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July 22, 2019


PARTIES OF RECORD

Re: Electronic Investigation Into the Measuring, Recording, and Reporting of Water Loss by Kentucky's Jurisdictional Water Utilities, Case No. 2018-00394

The Commission has been advised that the American Water Works Association (AWWA) did not authorize the attached written comments that were filed into the record of the above-referenced case on June 12, 2019. Mr. Will Jernigan, P.E. drafted the comments independent of his affiliation with the AWWA. If any party to the pending case is interested in filing a response to Mr. Jernigan's comments then the Commission will allow responses to be filed into the record within ten days of receipt of this letter.

If you have any questions, please contact Angela M. Goad, Commission Staff Attorney, at (502) 782-2562.

Sincerely,


for Gwen R. Pinson
Executive Director

AMG

Attachments

Kentucky PSC Water Loss Reporting Recommendations

Review comments – 5/29/2019

Will Jernigan, P.E.

Principal Author – AWWA M36 Water Audits & Loss Control Programs, 4th Ed. (2016)

Co-Principal Investigator – WRF 4639 Level 1 Water Audit Validation Guidance Manual

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Chair, AWWA Water Loss Software Subcommittee

Secretary, AWWA Water Loss Control Committee

1. Comments offered in opposition of the 15% “Unaccounted for Water” (“UAW”) target, exploring what water loss metrics should be report, and ‘action level’.

Expert review comments:

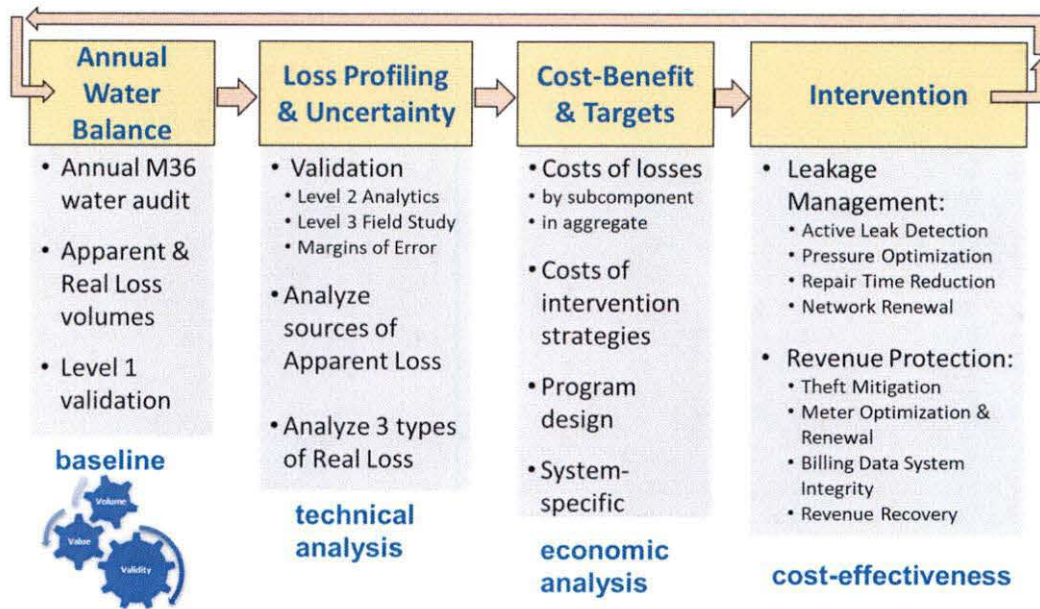
It is recommended to discontinue use of the “Unaccounted for water” and “Unaccounted for water percentage” metrics. Both of these metrics were abandoned by AWWA in 2003. For the present, it is recommended to utilize Water Loss (as defined by the M36 methodology, and conveyed in the AWWA Free Water Audit Software) in terms of volume and value (gal/connection/day, etc). Additional guidance on effective performance indicators is also forthcoming from the AWWA Water Loss Control Committee in mid 2019.

Annual Level 1 validated¹ water audits following the AWWA M36 method represent state-of-the-art for providing reliable water loss assessments. Current reporting structure for %UAW in Kentucky is very likely creating widespread inconsistency and inaccuracy in the water loss performance metrics reported to the PSC. The current PSC Water Loss Reporting category has no measure at all for data accuracy and the reliability of the “Unaccounted for water” performance metrics. This is the equivalent of saying the metrics reported by a system with no meters on their supply or customers are just as reliable as metrics from a fully metered system that does rigorous annual testing and validation. Water Research Foundation Project 4372B (2015²) demonstrated that systemic error is a widespread issue in water audits, resulting in implausible water loss results (near zero, impractically high, and negative water loss).

Regarding action level, investment in water loss reduction should only be made once a reliable water loss assessment can be established, and benefit-cost can be understood. The M36 methodology is illustrated below.

¹ Water Research Foundation Project 4639 *Level 1 Water Audit Validation Guidance Manual*, available here: <http://www.waterrf.org/Pages/Projects.aspx?PID=4639>

² Water Research Foundation Project 4372B *Water Audits in the United States: A Review of Water Losses and Data Validity*, available here: <http://www.waterrf.org/Pages/Projects.aspx?PID=4372>



The research in WRF 4372B and subsequent research projects have shown that it can often take several years of consistent water auditing with validation to resolve systemic underlying data error, particularly when said error is coming from established systems such as supply metering setups and billing system setups. As a general rule, water audit results are not actionable if the audit has not been Level 1 validated, if the Data Validity Score is at 50 or lower, and if the supply meters have not been recently tested in the field for independent volumetric verification.

2. *Comments offered concerning frequency of water auditing & reporting.*

Expert review comments:

Water balance volumes should be tracked regularly (on-going or monthly) on a rolling average basis, and the water audit (producing a water balance and performance indicators) should be performed annually. Annual is the appropriate frequency to update the water audit Data Validity Score based on operational policies & practices, and to update water loss cost assessments based on retail rate changes and marginal production cost changes. The combination of regular tracking and annual auditing is powerful for ensuring water loss intervention activities are timely, and effectiveness can be gauged.

3. *Comments offered concerning engagement of governing bodies and decision makers in the system's water audit and loss assessment.*

Expert review comments:

It is imperative that decision makers be engaged, for accountability and to ensure there is the allocation of resources where needed to take cost-justified action for water loss management. One example of this mechanism is California, where the annual Level 1 validated audit submittal requires a signature from an Executive at the water utility (CEO, CFO, Director, etc).

4. *Comments offered concerning applicability of water audits and water loss performance based on system size.*

Expert review comments:

Systems of all sizes experience all types of water loss, on the extent and ratios vary. The AWWA M36 water audit is applicable for retail water systems of all sizes. As a practical matter, some states look at a threshold of 3,300 connections and above for requiring water audits & reporting. This typically targets 80 to 90% of population in a given state.

5. *Comments offered concerning timeframe and process for setting appropriate water loss targets.*

Expert review comments:

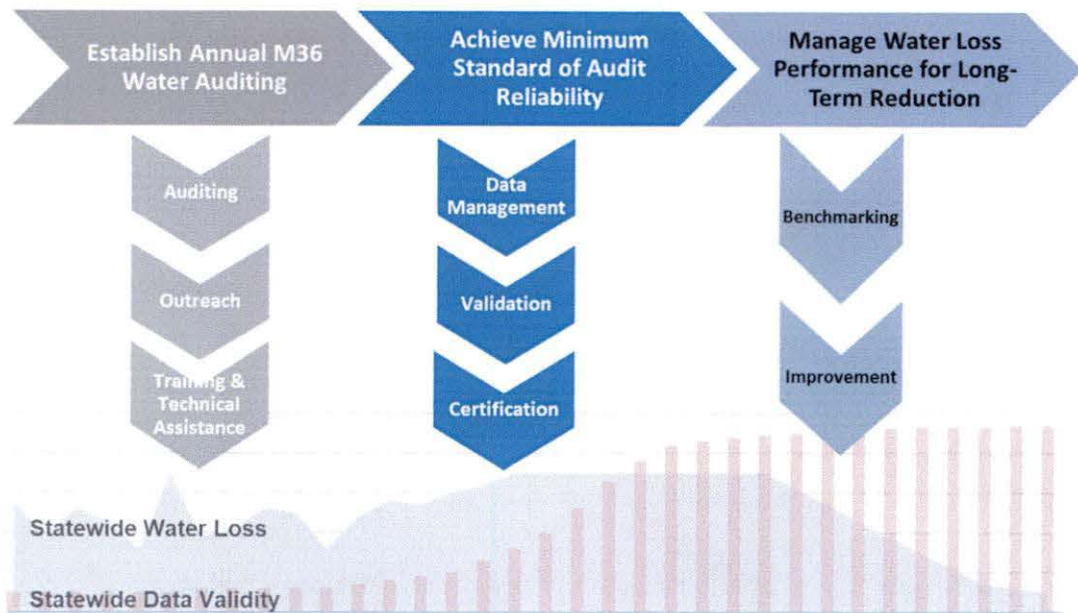
Based on content in comments above (#1, #2), any type of framework for performance targets should be developed judiciously only after several years of validated water audit data is available and analyzed. With regards to target-setting: by comparison water quality performance is governed by the principle universal constituent levels that protect public health. Water quantity & distribution system efficiency does not work like this. The appropriate target levels of water loss in any given system are dictated by physics (terrain/pressure, footprint/pipe mileage, number & density of customer taps) and economics (unit variable cost to acquire, treat and deliver water). These physical and economic parameters vary from one system to another, which means the appropriate targets will be unique to each water system. A few simple examples of this:

- a. Two systems with two very different terrains and pressure profiles will have very different 'unavoidable' levels of leakage.
- b. One system that purchases every unit of water at a high unit cost will have a leakage target that is economically justified to be much lower than another system that produces all its own water at a low unit cost.
- c. One system whose rate structure is heavily skewed to the consumptive charges over the fixed charges will experience significantly higher apparent losses (revenue loss) as compared to another system with low consumptive charges. The appropriate apparent loss targets for these two systems would be very different, as would be the intervention strategies.

6. *Comments offered concerning how to accomplish validation of water audits.*

Expert review comments:

As of 2019, five states have adopted requirements for Level 1 validation of annually submitted M36 water audits (GA, CA, HI, IN, NV). Three states (GA, CA, HI) have demonstrated a model of successful implementation that followed rational sequence: begin collecting audits, then establish actionable levels of data reliability, then use multiple years of validated audit results to build a performance framework. IN and NV have recently passed legislation and will be beginning their programs soon. An illustrative model is shown below.



In the 2nd phase of the sequence, states have successfully established an actionable level of data reliability by first ensuring foundational training and technical assistance for all water utilities subject to reporting. Based on the prevalence of systemic error (as revealed in WRF 4372B), foundational training & technical assistance is essential for water utilities to build internal capacity to do their own meaningful water audits every year. Initially, GA, CA and HI have accomplished validation of reported audits by third party, concurrent with the training and technical assistance program that builds utility capacity. After the initial period, those states have developed certification programs that enable and empower utilities, local consultants, and other interest parties to become certified for providing the necessary water audit validations each year. Georgia and California certifications are well-established as of 2018, with results showing effectiveness to yield an adequate number of certified individuals in the state to meet the need.

“ELECTRONIC INVESTIGATION INTO THE MEASURING, RECORDING, AND REPORTING OF WATER LOSS BY KENTUCKY’S JURISDICTIONAL WATER UTILITIES”

Review comments – 2/6/2019

Will Jernigan, P.E.

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Secretary, AWWA Water Loss Control Committee

1. KRS 278 is the enabling regulation for the PSC (Commission) to prescribe rules for performance of service by utilities. Presently the Commission requires an annual report which includes “...total line loss, including ‘unaccounted-for’ water”.
2. The PSC Water Loss Report in its current form has several issues that are very likely creating widespread inconsistency and inaccuracy in the water loss performance metrics reported to PSC. The issues are inventoried and described below and can be categorized as **method consistency and metrics accuracy**.
 - a. “Unaccounted for water” is codified as the volumetric sum of all water purchased and produced by the utility, minus water sold, authorized-unbilled consumption. In M36 terms, “Unaccounted for water” is the rough equivalent of Water Loss in the M36 water balance, with one major caveat and one minor caveat.
 - i. Major Caveat: PSC’s Water Loss Report (appendix A) omits any Master Meter & Supply Error Adjustment for either Water Produced or Water Supplied. It is well documented that supply measurement error is prevalent in the water industry and has by far the greatest impact on the accuracy of the water audit as compared to other systematic error. This omission is very likely creating widespread inconsistency and inaccuracy in the water loss performance metrics reported to PSC.
 - ii. Minor Caveat: PSC’s Water Loss Report (appendix A) omits Water Export from the derivation of the “Water Produced, Purchased & Distributed”. The M36 methodology recommends removing Water Exported when deriving Water Supplied. The impact of this omission in the PSC Water Loss Report does not affect the volumetric quantity of “Unaccounted for water”. It does, however, impact the “Unaccounted for water” when expressed as a percentage of supply. Measuring and tracking water loss performance on a percentage basis is no longer a recommended best-practice.
 - b. PSC Water Loss Report category “Water Sales” is the equivalent of M36 Billed Authorized Consumption (metered, unmetered), with the minor caveat noted above in 2.b. M36 recommends excluding Water Exported from the Billed Authorized

Consumption categories, but this is only relevant when it comes to the “percentage Unaccounted for water”, which is no longer recommended for use.

- c. PSC Water Loss Report Line 17 – ‘Utility and/or Water Treatment Plant water used’. The boundary of the water audit is paramount. If water used at a WTP is extracted prior to the plant effluent meter, it is not pertinent to the water loss calculation. If it is erroneously included in the water balance, it will erroneously overstate total authorized consumption, and erroneously understate the “Unaccounted for water” quantity. The proximity of off-take for the WTP usage line to the plant effluent meter is not factored into the Water Loss Form.
- d. PSC Water Loss Report category “Water Loss”.
 - i. Major categories of water loss are missing – Systematic Data Handling Error and Customer Metering Inaccuracies.
 - ii. Line 26 and 27 – strong potential for confusion. What is a break vs a leak? Is this only regarding reported breaks and leaks that have surfaced? Does it include those breaks and leaks that have been found through proactive leak detection? Are lines 26 and 27 meant to also include the utility’s estimate of leakage that has not been found? Water Research Foundation Project 4372A (2014) established that surfacing leakage is commonly only a very small fraction of total system leakage¹.
 - iii. It appears Line 31 “Unknown Loss” is a user-provided field rather than auto-calculated. This is true for the other subcategories in Water Loss, lines 25 – 30. The result is that mathematically Water Loss is the sum of only user-provided volumes. This method directly violates the concept of a water balance. Mathematically, water supplied into a network must equal authorized consumption + water loss. The AWWA M36 methodology requires Water Loss to be determined from a water balance, as the difference between Water Supplied and Authorized Consumption. The PSC Water Loss Form Line 33 notes that this should be equal, but the form itself does not ensure this to be the case. Even if the user follows the instruction on Line 33, the form as it is set up incentivizes the user to manipulate the numbers to make them equal out. This is very likely creating widespread inconsistency and inaccuracy in the water loss performance metrics reported to PSC.
- e. The PSC Water Loss Reporting form is presented as a monthly timeframe. While monthly tracking is absolutely recommended as a best practice, an annual timeframe is vital for establishing a water balance and calculating performance metrics. Seasonal variability and inherent lag-time between when supply meters are read and when customer meters are read cause a standalone monthly water balance to generally be an unreliable snapshot. Water loss is recommended to be tracked on a rolling average basis and annual basis.
- f. The current PSC Water Loss Reporting category has no measure at all for data accuracy and the reliability of the “Unaccounted for water” performance metrics. This is the

¹ Water Research Foundation Project 4372B Water Audits in the United States: A Review of Water Losses and Data Validity, available here: <http://www.waterrf.org/Pages/Projects.aspx?PID=4372>

equivalent of saying the metrics reported by a system with no meters on their supply or customers are just as reliable as metrics from a fully metered system that does rigorous annual testing and validation. Water Research Foundation Project 4372B (2015²) demonstrated that systemic error is a widespread issue in water audits, resulting in implausible water loss results (near zero, impractically high, and negative water loss).

3. To resolve the key issues discussed above of **method consistency** and **metrics accuracy**, it is recommended for the PSC to adopt the AWWA Free Water Audit Software (FWAS) with Level 1 Validation in lieu of the current Water Loss reporting worksheet . The FWAS includes confidence grading on inputs to quantify the data reliability, allowing the PSC to distinguish a low reliability audit versus a high reliability audit, and to aid utilities in benchmarking and improving data reliability over time. The FWAS also resolves the method consistency issues discussed above. The FWAS is freely available to all, even non-members of AWWA.
 - a. Note: FWAS current version is v5. The next version (v6) is scheduled for release in first quarter of 2020. The most significant update in v6 will be a streamlined interface with the data grading feature, making the FWAS notably more user friendly and easier to use for smaller systems.
4. It is recommended to discontinue use of the “Unaccounted for water” and “Unaccounted for water percentage” metrics. Both of these metrics were abandoned by AWWA in 2003. For the present, it is recommended to utilize Water Loss (as defined by the M36 methodology, and conveyed in the FWAS) in terms of volume and value (gal/connection/day, etc). Additional guidance on effective performance indicators is also forthcoming from the AWWA Water Loss Control Committee in mid 2019.

² Water Research Foundation Project 4372B Water Audits in the United States: A Review of Water Losses and Data Validity, available here: <http://www.waterrf.org/Pages/Projects.aspx?PID=4372>

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*Oldham County Water District
Oldham County Water District
2160 Spencer Court
La Grange, KY 40031

*Sandy Hook Water District
Sandy Hook Water District
1000 Howard's Creek Road
P. O. Box 726
Sandy Hook, KY 41171

*Western Rockcastle Water Association
Western Rockcastle Water Association, Inc.
371 New Brodhead Road
P. O. Box 627
Mt. Vernon, KY 40456

*Rattlesnake Ridge Water District
Rattlesnake Ridge Water District
3563 State Highway 1661
P. O. Box 475
Grayson, KY 41143-0475

*Crittenden-Livingston County Water D
Crittenden-Livingston County Water District
620 East Main Street
P. O. Box 495
Salem, KY 42078

*U. S. 60 Water District of Shelby an
U. S. 60 Water District of Shelby and Franklin
4596 Bagdad Road
P. O. Box 97
Bagdad, KY 40003

*Mountain Water District
Mountain Water District
6332 Zebulon Highway
P. O. Box 3157
Pikeville, KY 41502-3157

*South Logan Water Association, Inc.
South Logan Water Association, Inc.
114 S Main Street
Adairville, KY 42202

*Peaks Mill Water District
Peaks Mill Water District
7165 US 127 North
Frankfort, KY 40601

*Reid Village Water District
Reid Village Water District
903 Winchester Road
P. O. Box 610
Mt. Sterling, KY 40353

*Southern Madison Water District
Southern Madison Water District
207 North Dogwood Drive
P. O. Box 220
Berea, KY 40403

*Parksville Water District
Parksville Water District
10711 Lebanon Road
P. O. Box 9
Parksville, KY 40464

*Fern Lake Company
Fern Lake Company
34 Appolo Fuels Road
Middlesboro, KY 40965

*South 641 Water District
South 641 Water District
207 Main Street
P. O. Box 126
Hazel, KY 42047

*Rebecca W Goodman
Assistant Attorney General
Office of the Attorney General Office of Rate
700 Capitol Avenue
Suite 20
Frankfort, KENTUCKY 40601-8204

*South Eastern Water Association, Inc
South Eastern Water Association, Inc.
147 East Somerset Church Road
Somerset, KY 42503

*South Hopkins Water District
South Hopkins Water District
129 South Main Street
P. O. Box 487
Dawson Springs, KY 42408

*Water Service Corporation of Kentuck
Water Service Corporation of Kentucky
c/o Water Service Corp
500 West Monroe Street, Suite 3600
Chicago, IL 60661-3779

*Laurel County Water District #2
Laurel County Water District #2
3910 South Laurel Road
London, KY 40744

*Southeast Daviess County Water Distr
Southeast Daviess County Water District
3400 Bittel Road
Owensboro, KY 42301

*Garrard County Water Association, In
Garrard County Water Association, Inc.
315 Lexington Road
P. O. Box 670
Lancaster, KY 40444

*East Pendleton Water District
East Pendleton Water District
601 Woodson Road
Falmouth, KY 41040

*Whitley County Water District #1
Whitley County Water District #1
19 S Highway 25W
Williamsburg, KY 40769

*Todd County Water District
Todd County Water District
2201 New Highway 68 West
P. O. Box 520
Elkton, KY 42220

*Webster County Water District
Webster County Water District
478 US HWY 41-A South
P. O. Box 320
Dixon, KY 42409-0320

*Western Lewis-Rectorville Water and
Western Lewis-Rectorville Water and Gas District
8044 KY 3161
Maysville, KY 41056-9344

*Cannonsburg Water District
Cannonsburg Water District
1606 Cannonsburg Road
Ashland, KY 41102

*East Clark County Water District
East Clark County Water District
118 Hopkins Lane
P. O. Box 112
Winchester, KY 40391

*Western Mason County Water District
Western Mason County Water District
2573 Mary Ingles Highway
P. O. Box 49
Dover, KY 41034-0049

*Union County Water District
Union County Water District
409 North Court Street
P. O. Box 146
Morganfield, KY 42437

*West McCracken County Water District
West McCracken County Water District
8020 Ogden Landing Road
West Paducah, KY 42086

*Western Pulaski County Water Distric
Western Pulaski County Water District
2128 West Highway 80
Somerset, KY 42503

*Adair County Water District
Adair County Water District
109 Grant Lane
P. O. Box 567
Columbia, KY 42728

*Western Fleming County Water Distric
Western Fleming County Water District
1500 Ewing Road
P. O. Box 16
Ewing, KY 41039

*Ohio County Water District
Ohio County Water District
124 E Washington Street
P. O. Box 207
Hartford, KY 42347

*West Daviess County Water District
West Daviess County Water District
3400 Bittel Road
Owensboro, KY 42301