

Automated Water Meter Installation Performance Audit

September 2011

DURHAM



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CITY OF MEDICINE

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CITY OF DURHAM

Memorandum

To: Thomas Bonfield, City Manager

From: Germaine F. Brewington, MBA, CPA

Date: September 6, 2011

RE: Transmittal of Automated Water Meter Installation Performance Audit (September 2011)

The Department of Audit Services completed the report on the Automated Water Meter Installation Performance Audit dated September 2011. The purpose of the audit was to determine if the Department of Water Management has adequate controls over implementation of the Automated Water Meter Installation Project.

This report presents the observations, results, and recommendations of the Automated Meter Installation Performance Audit. City management concurs fully with the recommendations made. Management's response to the recommendations is included with the attached report.

The Department of Audit Services appreciates the contribution of time and other resources from employees of the Departments of Water Management and Technology Solutions in the completion of this audit.

Durham- Where Great Things Happen

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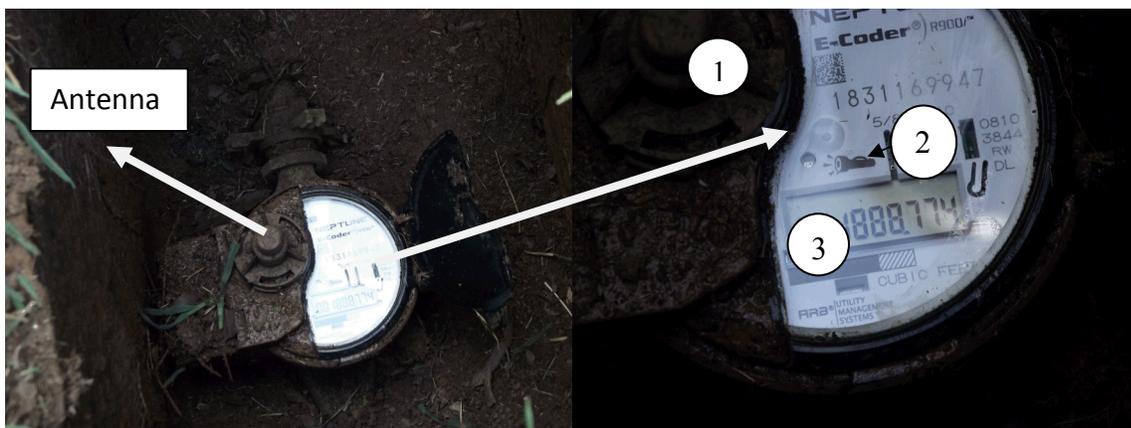
BACKGROUND INFORMATION

The City launched the Automated Water Meter Installation Project utilizing Automated Meter Reading (AMR) technology in late June 2010. Phase one of this project was completed in December, 2010, during which time 20,487 automated water meters were installed in districts 3, 4, 6, and 9. Currently phase two is underway. The City will replace an additional 20,500 meters during this phase. Subsequent projects will eventually replace every water meter in the City. The Water and Sewer Maintenance (WSM) Division of the Department of Water Management is overseeing the implementation of this project.

The AMR project, once fully implemented, will serve as a multi-faceted efficiency tool. The benefits of an AMR system include convenience for both the City and the customer. Research indicates use of AMR technology can provide benefits of improved customer service and responsiveness. The benefits should include quicker detection and quicker leak repairs, which will save thousands of gallons of potable water over the course of a year. Additionally, City staff will be able to detect meters that have malfunctioned or that have been tampered with and provide immediate corrective action. This information, coupled with analytical data available from the water meters, will help utility staff and customers better manage the City's water supply.

Vanguard Utility Service, Inc. an industry leader in the installation of residential and commercial water meters is installing the new water meters. Vanguard Utility Service, Inc. is providing services including: 1) removing and cataloging old water meters, and 2) installing and calibrating the new water meters. The WSM Division's crews will be working ahead of the Vanguard employees to evaluate water meter connections to ensure that the radio signal system will work.

The Neptune E-coder R900i is the new water meter that Vanguard Utility Service is installing.



Neptune E-coder R900i meter

- ① Antenna ② Flow Indicator ③ LCD Display

BACKGROUND INFORMATION (CONTINUED)

The Neptune E-Coder R900i provides high resolution, 8-digit, remote water meter reading and data logging. The product also provides value added features such as leak, tamper, and reverse flow detection. The data logging functionality provides up-to-the hour consumption data twenty-four hours a day. This information helps to identify existing or potential problems. Graphs can be generated to show a possible leak when usage does not approach or reach zero. When a leak flag is triggered, the WSM staff can identify when the event actually occurred; the same goes for negative consumption that implies a backflow event. Using Neptune's E-Coder R900i with data logging, the WSM staff can send a reader to retrieve up to 96 days of historical data directly from the water meter and then download the information directly into the ARB® N_SIGHT™ AMR host software¹. Descriptive statistics in the form of graphs and charts can be generated from the daily or hourly consumption information. This information can confirm the amount charged on the bill. Neptune's E-Coder R900i data logging is a simple system designed to minimize download time as well as service technician visits.

The reading of the water meter and the billing of customers are two separate processes. These processes must work seamlessly each billing cycle in order to bill customers on a timely basis.

The water meter reading process for the districts using AMR technology is as follows:

- The Customer Billing and Services (CBS) representative exports a route file from MUNIS to the WSM staff. The route file contains account information for the district scheduled for reading;
- The route files are loaded into a shifting band receiver (MX) by the WSM staff to collect the readings;
- Meter readers have a receiver in their vehicles and as they drive by water meter locations, the receiver collects water meter readings transmitted by the individual water meters. Once the receiver collects the water meter's information, data is transmitted to a laptop computer where it is matched with pre-loaded route information. As the receiver captures the reads, any missed reads are identified;
- The file is unloaded from the receiver to the WSM workstation once the meter reader has completed driving the assigned route;

¹ Neptune Technology Group. (2011). ARB Utility Management System Product Sheet. *Neptune Technology Group*. Retrieved from: <http://neptunetg.com/products/endpoints/ecoder-r900i/>.

BACKGROUND INFORMATION (CONTINUED)



Mobile Data Collector



Antenna used for data transmission on top of City vehicle

- The missed readings are loaded into a handheld device (TRX);
- The meter reader takes the TRX and manually reads the water meters with missed read codes. In addition, the meter reader collects any information not collected by the MX unit such as a missing water meter, a broken register, an incorrect Radio Frequency Identification Number (RFID) or a reading that could not be gathered for any other reasons (environmental or mechanical). The meter reader assigns a reader code based on the type of repair needed; and
- The route file containing the water meter reading information is uploaded to the import folder for the CBS representatives to import into the MUNIS system for billing.

The implementation of the new water meters does not alter the billing process. The billing process for districts is as follows:

- The CBS representatives scan the import file for any questionable readings and investigate any questionable reading before billing;
- Once the file is imported into MUNIS, the system flags readings where the following conditions exist: zero consumption, current read less than previous read, high read, inactive usage, low read, and any reader codes indicating water meter needs repair. The system does not generate a bill for accounts with the above exceptions;
- The CBS representatives will examine the exceptions and take further action if necessary such as requesting a re-read; and
- The CBS representative will estimate the water usage if the meter reader could not capture a read manually.

Purpose

The purpose of the audit was to determine if the Department of Water Management has adequate controls over implementation of the Automated Water Meter Installation Project.

We conducted this performance audit in accordance with generally accepted governmental auditing standards. Those standards require that we plan and perform the audit to obtain sufficient and appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Results in Brief

Overall, the Department of Water Management has adequate controls over the implementation of the Automated Water Meter Installation Project. The Department of Water Management should strengthen controls over service orders for both manual and automated water meter repairs generated in MUNIS.

Objectives

The objectives of the audit were to determine if:

- Adequate controls exist over the Automated Water Meter Installation Project; and
- Adequate controls exist over the repair/maintenance of both manual and automated water meters.

Scope

The scope of the audit included all current processes in place as they relate to controls over the Automated Water Meter Installation Project and the manual and automated water meter repair/maintenance process.

Methodology

In order to achieve the objectives of the engagement, the audit staff performed the following steps and procedures:

- Obtained and reviewed the contract with Vanguard Utility Service, Inc. (Contractor responsible for replacing the current water meter with the automated water meters);
- Interviewed Department of Water Management employees responsible for monitoring the Automated Water Meter Installation Project;
- Interviewed the Department of Water Management employees responsible for repairing meter reader sourced service orders;
- Verified data records from Vanguard Utility Service, Inc. against photographs of old/new water meters submitted by them;
- Verified documentation to ensure the Department of Water Management tracks progress of water meters replaced;
- Observed the automated water meter reading process in the field;
- Verified that payments to the Vanguard Utility Service, Inc. were processed for work completed;
- Verified the process in place to ensure the accuracy of information entered into MUNIS after replacement/installation;
- Documented the process of identifying water meters that require maintenance; and
- Analyzed service orders in MUNIS by reason code and status of service orders.

During the audit, staff also maintained awareness to the potential existence of fraud.

Finding 1: Adequate controls exist over the implementation of the Automated Water Meter Installation Project

The WSM Division of the Department of Water Management is responsible for overseeing the Automated Water Meter Installation Project. The Division ensures that Vanguard Utility Service, Inc. is replacing water meters in accordance with the contract. WSM staff perform the following procedures to oversee the implementation of the Automated Water Meter Installation Project:

- Test the AMR functionality of the water meters once Vanguard Utility Service, Inc. has installed the new water meters;
- Verify the accuracy of data provided by Vanguard Utility Service, Inc. regarding the new water meters by performing the following actions:
 - Check data records against the photographs submitted;
 - Review replacement consumption based on data submitted by the contractor to identify and investigate any large replacement consumption;
 - Document any concerns about incorrect information in the CBS issues/concerns workbook. The CBS staff will review the WSM staff documentation and analysis and correct information in the MUNIS system; and
 - Review replacement consumption based on the MUNIS Replacement Consumption Report, to identify and investigate any large replacement consumption;
- Track the number of water meters replaced, number of records received from the contractor and number of water meters pending installation;
- Verify delivery of water meters on site before the contractor receives payment;
- Monitor the water meter inventory and maintain a running total;
- Verify that water meters are working as intended and review all supporting documents for services rendered before approving payment for the vendor. If a water meter is not working, Vanguard Utility Service, Inc. replaces it before their payment request is approved;
- Track the return of each water meter and the reason for the return;
- Track old water meters turned in and secured in a locked container behind the stockroom at WSM (Water & Sewer Maintenance). WSM staff verify and document each old water meter serial number and final reading. Some of these water meters that are relatively new are placed in a separate container and used for replacement in areas of the City not part of the current contracted AMR installation project; and
- Hold bi-weekly status meetings to discuss the progress of the project.

Audit staff verified documentation to ensure controls are functioning as intended. No exceptions were noted.

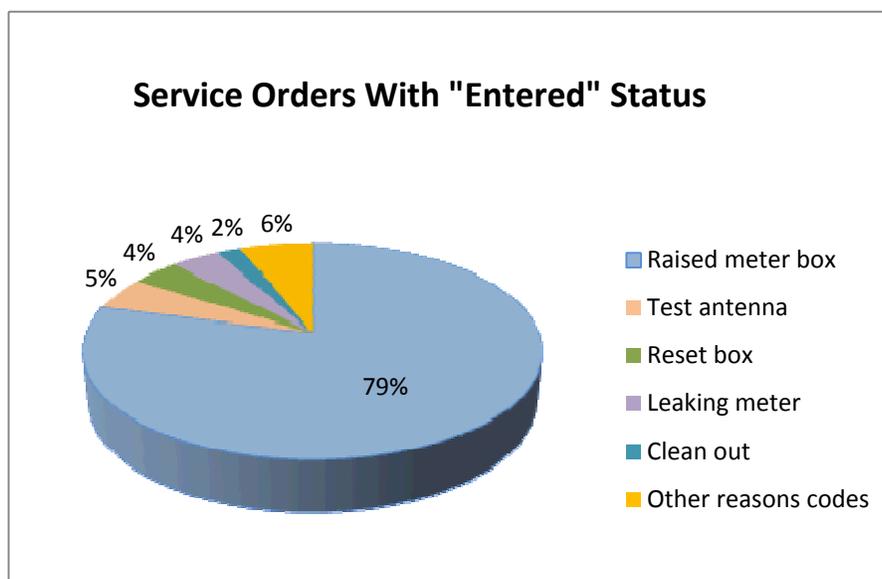
Finding 2: The Department of Water Management should strengthen controls over service orders for both manual and automated water meter repairs generated in MUNIS

Meter readers identify water meters that require repair/maintenance during the water meter reading process for both manual and automated water meters. The meter reader assigns a reader code based on the type of repair work needed. Once this information is imported into MUNIS, the system initiates a service order for the reader codes. Audit staff analyzed the miscellaneous type service orders assigned to water in MUNIS as of August 25, 2011.

The following table shows the number of service orders by the status.

<u>Status of Service Order</u>	<u>Number of Service Orders</u>
Cancelled	6,818
Completed	442
Entered	988
Printed/Exported	<u>12,232</u>
Total Service Orders in MUNIS	20,480

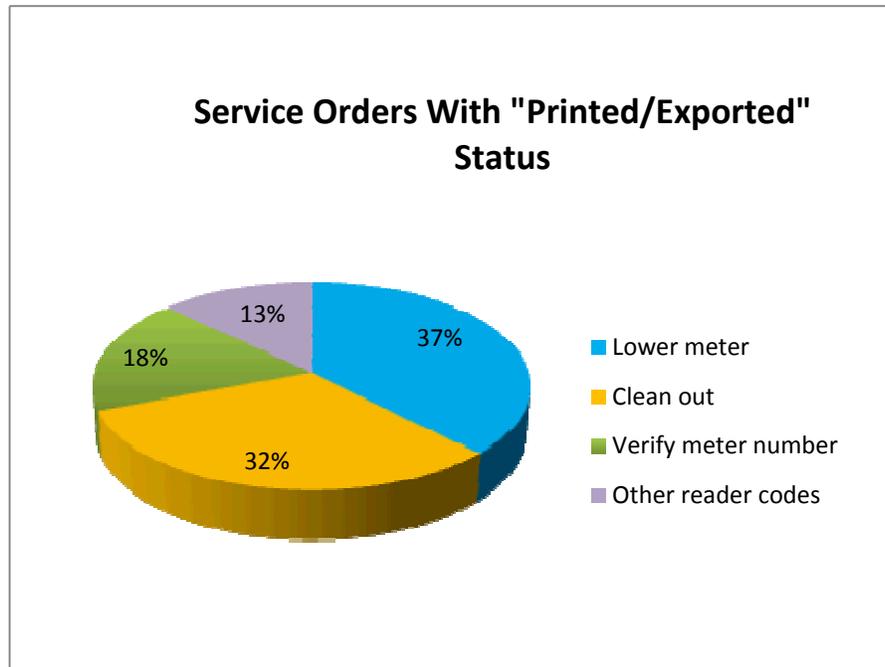
The service orders with an “entered” status are still open. The following chart shows the service orders with an “entered” status as the reason for repair.



AUDIT RESULTS (CONTINUED)

Of the 988 service orders with entered status, 79% are to raise the water meter box, 5% are to test the antenna, 4% are to reset the box, 4% are due to a leaking water meter, 2% are for clean out and 6% are for other reasons.

There are 12,232 service orders with a printed/exported status in MUNIS. The following chart shows the service orders with a printed/exported status as the reason for repair.



Of these 12,232 service orders, 37% are to lower water meter, 32% are for clean out, 18% are to verify the water meter number and 13% are for other reader codes.

The supervisor checks MUNIS on a daily basis for service orders with the entered status. These service orders are printed out and the work is assigned to his crew. Once the work is completed, the administrative assistant updates the status of the service order in MUNIS to "completed". Per the supervisor, service orders with the printed/exported status are completed but remain open in MUNIS. Audit staff could not verify if service orders with the printed/exported status were in fact completed.

The Supervisor manually tracks the total number of repairs performed by repair type on a daily basis. However, capturing total repairs performed does not provide information regarding performance delivery time and actual workload outstanding. Not closing out service orders in

MUNIS limits management's ability to manage workload and realize efficiencies in operations. Closing out service orders timely would provide valuable information regarding performance delivery time and actual outstanding workload. By analyzing work orders, one can improve efficiencies in operations. The Department is aware of this issue.

In addition to MUNIS, the Department also utilizes the City Works system to process service requests. Service requests are initiated in the City Works system through: 1) calls received from the public at the City's Durham One Call center, 2) input by CBS representatives, and 3) input by field representatives. Management monitors open service requests in the City Works system and holds staff accountable for closing the service requests in a timely manner. City Works service requests take priority over MUNIS generated service orders.

At present, City Works and MUNIS are not integrated. Per the WSM staff, meter reader sourced service orders do not import to City Works. The Department of Technology Solutions' staff stated that integration is feasible and meter reader sourced service orders generated in MUNIS can automatically generate a service order in City Works. This integration was to take place during the initial MUNIS implementation, however that integration has not happened.

Servicing work orders from two different systems is inefficient. Capturing all water meter repair work service orders in one system would allow the Division to prioritize work and analyze overall workload.

Recommendation 1

The Department of Water Management should work with the Department of Technology Solutions to study the feasibility of integrating the City Works system and MUNIS so that all water meter repair related service orders can be managed comprehensively. If feasible, the departments should complete the integration between the City Works system and MUNIS. Until integration is completed or if integration is not possible, the Department of Water Management should perform the following:

- Close out all service orders where work was completed but the service order is still open in MUNIS;
- Establish procedures to ensure timely closing of service orders in MUNIS; and
- Ensure management oversight exist over service orders in MUNIS.

Recommendation 2

The Department of Water Management should establish written guidelines to prioritize both manual and automated water meter repair work orders (MUNIS and City Works).

MANAGEMENT'S RESPONSE

Memo to: Germaine F. Brewington, Director of Audit Services
From: Donald F. Greeley, Director, Department of Water Management
Kerry Goode, Director, Technology Solutions Department
Date: September 21, 2011
Subject: Management's Response
Automated Water Meter Installation Performance Audit (September 2011)

The following is the management's response to the Automated Water Meter Installation Performance Audit dated September 2011.

Recommendation 1:

The Department of Water Management should work with the Department of Technology Solutions to study the feasibility of integrating the City Works system and MUNIS so that all water meter repair related service orders can be managed comprehensively. If feasible, the departments should complete the integration between the City Works system and MUNIS. Until integration is completed or if integration is not possible, the Department of Water Management should perform the following:

- Close out all service orders where work was completed but the service order is still open in MUNIS;
- Establish procedures to ensure timely closing of service orders in MUNIS; and
- Ensure management oversight exist over service orders in MUNIS.

Management's Response:

We concur. Management is in full agreement with the recommendation.

The Department will work with the Department of Technology Solutions and the CityWorks administrator to determine the feasibility of integrating the CityWorks system and MUNIS system. The ability to determine the feasibility may require the assistance of a CityWorks representative and a MUNIS representative. The integration between the two systems was originally scheduled for completion prior to the implementation of the MUNIS Utility Billing software in 2009. The integration is still incomplete at this time.

The Department will begin working on the interim measures to improve the control the service orders in MUNIS. However, this puts the Department in the situation of accounting for two service order systems which is inefficient. A portion of service orders in MUNIS (miscellaneous and are older than 3-months) will be fairly straight forward to clear out of the system. The balance of the service orders will need to be closely reviewed so as to close or generate a CityWorks service order. Internal staff will need to complete this due

to the nature the oversight needed to decide whether to close or do something else with the service order. Once the system is cleaned up a procedure to timely close MUNIS service orders can be developed. Performance measures to show the progress of closing the MUNIS service orders and ensuring MUNIS service orders are closed on a regular base will be developed and tracked immediately.

Implementation Dates:

1. Determination of feasibility of the integration of the CityWorks system and MUNIS will be targeted for completion by March 2012.
2. Close out all service orders where work was completed but the service order is still open in MUNIS is targeted for completion by January 2012.
3. Establish procedures to ensure timely closing of service orders in MUNIS is targeted for completion by February 2012.
4. Ensure management oversight exist over service orders in MUNIS is targeted to be started by October 2011.

Recommendation 2:

The Department of Water Management should establish written guidelines to prioritize all water meter repair work orders (MUNIS and City Works).

Management's Response:

We concur. Management is in full agreement with the recommendation.

The prioritization of work orders is an important maintenance business process. Prioritization drives the completion of critical work in a timely manner, but also drives the completion of all work based on how long a work order is in the system. Work order control on our water meter system also drives our ability to efficiently generate the Department's revenues. However, establishing guidelines to prioritize work orders from two systems will be very difficult, inefficient and not something the Department will want to do permanently. If the integration of Cityworks and MUNIS is not possible, the City will need to determine a process that will allow all Departments to utilize Cityworks and not use the MUNIS service order system at all. Interim guidelines can be developed as a stopgap to attempt to reconcile MUNIS and CityWorks service orders.

Implementation Date:

The Department will target to have guidelines in place to prioritize all water meter repair word orders by February 2012.