

TOWN OF BRIDGEWATER
WATER LOSS PREVENTION GRANT PROJECT
PROJECT NUMBER 06-05/WLP



PROJECT CONDUCTED 2007-2009

PREPARED BY:
Town of Bridgewater

PREPARED FOR:
MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF RESOURCE PROTECTION
AND
U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 1

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Table of Contents

1.0	Introduction	31
2.0	Water Audit (Task 1)	3
2.1	Measure the Supply	4
2.2	Measure the Authorized Metered and Unmetered Use	4
2.3	Pumping and Treatment Costs	4
2.4	Source Meter Testing	5
2.5	Distribution System Metering	5
2.6	Measure Water Losses	5
2.7	Analyze Audit Results	6
3.0	Water Rate Study (Task 1)	8
4.0	Leak Detection Survey (Tasks 2 - 4)	8
4.1	Equipment Purchase	10
4.2	GIS	11
4.3	Mutual Aid: East Bridgewater and Halifax	11
4.4	Training	11
4.5	Reporting	11
4.6	Recommendations	12
5.0	Municipal Building Survey (Task 5) Academy Building, Memorial Building, Town Hall, School Street Fire Station and Wastewater Treatment Plant	13
6.0	Conservation Plan (Task 6)	17
7.0	Educational Outreach (Task 6)	18
8.0	Grant Budget (Task 7)	22
9.0	Lessons Learned	22
10.0	Conclusions and Recommendations	24

Appendices and Tables

Appendix A Water Audit Forms 1 - 6

Appendix B Leak Detection Equipment

Appendix C Contractor Qualifications

Appendix D Memorandum of Mutual Agreement with E. Bridgewater and Halifax

Appendix E Leak Detection Completion Report

Appendix F Photographs of Municipal Building Water Using Devices

Appendix G Conservation Plan

Appendix H Educational Outreach Material

Table 1.0 Summary of Water Audit 2005 - 2008

Table 2.0 Building Inventory – Academy Building

Table 3.0 Building Inventory – School Street Fire Station

Table 4.0 Building Inventory – Town Hall, Memorial Building and Wastewater Plant

1.0 Introduction

As outlined in the scope of services for this contract, the grant consists of the tasks and deliverables presented in this report, consistent with the Town of Bridgewater's (Grantee) technical proposal and as outlined in the RFR of October 6, 2006. In order for a deliverable to be considered complete under the contract, the deliverables were completed in accordance with the contract specifications and with the approval of extension of the contract schedule.

This project implemented a water audit, purchased leak detection equipment, conducted a leak detection survey and leak repairs (presented as a match), inventoried and evaluated water-using facilities in the municipal buildings (match), and updated and implemented the Grantee's Water Conservation Plan (match). The goal of the Grantee's Management Permit is 10% unaccounted for water. There are several areas that water conservation has been addressed as a part of this grant work. Based on the results of this scope of work it was determined that the Grantee has achieved 95% water accountability and has documented approximately \$14,000 in total savings from leak repairs and conservation through public education.

Under this project, the Grantee committed to the repair of identified leaks in accordance with the terms of the Grantee's current Water Management Act Permit (permit number 9P-4-25-042.01). As outlined within the MassDEP's guidance document, the Grantee has quantified the water savings from the leak detection in the distribution system as \$6,220 and 1,555,200 gallons for six months.

A leak detection inventory of the five municipal buildings revealed six toilets and one faucet with leaks that were repaired. These are old fixtures and replacements are planned, however, interim repairs were made to minimize the loss of water. The drips were very minor at the faucet and the cost savings was estimate at approximately \$17/year for the estimated 4,200 gallons lost. The leaking toilets were estimated to result in potential water loss of as much as 820 gallons/day. From the six toilets, this would translate into approximately 1,795,800 gallons/year at a loss of \$7,200.

There have been estimated values associated with public education efforts presented by various national studies and economic researchers. One study indicated that an educational program could have an impact on between 2 – 5%. Approximately 300 students and 12 faculty and staff were directly involved with the education outreach undertaken in December 2008 as a part of this grant program. Based on an average household of 3.27 persons in Bridgewater (2000 US Census data), a simple change the way we brush our teeth, i.e. turning off the water while brushing, could result in a

savings up to \$1,490 (approximately 372,400 gallons). From conversations with parents of the second graders following the school presentation it was clear that these young people were excellent conservation advocates and this is likely a very conservative representation of the savings through this education outreach detailed in subsequent sections of this report.

Concurrent with and separate from this grant work, a water rate study was performed and an increase has been recommended, adopted and implemented for the fall of 2008 using an ascending rate structure. According to the WaterSense EPA website, this rate increase combined with water conservation education has been proven to be the most effective means of reducing water demand.

The Grantee also certifies that the skill level of the appropriate employee(s) and/or Grantees was adequate to perform the contracted tasks to high industry standards, and that the work conducted was done so in accordance with such standards [i.e., the American Water Works Association (AWWA) standards].

In accordance with Task 8, (Submit a Draft and a Final Project Report) and the related deliverables

- Two paper copies of a draft final report were provided to the Department's Project Coordinator for review and comment prior to the milestone schedule end date. The report includes a summary of the entire project, including methods, results and conclusions as well as recommendations on actions that should be taken to further reduce water losses and comment on the effectiveness of the project.
- The Final Report calculates the environmental results of the project and quantifies the water savings in both gallons of water and dollar value per year.
- Upon receipt of comments on the draft report from the Department, the Grantee will address these comments in the final report. The draft final report and final report will contain all project deliverables.
- One camera ready copy (unbound) and three printed copies of the final report, and two CDs with electronic versions of the final report which are compatible with the Department's systems (Word or a searchable Adobe PDF format) were submitted to the Department's Project Coordinator by the project end date.

The report was authored in Word as an accessible document and also provided both in an accessible/tagged PDF and finally output to RTF.

2.0 Water Audit (Task 1)

The Grantee conducted a water audit using fiscal years 2005 – 2008 to balance the volume of drinking water produced with the volume billed and account for the remaining water (loss) using the AWWA standard and the MassDEP guidance available through the Water Management Act Program – Water Management Act Program Guidance Document for a Water Audit and Leak Detection Survey - found in Attachment D of the scope of work for this grant and within the MassDEP's website. (<http://www.mass.gov/dep/water/approvals/guidance.pdf>)

Tasks completed for the water audit included the following:

- Review of data pertinent to the existing water system including general system information and data on source meters and metered connections.
- Review of production and sales records in order to determine the quantity of water pumped from each source and the quantity of water sold over the past three years. Estimated quantity of unmetered sold water.
- Review of operation and maintenance records to estimate costs for pumping and treating the water for the past three years.
- Review of billing and accounting procedures, including meter reading, printing of billing statements, and calculation of total water use for sources of error. Adjust water sales records to reflect any error found in billing and accounting procedures.
- Review of the latest master meter calibration test results and adjustment of the source quantities to reflect inaccuracies.
- Review of the Grantee's past meter testing results.
- Review of the most recent leak detection survey. Utilizing acquired information, the Grantee was able to determine the amount of unaccounted-for water in the system or the quantity of water that is potential leakage and estimated the cost per year due to the water losses.
- Complete water audit worksheet with calculate water losses.
- Provide recommendations for improvements to the system, including billing and accounting procedures, maintenance programs, and water usage.

Deliverables 1:

- Completed water audit survey and reporting forms as per Department guidance including items listed above are included in Appendix A.
- Technical memo summarizing the method or methods by which data was collected, schedule by which master meters are calibrated, and recommendations needed to improve

recording of water flows for sources of supply and distribution system measurement systems is presented in the following sections.

The MADEP Water Audit consists of six forms that were completed in order to determine the amount of water being used, the amount of water being lost, the budget being used, and the type of detections being used to eliminate leaks and minimize water loss. Water department records were reviewed for the past three years in order to collect the necessary data for the amounts of water being pumped, the meter records, the budget that outlined what services were being used and at what cost, along with meter sizes and adjustments.

2.1 Measure the Supply

The first form (Form 1) asks for the *Uncorrected Total Water Supply* from the Wells for the fiscal years of 2005-2006, 2006-2007, and 2007-2008. Information was gathered from water department records for the amount of water that was pumped from the wells for those fiscal years. After inputting the three years' data, it was totaled and then averaged. Personnel at the Water Plant then verified the data. This line item was put onto Line 1 on Form 6 along with Line 1 on Form 3.

2.2 Measure the Authorized Metered Use and Unmetered Use

The second form (Form 2) asks for the *Uncorrected Customer Meter Records* for the amount of water being sold and classifies its use as Residential, Industrial, Commercial, Agricultural, Institutional or Other. This information was also obtained through the Water Department records and the entered into the database used to calculate the three-year average. This information was entered on Line 4 of Form 6. The total amount of metered and unmetered water used in the past three years was then averaged and entered on Line 6 of Form 6.

2.3 Pumping and Treatment Costs

The third form (Form 3) is the *Pumping and Treatment Costs/ Annual Costs* for the past three years. In order to calculate the amount of money that was spent on the three fiscal years, 2005-2006, 2006-2007, and 2007-2008; the amount of money that was placed in each budget and the amount that was actually spent were found from end of the year records, water department budget summaries and additional information received from the Town Accountant. From there, a dollar figure was calculated and placed into the appropriate categories, i.e. chemicals, electricity, fuel and other. These calculations made it possible to determine the exact amount for each year, and then an average amount for the total of all three years was calculated. These total amounts were reviewed to see if there were any inaccuracies and there appeared to be a good comparison with the budget totals and line items reviewed. This form provided a summary of the average base pumping and treatment costs from the sources of supply.

2.4 Source Meter Testing

The fourth form (Form 4) summarizes the accuracy of the meters at the withdrawals wells and is entitled: *Source Meter Error Adjustments to the Total Amount of Water Supplied to the System*. There are ten groundwater wells that can be used to supply the water to the residents of Bridgewater. Not all wells are used at all times and withdrawals are in accordance with the water withdrawal permit. The Water Department schedules maintenance of the wells on a rotating basis. The firm of R.E. Chapman, drilling contractors, completed the flow performance testing for each of the three years considered. The meters are calibrated using pitot flow rate measurements. The accuracy of the meter was determined based on a comparison of the actual flow to the recorded flow measurements for several trials. Then an average error was applied. For example in 2006, the meters at wells 2, 3, 4, 5, 8 and 9 were calibrated and indicated a -1.83% total adjustment due to meter reading errors that were found to be in the range of -0.88% at well 4 to +11.40% at well 3, as shown on Form 6. In 2007, the meters at wells 1, 2, 3, 4, 5, and 6 were tested. In 2008, wells 8, 9 and wells 10A and B were tested. For the annual calculations for the wells that did not have their meter calibrated, the most recent error was applied as a conservative estimate.

2.5 Distribution System Metering

The fifth form (Form 5) is the *Distribution System Large Service Meter Adjustments*. The large meters are independently owned and the Water Department Rules and Regulations require biannual testing by their owners. It has not required that this information be provided to or for records to be maintained by the Water Department. This grant work includes the recommendation for the implementation of follow-up with this request for verification of testing for the water supply system source meters on a semi-annual basis.

In general, the information from this form provides a report of adjustments that might be made from large in line meters and an error correction applied to the gallonage. In the absence of current records for these large meters, a list of the large meters and their locations has been prepared and a null value applied to the calculations for this line item (line 5a, Form 6).

2.6 Measure Water Losses

Based on the results of Water Audit and review of water use in the Town of Bridgewater, the primary unmetered uses are categorized as Fire Fighting and Training, Bleeders, Water Main Flushing, Storage Tank Overflows, Public Construction Uses (including, Sewer System Maintenance, Street Cleaning, Construction and other incidental uses). For accounting purposes, the water department staff keeps an estimate of the quantity of water used by date and incident.

The Water Department performs on-going leak detection during the course of system maintenance and no significant leaks have been found that were not repaired in a timely manner.

2.7 Analyze Audit Results – Summary of Form 6

The table below is a summary of Form 6 of the Water Audit. As seen the system reports a 5% unaccounted for water loss. This is below the 10% target recommended by the Water Management Act. It was calculated that the average water usage is 620 million gallons per year and it costs approximately \$4.00 per 1000 gallons to deliver potable water to the Town for the various uses.

Table 1.0 Summary of Water Audit 2005 - 2008

DESCRIPTION		COMMENTS	FORM	RESULTS
1	Uncorrected Total Water Pumped From Sources of Supply		1	623,119,270
2a	Adjustments to Total Water Supply Master Meter Error		4	-2,462,839
2b	Faulty Valve Controlling Devices		(pg 4*)	0
3	Corrected Total Water Supply (Add Lines 1, 2a, and 2b)	Unadjusted Total		620,656,431
4	Uncorrected Customer Meter Records Total Amount Sold		2	568,793,300
5a	Adjustments to Metered Water Sales - meter error	Data not available	5	0
5b	Billing Procedure Error			0
6	Uncorrected Customer Meter Records		2	0
7	Corrected Total Quantity of Water Sold (Add Lines 4, 5a, 5b, and 6)	Adjusted Total		568,793,300
8	Total Amount of Water not sold (Subtract Line 7 from Line 3)	Unmetered		51,863,131
9	Total Unmetered Authorized Public Uses of Water		(pg 5*)	20,298,750
10	Total Unmetered Miscellaneous Losses		(pg 5*)	0
11	Total Identified Water Losses (Add Lines 9 and 10)	Estimated		20,298,750
12	Total Unidentified Water Losses (Subtract Line 11 from Line 8)	UAW		31,564,381
13	Potential Water System Leakage in gpd per mile of water main. Divide Line 12 by 365 then divide by total system miles of water main)	Leakage/mile		665
14	Percentage of unaccounted for water that may be attributed to leakage (Divide Line 12 by Line 3)	UAW leakage %		5%
15	Pumping and Treating Cost per gallon of water (Line 4 on Form 3)	Cost/gallon	3	\$0.004002
16	Annual Expenditure due to Unidentified Water Losses (Multiply Line 12 by 15)	UAW Cost		\$126,308

*refers to MADEP Water Management Act Program – Guidance Document and Forms for a Water Audit)

3.0 Water Rate Study (Task 1)

Concurrent with the preparation of this Water Loss Prevention Grant, the Water Department contracted with Wes Gardner to conduct a water rate study. Rapidly rising chemical costs will require the restructuring of water rates and result in an increase in customer costs. At the time that this grant was initiated the fee structure was a three-step rate:

Water Use, ft ³	Cost
0 – 1500	\$30.00
1501 – 3000	\$2.40/100 ft ³
Over 3001	\$3.20/100 ft ³

The results of the Water Audit showed that it costs approximately \$45.00/1500 cubic feet. The Water Department operates as an enterprise fund and is required to maintain fees sufficient to cover operating expenses. It is recommended that the Water Department increase the fees for service to the customers in order to cover the costs associated with providing the service.

A new rate structure was being finalized at the time of this report completion.

Water Use, ft ³	Cost
0 – 1000	\$30.00
1001 – 3000	\$2.45/100 ft ³
3001 – 20,000	\$4.16/100 ft ³
Over 20001	\$5.45/100 ft ³

4.0 Leak Detection Survey (Tasks 2 –4)

The leak detection survey, Tasks 2 and 3 of the grant; included the purchase of leak detection equipment, personnel training and distribution system survey. A detailed description of the equipment purchased is included in Appendix B and a copy of the supplier's qualifications and training included in Appendix C. In addition, field equipment was updated for GIS compatibility to increase the information available to the field personnel and reduce the amount of time in responding to a leak event. Under the terms of this grant, the equipment will be available for use by the Towns of East Bridgewater and Halifax, as part of mutual aid agreement, along with the opportunity for training of these towns' staff. A copy of the Mutual Aid agreement is included in Appendix D of this report.

The Grantee has included a thorough documentation of the methodology employed in the survey. The methods and Standard Operating Procedures (SOPs) were approved in writing by the MassDEP. Upon approval, the Grantee conducted a leak detection survey of all water mains and appurtenances of the water distribution system network that may include source of supply transmission lines. The Grantee thoroughly documented the leak detection survey; using the MassDEP guidance in Attachment D of the SOW to document the leak detection survey. Grantee personnel engaged in leak detection work were trained and are proficient in leak detection methods and the equipment used. Training was done by Liston, a subcontractor that was utilized and who possessed the required minimum of one year of experience in conducting leak detection surveys. The MassDEP prior to initiation of the survey work approved the subcontractor.

The survey consisted of a comprehensive leak detection survey of the entire water distribution system that was measured to be 130 miles of main, including hydrants, gate valves and service connections. Previous estimates of the length of water main incorrectly reported 200 miles. This was based on the Highway Department measurement of 200 miles of paved roadways in Bridgewater. The leak detection survey accurately measured only those roadways that have public water and provided the Water Department with a much-needed correction to its reporting database. As part of the leak detection survey, the Grantee or its subcontractor used a correlator to detect, record, analyze, and pinpoint the sound created by underground water leakage.

According to the report prepared by Liston, leaks were found at two hydrants. It was estimated that these leaks were 3 gpm, each. Conservatively, these leaks could have been on going for as long as six months. Six months prior to Liston's survey water department personnel had handled these hydrants as part of system maintenance and no leaks were noted. At 3 gpm, if the leaks had begun immediately after the hydrant flushing, each hydrant could have lost 777,600 gallons of water. At the current water rates of \$4.00/1000 gallons each hydrant could have resulted in a revenue loss of \$3,110. No leaks were found in the water mains during the course of the system survey.

Deliverables 3:

- Completed leak detection survey as per Department guidance.
- Submit a technical memo summarizing the method or methods by which data was collected.
- Leak repair plan

As a part of this grant the Grantee agreed to establish a priority system to implement leak repairs. Identified leaks were repaired in accordance with the terms of the Grantee's current Water Management Act Permit (permit number 9P-4-25-042.01) and any additional requirements issued

during the course of the Contract period by MassDEP. Leakage repairs were performed in conformance with industry standards and this report documents the leak repairs. It was estimated that the hydrants were leaking at 3 gpm, based on visual observation once the hydrant stems were exposed. This task was presented as part of the Grantee's match.

Immediately, plant personnel made the necessary repairs for the leaks found at the hydrants, The Grantee re-surveyed the two hydrants; specifically the plant personnel correlated the two locations upon completion of the repairs and found the repairs eliminated the leaks. As part of the submitted leak detection report and quarterly progress, as applicable, the Grantee has provided the Department dates leaks were found and repaired, and estimated water savings realized. As noted, it is estimated that it may have been another six months before the leaks at the two hydrants would have been detected with a resultant savings of \$6,220. The Grantee certifies that the work was conducted in accordance with industry standards.

Deliverables 4:

- Priority system of leak repair
- Completed leak repair forms
- Summary table of leaks detected, leaks repaired, total cost, and estimates of leakage removed based on visual observation of exposed leaking infrastructure
- Technical memo summarizing the method or methods by which data was collected is included in Appendix E, Mr. Liston's Leak Detection Completion Report and the documentation of the repairs as noted previously.

4.1 Equipment Purchase

According to Task 2, (*Purchase Correlating Leak Detection Equipment*), Joe Silva, Water Superintendent for the Town of Bridgewater requested information and specification on various types of leak detection equipment from several vendors. This request included an outreach to minority businesses. In accordance with the grant the leak detection equipment was to include a leak correlator and leak detection loggers. The vendor or alternative would provide staff training.

Written confirmation from the Grantee that the leak detection equipment has been purchased (Task 2 deliverable) is included in Appendix B.

- Written confirmation from the Grantee that the leak detection training, appropriate to the equipment purchased, has taken place. (Task 2 deliverable) is included in Appendix B.

4.2 GIS

Scott Lussier of Envisiongraphics provided GIS services that included the addition of an overlay of the distribution system that was installed in the field computers along with training of field personnel

in its use. This work will enable the field crews to use mapping that is compatible with that in the main office. The water department has used this tool to minimize response time and water loss in a recent water main break incident. GIS work or GIS-related costs were not eligible for grant reimbursement. GIS work was conducted as part of an eligible match.

4.3 Mutual Aid: East Bridgewater and Halifax

As noted previously, due to the specialized nature of the leak detection equipment, it was recommended by the Grantor that the Grantee establish an agreement with nearby communities to share the leak detection equipment. The Towns of Halifax and East Bridgewater agreed to participate in this with the Town of Bridgewater. This grant program included opportunities for the training of appropriate staff from the Towns of Halifax and East Bridgewater on proper use of newly purchased leak detection equipment. Documentation of the sharing agreement or memoranda of understanding with the towns of Halifax and East Bridgewater (Task 2 deliverable) is included in Appendix D.

4.4 Training

Jim Liston provided training and conducted the survey of the 130 miles of water mains and associated fixtures. Mr. Liston reported that no water main leaks were found. In order to test the equipment, a leak was created and a demonstration of the appropriate response was conducted.

4.5 Reporting

Mr. Liston completed the necessary documentation for the leak detection survey that was performed entirely by James D. Liston utilizing Fluid Conservation L-Mic and Radcom Technologies correlating system SoundSens. Copies of Mr. Liston's report are included in Appendix E. It is noted that the Standard Operating Procedures (SOPs) for the equipment include the programming of the loggers. The operators can place the pods on a series of valves and/or hydrants then leave in place for two recordings. These SOPs were held throughout the training and leak detection survey. The equipment manufacturer indicates that no maintenance or service requirements are necessary for five years, when battery maintenance is recommended. The product specifications sheet is included in Appendix B.

The initial calibration of the correlator is performed using two correlators. This calibration was performed as a part of this leak detection survey.

Weather conditions have no effect on the equipment and were not a factor during the survey performed. There was no condition encountered that had any impact on the survey, e.g. vandalism, traffic, road conditions.

The correlation survey consisted of placing leak-correlating Dataloggers at every intersection of the water distribution system. This was accomplished using hydrants, hydrant valves, mainline valves and service connections. There were no leapfrog connections. The length of run was dependent upon the field situations; however, the hydrants are typically set at distances of 400' or less. The Town of Bridgewater has adapted a maximum distance between hydrants of 400' for fire response needs. For the exceptionally long run, the data could be stored. The correlator is able to detect leaks from various pipe materials, indistinguishably. The type of pipe has no effect.

Mr. Liston specifically addressed the absence of leaks in the water main. "You can only find what is there. I have been doing surveys for over 30 years and you do run into a tight system every once and a while..."

4.6 Recommendations

It is recommended that the Water Department continue its program of leak survey and commended the Department on excellent system maintenance. As noted in his report:

While the distribution system was found to be in excellent condition, unaccounted for water is a very complex issue with many variables involved, with undetected leaks being one of those variables. A water department requires timely and accurate data from their master meters feeding the distribution system to help determine if and when a leak survey needs to be performed. The survey should not be performed solely on the absence of time since the last survey. It should be based upon accurate flow data into the distribution system. The data that should be looked at is total consumption, minimum night rates. If the consumption starts to rise, then at a certain threshold a new leak survey should be performed.

While leakage is part of the unaccounted for problem in the water industry, theft, non metered accounts and metered accounts with wrong type or size meter can also be part of the problem. All metered accounts with turbine and compound water meters should be evaluated for the potential of unaccounted for water loss. Equipment is available on the market today that will accurately log flow and consumption rates to help a water authority determine if a metered account is properly typed and sized. Once achieved the right size meter will generate additional revenues for the authority as well as reduce the unaccounted for water.

5.0 Municipal Building Survey (Task 5)

Task 5 was identified as *Inventory and Evaluate Water Using Facilities in Municipal Buildings*. This inventory was accomplished with the assistance of Constance Soares, an engineering intern from Bristol Community College, who was awarded a sponsorship through The Urban Massachusetts Alliances for Minority Participation (UMLSAMP) as a Student Research Opportunity. The research project provided a learning opportunity for Ms. Soares under the direction of the Grantee's Project Manager, Mrs. Sances, who is a licensed engineer. Together, they developed program for the inventory and evaluation of all water-using facilities in five of the Grantee's principle municipal buildings.

With the cooperation of the Board of Selectmen and Building Maintenance staff, Anthony DeSilva an inventory was performed and minor repairs were made as appropriate. Specifically, Mr. DeSilva, made repairs to correct leaks detected at the Town Hall first and second floor bathroom toilets (4 toilets), replacement of the handicap sink faucets at the Fire Station's first floor unisex bathroom, and replacement of the flushing mechanism in the women's' and men's bathroom on the first floor of the Academy Building (2 toilets). Mr. DeSilva noted that several of the fixtures in the Memorial Building are too old to repair and should be replaced. Mrs. Sances and Ms. Soares also noted that several of the toilets in the five buildings should be replaced with water saving units. In addition, it is recommended that water saving faucets replace the older style faucets to minimize water use. This inventory and any repairs were presented as a match only. Tables 2.0 – 4.0 are included as a summary of this inventory with detailed pictures of the facilities included as Appendix F.

The inventory of the five municipal buildings revealed six toilets and one faucet with leaks that could be repaired. These are old fixtures and replacements are planned, however, interim repairs were made to minimize the loss of water. The drips were very minor at the one noted and other faucets and the cost savings associated with the one faucet that was repaired was estimated at approximately \$17/year for the 4,200 gallons lost. The leaking toilets were estimated to result in potential water loss of as much as 820 gallons/day. From the six toilets, this would translate into approximately 1,795,800 gallons/year at a loss of \$7,200. The volume of water loss from these leaks was calculated based on the rate of leakage from the faucets, described as a slow steady drip, estimated at 350 gallons/month. The Town has planned to replace many of the water using fixtures with water conserving fixtures within the next year as funds become available.

Deliverables 5:

- Summary of inventory process and repair or retrofits is included on the following tables and a photographic inventory is included as Appendix F.

Table 2.0 Building Inventory – Academy Building

Photo ID	Floor	Description	Leak noted	In use	GPF	ADA	Work/Recommendations	Savings
AB1W	1 st	Women's Bathroom- 1 toilet, 1 sink	Yes	Yes	5 gal	No	Toilet handle replaced/flush mechanisms replaced. Unit replacement pending	\$1,200/300,000 gal/yr
AB1M	1 st	Men's Bathroom - 1 toilet, 1 sink	Yes	Yes	5 gal	Yes	Flush mechanisms replaced	\$1,200/300,000 gal/yr
ABWNC	1 st	Women's Bathroom- 1 toilet, 1 sink (Near Cell)	No	Yes	1.6 gal	No		
ABMCR	1 st	Men's Bathroom - 1 toilet, 1 sink (R – in cell)	No	No		No		
ABMCM	1 st	Men's Bathroom - 1 toilet, 1 sink (M – in cell)	No	No		No		
ABMCL	1 st	Men's Bathroom - 1 toilet, 1 sink (L – in cell)	No	No		No		
AB1K	1st	Kitchen Area (Sink)	No	No				
ABMU1	1st	Men's Bathroom Urinal (L- Police Officers)	No	No		No		
ABMU2	1st	Men's Bathroom Urinal (R- Police Officers)	No	No		No		
ABML	1st	Men's Bathroom (L- Police Officers)	No	No	1.6 gal	No		
ABMR	1st	Men's Bathroom (R- Police Officers)	No	No	1.6 gal	No		
ABMS	1st	Men's Shower Stall (Police Officers)	No	No		No		
AB2M	1st	Men's Bathroom - 2 sinks (Police Officers)	No	No		No		
ABBK	Basement	Kitchen Area - 1 sink (refrigerator connected)	No	Yes		No		
ABMWB	Basement	Unisex Bathroom - 1 toilet, 1 sink	No	Yes	1.6 gal	No		
ABW2	2nd	Women's Bathroom- 3 toilets, 2 sinks	Yes	Yes	5 gal	No	One sink not working/Sink units require replacement - interior parts worn beyond repair.	<\$1/yr 173 gal/yr
AB2K	2nd	Kitchen- Sink (refrigerator connected)	No	Yes		No		

Table 3.0 Building Inventory – School Street Fire Station

Photo ID	Floor	Description	Leak noted	In use	GPF	ADA	Work/Recommendations	Cost savings
FS1R	1st	Unisex Bathroom- R- (1 toilet, 1 sink)	Yes-Sink	Yes	1.6 gal	No bars or flat entrance	Handicap levers, recently replaced, are worn and new units needed	<\$1/yr 173 gal/yr
FS1L	1st	Unisex Bathroom - L- 1 toilet, 1 sink, 1 Utility Sink	No	Yes	1.6 gal	No bars or flat entrance		
FS1	1st	Ice Chest	No	Yes				
FS2W	2nd	Women's Bathroom (1 toilet, 1 sink, 1 shower)	No	Yes	1.6 gal	No bars		
FS2M	2nd	Men's Bathroom (2 toilets, 2 sinks, 2 shower stalls)	No	Yes	5 gal	No bars		
FS2K	2nd	Old Kitchen Setup	No	No				
FS2K	2nd	Kitchen (2 sinks) - Recently renovated	No	Yes				

Table 3.0 Building Inventory - Town Hall, Memorial Building and Wastewater Treatment Plant

Photo ID	Floor	Description	Leak noted	In use	GPF	ADA	Work/Recommendations	Cost Savings
TH1M	1st	Men's Bathroom (1 toilet, 1 sink)	Yes	Yes	1.6 gal	No bars or entrance	Replaced flushing mechanisms in toilets 5/08 - sink unit needs to be completely replaced	\$1,200/yr 300,000 gal/yr
TH1W	1st	Women's Bathroom (1 toilet, 1 sink)	Yes	Yes	1.6 gal	In progress	Replaced flushing mechanisms in toilets 6/08 - sink unit needs to be replaced	\$1,200/yr 300,000 gal/yr
TH2W	2nd	Women's Bathroom (1 toilet, 1 sink)	Yes	Yes	1.6 gal	No	Replaced flushing mechanisms in toilets 7/08 - sink unit need to be replaced	\$1,200/yr 300,000 gal/yr
TH2M	2nd	Men's Bathroom (1 toilet, 1 sink)	Yes	Yes	1.6 gal	No	Replaced flushing mechanisms in toilets 8/08 - sink units need to be replaced	\$1,200/yr 300,000 gal/yr
TH2K	2nd	Kitchen (1 faucet)	No	Yes				
TH2H	2nd	Heat (typical)	No	Yes				
THB	Basement	Hot Water Tank	No	Yes				
Memorial Building								
MB1	1st	Faucet	Yes	Yes			Entire unit needs to be replaced/too old for available parts	<\$1/yr 173 gal/yr
MBBW	Basement	Women's Bathroom (2 toilets, 1 sink)	No	Yes	1.6 gal	Needs ramp for entrance		
MBBK	Basement	Kitchen (Faucet)	No	Yes				
MBBM	Basement	Men's Bathroom (2 toilets, 2 sinks, Utility sink)	No	Yes	1.6 gal	Needs ramp for entrance		
Wastewater Treatment Plant								
WWTP-L	1st	Sink (for chemicals), dishwasher, eyewash	No	Yes				
WWTP-J	1st	Washer, Dryer, Utility Sink	No	Yes				
WWTP-B	1st	Unisex Bathroom- 1 toilet, 1 urinal, 1 sink	No	Yes	5 gal	No bldg ramp entrance		

6.0 Conservation Plan (Task 6)

The Water Loss Prevention Grant has met its commitment to update and implement the Grantee's Water Conservation Plan; the implementation includes a water conservation education and outreach program engaging area schools and colleges. The goal of the water conservation program is to reduce the volume of water lost in the system by increasing community awareness and implementing water saving practices throughout the Town. The Water Conservation Plan includes water conservation measures, universal metering, water accounting and loss control, costing and pricing, information and education, pressure management, landscape efficiency, reuse and recycling, water-use regulation, and integrated resource management.

Conservation efforts undertaken by the Water Department include water use reduction plans, working with public schools, and distributing conservation outreach and education information (i.e., produce local cable announcements) and support of Low Impact Development concepts to agricultural, commercial, industrial, and residential consumers.

Conservation activities such as water-use audits, distribution, and installation of water saving devices, replacements have been included in the completion of the Water Loss Prevention Grant. The Plan was prepared and implemented in accordance with the Water Resource Commission's (WRC) Water Conservation Standards.

In accordance with these conservation standards a review of the suggested tasks to be completed for a water conservation program included the following:

- Review of available information regarding the Grantee's existing water conservation practices including but not limited to the public education program, leak detection, water auditing, meter replacement program, master meter calibration, annual statistical reports, water use by category, water rate structure, water use by restriction bylaws, interconnection municipal agreements and other pertinent information.
- Implement an educational program to encourage water conservation and to promote public awareness of long-term economics and environmental benefits of water conservation.
- Implement a plan to address leak detection and repair in order to meet WRC Water Conservation Standards.
- Prepare recommendations to meet the standards for metering as outlined in the WRC Water Conservation Standards.
- Evaluate residential, municipal, industrial, commercial, and institutional water usage using annual statistical reports.

- Evaluate residential per capita water use and summer to winter demand ratio in accordance with MassDEP Water Management Policy.
- Prepare recommendations to improve water supply system management to meet the standards identified in the WRC Water Conservation Standards.
- Prepare and implement a Water Conservation Plan to meet the requirements as outlined in the WRC Water Conservation Standards.

Deliverables 6:

- A Draft Water Conservation Plan that addresses the above tasks, that also outlines the findings and recommendations for future activities and includes a summary of its implementation, was submitted for review and approval as Appendix G of the draft report.
- Specific outreach and education activities targeted at water conservation are summarized in Section 7.0 of this report.
- MassDEP approved an updated Water Conservation Plan, adopted by the Town of Bridgewater Water and Sewer Commission, that addresses the above tasks and that also outlines the findings and recommendations for future activities and includes a summary of its implementation is included as Appendix G.
- Demonstration of water loss reduction achieved as a result of Task 6 activities, included in Section 7.0 of this report.

7.0 Educational Outreach (Task 6)

As part of Task 6, an educational outreach program was developed.

Item 1 – Laminated 5.5” x 8.5” decorative plaques were installed at the seven locations that had water saving repair work done under grant (Town Hall: Four toilets; Academy Building: Two toilets; Fire Station: One sink) to document the grant and included an information handout included in Appendix [“Water-saving repairs to this toilet were performed as matching component of the Bridgewater Water Loss Prevention Project 06-05/WLP, financed with Federal Funds from the Environmental Protection Agency to the Massachusetts Department of Environmental Protection under a Safe Drinking Water Act State Revolving Loan Fund Set-aside Grant.”](#)

Item 2 – Educational Videos

Two videos “Liquid Assets” and Xeriscape Techniques” were acquired during the grant. “Liquid Assets” was aired on local cable several times in January 2009 with an interview of the Water and Sewer Superintendents included at the end of the video. The second video will be aired later in the year as cable schedule can be arranged. The Water Department recently completed renovation of a meeting space in the Academy Building that will include a library of water related material and training that can be used for educational outreach.

Item 3 – AWWA publications

“How Water Works Classroom Learning Kit” is available for use by community groups or individuals. Additional educational publications were purchased for this grant necessary to complete the water audit and outreach, including the newest AWWA publication for Public Officials. It was an asset in understanding the need for the water audit and education. It is also the resource being used for public officials training held at the AWWA international conference this year (2009). All these resources would not normally be part of our water budget and it was only through the grant that they could be purchased.

Item 4 – Elementary school program

On December 10 and 11, 2008, an educational outreach to the second grade classes was conducted at the George Mitchell Elementary School. It included a presentation by Ms. Shirley Young, an entrepreneur and engineer that demonstrated the use of water and discussed where water comes from. She distributed educational material obtained from AWWA and approved by the Grant Manager. Copies of the material are included in Appendix H, along with a copy of the summary report prepared by Ms. Young. Approximately 300 students participated along with 12 teachers and staff



and 350 copies of two pamphlets were distributed.

In a report prepared by the Sacramento, CA: California Urban Water Conservation Council, 1996 it was noted that “the literature survey indicated that children may play a



key role in modifying behavior, but media messages can first be directed toward education decision makers and teachers who in turn deliver the message to the children (and who, in turn, deliver the message to their parents). The social literature terms this the “two-step flow” of communication, a process which may be a more effective way of disseminating information in a way that will result in a change in water conservation behavior. (Page 13)

http://www.awwa.org/files/Resources/Waterwiser/references/PDFs/sustainable2008_mon5-5.pdf

Bridgewater is a growing community that maintains its small town feeling. Several parents approached the Grantee’s project manager and expressed their awareness of water conservation techniques brought home by their 8 and 9 year old children. This outreach included approximately 300 students and 12 faculty and staff directly involved with the educational program. There have been estimated values associated with public education effort presented by water conservation groups and economic researchers. Based on an average household of 3.27 persons in Bridgewater (2000 US Census data) and an estimate of 2 -5% savings associated with conservation could be \$596 - \$1,490 resulting from a change in teeth brushing behavior alone, i.e. turning off the water while brushing. This is calculated from a reduction in water use for this activity from 10 gallons per brush to 0.5 gallon per brush. For a potential impact on 1020 people and a 2 – 5% impact, this would result in a reduction in use from 7,447,752 gallons by as much as 372,388 gallons. From conversations with parents of the second graders, following the presentation of this program, it was clear that these young people were excellent conservation advocates and this is likely a very conservative representation of the savings through this education outreach.

This estimate of savings was based on typical water use and includes only this one behavior: tooth brushing. If the consumer was to turn off the faucet while brushing teeth assuming that the average person runs the water for two minutes and that the flow is 5 gpm at a standard faucet. If a person were to turn off the water while brushing, conservatively the water use would be reduced to 0.5 gallons of water use. The cost savings is based on the current cost to deliver and treat water at \$4.00/1000 gallons.

The estimates on conservation were taken from the 2006 Technical Learning College, Professional development continuing education course (<http://www.tlch20.com/courses/WaterConservation.pdf>) Table B-2 “Benchmarks for Estimating Residential End Uses of Water.”

In 1991 a study was conducted on the economics of water using survey information collected by the American Water Works Association (AWWA) and analyzed by Prof. Michael Niewsiadomy of the University of Texas. The results of Prof. Niewsiadomy’s analysis was presented in a publication in the Journal of Water Resources Research, Vol. 28, No3 pages 609-615 in March 1992, entitled

Estimating Urban Residential Water Demand: Effects of Price Structure, Conservation, and Education. EPA has referenced this work in their conservation recommendation web site. In this study Prof. Niewsiadomy notes that

“A problem which has received very little attention in the economic literature is the impact of conservation and public education programs on water demand. For example, there exist some engineering studies [U.S. Department of Housing and Urban Development, 1984] that have estimated the water savings of retrofitting houses with water-saving toilets and faucets, but few economic studies of the actual impact on water demand.

...For example, if a utility installs a device that saves 100 gal/hr the customer may react by using more water on the lawn, thereby partially offsetting the conservation impact of the device. The actual impact is an empirical question. The flaw in the engineering approach is that it does not allow for changes in consumer behavior. A similar problem persists with public education programs that encourage people to save water, which may convince people to conserve water out of a sense of public duty. But if the plea for conservation is not accompanied by an increase in water rates, the plan is likely to fail in the long run.

In reviewing the data, Niewsiadomy found that there was statistical evidence of an impact of public education in the western part of the country, based on the survey results.

In the USEPA Water Conservation Guidelines, Appendix A of that document it was noted that:

Information and education are critical to the success of any conservation program. Information and education measures can directly produce water savings, as when customers change their water-use habits. These savings can be difficult to estimate. Also, public education alone may not produce the same amount of sustained water savings as other, more direct approaches (such as leak repairs and retrofits).

But educational measures also can enhance the effectiveness of other conservation measures. For example, it is widely believed that information plays a role in how water consumers respond to changes in price. More generally, customers that are informed and involved are more likely to support the water system's conservation planning goals.

8.0 Grant Budget (Task 7)

Reporting was an on-going part of the Water Loss Prevention Grant. Quarterly reports were submitted to the Grantee Coordinator and two requests for extensions were granted. The Grantee has submitted the following Deliverables to the Department in accordance with the Milestone schedule.

Deliverables 7:

- The Grantee provided quarterly progress reports to the Department on or close to January 15th, April 15th, July 15th, and October 15th for the October 1 to December 31, 2007, January 1 to March 30, April 1 to June 30, and July 1 to September 30, 2008 reporting periods, respectively. These reports were submitted via email (Word 6.0 or other suitable software as determined by the Department) on a standard form provided by the Department and contained a summary and percentage of all work completed by task during the reporting period and planned activities for the next quarter.
- The Grantee provided fiscal spending reports on the same schedule as the progress reports. The fiscal reports listed the spending for the quarter, itemized by the expense categories listed in the SOW Attachment B-Budget. All fiscal spending reports, including required M/WBE reporting on the Department's Payment Voucher Attachment Form, was provided to the Department's Contract Manager identified in the Notice to Proceed letter.

9.0 Lessons Learned

The 2006 Water Loss Prevention Grant consisted of six separate but interrelated tasks. The largest components of this grant were the equipment purchase, training and distribution surveying. The selection and acquisition of the leak detection equipment was relatively easy. During the leak detection survey, no leaks were found in the system. In order to facilitate training, the contractor and the water department personnel "staged" a leak in order to demonstrate the effectiveness of the equipment. Attempts to outreach to possible W/MBE business for the purchase and/or training in the use of leak detection equipment took several hours time on the part of Joseph Silva, Water Department Superintendent, and no responses were received from the effort to fulfill a portion of the grant requirements to contract a specific amount of award monies with a W/MBE business. There appears to be limited W/MBE businesses in this field.

In addition, the purchase of the equipment was contingent upon the acceptance of mutual aid with the adjoining communities of East Bridgewater and Halifax. Both communities agreed and were willing to make use of the equipment. Several attempts were made to provide training to their staff and

ample notification was provided, however, neither community participated in the offered training. It is likely that they will make separate arrangements with the equipment supplier for training.

Fawn Sances, P.E., who also serves as a Water and Sewer Commissioner, served as the Grantee's project manager and performed the Water Audit and Municipal Building Survey. Constance Soares, an engineering intern from Bristol Community College, assisted her during the summer of 2008. The Urban Massachusetts Alliances for Minority Participation (UMLSAMP) Student Research Opportunity sponsored Ms. Soares work. The grant work provided a learning opportunity for Ms. Soares and similar student participation should be considered in future grant work.

Concurrent with this grant work, a water rate study was implemented by the firm of Wesley Gardner, CPA. This water rate study could have been included as a component of the grant and would have been an eligible cost. There were several over-lapping components between the Water Audit and the water rate study. For this reason, the results of the water study were found to support and duplicate portions of each other.

E.T. Engineering, an environmental engineering firm was contracted to review the results of the Water Audit and the Water Conservation Plan. E.T. Engineering had been a W/MBE contractor, however, their certificate had lapsed and they could not fulfill the re-certification prior to the completion of the grant. E.T. Engineering continued to complete their reviews as a general engineering consulting firm. They are currently in the process of updating their W/MBE status. This resulted in the need to request a waiver for a portion of the grant's W/MBE goals, which was granted.

The Building Survey revealed old and unreliable water fixtures in place, as well as non-conservative water using toilets. The coordination to repair or replace the fixtures proved difficult due to budget freeze and staff reductions. Only limited repairs could be made at the time of this grant. It is proposed to replace larger components in the future, as additional funding sources become available.

The educational outreach program encountered significant delays due to change in administration, policy and personnel. The implementation of an educational program was further limited by the difficulty in finding age appropriate material. Most material required bulk ordering. No samples were available for review and limited information was provided at the on-line websites. Shirley Young, owner of Global Advanced Technologies, was contracted as the educational outreach program presenter. Ms. Young is a registered W/MBE firm and her participation partially fulfilled the grant goals. Through persistence and cooperation from the Bridgewater-Raynham Regional School Superintendent's office and Mr. Brian Lynch, a program was brought into the 2nd grades

classes in December 2008. In addition, the two extensions that were granted on the completion of the grant allowed for the implementation of the proposed educational outreach.

10.0 Conclusions and Recommendations

The 2006 Water Loss Prevention Grant was an excellent opportunity for the Town of Bridgewater Water Department to acquire upgraded leak detection equipment and to engage in a share agreement with the adjoining towns of East Bridgewater and Halifax. The results of the survey of the 130 miles of water mains that make up the distribution system for the Town of Bridgewater indicated no leaks. This is not surprising as the Water Department has had an on-going leak detection program and responds immediately to the report of evidence of a system leak.

On the basis of the results of the Water Audit and the concurrent water rate study, it is recommended that an increase in water rates be considered due to the rising costs associated with chemical and fuel expenses.

Further, it is recommended that a priority be established for the replacement of aged and water intensive devices identified during the Municipal Building survey and improvements to the buildings handicap accessibility noted.

It is also recommended that the Water Department adopt the Water Conservation Plan and include an on-going educational outreach, obtain records from large meter owners and continue their successful system maintenance program. Following this recommendation, the Board of Water and Sewer Commissioners adopted the Conservation Plan.

The Town of Bridgewater appreciates the opportunity to participate in the Water Loss Prevention Grant program and looks forward to future grant opportunities.

Appendix A

Water Audit Form 1 - 6

FORM 1 UNCORRECTED TOTAL WATER SUPPLY FROM SOURCES OF SUPPLY MASTER METER READINGS

TOTAL ANNUAL AMOUNT (in million gallons per year)

YEAR	SOURCE	SOURCE	SOURCE	SOURCE	SOURCE	SOURCE	SOURCE	SOURCE	SOURCE	SOURCE	TOTAL
	1	2	3	4	5	6	7	8	9	10	

2007-2008	49376000	136882500	113766900	84143300	46150600	51951800	69564900	13013800	25663195	35956470	626,469,465
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2006-2007	20592100	170740000	93448060	77067300	30174800	50762299	117988700	36726067	(7395267)	(9852346)	597,499,326
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2005-2006	39810300	159333000	128460100	66776700	59138460	56810900	105887700	29171860	0	0	645,389,020
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Total of All: 1,869,357,811

Total divided by Three: 623,119,270
 Enter on Line 1 Form 6 and
 Enter on Line 1 Form 3

FORM 2 - UNCORRECTED CUSTOMER METER RECORDS

TOTAL WATER SOLD

YEAR	RESIDENTIAL	INDUSTRIAL	COMMERCIAL	AGRICULTURAL	INSTITUTIONAL	OTHER	TOTAL
2005-2006	369.14	*	*	*	*	198.77	567.91
2006-2007	395.12	*	*	*	*	49.13	508.52
2007-2008	569.13	30.62	4.44			25.76	629.95
						LINE a TOTAL	1706.38

Annual or Average Line b = Total divided by 3 =
(Enter on Line 4 - Form 6)

568.7933

Calculations:

Total amount of water metered in system over the past three years: (Line a)

1706.38

Average total amount of water metered over past three years: (Line b)

568.7933

Estimate of total amount of water sold but not metered in past three years: (Line c)

2005-2006 unmetered amount of water sold 0

2006-2007 unmetered amount of water sold 0

2007-2008 unmetered amount of water sold 0

TOTAL

0

Average of total amount of water sold but not metered over past three years: (Line c divided by 3)

0

(Enter on Line 6 - Form 6)

FORM 3

PUMPING AND TREATMENT COSTS

Annual Costs for the past three years

No.	Line	Category	Year (2005-2006)	Year (2006-2007)	Year (2007-2008)	Total	Average (total divided by 3)	
1	1a	Chemicals	\$153,887	\$144,857	\$170,643	\$469,388	\$156,463	
2	1b	Fuel	\$57,358	\$33,506	\$55,537	\$146,401	\$48,800	
3	1c	Electricity	\$154,554	\$157,381	\$172,167	\$484,102	\$161,367	
4	1d	H2O Purchase	\$0	\$0	\$0	\$0	\$0	
5	1e	Other	\$1,988,110	\$2,673,105	\$1,946,057	\$6,607,272	\$2,202,424	
			\$2,353,909	\$3,008,849	\$2,344,405			
	2					total avg	line a	\$2,569,054
	3							623,119,270 Gallons/yr
	4							\$0.004123 Per gallon

FORM 4 - Source Meter Error Adjustments to the Total Amount of Water Supplied to the System

Year 2006

No.	Meter Location	Well	Meter Test Date	Calibration/Test	Meter Error	times	Total Metered	Adjustment
					% (+/-)		(gallons)	(gallons +/-)
1	High St 03G	1			-29.21%		20592100	-6014952.4
2	Carvers Pond 04G	2	2/25/2006	Pitot	-0.76%		170740000	-1299109
3	High St 02G	3	2/25/2006	Pitot	11.40%		93448060	10657241
4	Carvers Pond 06G	4	2/25/2006	Pitot	-0.88%		77067300	-682012
5	Carvers Pond 07G	5	2/25/2006	Pitot	7.21%		30174800	2174190
6	High St 09G	6	2/25/2006	Pitot	n/a		50762299	0
7	High St 09G	8	2/25/2006	Pitot	1.25%		117988700	1478753
8	High St 10G	9	2/25/2006	Pitot	n/a		36726067	0
9	Plymouth St 11G	10A					-	
10	Plymouth St 12G	10B					-	

Average Percent: -1.83% Total Adjustment: 6314111.75

Year 2008

No.	Meter Location	Well	Meter Test Date	Calibration/Test	Meter Error	times	Total Metered	Adjustment
					% (+/-)		(gallons)	(gallons +/-)
1	High St 03G	1			-29.21%		49376000	-14422730
2	Carvers Pond 04G	2			-5.61%		136882500	-7679108.3
3	High St 02G	3			12.31%		113766900	14004705.4
4	Carvers Pond 06G	4			-3.86%		84143300	-3247931.4
5	Carvers Pond 07G	5			3.38%		46150600	1559890.28
6	High St 09G	6			-8.75%		51951800	-4545782.5
7	High St 09G	8	1/3/2008	Pitot	5.11%		69564900	3555891
8	High St 10G	9	1/3/2008	Pitot	23.99%		13013800	3122422
9	Plymouth St 11G	10A	1/3/2008	Pitot	0.63%		25663195	160559
10	Plymouth St 12G	10B	1/3/2008	Pitot	4.04%		35956470	1451433

Average Percent: 0.20% Total Adjustment: -6040652

Year 2007

No.	Meter Location	Well	Meter Test Date	Calibration/Test	Meter Error	times	Total Metered	Adjustment
					% (+/-)		(gallons)	(gallons +/-)
1	High St 03G	1	12/4/2007	Pitot	-29.21%		49376000	-14425022
2	Carvers Pond 04G	2	12/4/2007	Pitot	-5.61%		136882500	-7685468
3	High St 02G	3	12/4/2007	Pitot	12.31%		113766900	14006138
4	Carvers Pond 06G	4	12/4/2007	Pitot	-3.86%		84143300	-3244920
5	Carvers Pond 07G	5	12/4/2007	Pitot	3.38%		46150600	1557727
6	High St 09G	6	12/4/2007	Pitot	-8.75%		51951800	-4547209
7	High St 09G	8			5.11%		69564900	3554766
8	High St 10G	9			23.99%		13013800	3122011
9	Plymouth St 11G	10A			n/a			
10	Plymouth St 12G	10B			n/a			

Average Percent: -0.33% Total Adjustment: -7661977

Total Adjustment for 3 years:	-7388517
Average Adjustment for 3 yrs	-2462839

FORM 5 DISTRIBUTION SYSTEM LARGE SERVICE METER ADJUSTMENTS

Year 2007

House Number	Meter Location	Meter Test Date	Meter Size	Meter Error	Total Metered	Adjustments	Comments
1453	PLEASANT STREET	no record	1 1/2 " BOTTOM MTR # 68737753	n/a	18600	0	
45	FAIRWAY DRIVE	no record	1 1/2 METER # 11132862	n/a	8000	0	
15	SCOTLAND BLVD UNIT 1	no record	1 1/2 METER # 53078573	n/a	4000	0	
100	BRIDGESTONE WAY	no record	1 1/2 METER # 66723313	n/a	8800	0	
1200	VERNON STREET	no record	1 1/2" METER	n/a	7000	0	
	MEADOW LANE 7-8	no record	1 1/2" METER	n/a	144900	0	
	MEADOW LANE 31-32	no record	1 1/2" METER	n/a	116800	0	
	MEADOW LANE 22	no record	1 1/2" METER	n/a	55000	0	
	MEADOW LANE 18-19	no record	1 1/2" METER	n/a	105900	0	
	MEADOW LANE 13	no record	1 1/2" METER	n/a	62400	0	
	MEADOW LANE 27-28	no record	1 1/2" METER	n/a	131000	0	
	FRUIT STREET/GARAGE	no record	1 1/2" METER 57193962	n/a	4000	0	
71	RED MILL ROAD	no record	1 1/2" METER	n/a	8000	0	
545	BEDFORD STREET	no record	1 1/2" METER # 12665520	n/a	4400	0	
50	KEITH PLACE	no record	1 1/2" METER #61619065	n/a	11900	0	LOT # 50
95	GROVE STREET	no record	1 1/2" METER 59419531	n/a	66900	0	LOT # 50
1453	PLEASANT STREET	no record	1 1/2" TOP MTR # 68562211	n/a	18600	0	
	CAMPUS PL-G.N.C.	no record	1" HERSHEY METER	n/a	1000	0	
63	MAIN STREET	no record	1" METER	n/a	7800	0	
104	PLEASANT STREET	no record	1" METER	n/a	25200	0	
187	CONANT STREET	no record	1" METER	n/a	8100	0	
110	ELM STREET	no record	1" METER	n/a	17400	0	LOT # 45
	FRUIT STREET-BLDG. 2	no record	1" METER	n/a	3000	0	LOT # 45
5	HEMLOCK DRIVE	no record	1" METER	n/a	48500	0	
15	HERITAGE CIRCLE	no record	1" METER	n/a	39200	0	
10	HERITAGE CIRCLE	no record	1" METER	n/a	123200	0	
70	BROAD STREET	no record	1" METER	n/a	131400	0	
808	BEDFORD STREET	no record	1" METER	n/a	84600	0	
220	BEDFORD STREET	no record	1" METER	n/a	30700	0	
220	BEDFORD STREET	no record	1" METER	n/a	52100	0	179 MAIN ST.
220	BEDFORD STREET	no record	1" METER	n/a	25800	0	

FORM 5 DISTRIBUTION SYSTEM LARGE SERVICE METER ADJUSTMENTS

Year 2007

House Number	Meter Location	Meter Test Date	Meter Size	Meter Error	Total Metered	Adjustments	Comments
220	BEDFORD STREET	no record	1" METER	n/a	44100	0	
	ROUTE 24 SOUTH	no record	1" METER	n/a	167300	0	
	ROUTE 24 NORTH	no record	1" METER	n/a	156100	0	
1000	MAIN STREET	no record	1" METER	n/a	355500	0	
100	MARY LANE	no record	1" METER	n/a	17700	0	
120	MARY LANE	no record	1" METER	n/a	11000	0	259 MAIN ST.
	CAMPUS PLZA-GAMESTOP	no record	1" METER	n/a	9800	0	
	CAMPUS PL-RITE-AID	no record	1" METER	n/a	8600	0	
	CAMPUS PL-RADIO SHK	no record	1" METER	n/a	36300	0	
1225	PLEASANT STREET	no record	1" METER	n/a	1200	0	319 MAIN ST.
35	FIRST STREET	no record	1" METER	n/a	25000	0	
1097	SOUTH STREET	no record	1" METER	n/a	24600	0	
120	BRADLEY LANE	no record	1" METER	n/a	9100	0	
529	HIGH STREET	no record	1" METER # 42605801	n/a	3600	0	
341	BROAD STREET	no record	1" METER # 47332716	n/a	12000	0	
505	BEDFORD STREET	no record	1" METER # 49122140	n/a	1000	0	
85	COTTAGE STREET	no record	1" METER # 49482076	n/a	22400	0	
1	SANFORD DRIVE	no record	1" METER # 49482083	n/a	15100	0	
15	HAMMOND STREET	no record	1" METER # 51981535	n/a	9900	0	
91	YOKE ROAD	no record	1" METER # 52962397	n/a	9800	0	7 HIGH ST.
352	BROAD STREET	no record	1" METER # 52962398	n/a	5600	0	
345	GRANGE PARK	no record	1" METER # 53836539	n/a	5600	0	
85	HAYWARD PLACE	no record	1" METER # 56051352	n/a	30600	0	
15	PLYMOUTH STREET	no record	1" METER # 56877475	n/a	16800	0	29 WALL ST.
23	RED MILL ROAD	no record	1" METER # 57336737	n/a	11800	0	
21	RED MILL ROAD	no record	1" METER # 57336738	n/a	11900	0	37 WALL ST.
170	OLD FARM ROAD	no record	1" METER # 58161846	n/a	13300	0	DUPLEX
40	MEETING SQUARE DRIVE	no record	1" METER # 59683107	n/a	11300	0	
40	OLD WILLIS FARM ROAD	no record	1" METER # 59721676	n/a	4800	0	
434	ELM STREET	no record	1" METER # 62776638	n/a	8500	0	5-APTS
333	WATER STREET	no record	1" METER # 63092567	n/a	12000	0	
9	SUMMER STREET	no record	1" METER # 65043913	n/a	5600	0	

FORM 5 DISTRIBUTION SYSTEM LARGE SERVICE METER ADJUSTMENTS

Year 2007

House Number	Meter Location	Meter Test Date	Meter Size	Meter Error	Total Metered	Adjustments	Comments
86	CEDAR CREST DRIVE	no record	1" METER # 65119159	n/a	10500	0	
1111	PLYMOUTH STREET	no record	1" METER # 65739312	n/a	7500	0	LOT 15
32	SCOTLAND BOULEVARD	no record	1" METER # 66516942	n/a	35200	0	
1001	PLEASANT STREET	no record	1" METER # 66698065	n/a	12100	0	
1355	PLEASANT STREET	no record	1" METER # 66716431	n/a	1000	0	
60	GRANGE PARK	no record	1" METER # 66798812	n/a	8000	0	LOT # 27
470	PINE STREET	no record	1" METER # 67464191	n/a	42000	0	
24	HEMLOCK DRIVE	no record	1" METER # 67464336	n/a	30200	0	
8	ROMNEY ROAD	no record	1" METER # 67464337	n/a	10400	0	
38	HARVEST LANE	no record	1" METER # 67978723	n/a	4000	0	STROLLO
220	BEDFORD STREET	no record	1" METER # 68657724	n/a	38300	0	
52	SOUTH STREET	no record	1" METER # 68657725	n/a	25300	0	
220	BEDFORD STREET	no record	1" METER # 68657734	n/a	38900	0	
220	BEDFORD STREET	no record	1" METER # 68657742	n/a	41200	0	
220	BEDFORD STREET	no record	1" METER # 68657743	n/a	57300	0	
582	BEDFORD STREET	no record	1" METER # 93868592	n/a	5000	0	
55	FAIRWAY DRIVE	no record	1" METER #54660767	n/a	69400	0	
20	ARMSTRONG COURT	no record	1" METER #61390733	n/a	4700	0	
345	CONANT STREET	no record	1" METER #67464148	n/a	5800	0	
122	PARK AVENUE	no record	1" METER #37435224	n/a	8600	0	127 WALL ST.
	CAMPUS PLAZA-MCD	no record	1" METER 50949974	n/a	466010	0	
96	HEMLOCK DRIVE	no record	1" METER 51961543	n/a	52800	0	
1777	SOUTH STREET	no record	1" METER 60357370	n/a	29000	0	
1355	PLEASANT STREET	no record	1" METER 65739318	n/a	2000	0	
296	MAIN STREET	no record	1" METER 68865905	n/a	32900	0	
40	CENTRAL SQUARE	no record	1" METER# 52962398	n/a	12000	0	LOT # 9B
525	OLD FOREST STREET	no record	1" METER# 62019116	n/a	9100	0	LOT # 9B
	CAMPUS PL-PAPA GINO	no record	1" NEPTUNE METER	n/a	23200	0	
70	FIRST STREET	no record	1" METER	n/a	37900	0	
350	BEDFORD STREET	no record	2' METER	n/a	19100	0	LOT # 7
	MT. PROSPECT STREET	no record	2" BOTTOM METER	n/a	21100	0	
	CAMPUS PL-ROCHE BROS	no record	2" HERSEY METER	n/a	114500	0	

FORM 5 DISTRIBUTION SYSTEM LARGE SERVICE METER ADJUSTMENTS

Year

2007

House Number	Meter Location	Meter Test Date	Meter Size	Meter Error	Total Metered	Adjustments	Comments
576	BEDFORD STREET	no record	2" METER	n/a	1200	0	
180	MAIN STREET, BLDG. 1	no record	2" METER	n/a	25900	0	SHUT OFF 8/22/01
180	MAIN STREET, BLDG. 2	no record	2" METER	n/a	26100	0	LOT # 3
180	MAIN STREET, BLDG. 3	no record	2" METER	n/a	42700	0	LOT 16
180	MAIN STREET, BLDG. 4	no record	2" METER	n/a	89000	0	
180	MAIN STREET, BLDG. 5	no record	2" METER	n/a	149000	0	LOT 14A
180	MAIN STREET, BLDG. 6	no record	2" METER	n/a	191200	0	LOT 13A
180	MAIN STREET, BLDG. A	no record	2" METER	n/a	81000	0	LOT 12A
180	MAIN STREET, BLDG. B	no record	2" METER	n/a	14000	0	LOT 11
180	MAIN STREET, BLDG. C	no record	2" METER	n/a	17500	0	
180	MAIN STREET, BLDG. D	no record	2" METER	n/a	151000	0	
180	MAIN STREET, BLDG. E	no record	2" METER	n/a	162000	0	LOT 17
180	MAIN STREET, BLDG. F	no record	2" METER	n/a	106600	0	LOT 17
49	HEMLOCK DRIVE	no record	2" METER	n/a	106400	0	LOT # 1A
31	PERKINS STREET	no record	2" METER	n/a	5200	0	
	MEADOW LANE 48-49	no record	2" METER	n/a	99300	0	
	MEADOW LANE 40-41	no record	2" METER	n/a	98700	0	
	MEADOW LANE 39	no record	2" METER	n/a	115700	0	
	MEADOW LANE 33-34	no record	2" METER	n/a	100100	0	
	MEADOW LANE 23-24	no record	2" METER	n/a	116900	0	
	MEADOW LANE 16-17	no record	2" METER	n/a	90200	0	
	MEADOW LANE 9-10	no record	2" METER	n/a	123600	0	LOT # 2
	MEADOW LANE 25-26	no record	2" METER	n/a	125500	0	
10	HIGH POND DRIVE	no record	2" METER	n/a	1487300	0	
10	HIGH POND DRIVE	no record	2" METER	n/a	1243500	0	
87	CRAPO STREET	no record	2" METER	n/a	3200	0	3-APTS
620	BEDFORD STREET	no record	2" METER	n/a	48200	0	
15	SCOTLAND BLVD UNIT 4	no record	2" METER # 12066823	n/a	1700	0	
750	BEDFORD STREET	no record	2" METER # 54081590	n/a	6000	0	
	MEADOW LANE 44-45	no record	2" METER # 54997484	n/a	114500	0	
1	LAKESHORE CENTER	no record	2" METER # 56387880	n/a	30100	0	
8	GRANGE COURT	no record	2" METER # 56442953	n/a	11900	0	

FORM 5 DISTRIBUTION SYSTEM LARGE SERVICE METER ADJUSTMENTS

Year 2007

House Number	Meter Location	Meter Test Date	Meter Size	Meter Error	Total Metered	Adjustments	Comments
300	ELM STREET	no record	2" METER # 56856432	n/a	2800	0	
200	EAST CAMPUS ROAD	no record	2" METER # 66887900	n/a	344200	0	
1420	PLEASANT STREET	no record	2" METER #55113547	n/a	69300	0	
85	FIRST STREET	no record	2" METER #65070744	n/a	20900	0	
	PLEASANT STREET	no record	2" METER	n/a	9000	0	
48	HEMLOCK DRIVE	no record	2" METER 53078487	n/a	12000	0	
	MEADOW LANE 29-30	no record	2" METER 53635303	n/a	107900	0	
992	BEDFORD STREET	no record	2" METER 55113554	n/a	5300	0	
2	CENTRAL SQUARE	no record	2" METER 67464509	n/a	276200	0	ALSO 495MAIN ST
	MT. PROSPECT STREET	no record	2" METER 7331906	n/a	37300	0	
96	HEMLOCK DRIVE	no record	2" METER IN GARAGE	n/a	37600	0	LOT # 1A
	MT. PROSPECT STREET	no record	2" METER RECORDS ROOM	n/a	14600	0	LEFT SIDE
	MEADOW LANE 3-4	no record	3" METER	n/a	90200	0	
	MEADOW LANE 1-2	no record	3" METER	n/a	105900	0	
	MEADOW LANE 5-6	no record	3" METER	n/a	109500	0	
	MEADOW LANE 42-43	no record	3" METER	n/a	62400	0	SERVICE STATION
	MEADOW LANE 46-47	no record	3" METER	n/a	116800	0	
	MEADOW LANE 35-36	no record	3" METER	n/a	96100	0	
	MEADOW LANE 37-38	no record	3" METER	n/a	130900	0	
	MEADOW LANE 20-21	no record	3" METER	n/a	102300	0	30 CENTER ST.
	MEADOW LANE 14-15	no record	3" METER	n/a	109800	0	
	MEADOW LANE 11-12	no record	3" METER	n/a	114500	0	
10	HIGH POND DRIVE	no record	3" METER	n/a	839900	0	
500	SOUTH STREET	no record	3" METER	n/a	118700	0	
200	EAST CAMPUS ROAD	no record	3" METER	n/a	224100	0	
4	PARK AVE	no record	3" METER # 68094318	n/a	6000	0	
200	SOUTH STREET	no record	3" METER 59218732	n/a	6000	0	
415	CENTER STREET	no record	3" METER 66316900	n/a	132500	0	
131	SUMMER STREET	no record	3" METER 93458971	n/a	191100	0	
	MEADOW LANE	no record	3" METER	n/a	42000	0	IN CLUBHOUSE
91	BURRILL AVENUE	no record	3/4" METER # 45426572	n/a	900	0	
	ELWELL AVENUE	no record	4" METER	n/a	169100	0	

FORM 5 DISTRIBUTION SYSTEM LARGE SERVICE METER ADJUSTMENTS

Year

2007

House Number	Meter Location	Meter Test Date	Meter Size	Meter Error	Total Metered	Adjustments	Comments
135	BURRILL AVENUE	no record	4" METER # 59460486	n/a	6000	0	
137	BURRILL AVENUE	no record	4" METER # 59460845	n/a	143000	0	RECTORY
60	FIREWORKS CIRCLE	no record	4" METER # 60615858	n/a	14600	0	
200	SOUTH STREET	no record	4" METER 65344868	n/a	39900	0	LOT # 2
95	BURRILL AVENUE	no record	5/8" METER	n/a	4700	0	LOT # 1
115	ATKINSON DRIVE	no record	5/8 METER # 68865980	n/a	19100	0	
171	BROAD STREET	no record	5/8" METER	n/a	83500	0	
251	PINE STREET	no record	5/8" METER # 6886591	n/a	6700	0	
478	SOUTH STREET	no record	5/8" METER # 68865942	n/a	13200	0	PARISH CENTER
618	PLEASANT STREET	no record	5/8" METER # 68865943	n/a	4000	0	
950	HIGH STREET	no record	5/8" METER # 68865968	n/a	28700	0	
10	STONY BROOK DRIVE	no record	5/8" METER # 68865969	n/a	43300	0	
80	ROBERTS ROAD	no record	5/8" METER # 68865983	n/a	6000	0	
	MEADOW LANE, SECURITY	no record	5/8" METER #66642326	n/a	1500	0	
249	MAIN STREET	no record	5/8" METER 58657742	n/a	38800	0	
	BRIDGEWATER STATE CLG						
1	OPERATIONS CENTER	no record	2" METER	n/a	21100	0	
2	SHEA DURGIN	no record	4" METER	n/a	596000	0	
3	GREAT HILL APTS	no record	3" METER	n/a	222800	0	
4	MILES DINARDO DORM	no record	4" METER	n/a	390100	0	
5	EAST CAMPUS COMMON	no record	4" METER	n/a	113500	0	
6	MOAKLEY TECH CENTER	no record	?	n/a	47000	0	
7	BURNELL/HART	no record	4" METER	n/a	66400	0	
8	BURNELL/HART	no record	?	n/a	45600	0	
9	TINSLEY CENTER	no record	3" METER	n/a	106700	0	
10	SWENSON FIELD HOUSE	no record	3" METER	n/a	18700	0	
11	POPE HALL	no record	3" METER	n/a	151500	0	
12	ART CENTER	no record	2" METER	n/a	22500	0	
13	RONDILEAU CAMPUS CTR	no record	4" METER	n/a	194000	0	
14	POWER PLANT	no record	?	n/a	455000	0	
15	CONANT SCIENCE BLG	no record	?	n/a	119622	0	
16	CONANT SCIENCE BLG	no record	4" METER	n/a	11400	0	

FORM 5 DISTRIBUTION SYSTEM LARGE SERVICE METER ADJUSTMENTS

Year 2007

House Number	Meter Location	Meter Test Date	Meter Size	Meter Error	Total Metered	Adjustments	Comments
17	KELLY GYM	no record	4" METER	n/a	37200	0	
18	SCOTT HALL	no record	2" METER	n/a	135100	0	
19	POLI SCI BUILDING	no record	?	n/a	5000	0	
20	WOODWARD DORM	no record	3" METER	n/a	221300	0	
21	GARAGE	no record	2" METER	n/a	2200	0	
22	GATES HOUSE	no record	5/8" METER	n/a	3500	0	
23	HUNT HALL	no record	2" METER	n/a	25600	0	
24	TILLINGSHAST HALL	no record	2" METER	n/a	259000	0	
	AVERAGE PERCENTAGE	n/a	TOTAL ADJUSTMENTS	n/a		0	

CALCULATION

Enter Annual or AVG. = Add Total Adjust. For each year and divide by 3

(note: This form shows only one year usage - no meter testing results are available)

0

Enter on Line
5a - Form 6

FORM 6 - Water Audit Worksheet (*refers to MADEP Water Management Act Program – Guidance Document and Forms for a Water Audit)

Line No.	DESCRIPTION	FORM (+ or -)	RESULTS
1	Uncorrected Total Water Pumped From Sources of Supply	1	623,119,270
2a	Adjustments to Total Water Supply Master Meter Error	4	-2,462,839
2b	Faulty Valve Controlling Devices	(pg 4*)	0
3	Corrected Total Water Supply (Add Lines 1, 2a, and 2b)	Unadjusted Total	620,656,431
4	Uncorrected Customer Meter Records Total Amount Sold	2	568,793,300
5a	Adjustments to Metered Water Sales - meter error	5	0
5b	Billing Procedure Error		0
6	Uncorrected Customer Meter Records	2	0
7	Corrected Total Quantity of Water Sold (Add Lines 4, 5a, 5b, and 6)	Adjusted Total	568,793,300
8	Total Amount of Water not sold (Subtract Line 7 from Line 3)	Unmetered	51,863,131
9	Total Unmetered Authorized Public Uses of Water (See Page 5)	(pg 5*)	20,298,750
10	Total Unmetered Miscellaneous Losses (See Page 5)	(pg 5*)	0
11	Total Identified Water Losses (Add Lines 9 and 10)	Estimated	20,298,750
12	Total Unidentified Water Losses (Subtract Line 11 from Line 8)	UAW	31,564,381
13	Potential Water System Leakage in gpd per mile of water main. (Divide Line 12 by 365 then divide by total system miles of water main)	Leakage/mile	665
14	Percentage of unaccounted for water that may be attributed to leakage (Divide Line 12 by Line 3)	UAW leakage %	5.09
15	Pumping and Treating Cost per gallon of water (Line 4 on Form 3)	Cost/gallon	\$0.004002
16	Annual Expenditure Due to Unidentified Water Losses (Multiply Line 12 by 15)	UAW Cost	\$126,308

Appendix B

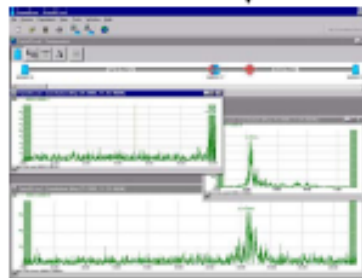
Leak Detection Equipment

data data data data data



- Uses 2 or more self contained Correlator Pods (CP)
- Several SoundSens carry cases can be linked together to give 24 or more Correlator Pods in one session
- No radio link or direct wire connection for operation
- Total flexibility for day or night working
- Cost effective and versatile solution to leak detection

↓



Typical SoundSense display showing Pipe Layout and Corrosion graphs, positioning the leak

— A —
HALMA GROUP
C O M P A N Y

data data data data data

TECHNICAL DATA			
Sensor Input	Analogue	Internal Accelerometer to pickup audible noise in pipeline Frequency range from 1 to 2,750 Hz Signal resolution from 12 bit A to D converter	
	Attachment of logger/ sensor	Powerful magnetic coupling to attach Correlator Pod to pipework / valve	
Logging Features	Memory	Recording 650,000 readings. (memory expandable to 1.35 million readings on request) Individual measurements can be pre-programmed into a series of 32 separate recordings	
	Sample Rate	1 to 5.5 KHz user adjustable (4.8 KHz default)	
	Delayed start	Either start at a nominated time, or after set delay period	
	Logger ID	Factory set Logger ID number Also user can enter another logger identity number to simplify recognition for operators	
	Clock	On board 24 hour real time clock with date facility.	
	Software	Compatible with Radcom "SoundSens" analysis software	
Communications	Serial Comms	4 pin MIL connector for RS232 communications via an interface unit to laptop PC, or desktop PC at 115,200 Baud	
	Serial Cable to PC	9 pin D extension cable supplied, to connect interface unit to PC Also can be used to connect one interface unit "in cascade" to an other interface unit for large scale Correlator Pod applications	
	Cable to Pods	The Interface unit is supplied with glanded cables and 4 Pin Military connectors to fit Correlator Pod Loggers.	
Physical	Dimensions	Individual Advanced Correlator Pod now with reduced dimensions: 160 H incl Magnet x570mm mm (8.3H x2.6D ") 2 Pod Carry Case: 370W x 320D x 150H mm (14.5W x12.8D x 5.9H ") 8 Pod Carry Case: 409W x 310D x 310H mm (16.0W x12.2D x12.2H ") 12 Pod Carry Case: 609W x 410D x 310H mm (23.9W x16.1D x12.2H ")	
	Construction	CPod: Die-cast aluminium enclosure, powdercoat spray painted Carry Case: Rugged construction with Aluminium Cladding	
	Weight	Individual Correlator Pod: 0.7 kg (1.54 lb) 2 Pod Case: 4.8 Kg (10.1lb) empty, 8 Kg (13.2lb) including 2 pods 8 Pod Case: 8 Kg (17.8lb) empty, 12 Kg (26.4lb) including 6 pods 12 Pod Case: 14 Kg (30.8lb) empty, 22.5 Kg (49.5lb) including 12 pods	
	Operating temperature	-10 to +50°C (-14 to +122°F)	
	Ingress protection	Individual Correlator Pods: IP68 submersible	
	Power	Correlator pod has Lithium-ion cell operational for 5 years under normal operating conditions. Carry Case interface unit contains NiCad battery which typically requires charging monthly or less. 240/110v switch mode charger supplied in kit with mains lead.	

R	S	S	5	9	0	1	/			/			/	A
---	---	---	---	---	---	---	---	--	--	---	--	--	---	---

Carry case size for	Correlator Pods supplied with system
02 = 2 Correlator Pods	02 = 2 Correlator Pods Supplied
08 = 8 Correlator Pods	to
12 = 12 Correlator Pods	12 = 12 Correlator Pods Supplied

CONCLUSIONS

Due to our policy of continuous product development, Radcom reserves the right to change specifications without notice.

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Appendix C



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Fax: (781) 435-1480

E-mail: jim@listonutilityservices.com

Website: www.listonutilityservices.com

James D. Liston

Experience

2004 – Present Liston Utility Services Stoneham, MA

Owner

- Water Audits
- Correlating Leak Detection Surveys
- Sonic Leak Detection Surveys
- 24 Hour Emergency Leak Detection
- Water Meter Datalogging
- Fire Flow Testing
- Loss of Head Testing
- Pressure Studies

1995-2004 RADCOM Technologies, Inc. Woburn, MA

General Manager

- Demonstrated new datalogging equipment throughout USA.
- Performed Studies to reduce unaccounted for water
- Suggested new products that increased earnings by 50%.

1983-1995 Boston Water and Sewer Commission
Boston, Massachusetts

Manager of Field Services

- Managed a staff of 10 personnel.
- Implemented a Master Meter Testing Program
- Implemented a Commercial Meter Testing Program.
- Implemented a Leak Detection program.
- Implemented a Water Meter Sizing Program for Increased Revenues

1979-1983 The Pitometer Associates Mount Clair, NJ

Pitometer Field Engineer

- Performed Master Meter Testing
- Performed Water Audits to reduce unaccounted for Water
- Performed Industrial Meter Testing
- Performed Leak Detection Surveys
- Performed Main Co-Efficient and Fire Flow Tests

Education

1976-1979 University of Lowell Lowell, MA

- B.S., Civil Engineering.

Appendix D

Memorandum of Mutual Agreement with E. Bridgewater and Halifax

(Copies of the Letters from East Bridgewater and Halifax
are included in the printed copies of the report only)

Memorandum of Understanding
Towns of E. Bridgewater and Halifax

It is our understanding that the Town of Bridgewater has applied for and has been granted a Water Loss Prevention Grant for fiscal year 2007-2008. A part of this grant includes the purchase of a correlator pod unit for leak detection. In order to maximize the purchase authorization, it has been recommended that the Town of Bridgewater make the equipment available for use by other communities. We have a history of a good working relationship with the Town of Bridgewater. Under this agreement, should the grant include the purchase of the equipment we will have use of the correlator for four weeks. This use will be scheduled by the Town of Bridgewater Water Department Superintendent. The equipment will be housed and maintained by the Town of Bridgewater. In the event of major maintenance requirements, we will participate in the cost. We agree to be responsible for the equipment while we have use of it and we will return the equipment in the same condition that we received it in. Training in the use of the equipment will be provided by the vendor and this training will be jointly available to our operators, as coordinated by the Town of Bridgewater.

The leak detection equipment will be a correlating data logger developed by SoundSens or comparable unit described as follows:

- Correlator Pods (loggers) are easy and quick to install below ground in a valve box
- No trailing cables or radio equipment required, ensuring security during day and night time operation
- No minimum distance restriction and longer distance deployment not hindered by radio transmission
- Flexible deployment methods available – allowing the efficient use of operational staff and generally avoiding costly night work
- Multiple time slots can be selected to allow for particular noisy networks and with pre-selecting logging time programmed into the loggers during the day –allows multi-point correlation at night.

The preferable model is the multiple Pod Correlation survey technique. Six Correlator Pods are deployed in a section of the water distribution system to be surveyed. The deployment can be either down a valve chamber or magnetically attached to the 4 inch barrel of a fire hydrant. They are programmed to record a number of time slices, then retrieved after the required logging period. This logging can occur during the day or pre-programmed to occur over night. The data is downloaded from the loggers into the correlation software. After downloading data from the deployed loggers, the software will survey the data to give an approximate location of any number of leaks in the section of the water distribution system. GIS or measured site information is then imputed into the topography module. The correlation software is then re-rerun to determine accurate leak position(s).

Appendix E

Leak Detection Completion Report

(Copies of the Leak Detection Completion Report are included in the printed copies of the report only)

Appendix F
Photographs of Survey of Municipal Buildings



Academy Bldg- 2nd fl. Womens AB-W-2R; large tank



Academy Bldg. 2nd Fl. Women's Bathroom Large Tank (3 all together)



Academy Bldg. 2nd Fl. Women's Bathroom; Hot and Cold Water (sinks not working properly)

Academy Bldg 2nd Fl. kitchen; sink/faucet with hot and cold water and has a refrigerator included.





Academy bldg. 1st fl. Women's Bathroom; Large Tank



Academy Bldg- 1st fl. Women's Bathroom; Sink with hot and cold water (not working properly; leaks)



Academy Bldg 1st fl Men's Bathroom; Large Tank



Academy Bldg
1st Fl. Men's
Bathroom Sink
with hot and cold
water



Academy Bldg Basement - Kitchen Sink (hot and cold water), Refrigerator, and Oven

Academy Bldg. 1st floor; Police Officers Bathroom- Urinal 2



Academy Bldg 1st floor
Police Officers Bathroom
Urinal 1

Academy Bldg 1st floor, Police Officers' Bathroom; Small tank



Academy Bldg 1st fl. Police Officers' Bathroom;
Small tank





Academy Bldg 1st floor Police Officers' Bathroom – Shower Stall



Academy Bldg 1st floor Police Officers' Bathroom – Sink with hot and cold

Academy Bldg 1st floor Police Officers' Bathroom – Sink with hot and cold



Academy Bldg basement Small tank bathroom and Sink with hot and cold water



Academy Bldg – 1st floor Kitchen Area with sink (hot and cold water) and refrigerator.



Academy Bldg 1st floor Women's Bathroom near Holding Cell- Small Tank

Academy Bldg 1st floor Women's bathroom near Holding Cell- faucet with cold and hot water



Academy Bldg 1st floor Men's Cell- Toilet with sink (not in working conditions)



Academy Bldg 1st floor Men's Cell- Toilet with Sink (not in working condition)

Academy Bldg 1st floor Men's Cell- Toilet with Faucet (not in working conditions)





Fire station 2nd floor Women’s Bathroom – 1 toilet, sink and shower stall



Fire station 2nd floor Women’s Bathroom Toilet



Fire station 2nd floor Men's Bathroom 2 sinks



Fire station 2nd floor Men's Bathroom 1 of 2 toilets 5gallon tanks



Fire station 2nd floor Men's Bathroom 2 of 2 toilets- 5 gallon tanks

Fire station 2nd floor Men's Bathroom/ Shower

Stall (1 of 2)

Fire station 2nd floor Men's Bathroom/ Shower

Stall (2 of 2)





Fire station 2nd floor Kitchen (hot and cold water both working properly)



Fire station 2nd floor- Old kitchen setup



Fire station 1st floor Unisex bathroom on the right hand side with 1 toilet and 1 sink
(Not handicap accessible; no bar on the side of the bathroom, no ramp on the doorway and the faucet is not working properly)



Fire station 1st floor Unisex bathroom on the left hand side (1 toilet, 1sink and a Utilities Sink)



Fire station 1st floor Ice Chest



Town Hall (1st floor Men's Bathroom Sink and not handicap accessible)



Town Hall Men's Bathroom 1st floor – Toilet



Town Hall 1st floor Women's Bathroom (1 toilet, 1 sink) (in process of being handicap accessible but sink is not working properly)



Town Hall 1st floor Women's Bathroom (Sink not working properly)



Town Hall 2nd floor Men's Bathroom 1 toilet and 1 sink (Toilet not flushing properly)



Town Hall 2nd floor Kitchen (sink not functioning properly; leaks)



Town Hall 2nd floor Women's Bathroom 1 sink and 1 toilet



Town Hall 2nd floor Heating Furnace using water (typical of bldg)



Town Hall Basement Hot Water Tank System



Memorial Bldg 1st floor Faucet in hallway (not functioning properly; leaks)



Memorial Bldg Basement Women's Bathroom
(2 toilets, 1 sink) (needs ramp for entrance to be
handicap accessible)

Memorial Bldg Basement (toilet 1.6 gallon
tank – newer model)





Memorial Bldg Basement Women's Bathroom Sink



Memorial Bldg Basement Kitchen with faucet



Memorial Bldg Basement Men's Bathroom with 2 toilets and 1 sink along with a Utility Sink (needs ramp for doorway in order to be handicap accessible)



Memorial Bldg Men's Bathroom in Basement Utilities Sink



Waste Water Treatment Plant (sink, dishwasher, eyewash) (sink specially designed for chemicals)



Waste Water Treatment Plant (Washer and Dryer and Utilities sink)



Waste Water Treatment Plant (utilities sink)



Waste Water Treatment Plant Restroom Unisex (1 toilet, 1 sink, and 1 urinal)

Waste Water Treatment Plant- Sink Hot and Cold Water



Appendix G
Conservation Plan

Town of Bridgewater Conservation Plan Water Conservation Measures

The Town of Bridgewater Water Department has incorporated the conservation measures recommended by Water Resource Commission's (WRC) Water Conservation Standards that use EPA derived guidance. The goal of the water conservation program is to reduce the volume of water lost in the system by increasing community awareness and implementing water saving practices throughout the Town. The Water Conservation Plan includes but is not limited to water conservation measures, universal metering, water accounting and loss control, costing and pricing, information and education, pressure management, landscape efficiency, reuse and recycling, water-use regulation, and integrated resource management. Conservation efforts include water use reduction plans, working with public schools, and distributing conservation outreach and education information (i.e., local cable announcements and news briefs in local newspaper) and Low Impact Development concepts to agricultural, commercial, industrial, and residential consumers.

Water facts for the Town of Bridgewater are:

- In 2007, for a population of 25,514 and annual residential water use of 568,793,300, it is estimated that the average water use per person was 61 gallons per day.
- There are three Town-owned wellfields that presently provide water for the Town
- There is one water treatment plant that removes iron and manganese from approximately 2/3rds of the water supply. The treated water is mixed with the remainder of the system to provide our high quality water.
- There are two water towers that serve to provide storage and pressure stabilization.
- The Town performs on-going testing of the water throughout the system and maintains compliance with the Massachusetts Water Management Act and the permit requirements.
- Approximately 78% of the water provided is used for residential purpose.
- The results of a leak detection survey of the entire 130 miles of water main that services Bridgewater indicated no leaks were found.
- Presently, it costs approximately 2.5 million dollars per year to provide water and it is estimated that cost relates to an approximate cost for water of \$4.00/1000 gallons. Currently chemicals and fuel account for approximately 15% of the total budget. Rising chemical and fuel costs will result in necessary rate increases.
- The Water Department operates as an enterprise fund and is not for-profit. All revenues generated provide for water collection, treatment and distribution.
- Water conservation remains the single most effective means of cost reduction.

Conservation measures are considered in three categories:

Level 1

- Universal metering
- Water accounting and loss control
- Costing and pricing
- Information and education

Level 2

- Water-use audits
- Retrofits
- Pressure management
- Landscape efficiency

Level 3

- Replacements and promotions
- Reuse and recycling
- Water-use regulation
- Integrated resource management

In addition, Conservation Tips For Community Water Suppliers have been included as referenced from the MADEP website, these water conservation tips were recommended for water suppliers from the Massachusetts Drought Management Task Force, the Executive Office of Energy & Environmental Affairs, and the Massachusetts Emergency Management Agency.

Level 1

- Universal metering
 - The Town of Bridgewater has upgraded its metering of all users and has implemented a meter calibration and testing program of its residential users. Current rules and regulations require annual testing and calibration of large meters by their owners. The Water Department will require that these results be submitted to the Water Department annually.
- Water accounting and loss control
 - The Town of Bridgewater Water Department has metering reading two and four times per year, depending upon the water usage of our customers. The Water Department maintains an on-going leak detection and repair program. A 2006 MADEP Water Loss Prevention/Leak Detection Grant program provided improved leak detection equipment purchase and training.
- Costing and pricing
 - The Town of Bridgewater has contracted with Wes Gardner, CPA to conduct a water rate study. The results of this study have recommended a three-year rate increase consisting of an ascending water use structure. In addition, the Board of Water and Sewer Commissioners for the Town of Bridgewater will recommend consideration of an annual cost of living factor to be included in the present rate structure.
- Information and education
 - The Water Department provides education to the public about water conservation techniques, including:
 - Educational outreach to the local elementary school through in-class programs and information available on its website.
 - Educational information for loan from the Water Department of American Water Works Association production, “How Water Works Classroom Learning Kit”.
 - The broadcasting of “Liquid Assets” that is described as “a public media and outreach initiative that seeks to inform the nation about the critical role that our water infrastructure plays in protecting public health and promoting economic prosperity. Combining a ninety-minute documentary with a community toolkit for facilitating local involvement, Liquid Assets explores the history, engineering, and political and economic challenges of our water infrastructure, and engages communities in local discussion about public water and wastewater issues.” <http://liquidassets.psu.edu/>

- Information on impacts of dry conditions on the water system and the environment is provided via local cable notification and public notice in the local newspaper.
- Information on the current status of our water supply so consumers can follow how the situation is changing – either for better or worse is available from the Water Department or may be updated on the department website.
- Tips on water conservation techniques for consumers are available in handouts at the Water Department office.
- The Department’s website provides an explanation of any water use restrictions that are or may be imposed, including clear statements of what is and what is not allowed
- The Water Department provides consumer information on low water use landscape techniques on the Water Department website and through specific videos available on-loan from the Water Department office.
- By-laws and Outdoor Watering Restrictions
 - The Town of Bridgewater passed a by-law, which empowers community to limit or ban outdoor watering using the DEP Model Water Use Restriction Bylaw/Ordinance - <http://www.mass.gov/dep/water/drinking/wmabylaw.pdf>.
 - This by-law limits outdoor watering hand held hoses only.
 - There is no filling of swimming pools from the distribution system allowed
- The largest commercial and industrial water users in the community are identified with the general recommendations to limit watering lawns and landscapes and to utilize xeriscaping techniques (reference educational section information below). The following recommendations are made for specific users
 - Restaurants: Put stickers on bathroom mirrors asking patrons to conserve water, run only full dishwasher loads, retrofit kitchen fixtures
 - Commercial: Educate employees on the cost-savings associated with water conservation, retrofit bathrooms with low flow toilets and spring loaded valves on faucets, full dishwasher loads in cafeterias
 - Industrial: Undertake employee education, heating and cooling options to reduce water use
 - Universities and other institutions: Install low flow bathroom fixtures and low flow shower heads, undertake education using signs, cover pools to reduce evaporation

Level 2

- Water-use audits
 - The Town of Bridgewater Water Department, through the 2006 Water Loss Prevention Grant was able to conduct a water audit with three-year cost and use averaging.
- Retrofits
 - The Water Department provides shower saving retrofit to its customers along with leak detection tablets; available at the Water Department office.
- Pressure management
 - The Water Department maintains two water towers to provide adequate pressure within the distribution system and requires new developments to perform a water adequacy study prior to approval, including fire flow and pressure.
- Landscape efficiency
 - Through the 2006 MADEP Water Loss Prevention Grant, the Water Department has available to it’s customers copies of water reducing landscaping techniques and two copies for loan of the DVD “Your Own Back Yard” a xeriscape primer, produced through the American Water Works Association.

- The Water Department is available to work with various community organizations to provide information on water saving gardening techniques, included the local garden club.

Level 3

- Replacements and promotions
 - The Water Department was awarded a Water Conservation Grant by the MADEP in 2007. This grant provided for the purchase of water saving devices and their installation in five of the municipal buildings.
 - The Water Department will continue to pursue grant programs and other funding sources to provide replacements and promotional opportunities for water conservation
- Reuse and recycling
 - The Water Department will work with other municipal departments to support and encourage water reuse and recycling projects and support the adoption of local regulations.
- Water-use regulation
 - The Water Department will update its management plans in accordance with state and federal guidelines as they relate to integrated resource management
 - The Water Department has completed a Water System Management and Emergency Preparedness Plan

Appendix H
Educational Outreach Material
(Copies of materials are included in printed reports)

Educational Outreach (Task 6)

- An educational outreach program was brought into the second grade classes at the George Mitchell Elementary School by Shirley Young and Fawn Sances on December 10th and 11th, 2008. In addition to a lively and interactive presentation to the students by Ms. Young, the grant provided educational materials for the students to bring home and share with their families. (*Every drop counts booklet* http://store.projectwet.org/index.php?main_page=product_info&cPath=6&products_id=65 and AWWA pub for grades K – 3 16 pages <http://www.awwa.org/bookstore/productDetail.cfm?ItemNumber=4592>, along with AWWA Teacher Resource booklets for water related learning activities.)
- Educational information for loan from the Water Department of American Water Works Association production, “How Water Works Classroom Learning Kit” is available for use by community groups or individuals.
- In January 2009, the local cable network has arranged the broadcasting of “Liquid Assets” that is described as “a public media and outreach initiative that seeks to inform the nation about the critical role that our water infrastructure plays in protecting public health and promoting economic prosperity. Combining a ninety-minute documentary with a community toolkit for facilitating local involvement, Liquid Assets explores the history, engineering, and political and economic challenges of our water infrastructure, and engages communities in local discussion about public water and wastewater issues.” <http://liquidassets.psu.edu/>
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Total Water Management, Neil S. Grigg

http://bookstore.icma.org/Total_Water_Management_Practi_P1845.cfm?UserID=1983560

Excerpt:

<http://www.awwa.org/files/Total%20Water%20Management.pdf>

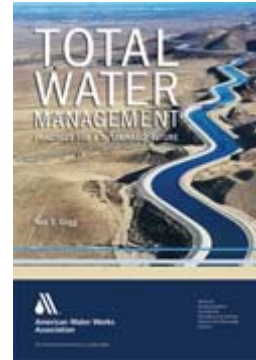
Total Water Management: Practices for a Sustainable Future

FEATURED ITEM **NEW!**

Neil S. Grigg, PhD, PE

Published by [American Water Works Association](#)

A quiet revolution is being led by men and women who care about sustainable public health, and the environment. This revolution is directed toward new balance water resources and the needs of the environment. It is Total Water



use of water resources, ways to manage and Management, or TWM.

TWM is the exercise of stewardship and shared governance of water resources among utilities, business, and government for the greatest good of society and the environment.

Total Water Management: Practices for a Sustainable Future explains what TWM means in unambiguous language. It expands, explains, and illustrates TWM concepts and how to apply them. It is a useful, practical book on water planning for water resource managers, designed to help managers fairly allocate limited water resources among competing users, based on social values, cost-effectiveness, and needs of the natural water systems.

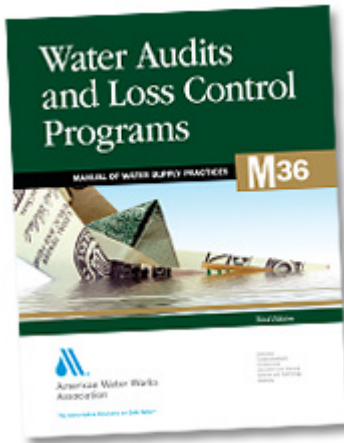
The book explains how to identify and involve all stakeholders in decision-making processes. It defines the viewpoint of each stakeholder group: utilities, consumers, industry, agriculture, government officials, regulators, suppliers, public interest groups, and others and their roles and responsibilities in making TWM successful.

Discover how to:

- Use TWM to balance competing uses through efficient allocation by planning and managing dynamically
- Adapt TWM to changing conditions and local and regional variations
- Use TWM to share responsibility, coordination, and conflict resolution to reach decisions with participation of all units of government and stakeholders

Total Water Management: Practices for a Sustainable Future offers powerful and urgently needed tools to balance needs of water management and the environment. This book serves as an instruction manual for integrating the water needs of society and the environment. It is about the balance between our responsibilities to provide safe and reliable water services and to protect the environment.

Hardcover. 2008. 308 pages. ISBN: 1-58321-550-6. Item 43542 \$149.00



NEW EDITION

AWWA Manual of Water Supply Practices M36 provides complete guidance on water auditing, leak detection, and water loss control programs. \$60.00

Manual M36 has a new name and significant new material. The third edition has more than twice the pages of the second edition. All chapters have been updated, and important new information has been added on a major advancement in water-auditing methodology, co-developed by the American Water Works Association and the International Water Association. The new methodology provides true accountability of real and apparent (billing errors, meter inaccuracy) water loss, and fast recovery of lost revenue.

Water Audits and Loss Control Programs provides

- Step-by-step procedures to conduct a water audit that assesses the efficiency of the water distribution system and water accounting practices
- Worksheets and sample calculations for each step of the water audit
- Specific techniques to identify, measure, and verify all water consumption and loss
- Techniques to identify and control apparent losses in metering and billing operations, and recover missed revenues
- Steps to implement a leakage and pressure management program to control real losses, conserve water, and contain costs
- Planning steps to assemble the proper resources, information, and equipment to launch a sustained accountability and loss-control program
- Approaches for setting short-term and long-term goals and measure return on investment
- Considerations for small water systems

Published By American Water Works Association

Edition: 2009 - Softbound - 285 pp.

ISBN 1583216316 - Catalog No. 30036

Water Basics for Decision Makers, Frederick Bloetscher

<http://www.awwa.org/files/Publications/Journal/2008/December/PDFs/JAW200812mediapulse.pdf>

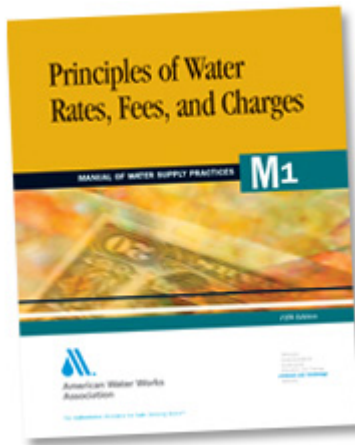
Water basics for decision makers; local officials' guide to water and wastewater systems.

Bloetscher, Frederick.

American Water Works Assn., ©2009 185 p. \$75.00 TD481

978-1-58321-585-2

The US Environmental Protection Agency published *Drinking Water Handbook for Public Officials* in 1992, and the Association published a successor in 1993. Bloetscher (civil engineering, Florida Atlantic U., Boca Raton) presents another successor, not only updating the data but also expanding the coverage to include wastewater systems. The guide is designed for elected and appointed local officials such as city managers, finance staff, public works personnel, engineers, and new utility managers. It covers regulations, classifications of water and sewage, water supplies, treatment, operations, collection, management and administration, financing, and planning. (Annotation ©2009 Book News Inc. Portland, OR)



M1 PRINCIPLE OF WATER RATES, FEES AND CHARGES 5TH, EDITION \$86.00

Water utilities faced with rising costs, drought, rising water demand, and other market forces have created a variety of rate structures.

This manual provides guidance and recommendations on choosing rate structures and setting water rates, fees, and charges which will cover utility costs and future needs. The manual covers all types of rate structures, such as block rates, uniform rates, conservation rates, surcharges, and many others.

Published By American Water Works Association

Edition: 2000 - Softbound - 341 pp.

ISBN 1-58321-069-5 - Catalog No. 30001

WATER SAVING TIPS

The following are from the EPA WaterSense website: <http://www.epa.gov/watersense/calculator/index.htm>



If you don't have a low-flow toilet, put a plastic bottle filled with water in your toilet tank to reduce the amount of water used per flush.



Put a bucket in the shower while you're waiting for the water to warm up, and use the water you catch for watering plants or cleaning.



To check for a toilet leak, put dye or food coloring into the tank. If color appears in the bowl without flushing, there's a leak that should be repaired.



Turn off the water while brushing your teeth.



Turn off the water while shaving, and instead fill the bottom of the sink with a few inches of water to rinse your razor.



Install a low-flow showerhead. It may cost you some money up front, but your water conservation efforts will save you money down the road.



Spend less time in the shower. If you lose track of time in the shower, bring a radio into the bathroom and time yourself by how many songs play while you're in there. Try to get your shower time down to one song (or less).



If you take a bath, keep the water level low, and consider re-using the water before you let it go down the drain.



Fix those leaky faucets. You may think that a constant drip is just annoying, but it's also a huge waste of water (you can lose about 20 gallons of water per day from a single drippy faucet!).



Install low-flow faucet aerators in your sinks.



When you wash your hands, turn on the water briefly to wet them, turn it off while you lather up, then on again to rinse. You'll save water and soap this way.



If you're in the market for a toilet, buy a low-flow model they use as little as half as much water as normal toilets. Also, look into the water-saving [dual flush toilets](#) currently used around the world.



If it's yellow, let it mellow. The saying may be cliché, but it's good advice for home use. If the "yellow" grosses you out, just put down the toilet lid.



Don't flush things down the toilet to dispose of them. Throw away tissues and other bathroom waste in the garbage can, which doesn't require gallons of water.

More ideas from EPA WaterSense:






- If your dishwasher has the blue Energy Star symbol on it, select "Energy Star machine." If you're not sure, your machine is probably standard.
- Energy Star dishwashers use about 4 gallons of water per load, and even standard machines only use about 6 gallons. Since hand washing generally uses about 20 gallons of water, dishwashers can be huge water-savers.
- When you eat out or use disposable tableware, you use about 5 gallons of water per person per day. Restaurant dishwashing averages out to about 5.5 gallons for 3 meals, and it takes roughly 4.5 gallons of water to produce 3 meals' worth of paper and plastic utensils, plates, and cups.
- It takes 330 gallons of water to irrigate a 1,000 sq. foot tract of land with ½ inch of water.
- Depending on the size of your lawn and whether you live in a dry region of the country, you could be using thousands of gallons a week to keep your grass green.
- The average pool takes 19,000 gallons of water to fill, and if you don't cover it, an additional 1,000 gallons of water per month can be lost due to evaporation

- If your household has more than one car, include the total washes and gasoline consumed for all of your vehicles: Washing a car uses about 150 gallons of water, so by washing less frequently you can cut back on water use. Refining gasoline takes water—for every gallon of gas you burn, you're using 1 to 2.5 gallons of water!
- Besides just drinking water, we indirectly consume the many gallons it took to grow the plants and raise the animals we eat. On average, a vegan, a person who doesn't eat meat or dairy, indirectly consumes nearly 600 gallons of water per day less than a person who eats the average American diet.
- It's essential that we all drink water, but when you drink from disposable plastic bottles you're consuming more water than you realize. The plastic used to make the average 16–32 ounce water bottle requires over 1.5 gallons of water to produce, so even if you're only drinking a small bottle of water, you're wasting gallons.
- Although many of us don't realize it, manufacturers use a lot of water to make the products we use. The average American can save over 10 gallons of water per day by recycling plastic. Recycling a pound of paper, less than the weight of your average newspaper, saves about 3.5 gallons of water. It takes about 100 gallons of water to grow and process a single pound of cotton, and the average American goes through about 35 pounds of new cotton material each year. Every time you throw away an old towel, shirt or blanket, you're flushing gallons down the drain.
- A rainwater collector is a container that catches water from rooftop storm gutters to be used on lawns and gardens and can collect 9 gallons of water a day, or more in areas with heavy rainfall.

Other websites of interest:

<http://www.wateruseitwisely.com/100-ways-to-conserve/index.php> <http://www.h2ouse.org/>

POTENTIAL WATER SAVINGS ON FIXTURES AND APPLIANCES

Plumbing Fixtures	Water Use: High-Efficiency Models	Water Use: Pre-1980 Models	Per-Capita Reduction in Daily Water Use from this Fixture or Appliance
	1.6 gal per flush	5 - 7 gal per flush	58%
	0.5 – 2.5 gal per min	3 – 7 gal per min	13%
	1.5 – 2.5 gal per min	5 -8 gal per min	4%
Appliances			
	24 – 48 gal per wash	56 gal per wash	38%
	7 gal per wash	9.5 – 14 gal per wash	Not Statistically Significant

See the Town of Bridgewater Water Department website to see this flyer and for further information on water-saving ideas. <http://www.bridgewaterma.org/Government/Water/index.shtml>

This project has been financed partially with federal funds from the U.S. Environmental Protection Agency (USEPA) to the Massachusetts Department of Environmental Protection (MADEP) under a Water Loss Prevention Competitive Grant. The contents do not necessarily reflect the views and policies of EPA or of MADEP, nor does the mention of trade names or commercial products constitute endorsement or recommendation for use.



Global Advanced Technology, Inc.

24 Ladd's Way, James Landing, Scituate, MA 02066

Tel:(781) 545-3546 Fax:(781) 545-5816

<http://www.GATIs.com/>

Subject: Water Conservation Out Reach Report

Water Conservation Out Reach Education was conducted on December 10 and 11, 2008 at the George H. Mitchell Elementary School in Bridgewater, MA. Presentations of twenty (20) minutes in length were given to eleven (11) classes of Second Graders. The teachers for the class rooms were: Mrs. Mastria, Mrs. Biela, Mrs. Burke, Mrs. Ohrenberger, Mrs. Allen, Mrs. Gibson, Ms. Pincolini, Mrs. Benton, Mrs. Ohman, Ms. Krawiec and Mrs. Ladurantaye. The presentation outline is as follows:

1. Discuss what water is made of – This is done with a question form to gain understanding of how much the students understand the atoms in the water molecule.
2. Discuss three physical forms of water – Solid, Liquid and Gas.
3. Talk about the water cycle – Water evaporates from surface water source; therefore, reduces the water level. Rainfalls and Snowfalls increase water level.
4. Discuss where Bridgewater tap water comes from – From Surface Water go through “cleaning process” to tap.
5. Show how much is one (1) gallon of water.
6. Discuss/Questions/Answers about daily water consumptions: Brushing teeth, Washing hands, Flushing toilets, Taking showers, Taking baths, Watering lawn, etc. This gives the children some idea of how much water is used.
7. Discuss is there is a drip of water every second, how much water is accumulated throughout one (1) year – 2400 gallons.
8. Two booklets were given out to the Children: Splash! Activity Book and Water Fun For You.

The story of drinking water and the Personal Water Use Chart were used as classroom resource guides. The presentations were conducted interactively with the children to increase participation and attention span.

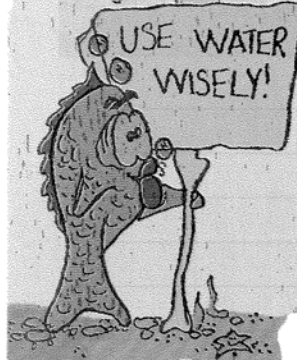
In summary, one teacher had shared the story about how her children had learned about water conservation the previous day; they had been shutting off water whenever water was not used. It was not the practice before; however, it showed that the children really learned how not to waste water.

Shirley Young

“the story of drinking water” and “Personal Water Use Chart” attached.

Fred and Sarah know some good ways to use water wisely. Can you think of other ways?

1. Take a 5 minute shower. This uses less water than a bath.
2. Turn off the water when you brush your teeth.
3. Use a bucket to wash your bike. Using a bucket uses less water than a hose.
4. Keep a jug of water in the refrigerator. You can always have cold water without running the faucet.



5. Carefully water your lawn and flowers.
6. Check your faucets for drips. A faucet with a little drip can waste lots of water.
7. _____
8. _____

*Use water only when you need it.
Always turn it off when you are finished.*

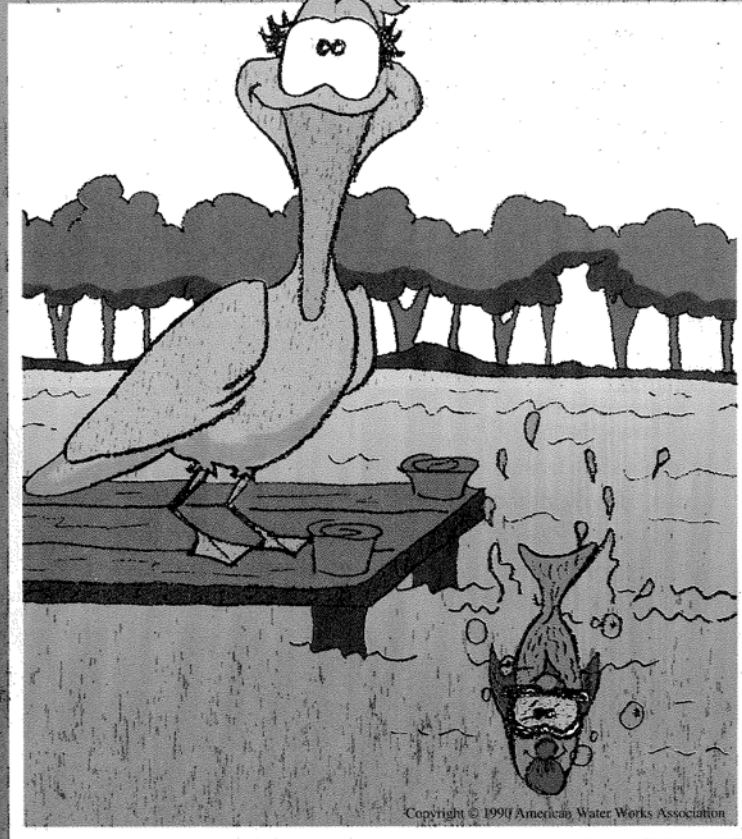
 American Water Works Association
6666 West Quincy Avenue, Denver, CO 80235

19P-50M-70054-02/08-PP



Splash!

Activity Book



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**American Water Works
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The Authoritative Resource for Safe Drinking Water™

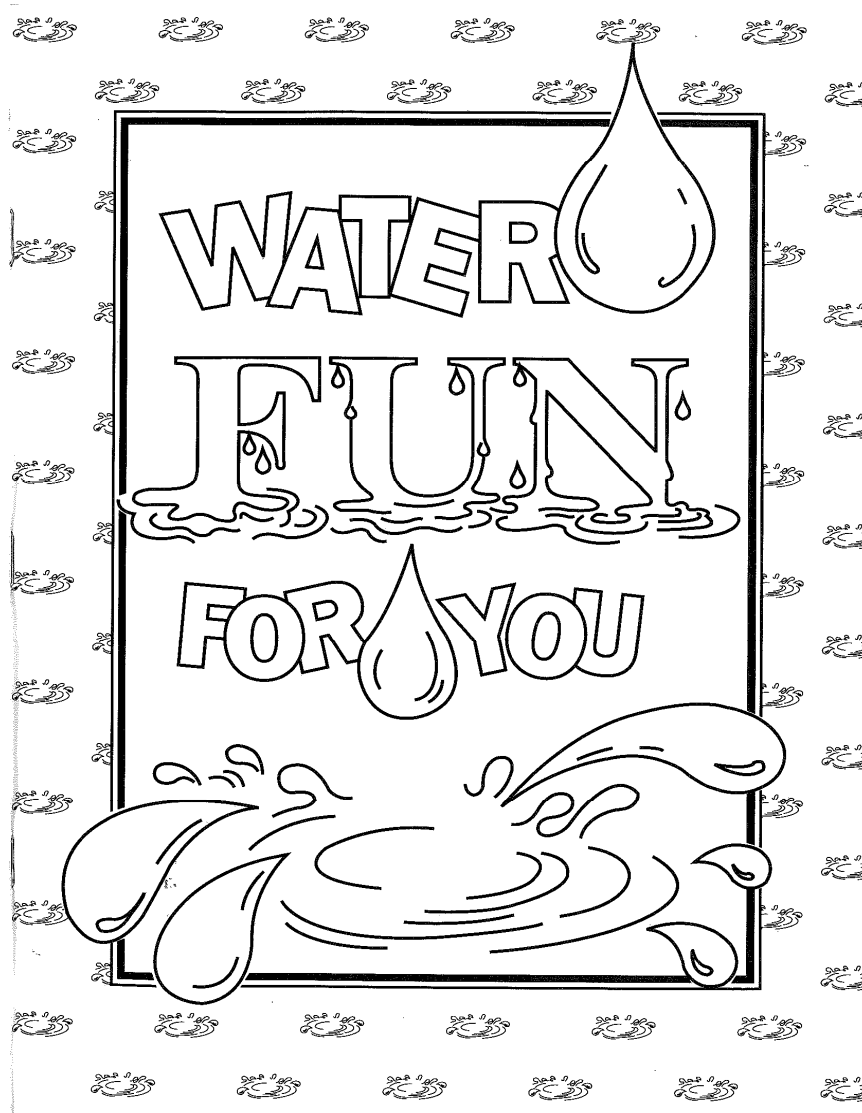
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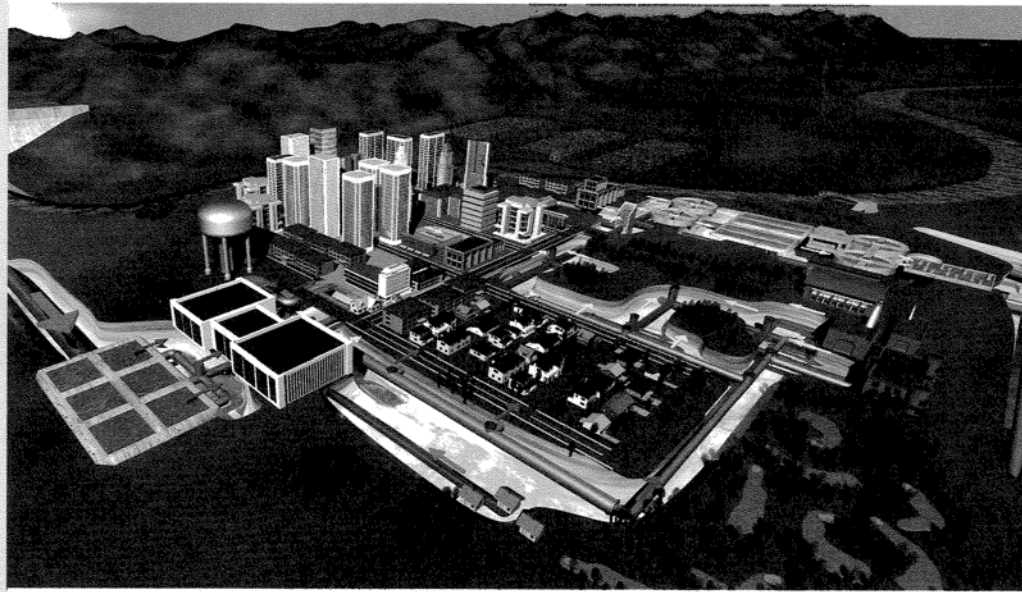
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06-05/WLP
Town of Bridgewater

Workbook

How Water Works™



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Association**

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Communications
Conferences
Education and Training
Science and Technology
Sections*