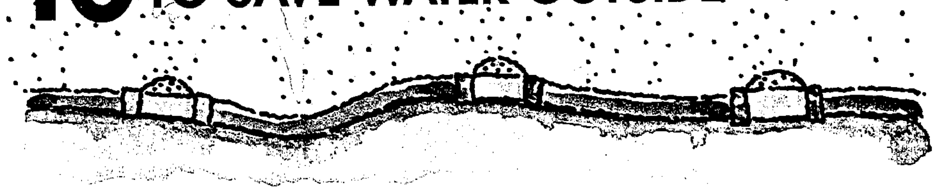
4 **Don't let the faucet run while you clean vegetables.** Just rinse them in a stoppered sink or a pan of clean water.

5 **Keep a bottle of drinking water in the refrigerator.** Running tap water to cool it off for drinking water is wasteful.

6 **Check faucets and pipes for leaks.** Leaks waste water 24 hours a day, seven days a week and often can be repaired with only an inexpensive washer.



10 THINGS YOU CAN DO TO SAVE WATER OUTSIDE



1 **Water your lawn only when it needs it.** A good way to see if your lawn needs watering is to step on the grass. If it springs back up when you move, it doesn't need water. If it stays flat, fetch the sprinkler.

2 **Deep-soak your lawn.** When you do water, do it long enough for the moisture to soak down to the roots where it will do the most good. A light sprinkling can evaporate quickly and tends to encourage shallow root systems.

3 **Water during the cool parts of the day.** Early morning generally is better than dusk since it helps prevent growth of fungus.

4 **Don't water the gutter.** Position your sprinklers so water lands on the lawn or garden, not on paved areas. Also avoid watering on windy days.

5 **Plant drought-resistant trees and plants.** Many beautiful trees and plants thrive with far less watering than other species.

6 **Put a layer of mulch around trees and plants.** Mulch will slow evaporation of moisture and discourage weed growth, too.

7 **Use a broom, not a hose, to clean driveways and sidewalks.**

8 **Don't run the hose while washing your car.** Clean the car with a pail of soapy water. Use the hose just to rinse it off.

9 **Tell your children not to play with the hose and sprinklers.**

10 **Check for leaks in pipes, hoses, faucets, and couplings.** Leaks outside the house may not seem as bad since they're not as visible. But they can be just as wasteful as leaks inside. Check frequently and keep them drip-free.

United States Environmental Protection Agency
Office of Water (4204)
EPA832-F-99-082
April 2000
www.epa.gov/owm/genwave.htm

EPA

Using Water Efficiently: Ideas for Residences

Efficient water use can have major environmental, public health, and economic benefits by helping to improve water quality, maintain aquatic ecosystems, and protect drinking water resources. Efficient use of water, through behavioral, operational, or equipment changes, if practiced broadly can help mitigate the effects of drought. Efficiency measures can also save the homeowner money on their water and energy bills. This list of measures is not meant to be comprehensive, but rather a starting point. Other sources of information on water efficiency are available through EPA's web site (http://www.epa.gov/OWM/genwave.htm), and innumerable other sources, some of which may be accessed through the EPA web site, or through WaterWiser, The Water Efficiency Clearinghouse (http://www.waterwiser.org).

Bathroom — where over half of all water use inside a house takes place:

- Do not let the water run while shaving or brushing teeth.
- Take short showers instead of tub baths. Turn off the water while soaping or shampooing.
- If you must use a tub, close the drain before turning on the water and fill the tub only half full. Bathe small children together.
- Never use your toilet as a waste basket.

Kitchen and Laundry — simple practices that save a lot of water:

- Keep drinking water in the refrigerator instead of letting the faucet run until the water is cool.
- Wash fruits and vegetables in a basin. Use a vegetable brush.
- Do not use water to defrost frozen foods; thaw in the refrigerator overnight.
- Scrape, rather than rinse, dishes before loading into the dishwasher; wash only full loads.
- Add food wastes to your compost pile instead of using the garbage disposal.
- Wash only full loads of laundry or use the appropriate water level or load size selection on the washing machine.

Equipment — homes with high-efficiency plumbing fixtures and appliances save about 30% of indoor water use and yield substantial savings on water, sewer, and energy bills:

- Consider purchasing high-efficiency toilets, or place a plastic container filled with water in the tank of your conventional toilet. Be sure it does not interfere with operation of the toilet's flush mechanisms.
- Install low-flow faucet aerators and showerheads.
- Consider purchasing a high efficiency washing machine which can save over 50% in laundry water and energy use.
- Repair all leaks. A leaky toilet can waste 200 gallons per day. To detect leaks in the toilet, add food coloring to the tank water. If the colored water appears in the bowl, the toilet is leaking. Toilet repair advice is available at <www.toiletology.com/index.shtml>.

Landscape Irrigation — depending on climate, up to 75% of a home's total water use during the growing season is for outdoor purposes (During drought conditions outdoor watering restrictions may be imposed, so some of the following tips will not apply.):

- Detect and repair all leaks in irrigation system.
- Use properly treated wastewater for irrigation where available.
- Water the lawn or garden during the coolest part of the day (early morning is best). Do not water on windy days.
- Water trees and shrubs, which have deep root systems, longer and less frequently than shallow-rooted plants that require smaller amounts of water more often. Check with the local extension service for advice on watering needs in your area.
- Set sprinklers to water the lawn or garden only – not the street or sidewalk.
- Use soaker hoses or trickle irrigation systems for trees and shrubs.
- Install moisture sensors on sprinkler systems.
- Use mulch around shrubs and garden plants to reduce evaporation from the soil surface and cut down on weed growth.
- Remove thatch and aerate turf to encourage movement of water to the root zone.
- Raise your lawn mower cutting height – longer grass blades help shade each other, reduce evaporation, and inhibit weed growth.
- Minimize or eliminate fertilizing, which promotes new growth needing additional watering.
- When outdoor use of city or well water is restricted during a drought, use the water from the air conditioning condenser, dehumidifier, bath, or sink on plants or the garden. Don't use water that contains bleach, automatic-dishwashing detergent or fabric softener.

Other Outdoor Uses:

- Sweep driveways, sidewalks and steps rather than hosing off.
- Wash the car with water from a bucket, or consider using a commercial car wash that recycles water.
- When using a hose, control the flow with an automatic shut-off nozzle.
- Avoid purchasing recreational water toys which require a constant stream of water.
- Consider purchasing a new water-saving swimming pool filter.
- Use a pool cover to reduce evaporation when pool is not being used.
- Do not install or use ornamental water features unless they recycle the water. Use signs to show the public that water is recycled. Do not operate during a drought.

Tyngsborough Water District
PO Box 305
Tyngsboro, MA 01879
Tel # 978-649-4577
PWS ID # 2301000

Your efforts in conserving our groundwater resources are critical for the success of this program.

The Department of Environmental Protection, Massachusetts' regulatory agency, requires all water utilities to institute a Water Management Program, which encourages conservation and increases public awareness in the responsible use of our groundwater resources. The Districts must demonstrate and report the success of your efforts as a water-wise consumer. Full compliance is mandatory and all automatic sprinkler systems are required to have rain sensors, backflow devices, plumbing permits and be set in compliance with our program hours.

Chelmsford Water District
20 Watershed Lane
Chelmsford, MA 01824-4884

Chelmsford Water District
20 Watershed Lane
Chelmsford, MA 01824-4884

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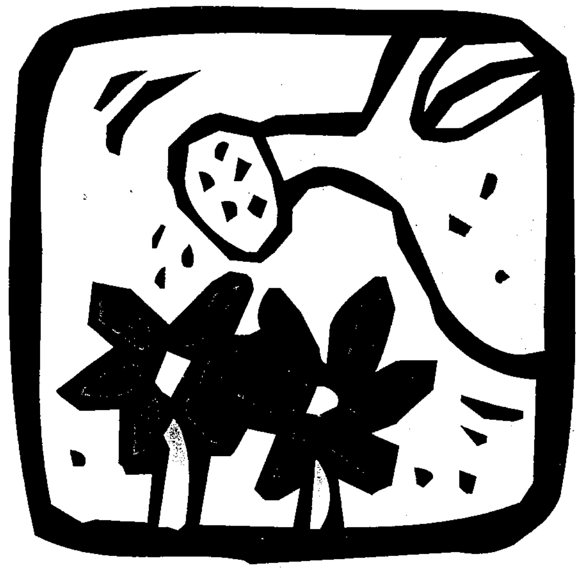
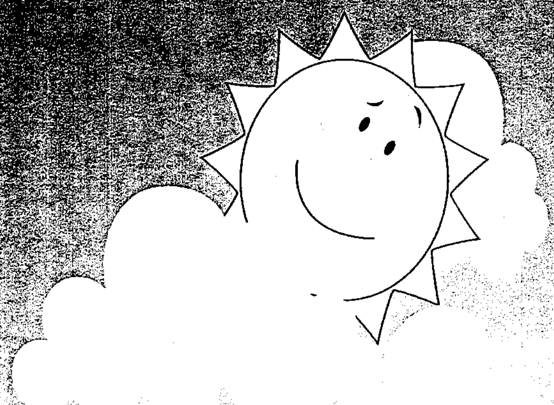
Summer Water Management Program

May 15th through September 15th



Chelmsford Water District
20 Watershed Lane
Chelmsford, MA 01824-4884



Water Districts of Chelmsford Summer Water Management Program

May 15th through September 15th

LEVEL 1:
6AM - 9AM **or** 6PM - 9PM

Odd numbered addresses on odd numbered calendar days and even numbered addresses on even numbered days are allowed to use automatic sprinkler systems and non-automatic sprinkler systems during these times only.

Watering with hand-held hoses and watering cans for small flower and vegetable gardens is allowed from 6AM to 9PM on your designated day using the odd/even model.

Levels in effect will be posted through the Districts and in the local media. The signs will show the level number in the following colors:

Level 1:
Level 2: YELLOW
Level 3: RED

LEVEL 2:
6PM - 9PM

Odd numbered addresses on odd numbered calendar days and even numbered addresses on even numbered days are allowed to use automatic sprinkler systems and non-automatic sprinkler systems during these times only.

Watering with hand-held hoses and watering cans for small flower and vegetable gardens is allowed from 6AM to 9PM on your designated day using the odd/even model.

Why Do We Need Levels?

To ensure adequate pressure and fire protection, storage tanks must be 3/4 full. If this amount cannot be replenished during non-watering times more restrictive hours must be established by going up a level.

You can also find out which level is in effect in your district by calling our offices at :

North Chelmsford Water District	**251-3931**
East Chelmsford Water District	**453-0121**
Chelmsford Water District	**256-2931** **256-2381**

- *Watch for water-wise tips for your landscaping needs in your bills and in the local media!*
- *Consult local nurseries and irrigation service providers for advise on water-wise landscaping maintenance.*
- *Our personnel are ready to address your concerns.*

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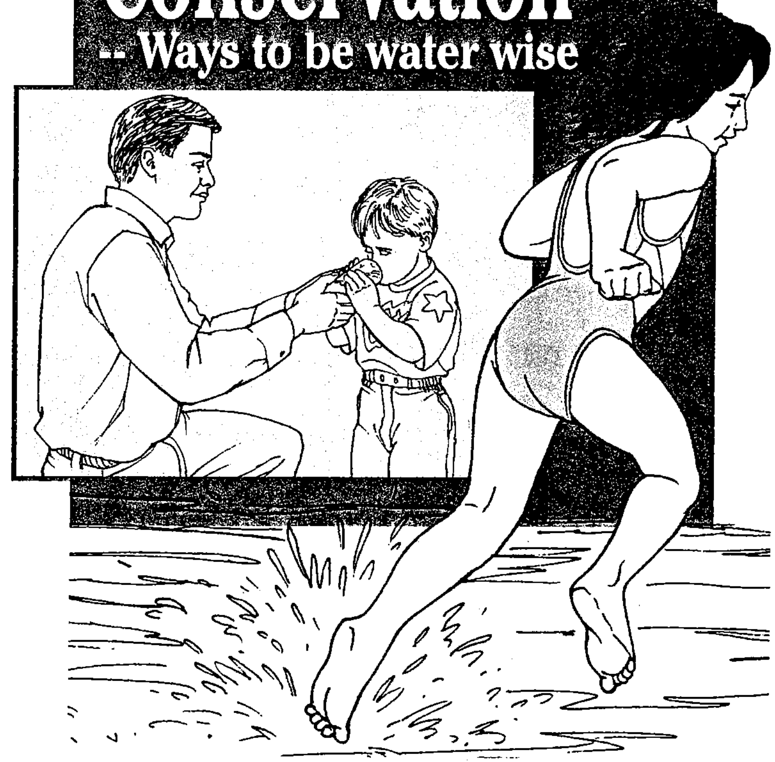
Water Conservation

-- Ways to be water wise



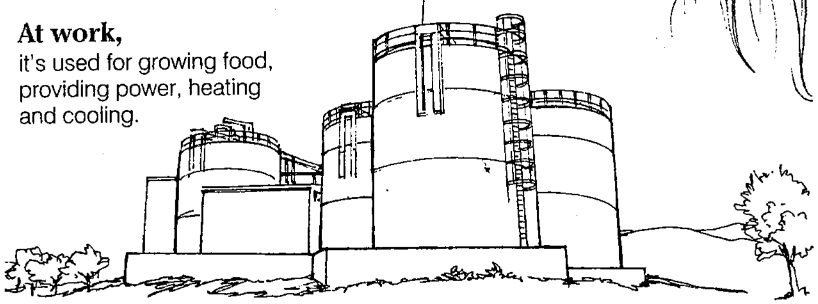
DRACUT WATER SUPPLY
59 Hopkins Street
Dracut, MA 01826
Office (978) 957-0441
Fax (978) 957-2073

Water -- it's the liquid we need to live!

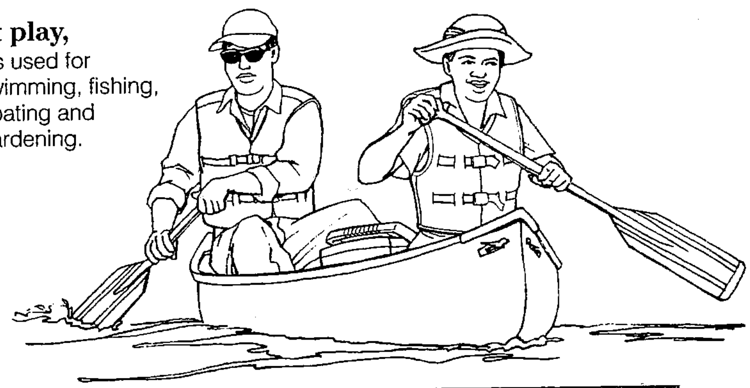
Water is vital to each of us every day. For example:

At home,
it's used for drinking, bathing, cooking and cleaning.

At work,
it's used for growing food, providing power, heating and cooling.



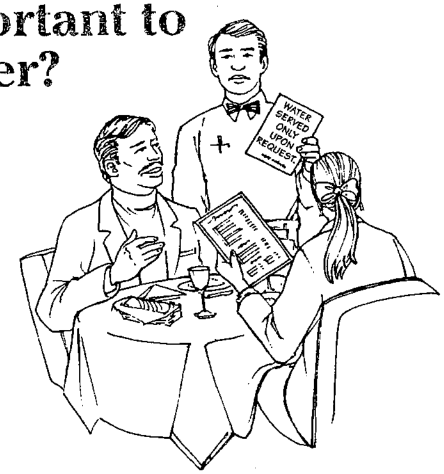
At play,
it's used for swimming, fishing, boating and gardening.



But water is a limited resource!

Price List A
2000 Edition

Why is it important to conserve water?



Because increasing demand for water has already led to shortages in many communities.

Water conservation has many benefits.
When you conserve water, you also:

- save money
- save energy
- help protect the environment.

Learn how to conserve water.
It may be the only way to avoid severe shortages in the future!

Conserving water is easy once you know how!

There are 3 basic ways to conserve water.

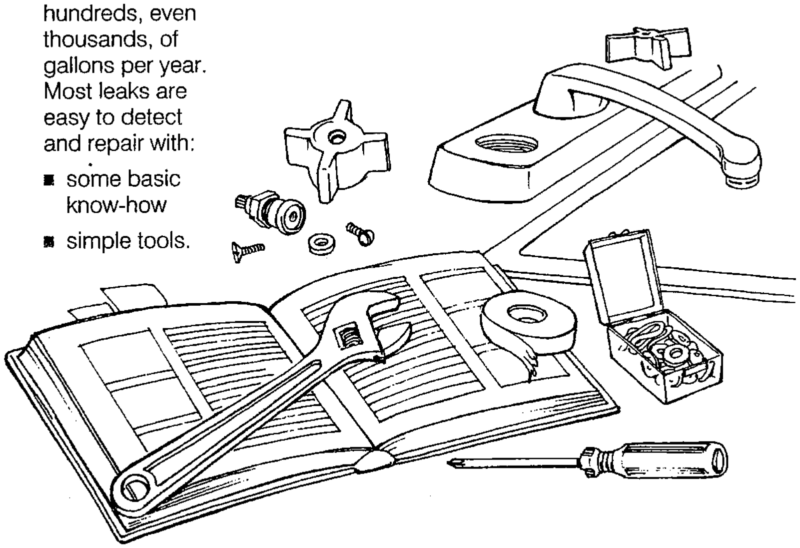
1. Economize.

A lot of water goes needlessly down the drain. This might have been OK when water was plentiful -- but not anymore! Think about the amount of water you're using, and look for ways to use less whenever you can.

2. Repair leaks.

A single dripping faucet can waste hundreds, even thousands, of gallons per year. Most leaks are easy to detect and repair with:

- some basic know-how
- simple tools.

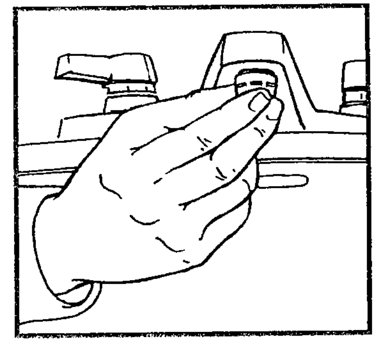


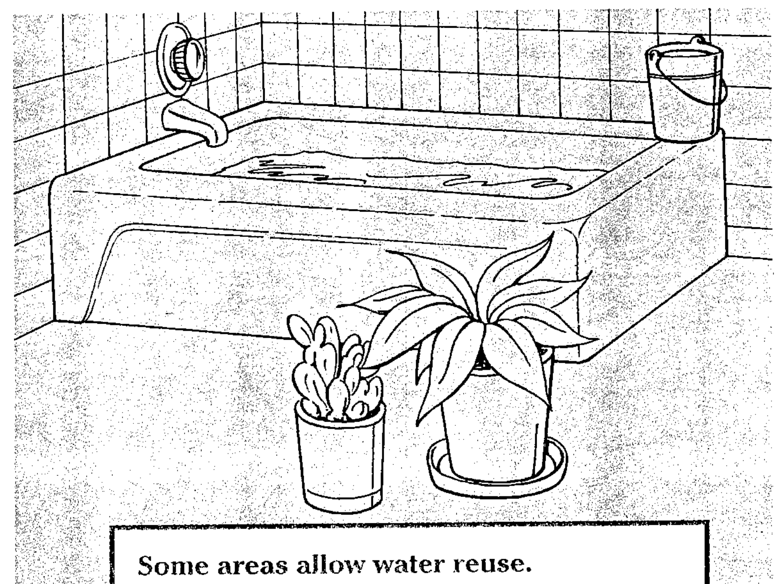
3. Install water-saving devices.

If you don't already have water-efficient or low-flow fixtures, you can cut your water use with:

- aerators (to mix air with water)
- displacement devices (to reduce the amount of water used in older toilets).

Make sure devices are installed properly.





Some areas allow water reuse.
Used water may be suitable for some purposes, even with no treatment or filtration. (Be sure to comply with all local laws and regulations regarding water reuse.)

Conserve water in the bathroom.

This is where most household water is used -- so it's where you can save the most.

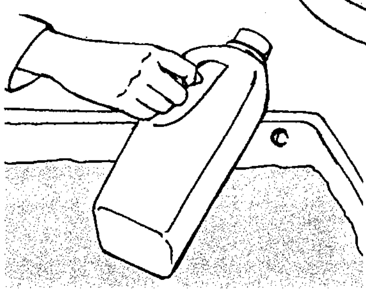
Conserve water in the toilet:

Economize.

Flush only when necessary. Don't use it to dispose of waste, disposable diapers, etc. Consider installing a low-flow toilet.

Repair leaks.

Add food coloring to tank water and check bowl in 15 minutes. (Don't flush.) Color in bowl probably means there's a leak.

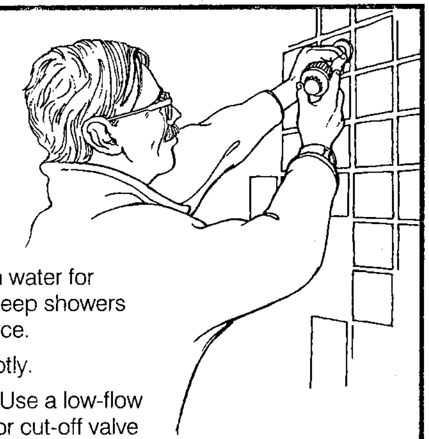


Install a displacement device.

Buy or make a displacement device, such as a toilet dam or weighted plastic jug full of water. Be sure it doesn't interfere with operating parts. Do not use a brick -- it may break apart and cause problems.

Conserve water in the sink:

- Plug the drain when you wash or shave. Don't run water when you brush your teeth.
- Repair leaks. Fix drips promptly.
- Install water-saving devices. Try a faucet aerator to reduce the amount of water used.



Conserve water in the tub or shower:

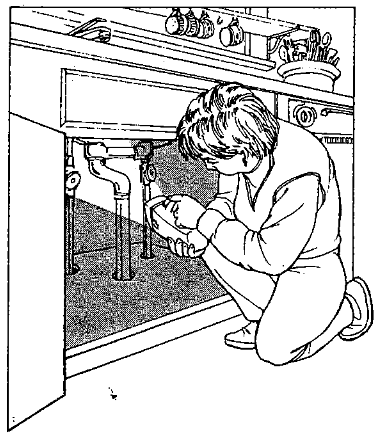
- Plug the drain before you run water for baths. Take shallow baths. Keep showers short with pressure at low force.
- Repair leaks. Fix drips promptly.
- Install water-saving devices. Use a low-flow shower head, flow restrictor or cut-off valve (lets you shut off water at shower head while soaping and shampooing, without changing the faucet setting).

Conserve water in the kitchen.

The kitchen is an excellent place for conservation.

Sink

- Check faucets and pipes for leaks. Replace washers, and repair or replace fixtures, if necessary.
- Install an aerator or flow restrictor in the faucet.

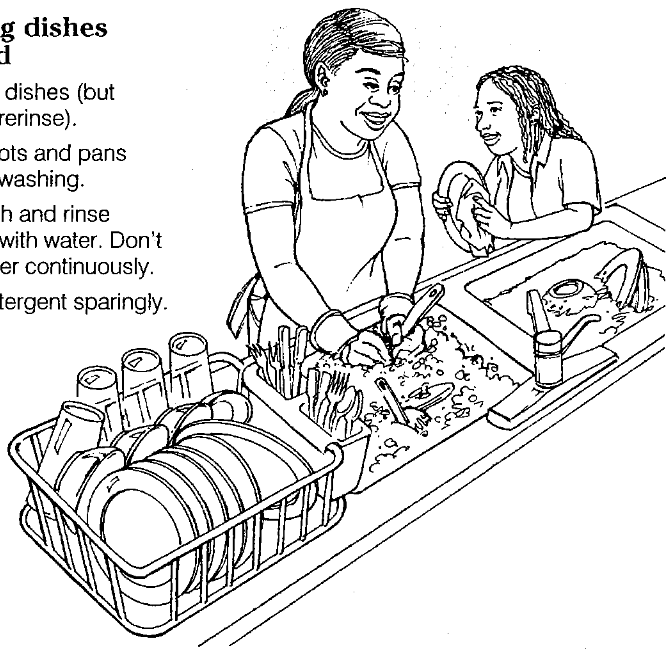


Garbage disposal

Use your sink disposal sparingly. Better yet -- compost garbage.

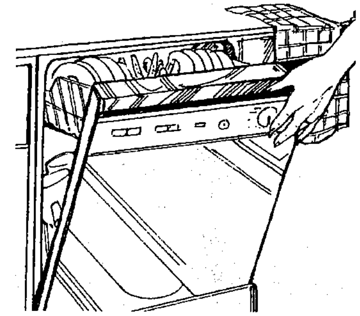
Washing dishes by hand

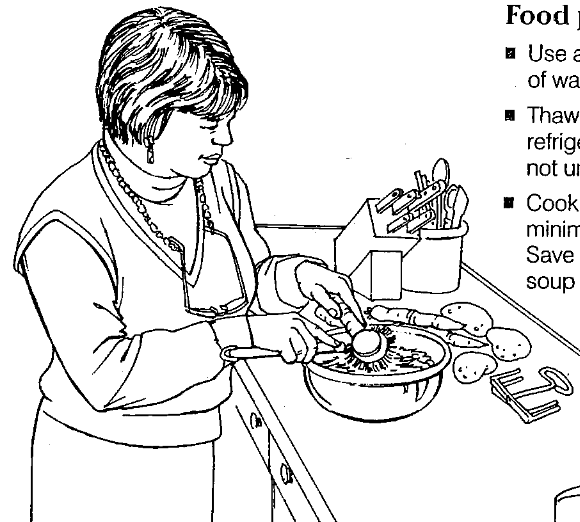
- Scrape dishes (but don't prerinse).
- Soak pots and pans before washing.
- Fill wash and rinse basins with water. Don't run water continuously.
- Use detergent sparingly.



Dishwasher

- Only do full loads and avoid extra cycles. Choose a water-saving model.
- Inspect all connections to make sure they're tight. Repair any leaks.



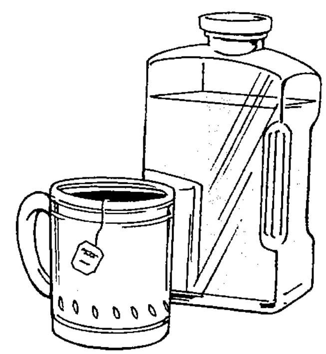


Food preparation

- Use a brush and bowl full of water to clean food.
- Thaw frozen food in your refrigerator or microwave, not under running water.
- Cook vegetables with a minimum amount of water. Save cooking water for soup stock.

Drinking

- Store water in the refrigerator instead of cooling water by running the tap.
- Make only the amount of coffee, tea, etc., you need.



Conserve water in the laundry.

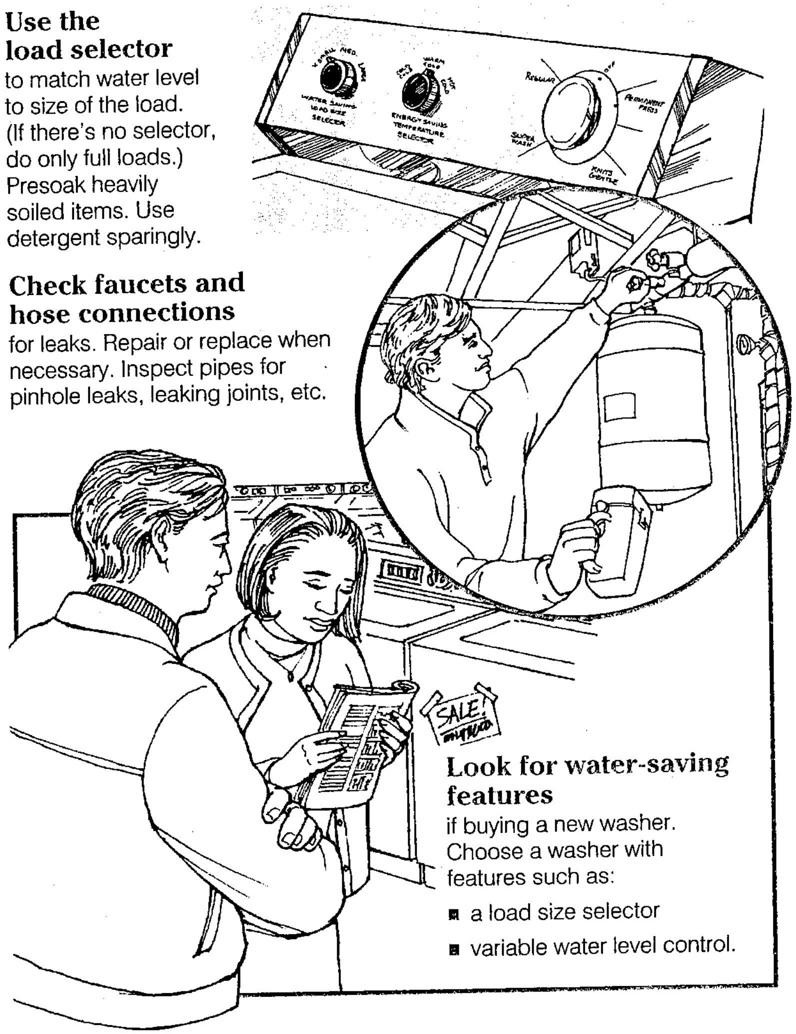
A lot of household water is used to wash clothes. So even small investments of time and money can really pay off!

Use the load selector

to match water level to size of the load. (If there's no selector, do only full loads.) Presoak heavily soiled items. Use detergent sparingly.

Check faucets and hose connections

for leaks. Repair or replace when necessary. Inspect pipes for pinhole leaks, leaking joints, etc.



Look for water-saving features

if buying a new washer. Choose a washer with features such as:

- a load size selector
- variable water level control.

Conserve water for household cleaning.

Regular cleaning

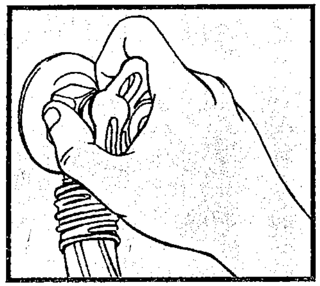
Use a pail or basin instead of running water. Use a sponge mop instead of a string mop (it uses less water for mopping and takes less water to keep clean).

Heavy cleaning

Presoak grills, oven parts, etc., overnight. Wash with an abrasive brush or pad, and use plenty of elbow grease to minimize water use!

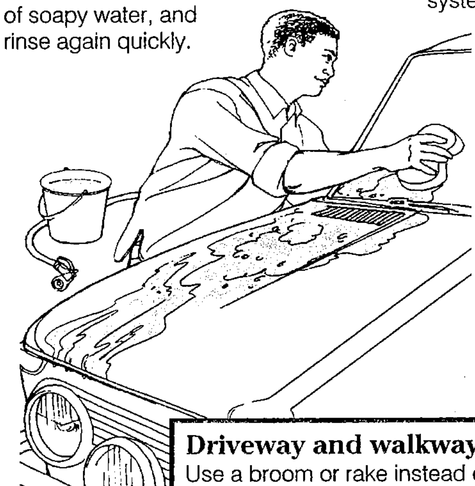
Conserve water outside the home.

Be as efficient outdoors as you are inside the home.



Car

Rinse your car once, wash from a bucket of soapy water, and rinse again quickly.

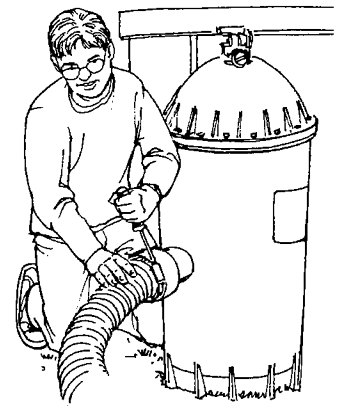


Hoses and irrigation systems

- Use a hose nozzle that you can shut off or adjust to fine spray. When finished, shut off at the house to avoid leaks.
- Consider an automatic sprinkler or a drip irrigation system.
- Check hoses and connectors -- repair or replace any leaky parts or sections.
- Keep irrigation systems running efficiently. Repair, replace or adjust sprinkler heads. Check the system for leaks.

Driveway and walkways

Use a broom or rake instead of water to remove leaves, clippings and debris.



Pool

- Keep the level low to minimize splashing. Use a cover to slow evaporation (keeps water cleaner, too).
- Check walls, filtration systems and inlets. Repair when needed.

Lawn and garden

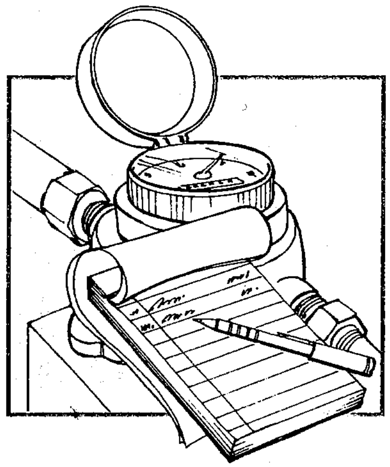
- Water slowly and thoroughly during cool, windless hours. Water as little as possible.
- Let grass grow taller in hot weather. Use mulch in the garden and around shrubs to save moisture.
- Plant native and other shrubs that don't need a lot of water. Consider alternatives to big, thirsty lawns.

Check your water system for leaks.

1. **Locate the water meter.***
   It may be in the basement, or wherever the water line enters your home.

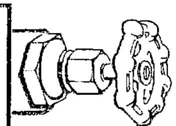
2. **Read the meter twice.**
   Read it first at night, after the day's water use has ended -- and again in the morning, before any water is used.

3. **Find the difference.**
   Subtract the first from the second reading to tell how much water (if any) leaked out overnight.



Repair leaks at once!

Check shut-off valves regularly.
Repair or replace, as needed. Shut-off valves simplify repairs and save water in emergencies.



Thinking about remodeling?
Ask about water recycling systems and water-saving fixtures. Insulate hot water pipes.

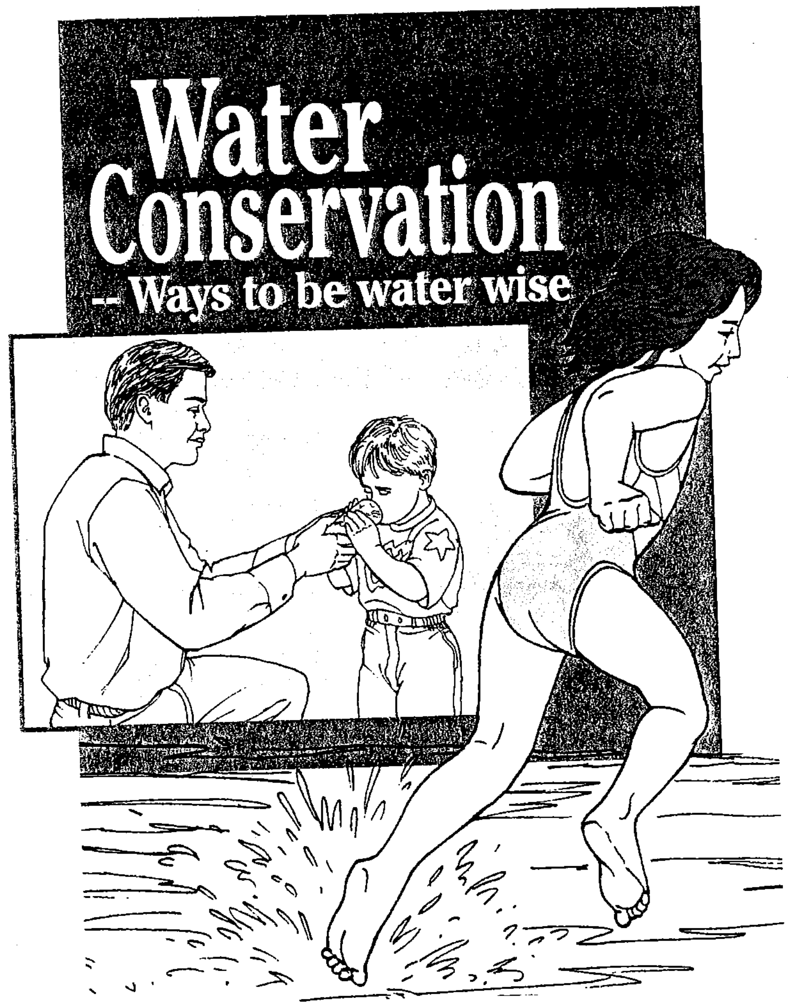
*Check with city officials if you can't find your meter.

You can conserve water every day -- in many ways!

Check with your local water agency for advice and information about water-saving programs.
And remember to:

- **Change wasteful habits.**
- **Repair leaks promptly.**
- **Use water-saving devices.**
- **Join a local organization that's working to conserve water.**

If everyone saves a little, we can all save a lot!



DRACUT WATER SUPPLY
59 Hopkins Street
Dracut, MA 01826
Office (978) 957-0441
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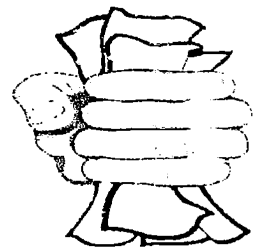
HAVE A HEALTHY LAWN AND SAVE



GOOD SOIL PREPARATION - is essential. Use 4-6" of good quality topsoil and add compost to provide nutrients and improve the soil texture. The ideal texture is loamy.

USE DROUGHT RESISTANT GRASSES - which will tolerate long periods of dry weather. For existing lawns these can be seeded in during regular spring maintenance. These grasses include: fescues, Indiangrass, big bluestem, little bluestem, Canada bluegrass, timothy and some varieties of Kentucky bluegrass.

DO NOT CUT LAWNS SO SHORT - two inches is too short. The minimum cut should be 3-3.5 inches. Make sure your mower blade is sharp so it makes a clean cut.

WATER INFREQUENTLY AND DEEPLY -enough to wet the root zone plus a small distance below. Light waterings discourage deep root growth, leaving grass more susceptible to drought and most of the water quickly evaporates.

WATER IN THE EARLY MORNING - and avoid watering in the wind or when the ground is already wet.

PROVIDE SOME SHADE FOR THE LAWN

REDUCE THE SIZE OF THE LAWN - plant more wildflowers and shrubs. These don't require as much watering.

Facts About

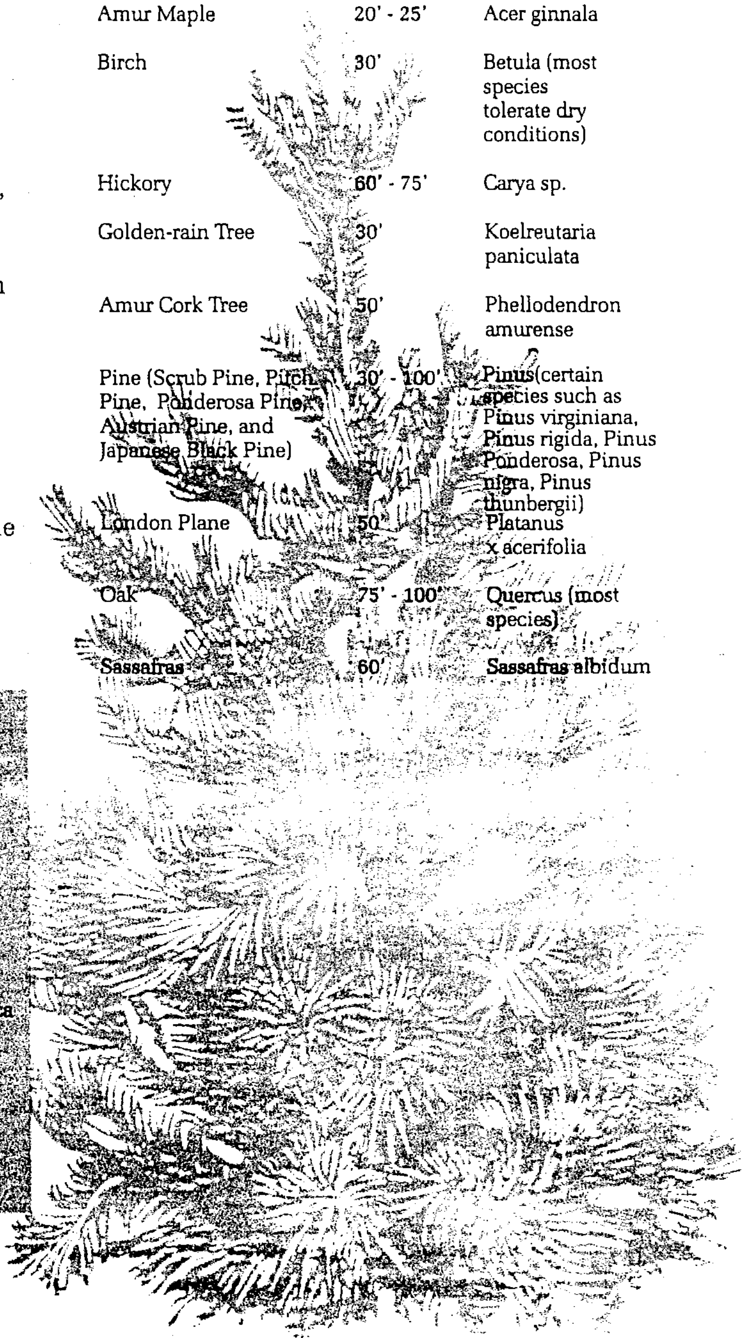
Low Water Use Plants

The plants in this guide are all hardy, tolerant of dry and droughty conditions. Remember, however, all new plantings need regular watering. When choosing the category and species for your yard or garden, be sure that you are choosing one suited for Massachusetts plant zones. According to the Arnold Aboretum and the USDA, the Boston area is in zones 5 and 6 respectively.

Most plant categories are listed by their common name. When making your plant selections, it is also important to be familiar with the Latin name, the language of horticulture and botany. Common names refer to different species in various parts of the country. Latin names are universal. This guide provides you with both.

Trees

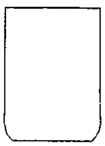
Common Name	Height	Latin Name
Amur Maple	20' - 25'	Acer ginnala
Birch	30'	Betula (most species tolerate dry conditions)
Hickory	60' - 75'	Carya sp.
Golden-rain Tree	30'	Koelreutaria paniculata
Amur Cork Tree	50'	Phellodendron amurense
Pine (Scrub Pine, Pitch Pine, Ponderosa Pine, Austrian Pine, and Japanese Black Pine)	30' - 100'	Pinus (certain species such as Pinus virginiana, Pinus rigida, Pinus Ponderosa, Pinus nigra, Pinus thunbergii)
London Plane	50'	Platanus x acerifolia
Oak	75' - 100'	Quercus (most species)
Sassafras	60'	Sassafras albidum



Annuals / Biennials

Common Name	Height	Latin Name
Cleome	2'- 3'	Cleome
Cosmos	3'	Cosmos sp.
Sweet William	2'	Dianthus barbatus
Marigold	4" - 16"	Dimorpotheca sp.
California Poppy	2'	Eschscholtzia californica
Gazania	6" - 18"	Gazania
Strawflower	3'	Heliochrysum bracteatum
Morning-glory	Vine	Ipomoea sp.

SOME INTERESTING FACTS



Americans drink more than 1 BILLION glasses of water per day.

On average, 50-70% of home water is used outdoors for watering lawns and gardens. Daily indoor per capita water use in a home with no water-conserving fixtures is 74 gallons.

Toilets are the number one biggest water user in the home. Approximately 28% of the home's water is used here.

Would you believe showers use almost 15% more water than the average bath?

By installing more efficient water fixtures and regularly checking for leaks, you can reduce daily per capita water use by almost 30%.

Average household water use annually = 127,400 gallons.
Average daily household water use = 350 gallons.

It takes about 4,776 gallons of water to raise a Christmas tree.

After thanksgiving dinner in 1999, 16.4 million Americans watched football. At half-time, American toilets flushed 16.4 million times and used 48.5 million gallons of water.

source: American Water Works Association

Water Conservation Program
Outside Watering
Town of Dracut

As a permanent policy and to assure water pressures and volumes throughout the year the following outside watering guidelines are in place for all water customers of the Dracut Water Supply District and the Kenwood Water Department.

We will follow and ODD/EVEN policy. You may water outside on the odd numbered days if your home address is an odd number, even numbered homes on even numbered days.

The watering outside times allowed are 7 days a week anytime between the hours of 8:00PM until 8:00AM

This policy if followed by our customers will provide the ability to allow outside watering with conservation efforts and allow the Water Departments to avoid the need of an outside watering ban.

While our systems are in great shape and improvements made we are under the control of the Department of Environmental Protection limiting the amounts of water we can pump from our wells. In addition with peak summer demands pumping stations and storage facilities will not keep pace without this program. Our goal is to provide complete water service with as little inconvenience as possible. With our help we will all be able to enjoy high quality, good pressures and no water bans required.

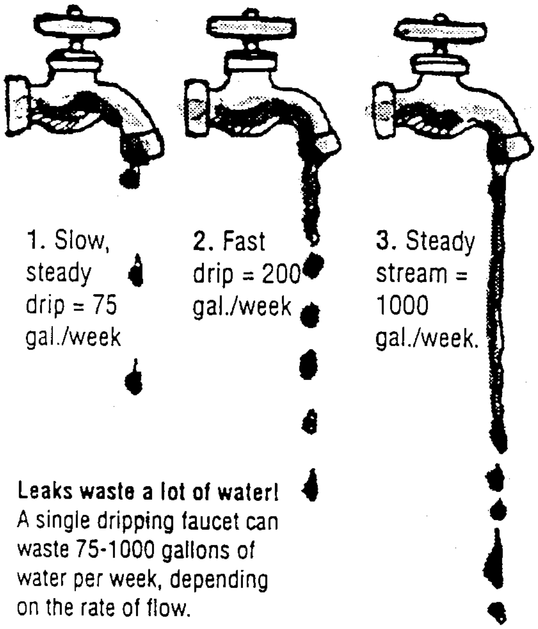
Violations of this program do carry penalties:

First Offense	Warning
Second Offense	$100.00
Third Offense	$200.00
Subsequent Offenses	$300.00 and possible Service Shutoff

Your help and efforts will avoid any outside water ban measures.

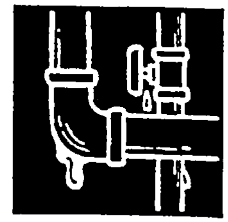
Thank you,
Gary W. McCarthy Superintendent/Executive Director

Stop Leaks/Save Water



Leaks waste a lot of water!
A single dripping faucet can waste 75-1000 gallons of water per week, depending on the rate of flow.

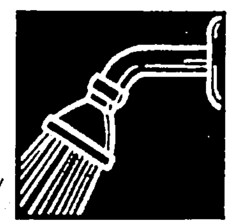
A Simple Test for Leaks



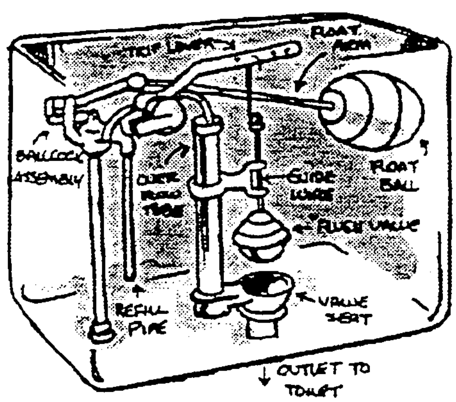
A leaky faucet is pretty obvious. But hidden leaks in the toilet, under the sink, or behind a washing machine can waste a gigantic amount of water. And they could be damaging your floor or ceiling too. Take a reading of your water meter. Wait an hour, making sure no one uses any water in your home. Check it again. If the reading has changed, you have got at least one leak. Investigate!

Faucets and Showerheads

Dripping, trickling, or oozing faucets and showerheads can waste from 75 to several hundred gallons of water a week depending on the size of the drip. Worn out washers are the main cause of these leaks and they cost about 25 cents to replace.



Faucets typically use 2 to 7 gallons per minute. Installing a low-flow faucet aerator can reduce the flow by as much as 25% or up to a gallon and a half per minute. Be sure to remove your aerator periodically to clean the particles that may have collected in the screen.

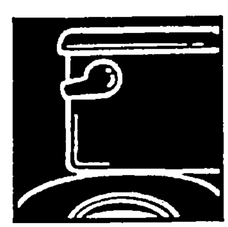


There are many variations to the names of each toilet part! Don't be surprised if your "How-To" book calls it something slightly different.

Toilets

That trickling sound that you hear at night could be wasting 50 gallons of water a day or more. But sometimes it leaks silently. Try this:

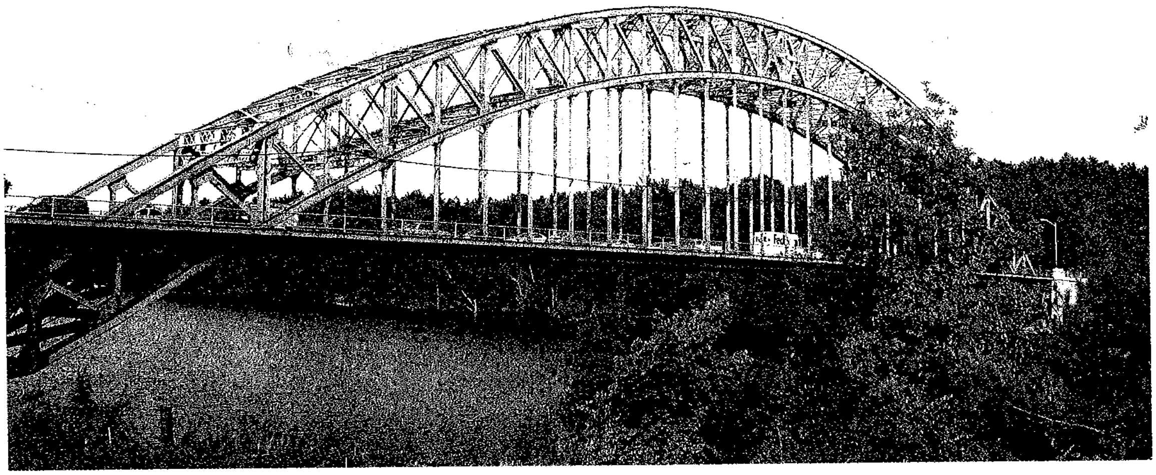
Crush a dye tablet in its envelope and carefully empty the contents into the center of the toilet tank and allow it to dissolve. Wait about 8-9 minutes. Inspect the toilet bowl for signs of blue dye indicating a leak.



If the dye has appeared in the bowl, your flapper or flush valve may need to be replaced. Parts are inexpensive and fairly easy to replace. If no dye has appeared in the 8 to 9 minutes time, you probably don't have a leak.

APPENDIX F

Master Plan Excerpts



Master Plan for Tyngsborough Massachusetts

Prepared for the

Tyngsborough Master Plan Committee

By

Brian K. Barber, City and Town Planning Consultant

In Association with

Daphne Politis, Optimal Solutions and

Bill Giezentanner, Giezentanner Associates

With financial assistance provided by

The Town of Tyngsborough, and the Commonwealth of Massachusetts through Executive Order 418, administered by the Massachusetts Department of Housing and Community Development, the Massachusetts Executive Office of Environmental Affairs, the Massachusetts Executive Office of Transportation and Construction, and the Massachusetts Department of Economic Development.

With the cooperation, review and participation of the Northern Middlesex Council of Governments.

May 2004

A Vision Statement for Tyngsborough

In twenty years the Town of Tyngsborough will be a destination community that attracts visitors to the community to tour its Village Center with its historic and cultural places and sites, utilizes its recreational facilities and nature trails along the Merrimack River, Mascuppic Lake and Flint Pond and shops at its enhanced commercial center in the Village Center and along Middlesex Road. Tyngsborough will also be a family-oriented community that retains its rural past, while providing high-tech jobs for its residents, affordable homes for families and an enhanced and protected quality of life. It youth will be provided with an excellent education and quality recreational and community programs, while it senior citizens will enjoy the new Cultural Center and access to quality health care in the region.

The Vision for Tyngsborough would incorporate the following components as well:

- An enhanced village setting for its Town Center and commercial nodes throughout the Town that ties together the history of the community with the specialty shops of the region;
- An improved transportation network that benefits from a widened Route 3, the establishment of the Park and Ride facility, improved public transportation to surrounding towns, placement of the historic Bridge on the National Register and increased use of the new Bridge to expedite traffic to Route 3, upgraded arterial streets and new bicycle pedestrian paths;
- Linked improvements connecting open spaces in the expanded Town Center with the Merrimack River, as well as enhancing the scenic views along the roadways bordering the river;
- High technology industrial parks that provide jobs for local residents and help diversify the tax base;
- Affordable housing opportunities for diverse economic and cultural groups that maintain the rural quality of life in the community;
- Enhanced usage of Middlesex Road as a gateway to the community that strengthens its commercial sector, while maintaining its scenic appeal and connection to the Merrimack River;
- Enhancement and protection of natural and cultural resources within the community to reinforce its rural past and history;
- Improved access to the Merrimack River, Mascuppic Lake and Flint Pond to generate new recreational and environmental activities; and
- Protected agricultural land that retains its prominence within the community.

This vision statement was prepared through an open participatory process and expresses the desires of Tyngsborough residents about future development of their Town. The Master Plan that follows is an elaboration of this vision in terms of the goals and objectives embedded in the Vision Statement, and the actions that should be taken to realize the vision. The Master Plan contains information about each of the topics important for future development, an analysis of that information, and recommendations for future actions to achieve the vision.

Acknowledgements

The Vision Statement and an associated set of Town Assets and Liabilities were prepared with the assistance of the Northern Middlesex Council of Governments (NMCOG). This Master Plan Report was prepared by Brian K. Barber, City and Town Planning Consultant, with the assistance of Daphne Politis of Optimum Solutions and Bill Giezentanner of Giezentanner Associates, and was guided by the Tyngsborough Master Plan Committee, and supported financially by an appropriation from the Town of Tyngsborough and a grant from the Commonwealth of Massachusetts, under Executive Order (EO) 418. The EO418 funds also supported the work of NMCOG in preparing the Vision Statement, Statement of Assets and Liabilities and a Scope of Services for the Master Plan preparation. Guidance and participation in both the visioning work and preparation of the Master Plan was received from the Tyngsborough Town Planner, Mark Whitehead.

The following are members of the Tyngsborough Master Plan Committee.

Name	Representative of:
Rich Lemoine, Co Chairman	Board of Selectmen
Mark Pease, Co Chairman	Planning Board
Peter Nicosia, Co Vice Chairman	Board of Selectmen
Darryl Wickens, Co Vice Chairman	Planning Board
Rick Flanagan	Highway Department
Deputy Chief Rich Burrows	Police Department
Will Mercier	Fire Department
Carol Devanney	Board of Health
Christine Chisolm	Community Preservation Committee
Lucy Gertz	Conservation Commission
Mindy Boyd	Recreation Committee
Christine Mechalides	Zoning Board of Appeals
Thomas Ives	Tyngsborough Water District
Denise Ziemlak	School Committee
Mary Calandrella	Historical Commission
Jeff Hannaford	Sewer Commission
Doria Sylvester	Tyngsborough Housing Authority
Fran Eagle	Finance Committee
Eric Spear	Library Trustees
Corliss Lambert	Capital Program Committee
Vacant	Member-At-Large
Linda Bown	Member-At-Large
George Geisenhainer	Member-At-Large
Jacqueline Schnackertz, Clerk	Board of Selectmen
Vacant	Member-At-Large

Master Plan Summary—Putting It All Together

Tyngsborough is at an important stage of its development. It still retains its open, semi-rural, historical character, both in its landscape and buildings. It still provides unobstructed and naturalistic views of the Merrimack River, unlike some of the surrounding cities and towns. There are extensive institutional and recreational land holdings in Tyngsborough that are coming under development pressures. Land is less expensive in Tyngsborough than in some surrounding communities, adding to the economic pressures for development. Tyngsborough has grown rapidly since 1980, and continues to grow, owing to the availability of moderately priced land and the Town's location on two important regional highways between two major cities, Lowell and Nashua. Moreover, Tyngsborough provides good quality town services and facilities, especially schools that attract new residents.

The vision that townspeople have for their future emphasizes the desire to retain the town's rural and village character, and preserve and enhance its natural and historic resources. A one and one-half year visioning and master planning process has produced a set of goals and objectives for the town that stress keeping its existing character, while balancing the tax base through further economic development, and continuing to provide high quality town facilities and services. The process involved public meetings, meetings with the Master Plan Committee and town officials, and dissemination of materials at meetings and electronically via the Internet. People of all ages were drawn into the process, which included meetings at Town Hall, at schools and the Senior Center. School children and Master Plan Committee members completed written and graphic assignments related to defining the town's future development.

The Master Plan developed through the activities of the last one and one-half years contains the goals and objectives, assessments of existing and likely future conditions, analyses of conditions and resources relative to sound community development planning principles, and recommendations for town actions to achieve its goals and objectives. The material is interrelated as is appropriate for a comprehensive Master Plan. It covers the topics of housing, economic development, transportation, open space and recreation, natural and cultural resources, land use and zoning, and town services and facilities. It also covers the desire of many townspeople to enhance the existing Town Center, to make it a more important commercial, cultural and social gathering place. Principal recommendations of the Master Plan are to:

- Create an expanded Town Center via three development nodes,
- Locate the proposed new Merrimack River Bridge in the Town Center area,
- Relocate Pawtucket Boulevard and use it with the new and existing bridge to create a loop circulation route for the Town Center,
- Emphasize and use historic resources,
- Develop mixed use commercial, residential, cultural village nodes,
- Carefully plan commercial corridors to minimize strip development impacts,
- Extend sewer service along Middlesex Road,
- Preserve the golf courses and institutional lands,
- Provide incentives for open space residential developments,
- Develop an open space corridor/ trail system,

- Provide a range of housing choices for existing and new residents, including affordable housing,
- Define an I-2 Zone to attract jobs,
- Improve the existing Multi-Service (Senior) Center, and
- Develop a Teen Center.

A build-out analysis was completed for Tyngsborough by the Northern Middlesex Council of Governments (NMCOG) which showed various impacts of development if all the developable land in town were used, as currently allowed under existing zoning bylaws. These data are compared with impacts of following the Master Plan recommendations and action program.

Category	Build-out	Master Plan
Additional Residents	5,166	4,838
Total Population	16,247	15,919
Additional Residential Units	1,700	1,582
Additional Comm./Ind. Floor Area	14,108,838 sf	497,100 sf
Additional Residential Water Demand	387,505 gpd	362,850 gpd
Additional Comm./Ind. Water Demand	1,058,163 gpd	27,231 gpd
Additional School Students	799	744
Additional Roads	38.1 miles	35.5 miles
Additional Solid Waste – Recyclable	1,885 tons/yr	1,754 tons/yr
Additional Solid Waste – Non-recyclable	766 tons/yr	713 tons/yr

At foreseeable rates of development residential build-out could occur between the years 2010 and 2015. The Master Plan has a significantly lower level of commercial and industrial development than the build-out analysis, principally because there is now a substantial amount of land zoned for commercial and industrial uses that is not likely to be developed.

Significant conditions that affect development planning are:

- Population has more than doubled since 1980 and continues to grow,
- 55% of Tyngsborough residents live east of the Merrimack River,
- Almost all of the town's business and commercial services are west of the river,
- Over one-half of Tyngsborough's land is open,
  - 47% Forest
  - 4% Agriculture
  - 28% Residential
- 10% of the town's surface area is water and wetlands, and river and ponds are important focal points for development and recreation,
- Sewer service limits commercial and industrial growth,
- There are substantial environmental constraints to development,
- There are under-utilized historic buildings that could contribute to town needs.

To meet town needs the following recommendations are made:

- Consider acquiring additional land for the Highway Department,
- Support development of a new Senior Center,
- Support development of a Teen Center,
- Work with developers to extend sewer lines along Middlesex Road,
- Implement a Town Storm-water Management Plan,
- Implement the Water System Master Plan,
- Reuse historic buildings in Town Center to meet town needs and add to the vitality of the Center,
- Explore the need for future Police Department facilities,
- Continue the work of the Master Plan Committee and this Master Plan by preparing more detailed plans for:
  - The Town Center,
  - A trails and pathway system,
- Develop new enrollment projections for schools to reflect recent growth trends.

An implementation program is proposed consisting of zoning actions, other growth management tools, public investments and administrative actions. Specific actions recommended are:

Specific Action	Lead Agency	Timing
ZONING ACTIONS		
Establish an Institutional/Open Space Zoning District for golf courses and other open lands with owner consent	Planning Board	2004 Town Meeting and Continuing Negotiations
Establish I-2 District on Zoning Map	Planning Board	2004 Town Meeting
Remove requirement that Town Meeting approve each Open Space and Recreation Development	Town Meeting	2004 Town Meeting
Provide density bonus in Open Space and Recreation Developments to encourage use	Planning Board	2004 Town Meeting
Remove Requirement that Town Meeting Approve each Multi-family Residential Development	Planning Board	2004 Town Meeting
Reduce R-3 Zoning District from 20,000 sq. ft. to 15,000 sq. ft. for Multi-family Development	Planning Board	2004 Town Meeting
Create Mixed-use Zone between River & Relocated Pawtucket Boulevard	Planning Board	2005 Town Meeting
Pass a "Corridor Protection Overlay District" along Kendall, Westford, & Middlesex Roads	Planning Board	2005 Town Meeting

Specific Action	Lead Agency	Timing
Pass an "Inclusionary Zoning" By-law for Multi-family Housing	Planning Board	2005 Town Meeting
OTHER GROWTH MANAGEMENT ACTIONS		
Work with Economic Development Committee or Commission to attract new jobs	All Town Departments	2004 & Continuing
Support location of new bridge just south of the existing bridge	All Town Government	2004 & Continuing
Support relocation of Pawtucket Boulevard before a new bridge is built	All Town Government	2004 & Continuing
Work to eliminate "Paper Streets"	Planning Board, Highway Dept., & Assessors Office	2004 & Continuing
Establish 300' riparian buffer areas for wildlife habitat	Conservation Commission	2004 & Continuing
PUBLIC INVESTMENT ACTIONS		
Construct sidewalks along arterial roads	Highway Department	2004 & Continuing
Include bike lanes in arterial road improvements	Highway Department	2004 & Continuing
Establish multi-purpose trails around Town Center and along roads leading to schools	Conservation Commission	2004 & Continuing
Build boat ramps and associated parking for access to the Merrimack River	Board of Selectmen	2005 & Continuing
Acquire land adjacent to the highway department	Town Meeting	2004
Construct a Multi-service Center and a Teen Center	Town Meeting	2004 & Continuing
Continue exploring options for a new Senior Center	Board of Selectmen	2004
Continue exploring options for new Main Police Station	Board of Selectmen	2004 & Continuing
Continue expansion of sewer service along Middlesex Road	Sewer Commission and Planning Board	2004 & Continuing
Implement Water Resources Plan and Storm-water Management Plan	Newly Created Dept. of Public Works	2004 & Continuing

Specific Action	Lead Agency	Timing
Implement existing traffic control recommendations	Highway Dept. and State Highway Dept.	2004 & Continuing
ADMINISTRATIVE ACTIONS		
Develop Town-wide Trail Plan	Conservation Commission	2004 & Continuing
Negotiate easements for a town-wide trail system	Board of Selectmen	2004 & Continuing
Identify appropriate locations for All Terrain Vehicles (ATVs) and Snowmobile use	Conservation Commission	2004 & Continuing
Pursue Designation of Historic Districts—Tyngsborough Center & James Butterfield Mill Area	Historic Commission and Board of Selectmen	2004 & Continuing
Prepare New School Enrollment Projections	School Department	2004
Create Master Plan Monitoring Committee	Board of Selectmen	2004
Create Town Department of Public Works	Board of Selectmen	2004

Most of these actions should be started in 2004. Many of them continue into following years, in recognition that master planning is an ongoing process, especially in its implementation phases. To oversee and prompt plan implementation actions it is recommended that a Master Plan Monitoring Committee be established to carry out the work the Master Plan Committee has identified as being needed in this Plan. The Master Plan Monitoring Committee should include a significant number of Town Officials including board, committee and commission members who manage town programs affecting future development. Town citizens should also be represented to ensure that public input continues to guide planning and management decisions.

Tyngsborough's future can simply result from the continuation of existing trends and practices, or it can be determined through community consensus and civic action. This Master Plan defines the consensus that has been reached and the actions necessary to achieve the vision reached through consensus. Implementing the Plan is up to community leaders and public officials, using normal powers and practices of government. In summary, the citizens of Tyngsborough can have the kind of town they would like if they are willing to adopt and practice the procedures and actions described in this Plan. The following pages report the Plan in text, tables, and maps and other graphics. Map 0-1 on the following page graphically summarizes major features of the Plan.

APPENDIX G

Massachusetts Bureau of Waste Site Clean Up

Site/Reportable Release Look Up

- **RTN:** -
- **Site Name/Location Aid:**
- **Street:**
- **City:** TYNGSBOROUGH
- **Status:**
- **Chemical Type:**

Search Results

Release Tracking Number(RTN)	City/Town	Release Address	Site Name/Location Aid	Reporting Category	Notification Date	Compliance Status	Date	Phase	RAO Class	Chemical Type	Release Tracking Number(RTN)
2-0014322	TYNGSBOROUGH	26 CUMMINGS RD	PICONICS INC	72 HR	05/29/2002	RAO	11/28/2003	PHASE II	B1	Hazardous Material	2-0014322
2-0014130	TYNGSBOROUGH	33 DAVIS ST	POLE #8	TWO HR	12/19/2001	RAO	02/22/2002		A1		2-0014130
2-0010921	TYNGSBOROUGH	385 DUNSTABLE RD	BFI FACILITY	72 HR	09/18/1995	RTN CLOSED	09/17/1996			Oil	2-0010921
2-0000135	TYNGSBOROUGH	385 DUNSTABLE RD	BFI	NONE	07/01/1985	RAO	10/31/1997		A3	Oil and Hazardous Material	2-0000135
2-0000136	TYNGSBOROUGH	475-530 DUNSTABLE RD	CHARLES GEORGE LANDFILL	NONE	01/15/1987	TIER 1A	10/01/1993				2-0000136
2-0011439	TYNGSBOROUGH	DUNSTABLE RD	TRANSFORMER RELEASE	TWO HR	10/15/1996	RAO	12/16/1996		A2	Oil	2-0011439
2-0011489	TYNGSBOROUGH	37 FOREST PARK AVE	NEAR LAKE MASCUPPIC	TWO HR	11/19/1996	RAO	01/17/1997		A2	Oil	2-0011489
2-0012350	TYNGSBOROUGH	FROST RD	FROST RD VENTURI VAULT	TWO HR	04/13/1998	RAO	04/20/1999		A2	Hazardous Material	2-0012350
2-0014581	TYNGSBOROUGH	45 KENDALL RD	LEE MARCHAND INC ROADWAY RELEASE	TWO HR	12/06/2002	RAO	07/09/2003		A1	Oil	2-0014581
2-0013767	TYNGSBOROUGH	KENDALL RD	CONCRETE SYSTEMS	TWO HR	04/05/2001	RAO	05/14/2001		A1	Oil	2-0013767

2-0015810	TYNGSBOROUGH	LAKE VIEW AND FROST ST	MOORES LUMBER YARDS & BUILDING CENTERS	TWO HR	07/06/2005	UNCLASSIFIED	07/06/2005				2-0015810
2-0015022	TYNGSBOROUGH	117 LAKEVIEW AVE	JUDITH SWENSON	120 DY	11/21/2003	RAO	11/21/2003		B1	Oil	2-0015022
2-0011751	TYNGSBOROUGH	1 LAKEVIEW ST	BIRCHMONT ST	TWO HR	06/05/1997	RAO	07/18/1997		A1		2-0011751
2-0001063	TYNGSBOROUGH	66 MASCUPPIC TRL	RESIDENCE	NONE	08/06/1993	RAO	02/08/1996	PHASE II	A2	Oil	2-0001063
2-0001046	TYNGSBOROUGH	75 MASCUPPIC TRL	RESIDENTIAL PROPERTY	NONE	07/15/1993	RAO	03/23/1995	PHASE II	A3	Oil	2-0001046
2-0000137	TYNGSBOROUGH	257 MIDDLESEX RD	TYNGSBOROUGH TIRE AND GAS INC	NONE	01/15/1987	RAO	08/16/2001	PHASE III	B1	Oil	2-0000137
2-0015340	TYNGSBOROUGH	271 MIDDLESEX RD	USED CAR DEALERSHIP	120 DY	07/23/2004	TIER 2	07/25/2005	PHASE II		Oil and Hazardous Material	2-0015340
2-0000392	TYNGSBOROUGH	292 MIDDLESEX RD	292 MIDDLESEX RD PROPERTY	NONE	04/15/1988	TIER 1D	08/09/1995				2-0000392
2-0012737	TYNGSBOROUGH	397 MIDDLESEX RD	TEXACO STATION	TWO HR	04/02/1999	RAO	02/25/2003	PHASE V	C	Hazardous Material	2-0012737
2-0013877	TYNGSBOROUGH	397 MIDDLESEX RD	TEXACO STA	TWO HR	06/25/2001	RAO	02/25/2003			Hazardous Material	2-0013877
2-0014066	TYNGSBOROUGH	397 MIDDLESEX RD	MIDDLESEX PETROLEUM	72 HR	10/26/2001	RAO	02/25/2003			Hazardous Material	2-0014066
2-0014845	TYNGSBOROUGH	397 MIDDLESEX RD	TEXACO GAS STATION	TWO HR	07/18/2003	RAO	10/06/2003		A1	Oil	2-0014845
2-0014572	TYNGSBOROUGH	431 MIDDLESEX RD	SMOKEY BONES RESTAURANT	TWO HR	12/02/2002	RAO	02/07/2003		A1	Oil	2-0014572
2-0010341	TYNGSBOROUGH	440 MIDDLESEX RD	TJ MAXX PLAZA	72 HR	06/16/1994	RAO	06/22/1995		A2	Hazardous Material	2-0010341
2-0010743	TYNGSBOROUGH	440 MIDDLESEX RD	TJ MAXX PLAZA	72 HR	04/21/1995	RAO	04/23/1996		B1	Hazardous Material	2-0010743
2-0000814	TYNGSBOROUGH	451 MIDDLESEX RD	STATE LINE SUNOCO FMR	NONE	04/15/1991	RAO	05/17/2004	PHASE IV	A2		2-0000814
2-0012843	TYNGSBOROUGH	397 MIDDLESEX ST	TEXACO STA	TWO HR	06/24/1999	RAO	02/25/2003			Hazardous Material	2-0012843
2-0015734	TYNGSBOROUGH	123 NORRIS RD	BROWNING FERRIS INDUSTRIES	TWO HR	05/03/2005	UNCLASSIFIED	05/03/2005			Oil	2-0015734
2-0012727	TYNGSBOROUGH	54 PAWTUCKET BLVD	STATELINE AUTO RECOVERY	72 HR	03/25/1999	TIER 1C	07/18/2000	PHASE IV		Oil	2-0012727
2-0013538	TYNGSBOROUGH	54 PAWTUCKET BLVD	STATE LINE AUTO RECOVERY CORP	72 HR	11/02/2000	RTN CLOSED	12/29/2000			Oil	2-0013538
2-0014305	TYNGSBOROUGH	58 PAWTUCKET BLVD	TRANSFORMER RELEASE	TWO HR	05/12/2002	RAO	07/03/2002		A2		2-0014305
2-0013840	TYNGSBOROUGH	17 PHALANX ST	MARK DESOUSA FAMILY TRUST	TWO HR	06/01/2001	RTN CLOSED	02/25/2004			Hazardous Material	2-0013840
2-0014189	TYNGSBOROUGH	RTE 3 @ EXIT 35	SOUTHBOUND HIGH SPEED LANE	TWO HR	02/11/2002	RAO	04/12/2002		A2	Oil	2-0014189
2-0011432	TYNGSBOROUGH	SCRIBNER RD	POLE 3	TWO HR	10/11/1996	RAO	12/10/1996		A1	Oil	2-0011432

2-0012345	TYNGSBOROUGH	SCRIBNER RD	POLE #2	TWO HR	08/12/1998	RAO	10/19/1998		A2	Oil	2-0012345
2-0014192	TYNGSBOROUGH	10 SPRUCE AVE	RESIDENCE	TWO HR	02/19/2002	RAO	01/31/2003		A2	Oil	2-0014192
2-0010348	TYNGSBOROUGH	11 12 WATERWAY PL	DESOUSA FAMILY TRUST	120 DY	06/17/1994	TIER 1C	07/15/1996	PHASE II		Hazardous Material	2-0010348
2-0000428	TYNGSBOROUGH	WESTECH DR	WEST TECH INDUSTRIAL PARK	NONE	10/15/1988	WCSPRM	01/13/1993			Oil	2-0000428
2-0000216	TYNGSBOROUGH	235 WESTFORD RD	PROPERTY LOT 15 & 16	NONE	07/15/1993	DEPNDS	09/02/1993				2-0000216
2-0011257	TYNGSBOROUGH	95 97 WESTFORD RD	PROPERTY	120 DY	05/30/1996	TIER 2	10/05/2001	PHASE IV		Oil and Hazardous Material	2-0011257
2-0013702	TYNGSBOROUGH	95 97 WESTFORD RD	MOBIL FACILITY NO 12369	72 HR	02/21/2001	RTN CLOSED	07/13/2004	PHASE II		Hazardous Material	2-0013702
2-0014645	TYNGSBOROUGH	95 97 WESTFORD RD	MOBIL GAS STATION	TWO HR	01/25/2003	RTN CLOSED	05/27/2004			Oil	2-0014645
2-0014757	TYNGSBOROUGH	95-97 WESTFORD RD	EXXON STATION	TWO HR	05/06/2003	RAO	09/12/2003		A1	Oil	2-0014757
2-0013640	TYNGSBOROUGH	97-95 WESTFORD RD	EXXON MOBIL STA E54	72 HR	01/02/2001	RAO	02/27/2001		A1	Oil	2-0013640
2-0014504	TYNGSBOROUGH	129 WILLOWDALE RD	TRANSFORMER RELEASE POLE 23-49	TWO HR	10/06/2002	RAO	12/04/2002		A2		2-0014504
2-0011080	TYNGSBOROUGH	2 WORDEN RD	RESIDENCE	TWO HR	01/24/1996	RAO	01/30/1997		A2	Oil	2-0011080
Total of 46 Records Matched.											

** Search Again ** Definitions **

[Contact: dbakely@state.ma.us]

[Sites] [BWSC Publications] [BWSC Home] [DEP Home][Privacy Policy]

APPENDIX H

Public Participation Materials

Town of Tyngsborough, Massachusetts
Comprehensive Wastewater Management Plan/Environmental Impact Report

Public Participation Program
Work Plan

March, 2005
EOEA No.11788

Tyngsborough, Massachusetts
Comprehensive Wastewater Management Plan/Environmental Impact Report
Public Participation Plan

Type of Program

FULL SCALE. The Comprehensive Wastewater Management Plan/Environmental Impact Report (CWMP/EIR) Public Participation Program will be conducted by the Sewer Commissioners (project proponent). The Tyngsborough Sewer Commission and the project consultant, Earth Tech, Inc., will conduct the public education/public forum aspect of the Project.

The project proponent will carry out project execution and technical communication with the general public, interest groups and agencies having jurisdiction.

Proposed Schedule of Public Participation

See "Tyngsborough CWMP Projected Schedule". This schedule is updated by the Sewer Commission (the Commission) and Earth Tech, Inc. on an as needed basis. Public participation activities will follow the "Projected Schedule". This Public Participation Program was outlined in "Exhibit A Plan of Study", dated January 2004, revised February 8, 2005, which is a part of the September 16, 2004 "Agreement" between the Town and Earth Tech Inc. It was also submitted to the Massachusetts Department of Environment Protection (MADEP) on September 28, 2004 in the "Request For Approval To Proceed" and as part of the State Revolving Fund (SRF) loan application package.

The schedule anticipates arranging for and making presentations at one public informational meeting during each of the remaining three phases of this CWMP/EIR, with a public hearing held in conjunction with the Phase III Draft CWMP/DEIR when this Report is available for public review and will have been submitted to the MADEP and Massachusetts Environmental Policy Act Office (MEPA) for review and approval.

Currently, the Commission is scheduling bi-weekly meetings at the Town Hall. Postings can be viewed at Town Hall for specific dates, times and locations of meetings. On-going regular meetings are also being held amongst the project consultant and the Commission.

It is also anticipated that a number of informal presentations and workshops will be held throughout the project for presentation and review by various entities having jurisdiction over or interest in the project.

Depository Records

The Town has been provided with 3 (three) three-ring Depository Record binders for placement by the Board and the CAC in three locations in Town for general public viewing. These Depositories are in the following locations:

Tyngsborough Sewer Commission
25 Bryants Lane
Tyngsborough, MA 01879

Hours:	Monday - Friday	8:00 A.M. to 4:00 P.M.

Tyngsborough Council on Aging
180 Lakeview Avenue
Tyngsborough, MA 01879

Hours:	Monday - Friday	8:30 A.M. to 4:00 P.M.

Tyngsborough Public Library
25 Bryants Lane
Tyngsborough, MA 01879

Hours:	Monday and Wednesday	9:00 A.M. to 9:00 P.M.
	Tuesday, Thursday and Friday	9:00 A.M. to 5:00 P.M.
	Saturday	9:00 A.M. to 2:00 P.M.
	Sunday	Closed

Summer Hours: Same as above except closing at 1:00P.M. on Fridays and closed Saturdays and Sundays.

These are titled, "Depository Record". Materials will be furnished to the Town from various sources for inclusion in the Depository Record. A Board representative will periodically update the Depository Record by inserting materials provided. In each, an identical project record will be kept. These "Depository Records" are not removable from the depositories.

The Depository Records contain:

Mailing List (for any interested party or parties)
Public Participation Work Plan
Exhibit A CWMP/EIR Scope of Work
Exhibit B Tyngsborough CWMP/EIR Projected Schedule
MADEP SRF Loan Project Approval Certificate (PAC)
Reference Materials
Media Coverage
Public Meeting(s) Record
Responsiveness Summaries
List of Appendices
Meeting Minutes
MEPA

Information and Consultation Mechanisms

The Town, through the Sewer Commission, will prepare and distribute periodic fact sheets, newsletters and mailings to the mailing list as a minimum and to a larger constituency at key points in the Plan's development.

Mailing List

A record will be kept of all persons attending public meetings and informal workshops. Periodic checks of the Depository Records under "Mailing List" will update this list and be utilized for distribution of fact sheets, newsletters, requested information and responsiveness summaries.

NOTICE OF PUBLIC MEETING

A Vote for Tyngsborough's Comprehensive Water Resources Management Plan is a vote for our future!

Article on the May 20 Town Meeting Warrant

When:

Tuesday, May 20, 2003
(Time?

Where:

DRAFT

Copies of the CWRMP Phase 1 draft report are available at Town Hall in the offices of the Board of Sewer Commissioners, the Town Clerk, and the Tyngsborough Public Library. Written comment may be made to Secretary Ellen Roy Herzfelder, EOEA, Attn: Diedre Buckley, Analyst, MEPA Office, 251 Causeway St., Suite 900 Boston, MA 02114 until May 22.

Contact the Board of Sewer Commissioners for more information on the CWRMP and future public meetings. You may also call Betsy Frederick of S E A Consultants Inc.at 617/498-4622 for more information.

Cast an informed vote on appropriations for Phases 2 through 4 of the CWRMP at Town Meeting on May 20.

Looking at Water: "Storing it, Conserving it, and Providing for the Future"

Goal of the Comprehensive Water Resources Management Plan (CWRMP): To identify appropriate water resources management strategies to meet present and future water demands and wastewater disposal needs for Tyngsborough while preserving the natural environment.

History of CWRMP

The Town Tyngsborough, under the auspices of the Board of Sewer Commissioners, undertook a wastewater management planning effort in 1997 that resulted in the recommendation of an eight-phase sewering plan. Phase 1 Sewers and portions of Phases 2 and 3 Sewers as identified in that plan were approved for immediate construction by regulatory agencies on the basis of Public Health concerns, and the requirement to comply with an administrative order relative to a failing sewage disposal system at the Town's school complex. The Town was directed by the Massachusetts Environmental Policy Act (MEPA) Unit of the Executive Office of Environmental Affairs (EOEA) to prepare an Environmental Impact Report (EIR) prior to implementing other phases of construction. A special procedure was developed, and a Certificate Establishing a Special Procedure for MEPA Review was issued in December 1998 (EOEA #1178).

This resulted in the **Phase I – Needs and Growth Management** draft report currently at MEPA and now available for public review and comment. This phase includes documentation of existing environmental conditions, evaluation of current and future water demands, drainage conditions and current and future wastewater disposal needs. The MEPA scope also requires that the community evaluate the potential secondary growth impacts that may be induced by public sewers when considering local and regional growth management policies.

The Tyngsborough Sewer Commission and its consultant, S E A Consultants Inc., form the Project Team for Phase 1 of the CWRMP. The Team is committed to developing a Plan that addresses the Town's needs, preserves its shared environmental resources and is supported by project stakeholders.

Progress to Date

- Phase 1 Needs Assessment and growth Management Report completed as Draft and submitted to MEPA for public comment.
- Findings significantly redefine, and reduce, the areas of Tyngsborough that may require wastewater management methods other than standard Title 5 on-site systems – reducing potential costs associated with sewer construction.
- Phase 1 is only the initial phase of study – further phases of the study will screen alternative methods appropriate for needs areas and provide recommendations based on a variety of factors including cost, regulatory requirements, operation and maintenance and quality of life issues (e.g. compatibility with Tyngsborough community vision/ objectives).
- It is important to continue this planning as a complementary planning effort to that under the Community Preservation Act and ongoing town-wide master planning.
- Town has already qualified for low-interest state revolving funds (SRF) for the rest of this project. Town Meeting must appropriate the funds for the Town to be eligible to access the loan amount.

04/24/03

Press Release

(DRAFT)

FOR IMMEDIATE RELEASE

CONTACT:
Al Curseaden, Superintendent
Town of Tyngsborough
Tyngsborough Sewer Commission
25 Bryants Lane
Tyngsborough, MA 01879
T. 978/649-2300x134
Fax 978/649-2301

DATE:
April 25, 2003

HEADLINE:
Tyngsborough's Comprehensive Water Resources Management Plan - Phase 1 is available for Public Review

The Town of Tyngsborough's Comprehensive Water Resources Management Plan's (CWRMP) Phase 1– Needs and Growth draft report has been prepared and submitted to the Massachusetts Environmental Policy Act (MEPA) Unit of the Executive Office of Environmental Affairs (EOEA) for review. Copies of the Phase 1 report are available at the Town Hall in the offices of the Board of Sewer Commissioners, the Town Clerk, and the library. Informational flyers giving highlights of the CWRMP will also be at these locations. You, the community, are invited to participate in this very important planning process for Tyngsborough's future by reviewing these documents and submitting written comments to: Secretary of Environmental Affairs Ellen Roy Herzfelder, EOEA, Attn: Diedre Buckley, Analyst, MEPA Office, 251 Causeway St., Suite 900, Boston, MA 02114. The deadline for submitting comments to MEPA is May 22.

May 20 is the date of the Annual Town Meeting. Findings of the Phase 1 report significantly redefine, and reduce, the areas of Tyngsborough that may require wastewater management methods other than the standard Title 5 on-site systems, thus reducing potential costs associated with sewer construction. These are only the initial phases of the study. It is important to continue this planning as a complementary planning effort to that under the Community Preservation Act and ongoing town-wide master planning. The Town has already qualified for low-interest state revolving funds (SRF) for the remainder of this project. Town Meeting must first appropriate the funds before the Town can access the loan amount. The Board of Sewer Commissioners invites you to be a participant in planning for Tyngsborough's future. You are urged to review the draft report of the Phase 1 – Needs Assessment and Growth Management and come to Town Meeting on May 20. For more information about the CWRMP, Contact NAME? at TELEPHONE?

####

Why Are Sump Pumps a Problem?

When extraneous water enters into the municipal sewer system from

sump pumps, it adds to the volume that is collected, pumped and treated through the Town's wastewater system.

This extra volume of <u>clean water</u> costs **YOU**, the rate payer, when the Town is billed through its contracts with Dracut, Chelmsford and Lowell.

Not only does it cost to treat water that is already clean, but it limits the amount of wastewater that can be sent through the system.

That means that your neighbors, who have problems with their on-site wastewater disposal systems, may not be able to be serviced through the Town's wastewater system.

Comprehensive Wastewater Management Plan (CWMP)

The Town is in the process of completing the second of four phases of the CWMP. The Town completed the Phase I, *Needs and Growth Management*, in March 2003. This phase identified areas of Town unable to sustain long-term with the current method of on-site wastewater disposal.

Phase II will provide a long-term solution to the problems identified in the Phase I Report.

The Town needs to move forward to complete the last two phases, Phase III and IV. These will identify a draft and final recommended plan for the Town, as well as identify and mitigate any environmental issues. Individual cost scenarios, funding options and schedules are part of he final phases.

Funding for the last two phases, in the form of a low-interest loan, has been secured through the State's Revolving Fund Loan Program. Voice your support at Town Meeting for this most important project!

On Tuesday, May 16th, an article supporting the funding for Phase III and Phase IV will be heard at Town Meeting.

Information on the CWMP can be found at the following locations:

- Sewer Commission Office
- Public Library
- Senior Center

PLEASE SUPPORT YOUR MUNICIPAL SEWER SYSTEM!

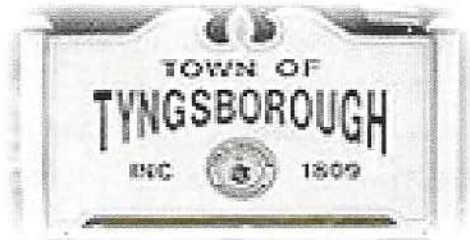
YOU Make it Work

Homeowners and businesses alike are being challenged to take water conservation to heart. With smart habits and efficient water use, you can lower the Town's escalating costs and ultimately those passed on to **YOU**, the consumer!

KEEP YOUR SEWER BILLS UNDER CONTROL

Illegal connections to the municipal sewer system add to the daily volume of wastewater that is collected, pumped and treated through the Town's Intermunicipal connections. This costs ***YOU,*** the rate payer.

Disconnect those illegal sump pumps and down-spouts <u>BEFORE</u> we are faced with raising rates!



Helpful Town Hall Telephone Numbers

Town Hall, Main........978-649-2300

Board of Selectmen and Town Administrator	X100
Accountant	X123
Assessor	X121
Board of Health	X118
Building Inspector	X112
Cable TV	X135
Community Bulletin Board	X140
Conservation Commission	X116
Planning Board	X115
Recreation	X150
Sewer Commission	X134
Tax Collector	X128
Town Clerk	X129
Zoning Board of Appeals	X112

For More Information

Tyngsborough Sewer Commission
25 Bryants Lane
Tyngsborough, MA 01879

Phone: 978-649-2300 X 134
Fax: 978-649-2301
Website: www.tyngsboroughmass.com

Prepared by:
Earth Tech, Inc., Concord, MA
March 2006
EarthTech

Tyngsborough Sewer Commission

Tired of Paying for Clean Water Going Down the Drain?

APPENDIX I

Phase III and Phase IV Scope of Work

PHASE III – DRAFT EIR

1.0 EVALUATION OF SHORT LISTED ALTERNATIVES

1.1 Evaluation of Costs

A cost-effective analysis will be performed on the short list of alternatives previously identified for detailed evaluation. This analysis will include a calculation of the direct monetary costs of each alternative using present worth or equivalent uniform annual cost as a basis. The analysis will include consideration of all project costs over the planning period.

A. Short List of Alternatives

A short list of alternatives to meet Tyngsborough's long-term wastewater needs will be developed. A screening process will be used which will reject options which do not meet physical constraints of the planning area, such as climate, soils and topography, or if they are incompatible with air and water quality plans. The screening process will determine those alternatives, which appear to provide the greatest environmental and cost benefit. A preliminary assessment of the major environmental, technical, financial and institutional considerations for each alternative will be performed in order to screen and short list the alternatives. Factors will include reliability, complexity, ability of implementation, and capital and operating costs. Maintenance of water balance within the drainage sub-basins will also be considered. Following the initial screening of the wastewater alternatives, the resultant short list of the most feasible options will be evaluated in detail as identified in the CWMP/EIR Phase II.

B. Identification of Feasible Sites Based on Screening Analysis

The feasible site or sites to accommodate the recommended wastewater facilities will be identified upon the completion of the detailed screening described in the previous tasks. The results of the screening process and the reasons for selecting the proposed site/sites will be summarized.

C. Present Worth Analysis

A present worth analysis will be performed for all wastewater alternatives, which have been short-listed for further evaluation. The analysis will be performed in accordance with the examples set forth in Appendix A of the Guide to Comprehensive Wastewater Management Planning.

D. Equivalent Uniform Annual Costs

An equivalent uniform annual cost analysis will be performed in order to compare the annualized costs for each alternative. This analysis will be performed by applying the appropriate financial factors to the present worth costs calculated over the 20-year planning period.

E. Cost Effective Analysis

The cost effective analysis of each alternative will be developed and will include all costs associated with construction of and operation of the wastewater facilities included in each plan alternative. Costs to be included in this analysis are: (1) the capital costs including the cost of construction of the wastewater facilities and any costs associated with the lease, easement or acquisition of land and rights-of-way; (2) the cost of engineering, legal, fiscal and administrative elements of the project; (3) contingency: (4) the operation and maintenance costs including the costs for labor, utilities, materials, contractual services, expenses, replacement of equipment and parts to ensure effective and dependable operation during the 20 year planning period; and (5) the salvage value based on a straight line depreciation from the initial cost at the time of analysis to the end of the 20 year planning period. The impact that grants and loans have on the cost effective analysis will also be discussed. The construction cost index from the Engineering News Record will be utilized and referenced in the capital cost estimate. The operation and maintenance costs will be adjusted to reflect any revenues received from the sale or distribution of wastewater facility byproducts.

1.2 Environmental Evaluation

The short listed alternatives will be screened for their environmental impacts. The number of alternatives will be reduced by the rejection of alternatives due to adverse impacts. The evaluation will assess both beneficial and adverse direct and indirect environmental impacts of each alternative. The potential for mitigation of direct and indirect adverse impacts will also be evaluated for each of the alternatives. Such mitigation measures may include: changes in design, size or location of facilities; rerouting of sewers to avoid sensitive areas; phased construction of facilities; or additional controls for noise, odor and aesthetic impacts.

A. Direct Impacts

Direct impacts will be evaluated for each alternative. Direct impacts are those impacts which, are considered to be directly related to the construction and operation of the wastewater facilities. The following direct impacts will be evaluated for each alternative:

1. Impacts on historical, archaeological, geological, cultural, conservation, or recreational areas;

2. Impacts on wetlands, flood plains, and agricultural land;

3. Impacts to zones of contribution of existing and proposed water supply sources;

4. Impacts on surface and groundwater resources and water balance within drainage sub-basins;

5. Displacement of households, businesses or services;

6. Noise pollution, air pollution, odor, and public health problems associated with construction and operation of each alternative; and

7. Violation of federal, state, or local environmental and land-use statutes, or regulations and plans imposed by such statutes and regulations. An example of one such regulation is Title 5 of the State Environmental Code.

B. Indirect Impacts

Indirect impacts will be evaluated for each alternative. Indirect impacts consist of impacts which are induced changes in the patterns of land-use and population growth and other environmental effects resulting from changes in land use and population. The environmental assessment will determine if the indirect impacts will contravene existing Federal, State and local environmental and land use statutes, regulations or standards. The following indirect impacts will be evaluated for each alternative:

1. Changes in Development and Land Use Patterns
   Each alternative will be evaluated to determine if its implementation will change the rate, density or type of development, including residential, commercial, municipal, and industrial development, or if it will change the use of open space or other categories of land.

2. Pollution Stemming from Changes in Land Use
   Each alternative will be evaluated to determine if its implementation will cause air, water, noise, solid waste or pesticide pollution as a result of the induced changes in population and land use.

3. Damage to Sensitive Ecosystems
   Each alternative will be evaluated to determine if its implementation will cause damage to sensitive ecosystems (such as wetlands and habitats for endangered species) and environmentally protected areas (such as parks, conservation land and historic sites) as a result of changes in population and land use.

4. Socioeconomic Pressures for Expansion
   Each alternative will be evaluated to determine if its implementation will cause socioeconomic pressures for expansion of the presently proposed infrastructure resulting from induced changes in land use and population.

1.3 Institutional Arrangements

A comparison of the existing institutional arrangements and those required to implement each alternative will be included in the evaluation of alternatives. The organization, which will be responsible for the management of the wastewater facilities, will be identified for each alternative. The costs to each jurisdiction for construction, operation and maintenance of the facilities will be estimated.

1.4 Flow and Waste Reduction

The potential for flow and waste reduction will be evaluated for all alternatives, including the option to optimize existing wastewater facilities as previously discussed. The short listed alternatives will be further discussed. Types of flow and waste reduction, which will be discussed, include: (1) measures for reducing sewer system infiltration/inflow; (2) water conservation measures; (3) land use and development regulations; (4) industrial reuse, recycling and pretreatment programs; (5) treated effluent reuse; (6) continuation of the use of on-site systems; and (7) pollution prevention initiatives.

1.5 Decentralized I/A Technologies

Decentralized innovative/alternative (I/A) alternatives will be evaluated in meeting long-term wastewater treatment and disposal needs. In addition to the conventional Title 5 septic system, the following types of I/A alternatives will be evaluated: recirculating sand filters; peat systems; attached growth systems; fixed film systems; sequencing batch reactors; and trickling filters. The opportunities for utilizing package plants and cluster systems will be evaluated. The site compatibility, pollutant removal efficiency, groundwater and surface water impacts, and operation and maintenance requirements of these I/A systems will be evaluated and compared to the other alternatives.

1.6 Conventional vs Alternative Sewer Systems

Alternative arrangements of interceptors and trunk lines will be compared to determine the most cost-effective configuration. The sizes of interceptors will be based on design flows and a cost-effective analysis of alternative pipe sizes. The cost-effective analysis for collector sewers will compare conventional gravity sewers with alternative sewer systems such as pressure sewers, vacuum sewers and STEP systems. The preliminary routing will be presented on a GIS map, which delineates the areas of need over the 20-year planning period.

1.7 Residuals Disposal

Options for sludge and septage disposal will be evaluated including: (1) stabilization and subsequent land application; (2) stabilization and landfilling; (3) sludge incineration and disposal of resultant ash; or (4) contract services for sludge and septage processing and disposal. The potential sludge classifications of the sludge or septage products will also be evaluated.

1.8 Location of Facilities

Sites for treatment facilities, interceptors, transmission lines, and pump stations will be evaluated based on the following considerations: (1) to locate facilities away from residential areas which would be affected by items such as odors and noise; (2) to minimize aesthetic problems through proper design and landscaping at the facility sites; and (3) to locate facilities outside of environmentally sensitive areas.

1.9 Phased Construction

A cost analysis of phased development will be included in this plan. Factors which will be considered are: (1) relative cost of providing excess capacity initially compared with the present worth of deferred costs for providing capacity when needed; and (2) uncertainties of projected long-term wastewater flows and possible technological advances or flow waste reduction measures which may limit the need for excess capacity.

1.10 Flexibility and Reliability

The flexibility of wastewater alternatives will be assessed in providing sufficient land to allow for expansion of the wastewater facilities to handle unforeseen increases in wastewater flows or pollutant loads. The reliability of wastewater facilities and their most critical processes will be evaluated.

2.0 PLAN SELECTION

The selected plan will be cost effective and will be the most economical means of meeting the applicable effluent, water quality and public health requirements over the design life of the facilities while recognizing environmental, technical and institutional considerations.

2.1 Comparison And Ranking Of Alternatives

Using the evaluation of the short listed alternatives performed in Task 3 as a basis for costs, environmental impacts and benefits, the alternatives will be compared and ranked. Impacts will be considered in quantitative terms, wherever possible, or will be made by a narrative description.

A. Environmental Impacts

All significant direct and indirect impacts will be weighed to derive a value judgment as to the net overall effect of each alternative relative to other alternatives. For example, alternatives, which have indirect impacts with a high potential for contravening an environmental or land-use statute or regulation, will be ranked below those alternatives, which do not.

B. Monetary Costs

The costs of each alternative will be presented, compared and ranked.

C. Implementation Capability

The ability of the federal, state, regional and local governmental units to implement each of the alternatives will be weighed carefully. Tyngsborough must be capable of bearing the local share of the costs of the selected alternative and must have the necessary institutions created in time to carry out the selected plan.

D. Regulatory, Design and Reliability Requirements

Each alternative will be evaluated to determine if it will meet the applicable regulatory requirements and design and reliability criteria. Other considerations such as water quality objectives, flexibility, use of resources and energy, and public acceptability will be evaluated.

3.0 RECOMMENDED PLAN

The comparison and ranking of alternatives will culminate in the recommendation of the wastewater alternative with the greatest environmental and cost benefit to Tyngsborough. This section of the CWMP/EIR will include a description of the critical components of the recommended plan. The environmental impacts, preliminary design criteria, financing analysis and implementation schedule of the recommended plan will also be discussed.

3.1 Detailed Recommended Plan

A detailed discussion of the proposed wastewater facilities in the recommended plan for Tyngsborough will be provided.

3.2 Environmental Impacts

The direct and indirect environmental impacts of the recommended plan will be discussed. The impacts on surface water and groundwater quality, water supply, air quality, noise levels, wetlands, floodplains, endangered species, historical and archaeological sites, conservation land, agricultural land and any other applicable environmentally sensitive area, for the recommended plan will be discussed. Measures to mitigate adverse impacts will also be described.

3.3 Institutional Impacts

The institutional requirements for implementing the recommended plan will also be presented. Typical institutional requirements include: intermunicipal agreements;

establishment of a form of government to oversee the wastewater management program; sewer use rules and regulations; betterment regulations; sewer user charge system; septage management plan; water conservation program; and a sewerage system staffing and operations plan.

3.4 Preliminary Design Criteria

Preliminary design criteria will be developed for the recommended wastewater facilities. Such information may include schematic flow diagrams, unit processes, site plans, sewer layout plans, and design data regarding wastewater flow rates, detention times, and sizing of units. The requirements for operation and maintenance of the treatment works will also be summarized. Total project cost estimates for the recommended facilities, together with a schedule for completion of all work will also be presented. Total project costs will consist of engineering (study, design and construction phase), construction, contingency, legal, administrative, land acquisition, easements and other related costs.

3.5 Financing Plan

The financing requirements necessary for the implementation of the recommended plan will be presented. The costs of the recommended wastewater facilities will be presented and the availability of any federal, state or private assistance for reducing costs will be discussed. The estimated costs per household will be presented and the method of cost distribution will be presented. The costs per commercial and industrial user will also be presented. The financial and/or economical impacts to the planning area will be analyzed and presented.

3.6 Implementation Plan

A schedule for implementation of the recommended plan will be presented. This schedule will detail the design and construction of the recommended wastewater facilities and will also include any plan to phase construction of these facilities. The critical path items of the schedule will be identified.

4.0 PREPARATION OF DRAFT CWMP/EIR

4.1 General

The Phase II "Alternatives and Site Identification" will include a proposed scope for the detailed environmental evaluation of selected alternatives for the Phase III "Draft EIR/Facilities Plan". This scope will be submitted to the Secretary of Environmental Affairs for review and approval.

4.2 Preparation of Draft CWMP/EIR

The selected alternatives will be analyzed in accordance with the revised scope issued by the Secretary of Environmental Affairs. The Draft CWMP/EIR will present a draft recommended wastewater management plan that describes the proposed solutions to Tyngsborough's identified wastewater disposal problems. It will present the specific recommendations for upgrading the on-site systems, operation and maintenance, wastewater collection, transmission, treatment and disposal and residual treatment and disposal. It will also present the costs of any proposed solutions and how they will be financed, the appropriate design criteria for the recommended systems and facilities, the environmental impacts of the plan and any necessary mitigation, and the needed management system to assure that the solutions can be implemented and supported. The Phase II "Alternatives and Site Identification" will also include a proposed scope for the Phase III "Draft CWMP/DEIR".