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June 12, 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 received the attached written comments from the American Water Works Association (AWWA), which is being filed in the record of the above-referenced case. If any party to the pending case is interested in filing a response to the AWWA'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,

A handwritten signature in blue ink that reads "Gwen R. Pinson".

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, 4<sup>th</sup> Ed. (2016)

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

AWWA/ANSI-US Expert Appointee for ISO Global Water Loss Standard

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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.

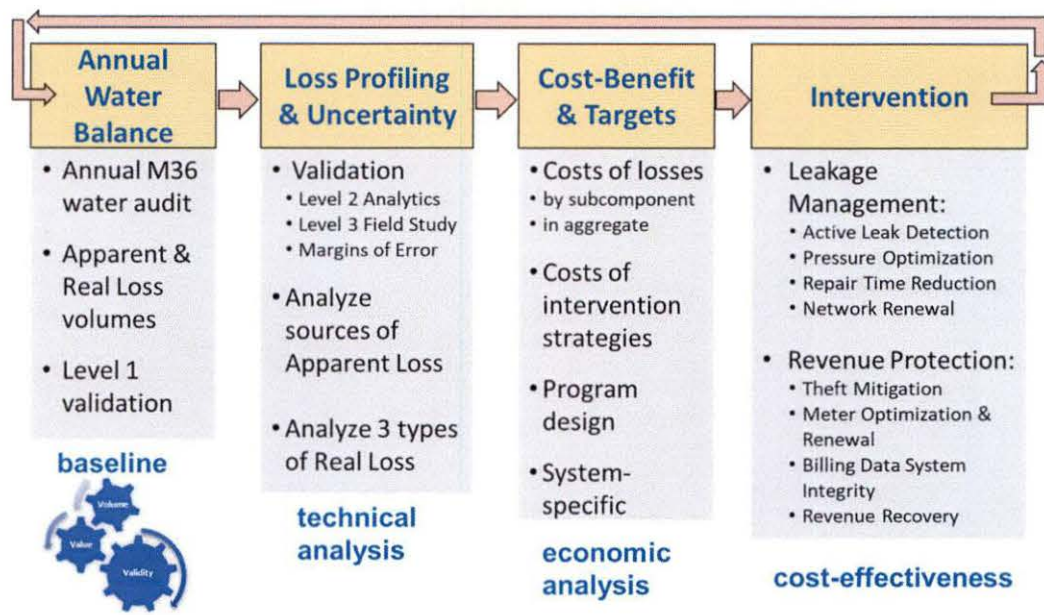
Annual Level 1 validated<sup>1</sup> water audits following the AWWA M36 method represent state-of-the-art for providing reliable water loss assessments. Current reporting structure for %UAW in Kentucky is very likely creating widespread inconsistency and inaccuracy in the water loss performance metrics 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 (2015<sup>2</sup>) 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.

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

<sup>2</sup> 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:

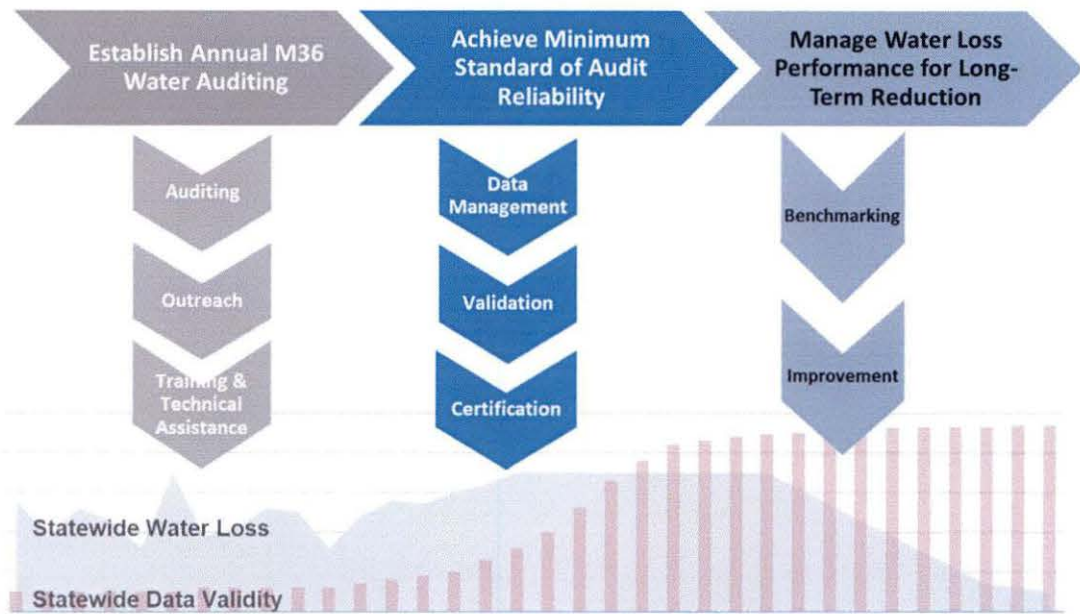
Based on content in comments above (#1, #2), any type of framework for performance targets should be developed judiciously only after several years of validated water audit data is available and analyzed. With regards to target-setting: by comparison water quality performance is governed by the principle 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 2<sup>nd</sup> 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.

Principal Author – AWWA M36 Water Audits & Loss Control Programs, 4<sup>th</sup> 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. 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 leakage<sup>1</sup>.
  - 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

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<sup>1</sup> 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 (2015<sup>2</sup>) 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.

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<sup>2</sup> 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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\*Center Ridge Water District No. 2  
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\*Murray #2 Water District  
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\*Black Mountain Utility District  
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\*Barkley Lake Water District  
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\*McKinney Water District  
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\*North Marshall Water District  
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\*Trimble County Water District #1  
Trimble County Water District #1  
P. O. Box 63  
34 E Morgan Drive  
Bedford, KY 40006-0063

\*North Shelby Water Company  
North Shelby Water Company  
4596 Bagdad Road  
P. O. Box 97  
Bagdad, KY 40003

\*North Mercer Water District  
North Mercer Water District  
4795 Louisville Road  
P. O. Box 79  
Salvisa, KY 40372

\*North McLean County Water District  
North McLean County Water District  
217 Hill Street  
P. O. Box 68  
Livermore, KY 42352

\*Nebo Water District  
Nebo Water District  
45 North Bernard Street  
Nebo, KY 42441

\*Monica Braun  
STOLL KEENON OGDEN PLLC  
300 West Vine Street  
Suite 2100  
Lexington, KENTUCKY 40507-1801

\*North Manchester Water Association,  
North Manchester Water Association, Inc.  
7362 N Highway 421  
Manchester, KY 40962

\*Carroll County Water District #1  
Carroll County Water District #1  
205 Main Cross Street  
P. O. Box 350  
Ghent, KY 41045

\*Powell's Valley Water District  
Powell's Valley Water District  
31 Adams Ridge Road  
P. O. Box 550  
Clay City, KY 40312

\*Rowan Water, Inc.  
Rowan Water, Inc.  
1765 Christy Creek Road  
Morehead, KY 40351

\*Hardin County Water District #1  
Hardin County Water District #1  
1400 Rogersville Road  
Radcliff, KY 40159-0489

\*Henderson County Water District  
Henderson County Water District  
655 South Main Street  
P. O. Box 655  
Henderson, KY 42419-0655

\*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  
2335 Sanders Road  
Northbrook, IL 60062-6196

\*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