

# OFFICE OF THE CITY AUDITOR PERFORMANCE AUDIT

## Improvements in Water Meter Testing Needed



May 2019



CITY OF  
KANSAS CITY,  
MISSOURI

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CITY OF FOUNTAINS  
HEART OF THE NATION



KANSAS CITY  
MISSOURI

## Office of the City Auditor

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May 20, 2019

Honorable Mayor and Members of the City Council:

This audit focuses on Water Services' testing and replacement of 5/8" water meters, which are primarily residential meters. This audit was initiated in response to audit suggestions submitted by members of the public.


Although Water Services tests new certified meters, the department does not follow some new meter testing recommended practices. Some new meters failed accuracy tests but were installed. Samples of new meters chosen for testing were not randomly selected and sample sizes were not large enough to draw conclusions about the accuracy of the entire batch. Some new meter shipments were not tested. Testing a statistical sample of new meters from a shipment provides reasonable assurance that the entire batch of meters is accurate which would confirm the manufacturer's certified accuracy test results.

Water Services should improve how it tests the accuracy of meters pulled from service. We found the order in which the set of three tests are performed does not follow recommended practices; some pulled meters were tested repeatedly, which can change a meter's performance from what it was when in the field; and two pulled meters failed accuracy tests but were reported as passed. Most pulled meter tests were performed within department timeliness goals.

Water Services does not have a water meter replacement strategy. Meters have a limited life span and will deteriorate and lose peak efficiency over time. As water meters age, they tend to slow down or under-register without completely stopping which may result in lost revenue. To have an effective water meter replacement strategy, Water Services needs to do ongoing testing of meters in service and develop a comprehensive database with meter information and test data.

We make recommendations to improve meter testing processes and develop a water meter replacement strategy.

The draft report was made available to director of water services on March 29, 2019, for review and comment. His response is appended. We would like to thank the Water Services Department for their assistance during this audit.

  
Douglas Jones  
City Auditor



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# Improvements in Water Meter Testing Needed

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## Introduction

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### Objectives

We conducted this audit of water meter testing and replacement under the authority of Article II, Section 216 of the Charter of Kansas City, Missouri, which establishes the Office of the City Auditor and outlines the city auditor's primary duties.

A performance audit provides "findings or conclusions based on an evaluation of sufficient, appropriate evidence against criteria. Performance audits provide objective analysis to assist management and those charged with governance and oversight in using the information to improve program performance and operations, reduce costs, facilitate decision making by parties with responsibility to oversee or initiate corrective action, and contribute to public accountability."<sup>1</sup>

This report is designed to answer the following question:

- Does the Water Services Department appropriately test and replace water meters to ensure meter accuracy?

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### Scope and Methodology

Our review focuses on Water Services' testing and replacement of 5/8" meters. Our audit methods included:

- Reviewing the American Water Works Association's (AWWA) Manual of Water Supply Practices M6 "Water Meters Selection, Installation, Testing, and Maintenance" (Fifth Edition, 2012) to identify recommended practices related to new and in-use water meter testing and replacement.
- Reviewing Water Services policies and procedures and interviewing department staff to identify water meter testing and replacement practices.

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<sup>1</sup> Comptroller General of the United States, *Government Auditing Standards* (Washington, DC: U.S. Government Printing Office, 2011), p. 17.

## *Improvements in Water Meter Testing Needed*

- Analyzing Water Services test data for 5/8" water meters pulled from service per customers' request from May 2017 to January 2019 to determine whether the department followed AWWA recommended testing practices and accuracy limits and department policies.
- Reviewing a sample of Water Services' water meter invoices from April 2017 to September 2018 to identify newly purchased 5/8" meters.
- Comparing newly purchased 5/8" water meters to meter testing data to determine whether the department followed department policy and AWWA recommended practices for testing new meters.<sup>2</sup>

We conducted this performance audit in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, 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. No information was omitted from this report because it was deemed privileged or confidential.

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## **Background**

### **Water Meters**

Water meters measure the volume of water that passes through a meter. The Water Services Department has about 170,000 water meters in service. The majority of the water meters are 5/8" meters, which are primarily for residential use.

Water Services' meters are attached to meter transfer units (MTU). The MTU communicates with the meter to collect the usage data and transfers the data to collection units which upload the data to the department's billing system.

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<sup>2</sup> We could not determine whether meters tested from May 2017 to December 2017 would have passed or failed AWWA accuracy limits because Water Services selected the wrong test settings on the test bench when testing the meters. Water Services corrected this issue in January 2018.



## **Meter Testing and Test Bench**

The Meter Field Services Division of Water Services tests the accuracy of newly purchased and in-service water meters. Meter accuracy can be affected by sediment, chemical build-up, rates of flow<sup>3</sup>, quantity of water metered, age, type of meter, and installation quality. Water Services' testing compares meter performance to accuracy limits set by the American Water Works Association at defined flow levels and volumes. A set of three tests measures the meter's accuracy at high, medium, and low flow rates. According to Water Services, if the meter does not pass even one of the three tests, then the meter fails the accuracy test.

Water Services' meter testing equipment, the test bench, is calibrated twice a year to help ensure testing accuracy. Meter shop staff are certified by the manufacturer to operate the test bench. The test bench software was most recently updated in November 2018.

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<sup>3</sup> Flow rate measures how fast water flows through a meter. It is often measured by gallons per minute (GPM).

*Improvements in Water Meter Testing Needed*

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## Findings and Recommendations

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### Water Services Did Not Follow Some New Meter Testing Recommended Practices

The American Water Works Association (AWWA) recommends testing a statistical sample of certified<sup>4</sup> new meter shipments to verify accuracy and to maintain confidence in the manufacturer's accuracy testing.

#### **Some New Meters Failed Tests but Were Installed**

Although Water Services tests new certified meters, as recommended by AWWA, the department did not follow its own policy for how to handle failed newly purchased meters and installed meters that did not pass the department's testing. The department's written policy states that "any new meter that does not meet the minimum specified accuracy requirements will be returned to the manufacturer and a second sample will be tested. If the second sample also fails, a third sample will be tested in the presence of a manufacturer's representative. If the third sample fails, the entire batch will be returned to the manufacturer."<sup>5</sup>

In fiscal year 2018, 47 out of 246 certified new meters failed their accuracy testing. Although the department's policy says to return failed meters to the manufacturer, none were. Instead, all 47 failed meters were installed. Based on the tests run, most of the failed meters were over-registering the amount of water that ran through the meter.

Despite the department's test data showing meter failures, staff said they have never had a new meter that they considered to have failed the accuracy test. Meters purchased by Water Services have certified accuracy test results from the manufacturer. The purpose of testing a sample of certified new meters is to ensure the manufacturer's testing results are accurate. Installing a failed meter can lead to inaccurate registration of water usage. Customers may overpay for water that they did not use or Water Services may lose revenue because of underreported water usage.

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<sup>4</sup> We use the term "certified new meters" to refer to new meters with certified meter accuracy test results from the manufacturer.

<sup>5</sup> Kansas City, MO Water Services Department Meter Field Services Meter Management Program Operating Procedures, p. 2.

## *Improvements in Water Meter Testing Needed*

Recommendation To ensure meters accurately register water usage, the director of water services should not install new water meters that fail their accuracy testing.

### **Department Not Following Recommended Statistical Sampling**

Water Services does not use statistical sampling for testing of new meter shipments.

**Water Services is not using random sampling to select new meters for testing.** The American Water Works Association (AWWA) recommends testing a statistical sample of new meters with certified test results before installing the meters.<sup>6</sup> AWWA states that testing a statistical sample of water meters for how accurate they register water usage at various flow rates and flow quantities will provide reasonable assurance that the manufacturer's test results are accurate. Selecting a random sample of all new meters received in a shipment helps ensure that all meters have the same probability of being tested.

Water Services' meter testing data shows that samples from some shipments were not randomly selected, as required by statistical sampling, but instead were made up of water meters with sequential serial numbers. For example, the sample of new meters from the September 2017 shipments tested had 10 to 30 meters with sequential serial numbers. Testing sequentially numbered meters results in some meters in the shipments being less likely to be included in the sample than others.

By not using a statistical sample of randomly selected new water meters, Water Services' test results cannot be generalized to the entire shipment of meters and Water Services cannot be reasonably assured of the accuracy of the new water meters.

**Water Services' sample size policy is not adequate to confidently draw conclusions about the accuracy of the entire batch of new meters.** AWWA recommends testing a statistical sample of certified new meters, which requires a sample size sufficient to provide reasonable assurance that the sample represents the entire batch of new water meters. While Water Services chooses sample sizes based on the size of the new meter shipments, the sample sizes are not large enough to determine with a high level of confidence whether the sample test results accurately represent the entire shipment. For example, Water

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<sup>6</sup> American Water Works Association *Manual of Water Supply Practices M6, Water Meters Selection, Installation, Testing, and Maintenance*, (Fifth Edition, 2012), p. 57.

Services' policy requires a sample of 25 new meters to be tested if the batch size is between 500 and 1,000. (See Exhibit 1.) However, a sample from a batch of 500 meters with a 90 percent confidence interval and 10 percent margin of error would require a sample size of 60 meters. Testing 60 out of 500 meters will provide a higher degree of confidence that the accuracy test results will represent the entire batch.

Exhibit 1. Water Services' Policy for Meter Sample Size

Number of Meters in Batch	Sample Size to Test
<20	1
20-100	3
100-500	10
500-1000	25
>1000	50

Source: Water Services Meter Management Program Operating Procedures.

**Recommendation** To be reasonably confident that new meters with certified meter accuracy test results from the manufacturer are accurate, the director of water services should update water meter testing policies and procedures to require random sampling of new meters and a sample size that provides adequate confidence that the sample represents the accuracy of the entire batch.

### Some New Meter Shipments Not Tested

Although Water Services' policy states a sample of each batch of new meters will be tested to ensure the meters meet the department's accuracy requirements, some new meter shipments were not tested. We compared water meter serial numbers from shipments between April 2017 and September 2018 to the department's testing data. New meters were not tested for four of seven shipments. (See Exhibit 2.) When certified new meters are not tested, the department cannot verify their accuracy and maintain confidence in the manufacturer's test results.

Exhibit 2. Required vs. Actual Number of New Meters Tested

Packing Slip Date	Order Quantity	Number of Meters to Test Per Dept Policy	Number of Meters Tested
04/25/2017	1,000	25	48
09/05/2017	2,000	50	133
11/06/2017	1,270	50	0
11/06/2017	100	3	0
01/25/2018	40	3	0
06/24/2018	2,000	50	0
09/26/2018	1,390	50	49

Source: Packing slips for meter batches; Water Department Meter Field Services, Meter Management Program Operating Procedures; and test bench data.

## *Improvements in Water Meter Testing Needed*

Recommendation To ensure new meters are accurate, the director of water services should ensure that a sample of each new water meter batch is tested.

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## **Department Should Improve Pull Meter Testing**

### **Water Services Not Using Recommended Flow Test Order on In-Service Meters**

Water Services' high, medium, low flow accuracy test order could affect test results of "pulled meters." A pull test is an accuracy test on a previously in-service meter that a customer requests, usually because their water use is registered higher than usual. AWWA recommends a low, medium, and high test flow order for in-service meters. If a meter has been in-service for some length of time and is tested first on the high flow, there is a possibility of obtaining a false impression of the meter's condition on lower flow rates.<sup>7</sup>

Water Services' staff said their practice of following a high, medium, low flow test order is desirable because the high flow test will purge the meter of all debris. However, meters that are previously placed in service, such as pulled meters, should be tested in as close to the same condition as the meter was while in service.<sup>8</sup>

Recommendation To ensure pulled meters are tested according to recommended practices, the director of water services should ensure pulled water meters are tested with a low, medium, high flow order.

### **Water Services Repeatedly Tested Some Pulled Meters**

Water Services repeated accuracy tests on some pulled meters after initial test failures were recorded. Water Services management said that if a meter failed one or more of the three flow tests in a set, then the meter is considered to have failed; however, in practice, some of the meters were tested multiple sets of times.

Of the 39 meters which received a pull test, 26 meters failed the first set of tests. The department retested 21 out of the 26 failed

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<sup>7</sup> American Water Works Association *Manual of Water Supply Practices M6, Water Meters Selection, Installation, Testing, and Maintenance*, p. 77.

<sup>8</sup> American Water Works Association *Manual of Water Supply Practices M6, Water Meters Selection, Installation, Testing, and Maintenance*, p. 69.

meters several times before the meters passed, including two meters that were tested four sets of times before passing.<sup>9</sup> To determine how a meter performed in the field, the meter should be as close to the same condition during testing as it was when in use.<sup>10</sup> Repeated testing, which would include water run through the meter at high flow, could change the meter's performance.

Pull tests are conducted at the request of the customer. The customer is charged a \$75 fee for the pull test if the meter passes the accuracy testing. If a pull test fails at least one set of tests, the customer should not be charged.

Recommendation To ensure pull meter test accuracy, the director of water services should ensure pulled water meters are tested only once.

**Two Pulled Meters Failed Accuracy Test But Were Reported as Passed**

Two meters pulled for testing at the customers' request failed the accuracy tests according to the test bench data; however, the reports sent to Water Services' Customer Service Division, said that the two meters passed. The customers were notified by Customer Service that the meters passed and a \$75 charge was applied to their next scheduled bill.

Recommendation To ensure customers are treated fairly, the director of water services should reimburse customers charged for pull tests that failed but were reported as passed.

**Most Pulled Meters Tested Timely**

Most meters pulled from the field for accuracy testing were completed within the department's required seven days. AWWA recommends completing tests on pulled meters as soon as possible to prevent the drying of deposits in the measuring chamber, as this condition tends to give a negative impression of the meter's condition while it was in service.<sup>11</sup> Thirty out of 39 meters were tested within seven days. Testing meters as soon as possible after removal from the field will help ensure that the meters reflect the condition they were in while in the field.

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<sup>9</sup> We did not count a pulled meter as retested if the test was repeated due to an obvious operator or system error such as when the wrong start and end meter read was entered or the start and end read was null.

<sup>10</sup> *American Water Works Association Manual of Water Supply Practices M6, Water Meters Selection, Installation, Testing, and Maintenance*, p. 69.

<sup>11</sup> *American Water Works Association Manual of Water Supply Practices M6, Water Meters Selection, Installation, Testing, and Maintenance*, p. 77.

## **Water Meter Replacement Strategy Needed**

### **Water Services Does Not Have Replacement Strategy for Meters**

Water Services does not have a strategy for replacing water meters. According to AWWA, a water meter will deteriorate and lose its peak efficiency over time like any other mechanical device. Water Services said they are currently working on addressing problems with the automatic meter reading system rather than replacing the meters themselves. However, Water Services will replace a meter when they replace the connected MTU if they think it is an old meter.

Water Services has a policy stating meters will be exchanged and tested based on both consumption (5,000 CCF<sup>12</sup>) and time limits (every 15 years), but the policy has not been implemented. In addition, Water Services does not consistently track meter age in its inventory and does not track consumption data for 5/8" meters.

AWWA recommends establishing a replacement strategy based on the ongoing testing of meters in service<sup>13</sup> and that a meter testing program maintain an accurate and readily available database of meter records. Water Services does not have either of these components.

**Water Services does not perform ongoing testing of in-service water meters.** AWWA recommends that a utility's own test results be used to determine the length of time its meters should remain in service between tests.<sup>14</sup> Having an ongoing testing program and analyzing a utility's own data will help to establish performance criteria about when meters should be replaced rather than just basing replacement on age, consumption, or meter type. It is important for a utility to use its own data to determine when meters should be replaced because each utility's water has its own chemical and physical characteristics that affect meter performance in unique ways.

AWWA recommends methods for meter sampling to determine the number of years a meter should remain in service.<sup>15</sup> For example,

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<sup>12</sup> A CCF is 100 cubic feet.

<sup>13</sup> *American Water Works Association Manual of Water Supply Practices M6, Water Meters Selection, Installation, Testing, and Maintenance*, p. 67.

<sup>14</sup> *American Water Works Association Manual of Water Supply Practices M6, Water Meters Selection, Installation, Testing, and Maintenance*, p. 68.

<sup>15</sup> *American Water Works Association Manual of Water Supply Practices M6, Water Meters Selection, Installation, Testing, and Maintenance*, pp. 54-55.



one recommended method is statistical sample testing of the meter distribution system. According to AWWA, sample testing is an economical approach to determine the factors affecting meter performance and to monitor the accuracy of the metering system.

**Water Services does not have a comprehensive water meter database with descriptive meter information and test data.**

AWWA recommends a meter testing program maintain an accurate and readily available database of meter records.<sup>16</sup> The database should provide basic data for each meter, such as size, make, type, serial number, date of purchase or date of installation, meter location, and testing data.<sup>17</sup>

Water Services does have a spreadsheet of active meters that includes meter ID, serial number, maker, model, size, and meter address. The department has accuracy testing data on some new meters and some meters pulled from service but the department's testing data is not merged with its descriptive meter data.

AWWA recommends that meter data be entered into the system at the time a meter is purchased or installed.<sup>17</sup> Water Services does not have accurate meter installation dates and purchase dates are not recorded in the meter inventory. The department can request the manufacturer provide a database of certified meter test results to establish the beginning history of a meter.

Having a database of active and inactive meters that includes descriptive and testing data allows analysis of meter accuracy by different characteristics such as year, meter type, make, etc. Meter replacement decisions can be made based on meter performance rather than age or consumption only. Older meters of a certain type may actually be functioning better than a newer meter type.

Meters have a limited life span. As water meters age, they tend to slow down or under-register water usage without completely stopping. Without a comprehensive water meter replacement strategy to ensure accurate meters, the cost for water service may not be equitably distributed among all customers and the department could lose revenue.

Recommendation	To ensure meters are replaced strategically based on water conditions unique to the city and meter performance, the director
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<sup>16</sup> *American Water Works Association Manual of Water Supply Practices M6, Water Meters Selection, Installation, Testing, and Maintenance*, p. 58

<sup>17</sup> *American Water Works Association Manual of Water Supply Practices M6, Water Meters Selection, Installation, Testing, and Maintenance*, p. 103.

### *Improvements in Water Meter Testing Needed*

of water services should develop a comprehensive water meter replacement strategy that includes:

- Water meter replacement criteria based on ongoing testing of in-service meters; and
- A comprehensive water meter database that includes active and inactive meters with basic meter descriptive characteristics such as size, make, model, serial number, date of purchase, date of installation, meter location, and accuracy test data.

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## **Recommendations**

1. The director of water services should not install new water meters that fail their accuracy testing.
2. The director of water services should update water meter testing policies and procedures to require random sampling of new meters and a sample size that provides adequate confidence that the sample represents the accuracy of the entire batch.
3. The director of water services should ensure that a sample of each new water meter batch is tested.
4. The director water services should ensure pulled water meters are tested with a low, medium, high flow order.
5. The director of water services should ensure pulled water meters are tested only once.
6. The director of water services should reimburse customers charged for pull tests that failed but were reported as passed.

7. The director of water services should develop a comprehensive water meter replacement strategy that includes:
  - Water meter replacement criteria based on ongoing testing of in-service meters; and
  - A comprehensive water meter database that includes active and inactive meters with basic meter descriptive characteristics such as size, make, model, serial number, date of purchase, date of installation, meter locations, and accuracy test data.

*Improvements in Water Meter Testing Needed*

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## **Appendix A**

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### **Director of Water Services' Response**

*Improvements in Water Meter Testing Needed*



**KC WATER**  
**OFFICE OF THE DIRECTOR**

**RECEIVED**

**MAY 17 2019**

**CITY AUDITOR'S OFFICE**

**Date:** May 17, 2019  
**To:** Douglas Jones, City Auditor  
**From:** Terry Leeds, Director *TL*  
**Subject:** Response to Performance Audit: *Improvements in Water Meter Testing Needed*

**1. Water Services should not install new water meters that fail their accuracy testing.**

Agree.

KC Water relies on the meter manufacturer's certified test results, which are shipped with each new meter, to ensure meter accuracy. All new meters installed are accurate as evidenced by the manufacturer's certified testing. Our policy has been to conduct random sampling and testing of new meters to maintain confidence in the manufacturer's tests. However, the KC Water test bench has been inoperable for periods of time over the last few years due to a variety of issues including a move in December 2016 from the 18<sup>th</sup> St location to a new location on Wabash and to install new software that occurred in February 2017. After the move and installation of the new software, many of the tests conducted, using new meters, were for training purposes and to test fixes after troubleshooting problems with the test bench.

However, because we failed to properly document the purpose of all the testing conducted, we plan to exchange and retest the meters that the meter test bench indicated failed the testing and were installed. Completion will depend on the response rate from customers who have meters inside the house and scheduling an appointment. Target completion date is June 1, 2019.

Moving forward, all meter testing will be labelled to describe the purpose, e.g. training, bench test, new meter random sampling test, pull and test, etc. No new meter tested as part of random sampling will be installed after failing a KC Water test. Meters that fail a second test will be returned to the manufacturer.

The Meter Shop Supervisor is now required to review and approve all new randomly sampled and tested meters.

**2. Water Services should update water meter testing policies and procedures to require random sampling of new meters and a sample size that provides adequate confidence that the sample represents the accuracy of the entire batch.**

Agree in part.

We will update the water testing policies and procedures. Target completion date for the update is June 8, 2019.

Because the manufacturer certifies their flow tests on all new meters and sends the results with each shipment, testing of new meters by KC Water will be done primarily for training purposes to maintain skills for testing pulled and large rebuilt meters. New meters selected for testing will not be done in order to provide a confidence level that represents the accuracy of the entire batch. Our position is the entire batch has already been tested by the manufacturer and passed for accuracy.

See City Auditor's comment about Water Services' response to recommendation #2 on page 23.

**3. Water Services should ensure that a sample of each new water meter batch is tested.**

Agree. This will begin immediately.

**4. Water Services should ensure pulled water meters are tested with a low, medium, high flow order.**

Agree.

Per the AWWA Manual, a low, medium high flow should be used, however, the test bench was installed by the manufacturer with a high, medium, low test sequence. We worked with MARs to reprogram the test bench to a low, medium, high test on April 17, 2019.

**5. Water Services should ensure pulled water meters are tested only once.**

Disagree.

Tests can be negatively impacted for a variety of reasons such as user error (entering the wrong start and end reads) the test bench losing connection to the computer, using the wrong test with inaccurate tolerance levels. Under those scenarios, we need to retest the pulled meter. However, notes will be entered on the second test stating why the first test was invalid.

**6. Water Services should reimburse customers charged for pull tests that failed but were reported as passed.**

Agree in part.

This comment was directed at two meters that were tested and the report from the test bench showed the meters had passed. However, when reviewing the results, both meters were slightly outside of the tolerance range. After investigating this with Mars, who developed and supports our test bench, they said a programming error was discovered in 2018 which caused the reports to drop off the decimal points or cubic feet in the calculation and resulted in those tests showing as passed.



The programming error was fixed in version 3.0 of the test bench software which was updated October 19, 2018.

One meter tested out of tolerance by .01% on the low flow but stated that it had passed. We have contacted the customer and processed a refund for the cost of the test.

The second meter was still available as we keep pulled meters for 12 months in the event additional testing is required. We ran the test again on that meter on February 1, 2019 and it passed on all flows. However, we will reimburse the customer for this meter test based on the original test results.

Going forward, we will only charge the customer for a meter pull and test if the test results are within or below tolerance levels set by the AWWA. In addition, the Meter Shop Supervisor and the Special Accounts Supervisor are now required to review the results to ensure accuracy and appropriate tolerance levels.

**7. Water Services should develop a comprehensive water meter replacement strategy that includes:**

- **Water meter replacement criteria based on ongoing testing of in-service meters; and**
- **A comprehensive water meter database that includes active and inactive meters with basic meter descriptive characteristics such as size, make, model, serial number, date of purchase, date of installation, meter locations, and accuracy test data.**

Agree.

As meters age, they tend to under register the amount of water flow. A comprehensive water replacement strategy needs to be developed to minimize loss of revenue. Target date to develop a meter replacement strategy is September 1, 2019.

The meter replacement strategy will be based on testing of pulled meters and will use the results of the testing to determine the age where the average loss of accuracy outweighs the cost to replace the meter.

The meter data described above needs to be available in our systems to support the meter replacement strategy.

cc: Troy M. Schulte, City Manager

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*Improvements in Water Meter Testing Needed*

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**Appendix B**

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**City Auditor's Comments on the Director of Water Services's Response**

*Improvements in Water Meter Testing Needed*

## City Auditor's Comments on the Director of Water Services' Response

Under Government Auditing Standards, when an audited entity's response comments are inconsistent with findings, conclusions, or recommendations or do not adequately address recommendations, auditors should evaluate the validity of the comments. If they disagree, auditors should explain in the report their reason for disagreement. This appendix is the city auditor's written comments on the director of water services' response to this audit. The director's response is Appendix A.

### Comment to Recommendation 2

We disagree with Water Services' decision to not perform statistical sample testing of new meters purchased with certified test results from the manufacturer. Although the department states testing of new meters will be done for training purposes, that is not sufficient to address American Water Works Association's (AWWA) recommended practice. When meters have certified test results from the manufacturer, AWWA recommends testing a statistical sample of new meters, rather than all new meters, in order to provide reasonable assurance that the manufacturer's test results are accurate.<sup>18</sup>

As stated in the report, the department's test bench data in fiscal year 2018 showed 47 out of 246 certified new meters tested failed their accuracy testing despite the manufacturers' certification that the meters' test results were within accuracy tolerances. While it is beneficial to the city that the department is purchasing meters tested by the manufacturer, the manufacturer is not an objective third party.

The department's decision to discontinue accuracy testing of new meters is a change from Water Services' current written operating procedures that state "despite the fact that new meters are typically tested and certified by the manufacturer, WSD will test a sample of each batch of new meters received to ensure that new meters that are purchased meet WSD's specified accuracy requirements."

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<sup>18</sup> *American Water Works Association Manual of Water Supply Practices M6, Water Meters Selection, Installation, Testing, and Maintenance*, (Fifth Edition, 2012), p. 57.