



CITY OF KILLEEN

WATER METER REPLACEMENT PROGRAM

Audit Report #24-03

A Report to the City of Killeen Audit Committee

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EXECUTIVE SUMMARY



AUDIT REPORT HIGHLIGHTS

Why Was This Audit Conducted?

The City Auditor proposed this audit to the Audit Committee as part of an ongoing effort to review new programs and revenue-generating activities.

The City Auditor appreciates the cooperation of Development Services, Public Works, Finance and Information Technology management and staff on the completion of this audit.

Water Meter Replacement Program Audit

Mayor and Council,

I am pleased to present this audit of the Water Meter Replacement Program.

Audit Objectives

The objectives of the audit were to (1) determine the status of the City's Water Meter Replacement Program; (2) conduct benchmark analysis on water meter replacement programs implemented in other Texas cities, and (3) assess the costs and benefits of accelerating the rollout of smart meters.

Audit Results

In August 2021, the City of Killeen launched its Water Meter Replacement Program for the purpose of upgrading the City's aging infrastructure of 55,000+ mechanical water meters to a digital-based Advanced Metering Infrastructure (AMI). The authorizing resolution proposed a 5-to-10-year rollout of digital smart meters. Management subsequently opted for an 11-year rollout to be accomplished in increments of 5,000, paid for out of available funds in the Capital Improvement Program Fund. The incremental rollout, which is scheduled for completion in FY 2033 does have several benefits: (1) It is fiscally conservative and avoids the need for additional debt; (2) it allows ample time to employ lessons learned from prior installments; and (3) the measured pace ensures a less disruptive replacement cycle as the meters reach their end of life. It does, however, delay the full benefits of the program, such as early leak detection and reduction of revenue loss from the aging infrastructure, estimated at \$2 million annually. Further, the planned rollout is markedly more conservative than those of other municipalities, including the City of Fort Worth, which replaced its 275,000 water meter system in 2.5 years, and Cedar Park, which replaced its entire system of 23,800 water meters in approximately 7 months. Since the original proposal did provide a range of timeframes, it is worth considering the relative costs and benefits of those options in choosing the best path forward.

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INTRODUCTION

The City Auditor conducted this performance audit of the Water Meter Replacement Program pursuant to Article III, Chapter 40 of the City Charter, as amended May 11, 2013, and in accordance with the City Auditor's Bi-Annual Audit Plan, approved by the Audit Committee on July 18, 2023. The purpose of the audit was to review the status of the City's Water Meter Replacement Program.

The objectives of the audit were to (1) determine the status of the City's Water Meter Replacement Program; (2) evaluate the program compared to other Texas cities' meter replacement programs; (3) assess the costs and benefits of accelerating the rollout of smart meters.

The scope of the audit focused on water meter replacement activities from FY 2021 through June 2024.

Background

The history of the water meter in the United States dates back to the mid-19th Century. In 1850, the first water meter patent in the U.S. was recorded by William Sewell of Williamsburg. Early water meters were mechanical and functioned like a water mill, using a gear-driven counting mechanism to measure water use. Mechanical water meters, also referred to as analog meters, remained in widespread use through the 20th Century and into the first decade of the 21st Century. However, that began to change early in the second decade of the 21st Century when advances in water meter technology coupled with problems inherent with analog meters prompted the transition away from mechanical meters in favor of "smart" digital water meters. The problems most often cited with mechanical meters were revenue loss due to inaccurate measurement of water use and the inability to detect leaks in real time.



Revenue Loss

The mechanical nature of analog meters makes them subject to wear over time as water flow, mineral buildup, and debris take their toll on the moving parts. This, in turn, diminishes the accuracy of the meters, which may begin to go out of calibration in as little as two years, according to some industry studies. Generally, the inaccuracies accrue on the side of underbilling as the aging meters fail to capture total waterflow. The U.S. Environmental Protection Agency estimates total revenue loss nationwide resulting from inaccurate water meters at \$2.6 billion annually.



Leak Detection

In addition to revenue loss, analog meters are not adept at real time leak detection for non-visible leaks.

Typically, unexpected swells in water use due to leaks may not be detected until meter readings occur at the end of a billing cycle, by which time hundreds, even thousands of gallons of water may have been lost. The U.S. Environmental Protection Agency estimates that nearly a trillion gallons of water are lost annually through leaks.



The impact of undetected leaks is both financial and environmental, affecting not only the customer's pocketbook, but also impacting local water conservation efforts.

Transition to Smart Meters

The movement toward electronic "smart" meters began in earnest around 2013 when mainstream manufacturers began producing them. The benefits of the electronic meters are severalfold. The meters do not have moving parts, and therefore are not subject to wear and the diminished accuracy that results from wear. Instead, the electromagnetic meters use embedded electrodes to measure water velocity. In addition, smart meters are the primary component of what is referred to as the advanced metering infrastructure (AMI), an

integrated network of water meters, communication networks, and sensors that allows for automated billing and real time monitoring. Through the AMI, both Utility Collections staff and customers will be able to monitor water usage in real time, allowing for early leak detection and other cost saving measures.



Source: Internet, Information Technology, Engineering

How AMI Works

Under the AMI system, a radio antenna connected to a digital water meter will transmit data on water usage to a base station mounted on one of the City's water towers. The base station will then relay the data to an encrypted cloud-based server, from which Utility Collections can download water usage data for billing purposes, as well as for real time monitoring. In addition, the AMI system will allow the customer to access their account and monitor their water usage in real-time through a customer portal. Access to this real-time data can assist both Utility Collections staff and customers in identifying leaks as they occur. Further, it will help customers to better manage their monthly water usage, thereby enhancing overall conservation efforts.

Statement of Compliance with Audit Standards

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. Those standards also require that we, as internal auditors, meet the criteria for independence. We believe that we met those independence standards, and that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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FINDINGS AND RECOMMENDATIONS

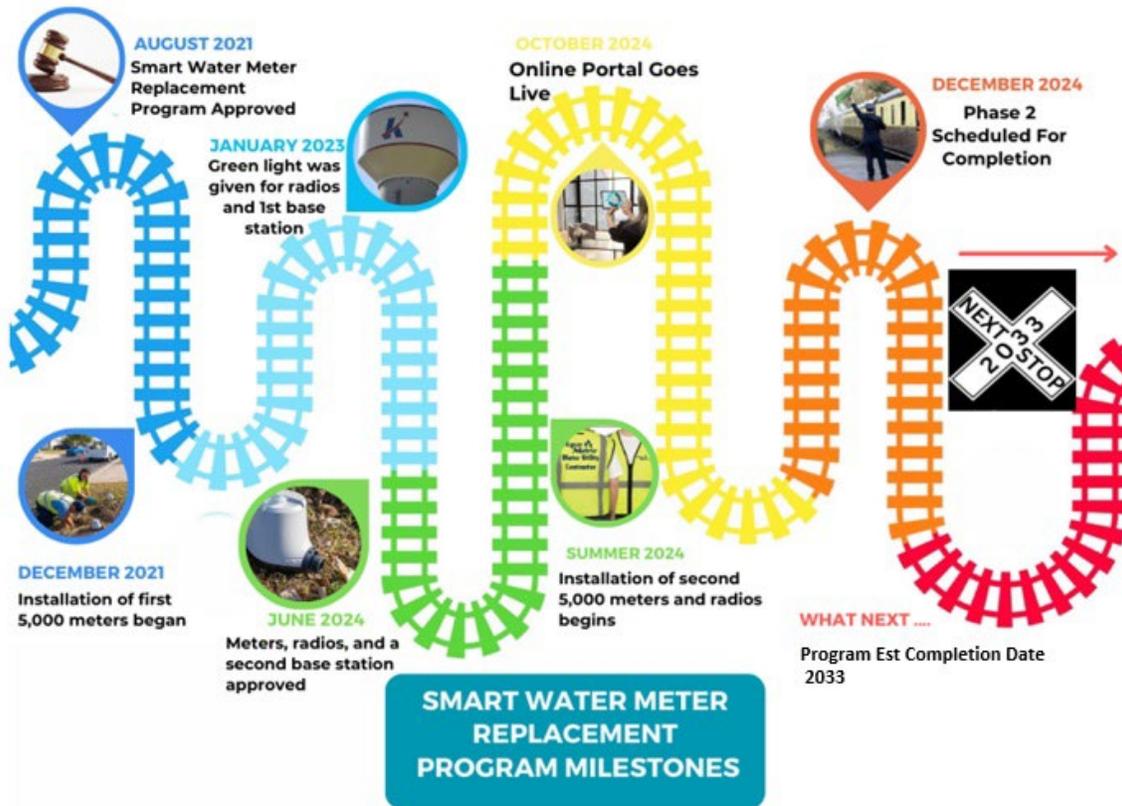
The City's Water Meter Replacement Program is on track, but at a much more modest pace than other municipalities with similar meter replacement programs.

In August 2021, the City launched its Water Meter Replacement Program to upgrade the City's aging infrastructure of 55,000+ mechanical water meters to a digital-based Advanced Metering Infrastructure (AMI). The original proposal to City Council suggested a 5-to-10-year rollout of digital smart meters. Management subsequently opted for an 11-year rollout to be accomplished in increments of 5,000, paid for out of available funds in the Capital Improvement Program Fund. As of the end of the 3rd quarter of FY 2024, the pilot project of 5,000 smart meters and radio antenna transmitters was nearing completion. In addition, the second 5,000-meter installment, outsourced to Aqua-Metric was authorized by City Council on June 4, 2024. Based on the program's current trajectory, it should be fully implemented by FY 2033. The incremental rollout does have several benefits: (1) it is fiscally conservative and avoids the need for additional debt; (2) it allows ample time to employ lessons learned from prior installments; and (3) the measured pace ensures a less disruptive replacement cycle as the meters reach their end of life. It does, however, delay the full benefits of the program, such as early leak detection and reduction of revenue loss from the aging infrastructure, estimated at \$2 million annually. Further, the planned rollout is markedly more conservative than those of other municipalities that outsourced their replacement programs to Aqua-Metric. The City of Fort Worth, for example, replaced its 275,000 water meter system in 2.5 years. Amarillo is on track to complete the replacement of its 70,000 meter system in 3.75 years. Cedar Park replaced its entire system of 23,800 water meters in approximately 7 months. While Councilmembers were provided a range of timeframes in the initial proposal for the replacement program, they would further benefit from a rendering of the relative costs and benefits of those timeframes in determining the best path forward, be it the current path or another option.

Water Meter Replacement Program – Project Milestones and Timeline

In August 2021, City Council authorized management to initiate its Water Meter Replacement Program. The purpose of the program is to upgrade the City’s aging infrastructure of 55,000+ mechanical water meters to a digital-based Advanced Metering Infrastructure. The original proposal suggested a 5-to-10-year replacement plan, beginning with an installment of 5,000 meters to serve as a pilot project. Management ultimately opted for an 11-year plan, accomplished in phases of 5,000 meters, paid for out of available funds in the Capital Improvement Program (CIP) Fund, and scheduled for completion in FY 2033.

Project Milestones



Source: Public Works, Engineering, Utility Collections, Information Technology

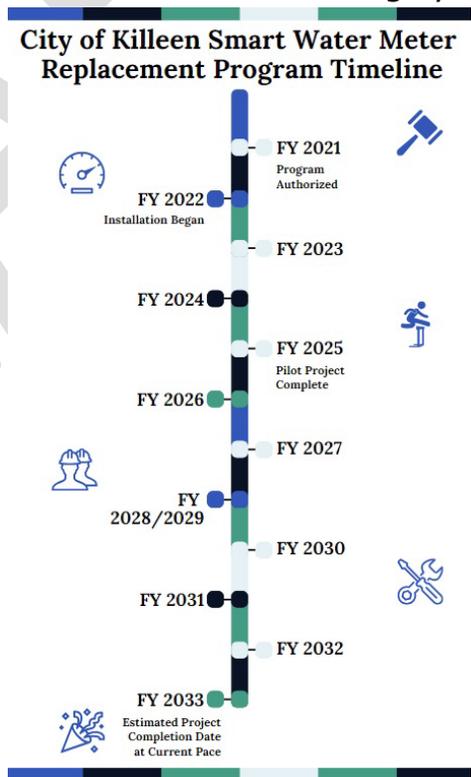
Phase 1 of the Water Meter Replacement Program began in the first quarter of FY 2022, in December 2021, with the installment of the first 5,000 meters. which was accomplished in-house, by City staff. In January 2023, City Council authorized the purchase and installation of 5,000 companion radio antennas for the digital meters, along with the

first base station. The installation of the radio antennas was outsourced to Aqua-Metric.

In June 2024, City Council authorized another 5,000 digital meters and companion radio antennas under Phase 2 of the program. Phase 2 was fully outsourced to Aqua-Metric and is expected to be completed by December 2024. In addition, Information Technology began working with Utility Collections on testing and training for the automated billing function and setting up the customer portal. Management expects to go live with the customer portal in the first quarter of FY 2025. Both Phase 1 and Phase 2 encompassed the area of North Killeen, north of the railroad tracks.

Program Timeline

The Water Meter Replacement Program’s timeline is driven largely by available funding, specifically Water and Sewer excess fund balance transferred annually to the CIP Fund. The FY 2025 Proposed Budget for the program in the CIP Fund provides for future funding of \$1.85 million annually through FY 2029, which should pay for the annual rollout of 5,000 meters and companion radios over the next 5 years. Assuming the availability of future funding remains constant, the program should be fully implemented by FY 2033.¹



Source: Public Works, Engineering

There are several benefits to the extended plan: (1) It is a fiscally conservative approach that relies on Water and Sewer excess fund balance transfers to the CIP Fund. As such, the extended plan avoids the need for borrowing, whether in the form of bond issuance or loans. (2) The plan also allows ample time to employ any lessons learned

¹ The City’s Financial Governance Policy regarding enterprise funds requires that the City maintain a working capital balance of 18 to 22 percent of operating expenses. Working capital balances in excess of the 22 percent ceiling shall be appropriated for non-recurring capital projects. Should working capital fall below the minimum threshold, the City shall refrain from making additional appropriations.

from the pilot project, which should be completed in the first quarter of FY 2025, and will include automated billing for Phase 1 recipients, as well as the creation of the online customer portal. (3) Finally, the extended plan allows for a staggered, and therefore less disruptive, replacement cycle when the smart meters begin to reach their end of life.

While the manufacturer specs tout a 20-year life span for the digital meter's battery, one city we reached out to said they had encountered some battery life issues, with a small number of meters requiring replacement at around 5 years. It should be noted, however, that several other cities contacted had not experienced any such battery life issues.

Program Cost

As of June 30, 2024, the City had expended \$1,792,358 on its Water Meter Replacement Program, with \$1,552,450 remaining in the FY 2024 budget related to Phase 2 of the program. Current estimates of the total program cost range from \$18 million to \$20 million.

Water Meter Replacement Programs – Other Municipalities

The benefits of the extended plan notwithstanding, the City's incremental pace is decidedly more conservative than those of other municipalities with similar water meter replacement programs. As noted in the introduction, the nationwide trend toward digital water meters began in earnest during the last decade. More than a few Texas municipalities had initiated water meter replacement programs in the last decade, all of which had adopted a more aggressive replacement schedule. However, for comparative purposes, we limited our analysis to those municipalities that, like Killeen, had outsourced their replacement efforts to Aqua-Metric. They were: (1) Fort Worth, (2) Amarillo, and (3) Cedar Park. The following is a brief discussion of each.

City of Fort Worth, Texas

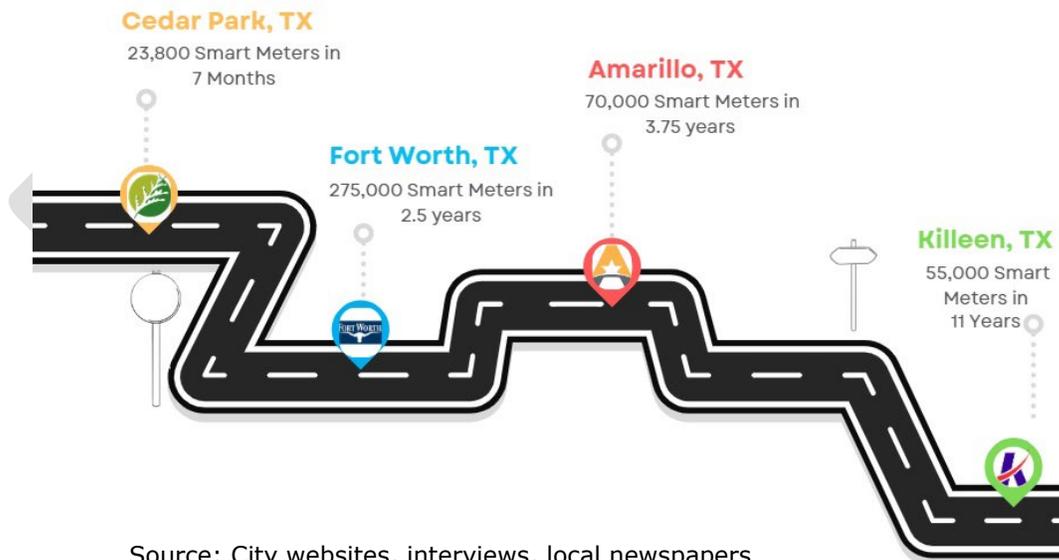
The City of Fort Worth began planning the AMI upgrade of its 275,000 water meter system in 2015. However, actual installation of the digital water meters, which was outsourced to Aqua-Metric, began in 2018 and was accomplished over a 2.5-year period. This equates to an installation rate of 110,000 meters per year making it the most aggressive plan in terms of annual workload. The replacement

program was funded in large part by the Texas Water Development Board, through a State Water Implementation Fund for Texas (SWIFT) loan.

City of Amarillo

The City of Amarillo initiated its AMI upgrade in March 2022. With approximately 70,000 water meters systemwide, Amarillo’s infrastructure is the closest in size to Killeen’s 55,000+ system. The replacement program was outsourced to Aqua-Metric and was initially scheduled for completion in April 2024. However, Amarillo had to push the program’s completion date back to December 2025, due in part to supply chain issues, according to staff. The 3.75-year project timeline equates to an annual installation rate of about 19,000 meters. The replacement program was funded through the Texas Water Development Board’s Drinking Water State Revolving Fund (DWSRF) Loan Program.

Timeline for Smart Water Meter Replacement Programs Across Municipalities



Source: City websites, interviews, local newspapers

City of Cedar Park

The City of Cedar Park was the most aggressive in terms of its project timeline coming in at less than one year. The City initiated the AMI upgrade of its 23,800 meter system in 2017. Program implementation

was outsourced to Aqua-Metric and was completed in approximately 7 months, which equates to an annualized installation rate of about 49,000 meters. The program was funded in part by the City's fund balance, supplemented by bond proceeds.

Considering the 5-Year Option

As previously mentioned, management's initial proposal for the Water Meter Replacement Program suggested a 5-to-10-year implementation plan. Management opted for a fiscally conservative approach that relies on available funding and is currently on track for an 11-year rollout. This assumes that future transfers of excess Water and Sewer fund balances to the CIP Fund remain constant. By contrast, the above-mentioned benchmark cities adopted timeline-based approaches and marshaled resources, accordingly. While there are clear benefits to the City's funding-based approach, there are also benefits to a timeline-driven approach. The shorter timeframe would lessen the risk of project disruption through turnover in key positions. It would also lessen the time period during which Utility Collections would have to maintain a dual-track billing system of manual meter readers and automated billing through its Advanced Metering Infrastructure. Further, the shortened timeframe would reduce revenue loss from the mechanical meters. Finally, it would hasten online access to real-time monitoring for the purpose of early leak detection and enhanced water conservation capabilities.

Revenue Loss Avoidance

Water and Sewer management estimates revenue loss from the City's aging mechanical meter infrastructure at approximately \$2 million annually. This is based on annual purchases of approximately 6 billion gallons of water from the Bell County Water District and a water meter billing accuracy rate of about 95 percent (i.e., revenue loss of 5 percent) on the City's infrastructure of analog meters. On a per meter basis this averages out to about \$36 in lost revenue annually per account for the City's 55,000+ water meters.

Under the extended plan, the City will continue to lose revenue on the remaining inventory of mechanical meters through FY 2033. Based on a replacement rate of 5,000 meters annually, this would amount to approximately \$7.8 million in lost revenue by the end of the replacement program. This assumes that future funding allows for the continued annual rollout of 5,000 smart meters.

Under the 5-year plan, the City would also continue to lose revenue, but only through FY 2029. The 5-year plan would require a doubling of the replacement schedule to 10,000 annually, increasing to 15,000 in the final year. The estimated revenue loss under the 5-year plan would be reduced to approximately \$4 million for a net reduction of approximately \$3.8 million in future revenue losses, which would offset, at least in part, any additional borrowing costs. Additional borrowing costs could be further reduced by grants. The City of El Paso, for example, secured over \$5 million in federal grants from the Bureau of Reclamation and the Environmental Protection Agency for their water meter replacement program.

Enhanced Water Conservation

While the City recently downgraded its Water Conservation Plan from Stage 2 to Stage 1, due to increased rainfall, it remains in a state of water conservation. One of the main benefits of smart meters is the capability of early leak detection through real-time monitoring of water flow by Utility Collections staff, or by residents through the customer portal. The U.S. Environmental Protection Agency estimates that nearly a trillion gallons of water is lost annually through leaks. The impact of undetected leaks is both financial and environmental, affecting not only City coffers and the customer's pocketbook, but also impacting water conservation efforts.

In addition to early leak detection, real-time monitoring afforded by the customer portal will help empower residents and businesses to better manage their water consumption. For example, San Antonio Water System (SAWS) management noted that their transition to smart meters had helped a significant number of residents with irrigation systems to reduce their activity and bring them into compliance with SAWS Stage 2 drought restrictions. Similarly, the City of Killeen's Water and Sewer Department recently raised its fees for upper tier water usage levels, in part to encourage customers to moderate their water usage. Real-time monitoring through the customer portal would help customers to better manage their water usage to avoid triggering the higher rates. Toward that end, the sooner that water meter replacement is achieved, the greater the benefits in terms of facilitating customers' water conservation efforts.

Timeline Driven vs Funding Driven

Ultimately, the different approaches adopted by Killeen and the benchmark cities boil down to one of timeline driven by funding versus

funding driven by timeline. There is merit to both approaches. One is a fiscally conservative, measured approach, while the other uses debt issuance to accelerate the benefits of the program. The initial proposal for the Water Meter Replacement Program suggested alternative timelines for implementation. However, it did not fully develop for City Council's consideration a thorough cost-benefit analysis of the different timelines proposed. Since the program is still in its infancy, there remains time for management to revisit the initial options presented to City Council and provide a cost-benefit analysis of those options for consideration in choosing the best path forward for the City.

Recommendations:

The City Auditor Recommends that the Executive Director of Development Services:

1. Work with the Executive Director of Public Works, Executive Director of Information Technology, and the Executive Director of Finance to develop a cost-benefit analysis for the alternative timelines presented to City Council in the initial proposal for implementation of the Water Meter Replacement Program.
2. Work with the Executive Director of Public Works, Executive Director of Information Technology, and the Executive Director of Finance to research potential grant funds available to supplement CIP funds designated for the Water Meter Replacement Program, including but not limited to the Federal Bureau of Reclamation and the Environmental Protection Agency.

VIEWS OF RESPONSIBLE OFFICIALS

We provided copies of the draft report to the Executive Directors for Development Services, Public Works, and Finance, the Operations Manager for Water and Sewer, City Engineer, and Assistant City Engineer for review and comment. They agreed with the conclusions in the report, and their feedback and input are reflected throughout the report.

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OBJECTIVES, SCOPE AND METHODOLOGY

Objectives

The objectives of the audit were to (1) determine the status of the City's Water Meter Replacement Program; (2) evaluate the program compared to other Texas cities' meter replacement programs; (3) assess the costs and benefits of accelerating the rollout of smart meters.

Scope and Methodology

The scope of the audit focused on water meter replacement activities from FY 2021 through June 2024.

To address the audit objectives, we:

- ▶ Held discussions with key personnel, including the Water and Sewer Director; Assistant City Engineer; Utility Collections Director; Information Technology Director; Budget Director; Financial Consultant for Infrastructure Management; Utility Programs Manager; City of Cedar Park; Utilities Analyst, City of Amarillo; and Utility Services Supervisor, City of Arlington.
- ▶ Conducted research on the history of water meters and the development of digital "smart" meters.
- ▶ Conducted research on benchmark cities in Texas with water meter replacement programs completed or in progress.
- ▶ Reviewed resolutions, reports, budget data and other pertinent documents related to the Water Meter Replacement Program.
- ▶ Analyzed future revenue loss under different project timelines.

Statement of Compliance with Audit Standards

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. Those standards also require that we, as internal auditors, meet the criteria for independence. We believe that we met those independence standards, and that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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