2.0 WASTE MINIMIZATION ISSUES

A. INFILTRATION/INFLOW

1. Interim I/I Policy Summary

The Massachusetts DEP (MassDEP), with the cooperation of the U.S. Environmental Protection Agency (EPA), Region I, has developed an interim I/I policy. The intent of the policy is to establish clear surface water discharge permit conditions necessary for permitted municipalities to manage I/I in a comprehensive and consistent manner until MassDEP develops comprehensive sewer system Operation & Maintenance (O&M) guidance. Consistent analyses among municipalities will assist MassDEP and EPA in evaluating facility performance and O&M in the permit renewal (National Pollutant Discharge Elimination System [NPDES]), CWMP, and financial assistance (State Revolving Fund [SRF]) processes. Under the interim I/I policy, each community shall develop and implement a plan to control I/I entering the sewer system. The plan shall describe the community's program for preventing I/I- related effluent limit violations, and all unauthorized discharges of wastewater, including overflows and bypasses due to excessive I/I.

2. I/I Issues and Problems

I/I consists of groundwater, rainwater and snowmelt that enter sewer systems through a variety of defects or illegal connections. Infiltration occurs when existing sewer lines undergo material and joint degradation and deterioration, as well as when sewer lines are poorly designed and/or constructed. Inflow normally occurs when rainfall enters the sewer system through direct connections such as roof leaders, yard drains, catch basins, sump pumps, manhole covers and frame seals, or indirect connections with storm sewers.

Extraneous water from I/I sources reduces the capacity and capability of sewer systems and treatment facilities to transport and treat domestic and industrial wastewater. During periods of high groundwater and large or sudden storm events, I/I entering the system may cause sewer surcharging, wastewater backups into homes, businesses or factories, localized overflows of untreated sewage and inadequate treatment at wastewater treatment facilities. These effects of I/I increase the cost of operating the collection and treatment systems and adversely impact public health, welfare and the environment. The control of I/I by sewer system rehabilitation, and an ongoing O&M program to identify areas in need of rehabilitation are essential to protect the enormous investment in sewers and wastewater treatment facilities, as well as for protection of public health and the environment.

Oxford's municipal sewer system consists of about 11,000 feet of gravity sewer and 22,000 feet of force main, all of which is poly vinyl chloride (pvc). There are four pumping stations. Construction of all of the gravity sewers has occurred since 2000, so there is little concern regarding I/I in the municipal sewer system. Private sewers serving Thayer Pond Village in north Oxford are older, and the Town may require this condominium association to conduct an I/I evaluation in the future. Overall, however, there is no need for the Town of Oxford to develop a plan to control I/I entering the sewer system.

The ORSD, which serves residents in northwest Oxford and the southern part of Leicester, operates and maintains about 14 miles of sewers and four pumping stations within the district. Portions of the sewer system date back to 1910, with construction continuing through 2003. Pipe materials include vitrified clay, asbestos cement and pvc for gravity lines, and pvc for force mains and low pressure sewers. The sewer system has experienced I/I issues that result in increased flows at the WWTP during and after wet weather events; the District is currently developing a three- to five-year plan to address these concerns.

Figure 2-1 shows the Oxford municipal sewer system and the ORSD sewer system within Oxford.

B. WATER REUSE

1. Interim Guidelines on Reclaimed Water Use

a. Purpose and Approach

There are several parts of the state where rapid growth and demographic changes have caused water resource areas such as aquifers, rivers, ponds and wetlands to suffer changes associated with significantly lower water tables and diminished base flow. The use of reclaimed water[1] for purposes that do not require the extraordinary quality of drinking water can significantly reduce the pressure to develop new drinking water sources, or to over-employ existing water sources. This Phase II Report will investigate the feasibility of using reclaimed water within the Town of Oxford to minimize the impact on local groundwater and surface water resources.

Reclaimed water applications in Massachusetts have been limited to spray irrigating golf courses, landscaping, artificially recharging aquifers and toilet flushing. The artificial recharging of aquifers is permitted only in basins, sub-basins and watersheds acknowledged to be stressed water resource areas, where it is necessary to replenish streamflow, 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 are extremely rigorous, requiring that reclaimed water be virtually pathogen- and contaminant-free. WWTPs contracted to deliver reclaimed water must not only demonstrate the ability to consistently meet the rigorous water quality standards, but must also have an alternate disposal option that can be employed immediately if reclaimed water criteria are not met. Best Management Practices aimed at minimizing direct human exposure are required of all projects to protect public health. This can be achieved by:

- Reducing pathogenic bacteria, viruses and parasites to a level as low as can be reasonably achieved.

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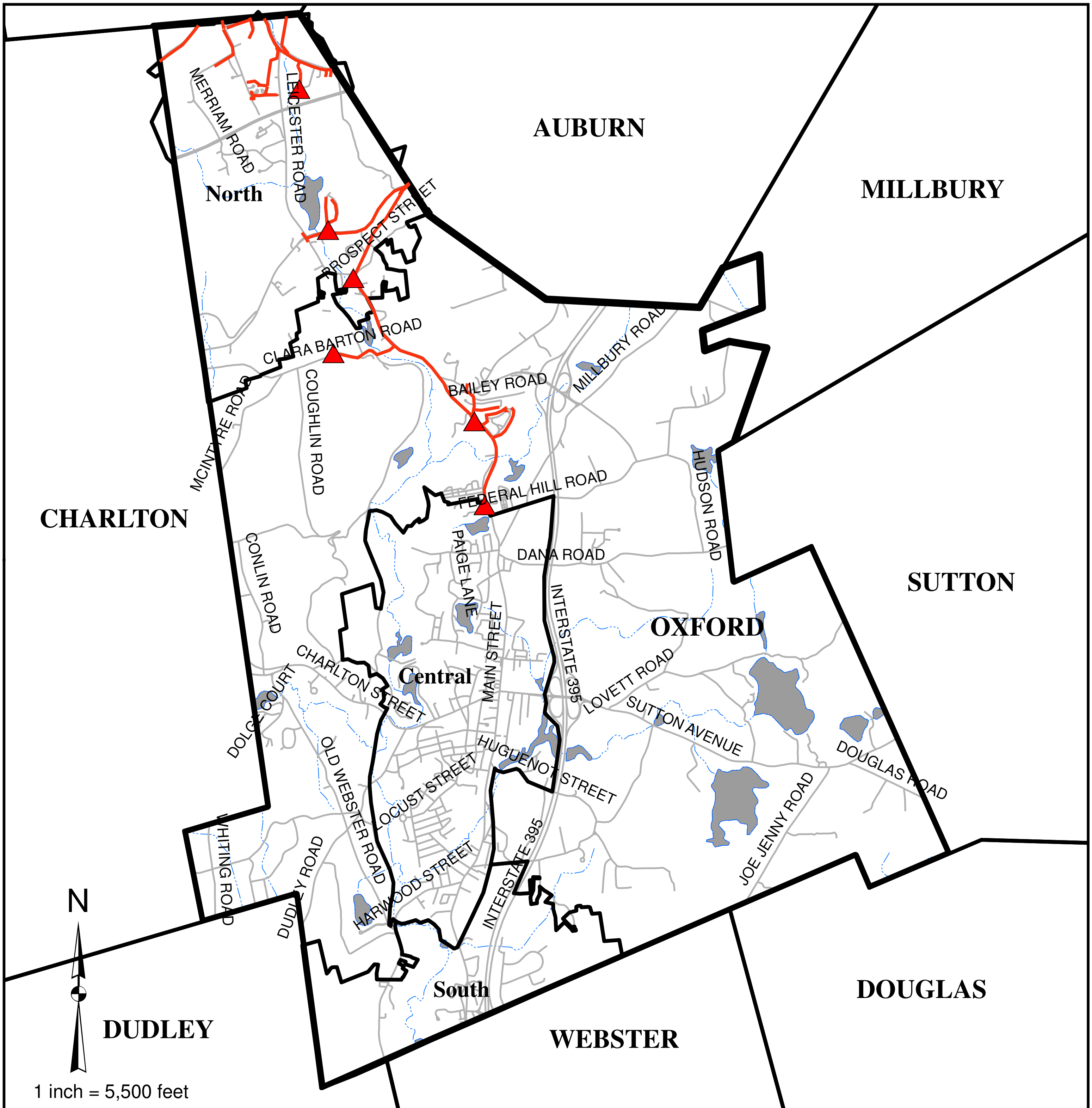
[1] Reclaimed water is wastewater that has been treated at a WWTP to an advanced degree and used again for various applications.



Legend

Focus Areas

Pump Stations

Sewers

TOWN OF OXFORD, MASSACHUSETTS
FIGURE 2-1
EXISTING SEWER SYSTEM

Data compiled from MassGIS and FST

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- Controlling chemical contaminants.

- Limiting public exposure.

- Maintaining levels of chemicals and pathogens so that they pose no appreciable risk of harm to public health or the environment, considering both planned and occasional unplanned exposure or changes in site conditions and use.

- Implementation of site-specific best management practices and public awareness programs that promote safe use.

b. Regulatory Framework

Reclaimed water use projects will be permitted after the applicant demonstrates that the proposed work will comply with the guidelines. The following permits/standards will be required:

- **Groundwater Discharge Permit - 314 CMR 5.00**
  Establishes wastewater treatment processes, effluent quality and monitoring. Places responsibility of violations on WWTP owner.

- **Treatment Plant Reliability**
  Requires treatment plant design in accordance with TR-16 Guidelines, and if the project is located in a Zone II of a water supply, additional treatment to EPA Class I Reliability Standards is necessary. Generally, two power supplies, backup process equipment and unit redundancy, emergency storage and spare parts inventory to minimize down time of repairs achieve this reliability.

- **NPDES Permit - 314 CMR 3.00**
  Provides that reused water discharged into an unlined surface water may require an NPDES permit from EPA and a Water Quality Certification permit from MassDEP. Requires execution of a binding agreement between the permittee and water user.

- **Water Management Act - 310 CMR 36.00**
  Applies to users of reclaimed water if supplementary pumping of ground or surface waters at a rate of more than 100,000 gpd is necessary.

- **MEPA Permit - 301 CMR 11.00**
  Applicability depends if the Massachusetts Environmental Policy Act (MEPA) thresholds are exceeded and state funds are used to finance the work.

- **Local Permits**
  Because of proximity to wetlands and impacts to groundwater, reuse projects usually require a Conservation Commission Order of Conditions and Board of Health Construction Permit.

- **Public Awareness**
  Provides for information program to the public such as brochures on treatment and reuse, notification signage, cross-connection/backflow prevention and use of purple-colored piping for identification.

2. Reuse Concepts

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 is to reuse wastewater for non-potable needs. 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. Some of the better-known water reuse applications include:

- Landscaping for residential, commercial and industrial applications.

- Agricultural Irrigation

- Fire Protection

- Commercial/industrial uses for cooling water and other non-potable applications within facilities, and for irrigation outside facilities.

The health risks associated with the specific wastewater produced in Oxford would have to be addressed as part of the development of a wastewater reclamation program.

The drawbacks of reclaimed water use can be mitigated through careful planning. A rate structure in conjunction with the potable water rate structure would be needed to ensure that incentives are still present to encourage consumers to use reclaimed wastewater for their non-potable water needs. Consumers would have to be educated as to the benefits and proper use of a reclaimed wastewater system. Such educational objectives could be included in the water conservation plan. Finally, construction costs must be minimized. Installing a reclaimed wastewater distribution system within an existing sewered area would be very costly due to restoration costs associated with the new piping. However, if construction is coordinated with other projects, such as construction of a new wastewater collection system, economic benefits could be realized, as construction of dual pipes within a single trench greatly reduces costs.

3. Potential Reuse

Some examples of reuse in New England are described below:

- **Office Parks - Route 495 Area**
  Reuse effluent for below-grade lawn and shrub irrigation and for toilet flushing.

- **Foxboro Stadium**
  Reuse for toilet flushing.

- **Generating Station - Cranston, RI**
  Advanced secondary effluent (4 MGD) pumped 9 miles to power station for cooling water. Evaporation reduces volume by one-third, with remainder returned to WWTP.

- **Spray Irrigation Water Reuse in Ski Areas**
  Beneficial water reuse has been practiced in Vermont and other northern states or high elevation terrains for almost three decades. Ski areas with large and complex wastewater utility systems rely on spray irrigation to also provide a source of beneficial water reuse for supplementing snow-making pond reservoir water, spray irrigation of golf course fairways, and recharging wetlands. Several such systems operate year-round in southern and central Vermont ski resorts, while a lesser amount operates in western Massachusetts, New Hampshire and Maine. Application rates are always regulated by discharge permit based on seasonal and climatic conditions and nutrient loadings, but application can be made in all four seasons.

- **Golf Courses**
  The Links at Bayberry Hills in Yarmouth, MA. Yarmouth became the first municipality in Massachusetts to use reclaimed water to irrigate a golf course. To alleviate some of the system demand placed on the water treatment plant during periods of peak summer demand, reclaimed water is used to irrigate the golf course (May through October). The golf course is limited by permit to 12 million gallons of reclaimed water per year, and additional water requirements are supplemented with potable water. The reclaimed water is stored in two tanks, one a 175,000-gallon tank, and the other a 10.5-million gallon storage tank. The larger tank was designed to store treatment plant effluent during the non-growing season.

For new developments that employ water reuse for toilet flushing and irrigation, the overall annual potable water conservation is significant. Discharge leaching area size will also be reduced somewhat, although not significantly, as leaching areas must be sized to allow for periods when demand for reuse is low.

4. Community Reuse

The Town of Oxford presently has no water reuse applications as described above. In the future, it may be possible to provide irrigation for agricultural sites, office/industrial parks, or the public golf course in North Oxford if the Town is able to identify feasible and cost-effective wastewater treatment alternatives, and effluent storage and disposal options when reuse is not viable.

5. Water Reuse Opportunities vs. Surface Water Discharge

The uses of reclaimed water for golf courses and landscaping irrigation are seasonal, as frost depth exceeds the shallow pipe network lineal depth. In central Massachusetts the frost-free time is April 27 through October 17 (i.e., ± 172 days), and the growing season is May 7 through October 2 (i.e., ± 147 days). At an average irrigation rate of two inches/week, approximately 7,800 gpd/acre can be applied, or a total of about 1,146,600 gallons/acre for the growing season.

This amount is tiny, however, compared with the average daily wastewater flow of about 1,300,000 gallons predicted for the Town of Oxford in 2030 in the CWMP Phase I Report.

The volume discharged for aquifer recharge is substantially greater than for irrigation purposes as the distribution piping can be placed at a greater depth or leaching trenches provided. In the latter case, application rates of 1.0 gpd/square foot (equivalent to 11 inches/week) or greater are not unusual. At this rate, one acre of leaching can discharge 43,500 gpd to groundwater. For year-round operation, aquifer recharge can accommodate approximately 16 million gallons of wastewater effluent per acre.

C. FLOW AND WASTE REDUCTION

1. Flow and Waste Reduction

Flow and waste reduction include the steps that a municipality can take to decrease the amount of wastewater flow, and the potency of the flow that is collected in the sewer system and conveyed to the WWTF.

2. Flow Reduction

In addition to minimizing I/I and continuing use of individual on-site treatment systems,[2] municipalities can implement water conservation measures to control wastewater flow. The Massachusetts Water Resources Commission has provided guidance on water conservation measures that a municipality should implement. In October 1992, the Commission published a document establishing water conservation standards and recommendations applicable to communities within the Commonwealth of Massachusetts. This program identified the following categories for water conservation: (1) public education; (2) leak detection and repair; (3) metering; (4) pricing; (5) residential water use; (6) public sector water use; (7) industrial, commercial, and institutional water use; and (8) water supply system management. Under each category, the Commission outlines minimum standards that must be implemented as well as additional recommendations that each community should consider. Table 2-1 provides a summary of each category.

3. Community Status on Water Conservation Measures

The Town of Oxford has a residential per capita water consumption of about 65 gpd, which is the goal adopted by MassDEP for conservative water use. Aquarion Water Company (Aquarion) owns and operates the vast majority of the public water system in town, and the current residential water usage indicates that Aquarion has a good water conservation program. The Town of Oxford will be assuming ownership and operation of this water system in 2010, and expects to carry out similar water conservation efforts.

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[2] There will be continued use of approximately 1,250 of the 3,700 existing on-site systems in the town, and the number of such systems will grow in the future as the population increases.

Table 2-1
Water Conservation Categories, Standards and Recommendations

Category	Standard	Recommendations
Public Education	No specific standard was given.	The goal of this category is for a community to implement a program that promotes public awareness of the long-term economic and environmental benefits of conserving water.
Leak Detection and Repair	(1) A full leak detection survey of the distribution system should be completed every two years. (2) Leak detection and repair should be recognized as expenses of the water supply system and included in a full-cost pricing structure.	(1) Because leak detection requires substantial skill, regularly trained, in-house teams are recommended. Communities should investigate the advantages of sharing leak detection equipment and personnel to reduce costs. (2) There should be consideration given to assuring the penalty for water theft.
Metering	(1) Each public water supplier should develop a program to implement 100% metering of all public sector and private users with meters. (2) The metering program should include regular meter maintenance. (3) The metering program should include regular meter reading of all public sector users and regular accounting of their use. (4) Meter reading and billing for domestic accounts should be done quarterly. (5) Master meters should be calibrated annually.	(1) Meter reading and billing for the largest users should be done more frequently than domestic accounts. (2) Exterior meter reading devices should be installed. (3) Meter reading and billing frequency would be most effective if done on a monthly basis.
Pricing	(1) Water pricing structure should include the full cost of operating the water supply system. (2) Water supply system operations should be fully funded by water supply system revenues. (3) Each water supplier should regularly evaluate existing rate structures, including any peak demand and seasonal pricing components. In addition, the water supplier should consider all possible pricing options, such as increasing block rates. (4) Water and sewer rates, where applicable, should be billed so as to inform customers of their actual use and cost of each.	(1) Each water supplier should establish an enterprise account for water. (2) Water suppliers should consider adopting an increased seasonal rate to moderate peak demands and/or to protect/maintain supply levels.

Table 2-1 (Continued)
Water Conservation Categories, Standards and Recommendations

Residential Water Use	(1) Water suppliers, in cooperation with manufacturers and professional organizations, should make available to residential users at least the following water saving devices: low-flow shower heads; faucet aerators, toilet displacement devices and/or low-flow toilets, toilet leak detection kits; and educational literature about installation and water conservation savings (in gallons and dollars), including outdoor watering and xeriscaping. (2) The state plumbing code should be strictly and consistently enforced at the local level.	(1) In order to ensure proper installation and greater payoff of retrofit devices, professional installation is recommended. (2) Water audits should be made available to residential customers.
Public Sector Water Use	(1) Government facilities, including school departments and hospitals, should account for their full use of water, based on full metering of public buildings, parks and other facilities. (2) Public buildings should be built or retrofitted with equipment that reduces water use. (3) Water used by contractors using fire hydrants for pipe flushing and construction should be metered and they should be charged, including service fees. (4) Irrigation of municipal property should be sensitive to soil moisture. (5) Strictly apply plumbing codes and incorporate other conservation measures in new and renovated buildings.	(1) Encourage manufacturers to provide water saving devices to municipalities for demonstration projects for free or at reduced cost; master water temperature regulation should be considered for public buildings (2) Encourage xeriscaping or use of native vegetation to reduce outdoor watering; emphasize the advantages of drip irrigation over broadcast watering, and promote these measures in educational campaigns. (3) Investigate the potential uses of non-potable water supplies and small irrigation wells for landscaping, street cleaning and building washing, according to public health considerations, existing connection programs, and plumbing board decisions.
Industrial, Commercial and Institutional Water Use	(1) All industrial, commercial, and institutional water users should develop and implement a written water policy. (2) All industrial and commercial water users should carry out a water audit.	(1) All industrial, commercial, and institutional users should install/retrofit water saving sanitary devices. (2) Industrial and commercial users should work with code officials, standards committees, state programs, manufacturers, and legislators to promote water conservation.
Water Supply System Management	(1) Municipalities should develop regulations, by-laws or ordinances that can be imposed in the event of water supply emergency. (2) Water suppliers should develop strategies to reduce daily and seasonal peak demands and should develop contingency plans for seasonal shortages. (3) Water suppliers should carry out water supply system audits every 3 to 5 years. (4) Water suppliers should develop a plan to identify all uses of water. (5) Water suppliers should investigate and develop plans for interconnections with other systems for emergency supplies.	(1) Communities should develop a local water resources management plan. (2) Water suppliers should keep local officials regularly informed of water consumption and supply availability. (3) Communities should adopt municipal by-laws requiring commercial, industrial and institutional water users to carry out regular water audits.

4. Waste Reduction

Measures for waste reduction include Industrial Pretreatment Programs (IPPs) and pollution prevention initiatives. These programs aim at removing or decreasing the so-called "toxic pollutants" discharged into the municipal wastewater collection system. Toxic pollutants are, in general, defined as non-biodegradable wastes that will either interfere with the municipal wastewater treatment processes, or will pass through treatment works and harm the environment.

The Town of Oxford currently does not have the magnitude and type of industrial wastewater flow that would require establishing an IPP. If the situation changes in the future, then the Town would need to consider developing its own IPP, or falling under the umbrella of the IPP created for the community or wastewater district that receives and treats the industrial wastewater.

In addition to pollution prevention for industry, improper disposal of hazardous wastes from residential sources can be eliminated through public education and implementation of hazardous waste drop-off programs. The Town of Oxford's solid waste management budget presently does not contain funding for household hazardous waste collections. If, in the future, municipal budgets allow, the Town may consider sponsoring a household hazardous waste "drop-off day," and may post educational materials to consumers/residents via the Town's official website. The information would educate people on minimizing disposal of toxic compounds to the sewer system, and provide advice on non-toxic alternatives and proper disposal practices for hazardous wastes.

D. STORMWATER RECHARGE

1. Stormwater/Wastewater Recharge

There has recently been a drive in Massachusetts to harness relatively small wastewater flows by constructing decentralized, small-scale WWTPs with groundwater discharge systems. The cost for constructing satellite wastewater treatment systems in small suburban communities is, in general, significantly more than the cost for connecting them to existing regional wastewater treatment facilities. In addition, siting these facilities is often problematic. Yet, compared to stormwater flows, wastewater flow represents a small percentage of recharge potential. For example, the land area of Oxford is approximately 26.7 square miles. If we conservatively estimate that only 30 percent of the annual precipitation of 43.8 inches infiltrates into the ground, the annual volume of stormwater infiltration is over 6 billion gallons. Diverting the entire estimated future wastewater flow of 1.3 mgd to a groundwater disposal site amounts to only 474 million gallons annually, which is less than 8 percent of the estimated average annual stormwater infiltration.

Stormwater recharge is the most cost-effective method of replenishing groundwater supplies. This can be done by establishing policies and mechanisms to provide stormwater infiltration systems in new site developments, and by promoting rehabilitation of existing stormwater discharge systems to include stormwater infiltration systems when feasible. The following text describes actions taken on the state and local levels to promote stormwater recharge.

2. Massachusetts' Stormwater Management Policy

Massachusetts' Stormwater Management Policy has helped curb the loss of stormwater recharge from site development by requiring, to the maximum extent practicable, that the annual recharge from the developed site approximate the recharge from the site prior to development. However, the policy applies only to site developments that:

- Require a Notice of Intent to the local Conservation Commission.
- Are not single-family house projects.
- Are residential subdivisions greater than four lots.
- Are residential subdivisions with four or fewer lots, where the discharge will affect a critical area.

Presently, MassDEP is proposing new stormwater management regulations that require a special permit for the following activities:

- All site developments five acres or greater.
- Any repair or reconstruction of more than 5,000 square feet or 5% paved surface with an area of at least 5 acres.
- Substantial building or structural improvement that includes repair of a roof, where the total cost of the project exceeds 50% of the "fair market value" of the building or structure before the start of construction on property with an area of at least 5 acres.

3. Community-Specific Approach to Stormwater Recharge

a. New Developments

The Town of Oxford enacted three new chapters to their General By-Laws in January 2005 related to stormwater management: Chapter 65 - *Discharges to the Municipal Storm Drain System*, Chapter 66 - *Stormwater Management and Land Disturbance* and Chapter 67 - *Stormwater Management Requirements*. These by-laws were enacted to bring the Town into compliance with EPA's Phase II Requirements for municipal separate storm sewer system (MS4) communities. One of the primary objectives of these by-laws was to encourage groundwater recharge of stormwater where practicable. The Town has the ability to require groundwater recharge through the submission of a "Stormwater Management Plan", which is mandated by Chapter 67.

The Town's local by-laws encourage new site developments to install infiltration facilities to offset groundwater recharge loss due to construction of impervious surfaces (buildings, driveways, roadways, etc.) where practicable. Specifically, the rate of post- development runoff shall not exceed the rate of pre-development runoff for the 10-, 25- and 100-year storm events. The Town of Oxford encourages recharge of stormwater runoff where soil conditions allow, usually by directing rooftop runoff to dry wells or other leaching structures. Roof runoff is considered to be “clean” and can discharge into the ground without pretreatment. The benefit of this type of stormwater management is to minimize the runoff from the site that would be received by the MS4.

The Town’s Stormwater Management By-Laws also require a Land Disturbance Permit (LDP) for any activity that results in the disturbance of 10,000 square feet or more of land that drains to the MS4, and for all subdivisions regardless of size. By requiring an Erosion Control and Sedimentation Plan as part of the LDP application, the Town can minimize the site development impacts to their storm sewer system. The Town can also encourage the recharge of stormwater runoff where practical as a condition of the LDP permit.

b. Existing Systems

As discussed above, one way to increase groundwater recharge in residential areas is to collect roof runoff and discharge it into a dry well. However, if the house lot cannot support a septic system, a dry well may not be functional, either, and achieving even this amount of recharge in existing residential neighborhoods may not be practical.