ABINGTON WATER CONSERVATION GRANT PROJECT

PROJECT NUMBER 09-09/WCG

PROJECT CONDUCTED FOR THE YEARS 2010-2012

PREPARED BY:

THE TOWN OF ABINGTON, MASSACHUSETTS
AND
THE ABINGTON & ROCKLAND JOINT WATER WORKS

PREPARED FOR:

MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF RESOURCES PROTECTION

AND

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 1
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MASSACHUSETTS EXECUTIVE OFFICE OF ENERGY and ENVIRONMENTAL AFFAIRS
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Introduction

In accordance with the requirements of the Massachusetts Department of Environmental Protection (MassDEP) Water Conservation Grant Project 09-09WCG, the Town of Abington, Massachusetts is pleased to submit the Final Project Report. A water audit, leak detection survey and repairs, public outreach water conservation brochure, and conservation based water rate study were completed under this project. This report summarizes the project, including the methods of data collection, results, conclusions and recommendations to further reduce water losses and project effectiveness.

The Towns of Abington and Rockland form the Abington & Rockland Joint Water Works (ARJWW). The Joint Water Works is supplied with water from two surface water supplies located in the South Coastal Watershed at the Great Sandy Bottom Pond and the Hingham Street Reservoir. A third water source is a groundwater supply in the Taunton Watershed located at the Myers Avenue Well Field. There is a drinking water treatment plant located at each of the three sources.

At both Great Sandy Bottom Pond and Hingham Street Reservoir water is pumped from the reservoirs to the water treatment plants located adjacent to each of the sources respectively. The Myers Avenue Well Field consists of four gravel packed wells. Water from the wells is pumped directly to an onsite treatment plant. Water from all three sources is pumped directly into the distribution system at three discrete points.

The Great Sandy Bottom Pond Water Treatment Plant, located in the town of Pembroke, was built in 1989 and has a capacity of 3.81 million gallons per day (mgd). Treatment processes for the plant include micro screening, coagulation, flocculation, sedimentation, filtration, iron and manganese removal, powder activated carbon for odor and taste control, pH adjustment and chlorine disinfection. Finish water pumps pump water from the clearwell into the distribution system.

The Hingham Street Reservoir Water Treatment Plant, located in the town of Rockland, built in 1972, is a conventional filtration plant and has a capacity of 2.0 mgd. Treatment processes for the plant include coagulation, pH adjustment, iron and manganese removal and chlorine disinfection. Three finish water pumps pump water from the clearwell into the distribution system.

The Myers Avenue Well Field Water Treatment Plant, located in Abington, was built in 1975 and has a capacity of 1.0 mgd. Treatment processes for the plant include pH adjustment, iron and manganese removal and chlorine disinfection. Water is pumped directly from the wells, through the treatment plant and into the distribution system. There is no clearwell or storage capacity at the treatment plant.

The ARJWW water treatment plants are continuously monitored 24 hours a day 7 days a week to provide the highest quality water to the residents of Abington and Rockland. On average, the plants produce approximately 1 billion gallons of water each year. Water quality is continuously monitored by laboratory testing and online analysis to assure the ARJWW’s water meets and exceeds state and federal drinking water regulations at all times.

The combined distribution system for both towns consists of two service areas. There is the Main Service Area serving the majority of users in Abington and Rockland and the Lincoln Street High Service Area, which serves the northwest corner of Abington. There are seven check valves, which isolate the northwest high services area of Abington. The Lincoln Street Booster Pump Station creates the high pressure service in this area. There are four water storage facilities maintained outside of the water treatment plants which provide storage capacity for peak demands of short duration, minimize pressure fluctuations during periods of demand changes and provide supply for
fire fighting needs and emergency storage capacity. The joint distribution system includes approximately 120 miles of pipe. Roughly 55 miles of pipe are Abington, 55 miles are in Rockland, and 10 miles stretch from the GSBP WTP in Pembroke through Hanson up to the Rockland town line. Water main pipes range in size from 4-inch up to 20-inch and pipe materials include unlined cast iron, lined cast iron, ductile iron, transite and PVC. There are 11,087 service connections in the joint distribution system, roughly 5,000 of which are located in Abington and 6,000 of which are in Rockland or serviced off the GSBP WTP transmission main.

The Towns of Abington and Rockland were each awarded a MassDEP Water Conservation Grant in 2009 to complete a water audit, leak detection survey, leak repairs, conservation based water rate study and water conservation brochure. The purpose of the project was to promote water conservation and identify and reduce the amount of unaccounted for water in each town's drinking water works and distribution systems in addition to conserving water. Identifying the source of unaccounted for water and eliminating potential water losses will reduce the quantity of water withdrawn from the ARJWW’s three active water supply sources. A reduction in water losses will also reduce the amount of water requiring treatment and pumping at the water treatment facility located at each water source, ultimately saving labor, energy and chemical costs. Correlating a monetary value to the reduction in water losses emphasizes the overall benefit of the project and helps promote water conservation now and in the future.

Task 1 – Water Audit

The purpose of a water audit is to balance the volume of drinking water produced with the volume billed and account for the remaining water (loss). By identifying the amount of water lost and comparing it to the costs associated with this loss, each town in conjunction with the ARJWW will be able to select and implement programs to reduce losses to their water system. The Towns of Abington and Rockland are supplied water by a combined water system run by the ARJWW. A request to analyze the ARJWW’s overall system water losses was made to MassDEP as both towns are interconnected and there is no definitive way of identifying the amount of water distributed from each of the three sources to each town. Once the overall ARJWW’s water losses are determined, the water loss for each town will be estimated based on each Town’s metered consumption records compared to the overall treated water distributed into the combined system. In 2011 Weston & Sampson Engineers, Inc. initiated a Water Audit of the ARJWW water system. For this audit, the most recent three-year period was examined (2008, 2009, and 2010). Data was collected from the following sources: the ARJWW’s MassDEP Public Water Supply Annual Statistical Reports (ASRs), service and calibration records, accounting records and discussions with the ARJWW. The MassDEP provided the Water Management Act (WMA) Program’s Guidance Document and Forms for a Water Audit to help determine the total unaccounted for water in the system. The completed Forms 1 through 6 are attached in Appendix A and summarized below.

Form 1 – Uncorrected Total Water Supply from Sources of Supply Master Meter Reading
This form is used to summarize the pumping records for the water supply sources. The surface water bodies of Great Sandy Bottom Pond and the Hingham Street Reservoir along with the Myers Avenue Well Field currently supply all of the Joint Water Works' water needs. The ARJWW did not purchase any water from other communities during the three year period reviewed. Water from each of the sources is directed through a treatment plant at each location and the finished water is then directed into the distribution system at three discrete points. The average annual source water supply was determined to be approximately 1,027 million gallons (MG).
Form 2 – Uncorrected Customer Meter Records
This form is used to summarize metered readings for individual users. The towns of Abington and Rockland bill their customers quarterly. A water rate study was completed under this project and will be discussed in more detail under the Conservation-Based Water Rate Study section of this report.

Currently within the ARJWW customer area, 50% of the small meters are on a fixed network and are read remotely. Approximately 40% of the small meters are setup for mobile meter reading while the remaining meters (less than 10%) require a meter reader to manually read the individual meters. The ARJWW has focused the last several years on switching over all manual read meters to the fixed network. Once the manual read meters are all converted over, the focus will be on transferring the mobile reads over to the fixed network. All meters are read quarterly including large meters. The ARJWW is considering monthly readings of all large meter customers. From 2007-2008 one hundred percent of all large meters, 2″ and larger, were either right-sized or replaced and added to the fixed network. Presently there is no large meter testing program in-place.

The ARJWW’s is about halfway through their phased 10-year small meter replacement program. Meter replacements are completed in-house by ARJWW water personnel. The small meter replacement program will convert all small meters to a Neptune fixed network system. This fixed network allows for comprehensive and instantaneous usage data collection. A fixed network not only eliminates the need to send personnel out in the field to read the meters but it also helps reduce water theft and loss due to readily available data. Of the 50% of meters in the system that have not been replaced, approximately 40% are Neptune meters and the balance is a mix of other meter types. The replacement of all small meters will produce a more accurate and reliable meter reading system and decrease the labor required for meter readings quarterly, allowing for the reallocation of personnel’s time to other tasks.

The total metered customer water use for the years 2008, 2009, and 2010 was obtained from the Joint Water Works Annual Statistical Reports. The Annual Statistical Report (ASR) information is generated from meter readings done individually in each town by the respective Water Departments. The breakdown of information includes residential, industrial, commercial and municipal categories. The three-year average annual water usage for the ARJWW, based on customer meter records, is 924 MG. Utilizing actual meter reading data obtained from both Abington and Rockland, a percent of the overall water sold by the ARJWW can be determined. For the three year period of the Water Audit, the Town of Abington's average annual water usage was 429 MG and the Town of Rockland's average annual water usage was 495 MG. Over the course of the auditing period, no water was sold that was not metered; therefore the annual average of water sold but not metered was zero.

Form 3 – Pumping and Treatment Costs
This form outlines the average base pumping and treatment costs for the water supply source. The pumping and treatment costs for the treatment plants and the pumping station include the cost for chemicals, fuel and electricity. The ARJWW did not purchase water from other sources during the reporting period so there are no costs associated with this. The pumping and treatment costs were entered on Form 3 and the total average annual pumping and treatment cost calculated is $631,341 for the combined system. Factoring in the amount of treated and pumped water supplied to the system, the cost is approximately $615 per million gallons pumped and treated.

The towns of Abington and Rockland each contribute 50% to the total ARJWW capital budget. This is accomplished through a separate line item in each town's annual budget. Therefore the costs of pumping and treating identified on Form 3 are shared equally between Abington and Rockland.
Form 4 – Source Meter Error Adjustments to the Total Amount of Water Supplied to the System
This form uses the source water meter errors determined after calibration to adjust for known water volume errors. Through Environmental Instrument Services, Inc. (EIS), the ARJWW performs annual testing and calibration of its source meters. The ARJWW receives reports following completion of the testing and calibration but EIS does not report a percent error on the report. Therefore, no records of source meter errors exist. A value of zero was entered for the Source Meter Error Adjustment and Average Adjustment on Form 4 and Form 6.

Form 5 – Distribution System Large Service Meter Adjustments
This form provides a water volume adjustment to large distribution system meter errors after calibration. The ARJWW currently does not test large meters (>2") and does not currently receive any testing or calibration reports for the large meters in the water system. As a result, a value of zero gallons was used for the total annual adjustments to large metered water sales on Form 5.

There are approximately 70 large meters in the system, ranging in size from 2 to 4-inch. All large meters in Abington and Rockland were either replaced or right-sized from 2007-2008. As properties are sold or have a change in use the ARJWW evaluates the current meter for the future type of use and right-sizes the meter as needed.

Form 6 – Water Audit Worksheet
This form summarizes the unaccounted for water losses and associated costs based on data provided from Forms 1 through 5. In addition, the following information was analyzed and incorporated into Form 6:

- Faulty Valve Controlling Devices – The ARJWW does not have altitude valves on any of the water storage tanks. There are no recorded incidents of tank overflows from 2008 through 2010. There are two pressure zones throughout the distribution system and pressure reducing valves are not used. There are no pressure relief or surge relief valves in the system. A value of zero million gallons was entered on Form 6 Line 2b.

- Billing Procedure Error – The ARJWW handles all billing, collections and any issues or concerns associated with the billings for both towns. No billing procedure errors were identified during the course of this audit, therefore a value of zero was entered on Form 6 Line 5b. The Towns of Abington and Rockland collect the meter reading data and all data is downloaded into each town's billing system, Data National Billing System. Any errors that do occur are handled through an abatement process but are either minimal or non-existent.

- Unmetered Authorized Public Uses of Water – The annual average was calculated to be approximately 11.815 million gallons as reported by the ARJWW from information obtained from each town's Water Department. Fire protection, hydrant and water main flushing are all unmetered water uses that contribute to this total. Other unmetered authorized public uses of water were considered to be negligible to the overall total. A value of 11.815 million gallons was entered on Form 6 Line 9.

- Unmetered Miscellaneous Losses – The annual average was calculated to be approximately 6.021 million gallons as reported by the ARJWW. Bleeders and blowoffs, service leaks, main breaks, illegal connections, theft and meter malfunctions are all unmetered miscellaneous losses contributing to this total. A value of 6.021 million gallons was entered on Form 6 Line 10.
Based on the data processed on Form 6, the total identified annual water losses for the Abington & Rockland Joint Water Works were estimated to be 17.836 million gallons and the annual unidentified water losses were 85.235 million gallons. The percentage of unaccounted for water was estimated at 8.3% and the annual cost due to unidentified water losses was approximately $52,402. Utilizing consumption records for each town, unidentified water losses were estimated to be 39.573 million gallons for Abington and 45.662 million gallons for Rockland and. This equates to $24,329.48 and $28,073.00 of annual expenditure due to unidentified water losses for Abington and Rockland, respectively.

**Task 2 – Leak Detection Survey and Task 3 – Leak Repairs**

The purpose of a leak detection survey is to locate, identify and repair leaks in the distribution system. In 2011, the Town's of Abington and Rockland each contracted Water & Waste Pipe Testing, Inc. to perform correlation leak detection surveys of the water distribution system in each town. Water & Waste Pipe Testing, Inc. is owned and operated by Carl M. Sopper with one additional employee, Alex J. Sopper. Mr. Carl Sopper has 37 years of experience conducting leak detection surveys, 30 of those being as owner of Water & Waste Pipe Testing, Inc. Alex Sopper has 6 years of experience. Approximately 55 miles of distribution system was surveyed in Abington and 55 miles in Rockland by both personnel. A Metrotech HL90 Leak Detector with a G10 Contact Microphone and G30 and G50 Ground Microphones was used each day on the survey. A Flow Metrix ZCorr Correlator was used on leaks that were difficult to pinpoint with the Metrotech HL90. The Metrotech HL90 microphones were placed directly on hydrant spindles, gate valve operating nuts, service valve keys or directly on the ground above a pipeline. The Flow Metrix Zcorr Correlator utilizes loggers that are placed directly on hydrant spindles and gate valve operating nuts from which they acquire a three minute sound recording. This data is downloaded to a laptop computer, which prepares a graph indicating if a leak is present and its location. Each piece of equipment utilized on both projects was maintained and operated in accordance with the manufacturer's specifications and official standard operating procedures. Neither piece of equipment requires calibration or testing prior to use. The weather, traffic and pipe material in the distribution systems were not factors in conducting either of the leak detection surveys. Additional information regarding Water & Waste Pipe Testing, Inc.’s standard operating procedures can be found in Appendix B.

**Survey Results**

Every hydrant and accessible gate valve and service box were surveyed. Soundings were taken at 8-10 foot intervals over all non-metallic pipe by walking directly over the pipeline. The distance between listening posts averaged 300 feet. In some instances the listening posts were as much as 600 feet apart. In these cases, the ground microphones were used to listen at 4-6 foot intervals. Water & Waste Pipe Testing, Inc's Final Report summarized the leak detection survey project for each town, including methods, results, conclusions and recommendations to further reduce water losses (see Appendix B). A summary table of all the leaks found in Abington and in Rockland can be viewed below.
## LEAK DETECTION SUMMARY TABLE

<table>
<thead>
<tr>
<th>Town</th>
<th>Date Located</th>
<th>Location of Leak</th>
<th>Description of Leak</th>
<th>Estimated Flow (GPD)*</th>
<th>Repair Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abington</td>
<td>6/21/2011</td>
<td>26 Camp St</td>
<td>6” main leak</td>
<td>28,800</td>
<td>6/22/2011</td>
</tr>
<tr>
<td>Abington</td>
<td>6/21/2011</td>
<td>238 Summit Rd</td>
<td>Service leak on homeowner's side</td>
<td>10,080</td>
<td>Not repaired</td>
</tr>
<tr>
<td>Abington</td>
<td>6/21/2011</td>
<td>619 Randolph St</td>
<td>Hydrant leak</td>
<td>2,880</td>
<td>6/21/2011</td>
</tr>
<tr>
<td>Abington</td>
<td>7/5/2011</td>
<td>Corner of Randolph St &amp; Dorsey St</td>
<td>Hydrant leak</td>
<td>4,320</td>
<td>7/5/2011</td>
</tr>
<tr>
<td>Abington</td>
<td>7/5/2011</td>
<td>138 Randolph St</td>
<td>Hydrant leak</td>
<td>1,440</td>
<td>7/5/2011</td>
</tr>
<tr>
<td>Abington</td>
<td>7/5/2011</td>
<td>55 Barry Ter</td>
<td>1-1/4” main leak</td>
<td>10,080</td>
<td>main discontinued</td>
</tr>
</tbody>
</table>

**Abington Total = ~121,000**

<table>
<thead>
<tr>
<th>Town</th>
<th>Date Located</th>
<th>Location of Leak</th>
<th>Description of Leak</th>
<th>Estimated Flow (GPD)*</th>
<th>Repair Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rockland</td>
<td>7/7/2011</td>
<td>206 Vernon St</td>
<td>Hydrant leak</td>
<td>4,320</td>
<td>7/7/2011</td>
</tr>
<tr>
<td>Rockland</td>
<td>7/11/2011</td>
<td>396 Pleasant St West</td>
<td>Hydrant leak</td>
<td>2,880</td>
<td>7/11/2011</td>
</tr>
<tr>
<td>Rockland</td>
<td>7/14/2011</td>
<td>Corner of Rice Ln and Cottonwood Ln</td>
<td>Hydrant leak</td>
<td>2,880</td>
<td>8/8/2011</td>
</tr>
<tr>
<td>Rockland</td>
<td>7/20/2011</td>
<td>43 Old Market St</td>
<td>Service leak</td>
<td>7,200</td>
<td>8/10/2011</td>
</tr>
</tbody>
</table>

**Rockland Total = ~25,000**

* The total annual rate of leakage for Abington & Rockland was approximately 53.3 million gallons, equating to $32,800 ($27,200 Abington and $5,600 Rockland) annually in pumping and treating costs.

### Abington Survey Results

The results of the survey conducted in the Town of Abington pinpointed a total of 12 leaks in the distribution system. There were three mainline leaks, two service leaks and seven hydrant leaks located. The total rate of leakage for the 12 leaks found was estimated at 121,000 gallons per day or approximately 44.2 million gallons per year. The Town considered all the leaks found during the survey as priority repairs. All leaks except one were repaired by the Town within two months of detection. One service leak was found to be on the property owner's side of the curb stop and was repaired by the property owner. Water & Waste Pipe Testing, Inc. was not present during all of the leak repairs but upon repair of the leaks by the water department they resurveyed the areas and confirmed that all the leaks were repaired completely and no additional leaks were found. In the case of the service leak on private property, the water department turned off the service while Water & Waste Pipe Testing, Inc. surveyed the area to determine that there were no additional leaks in this location.

### Rockland Survey Results

The results of the survey conducted in the Town of Rockland pinpointed a total of five leaks in the distribution system. There were two service leaks and three hydrant leaks located. The total rate of leakage for the five leaks found was estimated at 25,000 gallons per day or approximately 9.1 million gallons per year. The Town considered all the leaks found during the survey as priority
repairs. All leaks were repaired by the Town within one month of detection. Water & Waste Pipe Testing, Inc. was not present during the repairs but upon repair by the water department they returned to resurvey the areas where leaks were detected and confirmed that all the leaks were repaired completely and no additional leaks were found.

**Task 4 – Conservation-Based Water Rate Study**

The purpose of the water rate study was to evaluate the water rates and adjust them as needed to provide adequate revenue for current and projected water operation and maintenance costs for the Towns of Abington and Rockland and the Abington & Rockland Joint Water Works.

In 2011, Woodcock & Associates, Inc. initiated a comprehensive water rate study for the Abington & Rockland Joint Water Works. The study included reviewing the budgets and projections for the ARJWW as well as budgets and projections for the Towns of Abington and Rockland. Historically, the rates in both towns have been set equal. The ARJWW costs are shared by both towns based on each town’s water use. The billing and collection functions for both towns are carried out by the ARJWW. Capital expenses are paid for each town and any costs that are town specific are paid solely by each town. Operations are funded through a water enterprise fund in each town. The current water rates (effective July 1, 2011) include a billing charge of $32 per quarter for all meter sizes plus a charge of $3.15 per hundred cubic feet (ccf) of metered water use. Customers with fire sprinkler connections pay $25/quarter for each inch of diameter of the fire service connection. Alternatives to the existing uniform rate structure were examined to review potential means to better encourage water conservation and less wasteful use.

**Conservation Rates**

The genesis of conservation rates provides an interesting backdrop. During the 1970s and early 1980s, setting rates to achieve a societal or public policy objective was typically dismissed as an inappropriate goal or criterion. Many of the traditional rate practitioners believed that water rates and charges should be set to recover costs, and other matters had no place in the rate setting process. This somewhat narrow view has all but disappeared, and the notion of setting rates to encourage conservation is broadly accepted now.

In setting rates to encourage water conservation, it must be recognized that there are a number of limitations, and there are a number of other goals or objectives that are often conflicting. Generally, it is the non-essential water uses that are the intended target of conservation rates. By setting the rates for non-essential use at higher amounts, there is the expectation that consumers will respond to the higher prices with lower uses. There are several problems or issues that come up when designing conservation rates.

- The definition of essential and non-essential use is not broadly accepted. There are some uses, such as over-watering lawns or washing sidewalks that most can agree are non-essential. Similarly, water used for drinking, health and sanitation is viewed as essential. However, owners of businesses such as golf courses or nurseries need some amount of irrigation to stay in business; they view irrigation water as an essential use. Even some agricultural uses can be debated as essential or non-essential. For example, is irrigation water for non-native plants that need large volumes of water to grow in a non-native area essential?
- Perhaps more troublesome, even if all agree that residential lawn watering is a non-essential use, it is difficult to identify and measure each customer’s in-door and outside water use. In the absence of separate irrigation meters and/or monthly billing, it is hard to determine what
is indoor vs. outdoor use. Just looking at the volume of use in a billing period provides little
guidance. A home with a large family and no outdoor use can use far more water in a
billing period than a single person with a large lawn that is watered daily. While a
comparison between winter and summer use can be quite helpful in determining outdoor use
(it is assumed that there is little outdoor water use in New England during the November –
February months), few towns read meters frequently enough to accurately determine a true
winter period’s water use. Even if such water use data were available, the billing systems of
many towns do not have the flexibility to look at winter use of each individual account.

- When rates are set higher to encourage wise water use, the impacts of customers responding
  with reduced purchases can have a significant impact on revenues. Most water system costs
  are relatively fixed. A 10% drop in water use at the higher conservation rates may equal a
  20% or 30% drop in revenues with little corresponding reduction in costs. Results such as
  these have left many communities passing on more rate increases to recover their costs and
  consumers angrily reacting to what they view as a penalty for doing what they were asked –
  “you asked me to conserve, I did, and then you go and increase the rates.” Without
customer support, it is difficult for water managers to convince the public to spend funds on
needed capital projects.

- Lastly, the cost of water is typically such a small portion of household budgets that even
  large percentage increases can result in relatively small overall dollar increases. Under the
current rates, a typical residential customer on Abington or Rockland, using about 200
gallons/day has a quarterly water bill of $108 or just over $1 a day. When compared to
other utility bills such as cable television, electricity, or cellular telephone service, the cost
of water is typically quite small.

With this background, we once again looked at Abington and Rockland’s water rates to see where
changes might lead to increased water conservation. In general, there are a few areas where
changes could be made; however, each such change raises other issues.

- Many towns have a minimum water allowance that goes with the billing charge. Customer’s
  pay for a minimum quantity of water whether it is needed or not. In cases where customers
  consistently use less than the minimum, there is little incentive to conserve. Because the
towns do not have a minimum allowance, there is no disincentive in Abington and
Rockland’s billing charge to address. The billing charge should be maintained.

- Many communities have developed increasing block water rates to discourage customers
  that use large quantities of water. Increasing block water rates charge a progressively larger
rate per hundred cubic feet as water use increases. The belief is that larger quantities of
water use are most frequently associated with large irrigation uses. While this may be the
case, large water use may also be due to larger families (more people per household). When
the increasing block rates and the various steps are developed based on average or typical
residential customers, non-residential customers can be negatively impacted. While there
are not many non-residential customers, there are some in both towns. A restaurant may be
very careful to not waste water, but due to the nature of the business, will often use more
than a single family residential customer. To avoid such unintended inequities, non-
residential customers can be charged using different rates or steps. This allows all
residential customers to be treated separately, but it does not eliminate the disparities
between large and small families. Further, not all non-residential customers are the same: a
bank uses water quite differently than a restaurant. The non-residential rates would need to be carefully developed to not unfairly penalize larger volume, non-residential customers.

- With greater frequency, water rates are being developed by customer class or meter size. This practice enables the community to recognize the different costs of serving different customer classes and can allow the development of rates that can target wasteful residential uses. In some cases, meter size is used as a surrogate for customer class. Both Abington and Rockland have a very homogeneous customer base. Over 90% of the water use is by residential customers in both towns. Further, 98% of the customers have a 5/8” water meter. In this case, it makes little sense to develop a schedule of water rates that varies by customer class or meter size.

- Seasonal rates are another alternative that can be effective, because non-essential outdoor uses typically occur in the warmer months. To be truly effective, the various seasonal rate alternatives need monthly billing. Both Abington and Rockland customers receive quarterly water bills. Billing is done by cycle, so the billing period varies for the customers. For example, some customers may get a clear summer water bill for water use in May – July and a clear winter bill for use in November – January, however, others will overlap these periods with no clear summer or winter quarter. With quarterly water billing it is difficult to adopt fair seasonal rates for all customers.

Based on the forgoing, we do not believe a major change in Abington and Rockland’s water rate structure is warranted. Because the towns have sewer service that is billed based on metered water use, there have been requests for irrigation meters that would measure the water use used in irrigation but not returned to the sewers. We believe that irrigation meters provide an excellent opportunity to measure water used for irrigation, particularly the larger users that wish to pay an additional amount for an irrigation meter.

We recommend that the towns allow irrigation meters under certain conditions:

- The full cost of purchasing, installing, and testing a separate irrigation meter should be borne by the customer. Testing should be done and paid for by the customer at regular schedules.

- These meters should only be allowed on irrigation systems that have rain sensors and can be programmed to only operate early in the morning or late in the evening when other residential demands are low.

- Customers with a second or irrigation meter should be charged the full billing or service charge on these meters as well as the primary meter.

- Perhaps most importantly, we recommend that the towns adopt a separate rate for irrigation meters that is 20% greater than the standard uniform rate. Water used for irrigating lawns is a non-essential use, and the privilege of using water for this non-essential use should carry a premium to discourage waste. Furthermore, irrigation water is typically the most expensive water provided by water utilities. It is often used at peak demand periods (hot summer days) necessitating additional storage, oversized pipes, and pumps with greater capacity.

**Proposed Revisions to Water Rates & Charges**

In 2012, after several meetings with the ARJWW and the Abington and Rockland Water Commissions, Woodcock & Associates completed the water rate study. A copy of the water rate study is included in Appendix C for reference. In order to fund various water system improvements
identified by Weston & Sampson Engineers, Inc. and the ARJWW, Woodcock and Associates recommends that each town budget $1.5 million per year for capital improvements. A significant rate increase will be required in both towns to fund the much needed capital projects. The following recommendations were made as a result of the water rate study:

- Retain the current billing charge with increases as noted in Table 1 below. This charge provides some predictable revenues while not providing any “free water” allowance that sometimes is included with such a charge.
- Revise the *private* fire service charges as presented in Table 2 so the ratio for various size connections is in proportion to the capacity of various size pipes.
- Adopt new *public* fire protection charges as shown in Table 3. These charges will recover the costs associated with public fire protection in a more equitable manner than the current practice of including the costs in the metered rates.
- Retain the current uniform charge for metered water use, but consider the adoption of seasonal rates if the town’s change to monthly (or bimonthly) billing. See Table 4.
- Adopt a new irrigation rate that would apply to the metered water use on irrigation systems. As presented on Table 4, this charge should be 20% higher than the regular metered rate to reflect the added costs associated with the provision of this peak demand service that is a non-essential use of water.
- Consider the adoption of a low income discount for customers of owner occupied accounts that can demonstrate they have qualified for an income based discount on another utility service (electric, gas, etc.). The discount could apply to the proposed new public fire protection charge.

### TABLE 1. BILLING CHARGES (S/QUARTER)

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### TABLE 2. PRIVATE FIRE SERVICE CHARGES (S/QUARTER)

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TABLE 3. PUBLIC FIRE SERVICE CHARGES ($/QUARTER)

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<tr>
<th>Meter Size (in)</th>
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<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
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TABLE 4. METERED WATER RATE ($/ccf)

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<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
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The ARJWW intends to adopt these new rates in 2013. By conducting periodic water rate studies Abington, Rockland, and the ARJWW can continue to evaluate the current water rates and schedule adjustments as needed to provide adequate revenue for current and future water operations and maintenance costs.

**Task 5 – Public Outreach and Education**

A water conservation brochure was developed by Weston & Sampson Engineers, Inc. under this grant to encourage water conservation and promote public awareness of the long-term economic and environmental benefits of water conservation. The ARJWW distributed the conservation brochure to all customers in the combined system. The brochure was distributed independently of the quarterly water bill and will serve as a helpful tool as customers are informed of the proposed water rate changes. It is anticipated that the brochure will resonate significantly with customers and at least 25% of the water customers will make immediate changes to their water use practices. Adding in the concern many customers will have with the rate increase, the ARJWW anticipates an overall drop in water production of 2-4% (18.5-37 MG) as a result of the water conservation brochure. Although there will be a loss in revenue from selling this water to the customers, the rate increase along with the annual pumping and treating cost savings ($11,400-$22,700), will outweigh the revenue loss.

**Conclusions and Recommendations**

The water audit findings indicate that the unidentified water loss for the Abington & Rockland Joint Water Works is approximately 8.3% of the water pumped into the distribution system, or roughly 85,235 million gallons annually. The annual pumping and treatment cost for the ARJWW is approximately $631,300 or $615 per million gallons of water pumped and treated. The annual cost associated with the unidentified water loss is $52,402. The percent of unidentified water loss was estimated to be 8.3%, which is below the Water Management Act standards of 10%, meeting the goals set by both towns and the ARJWW.

For the three years surveyed, the average residential per capita water consumption was estimated to be 66.4 gallons per capita day (gpcd). This is due to a high residential consumption in 2008 of 71.82 gpcd. In 2009 and 2010 the residential per capita consumption was 61 gpcd and 64 gpcd
respectively which complies with the Water Management Act standards of 65 gpcd and also meets the goals of each town and the ARJWW.

The towns of Abington and Rockland each contribute 50% to the capital expenses of the ARJWW. Therefore the annual cost associated with pumping and treatment is shared equally between the towns. Due to the configuration of the distribution systems, it is not feasible to determine the specific unidentified water loss for each town individually. However, utilizing consumption records for both towns, the unidentified water loss for Abington and Rockland was estimated at 39.6 MG ($24,300) and 45.6 MG ($28,100), respectively.

A total of 17 leaks in the joint distribution system were found during the leak detection surveys; 12 leaks in the Town of Abington and 5 leaks in the Town of Rockland. The leak detection surveys estimated a total water loss of approximately 53.3 million gallons per year (44.2 Abington, 9.1 Rockland) or approximately 5.2% of the water pumped into the ARJWW distribution system annually. The approximate annual pumping and treatment cost savings following repairs is $32,800 ($27,200 Abington, $5,600 Rockland) or 5.2% of the total water pumped and treated annually.

We recommend that the Towns of Abington and Rockland together with the Abington & Rockland Joint Water Works move forward with the following actions to help identify and minimize future water losses:

- Continue with the water meter replacement programs in each town, including the installation of the fixed network system capable of conducting continuous data collection for intermittent and immediate water leak detection.
- Continue to test and calibrate the source meters at each of the three water treatment plants yearly. Improve upon the meter testing program by requiring the testing firm to submit meter service reports indicating what work was done and the percent error found in calibration. If the only calibration being done is to the electronics, consider having the physical properties of the meter tested to determine the actual flow across the meter and calculate the percent error of the meters.
- Although all large meters in the system were replaced in 2007-2008, consider implementing a large meter testing and calibration program which will evaluate each meter in the system every 1-2 years. This program will help maintain large meter accuracy as well as provide a review of the condition and water use of each meter.
- Consider metering some if not all authorized water uses (fire protection, hydrant and water main flushing) that are currently unmetered.
- Maintain current voluntary and involuntary outside water use restrictions as needed for drought management throughout the system. Continue to modify the program as needed and follow up on enforcement of violations.
- Re-evaluate the effectiveness of the water rate increase after the rates have been implemented for one year. Based on the proposed rate increase, each town will meet current and future operational costs and increase their capital improvements budget to $1.5 million. Utilize these funds to complete system wide water treatment and distribution improvements to optimize the water treatment process and reduce the likelihood of water main breaks and leaks.
- Consider sending out the water conservation brochure every 1-2 years. Continue distribution of educational material to customers in the annual consumer confidence report.
- Continue to conduct the public outreach and education campaign to encourage water conservation and promote public awareness of the economic and environmental benefits, including the annual outreach by the ARJWW to all 5th graders in each town.
• Make available to customers a list of water conservation devices, including low flow shower heads, sink aerators, toilet tank banks and toilet leak detections tablets.
• Consider updating the Abington Water Department’s link on the Town’s website to include all water conservation information noted in this report.
• Consider creating a link for the Rockland Water Department on the Town of Rockland’s website and include all water conservation information noted in this report.
• As recommended by Water & Waste Pipe Testing, Inc. continue to conduct system wide leak detection surveys every two years to eliminate water leaks and further reduce the percentage of unaccounted for water.
• Consider conducting a follow-up water audit within the next five years to evaluate the savings associated with the effectiveness of any recommendations that have been implemented throughout the water system.

By implementing these recommendations, both towns and the ARJWW will further their ongoing water conservation efforts, minimize water losses throughout the system, reduce operating costs, and improve revenue generation for the combined water system.

**Project Effectiveness**

The Water Conservation Grant Project benefited both the Towns of Abington and Rockland and the Abington & Rockland Joint Water Works greatly in identifying areas where more accurate information is needed, identifying and quantifying unaccounted for water, locating leaks, adoption of a new water rate policy, and establishing a water conservation brochure for additional public outreach and education. These completed tasks will ultimately lead to reduced water leakage and waste in the distribution systems of each Town, further lowering the amount of unaccounted for water and reducing the costs to pump and treat water within the ARJWW. Incorporating the goals and objectives of the ARJWW and each Town with the recommendations discussed in this report will enhance operation of the system, help to identify and reduce the amount of unknown and unaccounted for water in the system, increase revenue for much needed capital improvements, and increase public awareness of the benefits of water conservation.
APPENDIX A

WATER AUDIT FORMS 1-6
<table>
<thead>
<tr>
<th>YEAR</th>
<th>SOURCE 1</th>
<th>SOURCE 2</th>
<th>SOURCE 3</th>
<th>SOURCE 4</th>
<th>SOURCE 5</th>
<th>SOURCE 6</th>
<th>SOURCE 7</th>
<th>SOURCE 8</th>
<th>SOURCE 9</th>
<th>TOTAL</th>
<th>Comment</th>
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<td>376.83</td>
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**TOTAL** 3080.726

Avg. = Total divided by 3 = 1026.9087

Enter on Line 1 - Form 6 and Enter on Line 1 - Form 3
### FORM 2 - Uncorrected Customer Meter Records

**Total Water Sold**

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<tr>
<th>YEAR</th>
<th>Residential</th>
<th>Industrial</th>
<th>Commercial</th>
<th>Agricultural</th>
<th>Institutional</th>
<th>Other</th>
<th>Total</th>
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<td>2008</td>
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<tr>
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<td>65.29</td>
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<td>0</td>
<td>10.12</td>
<td>879.92</td>
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</table>

**Calculations**

1. Total amount of water metered in system over the past three years (Line a ____________) 2771.514
2. Average total amount of water metered over past 3 years (Line b = Line a/3 = ____________) 923.838
3. Estimate of total amount of water sold but not metered in past 3 years (Line c ____________) 0
4. Average of the total amount of water sold but not metered over past 3 yrs. (Div. Line c by 3 = ____________) 0

Enter on Line 6 - Form 6
## FORM 3 - PUMPING AND TREATMENT COSTS

### Annual Costs for the past three (3) years

<table>
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<tr>
<th>No.</th>
<th>Category</th>
<th>Year 2008</th>
<th>Year 2009</th>
<th>Year 2010</th>
<th>Total</th>
<th>Average = Total Divided by 3</th>
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<td>$631,341</td>
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### CALCULATIONS

**Line 1**  
Average of the total amount of treated and pumped water supplied to the system over the past three years  
Form Line a - Form 1  

**Line 2**  
If water is purchased, average of the amount purchased over the past three years  
See Page 4  

**Line 3**  
Total amount of water supplied from total of sources and total purchased  
Add Lines 1 and 2  

**Line 4**  
Average pumping and treating divided by the purchasing cost of water  
Divide Totals - Line a (from above) by Line 3  

Enter on Line 15  
Form 6  

**Line 1**  
1026.909  

**Line 3**  
1026.909  

**Line 4**  
$614.80
### Form 4 - Source Meter Error Adjustments to the Total Amount of Water Supplied to the System

#### Year: 2008

<table>
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<th>No.</th>
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<th>Calibration/Test</th>
<th>Meter Error % (+ or -)</th>
<th>time</th>
<th>Total Metered (gallons)</th>
<th>Adjustment in gallons (+ or -)</th>
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**Average Percent:**  
**Total Adjustments:** 0

#### Year: 2009

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<th>time</th>
<th>Total Metered (gallons)</th>
<th>Adjustment in gallons (+ or -)</th>
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**Average Percent:**  
**Total Adjustments:** 0

#### Year: 2010

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<th>time</th>
<th>Total Metered (gallons)</th>
<th>Adjustment in gallons (+ or -)</th>
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</tbody>
</table>

**Average Percent:**  
**Total Adjustments:** 0

### Calculation

Average Adjustment - Add total adjustments for each of the three years and divide by 3

Enter also on line 2a of Form 6
FORM 5 - DISTRIBUTION SYSTEM LARGE SERVICE METER ADJUSTMENTS

<table>
<thead>
<tr>
<th>No.</th>
<th>Meter Location</th>
<th>Meter Test Date</th>
<th>Meter Size</th>
<th>Meter Error % (+ or -)</th>
<th>Total Metered (gallons)</th>
<th>Adjustment in gallons (+ or -)</th>
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<tr>
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</tbody>
</table>

AVERAGE PERCENT:  
TOTAL ADJUSTMENTS: N/A

Year 2009

<table>
<thead>
<tr>
<th>No.</th>
<th>Meter Location</th>
<th>Meter Test Date</th>
<th>Meter Size</th>
<th>Meter Error % (+ or -)</th>
<th>Total Metered (gallons)</th>
<th>Adjustment in gallons (+ or -)</th>
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</table>

AVERAGE PERCENT:  
TOTAL ADJUSTMENTS: N/A

Year 2010

<table>
<thead>
<tr>
<th>No.</th>
<th>Meter Location</th>
<th>Meter Test Date</th>
<th>Meter Size</th>
<th>Meter Error % (+ or -)</th>
<th>Total Metered (gallons)</th>
<th>Adjustment in gallons (+ or -)</th>
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</tr>
</tbody>
</table>

AVERAGE PERCENT:  
TOTAL ADJUSTMENTS: N/A

CALCULATION

AVG. ADJUSTMENT = Add Total Adjust. for each year and divide by 3

N/A

Enter on Line 5a - Form 6
**FORM 6 - WATER AUDIT WORKSHEET**

Please place gallonage value in the Results in mgd column and perform calculations.

<table>
<thead>
<tr>
<th>Line No.</th>
<th>DESCRIPTION</th>
<th>FORM</th>
<th>LINE</th>
<th>RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Uncorrected Total Water Pumped From Sources of Supply</td>
<td>1</td>
<td>Line 1</td>
<td>1026.909</td>
</tr>
<tr>
<td>2a</td>
<td>Adjustments to Total Water Supply Master Meter Error</td>
<td>4</td>
<td>Line 2a</td>
<td>0</td>
</tr>
<tr>
<td>2b</td>
<td>Faulty valve controlling devices</td>
<td>Pg. 5</td>
<td>Line 2b</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Corrected Total Water Supply Add Lines 1, 2a and 2b)</td>
<td></td>
<td>Line 3</td>
<td>1026.909</td>
</tr>
<tr>
<td>4</td>
<td>Uncorrected Customer Meter Records Total Amount Sold</td>
<td>2</td>
<td>Line 4</td>
<td>923.838</td>
</tr>
<tr>
<td>5a</td>
<td>Adjustments to Metered Water Sales - meter error</td>
<td>5</td>
<td>Line 5a</td>
<td>0</td>
</tr>
<tr>
<td>5b</td>
<td>Billing Procedure error</td>
<td>Pg. 6</td>
<td>Line 5b</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>Total Amount of Unmetered Water 'sold'</td>
<td>2</td>
<td>Line 6</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>Corrected Total Quantity of Water Sold Add Lines 4, 5a, 5b and 6</td>
<td></td>
<td>Line 7</td>
<td>923.838</td>
</tr>
<tr>
<td>8</td>
<td>Total amount of water not sold Subtract Line 7 from Line 3</td>
<td></td>
<td>Line 8</td>
<td>103.071</td>
</tr>
<tr>
<td>9</td>
<td>Total Unmetered Authorized Public Uses of Water See Page 5</td>
<td></td>
<td>Line 9</td>
<td>11.815</td>
</tr>
<tr>
<td>10</td>
<td>Total Unmetered Miscellaneous Losses See Page 5</td>
<td></td>
<td>Line 10</td>
<td>6.021</td>
</tr>
<tr>
<td>11</td>
<td>Total Identified Water Losses Add Lines 9 and 10</td>
<td></td>
<td>Line 11</td>
<td>17.836</td>
</tr>
<tr>
<td>12</td>
<td>Total Unidentified Water Losses-Subtract Line 11 from Line 8</td>
<td></td>
<td>Line 12</td>
<td>85.235</td>
</tr>
<tr>
<td>13</td>
<td>Potential water system leakage in gpd per mile of watermain. Divide Line 12 by 365 then divide by total system miles of watermain Balance Line 13</td>
<td></td>
<td>Line 13</td>
<td>1883.230</td>
</tr>
<tr>
<td>14</td>
<td>Percentage of unaccounted for water that may be attributed to leakage - Divide Line 12 by Line 3</td>
<td></td>
<td>Line 14</td>
<td>8.30%</td>
</tr>
<tr>
<td>15</td>
<td>Pumping and treating cost per gallon of water Line 4 on Form 3</td>
<td></td>
<td>Line 4 $</td>
<td>$614.80</td>
</tr>
<tr>
<td>16</td>
<td>Annual Expenditure Due to Unidentified Water Losses Multiply Line 12 by 15</td>
<td></td>
<td></td>
<td>$52,402.48</td>
</tr>
</tbody>
</table>

**Unadjusted Total:**

**Adjusted Total:**

**Unmetered:**

**Estimated:**

**UAW:**

**Leakage/mile:**

**UAW leakage %:**

**Cost/gallon:**

**UAW Cost:**
APPENDIX B

2011 LEAK DETECTION SURVEY REPORT
&
WATER & WASTE PIPE TESTING, INC.'s SOPs
Submitted to:

Town of Abington
Water Department
366 Centre Ave.
Abington, MA 02370

WATER LEAK DETECTION SURVEY
for the
TOWN OF ABINGTON, MA

DEP GUIDELINE REPORT

June/July, 2011

Conducted by:
Water & Waste Pipe Testing, Inc., Rowley, MA 01969
December 3, 2011

Town of Abington
Water Department
366 Centre Ave.
Rockland, MA 02370
ATTN: Mr. Daniel Callahan,
Manager of the Abington & Rockland Joint Water Works

Dear Mr. Callahan,

Starting on the date of June 21st, 2011, through July 12th, 2011, our company conducted and completed a comprehensive water leak detection survey on the entire water distribution system - approximately 55 miles - for the Town of Abington, MA. After thoroughly listening with our leak detection equipment on every hydrant and selected gate valves, and walking directly over all PVC mains and certain areas of AC mains throughout the water system, a total of 12 leaks (3 main leaks, 2 service leaks and 7 hydrant leaks) were detected and pinpointed. These leaks are listed on the leak page following in this report. We estimate the daily water leakage from the 12 leaks detected to be approximately 121,000 gallons per day. Conducting the survey every two years proves to be beneficial to the Town of Abington Water Department in reducing the unaccounted for water leakage, with their goal being at least 10% or lower, as well as many other benefits pointed out in the following report.

We look forward to working with you and your staff on the next leakage survey if we are the lowest bidder and are awarded the contract. If you have any questions or need our services in the near future, please feel free to call at your convenience.

Sincerely,

Carl M. Sopper, President
TOWN OF ABINGTON, MA
WATER LEAKAGE SURVEY
REQUIRED DEP GUIDELINES

PERSONNEL:

Carl M. Sopper: 37 years experience in leak detection - 7 years employed with Pipeline Testing Service where I received my training on-the-job, and 30 years in my own business. Business founded in 1981, conducting leak detection surveys for 30 years.

Alex J. Sopper - 6 years on-the-job experience with Water & Waste Pipe Testing. SOP for employee was 1 year working directly with employer before working solo. Periodically checked for accuracy of leaks detected.

EQUIPMENT:

METROTECH HL90 LEAK DETECTOR: Used in the field every survey day. The equipment includes a G10 contact microphone, amplifier, headphones, G30 and G50 ground microphone. Manufacturer’s SOP is for the technician to place the G10 contact microphone on the hydrant spindle, the gate valve operating nut, and the service valve key. Sound from the contact microphone is fed to the amplifier in to the headphones, where we determine if the sound is a leak or not. The G30 and the G50 ground microphones are used when we walk directly over the pipeline. It works in the same way as the G10, except the microphone is placed on the ground to amplify sound from the actual pipeline to determine whether or not a leak exists. This piece of equipment was used exactly according to the Manufacturer’s SOP. There is no maintenance/service schedule for this equipment. However, we maintain it by changing the batteries when needed, and by servicing at Utilitronics, Inc., when the BNC connectors or other components of the amplifier need repair. This equipment does not require calibration.

FLOW METRIX ZCORR CORRELATOR: Equipment setup includes a PC laptop, 4 loggers, a docking station, USB cords from the docking station to the laptop, and ZCORR computer software. We use this equipment on leaks that are difficult to pinpoint with the Metrotech HL90. Loggers, which are cylinders approximately 8 inches long with magnets on the bottom, are placed on either hydrant spindles or gate valve operating nuts. Before the logger is placed on the
contact points, they are placed in a slot in the docking station with connecting pins. Information is entered on the computer as to the location of the leak, the technician's user name, material of the pipe, size of the pipe, and distance between loggers placed. This information is stored in the logger. Once this information is entered into the loggers, the loggers are physically placed on either the hydrant or gate valves, and a 3 minute sound recording will be conducted by the logger. The computer program will indicate when the loggers are finished their recording. The loggers are retrieved and placed back into the logging station where the information recorded by the logger is loaded into the computer program. The data received takes one minute to import. Once this is achieved, a picture appears on the computer screen of a graph line. If there is a spike in the graph line, this is where the location of the leak is. It will also tell the location of the leak by the distance between each logger. The software saves this information for future analysis. The leak is then marked in the road for the Town to repair. This equipment is also used exactly as per the manufacturer's SOP. The manufacturer requires that the logger nicad batteries be changed every five years. The equipment was serviced as per the manufacturer's schedule. All loggers were last serviced with new nicad batteries on April of 2008. This equipment requires no calibration or testing prior to use.

SCHONSTEDT MAGNETIC LOCATOR: This battery operated hand held device is approximately 3 feet long, tubular in appearance, about 2” diameter. The unit also has a volume control and a small LED screen indicating the existence of a buried ferris metal service box or gate box. This was used several times during the survey to located buried services. The manufacturer's SOP includes powering on the equipment and volume control. The device is then waved over the area where a suspected gate box or service box exists. The equipment emits a low frequency sound, which increases as it gets closer to the buried object. The LED screen has a graph which more accurately pinpoints the object. The higher the graph line, the more accurate the location. This equipment was used as per the manufacturer’s SOP. The manufacturer’s maintenance/service schedule requires battery changes when needed. The LED screen indicates low battery. The manufacturer also requires that it be stored in it's case when not in use. The equipment is serviced as per the manufacturer’s schedule. This equipment requires no calibration or testing prior to use.

ADDITIONAL TOOLS USED DURING THE SURVEY:
- Gate box keys and service box keys are used with the G10 contact microphone to listen for leaks.
- Hydrant wrench, used to tighten down any leaking hydrant, or to remove a hydrant cap to see if water is in the barrel of the hydrant, which would be confirmation of a leaking hydrant.
- Pry bar, used to open gate box covers to place contact microphone on the gate nut or on the gate valve key itself.
- Service box nut opener, used to loosen the hexagon nut that secures the service box cover.
- Gate box cleaning tool, a T-shaped metal rod, approximately 6 feet long, with clam shell spoons at the bottom of the tool, to clean out any debris that may be in a gate box or service box.

**LEAK DETECTION SURVEY STANDARD OPERATING PROCEDURES:**

When we arrived in the Town of Abington to begin the survey, we directly reported to Mr. Joseph LaPointe, Water Department Foreman, as to our work locations for that particular survey day. Water leaks that were detected and pinpointed were reported to Mr. LaPointe. He was informed of the leak, its location, and its severity or need to be prioritized for repair. Mr. LaPointe and his staff assisted us when they were available, such as when we needed plans for a certain area where a leak was detected. They would meet us on site with the plans. At the end of each survey day, an updated leak sheet was submitted to Mr. LaPointe at the Water Department, along with our schedule for the next survey date. Mr. Daniel Callahan, Manager of the Abington & Rockland Joint Water Works was also updated as to our progress.

There was no time recorded for each leak located. However, all 12 leaks were detected between the hours of 9 am and 3 pm daily.

The Abington Police Department was notified by letter before the start of the survey, explaining our work procedures, both vehicle’s descriptions and registration numbers, and our safety procedures, such as using caution lights, signs indicating the leak survey is in progress, and safety vests being worn during the survey. We had no issues or complaints from the Police Department about our work procedures or traffic issues.

The weather during the survey was sunny and clear, with temperatures between 80 to 90 degrees during the entire survey. We experienced only one rain day, on June 23, during the duration of the survey.

The ground cover material at each site of a detected leak was 90% asphalt and 10% gravel or sod (mostly on the homeowner’s property).
The survey technician listened to every hydrant and accessible gate valve and/or accessible service boxes, while walking directly over the pipeline and listening at 8 to 10 foot intervals on non-metallic pipes.

The distance between listening posts was on the average 300 feet. This does vary - some listening posts were as much as 600 feet apart. These areas were checked with our ground microphone more closely, 4 to 6 foot intervals, especially in front of homes that had service lines.

**WATER & WASTE PIPE TESTING REPORTING SOPS:**

The leaks are first reported orally to the Water Foreman, then they are listed on the field leak sheet as to location, description of leak, estimated gallons per minute, and whether the leak was located using the contact mike, ground mike, or leak correlator. The leak is then noted on a water system hydrant map provided to us by the town. Every hydrant that was listened to is circled on the map. Circling the hydrants as we listen to them indicates to us when each section would be completed. In our final report the leaks are listed again and noted whether they have been repaired.

The survey data chart is included in this report, with a breakdown of gallons per minute for each leak, the category of each leak (service leak, hydrant leak, etc.) total gallons per minute for all 12 leaks, a daily water leakage unaccounted for loss, and a total of unaccounted for loss for 1 year, along with a savings total to the town for all leaks detected and repaired. Also included with this report are our daily log reports. A system map is also included in this report, marking the locations of the leaks detected.

**FOLLOW-UP:**

To date, 11 of the 12 leaks have been repaired by the Water Department. The one unrepaired service leak, at #238 Summit St., is on the homeowner's side of the curb stop valve, and the homeowner is responsible to repair the leak at their expense. On December 2, 2011, Water & Waste Pipe Testing survey personnel met with Abington Water Department crew to shut off the curb stop valve, eliminating the leak sound so that we could survey the area for any additional leakage, and no leakage was recorded. We also returned to recheck the 11 leaks that were repaired and no additional leakage was recorded.
TOWN OF ABINGTON, MA  
LIST OF LEAKS DETECTED  
JUNE/JULY, 2011

<table>
<thead>
<tr>
<th>LEAK#</th>
<th>DATE LOCATED</th>
<th>LOCATION OF LEAK</th>
<th>DESCRIPTION OF LEAK</th>
<th>GPM</th>
<th>REPAIR DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6/21/11</td>
<td>26 Camp St.</td>
<td>6&quot; main leak</td>
<td>20</td>
<td>6/22/11</td>
</tr>
<tr>
<td>2</td>
<td>6/21/11</td>
<td>238 Summit Rd.</td>
<td>Service leak at curb stop - homeowner's side</td>
<td>7</td>
<td>Not repaired</td>
</tr>
<tr>
<td>3</td>
<td>6/21/11</td>
<td>58 Coleman St.</td>
<td>6&quot; main leak</td>
<td>30</td>
<td>6/27/11</td>
</tr>
<tr>
<td>4</td>
<td>6/21/11</td>
<td>619 Randolph St.</td>
<td>Hydrant leak</td>
<td>2</td>
<td>6/21/11</td>
</tr>
<tr>
<td>5</td>
<td>6/21/11</td>
<td>91 Strawberry Lane</td>
<td>Hydrant leak</td>
<td>2</td>
<td>6/21/11</td>
</tr>
<tr>
<td>8</td>
<td>6/27/11</td>
<td>35 Jennings Ave.</td>
<td>Hydrant leak</td>
<td>3</td>
<td>6/27/11</td>
</tr>
</tbody>
</table>

-6-
<table>
<thead>
<tr>
<th>LEAK#</th>
<th>DATE LOCATED</th>
<th>LOCATION OF LEAK</th>
<th>DESCRIPTION OF LEAK</th>
<th>GPM</th>
<th>REPAIR DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>6/29/11</td>
<td>62 Patricia Cir.</td>
<td>Service leak</td>
<td>5</td>
<td>9/8/11</td>
</tr>
<tr>
<td>10</td>
<td>7/5/11</td>
<td>Corner of Randolph St. &amp; Dorsey St.</td>
<td>Hydrant leak</td>
<td>3</td>
<td>7/5/11</td>
</tr>
<tr>
<td>11</td>
<td>7/5/11</td>
<td>138 Randolph St.</td>
<td>Hydrant leak</td>
<td>1</td>
<td>7/5/11</td>
</tr>
<tr>
<td>12</td>
<td>7/5/11</td>
<td>55 Barry Terr.</td>
<td>1-1/4” main leak</td>
<td>7</td>
<td>main discontinued</td>
</tr>
</tbody>
</table>
TOWN OF ABINGTON, MA
WATER LEAK DETECTION SURVEY
SURVEY DATA CHART
JUNE/JULY, 2011

<table>
<thead>
<tr>
<th></th>
<th>TOTAL</th>
<th>Total gallons per day</th>
<th>Total gallons per year</th>
<th>Revenue saved after repairs (based on National avg. of $2,500.00 per mil. gal.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of leaks detected</td>
<td>12</td>
<td>121,000 gallons</td>
<td>44.2 million Gal.</td>
<td>$111,000.00 per year</td>
</tr>
<tr>
<td>Total main leaks</td>
<td>3</td>
<td>82,000 gallons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total service leaks</td>
<td>2</td>
<td>17,000 gallons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total hydrant leaks</td>
<td>7</td>
<td>22,000 gallons</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SURVEY DAILY LOG

City/Town: ABINGTON
Date: 6-21-11
Survey Personnel: CARL SOPPER Truck #1
ALEX SOPPER Truck #2
Weather Conditions: Sunny 80° Wind Calm
Area Surveyed: TRUCK # 1 QUADRANT SECTION Broadneck, BEDFORD ST.
NORTH TO ROCKLAND TOWN LINE TRUCK # 2 QUADRANT
SECTION FROM BEDFORD, RANDOLPH TO WEYMOUTH TOWN LINE
Distance Surveyed: APPROX 20 MILES
Total hours on survey: 6.5 hrs
Leak Detection Equipment Used: Acoustic √ Correlator √

Leaks Detected:

<table>
<thead>
<tr>
<th>Type</th>
<th>GPM</th>
<th>Priority</th>
<th>Repaired - Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot; MAIN LEAK</td>
<td>20</td>
<td>HIGH</td>
<td>YES ON 6-22-11</td>
</tr>
<tr>
<td>38&quot; SERVICE LEAK</td>
<td>7</td>
<td>M.D.</td>
<td></td>
</tr>
<tr>
<td>54&quot; COLEMAN ST</td>
<td>30</td>
<td>HIGH</td>
<td></td>
</tr>
<tr>
<td>6&quot; MAIN LEAK</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HYDR LEAK</td>
<td>2</td>
<td>LOW</td>
<td>YES - 6-21</td>
</tr>
<tr>
<td>HYDR VALVE</td>
<td>2</td>
<td>LOW</td>
<td></td>
</tr>
</tbody>
</table>

Survey completed to date: 15 %
Comments: HYDR LEAKS WERE TURNED DOWN TIGHT
BY SURVEY TECH ALEX SOPPER. LEAK DETECTED ON
COLEMAN ST WAS PINPOINTED BY ACOUSTIC CORRELATOR
WAS USED HOWEVER THE CORRELATOR WAS OFF BY 30 FT
MAIN LEAK ON COLEMAN ST IS OF HIGH PRIORITY - DIG SAFE WAS
CALLED IN BY W.D.

Authorized Signature: [Signature]
SURVEY DAILY LOG

City/Town: ABINGTON MA
Date: 6-28-11
Survey Personnel: ALEX J. JODER

Weather Conditions: CLOUDY QTC. 65° SOME SHOWERS
Area Surveyed: QUADUOLE SECTION FROM RANDOLPH ST SOUTH
TO BEDFORD ST EAST TO LINCOLN BLVD

Distance Surveyed: 8 MILES
Total hours on survey: 6 HRS
Leak Detection Equipment Used: Acoustic ✓ Correlator

Leaks Detected:

<table>
<thead>
<tr>
<th>Type</th>
<th>GPM</th>
<th>Priority</th>
<th>Repaired - Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>HYDR LEAK</td>
<td>2</td>
<td>LOW</td>
<td>YES</td>
</tr>
<tr>
<td>HYDR LEAK</td>
<td>2</td>
<td>LOW</td>
<td>YES</td>
</tr>
</tbody>
</table>

Survey completed to date: 25%
Comments:

Authorized Signature: [Signature]
**SURVEY DAILY LOG**

City/Town: **ABINGTON MA**
Date: **6-27-11**
Survey Personnel:
- **Cary L. Soper** Truck #1
- **Alex Soper** Truck #2

Weather Conditions: SLOW WINDS, CALM WINDS

Area Surveyed:
- **Bedford St.** From Weymouth to Brockton Ave
- **Quadrant Section** From North St. South to Orange St.
- **Truck #2 Quadrant.**

Distance Surveyed: **10 MILES**
Total hours on survey: **7.0 HRS**
Leak Detection Equipment Used: Acoustic ✔ Correlator

Leaks Detected:

<table>
<thead>
<tr>
<th>Type</th>
<th>GPM</th>
<th>Priority</th>
<th>Repaired - Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HYDR LEAK</strong></td>
<td>3</td>
<td><strong>Low</strong></td>
<td>6-27-11</td>
</tr>
</tbody>
</table>

Survey completed to date: **45%**

Comments:
- **Leak repaired** at W.D. 624 Coleman St.
- **360° leak at W.** Crack in main 3/06 pm

Authorized Signature: [Signature]
**SURVEY DAILY LOG**

**City/Town:** ABINGTON MA  
**Date:** 6-29-11  
**Survey Personnel:** TRIKE #1 CARL SUPPER  
TRIKE #2 ALEX SUPPER  
**Weather Conditions:** Sunny 50% wind  calm  
**Area Surveyed:**  
TRIKE #1 CENTRE QUA SOUTH TO SUMMER ST TO ROCKLAND TOWN LINE  
TRIKE #2 GRAVELAND ST SOUTH TO BROADST  
**Distance Surveyed:** 16.7 miles  
**Total hours on survey:** 8.5  
**Leak Detection Equipment Used:** Acoustic ✓ Correlator

**Leaks Detected:**

<table>
<thead>
<tr>
<th>Type</th>
<th>GPM</th>
<th>Priority</th>
<th>Repaired - Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service</td>
<td>5</td>
<td>Med</td>
<td></td>
</tr>
</tbody>
</table>

Survey completed to date: 70%  
**Comments:**  
Two Service Leaks at Summer Rd &  
Patricia Ave need to be evaluated by  
We hope they can be fixed soon. We will set up on July 5th with Foreman Joe Lamour  

**Authorized Signature:** [Signature]
SURVEY DAILY LOG

City/Town: ABINGTON MA
Date: 7-5-11
Survey Personnel: TRUCK #1 CARL SOPER
TRUCK #2 ALFIE SOPER
Weather Conditions: Sunny 80°F Calm Wind
Area Surveyed: TRUCK #1 Summer St South TO Walnut St TO
WASHINGTON ST TO WHITMAN TOWN LINE. TRUCK #2
AGAIN SOUTH TO WHITMAN LINE REREAD LEAK SOUNDER
Distance Surveyed: 12 MILES
Total hours on survey: 9 hrs
Leak Detection Equipment Used: Acoustic V Correlator

Leaks Detected:

<table>
<thead>
<tr>
<th>Type</th>
<th>GPM</th>
<th>Priority</th>
<th>Repaired - Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>HYDF</td>
<td></td>
<td>LOW</td>
<td>YES</td>
</tr>
<tr>
<td>HYDF</td>
<td></td>
<td>LOW</td>
<td>YES</td>
</tr>
<tr>
<td>MAIN possible</td>
<td>10+</td>
<td>HIGH</td>
<td></td>
</tr>
</tbody>
</table>

Survey completed to date: 99 %
Comments: survey completed today need to go over
the leaks that were detected with person deb report
on thursday 7-7-11 will follow up on leaks that
will be repaired as a later date

Authorized Signature: [Signature]
**SURVEY DAILY LOG**

**City/Town:** Woburn, MA  
**Date:** 7-7-11  
**Survey Personnel:** Carl Sawyer, Truck #1

**Weather Conditions:** Sunny, High 80's

**Area Surveyed:** 16 and Cantin areas at Barry Rd & 62 Parking Lot

**Distance Surveyed:**

**Total hours on survey:** 5.5

**Leak Detection Equipment Used:** Acoustic, Correlator

**Leaks Detected:**

<table>
<thead>
<tr>
<th>Type</th>
<th>GPM</th>
<th>Priority</th>
<th>Repaired - Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Survey completed to date: 100%

**Comments:** Leak survey completed, need to return for follow-up areas leaks are required

**Authorized Signature:** [Signature]
City or Town Surveyed: ABINGTON MA

Leak # 1

DIAGRAM OF LEAK

Location of Leak: 24 CAMP ST

Description of Leak: 6" MAIN CRACK/BRIDGE 180°

Date Located: 6-21-11  Date Repaired: 6-22-11

Estimated GPM: 50

Remarks:
City or Town Surveyed: ABINGTON, MA

Leak # 2

DIAGRAM OF LEAK

Location of Leak: 238 SUMMIT RD

Description of Leak: SERVICE LEAK

Date Located: 6-31-11 Date Repaired:

Estimated GPM: 74

Remarks:
WATER & WASTE PIPE TESTING INC.
WATER LEAKAGE SURVEY REPORT

City or Town Surveyed: ABINGTON MA

Leak # 3

DIAGRAM OF LEAK

Location of Leak: 58 COLEMAN ST

Description of Leak: 6" MAIN BREAK

Date Located: 6-21-11  Date Repaired:  

Estimated GPM: 30

Remarks:
WATER & WASTE PIPE TESTING INC.
WATER LEAKAGE SURVEY REPORT

City or Town Surveyed: ABINGTON MA

Leak # 4

DIAGRAM OF LEAK

Location of Leak: 619 RANDOLPH ST
Description of Leak: HOT LEAK
Date Located: 6-21-11 Date Repaired: 6-21-11
Estimated GPM: 2

Remarks:
City or Town Surveyed: ABINGTON MA

Leak # 5

Location of Leak: G1 STRAWBERRY LN

Description of Leak: HYDR-LEAK

Date Located: 6-21-11  Date Repaired: 6-21-11

Estimated GPM: 2

Remarks:
WATER & WASTE PIPE TESTING INC.
WATER LEAKAGE SURVEY REPORT

City or Town Surveyed: ABINGTON, MA

Leak # 6

DIAGRAM OF LEAK

Location of Leak: 675 CHESTNUT ST

Description of Leak: HYDR LEAK

Date Located: 6-23-11 Date Repaired: 6-23-11

Estimated GPM: 2

Remarks:
City or Town Surveyed: ABINGTON MA

Leak # 7

DIAGRAM OF LEAK

Location of Leak: 59 COLONIAL RD
Description of Leak: HYD. LEAK
Date Located: 6-23-11 Date Repaired: 6-23-11
Estimated GPM: 2
Remarks:
City or Town Surveyed: ABINGTON MA

Leak # 8  DIAGRAM OF LEAK

Location of Leak: 35 JENNINGS AVE

Description of Leak: HYD VEA

Date Located: 6-27-11  Date Repaired: 6-27-11

Estimated GPM: 3

Remarks:
City or Town Surveyed: ABINGTON MA

Leak #9

DIAGRAM OF LEAK

Location of Leak: 62 PATRICA CIR

Description of Leak: SERVICE LEAK

Date Located: 6-29-11  Date Repaired: 9-8-11

Estimated GPM: 5

Remarks:
City or Town Surveyed: ABINGTON MA

Leak #: 10

DIAGRAM OF LEAK

Location of Leak: COR. OF DOSEY ST & RANDOLPH ST

Description of Leak: HYD LEAK

Date Located: 7-5-11 Date Repaired: 7-5-11

Estimated GPM: 3

Remarks:
WATER & WASTE PIPE TESTING INC.
WATER LEAKAGE SURVEY REPORT

City or Town Surveyed: Arlington, MA

Leak #: 11

DIAGRAM OF LEAK

Location of Leak: 138 Randolph St

Description of Leak: HYD LEAK

Date Located: 7-5-11  Date Repaired: 7-5-11

Estimated GPM: 1

Remarks:
WATER & WASTE PIPE TESTING INC.
WATER LEAKAGE SURVEY REPORT

City or Town Surveyed: ABINGTON MA

Leak #: 12

DIAGRAM OF LEAK

Location of Leak: 55 BARRY Rd

Description of Leak: LEAK ON 1 1/4 MAIN

Date Located: 7-5-11

Date Repaired:

Estimated GPM: 7

Remarks: 1 1/4 MAIN WILL BE DISCONTINUED, 3 NEW SERVICES WERE INSTALLED OFF 12" MAIN ACROSS FROM THE 1 1/4 LINE
CONCLUSIONS AND RECOMMENDATIONS:

Based on the results of this leak detection survey, the unaccounted for water leakage found can be attributed to the detectable and repairable water leaks in the system. It does not include water used for firefighting, flushing programs, street cleaning, etc. The amount of water from the leaks detected during the survey can be defined as the difference between the amount of water produced and the amount of water sold, which is registered on the customer's meters. The actual consumption records over the next 12 months following the completion of the survey will more accurately indicate the volume of water which had been leaking throughout the system prior to the leak detection survey. The following are some additional benefits of having a water leakage survey conducted:

- Reduced property damage from water breaks surfacing
- Reduced risk of contamination
- Decrease in water rates for customers since it is they who pay for leakage

We strongly believe that a continuous water leakage survey conducted every two years would continue in the present reduction of water loss in the system, thus increasing revenue in the Town of Abington Water Department's budget.
ACKNOWLEDGMENTS:

We would like to mention our appreciation to Mr. Daniel Callahan, Manager of the Abington & Rockland Joint Water Works, and Mr. Joe LaPointe, Foreman, and his staff, for their full cooperation in helping us make the survey successful. We would also like to thank Ms. Tara McManus, Project Engineer for Weston & Sampson, for her participation in the project. We hope we can be of some service to the Town of Abington Water Department on any future leakage surveys.
Abington & Rockland Joint Water Works
Leak Repair Form

<table>
<thead>
<tr>
<th>Day and Date</th>
<th>6/22 2011</th>
<th>Location of Leak: 26 Camp Street</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work Begun</td>
<td>8:00 A.M.</td>
<td>Work Finished: 12:00 P.M.</td>
</tr>
<tr>
<td>Weather A.M.</td>
<td>Sunny</td>
<td>P.M.: Sunny</td>
</tr>
<tr>
<td>Manpower</td>
<td>Operator</td>
<td>Equipment: CAT Backhoe</td>
</tr>
<tr>
<td></td>
<td>Dump Driver</td>
<td>Dump Truck</td>
</tr>
<tr>
<td></td>
<td>2 Laborers</td>
<td>Utility Truck with Pump</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jack Hammer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pump</td>
</tr>
<tr>
<td>Type of Leak</td>
<td>6&quot; Main</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(main, service, hydrant, valve, etc.)</td>
<td></td>
</tr>
<tr>
<td>Rate of Leak (A, B, or C)</td>
<td>C</td>
<td>(0 ≤ A &lt; 5 gpm ≤ B ≤ 10 gpm &lt; C)</td>
</tr>
<tr>
<td>Surface Condition</td>
<td>Paved Street</td>
<td>(paved street, driveway, sidewalk, grass, cross-country, etc.)</td>
</tr>
<tr>
<td>Existing Pipe Material &amp; Size (if applicable)</td>
<td>6” CI</td>
<td>(D1, CI, AC, Cu, PE, etc.)</td>
</tr>
<tr>
<td>Description of Work &amp; Materials Used to Repair Leak</td>
<td>6” Cast Iron Circumference Break In Sewer Trench Lateral</td>
<td></td>
</tr>
</tbody>
</table>

Visitors

Remarks

Superintendent/Foreman: Joe Labrado
Abington & Rockland Joint Water Works
Leak Repair Form

Day and Date 6/27 2011 Page 1 of 1

Location of Leak 58 Coleman ST

Work Begun 8:00 A.M. Work Finished 1:00 P.M.

Weather A.M. Sunny P.M. Sunny

Equipment Cat 420 Backhoe

Manpower Backhoe Operator

Truck Driver

2 Laborers

Utility Truck

Jack Hammer and Pump

Type of Leak 6" Circumference Leak (main service, hydrant, valve, etc.)

Rate of Leak (A, B, or C) C (0 ≤ A < 5 gpm ≤ B < 10 gpm < C)

Surface Condition Paved Street (paved street, driveway, sidewalk, grass, cross-country, etc.)

Existing Pipe Material & Size (if applicable) 6" Cast Iron (DI, CI, AC, Cu, PE, etc.)

Description of Work & Materials Used to Repair Leak (continue on separate sheet as needed)

Pipe Sitting on Fractured Ledge Repaired with 6" Stainless Steel Wrap

Visitors

Remarks

Superintendent/Foreman Joe LaPointe
Abington & Rockland Joint Water Works
Leak Repair Form

Day and Date  7/6/20  Page 1 of 1
Location of Leak  55 Barry Road
Work Begun  8:AM.  Work Finished  5 Days
Weather A.M.  Sunny  P.M.  Sunny
Manpower  Backhoe Operator
           Truck Driver
           2 Laborers
           Equipment  CAT 420 Backhoe
           Utility Truck
           Pump & Jackhammer

Type of Leak  1/4 Copper Pipe Feeding 3 Houses
              (main, service, hydrant, valve, etc.)
Rate of Leak (A, B, or C)  B
              (0 ≤ A < 5 gpm ≤ B ≤ 10 gpm < C)
Surface Condition  Paved Street
              (paved street, driveway, sidewalk, grass, cross-country, etc.)
Existing Pipe Material & Size (if applicable)  12" Ductile
              (DI, CI, AC, Cu, PE, etc.)

Description of Work & Materials Used to Repair Leak (continue on separate sheet as needed)
We had to tap 3 - 1" services off 12" main and
run 1" Copper to the three existing curb stops - used
200 feet of 1" Copper - 3 - 12x1 Staples - 3 curb stops and
3 couplings and then eliminated the 1/2" Copper Line

Visitors
Remarks
Superintendent/Foreman  Joe LaRocca
Submitted to:

Weston & Sampson
5 Centennial Drive
Peabody, MA 01960

WATER LEAK DETECTION SURVEY
for the
TOWN OF ROCKLAND, MA

DEP GUIDELINE REPORT

July/August, 2011

Conducted by:
Water & Waste Pipe Testing, Inc., Rowley, MA 01969
August 15, 2011

Town of Rockland
Water Department
366 Centre Ave.
Rockland, MA 02370
ATTN: Mr. Daniel Callahan,
Manager of the Abington & Rockland Joint Water Works

Dear Mr. Callahan,

Starting on the date of July 7th, 2011, through August 12th, 2011, our company conducted and completed a comprehensive water leak detection survey on the entire water distribution system - approximately 55 miles - for the Town of Rockland, MA. After thoroughly listening with our leak detection equipment on every hydrant and selected gate valves, and walking directly over all PVC mains and certain areas of AC mains throughout the water system, a total of 5 leaks (2 service leaks and 3 hydrant leaks) were detected and pinpointed. These leaks are listed on the leak page following in this report. We estimate the daily water leakage from the 5 leaks detected to be approximately 25,000 gallons per day. Conducting the survey every two years proves to be beneficial to the Town of Rockland Water Department in reducing the unaccounted for water leakage, with their goal being at least 10% or lower, as well as many other benefits pointed out in the following report.

We look forward to working with you and your staff on the next leakage survey if we are the lowest bidder and are awarded the contract. If you have any questions or need our services in the near future, please feel free to call at your convenience.

Sincerely,

Carl M. Soppe, President
TOWN OF ROCKLAND, MA
WATER LEAKAGE SURVEY
REQUIRED DEP GUIDELINES

PERSONNEL:

Carl M. Sopper: 37 years experience in leak detection - 7 years employed with Pipeline Testing Service where I received my training on-the-job, and 30 years in my own business. Business founded in 1981, conducting leak detection surveys for 30 years.

Alex J. Sopper - 6 years on-the-job experience with Water & Waste Pipe Testing. SOP for employee was 1 year working directly with employer before working solo. Periodically checked for accuracy of leaks detected.

EQUIPMENT:

METROTECH HL90 LEAK DETECTOR: Used in the field every survey day. The equipment includes a G10 contact microphone, amplifier, headphones, G30 and G50 ground microphone. Manufacturer’s SOP is for the technician to place the G10 contact microphone on the hydrant spindle, the gate valve operating nut, and the service valve key. Sound from the contact microphone is fed to the amplifier into the headsets, where we determine if the sound is a leak or not. The G30 and the G50 ground microphones are used when we walk directly over the pipeline. It works in the same way as the G10, except the microphone is placed on the ground to amplify sound from the actual pipeline to determine whether or not a leak exists. This piece of equipment was used exactly according to the Manufacturer’s SOP. There is no maintenance/service schedule for this equipment. However, we maintain it by changing the batteries when needed, and by servicing at Utiltronics, Inc., when the BNC connectors or other components of the amplifier need repair. This equipment does not require calibration.

FLOW METRIX ZCORR CORRELATOR: Equipment setup includes a PC laptop, 4 loggers, a docking station, USB cords from the docking station to the laptop, and ZCORR computer software. We use this equipment on leaks that are difficult to pinpoint with the Metrotech HL90. Loggers, which are cylinders approximately 8 inches long with magnets on the bottom, are placed on either hydrant spindles or gate valve operating nuts. Before the logger is placed on the contact points, they are placed in a
slot in the docking station with connecting pins. Information is entered on the computer as to the location of the leak, the technician's user name, material of the pipe, size of the pipe, and distance between loggers placed. This information is stored in the logger. Once this information is entered into the loggers, the loggers are physically placed on either the hydrant or gate valves, and a 3 minute sound recording will be conducted by the logger. The computer program will indicate when the loggers are finished their recording. The loggers are retrieved and placed back into the logging station where the information recorded by the logger is loaded into the computer program. The data received takes one minute to import. Once this is achieved, a picture appears on the computer screen of a graph line. If there is a spike in the graph line, this is where the location of the leak is. It will also tell the location of the leak by the distance between each logger. The software saves this information for future analysis. The leak is then marked in the road for the Town to repair. This equipment is also used exactly as per the manufacturer's SOP. The manufacturer requires that the logger nicad batteries be changed every five years. The equipment was serviced as per the manufacturer's schedule. All loggers were last serviced with new nicad batteries on April of 2008. This equipment requires no calibration or testing prior to use.

SCHONSTEDT MAGNETIC LOCATOR: This battery operated hand held device is approximately 3 feet long, tubular in appearance, about 2" diameter. The unit also has a volume control and a small LED screen indicating the existence of a buried ferris metal service box or gate box. This was used several times during the survey to located buried services. The manufacturer’s SOP includes powering on the equipment and volume control. The device is then waved over the area where a suspected gate box or service box exists. The equipment emits a low frequency sound, which increases as it gets closer to the buried object. The LED screen has a graph which more accurately pinpoints the object. The higher the graph line, the more accurate the location. This equipment was used as per the manufacturer's SOP. The manufacturer's maintenance/service schedule requires battery changes when needed. The LED screen indicates low battery. The manufacturer also requires that it be stored in it's case when not in use. The equipment is serviced as per the manufacturer's schedule. This equipment requires no calibration or testing prior to use.

ADDITIONAL TOOLS USED DURING THE SURVEY:
- Gate box keys and service box keys are used with the G10 contact microphone to listen for leaks.
- Hydrant wrench, used to tighten down any leaking hydrant, or to remove a hydrant cap to see if water is in the barrel of the hydrant, which would be confirmation of a leaking hydrant.
- Pry bar, used to open gate box covers to place contact microphone on the gate nut or on the gate valve key itself.
- Service box nut opener, used to loosen the hexagon nut that secures the service box cover.
- Gate box cleaning tool, a T-shaped metal rod, approximately 6 feet long, with clam shell spoons at the bottom of the tool, to clean out any debris that may be in a gate box or service box.

LEAK DETECTION SURVEY STANDARD OPERATING PROCEDURES:

When we arrived in the Town of Rockland to begin the survey, we directly reported to Mr. Bill Royal, Water Department Foreman, as to our work locations for that particular survey day. Water leaks that were detected and pinpointed were reported to Mr. Royal. He was informed of the leak, its location, and its severity or need to be prioritized for repair. Mr. Royal and his staff assisted us when they were available, such as when we needed plans for a certain area where a leak was detected. They would meet us on site with the plans. At the end of each survey day, an updated leak sheet was submitted to Mr. Royal at the Water Department, along with our schedule for the next survey date. Mr. Daniel Callahan, Manager of the Abington & Rockland Joint Water Works was also updated as to our progress.

There was no time recorded for each leak located. However, all 5 leaks were detected between the hours of 9 am and 3 pm daily.

The Rockland Police Department was notified by letter before the start of the survey, explaining our work procedures, both vehicle's descriptions and registration numbers, and our safety procedures, such as using caution lights, signs indicating the leak survey is in progress, and safety vests being worn during the survey. We had no issues or complaints from the Police Department about our work procedures or traffic issues.

The weather during the survey was sunny and clear, with temperatures between 80 to 90 degrees during the entire survey. We experienced no rain days during the duration of the survey.

The ground cover material at each site of a detected leak was 90% asphalt and 10% gravel or sod (mostly on the homeowner's property).
The survey technician listened to every hydrant and accessible gate valve and/or accessible service boxes, while walking directly over the pipeline and listening at 8 to 10 foot intervals on non-metallic pipes.

The distance between listening posts was on the average 300 feet. This does vary - some listening posts were as much as 600 feet apart. These areas were checked with our ground microphone more closely, 4 to 6 foot intervals, especially in front of homes that had service lines.

**WATER & WASTE PIPE TESTING REPORTING SOPS:**

The leaks are first reported orally to the Water Foreman, then they are listed on the field leak sheet as to location, description of leak, estimated gallons per minute, and whether the leak was located using the contact mikes, ground mikes, or leak correlator. The leak is then noted on a water system hydrant map provided to us by the town. Every hydrant that was listened to is circled on the map. Circling the hydrants as we listen to them indicates to us when each section would be completed. In our final report the leaks are listed again and noted whether they have been repaired.

The survey data chart is included in this report, with a breakdown of gallons per minute for each leak, the category of each leak (service leak, hydrant leak, etc.) total gallons per minute for all 5 leaks, a daily water leakage unaccounted for loss, and a total of unaccounted for loss for 1 year, along with a savings total to the town for all leaks detected and repaired. Also included with this report are our daily log reports. A system map is also included in this report, marking the locations of the leaks detected.

**FOLLOW-UP:**

To date, all 5 leaks have been repaired by the Water Department. We returned on August 12, 2011, to recheck the leaks that were repaired, and no additional leakage was recorded.
TOWN OF ROCKLAND, MA
LIST OF LEAKS DETECTED
JULY, 2011

<table>
<thead>
<tr>
<th>LEAK#</th>
<th>DATE LOCATED</th>
<th>LOCATION OF LEAK</th>
<th>DESCRIPTION OF LEAK</th>
<th>GPM</th>
<th>REPAIR DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7/7/11</td>
<td>206 Vernon St.</td>
<td>Hydrant leak</td>
<td>3</td>
<td>7/7/11</td>
</tr>
<tr>
<td>2</td>
<td>7/11/11</td>
<td>42 Smith Rd.</td>
<td>Service leak</td>
<td>5</td>
<td>7/14/11</td>
</tr>
<tr>
<td>3</td>
<td>7/11/11</td>
<td>396 Pleasant St. West</td>
<td>Hydrant leak</td>
<td>2</td>
<td>7/11/11</td>
</tr>
<tr>
<td>4</td>
<td>7/14/11</td>
<td>Corner of Rice Lane and Cottonwood Lane</td>
<td>Hydrant leak</td>
<td>2</td>
<td>8/8/11</td>
</tr>
<tr>
<td>5</td>
<td>7/20/11</td>
<td>Approx.#43 Old Market St.</td>
<td>Service leak</td>
<td>5</td>
<td>8/10/11</td>
</tr>
</tbody>
</table>
**TOWN OF ROCKLAND, MA**  
**WATER LEAK DETECTION SURVEY**  
**SURVEY DATA CHART**  
**JULY, 2011**

<table>
<thead>
<tr>
<th>Number of Leaks</th>
<th>Total Gallons per Day</th>
<th>Total Gallons per Year</th>
<th>Revenue Saved after Repairs (based on National avg. of $2,500.00 per mil. gal.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of leaks detected</td>
<td>5</td>
<td>25,000 gallons</td>
<td>9.1 million Gal.</td>
</tr>
<tr>
<td>Total main leaks</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total service leaks</td>
<td>2</td>
<td>15,000 gallons</td>
<td></td>
</tr>
<tr>
<td>Total hydrant leaks</td>
<td>3</td>
<td>10,000 gallons</td>
<td></td>
</tr>
</tbody>
</table>
SURVEY DAILY LOG

City/Town: Rockland, MA
Date: 7-7-11
Survey Personnel: Truck #1: Carl Spencer  
Truck #2: Alex Spencer
Weather Conditions: Sunny, PCT, CLE, CALM, Wind
Area Surveyed: Truck #1: E WATER NORTH TO UNION ST, WEST TO 1ST ST, NORTH  
Truck #2: E WATER SOUTH  
Distance Surveyed: 18,000'
Total hours on survey: 9:15
Leak Detection Equipment Used: Acoustic / Correlator

Leaks Detected:

<table>
<thead>
<tr>
<th>Type</th>
<th>GPM</th>
<th>Priority</th>
<th>Repaired - Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>#401</td>
<td>3</td>
<td>LOW</td>
<td>YES 7-7-11</td>
</tr>
</tbody>
</table>

Survey completed to date: 18%
Comments: Survey started today 1 leak found  
And 1 possible lead with 45 sq. ft.  
Need WD to locate Curb Box for #42  
to check for leak.

Authorized Signature: [Signature]

23 Arrowhead Circle • Rowley, MA 01969
Office: (978) 948-5100
Fax: (978) 948-5150
Email: cms6706@eol.com
www.detectwaterleaks.com
SURVEY DAILY LOG

City/Town: Rockland, MA
Date: 7-8-11
Survey Personnel: Truck #2 Alex Saffer

Weather Conditions: Cloudy 70°F 10Kt Wind
Area Surveyed: Showers in late afternoon
Truck #2 west Water St south to Summer St East to Spring St

Distance Surveyed: 8 miles
Total hours on survey: 8:00
Leak Detection Equipment Used: Acoustic ✔ Correlator

Leaks Detected:

<table>
<thead>
<tr>
<th>Type</th>
<th>GPM</th>
<th>Priority</th>
<th>Repaired - Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Leaks Detected</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Survey completed to date: Approximately 35%
Comments:

Authorized Signature: [Signature]
City/Town: Rockland, MA
Date: 7-11-11
Survey Personnel: Truck #1 Carl Spooner
Truck #2 Alex Spooner
Weather Conditions: Sunny 93° No Wind
Area Surveyed: Truck #1 Pleasant North West To Liberty St To Forest St
Truck #2 Summer St South To Hanson Town Line
Distance Surveyed: 15 miles
Total hours on survey: 8
Leak Detection Equipment Used: Acoustic Correlator

Leaks Detected:

<table>
<thead>
<tr>
<th>Type</th>
<th>GPM</th>
<th>Priority</th>
<th>Repaired - Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service</td>
<td>6</td>
<td>High</td>
<td>No</td>
</tr>
<tr>
<td>Hydrant</td>
<td>2</td>
<td>Low</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Survey completed to date: 55%

Comments:

Authorized Signature: [Signature]
SURVEY DAILY LOG

City/Town: ROCKLAND MA
Date: 7-14-91
Survey Personnel: CARL SOPER, TRUCK #1

Weather Conditions: Sunny/Clear, Low Humidity
Area Surveyed: UNION ST / ENTERPRISE ROAD FROM W. WATER
              TO PARKWAY / SALTER ST & RICE AVE

Distance Surveyed: 10
Total hours on survey: 7.6 hrs
Leak Detection Equipment Used: Acoustic □ Correlator □

Leaks Detected:

<table>
<thead>
<tr>
<th>Type</th>
<th>GPM</th>
<th>Priority</th>
<th>Repaired - Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>HYDRANT</td>
<td></td>
<td>LOW</td>
<td></td>
</tr>
<tr>
<td>RICE AVE</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Survey completed to date: 65.90%
Comments:

Authorized Signature:
SURVEY DAILY LOG

City/Town: ROCKLAND, MA
Date: 7-18-11
Survey Personnel: ALEX SNIPER TRUCK #2

Weather Conditions: SWELL, Muggy, Cloudy, High 80's
Area Surveyed: EAGLE BEACH ST TO HANSON TOWN
LINE AREA BETWEEN NORTH AVE & AVE AVE

Distance Surveyed: 80,165
Total hours on survey: 8 x hrs
Leak Detection Equipment Used: Acoustic / Correlator

Leaks Detected:

<table>
<thead>
<tr>
<th>Type</th>
<th>GPM</th>
<th>Priority</th>
<th>Repaired - Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO LEAKS</td>
<td>DETECTED</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Survey completed to date: Approx 75%
 Comments:

Authorized Signature: [Signature]

**SURVEY DAILY LOG**

City/Town: **Rockland MA**
Date: **7-30-11**
Survey Personnel: **Carl Soper Truck #1**

Weather Conditions: Sunny 95°
Area Surveyed: Individual Pumps (OUT) Off
Harbor st Go over Leaks Found
In Several Areas of the System

Distance Surveyed: **5**
Total hours on survey: **8.6 hrs**
Leak Detection Equipment Used: **Acoustic**

Leaks Detected:

<table>
<thead>
<tr>
<th>Type</th>
<th>GPM</th>
<th>Priority</th>
<th>Repaired - Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>SERVICE</td>
<td>5</td>
<td>High</td>
<td>No</td>
</tr>
<tr>
<td>Special Markets</td>
<td></td>
<td></td>
<td>Tobe Repaired</td>
</tr>
</tbody>
</table>

Survey completed to date: **95%**

Comments:

Authorized Signature: [Signature]

# SURVEY DAILY LOG

**City/Town:** Rockland, MA  
**Date:** 7-31-11  
**Survey Personnel:** Carl Springer, Jack  
**Weather Conditions:** Hot 95°, BREEZY  
**Area Surveyed:** Union St, Main St  
**Distance Surveyed:** 2 miles  
**Total hours on survey:** 5 hrs  
**Leak Detection Equipment Used:** Acoustic  

**Leaks Detected:**

<table>
<thead>
<tr>
<th>Type</th>
<th>GPM</th>
<th>Priority</th>
<th>Repaired - Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO LEAKS</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Survey completed to date:** 99%  
**Comments:** Survey completed today. Need to return for follow-up. A few leaks are repaired as per the DEP specs at a later date.  
**Authorized Signature:**

---
# SURVEY DAILY LOG

**City/Town:** Rockland  
**Date:** 8-12-11  
**Survey Personnel:** Carl Soper  
**Weather Conditions:** Sunny  
**Area Surveyed:** Return to redact areas after repair  
**Distance Surveyed:**  
**Total hours on survey:**  
**Leak Detection Equipment Used:** Acoustic Correlator

## Leaks Detected:

<table>
<thead>
<tr>
<th>Type</th>
<th>GPM</th>
<th>Priority</th>
<th>Repaired - Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

**Survey completed to date:** 100%  
**Comments:**  
No additional leaks were detected after leak repairs

**Authorized Signature:** [Signature]
City or Town Surveyed: ROCKLAND, MA

Leak #1

DIAGRAM OF LEAK

Location of Leak: 206 VERNON ST

Description of Leak: HOT LEAK

Date Located: 7/7/11 Date Repaired: 7-7-11

Estimated GPM:

Remarks:
City or Town Surveyed: ROCKLAND MA

Leak #: 1

Location of Leak: 42 SMITH RD
Description of Leak: SERVICE AT MAN
Date Located: 7-11-11
Estimated GPM: 6

Remarks:
WATER & WASTE PIPE TESTING INC.
WATER LEAKAGE SURVEY REPORT

City or Town Surveyed: ROCKLAND, MA

Leak # 3

DIAGRAM OF LEAK

Location of Leak: 396 PLEASANT ST WEST

Description of Leak: HYDRANT LEAK

Date Located: 7-11-11  Date Repaired: 7-11-11

Estimated GPM: 2

Remarks:
Leak #4

Location of Leak: Cor of Rice Lane & Cottonwood Cr.

Description of Leak: Hydrant Leak

Date Located: 7-14-4

Estimated GPM: 2

Remarks: Hydrant is to be replaced with new hydrant.
City or Town Surveyed: Rockland MA

Leak #: 5

Diagram of Leak

Location of Leak: #43 Old Market St

Description of Leak: Abandon Serv Leak at Curb Stop

Date Located: 7-20-11

Date Repaired:

Estimated GPM: 5

Remarks:
CONCLUSIONS AND RECOMMENDATIONS:

Based on the results of this leak detection survey, the unaccounted for water leakage found can be attributed to the detectable and repairable water leaks in the system. It does not include water used for firefighting, flushing programs, street cleaning, etc. The amount of water from the leaks detected during the survey can be defined as the difference between the amount of water produced and the amount of water sold, which is registered on the customer's meters. The actual consumption records over the next 12 months following the completion of the survey will more accurately indicate the volume of water which had been leaking throughout the system prior to the leak detection survey. The following are some additional benefits of having a water leakage survey conducted:

- Reduced property damage from water breaks surfacing
- Reduced risk of contamination
- Decrease in water rates for customers since it is they who pay for leakage

We strongly believe that a continuous water leakage survey conducted every two years would continue in the present reduction of water loss in the system, thus increasing revenue in the Town of Rockland Water Department’s budget.
ACKNOWLEDGMENTS:

We would like to mention our appreciation to Mr. Daniel Callahan, Manager of the Abington & Rockland Joint Water Works, and Mr. Bill Royal, Foreman, and his staff, for their full cooperation in helping us make the survey successful. We would also like to thank Ms. Tara McManus, Project Engineer for Weston & Sampson, for her participation in the project. We hope we can be of some service to the Town of Rockland Water Department on any future leakage surveys.
Abington & Rockland Joint Water Works
Leak Repair Form

Day and Date: Wed 7-13 2011  Page 1 of 1

Location of Leak: Smith Rd

Work Begun: 8 AM  Work Finished: 1 AM

Weather A.M.: Sunny  P.M.: Sunny

Manpower: 4 Men

Equipment: Backhoe, Crane, Truck, Pump Truck, Pickup Truck

Type of Leak: Service Lead
(main, service, hydrant, valve, etc.)

Rate of Leak (A, B, or C): A
(0 ≤ A < 5 gpm ≤ B ≤ 10 gpm < C)

Surface Condition: Grass
(paved street, driveway, sidewalk, grass, cross-country, etc.)

Existing Pipe Material & Size (if applicable): 3/4" Copper Pipe
(DF, CI, AC, Cu, PE, etc.)

Description of Work & Materials Used to Repair Leak (continue on separate sheet as needed):

Replaced short piece copper and two 3/4 x 3/4 couplings

Visitors:

Remarks:

Superintendent/Foreman: [Signature]

[Other handwritten notes or signatures]
Abington & Rockland Joint Water Works
Leak Repair Form

Day and Date: Mon, 7-25, 2011  Page 1 of 1

Location of Leak: 23 Old Market St

Work Begun: 8 AM  Work Finished: 2 PM

Weather A.M.: Sunny  P.M.: Sunny

Manpower: 3 Men

Equipment: Backhoe  Dump Truck  Crane Truck  Pick Up

Type of Leak: Goose Neck Leak

(main, service, hydrant, valve, etc.)

Rate of Leak (A, B, or C): A

(0 ≤ A < 5 gpm ≤ B ≤ 10 gpm < C)

Surface Condition: Paved ST

(paved street, driveway, sidewalk, grass, cross-country, etc.)

Existing Pipe Material & Size (if applicable): Lead

(DI, CI, AC, Cu, PE, etc.)

Description of Work & Materials Used to Repair Leak (continue on separate sheet as needed):

No Materials cut and discontinued

Dead Line

Visitors:

Remarks:

Superintendent/Foreman: [Signature]
**Abington & Rockland Joint Water Works**  
**Leak Repair Form**

<table>
<thead>
<tr>
<th>Day and Date</th>
<th>Page 1 of 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location of Leak</td>
<td>Rice Ave</td>
</tr>
<tr>
<td>Work Began</td>
<td>8 AM</td>
</tr>
<tr>
<td>Work Finished</td>
<td>2 PM</td>
</tr>
<tr>
<td>Weather A.M.</td>
<td>Sunny</td>
</tr>
<tr>
<td>P.M.</td>
<td>Sunny</td>
</tr>
<tr>
<td>Manpower</td>
<td>6 Men</td>
</tr>
<tr>
<td>Equipment</td>
<td>Backhoe, Crane Truck, Dump Truck, Pickup Truck</td>
</tr>
<tr>
<td>Type of Leak</td>
<td>Hydrant</td>
</tr>
<tr>
<td>Rate of Leak (A, B, or C)</td>
<td>A</td>
</tr>
<tr>
<td>Surface Condition</td>
<td>Grass</td>
</tr>
<tr>
<td>Existing Pipe Material &amp; Size (if applicable)</td>
<td>6 CI</td>
</tr>
<tr>
<td>Description of Work &amp; Materials Used to Repair Leak (continue on separate sheet as needed)</td>
<td>New Hydrant, Short Piece Pipe, Hydrant Coupling</td>
</tr>
</tbody>
</table>

Visitors

Remarks

Superintendent/Foreman: [Signature]
ABINGTON & ROCKLAND
JOINT WATER WORKS

REQUIRED MASSDEP GUIDELINES

STANDARD OPERATING PROCEDURES

Conducted by:

WATER & WASTE PIPE TESTING, INC.
ABINGTON & ROCKLAND JOINT WATER WORKS

WATER LEAKAGE SURVEY

REQUIRED MASSDEP GUIDELINES

PERSONNEL:

Carl M. Sopper: 37 years experience in leak detection – 7 years employed with Pipeline Testing Service where I received my training on-the-job, and 30 years in my own business. Business founded in 1981, conducting leak detection surveys for 30 years.

Alex J. Sopper: 6 years on-the-job experience with Water & Waste Pipe Testing. Standard Operating Procedure (SOP) for the Water Conservation Grant is 1 year working directly with employer before working solo. Alex meets this criteria.

Personnel will complete the leak detection survey (approximately 60 miles of main, hydrants, gate valves, and service connections per town) using a Metrotech HL90 Leak Detector, Schonstedt Magnetic Locator, and miscellaneous tools.

EQUIPMENT:

METROTECH HL90 LEAK DETECTOR: This detector will be used in the field every survey day. The equipment includes a G10 contact microphone, amplifier, headphones, G30 and G50 ground microphone. The manufacturer's SOP is for the technician to place the G10 contact microphone on the hydrant spindle, the gate valve operating nut, and the service valve key. Sound from the contact microphone is fed to the amplifier in to the headsets, where we determine if the sound is a leak or not. The G30 and G50 ground microphones are used when we walk directly over the pipeline. It works in the same way as the G10, except the microphone is placed on the ground to amplify the sound from the actual pipeline to determine whether or not a leak exists. This piece of equipment will be used exactly according to the manufacturer's SOP. There is no maintenance/service schedule for this equipment. However, we maintain it by changing the batteries when needed, and by servicing at Utilitronics, Inc., when the BNC connectors or other components of the amplifier need repair. This equipment does not require calibration.

SCHONSTEDT MAGNETIC LOCATOR: This battery operated hand held device is approximately 3 feet long, tubular in appearance, about 2” diameter. The unit also has a volume control and a small LED screen indicating the existence of a buried ferris metal service box or gate box. This equipment may be used several times during the survey to locate buried gates or services. The manufacturer’s SOP includes powering on the equipment and volume control. The device is then waved over the area where a suspected gate box or service box exists. The equipment emits a low frequency sound, which increases as it gets closer to the buried object. The LED screen has a graph which more accurately pinpoints the object. The higher the graph line, the more accurate the location. This equipment will be used as per the manufacturer's SOP. The manufacturer’s maintenance/service schedule requires battery changes when needed. The
LED screen indicates low battery. The manufacturer also requires that it be stored in its case when not in use. The equipment is serviced as per the manufacturer’s schedule. This equipment requires no calibration or testing prior to use.

**ADDITIONAL TOOLS WHICH MAY BE USED DURING THE SURVEY:**

- Gate box keys and service box keys – used with the G10 contact microphone to listen for leaks.
- Hydrant wrench – used to tighten down any leaking hydrant, or to remove a hydrant cap to see if water is in the barrel of the hydrant, which would be confirmation of a leaking hydrant.
- Pry bar – used to open gate box covers to place contact microphone on the gate nut or on the gate valve key itself.
- Service box nut opener – used to loosen the pentagon nut that secures the service box cover.
- Gate box cleaning tool – a T-shaped metal rod, approximately 6 feet long, with clam shell spoons at the bottom of the tool, to clean out any debris that may be in a gate box or service box.

**LEAK DETECTION SURVEY STANDARD OPERATING PROCEDURES:**

When we arrive in Town to begin the survey, we directly report to the Superintendent and his Water Distribution Foreman as to our work locations for that particular survey day. Water leaks that are detected and pinpointed are reported to both the Superintendent and the Water Foreman. They are informed of the leak, its location, and its severity or need to be prioritized for repair. The Superintendent and his staff will assist us when they are available, such as when we need plans for a certain area where a leak is detected. They usually meet us on site with the plans. At the end of each survey day, an updated leak sheet is submitted to the Superintendent’s office at the Water Department, along with our schedule for the next survey date.

The Police Department of the municipality in which we are working is notified by letter before the start of the survey, explaining our work procedures, both vehicle’s descriptions and registration numbers, and our safety procedures, such as using caution lights, signs indicating the leak survey is in progress, and safety vests being worn during the survey.

On the average, the Joint Water Works’ distribution system has hydrants, gate valves, and service boxes located every 300 feet. The survey technician listens using the HL 90 acoustic leak detection equipment to every listening post (i.e. hydrants and accessible gate valve and/or accessible service box) in the distribution system as per the manufacturer’s SOP. In addition, to provide optimum coverage, the technician also uses the HL 90 equipment and walks directly over the pipelines, listening at 8 to 10 foot intervals on non-metallic pipes and at 4 to 6 foot intervals in areas where the listening posts are located at greater than 300 feet apart such as along cross-country water main installations or transmission mains. The technician also listens along pipelines at 4 to 6 foot intervals in front of homes that have service lines. Water, traffic, and pipe material are not anticipated to affect the outcome of the leak detection survey. Although the manufacturer’s SOP indicates that using the HL90 equipment at all listening posts is a sufficient method for detecting all leaks in the system, Water & Waste has determined, based on years of field experience, that completing additional listening along the pipelines themselves at the intervals noted above can identify additional leaks not always found via the manufacturer’s SOP.
WATER & WASTE PIPE TESTING REPORTING SOPs:

The leaks are first reported orally to the Superintendent, then every leak is listed on the field leak sheet according to date, time, weather conditions, traffic, location, surface material, pipe material, sketch, description of leak, estimated gallons per minute, and whether the leak was located using the contact mike or ground mike. The leak is then noted on a water system hydrant map provided to us by the town. Every hydrant that we listened to is circled on the map. Circling the hydrants as we listen to them indicates to us when each section would be completed. In our final report the repaired leaks are listened to again, and noted whether they have been fully repaired.

The survey data chart in the report includes a breakdown of gallons per minute for each leak, the category of each leak (main leak, service leak, hydrant leak, etc.), total gallons per minute for all leaks, a daily water leakage, unaccounted for loss, and a total of unaccounted for loss for 1 year, along with a savings total to the town for all leaks detected and repaired.

FOLLOW-UP:

Once all the leaks have been repaired by both the Water Department and the homeowner, we will return to listen in those areas to check for any additional leakage. An addendum to the final report will be submitted to Weston & Sampson Engineers after our follow-up procedure is completed. Weston & Sampson shall provide a final chart of all leaks indicating the date the leak was detected, repaired, and resurveyed as well as the leak location, type, class, rate, estimated leakage removed (gpd), and repair costs. Although the Owner is committed to repairing all leaks found during this survey, they intend to focus on repairing leaks based on a priority repair system, with greater leak rates completed first (A = leaks < 5 gpm; B = 5 gpm ≤ leaks ≤ 10 gpm; C = leaks > 10 gpm).

Survey personnel will not be present to observe the leak repair unless we are needed to resurvey the location of the leak. The Owner will provide information pertaining to date, time, weather condition, and leak rate observed during the repairs.
APPENDIX C

WATER RATE STUDY REPORT
Background

Woodcock & Associates, Inc. (W-A) was engaged as a sub-consultant to Weston & Sampson Engineers, Inc. under a water conservation grant from the Commonwealth to analyze Abington-Rockland’s water rates and their ability to encourage wise water use and water conservation.

The Abington/Rockland Joint Water Works operates the water treatment and distribution system for the Towns of Abington and Rockland. Historically, the rates in both towns have been set equal. The Joint system costs are shared by the Towns based on water use. The billing and collection functions for both towns are carried out by the Joint Water Works. Capital expenses are paid for by each town, with joint costs being shared and any costs that are specific to the towns paid solely by those towns; this can cause a minor difference between the overall costs per gallon in the two towns. The operations are funded through enterprise funds in the towns.

Joint Water Works

Table 1 presents the annual budgets for the Joint Water Works for FY2011 and FY2012. We have projected the Joint Water Works expenses through FY2017. In general, we increased most expenses by 2% per year, but increased energy related costs by 3% per year, chemicals by 5%, and employee benefits by 5%.

| TABLE 1. JOINT WATER WORKS BUDGET AND PROJECTIONS |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| WAGES AND SALARIES          | $1,475,495                  | $1,470,665                  | $1,500,100                  | $1,530,100                  | $1,560,700                  | $1,591,900                  | $1,623,700                  |
| EMPLOYEE BENEFITS           | $732,350                    | $761,917                    | $800,000                    | $840,000                    | $882,000                    | $926,100                    | $972,400                    |
| OFFICE SUPPLIES/COMPUTER    | $55,000                     | $55,000                     | $56,100                     | $57,200                     | $58,300                     | $59,500                     | $60,700                     |
| ELECTRICITY COSTS           | $350,000                    | $350,000                    | $360,500                    | $371,300                    | $382,400                    | $393,900                    | $405,700                    |
| FUEL COSTS                  | $25,000                     | $25,000                     | $25,800                     | $26,600                     | $27,400                     | $28,200                     | $29,000                     |
| CHEMICAL COSTS              | $250,000                    | $250,000                    | $262,500                    | $275,600                    | $289,400                    | $303,900                    | $319,100                    |
| LABORATORY COSTS            | $100,000                    | $75,000                     | $76,500                     | $78,000                     | $79,600                     | $81,200                     | $82,800                     |
| SYSTEM MAINTENANCE          | $150,000                    | $150,000                    | $153,000                    | $156,100                    | $159,200                    | $162,400                    | $165,600                    |
| EQUIPMENT MAINT.            | $50,000                     | $50,000                     | $51,000                     | $52,000                     | $53,000                     | $54,100                     | $55,200                     |
| BUILDING MAINT.             | $50,000                     | $50,000                     | $51,000                     | $52,000                     | $53,000                     | $54,100                     | $55,200                     |
| VEHICLE MAINTENANCE         | $5,000                      | $10,000                     | $10,200                     | $10,400                     | $10,600                     | $10,800                     | $11,000                     |
| CONSULTING FEES             | $25,000                     | $25,000                     | $25,500                     | $26,000                     | $26,500                     | $27,000                     | $27,500                     |
| WORK, COMP. & INS.          | $75,000                     | $95,000                     | $96,900                     | $98,800                     | $100,800                    | $102,800                    | $104,900                    |
| TAXES & MISC.               | $35,000                     | $50,000                     | $51,000                     | $52,000                     | $53,000                     | $54,100                     | $55,200                     |
| JT. BUDGET                  | $3,377,845                  | $3,417,582                  | $3,520,100                  | $3,626,100                  | $3,735,900                  | $3,850,000                  | $3,968,000                  |
| ABINGTON                    | $1,553,809                  | $1,606,264                  | $1,654,447                  | $1,704,267                  | $1,755,873                  | $1,809,500                  | $1,864,960                  |
| ROCKLAND                    | $1,824,037                  | $1,811,318                  | $1,865,653                  | $1,921,833                  | $1,980,027                  | $2,040,500                  | $2,103,040                  |
Rockland Expenses

Table 1 presented the Joint Water Works budget and expenses, as well as the allocations to Rockland and Abington. In addition, the Town of Rockland has its own operating expenses and share of debt service and capital costs. The Town’s local costs include police details, insurance and benefits, engineering, maintenance, internal service charges, debt service, and an allowance for capital expenses to be funded through water rates. Table 2, below, presents the budget and projected expenses for Rockland.

<table>
<thead>
<tr>
<th>TABLE 2. SUMMARY OF ROCKLAND EXPENSES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BUDGET</strong></td>
</tr>
<tr>
<td>Personnel Services</td>
</tr>
<tr>
<td>Purchase of Services</td>
</tr>
<tr>
<td>Supplies</td>
</tr>
<tr>
<td>Other Charges</td>
</tr>
<tr>
<td>Joint Expenses</td>
</tr>
<tr>
<td>Intern. Serv Charges</td>
</tr>
<tr>
<td>Capital</td>
</tr>
<tr>
<td>Debit Service</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

As shown on this table, we have provided for an allowance of $1.5 million for various capital improvements (water distribution, supply and treatment improvements) that have been identified by the Joint Water Works and Weston & Sampson Engineers. This one item results in the level of increases that are presented. In reviewing this it must be recognized that water systems contain long lived assets; which, in many cases, are among the most valuable assets in a community. The replacement values run well into the millions of dollars. As outlined in the Commonwealth’s Water Infrastructure Finance Commission’s recent report, there is a spending gap of $10.2 Billion over the next 20 years between current funding for water infrastructure and the actual need.

Abington Expenses

Like the Town of Rockland, Abington’s water system operations include various expenses in addition to the Joint Water Works expenses discussed earlier. Abington’s water system expenses are categorized somewhat differently than those in Rockland, but generally include the same types of expenses. As with the Town of Rockland, we have included $1.5 million in capital improvements to be funded by rates through the year 2017. Table 3, on the following page, presents a summary of the total budgets and projections for the Town of Abington.
## TABLE 3. SUMMARY OF ABINGTON EXPENSES

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel Services</td>
<td>$91,709</td>
<td>$91,709</td>
<td>$93,500</td>
<td>$93,500</td>
<td>$93,500</td>
<td>$93,500</td>
<td>$93,500</td>
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<tr>
<td>Purchase of Services</td>
<td>$140,000</td>
<td>$140,000</td>
<td>$142,800</td>
<td>$142,800</td>
<td>$142,800</td>
<td>$142,800</td>
<td>$142,800</td>
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<tr>
<td>Supplies</td>
<td>$10,000</td>
<td>$10,000</td>
<td>$10,200</td>
<td>$10,200</td>
<td>$10,200</td>
<td>$10,200</td>
<td>$10,200</td>
</tr>
<tr>
<td>Other Charges</td>
<td>$362,480</td>
<td>$-</td>
<td>$-</td>
<td>$-</td>
<td>$-</td>
<td>$-</td>
<td>$-</td>
</tr>
<tr>
<td>Joint Expenses</td>
<td>$1,553,809</td>
<td>$1,606,264</td>
<td>$1,654,447</td>
<td>$1,704,267</td>
<td>$1,755,873</td>
<td>$1,809,500</td>
<td>$1,864,960</td>
</tr>
<tr>
<td>Capital</td>
<td>$-</td>
<td>$165,000</td>
<td>$1,500,000</td>
<td>$1,500,000</td>
<td>$1,500,000</td>
<td>$1,500,000</td>
<td>$1,500,000</td>
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<tr>
<td>Debit Service</td>
<td>$250,465</td>
<td>$532,152</td>
<td>$409,155</td>
<td>$406,742</td>
<td>$404,527</td>
<td>$402,088</td>
<td>$395,512</td>
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<tr>
<td></td>
<td>$2,408,463</td>
<td>$2,545,125</td>
<td>$3,810,102</td>
<td>$3,857,509</td>
<td>$3,906,900</td>
<td>$3,958,088</td>
<td>$4,006,972</td>
</tr>
</tbody>
</table>

### Rate Revenue Required

Tables 2 and 3 presented the total expenses for the towns of Rockland and Abington that must be raised. In addition to the water and sewer rates charged to customers in the towns, the Joint Water Works receives some miscellaneous revenues that can offset the expenses as well. These revenues are from miscellaneous service charges and some interest earnings of the Joint Water Works. In total the revenue offsets are estimated to be approximately $90,000/year for Rockland and $73,200/year for Abington. These include revenues from activities such as backflow checks, but do not include charges for private fire sprinklers; we have derived new charges for these fees separately.

Table 4, below, presents the projected revenues that will be required from rates and charges in each town. The total expenses are those presented in Tables 2 and 3. We have deducted the projected miscellaneous revenues and added a small allowance for uncollected accounts.

## TABLE 4. PROJECTED REQUIREMENTS FOR RATE REVENUES

### Rockland

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Expenses</td>
<td>$2,760,838</td>
<td>$4,176,469</td>
<td>$4,223,525</td>
<td>$4,277,157</td>
<td>$4,332,854</td>
<td>$4,388,028</td>
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<tr>
<td>Less Misc. Revenues</td>
<td>(89,800)</td>
<td>(89,800)</td>
<td>(89,800)</td>
<td>(89,800)</td>
<td>(89,800)</td>
<td>(89,800)</td>
</tr>
<tr>
<td>Allow. For Uncollect.</td>
<td>26,980</td>
<td>41,279</td>
<td>41,755</td>
<td>42,297</td>
<td>42,859</td>
<td>43,416</td>
</tr>
<tr>
<td>Total Required</td>
<td>$2,698,018</td>
<td>$4,127,948</td>
<td>$4,175,479</td>
<td>$4,229,654</td>
<td>$4,285,914</td>
<td>$4,341,645</td>
</tr>
</tbody>
</table>

### Abington

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Expenses</td>
<td>$2,545,125</td>
<td>$3,810,102</td>
<td>$3,857,509</td>
<td>$3,906,900</td>
<td>$3,958,088</td>
<td>$4,006,972</td>
</tr>
<tr>
<td>Less Misc. Revenues</td>
<td>(73,200)</td>
<td>(73,200)</td>
<td>(73,200)</td>
<td>(73,200)</td>
<td>(73,200)</td>
<td>(73,200)</td>
</tr>
<tr>
<td>Allow. For Uncollect.</td>
<td>24,969</td>
<td>37,746</td>
<td>38,225</td>
<td>38,724</td>
<td>39,241</td>
<td>39,735</td>
</tr>
<tr>
<td>Total Required</td>
<td>$2,496,894</td>
<td>$3,774,648</td>
<td>$3,822,535</td>
<td>$3,872,424</td>
<td>$3,924,129</td>
<td>$3,973,507</td>
</tr>
</tbody>
</table>
Existing Rates and Charges

As discussed earlier, the water rates and charges in Abington and Rockland are the same. The rates include a billing or service charge of $32 per quarter for all meter sizes plus a charge of $3.15 per hundred cubic feet (ccf) of metered water use. Customers with private fire sprinkler connection pay $25/quarter for each inch of diameter of the fire service connection. For example, 2” connections are charged $50/quarter while 6” connections are charged $150/quarter.

As part of the work we performed in our examination of the towns’ water rates, we examined alternatives to the existing uniform rate structure that may better encourage water conservation and less wasteful use.

*Conservation Rates*

The genesis of conservation rates provides an interesting backdrop. During the 1970s and early 1980s, setting rates to achieve a societal or public policy objective was typically dismissed as an inappropriate goal or criterion. Many of the traditional rate practitioners believed that water rates and charges should be set to recover costs, and other matters had no place in the rate setting process. This somewhat narrow view has all but disappeared, and the notion of setting rates to encourage conservation is broadly accepted now.

In setting rates to encourage water conservation, it must be recognized that there are a number of limitations, and there are a number of other goals or objectives that are often conflicting. Generally, it is the non-essential water uses that are the intended target of conservation rates. By setting the rates for non-essential use at higher amounts, there is the expectation that consumers will respond to the higher prices with lower uses. There are several problems or issues that come up when designing conservation rates.

- The definition of essential and non-essential use is not broadly accepted. There are some uses, such as over-watering lawns or washing sidewalks that most can agree are non-essential. Similarly, water used for drinking, health and sanitation is viewed as essential. However, owners of businesses such as golf courses or nurseries need some amount of irrigation to stay in business; they view irrigation water as an essential use. Even some agricultural uses can be debated as essential or non-essential. For example, is irrigation water for non-native plants that need large volumes of water to grow in a non-native area essential?
- Perhaps more troublesome, even if all agree that residential lawn watering is a non-essential use, it is difficult to identify and measure each customer’s in-door and outside water use. In the absence of separate irrigation meters and/or monthly billing, it is hard to determine what is indoor vs. outdoor use. Just looking at the volume of use in a billing period provides little guidance. A home with a large family and no outdoor use can use far more water in a billing period than a single person with a large lawn that is
watered daily. While a comparison between winter and summer use can be quite helpful in determining outdoor use (it is assumed that there is little outdoor water use in New England during the November – February months), few towns read meters frequently enough to accurately determine a true winter period's water use. Even if such water use data were available, the billing systems of many towns do not have the flexibility to look at winter use of each individual account.

- When rates are set higher to encourage wise water use, the impacts of customers responding with reduced purchases can have a significant impact on revenues. Most water system costs are relatively fixed. A 10% drop in water use at the higher conservation rates may equal a 20% or 30% drop in revenues with little corresponding reduction in costs. Results such as these have left many communities passing on more rate increases to recover their costs and consumers angrily reacting to what they view as a penalty for doing what they were asked – "you asked me to conserve, I did, and then you go and increase the rates." Without customer support, it is difficult for water managers to convince the public to spend funds on needed capital projects.

- Lastly, the cost of water is typically such a small portion of household budgets that even large percentage increases can result in relatively small overall dollar increases. Under the current rates, a typical residential customer on Abington or Rockland, using about 200 gallons/day has a quarterly water bill of $108 or just over $1 a day. When compared to other utility bills such as cable television, electricity, or cellular telephone service, the cost of water is typically quite small.

With this background, we once again looked at Abington and Rockland's water rates to see where changes might lead to increased water conservation. In general, there are a few areas where changes could be made; however, each such change raises other issues.

- Many towns have a minimum water allowance that goes with the billing charge. Customer's pay for a minimum quantity of water whether it is needed or not. In cases where customers consistently use less than the minimum, there is little incentive to conserve. Because the towns do not have a minimum allowance, there is no disincentive in Abington and Rockland's billing charge to address. The billing charge should be maintained.

- Many communities have developed increasing block water rates to discourage customers that use large quantities of water. Increasing block water rates charge a progressively larger rate per hundred cubic feet as water use increases. The belief is that larger quantities of water use are most frequently associated with large irrigation uses. While this may be the case, large water use may also be due to larger families (more people per household). When the increasing block rates and the various steps are developed based on average or typical residential customers, non-residential customers can be negatively impacted. While there are not many non-residential customers, there are some in both towns. A restaurant may be very careful to not
waste water, but due to the nature of the business, will often use more than a single family residential customer. To avoid such unintended inequities, non-residential customers can be charged using different rates or steps. This allows all residential customers to be treated separately, but it does not eliminate the disparities between large and small families. Further, not all non-residential customers are the same: a bank uses water quite differently than a restaurant. The non-residential rates would need to be carefully developed to not unfairly penalize larger volume, non-residential customers.

- With greater frequency, water rates are being developed by customer class or meter size. This practice enables the community to recognize the different costs of serving different customer classes and can allow the development of rates that can target wasteful residential uses. In some cases, meter size is used as a surrogate for customer class. Both Abington and Rockland have a very homogeneous customer base. Over 90% of the water use is by residential customers in both towns. Further, 98% of the customers have a 5/8” water meter. In this case, it makes little sense to develop a schedule of water rates that varies by customer class or meter size.

- Seasonal rates are another alternative that can be effective, because non-essential outdoor uses typically occur in the warmer months. To be truly effective, the various seasonal rate alternatives need monthly billing. Both Abington and Rockland customers receive quarterly water bills. Billing is done by cycle, so the billing period varies for the customers. For example, some customers may get a clear summer water bill for water use in May – July and a clear winter bill for use in November – January, however, others will overlap these periods with no clear summer or winter quarter. With quarterly water billing it is difficult to adopt fair seasonal rates for all customers.

Based on the forgoing, we do not believe a major change in Abington and Rockland’s water rate structure is warranted. Because the towns have sewer service that is billed based on metered water use, there have been requests for irrigation meters that would measure the water use used in irrigation but not returned to the sewers. We believe that irrigations meters provide an excellent opportunity to measure water used for irrigation, particularly the larger users that wish to pay an additional amount for an irrigation meter.

We recommend that the towns allow irrigation meters under certain conditions:

- The full cost of purchasing, installing, and testing a separate irrigation meter should be borne by the customer. Testing should be done and paid for by the customer at regular schedules.

- These meters should only be allowed on irrigation systems that have rain sensors and can be programmed to only operate early in the morning or late in the evening when other residential demands are low.
• Customers with a second or irrigation meter should be charged the full billing or service charge on these meters as well as the primary meter.

• Perhaps most importantly, we recommend that the towns adopt a separate rate for irrigation meters that is 20% greater than the standard uniform rate. Water used for irrigating lawns is a non-essential use, and the privilege of using water for this non-essential use should carry a premium to discourage waste. Furthermore, irrigation water is typically the most expensive water provided by water utilities. It is often used at peak demand periods (hot summer days) necessitating additional storage, oversized pipes, and pumps with greater capacity.

Proposed Revisions to Water Rates & Charges
In the following sections we provide recommendations for revisions to the various water rates and charges in Abington and Rockland. While our individual calculations showed some minor differences, we have kept the charges the same in each town. There are several recommended revisions or changes to the rates and charges. These are recommended for adoption for FY2013. We have provided projections for the water rates and charges for FY 2013 (starts July 1, 2012) through FY 2017. In all cases, the projections are based on various assumptions, and the further away they are, the more speculative they become. It is recommended that the Joint Water Works Commissioners view the projections after 2013 as possible impacts that can be used for planning purposes. The annual review of the water rates and charges should be part of the Commission’s ongoing financial reviews.

Fire Protection
Water distribution systems are typically designed to meet the maximum day water demand plus an allowance for fire protection. Storage facilities are often designed to provide a substantial volume (often 50%) for standby fire protection. The requirements for fire service are often a large portion of the total costs. In both Rockland and Abington the costs associated with fire protection are approximately 28% of the total costs presented earlier on Table 4. Based on these projected expenses, there is nearly $1 million associated with fire protection in each town.

The bulk of this cost is associated with the provision of public fire protection (through public fire hydrants). However, there are a number of properties in both towns that have a separate private fire service connection to the property that ranges from 2” to 8”. These properties get a valuable service from the town water systems that provide protection from fires and reduced property insurance premiums. The cost of private fire protection is nearly 8% of the overall fire protection costs in Rockland and over 5% in Abington.

The current charges for private fire protection are $100 per year per inch diameter of the service ($25/inch per quarter). The demand placed on the water system from the private fire
services is not a multiple of the diameter; rather it is in proportion to the diameter to the 2.63 power. We recommend private fire service charges that are based on the potential demand they can place on the system. The proposed private fire service charges for the towns in FY 2013 are presented below along with the projections through 2017:

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>2</td>
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<td>$54</td>
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<td>$75</td>
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<td>$84</td>
<td>$87</td>
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<td>$93</td>
</tr>
<tr>
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<td>$100</td>
<td>$107</td>
<td>$111</td>
<td>$115</td>
<td>$119</td>
<td>$123</td>
</tr>
<tr>
<td>6</td>
<td>$150</td>
<td>$160</td>
<td>$165</td>
<td>$170</td>
<td>$176</td>
<td>$182</td>
</tr>
<tr>
<td>8</td>
<td>$200</td>
<td>$213</td>
<td>$220</td>
<td>$227</td>
<td>$234</td>
<td>$242</td>
</tr>
</tbody>
</table>

Prior to the adoption of Proposition 2 1/2 (Mass. Gen. Laws Ch. 59 § 21C) in 1980, most cities and towns in the Commonwealth received contributions or payments from the town’s general fund for the cost of public fire service. Because the benefit from public fire protection is somewhat proportional to the value of property, recovering these costs through property taxes is viewed as a fair recovery mechanism. With the property tax limitations adopted in 1980, most towns ceased the recovery of public fire protection costs through property taxes, and recovered all fire protection related costs through the water rates and charges.

The recovery of fire protection costs through water rates is not considered to be the most equitable manner to recover these costs. Water use is not a good indicator of the amount of fire protection being provided or the value of the service. In addition, most of the fire protection costs are fixed and are better suited for recovery through a fixed charge. We recommend that Abington and Rockland add a fixed public fire protection component to the rates and charges, and that the public fire charges vary with meter size. Larger water meters are typically associated with larger buildings with greater structural values and they thus receive greater benefit from public fire protection. We recommend that the public fire charges increase in proportion to the capacity (in gallons per minute) of various size water meters. The proposed quarterly public fire protection charges for FY 2013 and the projections through 2017 are shown on the following page.

---

1 From the Hazen Williams engineering formula for flow through a closed conduit under pressure.
2 Outside Massachusetts, the practice of recovering public fire protection costs through property taxes is still somewhat common.
TABLE 6. PUBLIC FIRE SERVICE CHARGES ($/QUARTER)

<table>
<thead>
<tr>
<th>Meter Size (in)</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
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<tr>
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<td>$22</td>
<td>$23</td>
<td>$23</td>
<td>$24</td>
<td>$25</td>
</tr>
<tr>
<td>3/4</td>
<td>$33</td>
<td>$34</td>
<td>$35</td>
<td>$36</td>
<td>$37</td>
</tr>
<tr>
<td>1</td>
<td>$55</td>
<td>$57</td>
<td>$58</td>
<td>$60</td>
<td>$62</td>
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<tr>
<td>1.5</td>
<td>$110</td>
<td>$114</td>
<td>$117</td>
<td>$120</td>
<td>$124</td>
</tr>
<tr>
<td>2</td>
<td>$176</td>
<td>$182</td>
<td>$187</td>
<td>$193</td>
<td>$199</td>
</tr>
<tr>
<td>3</td>
<td>$353</td>
<td>$363</td>
<td>$374</td>
<td>$386</td>
<td>$397</td>
</tr>
<tr>
<td>4</td>
<td>$551</td>
<td>$568</td>
<td>$585</td>
<td>$602</td>
<td>$621</td>
</tr>
</tbody>
</table>

The recovery of public fire service costs through the proposed public fire charge removes considerable expenses that would otherwise need to be recovered through the water rates. The impact of this is discussed in the section related to the metered water rates.

Billing Charge

Billing charges are typically used to recover the costs of meter reading, billing and collection. These costs are unrelated to customer water use and are best recovered through a fix charge in proportion to the cost of these activities. These charges are currently the same for all meter sizes. Because nearly every customer has a 5/8” water meter, we recommend that this practice continue. The proposed 2013 charges and the projections through 2017 are presented in Table 7 below.

TABLE 7. BILLING CHARGES ($/QUARTER)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5/8</td>
<td>$32.00</td>
<td>$40.00</td>
<td>$41.00</td>
<td>$41.00</td>
<td>$42.00</td>
<td>$42.00</td>
</tr>
<tr>
<td>3/4</td>
<td>$32.00</td>
<td>$40.00</td>
<td>$41.00</td>
<td>$41.00</td>
<td>$42.00</td>
<td>$42.00</td>
</tr>
<tr>
<td>1</td>
<td>$32.00</td>
<td>$40.00</td>
<td>$41.00</td>
<td>$41.00</td>
<td>$42.00</td>
<td>$42.00</td>
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<tr>
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<td>$40.00</td>
<td>$41.00</td>
<td>$41.00</td>
<td>$42.00</td>
<td>$42.00</td>
</tr>
<tr>
<td>3</td>
<td>$32.00</td>
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</tr>
<tr>
<td>4</td>
<td>$32.00</td>
<td>$40.00</td>
<td>$41.00</td>
<td>$41.00</td>
<td>$42.00</td>
<td>$42.00</td>
</tr>
</tbody>
</table>

Metered Water Rates

As discussed earlier, we examined several alternative water rate structures for Abington and Rockland. We believe that the existing uniform rate structure should be retained and that a separate, and higher irrigation rate be implemented. All costs that are not recovered through the miscellaneous charges, public and private fire protection charges and the billing charges should be recovered through the metered water rate.

Table 8, on the following page, presents the metered water rate we recommend for 2013 and the projections through 2017. We also recommend that the towns allow the installation of irrigation meters. It is unknown what additional revenues may be derived from these meters.
As we discussed earlier, each of these meters should be assessed an additional billing charge, but not the public fire protection charge – this cost is recovered once through the primary meter.

<table>
<thead>
<tr>
<th>TABLE 8. METERED WATER RATE ($/ccf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Rate</td>
</tr>
<tr>
<td>Current: $3.15</td>
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<tr>
<td>2013: $4.47</td>
</tr>
<tr>
<td>2014: $4.50</td>
</tr>
<tr>
<td>2015: $4.55</td>
</tr>
<tr>
<td>2016: $4.60</td>
</tr>
<tr>
<td>2017: $4.60</td>
</tr>
<tr>
<td>Irrigation Rate</td>
</tr>
<tr>
<td>Current: $3.15</td>
</tr>
<tr>
<td>2013: $5.36</td>
</tr>
<tr>
<td>2014: $5.40</td>
</tr>
<tr>
<td>2015: $5.46</td>
</tr>
<tr>
<td>2016: $5.52</td>
</tr>
<tr>
<td>2017: $5.52</td>
</tr>
</tbody>
</table>

As noted earlier, the recovery of public fire service costs with a dedicated charge reduces the amount that would need to be recovered through the metered rate. If the recommended public fire service charge is not adopted by the Commissioners, the metered rate would need to increase by more than $1.00 per ccf or about 25% from $4.47 to $5.54/ccf. The irrigation rate for 2013 would become $6.65/ccf.

**Impacts on Customers**

A typical residential customer using 2400 cubic feet per quarter (about 200 gallons per day) now has a water bill of $107.60 or just under $36 per month. Under the proposed rates and charges for 2013, including the proposed new public fire service charge, the quarterly bill would increase about $62 to $169.28 per quarter. This is an increase of about 68 cents a day.

**Affordability**

As the cost of water service increases across the country, issues of affordability have grown. Drinking water is an essential service, which everyone must have to live. For customers that simply can’t afford the cost of essential water use, easily administered discount programs can be adopted.

Should the towns elect to offer an affordability program, we strongly urge that it NOT be based on age or ability; neither of these conditions results in customers that are unable to afford the water bill. Many able, young families may not be able to afford the cost of the water bill due to job losses and/or rising bills. To be eligible for a discount, we suggest that only property owners that pay the water bill be eligible; renters often have the cost of water included in the rent. Customers who can provide a recent electric or natural gas bill that shows they have been qualified for a low income gas or electric rate could be provided a discount to make their drinking water more affordable. We do not suggest that the usage charge (metered rate) be reduced, as customers should continue to be encouraged to save water, despite income limitations. Rather, we suggest that the public fire service charge be waived each quarter. We also suggest that the verification with an electric or gas bill be required each year to receive the discount.
Summary
In order to fund various system improvements that have been developed by Weston & Sampson Engineers with the Joint Water Works, we have recommended that each town budget $1.5 million per year for capital improvements. The funding of the needed capital projects will result in significant rate increases in both towns for Fiscal Year 2013.

Because of the magnitude of the increases, it is an appropriate time to review and evaluate the structure of the water rates and charges in each town. As part of this evaluation, an essential element we have kept in mind is the ability of any new rate structure to encourage wise use of water and discourage wasteful use.

We recommend the following changes to the rate structures in each town:

- Retain the current billing charge with increases as indicated on Table 7. This charge provides some predictable revenues while not providing any “free water” allowance that sometimes is included with such a charge.
- Revise the private fire service charges as presented in Table 5 so the ratio for various size connections is in proportion to the capacity of various size pipes.
- Adopt new public fire protection charges as shown in Table 6. These charges will recover the costs associated with public fire protection in a more equitable manner than the current practice of including the costs in the metered rates.
- Retain the current uniform charge for metered water use, but consider the adoption of seasonal rates if the town’s change to monthly (or bimonthly) billing. See Table 8.
- Adopt a new irrigation rate that would apply to the metered water use on irrigation systems. As presented on Table 8, this charge should be 20% higher than the regular metered rate to reflect the added costs associated with the provision of this peak demand service that is a non-essential use of water.
- Consider the adoption of a low income discount for customers of owner occupied accounts that can demonstrate they have qualified for an income based discount on another utility service (electric, gas, etc.). The discount could apply to the proposed new public fire protection charge.
APPENDIX D

WATER CONSERVATION BROCHURE
What is Water Conservation?
Water conservation is the beneficial reduction in water loss, use, or waste. On a consumer level, water conservation can be accomplished by changing one's actions, behaviors or method of water use. By turning off the faucet while brushing your teeth or taking shorter showers, you could save more than 200 gallons a month. Always keep water conservation in the back of your mind - every little change makes a difference.

Why Conserve?
The growing population across our region is putting stress on available water supplies. When we turn on our faucets, we expect to receive a reliable supply of high quality water without interruption or contamination. The Abington & Rockland Joint Water Works (JWW) is committed to providing this high level of service and water quality to its customers. However, the increased demand for water inevitably puts added stress on our water supply, environment, and infrastructure. Water efficiency is the least expensive way to stretch our current treatment and distribution infrastructure while also minimizing the impact on the environment. In order to maintain the high level of service and water quality expected, the JWW intends to increase water rates within the next year to help fund replacement of aging infrastructure. Residents and Water Commissioners have voiced concerns with an increasing issue with the water quality's aesthetics or "rusty water". This aesthetic issue is mainly caused by old cast iron water mains, some over 100 years old, which have reached their useful life. Our goal is to replace roughly 32 miles of water main (25% of the water system) over the next 25 years.
Water Conservation Ideas

Household Options

- Install water efficient fixtures and appliances such as toilets, shower heads, faucet aerators, dishwashers, and especially clothes washers.
- Keep a container of water in the refrigerator. Waiting till the water "runs cool" is wasteful.
- Wash only full loads of laundry or dishes or use the lowest water setting possible for light loads.
- Take a shower instead of a bath and save up to 50 gallons each time.
- Flush the toilet only when necessary and don’t use it as a wastebasket – you are not only wasting water but also putting an unnecessary burden on the wastewater collection system.
- Test for leaky toilets – place a few drops of food coloring in the toilet tank. If the color shows up in the bowl without flushing you have a leak. Old flapper valves are a common reason why toilets leak. This is an inexpensive part to replace and can save thousands of gallons a year.
- To test for leaks in your house, take a reading of your water meter. After an hour or two check the meter again, making sure no one has used water in the house. If the reading has changed you have at least one leak and need to investigate further.

Lawn and Landscape

- Water only when needed – overwatering when the soil is saturated will only cause the water to runoff. No matter how much you water it, the sidewalk will not grow. 1-inch of water per week should be enough (rainfall and watering). We receive enough rainfall in Massachusetts to naturally provide the water needed for healthy lawns with good soil.
- Timing is critical – In the case of a drought, the best time to water is early morning or late evening and not during the hottest part of the day (8 am – 6 pm). Also do not water at night during hot and humid weather as you run the risk of lawn disease such as brown patches or dollar spots.
- Setup a rain barrel – water is collected through a roof drain spout and stored in the rain barrel. A full barrel can water up to a 200 sq. ft. garden. Barrels can be purchased at your local hardware store or for more decorative options, online.
- Mow your lawn when the grass is 2½ to 4 inches high – a sharply mowed lawn will help provide small grass clippings which will in turn strengthen the topsoil.
- Aerate your lawn in the spring and fall to help increase water absorption and retention.

Want More Information?
Environmental Protection Agency’s (EPA’s) Conservation in the Home Section:
http://water.epa.gov/infrastructure/sustain/waterefficiency.cfm
For a list of Energy Star products including clothes washers and dishwashers go to:
www.energystar.gov/index.cfm?c=products.pr_find_es_products
General Water and Energy Savings Measures:
www.energystar.gov
www.epa.gov/watersense
For rain barrel info & options go to:
www.mass.gov/dep/water/resources/rainbarl.htm

Lincoln Street Water Storage Tank

Community Participation
You are invited to participate in our public meetings. This participation will provide you with the opportunity to voice your concerns or become actively involved in decisions affecting your drinking water. Please check the town hall bulletin boards or contact the JWW’s office at (781)878-0901 to determine the time and location of the scheduled meetings.

Questions?
For more information about this brochure or if you have any question regarding your drinking water, please call Daniel F. Callahan, Water Superintendent, at (781)878-0901.