

Massachusetts Department of Environmental Protection

Sustainable Water Management Initiative Grant Program  
(SWMI)

FINAL REPORT

Westford Water Department SWMI Implementation Project to Improve  
the Efficiency of Water Use and Reduce Water Demand

BRP 2014-06

March 20, 2015 through June 30, 2015

Grantee: Westford Water Department

## **Project Summary**

The goal of the Westford Water Department (WWD) SWMI Implementation Project was to improve the efficiency of water use and reduce water demand of WWD customers through implementation of three key programs: residential rebates and water-saving device giveaways, municipal building retrofits to low-flow toilets, and installation of radio read water meters/interface devices. These programs will improve the efficiency of water use in Westford and help reduce water demand. The rebate program will be instrumental in helping the WWD meet the Massachusetts performance standard of 65 residential gallons per capita day (RGPCD) while both this program and the municipal building retrofit program will reduce overall demand. Finally, radio-read interface devices were purchased and installed to continue the WWD's effort to move from quarterly to monthly reading and billing to help encourage conservation, reduce RGPCD and overall system demands, and improve operations of the WWD.

The project took place between March 20, 2015 and June 30, 2015, and included four tasks:

1. Rebate and Water Saving Device Program
2. Municipal Building Retrofit Program
3. Radio Read Meter/Interface Program
4. Reporting

The project resulted in replacement of 61 inefficient toilets, 8 inefficient clothes washers, 200 inefficient shower heads, and 700 inefficient aerators, and the installation of 500 radio read meters/interfaces. In its entirety, the project is estimated to have saved 9.7 million gallons of water annually, 48 million gallons over a five year period, and 142 million gallons over the lifetime of the expected useful lives of the appliances and water saving devices.

## **Discussion of Individual Tasks**

### Task 1 Rebate Program

Rebates were offered to residential customers of the WWD for qualifying high-efficiency WaterSense-labeled toilets and Energy Star-labeled clothes washers with a Water Factor (WF) of 4.0 or less. WaterSense-labeled toilets that use 1.28 gallons per flush or less received a \$100 rebate. Energy Star labeled Clothes washers with WF of 4.0 or less received a \$75 rebate. Rebates were limited to two toilets and one washer per household or metered account. Advertising materials were developed for the rebate program and were displayed on the WWD website and Westford town website, monthly town newsletter (electronic), customer water bills, at municipal buildings, in the WWD semiannual Newsletter, in the local newspaper (Westford Eagle), at two local hardware stores and home improvement stores, and on Westford Cable TV (CAT). In addition, low-flow faucet aerators and showerheads were purchased as part of the match contribution and made available free to Westford residents at the WWD office and the J.V. Fletcher library.

During the rebate program, the WWD gave away the following water-saving devices (Watersense-labeled):

500 bathroom aerators at a cost of \$265.00

300 kitchen aerators at a cost of \$565.00

200 showerheads at a cost of \$636.00

During the rebate program, the WWD rebated the following number of eligible Watersense-labeled toilets and Energy Star-labeled clothes washers:

61 Toilets at \$6,100 expended

8 clothes washers at \$600 expended

The WWD originally planned to give away 200 bathroom aerators, 200 kitchen aerators, and 100 showerheads but due to strong customer demand for the devices (especially the low-flow showerheads) additional devices were ordered and distributed.

Using lessons learned from a previous rebate program, the WWD offered the water-saving devices at the town library where foot traffic is substantially higher than the WWD office. This proved to be effective as significantly more devices were given away at the library than the WWD office.

The WWD newsletter (InFLOWmation) was frequently referenced when customers requested the water-saving devices or inquired about the rebate program. Since this newsletter is sent to all WWD customers it proved to be very effective in getting the word out about the rebate program and water-saving devices.

A message advertising the rebate program (including a link to the website) was included in all 3 quarterly billing mailings.

Although the budget for the rebate program was not exhausted the response to the rebate program was positive. Significantly more toilet rebates were issued than clothes washer rebates. Flyers were sent to multiple home improvement and large appliance stores at the beginning of the last month of the program as a final attempt to increase demand. An extended rebate period would most likely result in a higher number clothes washer rebate applications.

#### Task 2 Municipal Building Retrofit Program

The WWD identified 32 old inefficient toilets within municipal buildings requiring retrofit to EPA Watersense-labeled low flow (1.28 GPF) toilets. Upon awarding of the grant, the WWD re-inventoried the buildings and identified an additional toilet requiring retrofit for a total of 33 inefficient toilets within several municipal buildings (Roudenbush facilities, JV Fletcher Library, American Legion Field, Nabnasset Fire Station, Westford Museum, Blanchard Waste Water Treatment Plant). In addition, the WWD discovered that a majority of these toilets were of the flushometer variety – which are not currently certified by the EPA Watersense program. After consulting with the MassDEP it was decided that 1.28 GPF flushometers would be sufficient

replacements for the old flushometers. The WWD purchased the toilets and hired a Massachusetts licensed plumber to install the new toilets.

#### Task 3 Radio Read Meter/Interface Program

The WWD purchased 500 R900 RF Meter Interface Units on 3/23/2015. Installation of the units began immediately upon receipt and work was completed on June 1, 2015 (50 were directly purchased by the WWD as part of the match). Installation of the 500 radio read units has completed the upgrade of the distribution system to the point where all service meters can be read within one week or less. This is a significant step forward in the direction of conducting monthly meter reading, and subsequently monthly billing.

#### Task 4 Reporting

Project reporting includes an interim progress report which was submitted on April 30, draft final report, final report, and financial report.

#### **Estimated Water Savings**

Estimated water savings per device and appliance was determined using the American Water Works Association Research Foundation Residential End Uses of Water – 1999 (WRF), The Handbook of Water Use and Conservation – Amy Vickers 2001(Vickers), methods utilized in previous SWMI grant reports, and the Massachusetts Water Resource Association Supplemental Environmental Project, January 2010 (MWRA).

#### Showerheads

As previously mentioned, 200 showerheads using 1.5 GPM were distributed. Average water consumption for showering is 11.6 GPCD (WRF 1999). Homes outfitted with current plumbing code showerheads (2.5 GPM) use an average of 8.8 GPCD for showering (WRF 1999; Vickers 2001). Average Westford household size is 2.93 (MassDEP Annual Statistical Reporting worksheet for Estimating Population for RGPCD – US Census). Based on this information, the 1.5 GPM showerheads use an average of 5.28 GPCD for a saving of 3.52 GPCD (i.e. 40% less than the 2.5 GPM showerheads), as compared to the average consumption for showering (using 2.5 GPM showerheads). Assuming that each household has 2 showerheads (i.e. 100 households were fully outfitted with the 1.5 GPM showerheads), the showerhead program saved approximately 376,446 gallons per year or 1.88 million gallons over 5 years. Since the probable service life of the showerhead is 10 years the savings is 3.76 million gallons. Even if one were to assume that only 50% of the showerheads are actually installed, the savings would still be a significant 1.88 million gallons of water.

#### Faucet Aerators (Bathroom and Kitchen)

The project distributed 500 1.0 GPM bathroom (standard) faucet aerators and 300 1.5 GPM kitchen faucet aerators. Knowing that per capita daily faucet use is 10.8 gallons (Vickers 2001), assuming that 50% of that usage comes from the bathroom, that the conversion to a 1.0 GPM aerator from a 2.0 GPM aerator results in a 50% reduction in consumption, that there are 2 bathrooms per household (i.e. 250 retrofitted homes), and applying the average household size of 2.93 (see above), we end up with an estimate that the program has retrofitted bathrooms serving a population of 732 people, each of whom is saving an average of 2.7 gallons per day, for a total



savings of 721,386 gallons per year or 3.61 million gallons over a 5 year period, or 7.21 million gallons over the expected 10 year service life of the aerators.

Assuming that the remaining 50% of per capita faucet use occurs in the kitchen and that 1.5 GPM aerator increases the kitchen efficiency by 25% (2.0 GPM to 1.5 GPM), and that there is one kitchen per household, our population of 300 people are each saving an average of 1.35 gallons per day in the kitchen, for a total savings of 147,825 gallons per year or 739,125 gallons over a 5 year period or 1.48 million gallons over the 10 year expected service life of the aerators.

Even if one were to assume that only 50% of the bathroom and kitchen aerators were installed, the lifetime water savings would still be a significant 4.34 million gallons of water.

#### Washing Machines

Rebates for eight eligible water-efficient clothes washing machines were provided to WWD residential customers. The average number of laundry loads per day per capita is 0.37 (WRF 1999) and the average Westford household size is 2.93 (US Census). This translates into 396 laundry loads per year per household. The average volume per load of clothes is 40.9 gallons (WRF 1999). Assuming an average washing machine capacity of 3.5 cubic feet this would result in a water factor of 11.69. The average capacity of clothes washers from the EPA Energy Star website is 4.0 cubic feet. Assuming conservatively that all machines have a capacity of 4.0 cubic feet and are the least-efficient machines eligible for the rebate (water factor of 4.0), the estimated water consumption per load is 16 gallons for the rebated clothes washers. Compared to older less water-efficient models, this results in a saving of 25 gallons per load relative to the average of machines currently in use. This results in an annual estimated total water savings of 9,900 gallons per machine. The eight washing machine rebates issued by the program are therefore estimated to save approximately 79,200 gallons of water per year or 396,000 gallons over a 5 year period. Since the average service life of a clothes washing machine is 15 years the rebated machines will save approximately 1.19 million gallons of water during that period.

#### Toilets

Rebates for sixty-one eligible EPA Watersense-labeled toilets were provided to WWD customers to a total of 46 housing units. Based on the US Census average Westford Household (2.93) the toilets in question will service the needs of a total of 135 people. On average, each of these people flushes their home toilet 5.05 times per day (WRF 1999) for a total of 682 daily flushes. Per the rebate criteria, toilets that use 3.5 gallons per flush (GPF) or more were replaced with 1.28 GPF (or less) toilets. The resulting savings is 2.22 GPF or more per flush. Using these figures, the estimated savings for the toilet program is 552,625 gallons per year or 2.76 million gallons over a five-year period. As the expected service life of a toilet is 20 years the estimated savings over the rebated toilets is 11.0 million gallons. In reality, the water savings may be higher since some of the toilets being replaced use more than 3.5 gallons per flush.

#### Radio Read Meter Interface Devices

The WWD currently performs quarterly meter reading and billing. With the installation of the 500 radio read interface devices automation of the distribution system is now completed, and can be read within only a week or less whereas in the past it would take several weeks. This

provides the WWD with the ability to implement monthly water reading with the ultimate goal of switching from quarterly to monthly billing.

The primary conservation benefit of monthly reading and billing is a raised consumer awareness of water usage. With increased awareness comes a greater willingness to conserve, especially when it can make the difference between a low and high water bill. In addition, monthly reading will allow the WWD to notify customers of high usage on a more timely fashion, quickly identify leaks thereby reducing water waste, and target high-use customers for additional water conservation education. While it is difficult to quantify the actual savings from monthly reading due to the many variables involved – a conservative estimate of 2% decrease in residential consumption is reasonable. Based on the WWD's 2014 residential metered water use of 379 million gallons, a 2% decrease in consumption would result in a savings of 7.6 million gallons per year or 38 million gallons over a 5 year period. Over the expected lifetime of 15 years for the interface devices the estimated savings is 114 million gallons.

#### Municipal Building Toilet Retrofits

A total of 33 toilets were retrofitted in several municipal buildings. These toilets were replaced with 1.28 GPF tank toilets or flushometers. The tank type toilets were EPA Watersense labeled. The following assumptions were made to estimate the amount of water saved:

- Toilets replaced were at least 3.5 GPF models. New models were 1.28 GPF for a total water savings of 2.22 GPF.
- WWD has conservatively estimated the average frequency of flushes per day for non-residential toilets to be 10 flushes per day (Vickers 2001, MWRA 2010).
- Number of workdays in a year of 260 days.

Based on the above assumptions, 33 low-flow toilets at 2.22 GPF savings results in a total of 73 GPF of water saved. At 10 flushes per day the water savings is 730 GPD and the annual water savings is 189,800 gallons. This is a conservative estimate since some of the town buildings are open greater than 5 days a week (library, fire station), and some of the buildings house preschool operations (Roudenbush Frost and Nabnasset). The estimated five year savings would be 949,000 gallons, and estimated savings over the expected service life of the toilets (20 years) is 3.8 million gallons.

## Summary of Water Savings for SWMI Grant Project

### Estimated Water Savings from Grant Program

Appliance	Annual Savings (MG)	5-Year Savings (MG)	Lifetime Savings (mg)
Showerheads	0.376	1.88	3.76
Bathroom Aerators	0.721	3.61	7.21
Kitchen Aerators	0.148	0.739	1.48
Washing Machines	0.079	0.396	1.19
Toilets (Rebate)	0.553	2.76	11.0
Radio Read Interfaces	7.6	38	114
Municipal Retrofit	0.19	0.949	3.8

**Totals** 9.7 48 142

**MG = Million Gallons**