Introducing Water Loss Auditing to Oklahoma Water Systems

DEQ
OKLAHOMA
DEPARTMENT OF ENVIRONMENTAL QUALITY

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I. Executive Summary

This report summarizes a pilot project conducted by the Oklahoma Department of Environmental Quality (DEQ) that took a preliminary look at water loss levels across the state and examined the feasibility of introducing water loss auditing according to a standardized method. DEQ staff members were trained on conducting the American Water Works Association (AWWA) M36 water loss auditing method, then selected a pool of forty small volunteer Community Water Supplies (CWSs) from across the state to receive a water loss audit during the spring through the late summer of 2015.

A wide range of auditing results were obtained from the participating systems, but on average around thirty percent of water produced by the CWSs was determined to be nonrevenue. Twenty-two percent of the nonrevenue water was real loss (loss due to water main leaks, overflows at storage facilities, and leaks on customer service taps), 4.4% of the nonrevenue water was apparent loss (paper losses primarily due to under-registering meters), with the remaining 3.6% classified as unbilled authorized consumption. For the forty CWSs, apparent losses were valued at $1,219,921.00, while real losses were worth either $2,502,744.89 (valued at variable production costs) or $6,398,325.56 (valued at retail costs).

The auditing process also illuminated a wide range of infrastructure and operating conditions at the participating systems, as indicated by a data validity score. The unitless data validity score is a gauge of how much confidence should be placed in the data: scores above fifty could indicate water loss audit results that were reliable, while scores below fifty point to problems with the accuracy and precision of data management at the CWSs. In the pilot project, data validity scores ranged from a low of twenty to a high of eight-three, with an average of fifty-three.

Based on the results of the pilot, DEQ recommends that the results of the pilot project should be built on by bottom-up leak detection and meter analysis work with the CWSs that have both high data validity and significant problems with real and/or apparent loss in order to pinpoint sources of water loss. Also, follow-up water loss audits should be conducted with the participating systems to gauge the success of CWSs efforts to improve water loss and data validity scores, and DEQ should continue to promote the use of the AWWA M36 method to all CWSs across the state. Finally, DEQ recommends that a CWS water loss auditing study broader in scope than this pilot project be conducted so that a more comprehensive statement about state-wide water loss levels can be made.

II. Introduction

A. Project Background & Funding

Community Water Systems (CWSs) have played an instrumental part in the growth and improvement of Oklahoma. They are essential for providing the clean, safe water needed for public health and safety, good hygiene, and economic growth. Since before the founding of our state, Oklahoma communities have constructed infrastructure to withdraw water from available resources, to treat that water to an acceptable level of cleanliness and purity, and to distribute it to the public via buried piping distribution systems. Given the impressive levels of growth and development the state has enjoyed since admission to the Union, it is accurate to say that Oklahoma's CWSs have been notably successful in meeting the various needs of the communities they support.

Yet for all their successes, many CWSs in the state operate with significant inefficiencies in terms of water and revenue losses. As Oklahoma strives to cope with increasing growth and development, higher costs for goods and services, and years of significant drought, it has become imperative that these inefficiencies be quantified, addressed, and brought under a reasonable level of control. Water loss auditing is the primary means for generating the information needed to accomplish this.

A water loss audit program identifies and quantifies amounts of real and apparent water losses from a distribution system. Real loss is defined as water that escapes the water distribution system through leakage, breaks, and storage overflows. This loss is water that is treated but is never delivered to customers and results in increased operational costs and stress on source water supplies. An apparent loss is water lost due to customer meter inaccuracies, billing system data errors, and/or unauthorized consumption. It is water that could have been sold and contributes to revenue loss and distorted data production and customer consumption patterns.

Currently, there is no standardized method of accounting for water loss at Oklahoma's CWSs. There is no data on how many CWSs in the state are tracking water loss, or on what methods may be used by those systems that are tracking it. To promote efficient stewardship of the state's supply of fresh water, the Oklahoma Department of Environmental Quality (DEQ) believes that CWSs across the state should begin conducting water loss auditing using a standardized, scientifically sound, repeatable, and comparable method. To take a first step towards determining the feasibility of standardizing and promoting water loss auditing, DEQ designed a pilot project where water loss auditing, conducted according to an industry-standard and using a best management practice method, would be conducted at forty small volunteer CWSs drawn from across the state. This report documents the results of that project. Approval for the project was obtained from the Environmental Protection Agency (EPA) in late 2014, and the pilot project was funded via the fifteen percent set-aside designated for technical assistance from the state Drinking Water State Revolving Fund (DWSRF).

B. Project Framework, Methodology, & Goals

To take a preliminary look at water loss levels across the state and to examine the feasibility of state-wide use of a standardized method of water loss auditing, the DEQ conducted a pilot project focused on conducting water loss auditing at forty small Oklahoma CWSs using the International Water Association / American Water Works Association (IWA/AWWA) Water Loss Audit Method, a best management practice methodology considered to be the industry standard for identifying and quantifying real and apparent water losses. To achieve this, a work plan and a Quality Assurance Project Plan (QAPP) were first developed for the project which were reviewed and approved by EPA in late 2014. Together, these documents established the framework that guided the pilot project's subsequent steps, including the training of DEQ staff to become water loss auditors, the selection of the participating CWSs, the actual auditing process, and the submittal and management of project data. The work plan and QAPP established the following goals for the project:

- Conduct a water loss audit using the AWWA M36 method at forty CWSs, drawn from four quadrants of the state.
- Determine the type and amount of water loss occurring at each CWS.
- Inform each CWS of the results of the water loss audit.
- Assist each CWS in developing a plan to address sources of water loss.
- Provide each CWS with information regarding grant or other funding opportunities to finance projects aimed at improving or reducing water loss.

Once the work plan and QAPP were approved, a pool of DEQ Environmental Specialists and Professional Engineers, drawn from the agency's Environmental Complaints and Local Services (ECLS) Division and Water Quality Division (WQD), attended a week-long training session in January 2015 focused on the AWWA M36 Water Loss Auditing Method, taught by staff from the Southwest Environmental Finance Center (EFC). The training included both classroom training and on-site, hands-on training at a nearby CWS. The focus of the training was to produce trained water loss auditors that could both conduct a water loss audit and teach CWS personnel how to use the AWWA Water Loss Auditing Software that is a companion to the M36 method and is available without charge from the AWWA. DEQ staff who completed the training received certification as water loss auditors.

Concurrent with training, an initial group of 80 CWSs were selected by DEQ to be potential participants in the pilot project, based on ECLS and WQD staff professional judgement. The potential participants were surveyed to gather general information about the CWSs and to determine their willingness to participate, and from the initial group forty CWSs were invited to take part. All of the participating CWSs served populations less than 10,000, and were either operated by towns, rural water districts, or a Native American tribe. The makeup of the final group of 40 systems was set by March, 2015, and was as follows:

Table 1: CWSs Participating in the Pilot Project

Ames	Antlers	Atoka RWD 3	Beaver	Burns Flat	Canute	Chattanooga	Cherokee RWD 7
Choctaw RWD 1	Colbert	Dewar	Drumright	Elmore City	Eufala	Fletcher	Grady RWD 6
Hominy	Hooker	Langley	Lenapah	Lexington	Locust Grove	Logan RWD 3	Lone Grove
Luther	Marietta	Mooreland	Noble	Otoe Missouria	Pawnee	Perkins	Perry
Pittsburg RWD 9	Sequoyah RWD 4	Shattuck	Stilwell	Thackerville	Thomas	Wayne	Wister

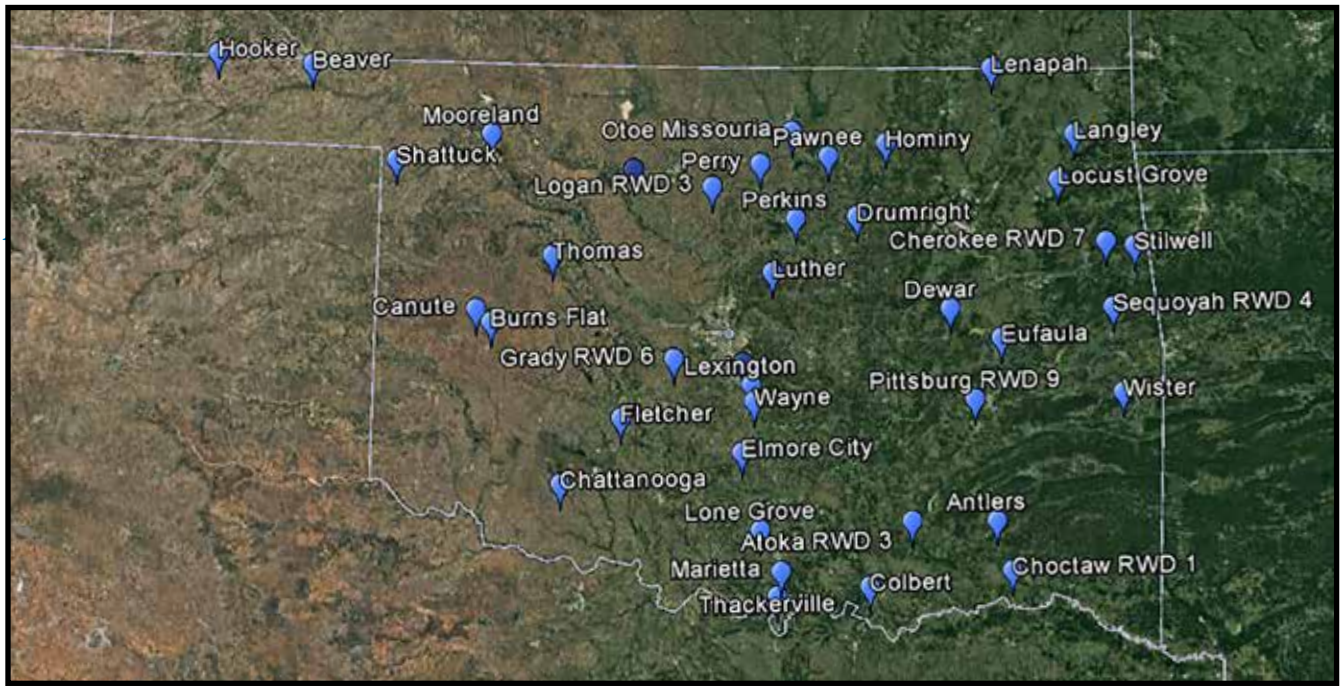


Figure 1: CWSs Participating in the Pilot Project

The forty CWSs in the pilot project represented a discretionary sampling of 3.7% of the total number of CWSs in Oklahoma. The audited CWSs serve 2.4% of the state's population, and the group was comprised of thirty-two municipal systems, seven rural water districts, and one tribal system. Additional details about the participating CWSs are in Table 2, below:

Table 2: Summary Characteristics of Auditted Community Water Systems	
Total Number of CWSs Audited:	40
Total Number of Persons Served:	75, 739
Percent of State CWSs represented by audit:	3.7%
Percent of Oklahomans served by audited systems:	2.4%
Total Number of Service Connections:	38,579
Total Miles of Main:	3,141.3

Water Loss Audits were then conducted at the participating systems, occurring from May through August 2015. Auditing was conducted according to the AWWA M36 method, and efforts focused on both conducting an audit and on teaching CWS personnel how to use the AWWA M36 auditing software. A copy of the AWWA software, which is a Microsoft Excel spreadsheet, was left with the CWSs personnel for their use. The completed audits were submitted to the Project Manager as they were completed for review, corrections, and analysis. Once the review process was completed, a finalized copy of the water loss audit, along with recommendations for improving the accuracy of future audits, for addressing sources of real and apparent loss, and information on available grants and loans, was sent to each CWS.

C. Deliverables

DEQ has produced the following deliverables for this pilot project:

- Each CWS has had a water loss audit performed according to the AWWA M36 method. CWS staff members were instructed on how to use the method, and were given a copy of the software for their own use.
- Each CWS has received a copy of the water loss audit report, along with recommendations on improving the accuracy of future audits, on how to address observed issues with real and apparent loss, and on funding opportunities available to address infrastructure deficiencies contributing to real loss.
- This report, which summarizes the pilot project and the water losses observed at the forty participating CWSs.
- A database containing the water loss audit results for the forty participating CWSs.

III. Collected Data: Sources, Characteristics, & Quality Control

A. Data Acquisition

To conduct the water loss audits, DEQ staff traveled to the CWS facilities and obtained the following data for the audit from system records, maps, and interviews with operators and officials:

1. Determination of Water Supplied

The volume of water supplied to the system was determined by examining production meter records for water produced by the system or purchase master meter records for delivery to customers. Concerning production meter records, thirty-six of the CWSs possessed adequate computerized or paper records for determination of this factor. Of the final four, two CWSs had no functioning raw or finished water production meters (and were relying on pump run-time and billing records to estimate production), one of the two wells at another CWS had no functioning meter (requiring estimation based on bulk sales records and splash pad usage), and one CWS had no production meters at all on its surface water treatment plant (requiring production estimation based on customer sales). For the eight CWSs that imported treated water from another source and the seven that exported water to other systems, all of the CWSs had adequate paper or electronic import and/or export metering records for the time frame examined.

2. Determination of Authorized Consumption

Authorized consumption was defined as any water delivered for consumptive purposes that was authorized or approved by the CWS. Authorized consumption was water that provided a benefit for the community, whether for billed or unbilled use, and in the water audit process was broken down into the following categories:

a. Billed Metered Consumption

Billed metered consumption represented the collective amount of water delivered to individual customers that had permanent meters and connections installed by the CWS. In general, billed metered usage is usually the largest source of the revenue for a CWS, and generally represents the largest amount of authorized use. All of the CWSs participating in the pilot project had the majority of their authorized water usage in this category.

b. Billed Unmetered Consumption

Billed unmetered consumption was authorized water consumption that was not directly metered. Usage in this category was billed to the customer based on either an estimate or a flat fee. Twenty-eight of the CWSs had no billed unmetered usage. Of the remaining twelve, six CWSs had billed unmetered usage via bulk sales at a tank filling station, two CWSs had municipal buildings or sites that were billed a flat fee for water usage, and one CWS had two residences and two businesses receiving a flat fee for water service. The final four CWSs had unspecified billed unmetered usage.

c. Unbilled Metered Consumption

Unbilled metered consumption was the authorized usage of water from a CWS that was metered but by CWS policy was not billed for and did not generate revenue. Typically, this usage is water that the CWS uses itself in treatment or distribution operations, or is provided to civic institutions and/or public properties free of charge. Sixteen of the CWSs participating in the pilot project reported unbilled metered usage, typically for city offices, police and fire departments, city parks, senior citizen centers, fairgrounds, and ball fields. Eleven of the audited systems reported unbilled metered usage but did not specify uses. Thirteen of the CWSs reported no unbilled metered usage.

d. Unbilled Unmetered

Unbilled unmetered consumption was authorized water consumption that was neither billed nor metered. This category includes usage such as water for firefighting, water used to flush water mains, street cleaning, and for fire flow tests. This category may also include water provided without charge to civic institutions and/or public properties if they are served by unmetered connections. During the audit process, auditors relied on the default value of 1.25% of water supplied (established by the water loss audit software) to estimate this category of water usage unless more accurate information was available, which resulted in twenty-nine of the audits using the default value. For the remaining eleven CWSs, unbilled unmetered usage was estimated based on knowledge and detailed descriptions of the use (flushing times and/or volume used), firefighting (incidents responded to, estimated water used at incident, and/or number of loads carried by fire trucks), or institutional connection (type, size, and usage of facility).

3. Determination of Apparent Losses

Apparent losses were defined as the non-physical losses that occur when water was successfully delivered to a retail user but was not measured or recorded accurately. In this type of loss, water was not physically lost from the water system, but rather the errors and inefficiencies in metering and data management represented lost revenue to the CWS. Apparent loss consisted of the following three major components:

a. Unauthorized Consumption

Unauthorized consumption referred to theft of water from the CWS. This category included water illegally drawn from hydrants, illegal connections, meter bypasses and tampering, and other efforts used to circumvent a CWS's ability to collect revenue for water. The water loss audit software established a default value of 0.25% of water supplied to estimate unauthorized consumption; auditors used this default value unless the CWS has more accurate information available. Thirty-nine of the audited CWSs in the pilot project relied on the default value for unauthorized consumption; one system chose to input a more specific value (however, no detail on how the value was determined was provided).

b. Customer Metering Inaccuracies

Customer metering inaccuracy referred to apparent water loss caused by the collective under-registering of customer meters. Over time, customer water meters become worn and generally begin to under-register the amount of water passing through them. During the water loss audit process, customer meter inaccuracy was either assigned an average percentage to represent under-registering or the auditor assigned a specific volume to represent metering error. For using percentages, the CWS was assigned a value from 0.0% to 9.9%, based on the average age of customer meters in the system. CWSs with new or newer water meters were assigned error percentages of 2.0% or less; whereas CWSs with older customer meters received values of 2.0% to 9.9%, based on the judgement of the auditor and system staff. If the CWS possessed more accurate information regarding customer meter under-registering, the auditor placed a volume amount in place of the error percentage.

In this pilot project, thirty-five of the CWSs were assigned a customer metering inaccuracy value between 0.1% and 9.9%. Two CWSs were assigned specific values for meter inaccuracy, both greater than the 9.9% allowed by software to account for extreme meter age and wear. Three of the CWSs had no percentage of meter error assigned, based on auditor and system judgement. These led to a range of customer meter error ranging from 0.0% up to a maximum of 21.0% (including the specific values for error converted to percentages) with an average value of 5.59%. Aside from under-registering, customer meter inaccuracy was also impacted by two other factors: improper meter sizing relative to the customer's consumption profile, and inappropriate meter type to record flow variations. However, these two factors were not considered during the preliminary assessment completed by this pilot project.

c. Systematic Data Handling Errors

Systematic data handling errors referred to apparent loss originating from accounting errors, problem with computerized billing/record keeping, policy and procedure errors, and any other type of data lapse that resulted in under-represented water usage in customer billing records. The water loss auditing software assigned a default value of 0.25% of water supplied to account for data handling errors, but auditors could substitute a specific value for the default percentage if the CWS had specific data regarding these errors. Thirty-nine of the audits relied on the default value of 0.25%, but one CWS water loss audit reported a specific value (equal to 8.9% of water supplied) to account for the discovery of a water clerk regularly reducing water usage billed to a significant number of customers in the CWS.

4. Assessment of Infrastructure Factors

Information on the water system infrastructure was included in the water loss audit in order to both accurately describe the water system and for use in calculating the performance factors that the water loss audit software produces. Each of the following factors had bearing on the amounts of real and apparent water loss that the system was experiencing and was accounted for to create an accurate audit:

a. Length of Mains

Length of mains referred to the length of all pipelines in the system owned by the CWS, starting from the point of system input metering. Information on the total length of system mains was obtained from computerized mapping, paper maps, and/or operator knowledge. The forty CWSs examined during this pilot project had a total of three thousand one hundred twenty-one miles of water main, with a minimum of 2.5 miles and a maximum of one thousand two hundred miles. In general, municipal and tribal water systems had shorter systems to maintain, while rural water districts typically had longer systems, with an average length of water mains at 78.5 miles.

b. Number of Active and Inactive Service Connections

The number of active and inactive service connections referred to the total number of distinct piping connections extending from the water main to a customer, including fire connections. The AWWA software required the input of the total number of connections, which may or may not equal the total number of accounts in CWS records. Auditors obtained this number from CWS records and operator/staff knowledge. For the forty CWSs in the pilot, the systems had a total of thirty-eight thousand, five hundred seventy-nine active and inactive connections, ranging from a low of ninety-six connections to a high of two thousand five hundred eighty-three. The average number of connections was nine hundred sixty-four.

c. Service Connection Density

Service connection density was calculated by dividing the total number of service connections by the length of system water mains, and was automatically calculated by the AWWA software. In general, rural water districts in the pilot project had lower service connection densities than municipalities and the tribal system, primarily because they serve rural areas with fewer customers per square mile. For this study, service connection density ranged from 0.05 connection per mile to one hundred forty-six connections per mile, with an average of 37.5.

d. Location of Customer Meters/ Avgerage Length of Utility- Owned Service Line

During the course of a water loss audit, auditors determined the estimated average distance of the water lines between the water main and the meter that are the responsibility of the CWS. This average length, if known, was added to the total length of water mains by the software and contributed to calculations of water loss and performance factors. If the average length of water lines connecting customer meters was not known, a value of zero was entered into the software, which was the case for thirty-two of the audited systems. The remaining eight systems had service line lengths ranging from four to thirty feet, with an average of fourteen feet.

e. Average Operating Pressure

Average operating pressure referred to the average water pressure in the distribution system of the CWS being audited. The source of this information was either a hydraulic model of the water system or operator knowledge. For the forty audited CWSs, pressure ranged from a minimum of thirty-five psi to a maximum of one hundred psi, with an average of 57.8 psi.

5. Determination of Cost Data

Three levels of costs for water production were obtained during the AWWA water loss audit process in order to assess the financial impact of real and apparent water loss at the CWSs. Each level of cost allowed for the consideration of different aspects of real and apparent water loss costs, and was determined in the following ways:

a. Total Annual Cost of Operating System

The total annual cost of operating the CWSs included costs for operations, maintenance, and any annually incurred costs for long-term upkeep of the systems. This category included employee salaries, materials, equipment, insurance, fees, administrative costs, and all other costs required to maintain the CWSs. In this pilot, total annual costs varied from $16,831.00 to $1,661,375.00 with an average of $398,688.00. For one CWS, no annual cost data records were available for the audited year due to a computer failure.

b. Customer Retail Unit Cost

Customer retail unit cost referred to the charge that customers pay for water service. For the purposes of this pilot project, the customer retail unit cost was calculated as the average cost per thousand gallons of water for eight thousand gallons per month of residential use. This term was used to simplify and standardize the wide variety of rate structures employed by the audited CWSs that often varied according to customer class, location, and usage. The water loss audits conducted revealed a range of customer retail unit costs, from $1.87 per thousand gallons to $17.00 per thousand gallons, with an average of $6.85 per thousand gallons. In general, CWSs that relied on groundwater requiring minimal treatment had lower customer retail unit costs than CWSs that utilized surface water requiring more extensive treatment and CWSs that purchased treated water from a wholesaler. Customer retail unit costs were not calculated for one CWS due to poor record keeping available for the audit year.

c. Variable Production Cost

Variable production cost was the cost to produce and supply the next unit of water. It was calculated by summing the chemical treatment and electrical costs over the audit time frame for CWSs that produced and treated their own water. For CWSs that purchased water from a wholesaler, variable production cost was set at the per-unit cost paid for water by the CWSs to the wholesaler. For the systems in the pilot project, a range from $4.32 per million gallons to $77,860.00 per million gallons was observed, with an average of $4,517.25 per million gallons. Variable production costs were not calculated for two of the CWSs due (in one case) to records being lost due to a computer system failure, and a lack of financial records needed to calculate the cost at the other. Similar to values seen for customer retail unit costs, CWSs that relied on minimally-treated groundwater generally had lower variable production costs than CWSs treating surface water or purchasing water from an adjacent wholesale system.

B. Quality Control / Data Validity

Data validity was a unitless score assigned to the water loss audit that represented the accuracy of the information used to calculate the water balance and performance factors. The score was a weighted composite of validity scores assigned to each data component, and could range in value from one to one hundred. Higher data validity scores indicated higher levels of confidence in the audit results; likewise, lower validity scores meant that the audit results were not necessarily reflective of actual system conditions.

The data validation method used by the AWWA software was a process-based approach where the auditor assigned a validity score to each data category as it was entered into the spreadsheet. The AWWA software provided a scale for each data validity assessment, with higher scores assigned to more accurate and precise methods of data acquisition and management (e.g. automated water meter reading systems were scored higher than analog meters that were visually read by staff). For the participating CWSs, data validity scores varied from a low of twenty to a high of eighty-three, with an average score of 53.

C. Database Development

Once the site visits and water loss auditing was complete, DEQ staff submitted the completed water loss audits and locally-observed recommendations based on the audits to the Project Manager for review. The Project Manager reviewed each audit for consistency, errors, omissions, and other quality control issues and resolved any problems by conducting follow-up interviews with the auditors or audited CWSs. After the audits passed this review process, data from the audits was entered and maintained in a Microsoft Excel spreadsheet. Copies of reviewed audits, along with written recommendations based on audit results, were then distributed to each of the participating systems.

IV. Calculated Water Loss Quantities

The AWWA Water Loss audit software used in this pilot project automatically performed the calculations to determine the types of water losses, the amounts of revenue and nonrevenue water, and populated a water balance table reflecting water transfer within the CWS. The values from each water balance table for CWSs participating in the pilot have been summarized in tables 3 and 4 and figure 2, both in terms of total gallons and in percentage:

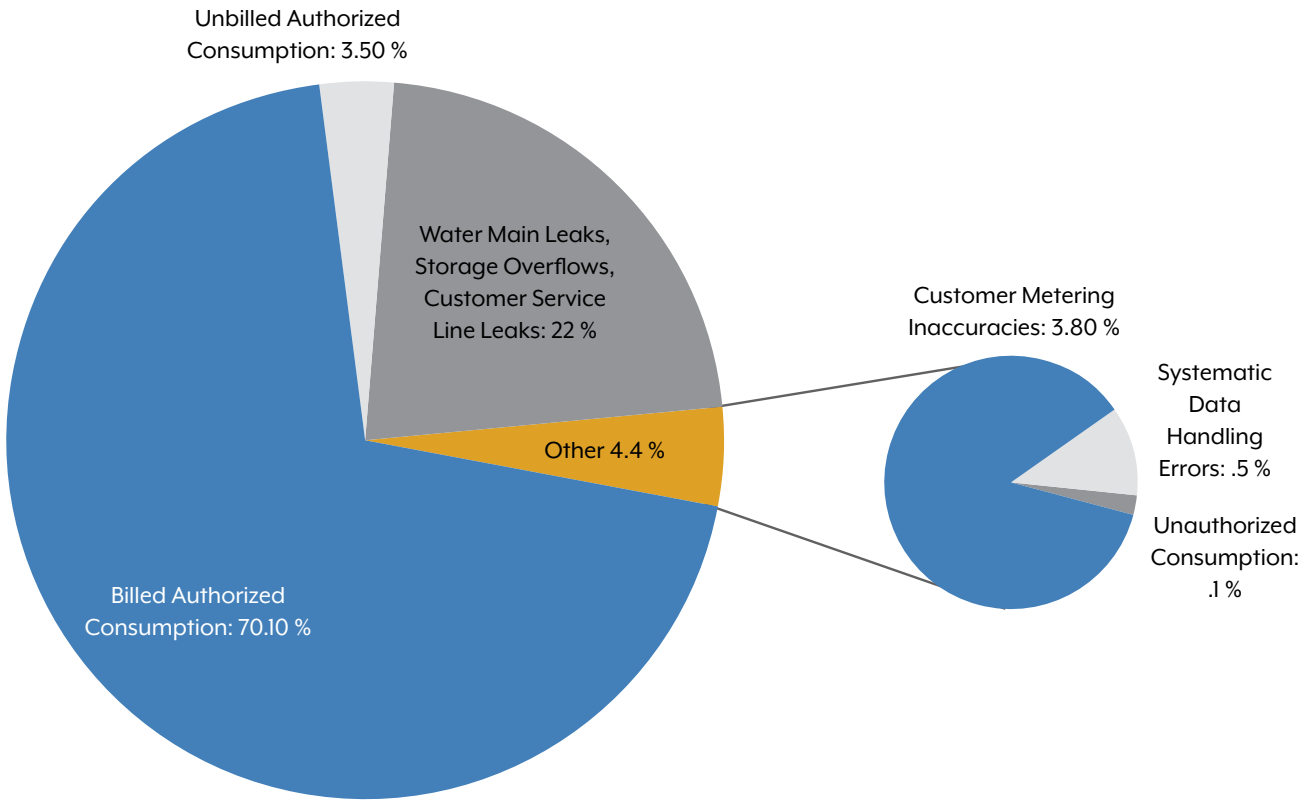
Table 3: Summary Water Balance - Total Yearly Gallons (± 15, 000 gallons)

Volume from Own Sources: 4,092,024,000	Water Sold As Exports: 449,299,000	Authorized Consumption: 3,194,855,000	Billed Authorized Consumption: 3,040,083,000	Billed Metered Consumption: 3,036,117,000	Revenue Water: 3,040,083,000
				Billed Unmetered Consumption: 3,967,000	
	Water Supplied: 3,889,134,000		Unbilled Authorized Consumption: 154,759,000	Unbilled Metered Consumption: 93,710,000	Non-Revenue Water: 1,298,351,000
				Unbilled Unmetered Consumption: 61,060,000	
		Water Losses: 1,143,583,000	Apparent Losses: 192,104,000	Unauthorized Consumption: 10,563,000	
				Customer Metering Inaccuracies: 162,588,000	
				Systematic Data Handling Errors: 18,956,000	
Water purchased as Imports: 246,408,000			Real Losses: 951,479,000	Water Main Leaks, Storage Overflows, Customer Service Line Leaks: 951,479,000	

Table 4: Summary Water Balance - Total Yearly Percentages

Volume from Own Sources: 94.3%	Water Sold As Exports: 10.4 %	Authorized Consumption: 73.6 %	Billed Authorized Consumption: 70.1%	Billed Metered Consumption: 70.0%	Revenue Water: 70.1%
				Billed Unmetered Consumption: 0.1%	
	Water Supplied: 89.6 %		Unbilled Authorized Consumption: 3.5%	Unbilled Metered Consumption: 2.1%	Non-Revenue Water: 29.9%
				Unbilled Unmetered Consumption: 1.4%	
		Water Losses: 26.4%	Apparent Losses: 4.4%	Unauthorized Consumption: 0.1%	
				Customer Metering Inaccuracies: 3.8%	
				Systematic Data Handling Errors: 0.5%	
Water purchased as Imports: 5.7%			Real Losses: 22.0%	Water Main Leaks, Storage Overflows, Customer Service Line Leaks: 22.0%	

Figure 2: Water Usage & Loss Percentages for Participating CWSs



A. Nonrevenue Water and Water Losses

1. Nonrevenue Water

Nonrevenue water was defined as the components of system input volume that are not billed and produce no revenue for the CWS; observed values and performance indicators for nonrevenue water are listed in Table 5.
The AWWA Water Loss Audit software calculated nonrevenue as the sum of apparent loss, real loss, unbilled metered consumption and unbilled unmetered consumption. The software reported nonrevenue water as the following three different performance indicators:

a. Nonrevenue Water as Percent of Supply

Nonrevenue water as percent of supply indicated the volume of nonrevenue water as a percentage of system input volume. This term was the performance indicator closest in concept to the older term "un-accounted for water" that has been used inconsistently for many years to portray water loss. In the pilot, nonrevenue water as percent of supply ranged from 5.8% to 91.0%, with an average value of 30.15%

b. Nonrevenue Water as Percent of Operating Cost (Variable Production Cost or Customer Retail Unit Cost)

Nonrevenue water was also examined in terms of value, as well as volume, and was compared to the total cost of operations for each CWS. For this examination, nonrevenue water was valued at both the variable production cost (the cost to produce the next unit of water) and the customer retail unit cost (calculated as the average per thousand gallon charge for 8,000 gallons of residential usage). In general, the value of nonrevenue water should be viewed from terms of the variable production costs unless water resources are strained and the ability of the CWS to meet future demand is in question.

In this type of analysis the maximum values for nonrevenue water as percent of operating cost can be quite high, easily exceeding 100% of operating costs in situations where water is either very expensive to produce/obtain, where water rates are high, or both. In such situations, nonrevenue water is a major drain on revenue and may be causing the CWS to operate in a deficit.

The ranges of nonrevenue water percentages of the participating CWSs, both as percentages of supply and of costs, are related in Table 5, below:

Table 5: Non-Revenue Water as a Percentage of Supply and of Operating Costs (Summarized from Appendix B)

	Minimum	Maximum	Average
Nonrevenue Water as % of Supply	5.8 %	91 %	30.15 %
Nonrevenue Water as % of Operating Cost (Variable Production Cost)	2.1 %	383.47 %	37.76 %
Nonrevenue Water as % of Operating Cost (Customer Retail Cost)	1.5 %	820.1 %	98.94 %

2. Apparent Losses

The totals and ranges of values of apparent loss are listed in Table 6, below.

Table 6: Apparent Losses (Summarized from Appendix B)

	Minimum	Maximum	Average	
Annual Apparent Loss:	70,000 gal/yr	25,093,000 gal/yr	4,80 2,600 gal/yr	192,104,000 gal/yr
Annual Cost of Apparent Loss:	$610.00	$163,449.00	$31,280.03	$1,219,921.00
Unauthorized Consumption	4,000 gal/yr	1,500,000 gal/yr	264,100 gal/yr	10,563,000 gal/yr
Customer Metering Inaccuracies	0 gal/yr	23,554,000 gal/yr	4,064,700 gal/yr	162,588,000 gal/yr
Systematic Data Handling Errors	4,000 gal/yr	12,592,000 gal/yr	473,900 gal/yr	18,956,000 gal/yr

Annually, apparent losses accounted for a smaller percentage of total water loss than real losses (4.4% as compared to 22%; see Figure 2). However, apparent losses still represented a significant loss of revenue to most systems participating in the audit, costing on average $31,280.03 per audited system and over $1.2 million for the group. Apparent losses were broken down by the AWWA water loss auditing method into the following three categories:

a. Unauthorized Consumption

Unauthorized consumption represented water that is stolen from a CWS, either via illegal taps, unauthorized connections to fire plugs, or other means. It was by far the smallest type of apparent loss observed in the pilot, accounting for 0.10% of the total water supplied. Values ranged from 4,000 gal/yr to 264,100 gal/yr, primarily based on the default value assigned to this category by the software (used by thirty-nine of the forty audited CWSs).

b. Customer Metering Inaccuracies

Customer Metering Inaccuracies was the largest category of apparent loss observed during the pilot, at 3.8% of total water supplied. Values ranged from zero gallons per year (assigned to three CWSs – one due to the installation of brand new meters, and two due to no information available on meter age) to a maximum of 23,554,000 gallons per year. Overall, metering inaccuracies accounted for a loss of over 162,000,000 gallons per year, and was a significant drain on revenue for several of the participating CWSs.

c. Systematic data Handling Errors

Systematic Data Handling Errors represented apparent water loss that was occurring via problems with metering and billing data management. Among the audited CWSs, this type of apparent loss ranked between that of customer metering inaccuracies and of unauthorized use, accounting for 0.5% of the total water supplied. Values ranged from 4,000 gallons per year to 12,592,000 gallons per year and were dependent on factors such as the type of record-keeping in use (paper versus computerized records), known and unresolved problems with billing software, and unread/unbilled accounts.

3. Real Losses

Overall, real water losses accounted for 22% of the total water supplied (Figure 2) and was the largest category of water loss observed from the group of CWSs. Real water loss was composed of three types of loss: water main leaks, storage area overflows, and leaks on customer service lines (portions that are the responsibility of the CWS). The AWWA software is not detailed enough to break down real water loss into these three categories and simply reports the amount as a total of all three. The AWWA software did, however, provide a number of performance indicators that detailed the volume, cost, and relative magnitude of real water loss. These are summarized in Table 7 and are defined and discussed below.

Table 7: Real Losses

	Minimum	Maximum	Average	
Current Annual Real Losses (CARL, 40 CWS systems)	140,000 gal/yr	102,530,000 gal/yr	23,787,000 gal/yr	951,479,000 gal/yr
Annual Cost of Real Loss (Valued at Variable Production Cost)	$24.00	$887,190.00	$65,861.71	$2,502,744.89
Annual Cost of Real Loss (Valued at Customer Retail Cost)	$805.00	$731,034.00	$177,731.27	$6,398,325.56
Unavoidable Annual Real Loss (UARL, 11 Systems)	6,570,000 gal/yr	242,470,000 gal/yr	42,234,000 gal/yr	464,570,000 gal/yr
Infrastructure Leakage Index (ILI, 11 systems)	0.11	13.61	3.26	N/A

a. Current Annual Real Losses (CARL)

Current Annual Real Loss (CARL) is defined as the volume of water lost from leaks (reported and unreported), background losses, and error-related overflows during the time frame examined by the audit. CARL is the total real water loss occurring within a CWS. For the participating systems, a total CARL of over 951,000,000 gallons of water was observed over the twelve-month time frame, accounting for twenty-two percent of the total water supplied. Values ranged from a minimum of 140,000 gallons per year to a maximum of 23,787,000 gallons.

b. Annual Cost of Real Loss

The AWWA software calculated the annual cost of real water loss based on both the variable cost of production and the customer retail unit cost. Pricing water at its cost of production, the total value of real water loss observed during the pilot was slightly over $2,500,000. Values ranged from a low of $24 to a high of $65,861, with lower real water loss costs typically found at systems with low levels of real loss, or at groundwater systems that required a minimum of treatment and/or relied on gravity to provide pressure (as opposed to more expensive treated surface water, water purchased from wholesalers, or systems requiring powered pumping).

c. Unavoidable Annual Real Loss (UARL)

The Unavoidable Annual Real Loss (UARL) was a term calculated by the AWWA software that represented the lowest loss technically achievable at a CWS based on the characteristics of the system. Since it is economically infeasible to build a CWS with absolutely no real water loss, the UARL represented the most efficient level of real loss that could be expected, using the best available material and most efficient operational methods. The UARL has been shown to be accurate only for larger CWSs. The calculations have not been substantiated for very small systems or for systems operating at pressures below thirty-five psi. Eleven of the CWSs participating in the pilot were large enough to conduct a UARL calculation, with a total of 464,570,000 gallons per year and values ranging from 6,570,000 gallons per year to 242,470,000 gallons per year. The real value of the UARL lies in its use in the calculation of the infrastructure leakage index, as described in the next section.

3. Infrastructure Leakage Index (ILI)

The Infrastructure Leakage Index (ILI) was a unitless performance indicator calculated by AWWA software that is a ratio of the CARL to the UARL (ILI=CARL/UARL). The ILI was an estimate of how well a system is managed and operated for the control of real water loss at the current operating pressure. In general, the closer to 1.0 the ILI is, the better managed the CWS. ILI values also provide a metric to determine if major line replacement projects would be cost-effective; higher ILI values indicate substantial revenue gains that could be realized by major line replacement. ILI values were calculated for the eleven CWSs in the pilot project that qualified for UARL calculations. ILI values ranged from 0.11 to 13.61.

The ILI score for a CWS was also an indicator of the economic feasibility of whether or not CWSs should undertake major line replacement projects to combat high levels of real water loss. An ILI score of 1.0 or less would indicate that observed levels of real loss were at or below what a well-managed and constructed system of similar size and pressure would expect for unavoidable background leakage. In this pilot project, four of the eleven CWSs had both ILI scores of less than 1.0 and nonrevenue

water (as percent of supply) levels greater than twenty percent. With high data validity, one could conclude that the wholesale replacement of all water mains in these systems would likely not be worth the cost.However, ILI values in this pilot project should be viewed with a measure of skepticism. The accuracy of the ILI is dependent on the validity of the data gathered for the audit. Given the range of data validity scores observed (particularly with calculated values less than 1.0), the ILI values in this pilot should be considered a preliminary approach to the concept with an eye towards improvement in accuracy in subsequent water loss audits.

V. Conclusions

An overview of the water loss auditing results for the forty participating CWSs yields the following conclusions:

- **On average, thirty percent of water being supplied was not generating revenue.**

It was surprising to learn that, on average, only seventy percent of water being purchased or treated and supplied was generating money to support the operation of the CWSs. However, values for nonrevenue water varied widely among the audited CWSs. Some CWSs were keeping nonrevenue water to very low levels, with the lowest level of 5.8% being on-par with water systems in other parts of the world that have been recognized as world-class in their management and operations. Other systems had astoundingly high levels of nonrevenue water, high enough that the long-term viability of some of the CWSs appears to be questionable. The wide range may be reflective of a similar range of system conditions and operator/management skills.

- **On average, the value of nonrevenue water represented a significant portion of CWSs' budgets**

The costs of nonrevenue water, priced at both variable production costs and customer retail costs, were quite significant when compared to operational costs. The average cost of nonrevenue water was almost thirty-eight percent of the average operational costs of the systems, and when considered at customer retail cost, was on average almost the entire cost of operating the CWS. In other words, if nonrevenue water could be theoretically reduced to zero and could be sold to customers, it would pay for the complete cost of operating the system. The complete reduction of nonrevenue water is not realistic, of course, but the fact that on average, the amount of water not generating revenue for the CWSs is enough to completely pay for system operations is a sobering thought.

Similar to the variation in nonrevenue water percentages, there was a wide variation in the observed costs of nonrevenue water. Values ranged from very low percentages (1-2%) to values that are difficult to comprehend, much less believe (383% and 820%, for nonrevenue water valued at variable production cost and customer retail cost, respectively). The maximum values observed for the cost of nonrevenue water seem to indicate that some CWSs are laboring under a very heavy financial burden placed on them by nonrevenue water. When considering the range of values for nonrevenue water, one should keep in mind that it is dependent on additional factors other than the simple volume of water. These values also account for operational costs (which vary according to the type of production, treatment, and/or the cost of purchase from a wholesale system) and on customer rates.

- **Real water loss represented the largest percentage of nonrevenue water**

By far, the largest portion of nonrevenue water over the entire group of CWSs was real water loss. On average, real water loss represented twenty-two percent of the total water supplied, and was costing systems $2,500,000 (valued at variable production costs) or $6,300,000 (valued at customer retail costs). Given that the total operational cost for the 40 CWSs was $15,500,000, the values of real water loss represented sixteen percent and forty-one percent of that cost, respectively. It is apparent from these results that real world revenue savings could be realized through active leak detection and repair on some, if not most of the participating CWSs.

The total volume of real water loss was observed to be 951,479,000 gallons. Using an estimated per capita daily usage of 100 gallons, the real water loss observed in this pilot project is enough water to serve over 26,000 people, roughly equivalent to a medium-sized city in Oklahoma.

These observations should be tempered with the knowledge that some of the real water loss is considered background leakage. Background leakage occurs at every water system (no water system can economically be made water-tight), and is considered the water leakage that will occur if a system is constructed with the best available materials, and is designed and operated under the most efficient and effective methods available. The water loss audit software provides a means to gauge the relative amounts of background leakage present in real water loss with the ILI performance factor.

The ILI results are considered accurate only for systems that operate above thirty-five psi, and that have more than a certain service connection density [specifically, when (length of mains * 32) + number of connections > 3000]. Of the audited CWSs in this pilot, eleven were of a size and pressure enough to qualify for ILI analysis. For this subset, the ILI ranged from 0.11 to 13.61, with an average of 3.26. Thornton, Sturm, and Kunkel (2008) report that the economic level of ILI (a level of real water loss below which it is not economically feasible to make repairs) likely lies in the range of 1.5 to 2.5 for most water systems. The average ILI of the eleven CWSs, 3.26, seems to indicate that locating and repairing leaks in the system would be economically advantageous.

- **Customer Metering Inaccuracies was the primary contributor to apparent loss.**

For apparent loss, the primary contributor was customer metering inaccuracies, which accounted for 3.8% of total water supplied. Unlike real loss, apparent loss is always valued at customer retail unit cost, and does not represent actual water lost. Rather, it represents revenue that is lost due to inaccurate metering. Compared to the other observed causes of apparent loss, customer metering inaccuracies accounted for 86.4% of the total apparent loss, at a cost of $1,050,000.

CWSs that address customer metering inaccuracies may not save actual water, but do receive benefits in other areas. First, improving the accuracy of customer meters increases the accuracy of water consumption data, which in turn improves data validity and accuracy of subsequent water loss audits. Secondly, since most customer water meters tend to under-register with increasing age, replacing old meters with newer, more accurate, and appropriately sized meters helps the CWSs recover lost revenue. Improved accuracy of data and increased recovery of revenue are often just as critical for CWS sustainability as reducing real water loss and can also be used to enhance real water loss reduction efforts.

VI. Recommendations

This pilot project was the first organized effort to promote a standardized, peer-reviewed method of water loss auditing to Oklahoma public water supplies. Before this effort, water loss auditing among Oklahoma's CWSs was conducted in a disorganized fashion, by several different methods of varying accuracies, and may not have been conducted at all. Outside of the 40 participating systems, conditions likely remain as such. Given that the drought conditions of years past will return, growth and land development will place increasing burdens on CWSs, and economic conditions are not likely to make a rapid improvement, there is benefit in continuing to promote water loss auditing according to the AWWA method.
To build upon the progress made during the pilot, DEQ recommends the following steps:

- **Begin bottom-up leak detection and meter analysis work with a subset of the 40 participating CWSs to identify and locate sources of real and apparent water loss, based on the AWWA water loss audit results.**

DEQ will select CWSs that have both significant amounts of real and/or apparent water loss and appropriate data validity for a follow-up project where leaks are identified, located, and quantified, and where meters are analyzed for accuracy. This work will be performed by the Oklahoma Rural Water Association at no cost to the participating systems, and the water loss data gathered by the project can be compared to that of the initial audits to gauge the accuracy of the AWWA water loss auditing method. The end product of the project will be information directly relatable to CWS efforts to reduce real and apparent water loss.

- **Conduct follow-up water loss audits at the Forty CWSs participating in the pilot project.**

Water loss auditing should be conducted at a facility at least on an annual basis. Given that the audits conducted during the pilot were the first time that the participating CWSs were exposed to the AWWA Water Loss Auditing method, many CWSs made discoveries about their systems that were previously unknown and were eager to address the problems discovered. Follow-up auditing will help illustrate the effectiveness of CWS efforts in reducing real and apparent loss, improving data validation, and enhancing overall system sustainability.

- **Continue to promote the AWWA Water Loss Auditing Method to more CWSs around the state.**

Judging from the success of the pilot project and other recent outreach efforts, interest in water loss auditing among Oklahoma's CWSs is high. DEQ wishes to capitalize on this interest with continued promotion of the AWWA water loss auditing method across the state. As more CWSs begin using the AWWA method, meaningful comparisons can be made between systems, and more accurate regional and state-wide water loss data will begin to coalesce.

- **Conduct a study investigating water loss using a more scientifically robust experimental design.**

This pilot project utilized a very small sample size compared to the total number of CWSs across the state. In addition, selection of the participating CWSs relied on professional judgement; inspectors selected CWSs to participate primarily based on which systems could benefit from the help and would be cooperative partners in the process. A larger study using a truly randomized sample would yield results that could be used to make inferences about water loss levels across the entire state.

VII. References

American Water Works Association. (2014). AWWA Free Audit Software V5.0. Retrieved from

http://www.awwa.org/resources-tools/water-knowledge/water-loss-control.aspx

Thornton, J. Sturm, R., & Kunkel, G. A. (2008). Water loss control. New York: McGraw-Hill.

Water audits and loss control programs. (2009). Denver, CO: American Water Works Association.

VIII. Appendices

A. GLOSSARY	
Apparent Losses	Losses attributed to inaccuracies in customer metering, systematic data handling errors, and/or unauthorized use (theft). Apparent losses differ from real losses in that they represent paper losses leading to revenue loss and customer data distortion.
Authorized Consumption	Water taken by users who are authorized by the CWS to do so. Users include retail customers, the CWS itself, and other users and customers to whom the CWS gives water. This water may be billed or unbilled, metered or unmetered.
Background Losses	Real water losses via small leaks and weeps at pipe joints that occur at flow rates too low to be detected by an active leak detection program. Background losses are directly influenced by water system pressure levels.
Current Annual Real Losses (CARL)	The total volume of water lost via leaks, overflows, and background losses.
Customer Meter Inaccuracies	Inaccuracies in water metering that are an important component of apparent water loss. Customer metering inaccuracies come about via meter wear, incorrect meter sizing or installation, corrosive water, or other causes.
Infrastructure Leakage Index (ILI)	A performance indicator that reflects how well a CWS distribution system is managed for control of real loss at a given operating pressure. ILI is calculated as the ratio of the Current Annual Real Loss to Unavoidable Annual Real Loss (CARL / UARL). A low ILI indicates a CWS that has managed real loss down to approaching the UARL. The ILI is dimensionless, and is used as a benchmarking performance indicator to compare CWSs, both nationally and internationally.
Leakage	Water lost from a distribution system via cracks, ruptures, or other defects in piping. Leakage includes water lost via reported leaks, unreported leaks, and background losses.
Nonrevenue Water	Water provided to a distribution system that generates no revenue. Includes unbilled authorized consumption, apparent losses, and real losses.
Pressure Management	Controlling losses and service impacts by optimizing water pressure in a CWS distribution system.
Real Losses	Physical losses of water from a CWS distribution system including leaks from water mains, overflows and leaks at storage facilities, and leakage from service connections. Does not include leakage occurring on lines that are the water customer's responsibility.
Revenue Water	The portion of authorized consumption that is billed and produces revenue. Includes billed metered and billed unmetered consumption
Unauthorized Consumption	Water taken from a CWS without permission or authorization, including withdrawals from fire hydrants, illegal taps and connections to mains, meter bypassing/tampering, and other means.
Unavoidable Annual Real Losses (UARL)	The lowest level of real loss technically achievable in a CWS, based on its given characteristics. UARL calculations are based on formulae derived from well-maintained and well-managed systems and incorporate the following CWS data: length of water mains, number of service connections, total length of private pipe, and average pressure in the system. UARLs have not been shown to be accurate for systems with few connections or that operate at low pressures.
Water Loss	The water volume difference between system input volume and authorized consumption, consisting of the sum of real and apparent loss.

B. WATER LOSS AUDIT DATA SUMMARY SPREADSHEET

Facility ID #	Facility Name	Water Produced (MG/yr)	Water Imported (MG/yr)	Water Exported (MG/yr)	Water Supplied (MG/yr)	Authorized Consumption (MG/yr)	BilledAuthorized Consumption (MG/yr)	Billed Metered Consumption (MG/yr)
OK2004403	Ames	10.535	0.000	0.000	10.535	10.246	8.524	8.524
OK1010302	Antlers	141.237	0.000	0.000	141.237	53.867	41.785	41.556
OK2000302	Atoka RWD #3	52.076	0.000	0.000	52.076	32.253	31.600	31.573
OK2000404	Beaver	179.645	0.000	0.000	179.645	119.193	114.051	114.051
OK2007505	Burns Flat	72.165	0.000	0.000	72.165	65.408	62.900	62.900
OK2007503	Canute	21.086	0.000	0.000	21.086	18.570	18.256	18.256
OK2001608	Chattanooga	16.000	0.000	0.000	16.000	14.200	14.000	14.000
OK3001126	Cherokee RWD #7	0.000	59.607	3.120	56.487	29.934	29.156	29.156
OK2001204	Choctaw RWD #1	73.671	19.144	0.000	92.816	70.959	69.799	69.799
OK2000716	Colbert	72.708	0.656	1.627	71.738	60.850	59.647	59.647
OK3005613	Dewar	0.000	25.679	0.000	25.679	17.958	17.578	17.578
OK2001902	Drumright	189.111	0.000	0.000	189.111	96.164	93.800	93.800
OK2002521	Elmore City	22.784	0.056	0.000	22.840	15.690	15.306	15.270
OK1020514	Eufaula	245.742	0.000	0.000	245.742	136.710	111.790	111.646
OK2001612	Fletcher	47.295	0.000	0.000	47.295	33.162	32.571	32.571
OK3002603	Grady RWD #6	149.664	0.000	0.000	149.664	107.641	105.770	105.770
OK1021306	Hominy	217.520	0.000	0.000	217.520	142.119	138.324	138.324
OK2007006	Hooker	1.776	0.000	0.000	1.776	1.514	1.492	1.492
OK1021604	Langley	54.756	0.000	11.167	43.589	52.270	51.709	51.709
OK1021501	Lenapah	10.667	0.000	0.000	10.667	6.654	6.421	6.421
OK2001409	Lexington	77.938	0.000	0.000	77.938	65.211	63.000	63.000
OK1021668	Locust Grove	154.412	0.000	0.000	154.412	50.407	44.907	44.907
OK2004230	Logan RWD #3	112.173	0.000	26.535	85.637	83.501	82.430	82.430
OK2001007	Lone Grove	146.770	0.000	0.000	146.770	115.286	100.268	100.212
OK2005503	Luther	21.164	0.000	0.000	21.164	3.000	1.910	1.848
OK2004301	Marietta	101.000	0.000	0.000	101.000	93.032	91.634	91.434
OK2007709	Mooreland	75.130	0.000	0.000	75.130	57.304	56.360	56.360
OK2001411	Noble	222.825	0.000	2.062	220.763	148.306	139.986	139.986
OK1021222	Otoe-Missouria Tribe	12.052	0.000	0.000	12.052	11.010	9.809	9.800
OK1021209	Pawnee	91.313	0.000	0.000	91.313	65.531	63.500	63.500
OK2006012	Perkins	96.408	0.000	0.000	96.408	83.406	80.456	80.408
OK1021206	Perry	299.179	0.000	36.000	263.179	271.920	267.300	267.300
OK3006107	Pittsburg RWD #9	0.000	39.460	0.000	39.460	18.614	18.120	18.120
OK3006809	Sequoyah RWD #4	0.000	45.729	0.000	45.729	37.372	36.800	36.800
OK2002304	Shattuck	199.345	0.000	0.000	199.345	192.242	185.718	182.718
OK1020205	Stilwell	748.757	0.000	368.788	379.969	642.351	604.469	604.362
OK2004303	Thackerville	83.624	0.000	0.000	83.624	72.405	72.346	72.346
OK2002001	Thomas	48.780	0.000	0.000	48.780	45.056	43.951	43.951
OK2004702	Wayne	22.716	0.000	0.000	22.716	21.595	21.407	21.359
OK3004014	Wister	0.000	56.077	0.000	56.077	31.944	31.233	31.233
	TOTAL	4092.024	246.408	449.299	3889.134	3194.8554	3040.083	3036.117
	MIN	0	0	0	1.776	1.514	1.492	1.492
	MAX	748.757	59.607	368.788	379.969	642.351	604.469	604.362
	AVERAGE	102.3006	6.1602	11.23248	97.22835	79.871385	76.002075	75.902925

Facility ID #	Facility Name	Billed Unmetered Consumption (MG/yr)	Unbilled Authorized Consumption (MG/yr)	Unbilled Metered Consumption (MG/yr)	Unbilled Unmetered Consumption (MG/yr)	Unauthorized Consumption (MG/yr)	Customer Metering Inaccuracies (MG/yr)
OK2004403	Ames	0.000	1.722	1.590	0.132	0.026	0.102
OK1010302	Antlers	0.229	12.082	10.317	1.765	0.353	4.206
OK2000302	Atoka RWD #3	0.027	0.653	0.002	0.651	0.130	0.977
OK2000404	Beaver	0.000	5.142	4.998	0.144	0.449	3.682
OK2007505	Burns Flat	0.000	2.508	0.000	2.508	0.180	1.284
OK2007503	Canute	0.000	0.314	0.050	0.264	0.053	0.185
OK2001608	Chattanooga	0.000	0.200	0.000	0.200	0.040	0.000
OK3001126	Cherokee RWD #7	0.000	0.778	0.072	0.706	0.141	1.088
OK2001204	Choctaw RWD #1	0.000	1.160	0.000	1.160	0.232	3.674
OK2000716	Colbert	0.000	1.203	0.306	0.897	0.179	0.000
OK3005613	Dewar	0.000	0.380	0.059	0.321	0.064	1.957
OK2001902	Drumright	0.000	2.364	0.000	2.364	0.473	2.901
OK2002521	Elmore City	0.036	0.384	0.107	0.277	0.057	1.521
OK1020514	Eufaula	0.144	24.920	21.848	3.072	0.614	14.816
OK2001612	Fletcher	0.000	0.591	0.000	0.591	0.118	0.000
OK3002603	Grady RWD #6	0.000	1.871	0.000	1.871	0.374	2.159
OK1021306	Hominy	0.000	3.795	0.000	3.795	0.544	11.215
OK2007006	Hooker	0.000	0.022	0.000	0.022	0.004	0.062
OK1021604	Langley	0.000	0.561	0.016	0.545	0.109	2.135
OK1021501	Lenapah	0.000	0.223	0.100	0.133	0.027	0.685
OK2001409	Lexington	0.000	2.211	1.237	0.974	0.195	6.353
OK1021668	Locust Grove	0.000	5.500	3.000	2.500	0.386	0.978
OK2004230	Logan RWD #3	0.000	1.070	0.000	1.070	0.214	2.329
OK2001007	Lone Grove	0.057	15.017	0.092	14.925	0.367	5.838
OK2005503	Luther	0.062	1.090	0.826	0.265	0.053	0.277
OK2004301	Marietta	0.200	1.398	0.135	1.263	0.253	4.819
OK2007709	Mooreland	0.000	0.944	0.005	0.939	0.188	5.575
OK2001411	Noble	0.000	8.320	5.560	2.760	0.552	14.191
OK1021222	Otoe-Missouria Tribe	0.009	1.201	1.050	0.151	0.030	0.631
OK1021209	Pawnee	0.000	2.031	0.890	1.141	0.228	14.000
OK2006012	Perkins	0.048	2.950	1.500	1.450	0.241	9.000
OK1021206	Perry	0.000	4.620	0.120	4.500	1.500	5.934
OK3006107	Pittsburg RWD #9	0.000	0.493	0.000	0.493	0.099	0.954
OK3006809	Sequoyah RWD #4	0.000	0.572	0.000	0.572	0.114	1.138
OK2002304	Shattuck	3.000	6.524	4.032	2.492	0.498	5.776
OK1020205	Stilwell	0.107	37.882	35.293	2.589	0.950	23.554
OK2004303	Thackerville	0.000	0.059	0.000	0.059	0.209	2.237
OK2002001	Thomas	0.000	1.105	0.495	0.610	0.122	2.339
OK2004702	Wayne	0.048	0.188	0.000	0.188	0.057	0.548
OK3004014	Wister	0.000	0.711	0.010	0.701	0.140	3.468
	TOTAL	3.967	154.759	93.71	61.06	10.563	162.588
	MIN	0	0.022	0	0.022	0.004	0
	MAX	3	37.882	35.293	14.925	1.5	23.554
	AVERAGE	0.099175	3.868975	2.34275	1.5265	0.264075	4.0647

Facility ID #	Facility Name	Data Processing Errors (MG/yr)	Revenue Water (MG/yr)	Non- Revenue Water (MG/yr)	Apparent Losses (MG/yr)	Real Losses (MG/yr)	Total Water Losses (MG/yr)	UARL (MG/yr)	Annual Cost of Apparent Losses	Annual Cost of Real Loss (Variable Production Cost)
OK2004403	Ames	0.021	8.524	2.011	0.150	0.140	0.290	N/A	$1,124	$92
OK1010302	Antlers	12.592	41.785	99.452	17.151	70.219	87.370	N/A	$163,449	$78,194
OK2000302	Atoka RWD #3	0.079	31.600	20.476	1.186	18.637	19.822	N/A	$5,845	$4,918
OK2000404	Beaver	0.285	114.051	65.594	4.416	56.036	60.452	N/A	$35,329	$4,386
OK2007505	Burns Flat	0.157	62.900	9.265	1.621	5.136	6.757	N/A	$6,583	$996
OK2007503	Canute	0.046	18.256	2.830	0.283	2.233	2.517	N/A	$2,903	$1,019
OK2001608	Chattanooga	0.035	14.000	2.000	0.075	1.725	1.800	N/A	N/A	
OK3001126	Cherokee RWD #7	0.065	29.156	30.451	1.294	28.379	29.673	36.12	$13,239	$89,916
OK2001204	Choctaw RWD #1	0.174	69.799	23.017	4.080	17.777	21.857	22.03	$33,009	$111,821
OK2000716	Colbert	0.145	59.647	13.718	0.324	12.191	12.515	N/A	$1,476	$21,309
OK3005613	Dewar	0.044	17.578	8.101	2.066	5.655	7.721	N/A	$20,656	$24
OK2001902	Drumright	0.235	93.800	95.311	3.608	89.339	92.947	6.57	$22,985	$288,698
OK2002521	Elmore City	0.038	15.306	7.534	1.616	5.533	7.150	N/A	$16,921	$2,671
OK1020514	Eufaula	0.279	111.790	133.952	15.710	93.323	109.032	19.58	$78,548	$79,511
OK2001612	Fletcher	0.081	32.571	14.724	0.200	13.933	14.133	N/A	$874	$4,672
OK3002603	Grady RWD #6	0.264	105.770	43.894	2.797	39.226	42.023	69.99	$47,522	286,777
OK1021306	Hominy	0.346	138.324	79.196	12.105	63.296	75.401		$60,828	211,257
OK2007006	Hooker	0.004	1.492	0.284	0.070	0.192	0.262	N/A	$610	$6,249
OK1021604	Langley	0.101	51.709	3.047	2.345	0.141	2.486	N/A	$13,366	$199
OK1021501	Lenapah	0.016	6.421	4.246	0.727	3.285	4.012	N/A	$3,201	$5,889
OK2001409	Lexington	0.158	63.000	14.938	6.705	6.022	12.727	N/A	$19,982	$497.22
OK1021668	Locust Grove	0.112	44.907	109.505	1.476	102.529	104.005	N/A	$10,524	$85,781
OK2004230	Logan RWD #3	0.140	82.430	29.743	2.683	25.990	28.673	242.47	$27,471	$16,361
OK2001007	Lone Grove	0.251	100.268	46.502	6.455	25.029	31.485	N/A	$39,571	$6,721
OK2005503	Luther	0.005	1.910	19.254	0.335	17.830	18.164	N/A	$1,924	$98,009
OK2004301	Marietta	0.229	91.634	9.366	5.301	2.668	7.968	N/A	$27,669	$2,113
OK2007709	Mooreland	0.141	56.360	18.770	5.903	11.922	17.826	N/A	$79,541	$30,045
OK2001411	Noble	0.345	139.986	82.839	15.087	59.432	74.519	8.73	$95,353	$16,641
OK1021222	Otoe-Miss.Tribe	0.025	9.809	2.243	0.686	0.356	1.043	N/A	$1,715	
OK1021209	Pawnee	0.159	63.500	27.813	14.387	11.395	25.782	N/A	$61,145	$887,190
OK2006012	Perkins	0.201	80.456	15.952	9.442	3.560	13.002	N/A	$42,583	$549
OK1021206	Perry	0.578	267.300	31.879	8.012	19.247	27.259	13.94	$32,048	$11,745
OK3006107	Pittsburg RWD #9	0.045	18.120	21.340	1.098	19.749	20.846	N/A	$10,702	$63,991
OK3006809	Sequoyah RWD #4	0.092	36.800	8.929	1.344	7.013	8.358	18.03	$13,445	$26,998
OK2002304	Shattuck	0.457	185.718	13.627	6.731	0.372	7.103	N/A	$74,040	$55
OK1020205	Stilwell	0.589	604.469	144.288	25.093	81.314	106.406	13.37	$46,923	$23,527
OK2004303	Thackerville	0.181	72.346	11.278	2.627	8.592	11.219	13.74	$16,027	4,990
OK2002001	Thomas	0.110	43.951	4.829	2.571	1.153	3.724	N/A	$64,277	$135.67
OK2004702	Wayne	0.053	21.407	1.309	0.658	0.463	1.121	N/A	$4,358	$172
OK3004014	Wister	0.078	31.233	24.844	3.686	20.447	24.133	N/A	$22,155	$28,626
	TOTAL	18.956	3040.083	1298.351	192.104	951.479	1143.583	464.57	$1,219,921	$2,502,745
	MIN	0.004	1.492	0.284	0.07	0.14	0.262	6.57	$610	$24
	MAX	12.592	604.469	144.288	25.093	102.529	109.032	242.47	$163,449	$887,190
	AVERAGE	0.4739	76.00208	32.45878	4.8026	23.78698	28.58958	42.2336	$31,280	$65,862

Facility ID #	Facility Name	Annual Cost of Real Losses (Retail Cost)	Non-Revenue Water as % of Supply	NRW % of Operating Cost (Productio Cost)	NRW % of Operating Cost (Customer Cost)	"Apparent Loss / Connection	"Real Loss / Connection	Real Loss / Mile of Main /Day	Real Loss / Connection / Day / PSI
OK2004403	Ames	$1,049	19.10%	9.20%	60.00%	/Day"	/ Day"	N/A	0.07
OK1010302	Antlers	$669,184	70.40%	42.50%	158%	3.28	3.07	N/A	2.94
OK2000302	Atoka RWD #3	$91,879	39.30%	3.70%	34.20%	39.49	161.66	747.57	N/A
OK2000404	Beaver	$448,287	36.50%	35.30%	464.80%	5.67	N/A	4,386.37	N/A
OK2007505	Burns Flat	$20,851	12.80%	3%	14.00%	10.94	N/A	N/A	0.28
OK2007503	Canute	$22,893	13.40%	4.50%	32.40%	4.59	14.54	382.44	N/A
OK2001608	Chattanooga	N/A	12.50%		N/A	2.9	N/A	590.75	N/A
OK3001126	Cherokee RWD #7	$290,319	53.90%	48.50%	143.10%	0.83	N/A	388.76	N/A
OK2001204	Choctaw RWD #1	$143,812	24.80%	23.70%	29.00%	6.47	N/A	243.51	N/A
OK2000716	Colbert	$55,468	19.10%	19.80%	49.80%	6.46	N/A	N/A	0.48
OK3005613	Dewar	$56,553	31.50%	20.70%	81%	0.59	22.27	N/A	0.27
OK2001902	Drumright	$569,089	50.40%	58.10%	110.40%	7.29	19.97	4,079.40	N/A
OK2002521	Elmore City	$57,936	33.00%	7.70%	30.50%	7.83	N/A	N/A	0.89
OK1020514	Eufaula	$466,613	54.50%	26.50%	99.10%	11.24	38.48	4,205.24	N/A
OK2001612	Fletcher	$60,959	31.10%	3.20%	36.00%	24.18	N/A	N/A	1.82
OK3002603	Grady RWD #6	$666,842	29.30%	31.78%	68.10%	1.04	72.85	252.63	N/A
OK1021306	Hominy	$318,063	36.40%	39.20%	54.80%	5.19	N/A		1.73
OK2007006	Hooker	$1,663	16.00%	4.60%	1.50%	28.84	150.79	N/A	0.01
OK1021604	Langley	$805	7.00%	3.00%	3.60%	0.21	0.58	N/A	0.01
OK1021501	Lenapah	$14,458	39.80%	5.80%	11.30%	11.19	0.67	900.02	N/A
OK2001409	Lexington	$17,945	19.20%	11.78%	25.40%	14.98	N/A	N/A	0.26
OK1021668	Locust Grove	$731,034	70.90%	106.00%	820.10%	15.92	14.3	N/A	2.51
OK2004230	Logan RWD #3	$266,136	34.70%	6.00%	40.90%	2.46	170.97	59.34	N/a
OK2001007	Lone Grove	$153,430	31.70%	7.80%	44.00%	7.31	N/A	N/A	0.7
OK2005503	Luther	$102,520	91.00%	176.50%	184.50%	12.61	48.91	N/A	2.7
OK2004301	Marietta	$13,925	9.30%	7.20%	11.40%	2.62	139.57	132.88	N/A
OK2007709	Mooreland	46,632	11.30%	17.30%	18.40%	12.05	N/A	34.94	N/A
OK2001411	Noble	$375,610	37.50%	29.20%	133.90%	33.53	N/A	N/A	1.64
OK1021222	Otoe-Missouria Tribe	N/A	18.60%		1.90%	18.79	74.01	55.81	N/A
OK1021209	Pawnee	$48,427	30.50%	120.30%	12.80%	19.58	N/A	N/A	0.52
OK2006012	Perkins	$16,056	16.50%	17.40%	28.80%	35.83	28.38	N/A	0.13
OK1021206	Perry	$76,990	12.10%	2.80%	7.70%	16.09	6.07	N/A	0.37
OK3006107	Pittsburg RWD #9	$192,550	54.10%	30%	81.90%	8.5	20.42	1,288.24	N/A
OK3006809	Sequoyah RWD #4	$70,131	19.50%	8.80%	18.50%	6.9	N/A	274.48	N/A
OK2002304	Shattuck	N/A	6.80%	38.60%	77.20%	4.79	N/A	N/A	0.02
OK1020205	Stilwell	$152,057	38.00%	8.00%	26.40%	22.3	1.23	3,480.90	N/A
OK2004303	Thackerville	$52,411	13.50%	8.80%	28.70%	39.04	N/A	235.4	N/A
OK2002001	Thomas	N/A	9.90%	383.47%	717.30%	6.55	N/A	158	N/A
OK2004702	Wayne	$3,068	5.80%	2.10%	4.00%	11.29	N/A	43.74	N/A
OK3004014	Wister	$122,681	44.30%	32.30%	93.20%	4.28	N/A	2,240.76	N/A
	TOTAL	6398325.56	12.06	14.05133024	38.586	490.2	988.74	24181.18	17.35
	MIN	805	0.058	0.021	0.015	0.21	0.58	34.94	0.01
	MAX	731034	0.91	3.834697651	8.201	39.49	170.97	4386.37	2.94
	AVERAGE	177731.266	0.3015	0.369771848	0.989384615	12.255	52.03895	1151.485	0.913157895

Facility ID #	Facility Name	"CARL (MG/yr)	ILI	Data Validation Score	Total Annual Operational Costs	Total Variable Production Costs ($/MG)	Service Connection Density	Production Meter Accuracy	Customer Meter Accuracy
OK2004403	Ames	0.14	N/A	43	$25,132	$660.96	50	-4.00%	-1.00%
OK1010302	Antlers	70.22	N/A	61	$600,000	$1,113.58	44	-3.00%	-7.50%
OK2000302	Atoka RWD #3	18.64	N/A	66	$295,085	$266.53	8	-1.00%	-3.00%
OK2000404	Beaver	56.04	N/A	52	$112,893	$76.26	26	-3.00%	-3.00%
OK2007505	Burns Flat	5.14	N/A	47	$268,000	$200.00	97	-3.00%	-2.00%
OK2007503	Canute	2.23	N/A	58	$89,660	$456.22	17	-5.00%	-1.00%
OK2001608	Chattanooga	1.73	N/A	20	N/A	N/A	31	5.00%	0
OK3001126	Cherokee RWD #7	28.38	0.79	83	$217,743	$9,986.55	3	0	-4%
OK2001204	Choctaw RWD #1	17.78	0.81	68	$642,324	$6,290.40	9	-2%	-5%
OK2000716	Colbert	12.19	N/A	42	$125,411	$1,748	34	-5%	0
OK3005613	Dewar	5.66	N/A	42	$100,000	$4.32	35	0	-10%
OK2001902	Drumright	89.34	13.61	37	$550,000	$3,231.49	21	-10%	-3%
OK2002521	Elmore City	5.53	N/A	44	$258,455	$482.70	38	-3%	-9%
OK1020514	Eufaula	93.32	4.77	53	$675,740	$852.00	29	-5%	-9.99%
OK2001612	Fletcher	13.93	N/A	32	$178,773	$335.33	66	5%	0
OK3002603	Grady RWD #6	39.23	0.56	62	$1,095,078	$7,316.00	3	-2.10%	-2.00%
OK1021306	Hominy	63.3		42	$726,000	$3,337.60	47	-2.00%	-7.50%
OK2007006	Hooker	0.19	N/A	53	$163,162	$32,570.13	54	-2.50%	-4%
OK1021604	Langley	0.14	N/A	51	$476,749	$1,406.08	44	-3%	-5%
OK1021501	Lenapah	3.29	N/A	26	$164,884	$1,792.69	13	35%	-9.50%
OK2001409	Lexington	6.02	N/A	54	$175,350	$82.57	47	-3.00%	-9%
OK1021668	Locust Grove	102.53	N/A	77	$95,205	$836.65	137	-2%	-2%
OK2004230	Logan RWD #3	25.99	0.11	73	$774,041	$629.52	1	-1%	-4%
OK2001007	Lone Grove	25.03	N/A	59	$647,171	$268.52	40	-5.50%	-5.50%
OK2005503	Luther	17.83	N/A	27	$60,000	$5,497.00	44	-5%	-14.80%
OK2004301	Marietta	2.67	N/A	73	$430,000	$792.08	22	0	-5%
OK2007709	Mooreland	11.92	N/A	47	$527,600	$2,520.00	13	-3%	-9%
OK2001411	Noble	59.43	6.81	60	$391,032	$280.00	79	-3%	-9%
OK1021222	Otoe-Missouria Tribe	0.36	N/A	46	$298,000	N/A	5%	-1%	-5.50%
OK1021209	Pawnee	11.39	N/A	50	$920,000	$77,860.00	85	-1%	-21%
OK2006012	Perkins	3.56	N/A	41	$250,000	$154.26	146	-1%	-9.90%
OK1021206	Perry	19.25	1.38	58	$1,661,375	$610.22	52	-2.50%	-2.50%
OK3006107	Pittsburg RWD #9	19.75	N/A	71	$254,000	$3,240.26	10	0%	-5%
OK3006809	Sequoyah RWD #4	7.01	0.39	53	$482,000	$3,849.60	11	-4%	-3%
OK2002304	Shattuck	0.37	N/A	57	$194,245	$148.63	35	0	-3%
OK1020205	Stilwell	81.31	6.08	50	$1,022,896	$289.33	28	-2%	-8%
OK2004303	Thackerville	8.59	0.63	80	$240,000	$580.79	11	0	-3%
OK2002001	Thomas	1.15	N/A	39	$16,831	$177.63	31	-9.90%	-5%
OK2004702	Wayne	0.46	N/A	68	$215,000	$371.54	15	-0.50%	-2.50%
OK3004014	Wister	20.45	N/A	44	$160,000	$1,400.00	24	0%	-9.99%
	TOTAL	951.49	35.94	2109	15579835	171715.44	1500.05	-0.53	-2.2347
	MIN	0.14	0.11	20	16831	4.32	0.05	-0.1	-0.213
	MAX	102.53	13.61	83	1661375	77860	146	0.35	0
	AVERAGE	23.78725	3.267273	52.725	399482.949	4518.827368	37.50125	-0.01325	-0.05587

Facility ID #	Facility Name	Import Meter Accuracy	Export Meter Accuracy	Main Length	Total # of Active and Inactive Connections	Average Oper. Pressure	Total Annual Operating Cost	Customer Retail Unit Cost ($/KG)	Variable Production Cost ($/MG)
OK2004403	Ames	0	0	2.5	125	41.0	$25,132	$7.50	$660.96
OK1010302	Antlers	0	0	27.2	1190	55.0	$600,000	$9.53	$1,113.58
OK2000302	Atoka RWD #3	0	0	68.3	573	55.0	$295,085	$4.93	$266.53
OK2000404	Beaver	0	0	35	904	60.0	$112,893	$8.00	$76.26
OK2007505	Burns Flat	0	0	10	968	52.0	$268,000	$4.06	$200.00
OK2007503	Canute	0	0	16	268	41.0	$89,660	$10.25	$456.22
OK2001608	Chattanooga	0	0	8	247	50.0	N/A	N/A	N/A
OK3001126	Cherokee RWD #7	-0.50%	-0.50%	200	548	85.0	$217,743	$10.23	$9,986.55
OK2001204	Choctaw RWD #1	-10%	0	200	1730	45.0	$642,324	$8.09	$6,290.40
OK2000716	Colbert	0	-7%	43.5	1500	46.0	$124,411	$4.55	$1,748.00
OK3005613	Dewar	-10%	0	22	776	75.0	$100,000	$10.00	$4.32
OK2001902	Drumright	0	0	60	1262	35.0	$550,000	$6.37	$3,231.49
OK2002521	Elmore City	-1%	0	10.5	394	43.0	$258,455	$10.47	$482.70
OK1020514	Eufaula	0	0	60.8	1780	90.0	$675,740	$5.00	$852.00
OK2001612	Fletcher	0%	0	8	524	40.0	$178,773	$4.38	$335.33
OK3002603	Grady RWD #6	0%	0	425.4	1478	76.0	$1,095,078	$17.00	$7,316.00
OK1021306	Hominy	0%	0	24.4	1150	87.0	$726,000	$5.03	$3,337.60
OK2007006	Hooker	0%	0	16.9	911	41.0	$163,162	$8.67	$32,570.13
OK1021604	Langley	0%	-1%	13	574	52.0	$476,749	$5.70	$1,406.08
OK1021501	Lenapah	0%	0	10	133	40.0	$164,884	$4.40	$1,792.69
OK2001409	Lexington	0	0	24.8	1154	55.0	$175,350	$2.98	$82.57
OK1021668	Locust Grove	0%	0%	12	1643	68.0	$95,205	$7.13	$836.65
OK2004230	Logan RWD #3	0%	-1%	1200	1006	100.0	$744,041	$10.24	$629.52
OK2001007	Lone Grove	0%	0	35	1402	70.0	$647,171	$6.13	$268.52
OK2005503	Luther	0%	0	8	350	50.0	$60,000	$5.75	$5,497.00
OK2004301	Marietta	0%	0	55	1205	50.0	$430,000	$5.22	$792.08
OK2007709	Mooreland	0%	0%	52	650	41.0	$527,600	$10.00	$2,520.00
OK2001411	Noble	0%	-3%	28	2200	45.0	$391,032	$6.32	$280.00
OK1021222	Otoe-Missouria Tribe	0	0	17.5	96	54.0	$298,000	$2.50	N/A
OK1021209	Pawnee	0%	0	13	1100	55.0	$920,000	$4.25	$77,860.00
OK2006012	Perkins	0%	0	11	1608	45.0	$250,000	$4.51	$154.26
OK1021206	Perry	0%	-2.50%	50	2583	55.0	$1,661,375	$4.00	$610.22
OK3006107	Pittsburg RWD #9	-0.90%	0	42	436	52.0	$254,000	$9.75	$3,240.26
OK3006809	Sequoyah RWD #4	0%	0	70	769	100.0	$482,000	$10.00	$3,849.60
OK2002304	Shattuck	0%	0	23.5	827	68.0	$194,245	$11.00	$148.63
OK1020205	Stilwell	0	-2%	64	1761	60.0	$1,022,896	$1.87	$289.33
OK2004303	Thackerville	0%	0	100	1099	50.0	$240,000	$6.10	$580.79
OK2002001	Thomas	0%	0	20	624	75.0	$16,831	$2.50	$117.63
OK2004702	Wayne	0%	0	29	421	40.0	$215,000	$6.63	$371.54
OK3004014	Wister	-5%	0	25	610	70.0	$160,000	$6.00	$1,400.00
	TOTAL	-27.40%	-17.00%	3138.8	38454	2271	$15,523,703	$259.54	$170,994.48
	MIN	-10.00%	-7.00%	8	96	35	$16,831	$1.87	$4.32
	MAX	0.00%	0.00%	1200	2583	100	$1,661,375	$17.00	$77,860.00
	AVERAGE	-0.70%	-0.44%	80.48205	986	58.23077	$408,519	$6.83	$4,621.47

AWWA Free Water Audit Software: System Attributes and Performance Indicators

WAS v5.0

Water Audit Report for: City of Ames,Ok (2004403)
Reporting Year: 2015 6/2014 - 7/2015

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 43 out of 100 ***

System Attributes:

	Apparent Losses:	0.150	MG/Yr
+	Real Losses:	0.140	MG/Yr
=	**Water Losses:**	**0.290**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:	$1,124	
	Annual cost of Real Losses:	$92	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	19.1%	
	Non-revenue water as percent by cost of operating system:	9.4%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	3.28	gallons/connection/day
	Real Losses per service connection per day:	3.07	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.07	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	0.14	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software: System Attributes and Performance Indicators

WAS v5.0

Water Audit Report for: Antlers PWA (OK1010302)
Reporting Year: 2015 6/2014 - 6/2015

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 61 out of 100 ***

System Attributes:

	Apparent Losses:	17.151	MG/Yr
+	Real Losses:	70.219	MG/Yr
=	**Water Losses:**	**87.370**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:	$163,449	
	Annual cost of Real Losses:	$78,194	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	70.4%	
	Non-revenue water as percent by cost of operating system:	42.5%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	39.49	gallons/connection/day
	Real Losses per service connection per day:	161.66	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	2.94	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	70.22	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0
American Water Works Association.

Water Audit Report for: **Atoka RWD-3 (OK2000302)**
Reporting Year: **2014** **10/2013 - 10/2014**

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 66 out of 100 ***

System Attributes:

	Apparent Losses:	1.186	MG/Yr
+	Real Losses:	18.637	MG/Yr
=	**Water Losses:**	**19.822**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:	$5,845	
	Annual cost of Real Losses:	$4,967	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	39.3%	
	Non-revenue water as percent by cost of operating system:	3.7%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	5.67	gallons/connection/day
	Real Losses per service connection per day:	N/A	gallons/connection/day
	Real Losses per length of main per day*:	747.57	gallons/mile/day
	Real Losses per service connection per day per psi pressure:	N/A	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	18.64	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0
American Water Works Association.

Water Audit Report for: **City of Beaver (2000404)**
Reporting Year: **2015** **3/2014 - 3/2015**

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 52 out of 100 ***

System Attributes:

	Apparent Losses:	4.416	MG/Yr
+	Real Losses:	56.036	MG/Yr
=	**Water Losses:**	**60.452**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:	$35,329	
	Annual cost of Real Losses:	$4,273	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	36.5%	
	Non-revenue water as percent by cost of operating system:	35.4%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	13.38	gallons/connection/day
	Real Losses per service connection per day:	N/A	gallons/connection/day
	Real Losses per length of main per day*:	4,386.37	gallons/mile/day
	Real Losses per service connection per day per psi pressure:	N/A	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	56.04	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0
American Water Works Association.

Water Audit Report for: **Town of Burns Flat (2007508)**
Reporting Year: **2015** **7/2014 - 6/2015**

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 47 out of 100 ***

System Attributes:

	Apparent Losses:	1.621	MG/Yr
+	Real Losses:	5.136	MG/Yr
=	**Water Losses:**	**6.757**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:	$6,583	
	Annual cost of Real Losses:	$1,027	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	12.8%	
	Non-revenue water as percent by cost of operating system:	3.0%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	4.59	gallons/connection/day
	Real Losses per service connection per day:	14.54	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.28	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	5.14	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0
American Water Works Association.

Water Audit Report for: **Canute Public Works Authority (2007503)**
Reporting Year: **2015** **7/2014 - 6/2015**

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 58 out of 100 ***

System Attributes:

	Apparent Losses:	0.283	MG/Yr
+	Real Losses:	2.233	MG/Yr
=	**Water Losses:**	**2.517**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:	$2,903	
	Annual cost of Real Losses:	$1,019	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	13.4%	
	Non-revenue water as percent by cost of operating system:	4.5%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	2.90	gallons/connection/day
	Real Losses per service connection per day:	N/A	gallons/connection/day
	Real Losses per length of main per day*:	382.44	gallons/mile/day
	Real Losses per service connection per day per psi pressure:	N/A	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	2.23	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0
American Water Works Association.

Water Audit Report for: Chattanooga PWS (OK2001608)
Reporting Year: 2014 1/2014 - 12/2014

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 20 out of 100 ***

System Attributes:

	Apparent Losses:	0.075	MG/Yr
+	Real Losses:	1.725	MG/Yr
=	**Water Losses:**	1.800	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:		
	Annual cost of Real Losses:		Valued at **Customer Retail Unit Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	12.5%	
	Non-revenue water as percent by cost of operating system:		Real Losses valued at Customer Retail Unit Cost
Operational Efficiency:	Apparent Losses per service connection per day:	0.83	gallons/connection/day
	Real Losses per service connection per day:	N/A	gallons/connection/day
	Real Losses per length of main per day*:	590.75	gallons/mile/day
	Real Losses per service connection per day per psi pressure:	N/A	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	1.73	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0
American Water Works Association.

Water Audit Report for: Cherokee County Rural Water District # 7 (Welling) (OK3001126)
Reporting Year: 2014 1/2014 - 12/2014

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 83 out of 100 ***

System Attributes:

	Apparent Losses:	1.294	MG/Yr
+	Real Losses:	28.379	MG/Yr
=	**Water Losses:**	29.673	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	36.12	MG/Yr
	Annual cost of Apparent Losses:	$13,239	
	Annual cost of Real Losses:	$283,410	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	53.9%	
	Non-revenue water as percent by cost of operating system:	139.8%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	6.47	gallons/connection/day
	Real Losses per service connection per day:	N/A	gallons/connection/day
	Real Losses per length of main per day*:	388.76	gallons/mile/day
	Real Losses per service connection per day per psi pressure:	N/A	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	28.38	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:	0.79	

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0
American Water Works Association.

Water Audit Report for: Choctaw RWD #1 (OK2001204)
Reporting Year: 2015 3/2014 - 2/2015

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 71 out of 100 ***

System Attributes:

Apparent Losses:	4.080	MG/Yr
+ Real Losses:	17.777	MG/Yr
= **Water Losses:**	**21.857**	MG/Yr
? Unavoidable Annual Real Losses (UARL):	22.03	MG/Yr
Annual cost of Apparent Losses:	$33,009	
Annual cost of Real Losses:	$111,821	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	24.8%	
	Non-revenue water as percent by cost of operating system:	23.7%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	6.46	gallons/connection/day
	Real Losses per service connection per day:	N/A	gallons/connection/day
	Real Losses per length of main per day*:	243.51	gallons/mile/day
	Real Losses per service connection per day per psi pressure:	N/A	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	17.78	million gallons/year
	? Infrastructure Leakage Index (ILI) [CARL/UARL]:	0.81	

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0
American Water Works Association.

Water Audit Report for: Colbert PWA (OK2000719)
Reporting Year: 2014 1/2014 - 12/2014

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 42 out of 100 ***

System Attributes:

Apparent Losses:	0.324	MG/Yr
+ Real Losses:	12.191	MG/Yr
= **Water Losses:**	**12.515**	MG/Yr
? Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
Annual cost of Apparent Losses:	$1,476	
Annual cost of Real Losses:	$21,309	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	19.1%	
	Non-revenue water as percent by cost of operating system:	19.8%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	0.59	gallons/connection/day
	Real Losses per service connection per day:	22.27	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.48	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	12.19	million gallons/year
	? Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0
American Water Works Association.

Water Audit Report for: **Dewar PWA (3005613)**
Reporting Year: **2015** **7/2014 - 6/2015**

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 42 out of 100 ***

System Attributes:

	Apparent Losses:	2.066	MG/Yr
+	Real Losses:	5.655	MG/Yr
=	**Water Losses:**	7.721	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:	$20,656	
	Annual cost of Real Losses:	$24	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	31.5%	
	Non-revenue water as percent by cost of operating system:	20.7%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	7.29	gallons/connection/day
	Real Losses per service connection per day:	19.97	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.27	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	5.66	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0
American Water Works Association.

Water Audit Report for: **Drumright (2001902)**
Reporting Year: **2014** **1/2014 - 12/2014**

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 37 out of 100 ***

System Attributes:

	Apparent Losses:	3.608	MG/Yr
+	Real Losses:	89.339	MG/Yr
=	**Water Losses:**	92.947	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	6.57	MG/Yr
	Annual cost of Apparent Losses:	$22,985	
	Annual cost of Real Losses:	$268,698	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	50.4%	
	Non-revenue water as percent by cost of operating system:	58.1%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	7.83	gallons/connection/day
	Real Losses per service connection per day:	N/A	gallons/connection/day
	Real Losses per length of main per day*:	4,079.40	gallons/mile/day
	Real Losses per service connection per day per psi pressure:	N/A	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	89.34	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:	13.61	

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0
American Water Works Association.

Water Audit Report for: Elmore City PWA (OK2002521)
Reporting Year: 2015 6/2014 - 5/2015

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 44 out of 100 ***

System Attributes:

Apparent Losses:	1.616	MG/Yr
+ Real Losses:	5.533	MG/Yr
= **Water Losses:**	7.150	MG/Yr
? Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
Annual cost of Apparent Losses:	$16,921	
Annual cost of Real Losses:	$2,671	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	33.0%	
	Non-revenue water as percent by cost of operating system:	7.7%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	11.24	gallons/connection/day
	Real Losses per service connection per day:	38.48	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.89	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	5.53	million gallons/year
	? Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0
American Water Works Association.

Water Audit Report for: Eufaula City of (OK1020514)
Reporting Year: 2014 1/2014 - 12/2014

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 53 out of 100 ***

System Attributes:

Apparent Losses:	15.710	MG/Yr
+ Real Losses:	93.323	MG/Yr
= **Water Losses:**	109.032	MG/Yr
? Unavoidable Annual Real Losses (UARL):	19.58	MG/Yr
Annual cost of Apparent Losses:	$78,548	
Annual cost of Real Losses:	$79,511	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	54.5%	
	Non-revenue water as percent by cost of operating system:	26.5%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	24.18	gallons/connection/day
	Real Losses per service connection per day:	N/A	gallons/connection/day
	Real Losses per length of main per day*:	4,205.24	gallons/mile/day
	Real Losses per service connection per day per psi pressure:	N/A	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	93.32	million gallons/year
	? Infrastructure Leakage Index (ILI) [CARL/UARL]:	4.77	

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0
American Water Works Association.

Water Audit Report for: Fletcher PWA (OK2001612)
Reporting Year: 2014 1/2014 - 12/2014

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 32 out of 100 ***

System Attributes:

	Apparent Losses:	0.200	MG/Yr
+	Real Losses:	13.933	MG/Yr
=	**Water Losses:**	**14.133**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:	$874	
	Annual cost of Real Losses:	$4,672	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	31.1%	
	Non-revenue water as percent by cost of operating system:	3.2%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	1.04	gallons/connection/day
	Real Losses per service connection per day:	72.85	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	1.82	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	13.93	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0
American Water Works Association.

Water Audit Report for: Grady County RWD #6 (3002603)
Reporting Year: 2014 2/2014 - 2/2015

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 62 out of 100 ***

System Attributes:

	Apparent Losses:	2.797	MG/Yr
+	Real Losses:	39.226	MG/Yr
=	**Water Losses:**	**42.023**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	69.99	MG/Yr
	Annual cost of Apparent Losses:	$47,552	
	Annual cost of Real Losses:	$286,977	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	29.3%	
	Non-revenue water as percent by cost of operating system:	31.8%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	5.19	gallons/connection/day
	Real Losses per service connection per day:	N/A	gallons/connection/day
	Real Losses per length of main per day*:	252.63	gallons/mile/day
	Real Losses per service connection per day per psi pressure:	N/A	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	39.23	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:	0.56	

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0
American Water Works Association.

Water Audit Report for: Hominy Public Works Authority (1021306)
Reporting Year: 2014 | 1/2014 - 12/2014

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 42 out of 100 ***

System Attributes:

	Apparent Losses:	12.105	MG/Yr
+	Real Losses:	63.296	MG/Yr
=	**Water Losses:**	**75.401**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:	$60,828	
	Annual cost of Real Losses:	$211,257	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	36.4%	
	Non-revenue water as percent by cost of operating system:	39.2%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	28.84	gallons/connection/day
	Real Losses per service connection per day:	150.79	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	1.73	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	63.30	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0
American Water Works Association.

Water Audit Report for: City of Hooker,Ok (2007006)
Reporting Year: 2014 | 1/2014 - 12/2014

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 53 out of 100 ***

System Attributes:

	Apparent Losses:	0.070	MG/Yr
+	Real Losses:	0.192	MG/Yr
=	**Water Losses:**	**0.262**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:	$610	
	Annual cost of Real Losses:	$6,249	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	16.0%	
	Non-revenue water as percent by cost of operating system:	4.6%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	0.21	gallons/connection/day
	Real Losses per service connection per day:	0.58	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.01	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	0.19	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

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American Water Works Association.

Water Audit Report for: **Langley PWA (OK1021604)**
Reporting Year: **2014** **1/2014 - 12/2014**

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 51 out of 100 ***

System Attributes:

	Apparent Losses:	2.345	MG/Yr
+	Real Losses:	0.141	MG/Yr
=	**Water Losses:**	**2.486**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:	$13,366	
	Annual cost of Real Losses:	$199	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	7.0%	
	Non-revenue water as percent by cost of operating system:	3.0%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	11.19	gallons/connection/day
	Real Losses per service connection per day:	0.67	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.01	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	0.14	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

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System Attributes and Performance Indicators

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American Water Works Association.

Water Audit Report for: **Lenapah (OK1021501)**
Reporting Year: **2015** **6/2014 - 6/2015**

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 28 out of 100 ***

System Attributes:

	Apparent Losses:	0.727	MG/Yr
+	Real Losses:	3.285	MG/Yr
=	**Water Losses:**	**4.012**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:	$3,201	
	Annual cost of Real Losses:	$5,889	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	39.8%	
	Non-revenue water as percent by cost of operating system:	5.8%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	14.98	gallons/connection/day
	Real Losses per service connection per day:	N/A	gallons/connection/day
	Real Losses per length of main per day*:	900.02	gallons/mile/day
	Real Losses per service connection per day per psi pressure:	N/A	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	3.29	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

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American Water Works Association.

Water Audit Report for: **Lexington Public Works (OK2001409)**
Reporting Year: **2015** **7/2014 - 6/2015**

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 54 out of 100 ***

System Attributes:

	Apparent Losses:	6.705	MG/Yr
+	Real Losses:	6.022	MG/Yr
=	**Water Losses:**	**12.727**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:	$19,982	
	Annual cost of Real Losses:	$497	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	19.2%	
	Non-revenue water as percent by cost of operating system:	11.8%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	15.92	gallons/connection/day
	Real Losses per service connection per day:	14.30	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.26	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	6.02	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

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Water Audit Report for: **Locust Grove PWS (ok1021668)**
Reporting Year: **2014** **1/2014 - 12/2014**

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 77 out of 100 ***

System Attributes:

	Apparent Losses:	1.476	MG/Yr
+	Real Losses:	102.529	MG/Yr
=	**Water Losses:**	**104.005**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:	$10,524	
	Annual cost of Real Losses:	$65,781	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	70.9%	
	Non-revenue water as percent by cost of operating system:	106.0%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	2.46	gallons/connection/day
	Real Losses per service connection per day:	170.97	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	2.51	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	102.53	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

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Water Audit Report for: **Logan County RWD #3 (2004230)**
Reporting Year: **2014** 11/2013 - 10/2014

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 73 out of 100 ***

System Attributes:

	Apparent Losses:	2.683	MG/Yr
+	Real Losses:	25.990	MG/Yr
=	**Water Losses:**	**28.673**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	242.47	MG/Yr
	Annual cost of Apparent Losses:	$27,471	
	Annual cost of Real Losses:	$16,361	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	34.7%	
	Non-revenue water as percent by cost of operating system:	6.0%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	7.31	gallons/connection/day
	Real Losses per service connection per day:	N/A	gallons/connection/day
	Real Losses per length of main per day*:	59.34	gallons/mile/day
	Real Losses per service connection per day per psi pressure:	N/A	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	25.99	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:	0.11	

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

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American Water Works Association.

Water Audit Report for: **Lone Grove Trust Authority (OK2001007)**
Reporting Year: **2014** 1/2014 - 12/2014

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 59 out of 100 ***

System Attributes:

	Apparent Losses:	6.455	MG/Yr
+	Real Losses:	25.029	MG/Yr
=	**Water Losses:**	**31.485**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:	$39,571	
	Annual cost of Real Losses:	$6,721	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	31.7%	
	Non-revenue water as percent by cost of operating system:	7.8%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	12.61	gallons/connection/day
	Real Losses per service connection per day:	48.91	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.70	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	25.03	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

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Water Audit Report for: Luther (2005503)
Reporting Year: 2014 1/2014 - 12/2014

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 27 out of 100 ***

System Attributes:

Apparent Losses:	0.335	MG/Yr
+ Real Losses:	17.830	MG/Yr
= **Water Losses:**	**18.164**	MG/Yr
? Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
Annual cost of Apparent Losses:	$1,924	
Annual cost of Real Losses:	$98,009	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	91.0%	
	Non-revenue water as percent by cost of operating system:	176.5%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	2.62	gallons/connection/day
	Real Losses per service connection per day:	139.57	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	2.79	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	17.83	million gallons/year
	? Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

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System Attributes and Performance Indicators

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Water Audit Report for: Marietta Public Works Authority (OK2004301)
Reporting Year:

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 73 out of 100 ***

System Attributes:

Apparent Losses:	5.301	MG/Yr
+ Real Losses:	2.668	MG/Yr
= **Water Losses:**	**7.968**	MG/Yr
? Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
Annual cost of Apparent Losses:	$27,669	
Annual cost of Real Losses:	$2,113	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	9.3%	
	Non-revenue water as percent by cost of operating system:	7.2%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	12.05	gallons/connection/day
	Real Losses per service connection per day:	N/A	gallons/connection/day
	Real Losses per length of main per day*:	132.88	gallons/mile/day
	Real Losses per service connection per day per psi pressure:	N/A	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	2.67	million gallons/year
	? Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

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Water Audit Report for: Town of Mooreland, Ok (OK2007709)
Reporting Year: 2014-15 4/2014 - 4/2015

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 47 out of 100 ***

System Attributes:

	Apparent Losses:	5.903	MG/Yr
+	Real Losses:	11.922	MG/Yr
=	**Water Losses:**	17.826	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:	$59,033	
	Annual cost of Real Losses:	$30,045	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	25.0%	
	Non-revenue water as percent by cost of operating system:	17.3%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	24.88	gallons/connection/day
	Real Losses per service connection per day:	N/A	gallons/connection/day
	Real Losses per length of main per day*:	628.16	gallons/mile/day
	Real Losses per service connection per day per psi pressure:	N/A	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	11.92	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

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Water Audit Report for: Noble (2001411)
Reporting Year: 14-15 7/2014 - 6/2015

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 60 out of 100 ***

System Attributes:

	Apparent Losses:	15.087	MG/Yr
+	Real Losses:	59.432	MG/Yr
=	**Water Losses:**	74.519	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	8.73	MG/Yr
	Annual cost of Apparent Losses:	$95,353	
	Annual cost of Real Losses:	$16,641	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	37.5%	
	Non-revenue water as percent by cost of operating system:	29.2%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	18.79	gallons/connection/day
	Real Losses per service connection per day:	74.01	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	1.64	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	59.43	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:	6.81	

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

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Water Audit Report for: **Otoe-Missouria Tribe (OK1021222)**
Reporting Year: **2015** **7/2014 - 6/2015**

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 46 out of 100 ***

System Attributes:

	Apparent Losses:	0.686	MG/Yr
+	Real Losses:	0.356	MG/Yr
=	**Water Losses:**	**1.043**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:	$1,715	
	Annual cost of Real Losses:		Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	18.6%	
	Non-revenue water as percent by cost of operating system:	0.6%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	19.58	gallons/connection/day
	Real Losses per service connection per day:	N/A	gallons/connection/day
	Real Losses per length of main per day*:	55.81	gallons/mile/day
	Real Losses per service connection per day per psi pressure:	N/A	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	0.36	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

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Water Audit Report for: **Pawnee (1021209)**
Reporting Year: **2015** **1/2015 - 12/2015**

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 50 out of 100 ***

System Attributes:

	Apparent Losses:	14.387	MG/Yr
+	Real Losses:	11.395	MG/Yr
=	**Water Losses:**	**25.782**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:	$61,145	
	Annual cost of Real Losses:	$887,190	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	30.5%	
	Non-revenue water as percent by cost of operating system:	120.3%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	35.83	gallons/connection/day
	Real Losses per service connection per day:	28.38	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.52	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	11.39	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

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Water Audit Report for: City of Perkins (2006012)
Reporting Year: 2014 | 1/2014 - 12/2014

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 41 out of 100 ***

System Attributes:

	Apparent Losses:	9.442	MG/Yr
+	Real Losses:	3.560	MG/Yr
=	**Water Losses:**	13.002	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:	$42,583	
	Annual cost of Real Losses:	$549	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	16.5%	
	Non-revenue water as percent by cost of operating system:	17.4%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	16.09	gallons/connection/day
	Real Losses per service connection per day:	6.07	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.13	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	3.56	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

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Water Audit Report for: Perry Water and Light District (1021206)
Reporting Year: 2015 | 5/2014 - 6/2015

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 56 out of 100 ***

System Attributes:

	Apparent Losses:	8.012	MG/Yr
+	Real Losses:	19.247	MG/Yr
=	**Water Losses:**	27.259	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	13.94	MG/Yr
	Annual cost of Apparent Losses:	$32,048	
	Annual cost of Real Losses:	$11,745	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	12.1%	
	Non-revenue water as percent by cost of operating system:	2.8%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	8.50	gallons/connection/day
	Real Losses per service connection per day:	20.42	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.37	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	19.25	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:	1.38	

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

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Water Audit Report for: Pittsburg RWD-9 (OK3006107)
Reporting Year: 2014 | 1/2014 - 12/2014

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 71 out of 100 ***

System Attributes:

	Apparent Losses:	1.098	MG/Yr
+	Real Losses:	19.749	MG/Yr
=	**Water Losses:**	20.846	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:	$10,702	
	Annual cost of Real Losses:	$63,991	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	54.1%	
	Non-revenue water as percent by cost of operating system:	30.0%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	6.90	gallons/connection/day
	Real Losses per service connection per day:	N/A	gallons/connection/day
	Real Losses per length of main per day*:	1,288.24	gallons/mile/day
	Real Losses per service connection per day per psi pressure:	N/A	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	19.75	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

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Water Audit Report for: Sequoyah County Rural Water 4 (3006809)
Reporting Year: 2015 | 1/2015 - 12/2015

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 53 out of 100 ***

System Attributes:

	Apparent Losses:	1.344	MG/Yr
+	Real Losses:	7.013	MG/Yr
=	**Water Losses:**	8.358	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	18.03	MG/Yr
	Annual cost of Apparent Losses:	$13,445	
	Annual cost of Real Losses:	$26,998	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	19.5%	
	Non-revenue water as percent by cost of operating system:	8.8%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	4.79	gallons/connection/day
	Real Losses per service connection per day:	N/A	gallons/connection/day
	Real Losses per length of main per day*:	274.48	gallons/mile/day
	Real Losses per service connection per day per psi pressure:	N/A	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	7.01	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:	0.39	

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

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Water Audit Report for: City of Shattuck (2002304)
Reporting Year: 2015 7/2014 - 6/2015

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 57 out of 100 ***

System Attributes:

	Apparent Losses:	6.731	MG/Yr
+	Real Losses:	0.372	MG/Yr
=	**Water Losses:**	7.103	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:	$74,040	
	Annual cost of Real Losses:	$55	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	6.8%	
	Non-revenue water as percent by cost of operating system:	38.6%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	22.30	gallons/connection/day
	Real Losses per service connection per day:	1.23	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.02	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	0.37	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0
American Water Works Association.

Water Audit Report for: Stilwell Area Development Authority (OK1020205)
Reporting Year: 2015 7/2014 - 6/2015

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 50 out of 100 ***

System Attributes:

	Apparent Losses:	25.093	MG/Yr
+	Real Losses:	81.314	MG/Yr
=	**Water Losses:**	106.406	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	13.37	MG/Yr
	Annual cost of Apparent Losses:	$46,923	
	Annual cost of Real Losses:	$23,527	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	38.0%	
	Non-revenue water as percent by cost of operating system:	8.0%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	39.04	gallons/connection/day
	Real Losses per service connection per day:	N/A	gallons/connection/day
	Real Losses per length of main per day*:	3,480.90	gallons/mile/day
	Real Losses per service connection per day per psi pressure:	N/A	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	81.31	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:	6.08	

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AWWA Free Water Audit Software:
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WAS v5.0

Water Audit Report for: Love County RWD #2 (OK2004303)
Reporting Year:

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 80 out of 100 ***

System Attributes:

	Apparent Losses:	2.627	MG/Yr
+	Real Losses:	8.592	MG/Yr
=	**Water Losses:**	**11.219**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	13.74	MG/Yr
	Annual cost of Apparent Losses:	$16,027	
	Annual cost of Real Losses:	$4,990	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	13.5%	
	Non-revenue water as percent by cost of operating system:	8.8%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	6.55	gallons/connection/day
	Real Losses per service connection per day:	N/A	gallons/connection/day
	Real Losses per length of main per day*:	235.40	gallons/mile/day
	Real Losses per service connection per day per psi pressure:	N/A	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	8.59	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:	0.63	

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0

Water Audit Report for: City of Thomas (2002001)
Reporting Year: 2015 6/2014 - 7/2015

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 39 out of 100 ***

System Attributes:

	Apparent Losses:	2.571	MG/Yr
+	Real Losses:	1.153	MG/Yr
=	**Water Losses:**	**3.724**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:	$64,277	
	Annual cost of Real Losses:	$136	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	9.9%	
	Non-revenue water as percent by cost of operating system:	383.5%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	11.29	gallons/connection/day
	Real Losses per service connection per day:	N/A	gallons/connection/day
	Real Losses per length of main per day*:	158.00	gallons/mile/day
	Real Losses per service connection per day per psi pressure:	N/A	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	1.15	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

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AWWA Free Water Audit Software:
System Attributes and Performance Indicators

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American Water Works Association.

Water Audit Report for: **Wayne Public Works Authority (OK2004702)**
Reporting Year: **2015** **1/2015 - 12/2015**

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 68 out of 100 ***

System Attributes:

	Apparent Losses:	0.658	MG/Yr
+	Real Losses:	0.463	MG/Yr
=	**Water Losses:**	**1.121**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:	$4,358	
	Annual cost of Real Losses:	$172	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	5.8%	
	Non-revenue water as percent by cost of operating system:	2.1%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	4.28	gallons/connection/day
	Real Losses per service connection per day:	N/A	gallons/connection/day
	Real Losses per length of main per day*:	43.74	gallons/mile/day
	Real Losses per service connection per day per psi pressure:	N/A	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	0.46	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

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AWWA Free Water Audit Software:
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American Water Works Association.

Water Audit Report for: **Wister Public Works Authority (OK3004014)**
Reporting Year: **2015** **7/2014 - 6/2015**

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 44 out of 100 ***

System Attributes:

	Apparent Losses:	3.686	MG/Yr
+	Real Losses:	20.447	MG/Yr
=	**Water Losses:**	**24.133**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:	$22,115	
	Annual cost of Real Losses:	$28,626	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	44.3%	
	Non-revenue water as percent by cost of operating system:	32.3%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	16.55	gallons/connection/day
	Real Losses per service connection per day:	N/A	gallons/connection/day
	Real Losses per length of main per day*:	2,240.76	gallons/mile/day
	Real Losses per service connection per day per psi pressure:	N/A	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	20.45	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

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Notes

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