

Summary Report of MWRA Demand Management Program Fiscal Year 2004

This report is organized into four sections, as follows:

1. Summary
2. Background and Long Range Water Supply Program
3. Ongoing Demand Management Programs and Detailed Activities for Fiscal Year 2004
4. Demand Management Plans for Fiscal Year 2005

1. Summary

This report has been prepared to meet the requirements of the Massachusetts Water Resources Authority's (MWRA) NPDES Permit MA0103284 - Part I, Item 10.c (page 14 of 32). The purpose of the demand management section (including water conservation) in MWRA's NPDES permit is to help maintain the dry day wastewater flow to the Deer Island Wastewater Treatment Plant below the 436 million gallons per day (mgd) permit limit.

MWRA has maintained the 365 calendar day running average dry day flow well below the 436 mgd limit and well below the 415 mgd trigger (see NPDES Permit Part I, Item 10.a and 10.b). For fiscal year 2004 (ending June 30, 2004), the 365-calendar day running average dry day flow to the Deer Island Wastewater Treatment Plant was 320.9 mgd and has averaged about 320 over the last five years (see Table 1). The dry day flow is reported monthly by MWRA as part of the NPDES Operational Performance Summary.

Table 1 – History of 365-Calendar Day Running Average Dry Day Flow

Fiscal Year	Running dry day flow (mgd)
2000	323.8
2001	323.5
2002	293.5
2003	330.4
2004	320.9
Five Year Average	318.4

MWRA continues to implement effective water demand management policies and programs for the MWRA-owned distribution system, as well as member community-owned distribution systems. The following bullets provide an overview of actions take during FY04. Background information and details on each program are provided in other sections of this report.

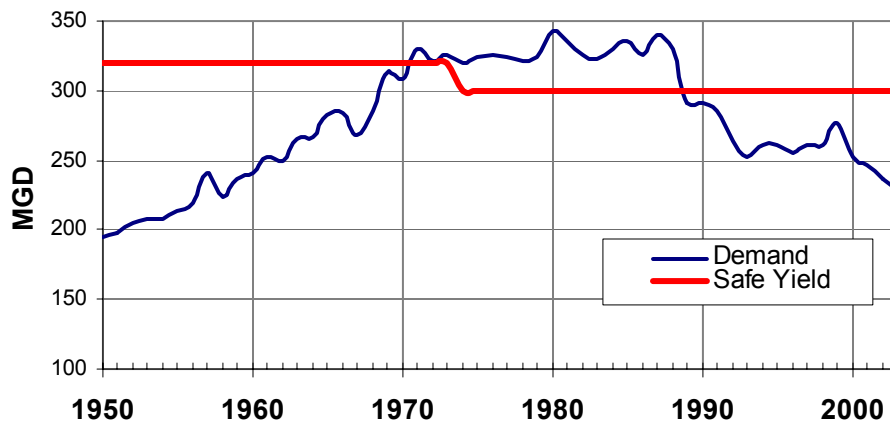
- Leak detection survey of 184 miles of MWRA distribution main, saving approximately 0.50 mgd of water;
- Leak detection survey of 3,605 miles of member community distribution main, saving approximately 5.7 mgd of water;

- \$19 million in interest-free loan funding of 22 local community water pipeline rehabilitation projects, providing 16 miles of new water main and 5 miles of cleaned and lined water main;
- Distribution of over 6,000 water saving fixtures;
- Distribution of approximately 52,000 pieces of water conservation literature; and
- 378 classroom presentations reaching more than 10,000 students in the service area.

The effectiveness of MWRA’s conservation efforts over the past year is demonstrated by the fact that baseline water demand (water withdrawal from MWRA reservoirs) continues to remain stable and comfortably below the system’s safe yield of 300 mgd (see Figure 1).

Figure 1 – MWRA Reservoir Withdrawals

MWRA Annual Average System Demand



For calendar year 2003, water demand was 231 mgd. Table 2 provides data on water use and wastewater generation over the most recent eight-year period. The data on Water Demand represents the total water withdrawal from MWRA reservoirs. The data on Wholesale Water Sales represents water provided by MWRA to all 47 fully and partially supplied communities (a population of about 2.3 million). Total Wastewater Generation data represents the total flow to the Deer Island Treatment Facility from all 43-member sewer communities (a sewered population of about 2 million). The Dry Day Wastewater Generation data represents flow to the Deer Island Treatment Facility during only dry days as defined in MWRA’s NPDES Permit.

Table 2 - MWRA Total Water Demand and Wastewater Generation

Calendar Year	Water Demand (Withdrawals)	Wholesale Water Sales	Total Wastewater Generation	Dry Day Wastewater Generation
1996	256 mgd	222 mgd	426 mgd	N/A
1997	258 mgd	226 mgd	353 mgd	N/A
1998	260 mgd	231 mgd	412 mgd	N/A
1999	276 mgd *	245 mgd	344 mgd	307 mgd
2000	252 mgd *	229 mgd	362 mgd	331 mgd
2001	247 mgd *	229 mgd	346 mgd	305 mgd
2002	238 mgd	219 mgd	340 mgd	309 mgd
2003	231 mgd	214 mgd	382 mgd	333 mgd

* Total withdrawals included an additional (temporary) demand from Cambridge while it rebuilt its own water treatment plant. For calendar year 1999, 15 mgd; calendar year 2000, 14 mgd; and calendar year 2001, 6 mgd.

Considerable additional data on MWRA demand management and water conservation programs can be found on MWRA's website at www.mwra.com.

2. Background and Long Range Water Supply Program

The MWRA, an independent public authority, was established through legislation in 1985 to provide wholesale water and sewer services to more than 2.5 million people in 61 cities and towns. Some of the Authority's goals, purposes and objectives relate directly to water demand management efforts, including:

- Efficient and economical operation of water delivery;
- Programs for leak detection for member communities; and,
- Repair, replacement, rehabilitation, modernization and extension of the delivery of water within the service area of the Authority.

From its inception, MWRA has made demand management/water conservation a high priority. In 1985, MWRA inherited a water system that had been exceeding its safe yield of 300 mgd for almost twenty years. In response to increasing water demand during the 60s, 70s and 80s, several water supply studies were undertaken by MWRA's predecessor agency, the Metropolitan District Commission (MDC). These studies, collectively called the Long Range Water Supply Study EIR 2020, projected the need for 70 mgd of additional supply by 2020 above a base demand of 340 mgd. The studies identified a series of supply development options including diversion of a portion of the Connecticut River flow. Demand management options were also examined. In 1986, the MWRA Board of Directors, through a series of water policy decisions, opted to aggressively pursue demand management strategies rather than pursue options for increasing water supply. This commitment to demand management resulted in the implementation of a highly successful water conservation program that has been a role model for water conservation efforts both nationally and globally.

Long Range Water Supply Program

Following the commitment by the Board of Directors in 1986 to demand management, MWRA in 1987 developed and launched its Long Range Water Supply Program (LRWSP). The LRWSP included 30 different recommendations to be completed over the next decade at a cost of tens of millions of dollars. The demand management components of the LRWSP were meant to reduce

water use and water losses throughout the service area. During a three-year trial program from 1987-1989, MWRA, along with its member communities, initiated demand management efforts that reduced average demand from 326 mgd in 1987 to 285 mgd in 1990 (see Figure 1). This reduction put average demand below the water system's safe yield of 300 mgd for the first time in over 20 years. With this success, the demand management components of the LRWSP were continued beyond the trial program. A detailed discussion of the demand management activities developed from the LRWSP, covering the 1991 through 2000 period, was provided in the Fiscal Year 2000 MWRA Demand Management Report.

Drought Management Plan

In addition to long range planning, the need for a short term drought management plan was made clear after two years of below average precipitation and overuse of the Quabbin-Ware-Wachusett system led to a potential drought warning in the 1988-1989 period. The MWRA Drought Management Plan was reviewed and approved by the state Department of Environmental Protection in 1989. Shortly thereafter, precipitation returned to normal and the reservoirs rose back to normal. In spring 2000, MWRA was involved in the Massachusetts Drought Management Task Force's development of a state drought response plan. The plan outlines agency responsibilities during drought and sets drought stage triggers based on hydrologic conditions. The plan is regionally flexible; for example, small water systems may need water use restrictions during a short-term drought while the MWRA service area would avoid restrictions due to the large storage volumes in Wachusett and Quabbin Reservoirs. Only a long-term drought affecting Wachusett and Quabbin would lead to significant restrictions in the MWRA service area. The plan also retains responsibilities for MWRA's direct lines of communication with the member communities and customers during a drought.

3. Ongoing MWRA Demand Management Programs and Activities During Fiscal Year 2004

Planning and Policies

A comprehensive review of water supply and demand in the MWRA service area was performed by MWRA during FY02 and is presented in a report entitled "MWRA Water System Supply and Demand", May 8, 2002. The report includes basic information about the MWRA/MDC reservoir system and the planning parameters used to evaluate system supply and yield. It also presents information on demand, both from within and outside the MWRA service area, and provides the regulatory and policy framework for consideration of system expansion proposals.

The report concludes that the MWRA/MDC water supply system is sufficient to meet both current and future demand from the existing service area. The projections of growth in the service area through 2025 are modest; the incremental water demand from new homes and businesses in the service area is projected to be less than 13 mgd. Further conservation, increased efficiencies in water use, and response to price increases could moderate demand, so that demand in the year 2025 could conceivably be less than current levels.

MWRA has adopted Policies that establish stringent controls and a rigorous approval process for entities seeking admission to the MWRA water system or to use MWRA water on an emergency basis. These policies include:

- **OP.05, Emergency Water Supply Withdrawals.** This policy applies to communities outside MWRA's water service area that are seeking water on an emergency basis. The MWRA may approve emergency withdrawals for no more than six months at a time.
- **OP.09, Water Connections Serving Property Partially Located in a Non-MWRA Community,** also referred to as the "Water Straddle" policy. This policy applies to all parties seeking to obtain water for a location, building, or structure situated entirely outside the MWRA water service area but located on a parcel of land, under single ownership, and which is subject to an integrated plan for use or development, that is partly inside the MWRA's water service area.
- **OP.10, Admission of New Community to MWRA Water System.** This policy applies to communities seeking admission to the MWRA water system, and to state, county, institutional, and federal facilities seeking MWRA water for a location outside MWRA's water service area, as defined in MWRA's Enabling Act.

Demand management is also an important component of regulations for MWRA's Continuation of Contract Water Supply (360 CMR 11.00) that is applicable to 21 communities that purchase water from the Authority under a cooperative contract basis.

Leak Detection and Repair of MWRA Distribution System

The MWRA initiated a leak detection and repair program in 1987 and, by 1990, found and repaired leaks saving more than 5 mgd of water loss from the Authority-owned distribution system. During the early 1990s, MWRA's leak detection and repair program was established into a routine survey performed by MWRA personnel. All MWRA distribution pipes (286 miles) are checked on a regular maintenance schedule for leaks with repairs made promptly. Over the past ten years, in-house inspections and repairs have annually eliminated about 0.60 mgd of lost water from the MWRA-owned distribution system.

During FY04, a total of 184 miles of MWRA-owned distribution main were surveyed for leaks. A total of 16 leaks were detected and repaired, accounting for approximately 0.5 mgd of water savings.

Rehabilitation and Replacement of MWRA Distribution System and Covered Storage

MWRA has established a Business Plan Strategy to rehabilitate 7 to 10 miles of water distribution pipeline each year. Rehabilitation (cleaning and lining), sliplining, and/or replacement of the MWRA's distribution system are critical elements of MWRA's Integrated Water Supply Improvement Program. While these capital-intensive projects are primarily intended to improve water quality and system reliability, reduction of pipeline leakage is an additional benefit. In addition, MWRA's ongoing construction of covered storage facilities to replace open reservoirs will continue to reduce water loss through evaporation.

Individual projects are detailed in MWRA's Capital Improvement Program (CIP). In the FY05-07 CIP, MWRA has budgeted expenditures in excess of \$2 billion to improve regional drinking water quality and upgrade the Authority's water transmission, distribution, and pumping systems. Some highlights include: the \$357 million, 405 mgd Walnut Hill Treatment Plant; the \$15 million Quabbin Water Treatment Plant, serving the Chicopee Valley Aqueduct Communities; the \$107

million, 115 million gallon Norumbega covered storage facility; the \$32 million, 25 million gallon Blue Hills covered storage facility; the \$659 million, 17.6 mile, 14 foot diameter Metrowest Water Supply Tunnel; the \$24 million Boston Low Service pipe and valve rehabilitation project (20 miles of 36 to 48-inch diameter cast iron pipe); and the \$105 million rehabilitation of Weston Aqueduct Supply Mains (34 miles of 48-60-inch diameter pipe).

Leak Detection and Repair of Member Community Distribution Systems

To help communities identify leaks in their local distribution systems, a program providing a free one-time leak detection survey was established during 1988 to 1990. This program established baseline data on recoverable leakage in the service area. MWRA surveyed 6085 miles of community pipes and detected 2,374 leaks representing 30 mgd of water loss. Each community successfully completed pipe repairs. MWRA extended its once through survey in member community systems to include a follow-up survey of areas where leaks had been repaired. These follow-up surveys first determined if the original leak had been successfully repaired, and second, if any background leakage may have been hidden by the original leak. This follow-up project located an additional 0.7 mgd of water loss.

Based on these successes, MWRA developed leak detection regulations that went into effect in July 1991. Communities are required to complete a leak detection survey of their entire distribution system at least once every two years. Communities can accomplish the survey in one of three ways: (1) using their own crews, (2) hiring their own contractor, or (3) using MWRA’s on-call task order contractor. Leak detection/repair work is generally cost effective as the value of the saved water often far exceeds the cost of the leak detection/repair work.

During FY04, a total of 3,605 miles of local water pipeline were surveyed for leaks. A total of 699 leaks were detected and repaired in community distribution systems, which accounted for about 5.7 mgd of water savings.

Table 3 shows the history of the last thirteen years of leak detection on community pipes.

Table 3 - Leak Detection on Community Pipes

Period	Miles Surveyed	Number of leaks	Estimated leakage-mgd
7/91-6/93	6227	1988	24.75
7/93-6/95	5924	1134	14.12
7/95-6/97	6013	1527	17.78
7/97-6/99	5924	1257	12.44
7/99-6/01	6650	928	9.25
7/01-6/03	6198	1046	9.20
7/03-6/04	3605	699	5.70

Rehabilitation and Replacement of Member Community Distribution Systems

MWRA implemented the pilot Water Infrastructure Rehabilitation Financial Assistance Program in 1997-1999. This program provided \$30 million in 25 percent grants and 75 percent interest-free loans to member water communities for water system rehabilitation projects. Local projects

implemented through this program resulted in the replacement of over 22,000 water meters and rehabilitation of over 80 miles of distribution pipeline. Water loss from both pipeline and valve leakage was reduced.

In November 1999, MWRA approved a new ten-year, \$250 million Local Pipeline Assistance Program established with the primary objective of improving water quality. A secondary benefit of the program is the reduction of water pipeline leakage.

Quarterly funding distribution under the Local Pipeline Assistance Program began in August, 2000 (FY01). Through the first four years of the program, \$68 million has been distributed to twenty-three communities for 91 projects. These projects have provided for a total of 86 miles of new lined water pipe and 43 miles of cleaning and lining of existing water pipe.

Table 4 shows the history of the Local Pipeline Assistance Program.

Table 4 – Summary of LPAP Program

Period	\$ Distributed	Projects Funded	Miles of New Pipe	Miles of Rehabilitated Pipe
FY01	17 million	32	18	22
FY02	16 million	19	16	7
FY03	16 million	18	16	9
FY04	19 million	22	16	5
Total	68 million	91	86	43

Water Metering and Monitoring

In 1993, MWRA completed a project to repair and replace its 148 large revenue meters to ensure accurate and reliable meter readings. Continued annual routine calibration and maintenance of the revenue meters allows MWRA to track water use and accurately charge its users for water. MWRA analyzes nighttime low flow data and historical trends from the revenue meters to help member communities identify potential water leakage in local systems.

During FY04, MWRA continued its ongoing program for operation and maintenance of the water metering system. All meters received routine calibration on a regular schedule.

Residential Water Conservation

In 1988, MWRA embarked on a three-year demand management pilot program to test strategies for residential conservation. MWRA’s goal focused on three areas: to educate consumers on the value of water, encourage consumers to accept the installation of water saving fixtures, and change behavior around water use. Towards this goal, “Operation Watersense” was created which initially tested two methods to encourage home installation of water saving devices. In the pilot program, over 4600 homes participated through a direct installation of water-saving fixtures in selected communities. Another 2400 participants picked up water savings kits from MWRA’s local depots. MWRA also included public housing and non-profit housing communities in its domestic water

savings effort. Under the public housing component, 5000 water saving device kits were distributed to community development corporations and housing authorities.

In 1990 an expanded program was initiated, Operation Watersense was offered to the 730,000 households of the MWRA service area. Basic services included installation of water saving fixtures and a report to the customer of household leaks. A customer service line was also made available to report problems and schedule new fixture installation. Over the next three years, Operation Watersense teams installed 1.3 million water-saving fixtures in 348,871 households in 42 communities. This work included both single family households and multi-family units. In addition, about 13,000 households received more than 86,000 fixtures at pickup depots held at the conclusion of field operations in each community. The program received strong support from municipal leaders, which helped to create awareness and foster support in the communities.

Direct installation of water-saving devices by MWRA was discontinued in 1993 following the completion of Operation Watersense. MWRA continues to provide low-flow device kits to member communities, housing authorities, development corporations, and individual customers at no cost. The low-flow device kits include: 2.5 gallon per minute (gpm) showerheads, 1.5 gpm bathroom faucet aerators, 2.2 gpm kitchen faucet aerators, toilet dams, and leak detection dye tablets. MWRA also maintains its water conservation hotline ((617) 242-SAVE).

During FY04, MWRA continued its program to distribute household water savings devices. A total of 6,162 water saving fixtures (2,310 showerheads, 254 toilet dams, 3,598 faucet aerators) were distributed to MWRA households and member community water departments. Along with the fixtures, homeowners and water departments were also provided with 150 rain gauges and 10,855 leak detection dye tablets.

Public Education Outreach

As a component of MWRA's residential demand management program (Operation Watersense), the Authority initiated a broad-based public information outreach campaign to raise awareness in the community of water as a valuable, limited resource. This program was designed to complement the distribution and installation of water saving fixtures. The public information program used a multimedia approach to capture the interest of the consumer and provide economical and practical ways to conserve water. Materials were tailored to different audiences and different situations. Print materials were developed for use as bill inserts by water departments and for distribution to customers at local events. Other outreach methods included public service advertising on radio and television, bus and subway posters, and establishment of a dedicated informational telephone hotline (242-SAVE). During the system-wide Operation Watersense program, over 600,000 pieces of public education literature were printed and distributed.

MWRA provides public education material to communities and individual customers at no cost. Member communities are encouraged to distribute the water conservation information to retail customers. Beginning in 1999, MWRA began distributing conservation outreach materials specifically focused on outdoor water use, including: a lawn and garden fact sheet, a poster, and a handbook on irrigation controllers. The fact sheet information has also been included on the MWRA web site. MWRA has participated in the work of an advisory group that meets periodically to develop statewide goals and policies for outdoor water use.

The following materials are available from MWRA:

- Water Conservation (Ducks) Bill Insert
- Home Water Conservation Guide
- Low Flow Toilet Fact Sheet
- Outdoor Water Conservation Fact Sheet
- Stop Leaks, Save Water Fact Sheet
- Irrigation Controllers for the Homeowner
- Water-Saving Fixture Installation Guide

During FY04 MWRA continued to target water conservation outreach to member communities including: water saving fixtures, household water leak prevention, low flow toilets, etc. Staff sent letters to 60 member communities (including sewer only communities) outlining the availability of these items and other free materials and water conservation kits. Communities were asked to return a request form indicating the quantities they needed. Most forms were returned promptly and follow-up telephone calls were made to communities who did not initially respond. About twenty-eight percent of the member communities took advantage of this offer. In all, 51,882 pieces of printed materials were distributed.

School Education

A major component of MWRA's water conservation education and public outreach program focuses on promoting water conservation awareness for young people. The School Education program, initiated in 1993, is designed to provide a science-based curriculum using a four step process: educational curriculum development, testing, wide-spread teacher training and continual follow-up, and support to educators. Educational materials have been designed for students from the elementary level to the high school level. Within the first three years of the program, this curriculum was used in 39 of 46 cities and towns the MWRA serves. Additionally, MWRA staff conduct dozens of teacher training workshops annually reaching hundreds of teachers. Along with teaching curriculum and teacher training workshops, the School Education program has created an annual student poster contest and writing contest. The School Education program for water conservation is offered in both water and sewer member communities.

During the FY04 (2003/2004) school year, MWRA's School Educational outreach programs for water conservation made 378 classroom presentations reaching more than 10,000 students in pre-kindergarten through college level classes in 34 communities. In addition to classroom visits, MWRA held a poster and writing contest. The writing focused on "How the MWRA Impacts Me" and the posters in all three categories (K-2, 3-5, and 6-8) focused on the MWRA at work. Nearly 1,000 posters and 300 essays were submitted. The Awards Ceremony was held at Deer Island.

Industrial, Commercial, and Institutional Audits and New Technologies

Concurrent with the development of domestic conservation program (Operation Watersense) during the late 1980s, MWRA applied the same philosophy to the non-domestic water use sector. MWRA targeted hospitals, large commercial buildings, biotech, manufacturing, food processing, hotels, recreational facilities, universities, etc. to tailor water conservation strategies that could be implemented for a specific user. By the early 1990s, over thirty industrial, commercial, institutional water audits had been completed. The changes recommended from these initial audits represented 0.7 mgd in water savings. The knowledge gained from the water audits was then shared with other

similar users through workshops and guidance materials. MWRA utilized technical assistance consultants to conduct the water audits, provide training, and conduct workshops.

During this program, MWRA worked extensively with health care institutions. MWRA found that typical per capita water use in hospitals ranging widely between 40 and 350 gallons per day. For example, in 1991 Norwood Hospital used 51.2 million gallons of water. MWRA conducted a water audit and found that a \$19,500 investment to eliminate seal and cooling water on medical air compressors and removing a vacuum pump resulted in an annual water reduction of 8.5 million gallons. This and other water saving projects were implemented by the hospital. Three years later, its water use came down to 36.6 million gallons.

MWRA has found that conservation initiatives for industrial, commercial, and institutional water users are widely available through consulting firms. With this availability, MWRA has scaled back its industrial, commercial, and institutional conservation program. MWRA has developed and offers at no cost a 52-page Guide To Water Management that contains detailed information to help facility managers reduce overall water use. In addition, detailed fact sheets on industrial, commercial, and institutional water users are available at MWRA's web site at <http://www.mwra.state.ma.us/water/html/indust.htm>. These include specifics on hospitals, schools, colleges and athletic facilities; restaurants; and commercial buildings.

Water Supply Citizens Advisory Committee

MWRA's 1986 decision to aggressively pursue water conservation rather than look for additional sources of water was strongly advocated by the Water Supply Citizens Advisory Committee (WSCAC). This unique citizen's group was formed in 1977 to review a proposed Connecticut River diversion plan to supply water to the metropolitan Boston area. From its beginning, the group has been a strong supporter of water conservation measures. It helped formulate the water conservation language in MWRA's enabling act legislation. In 1986, WSCAC encouraged MWRA to pursue demand management rather than look for new water supplies. During the late 1980's and early 1990's, the citizen's group took a lead role promoting trigger and drought management planning. With its long commitment to the water supply system, WSCAC continues to provide invaluable and independent citizen input on MWRA's policies and programs, while voicing public support of source protection and conservation. MWRA provides funding for WSCAC staff and office expenses as well as travel reimbursement.

During FY04, the Water Supply Citizens Advisory Committee has continued to strongly support MWRA's water conservation efforts. The committee has been active providing review and independent citizen input on water system expansion issues.

Massachusetts Plumbing Code

MWRA was at the forefront of promoting water conservation through its support of changing plumbing code regulations in Massachusetts. In 1989, Massachusetts was the first in the nation to change the state plumbing code that led to the production and utilization of 1.6 gallon/flush toilets. National legislation instituting plumbing code regulations followed in 1994. As a result of this state and national legislation, large-scale changes in toilet fixtures began to take place throughout the MWRA service area. Each year, in thousands of homes, older toilets are replaced with new more efficient ones, yielding permanent long-term water use reductions without direct MWRA intervention.

Other Activities

In addition to the activities outlined above, MWRA staff have also provided assistance to outside agencies in the area of water conservation. In celebration of Earth Day, MWRA provided water conservation fixtures and literature to the MA Waterwatch group at UMASS Dartmouth, and for EPA's Green Expo. Staff have also provided technical assistance to the Town of Billerica and the Center for Ecological Technology in developing homeowner water conservation guides.

4. Demand Management Plans for Fiscal Year 2005

MWRA plans to continue its demand management efforts at a similar level as FY04. The Authority's long-range planning, leak detection, system rehabilitation, water conservation and educational outreach programs have long been established as essential components of demand management. As initiated in FY03, MWRA's Community Support Program will continue to work with sewer only communities to include them in water conservation activities.

During FY05, Authority staff will continue to provide technical assistance to the Town of Reading in the development of its community water conservation program. The Town has contracted with CDM to initiate various water conservation activities, including energy-efficient appliance rebates, water saving fixture installation, and discounted outdoor conservation products.