

**COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION**

In the Matter of:

**APPLICATION OF HARDIN COUNTY)
WATER DISTRICT NO. 2 FOR A)
DECLARATORY ORDER THAT)
SAMPLE TESTING SATISFIES THE)
TESTING REQUIREMENTS OF 807) CASE NO. 2016-00432
KAR 5:066, SECTION 16(1) OR, IN)
THE ALTERNATIVE, FOR AN)
ORDER GRANTING A DEVIATION)
FROM 807 KAR 5:066, SECTION 16(1))**

APPLICATION

Pursuant to 807 KAR 5:001, Sections 14 and 19, and 807 KAR 5:066, Section 18, Hardin County Water District No. 2 (the “HCWD2”) applies to the Kentucky Public Service Commission (the “Commission”) for a declaratory order that sample testing 5/8- x 3/4-inch meters in accordance with HCWD2’s Sample Meter Testing Plan satisfies the testing requirements of 807 KAR 5:066, Section 16(1) or, in the event the Commission finds that the use of sample testing does not satisfy the regulation’s requirements, an order granting a deviation from the requirements of 807 KAR 5:066, Section 16(1), regarding the frequency of testing 5/8- x 3/4-inch meters.

In support of its application, HWCD2 respectfully states:

1. The full name and post office address of HCWD2 is: Hardin County Water District No. 2, P.O. Box 970, Elizabethtown, Kentucky 42702-0970.

2. HCWD2's electronic mail address is: jjeffries@hardincountywater2.org.

3. HCWD2 is not a corporation, limited liability company, or limited partnership. It has no articles of incorporation or partnership agreements.

4. HCWD2 is a water district organized pursuant to KRS Chapter 74 and was created by an Order of the Hardin County Court entered on June 23, 1965.

5. HCWD2's territory includes all of Hardin County, Kentucky, except for the city of Radcliff and the northern portion of Hardin County, and portions of Larue and Hart Counties. As of November 30, 2016, HCWD2 provided retail water service to approximately 27,470 customers.

6. Pursuant to 807 KAR 5:001, Section 4(8),¹ copies of all orders, pleadings and other communications related to this proceeding should be directed to:

James R. Jeffries
General Manager
P.O. Box 970
360 Ring Road
Elizabethtown, KY 42702
(270) 737-1056
jjeffries@hardincountywater2.org

¹ On December 12, 2016, HCWD2 gave notice pursuant to 807 KAR 5:001, Section 8, of its intent to file this application and of its use of electronic filing procedures.

Damon R. Talley
Stoll Keenon Ogden PLLC
P.O. Box 150
Hodgenville, KY 42748-0150
(270) 358-3187
Fax: (270) 358-9560
damon.talley@skofirm.com

Gerald E. Wuetcher
Stoll Keenon Ogden PLLC
2100 West Vine Street, Ste 2100
Lexington, KY 40507-1801
(859) 231-3017
Fax: (859) 259-3517
gerald.wuetcher@skofirm.com

Mary Ellen Wimberly
Stoll Keenon Ogden PLLC
2100 West Vine Street, Ste 2100
Lexington, KY 40507-1801
(859) 231-3047
Fax: (859) 246-3647
maryellen.wimberly@skofirm.com

7. 807 KAR 5:066, Section 16(1) requires that HCWD2 periodically test its 5/8- x 3/4-inch water meters so that no meter remains in service without testing for a period longer than 10 years. Historically, HCWD2's meter replacement program for residential meters required that (1) no meter remain in service past 10 years of age, and (2) each meter was removed after 10 years of service and replaced with a new or rebuilt meter that the manufacturer represented would

remain accurate for 15 years.² HCWD2 is current with its meter replacement program.

HCWD2's Sample Meter Testing Plan

8. In 2016 HCWD2 adopted a Sample Meter Testing Plan (the "Plan"), a copy of which is attached as **Exhibit 1** to this Application, requiring a representative sample of its meters that have been in service at least 10 years to be tested annually to ensure that all meters within their respective age groups meet the accuracy requirements set forth in 807 KAR 5:066, Section 15.

9. Under the Plan, HCWD2 will conduct annual sample testing of its meters using statistical sampling and analytical methodologies that the Commission has previously approved.

10. HCWD2 will test each meter at three different flow rates: a maximum flow rate of 15 gallons per minute ("gpm"); an intermediate flow rate of 2 gpm; and a minimum flow rate of 1/4 gpm. These flow rates are specified by 807 KAR 5:066, Section 15(2). The acceptability of the maximum and intermediate flow rates will be determined using the statistical method prescribed in *American National Standard Institute ANSI/ASQ Z1.9-2003 (R2013) (Sampling Procedures and Tables for Inspection by Variables for Percent Nonconforming)* (hereinafter referred to as the "ANSI Standard"). The Commission has approved the use of the

² If HCWD2 receives a complaint or inquiry about a meter that may be inaccurate, that meter is removed and tested. A replacement meter is installed for continuity of service. If the removed meter tests accurately and has sufficient useful life remaining, it may be installed at a new location.

ANSI Standard for electric and gas utilities conducting sample meter testing.³ The acceptability of the minimum flow rate will be determined by the means analysis test used by Kentucky-American Water Company and accepted by the Commission in Case No. 2009-00253.⁴ The size of the sample will be determined by the ANSI Standard. Sampled meters will be randomly selected by a computerized process.

11. HCWD2 has adopted the following schedule for its Sample Meter Testing Plan:

Year 1 (2016): Sample test the 10-year-old meters (those installed in 2006).

Year 2 (2017): Sample test the 11-year-old meters (those installed in 2006); sample test the 10-year-old meters (those installed in 2007)

Year 3 (2018): Sample test the 12-year-old meters (those installed in 2006); sample test the 11-year-old meters (those installed in 2007); sample test the 10-year-old meters (those installed in 2008).

³ See, e.g., *In the Matter of: Application of Farmers Rural Electric Cooperative for Adoption of a Sample Meter Testing Program*, Case No. 2013-00186 (Ky. PSC Aug. 8, 2014); *In the Matter of: Application of Kenergy Corp. for Approval of Sample Meter Testing Plan*, Case No. 2010-00034 (Ky. PSC May 14, 2010); *In the Matter of: Application of Grayson Rural Electric Cooperative Corporation for a Deviation from 807 KAR 5:041, Section 15(3), Sample Master Meter Testing Program*, Case No. 2009-00103 (Ky. PSC Sept. 25, 2009); *In the Matter of: Application of Salt River Electric Cooperative Corporation to Adopt a Sample Meter Testing Program*, Case No. 2005-00536 (Ky. PSC Feb. 6, 2006); *In the Matter of: Application of Fleming-Mason Energy Cooperative for Approval to Adopt a Sample Meter Testing Plan*, Case No. 2004-00173 (Ky. PSC Aug. 25, 2004); *In the Matter of: The Application of Louisville Gas and Electric Company for Approval of a Permanent Statistical Meter Sampling Plan*, Case No. 2000-278 (Ky. PSC Nov. 7, 2001); *In the Matter of: The Application of Columbia Gas of Kentucky, Inc. for Authority to Implement a Permanent Statistical meter Sampling Plan for Residential, Industrial and Commercial Class meters and for Authority to Deviate from 807 KAR 5:006, Section 25(5)(b)*, Case No. 2000-429 (Ky. PSC Feb. 26, 2001).

⁴ *In the Matter of: Kentucky-American Water Company's Request for Permission to Deviate from 807 KAR 5:066, Section 16(1)*, Case No. 2009-00253 (Ky. PSC Oct. 5, 2011).

Year 4 (2019): Sample test the 13-year-old meters (those installed in 2006); sample test the 12-year-old meters (those installed in 2007); sample test the 11-year-old meters (those installed in 2008); sample test the 10-year-old meters (those installed in 2009).

Year 5 (2020): Sample test the 14-year-old meters (those installed in 2006); sample test the 13-year-old meters (those installed in 2007); sample test the 12-year-old meters (those installed in 2008); sample test the 11-year-old meters (those installed in 2009); sample test the 10-year-old meters (those installed in 2010).

Year 6 (2021): Sample test the 15-year-old meters (those installed in 2006); sample test the 14-year-old meters (those installed in 2007); sample test the 13-year-old meters (those installed in 2008); sample test the 12-year-old meters (those installed in 2009); sample test the 11-year-old meters (those installed in 2010); sample test the 10-year-old meters (those installed in 2011).

12. HCWD2 will annually file with the Commission the sample test results. After the first group of meters reaches 15 years of age, HCWD2 will evaluate the data and request that the Commission: (1) extend the sample meter testing plan; (2) allow HCWD2 to replace meters on a 15-year cycle; or (3) approve another appropriate course of action.

**The Plan Satisfies Testing Requirements
Of 807 KAR 5:066, Section 16(1)**

13. Statistical sample testing permits conclusions to be reached concerning an entire group of meters after actually testing only a small, but statistically significant, percentage of the total number in the group. This use of statistical sample testing provides a highly reliable indicator of the accuracy of the

meters within each age group, identifies defective equipment, and is the functional equivalent of testing all meters within an age group.

14. In 2016, HWCD2 tested a sample group of its 10-year-old 5/8- x 3/4-inch meters installed in 2006. The results of these tests, which are shown in Appendix A to the Plan, show that the meters of this age group remain accurate at 10 years of age.

15. HCWD2's use of Commission-approved statistical sampling methods is consistent with and satisfies the requirements of 807 KAR 5:066, Section 16(1). Thus, statistical sampling, as proposed by HCWD2, may be used in lieu of testing all water meters within an age group. The Commission has previously recognized for natural gas and electric utilities that sample testing is a functional equivalent for the testing of all meters.⁵

Deviation from 807 KAR 5:066, Section 16(1)

16. 807 KAR 5:066, Section 18 authorizes the Commission to permit deviations from 807 KAR 5:066 when good cause is shown. If the Commission finds that HCWD2's use of Commission-approved statistical sampling and analytical methodologies to test the accuracy of its water meters in lieu of testing all meters fails to satisfy the requirement of 807 KAR 5:066, Section 16(1), then

⁵ *Supra* note 3.

HCWD2 requests a deviation from that regulation to permit HCWD2 to test its 5/8- x 3/4-inch meters in accordance with the Plan.

17. Good cause for a deviation exists in the present case.

a. Granting a deviation will ensure that HCWD2 immediately receives the cost benefits associated with the sample meter testing. HCWD2 estimates that its Plan will result in annual meter purchase savings of \$76,636. If HCWD2 were to continue replacing meters on a 10-year cycle, it would replace 5,749 meters over the next five (5) years. By extending the life of these meters from 10 to 15 years, HCWD2 will avoid making capital expenditures totaling **\$528,908** (5,749 meters x \$92.00 per meter = \$528,908). HCWD2 customers will benefit from these savings, as it will allow HCWD2 to delay future rate increases.

b. Unlike meters that are tested after 10 years of service and then not subject to further testing for another 10 years, HCWD2 will subject the meters in each age group that is 10 years or older to annual sample testing to ensure their accuracy.

c. The manufacturers of all of HCWD2's existing 5/8- x 3/4-inch meters have represented that their meters will remain accurate for 15 years. Under the Plan, the meters will not remain in service longer than 15 years without Commission approval.

d. The Plan is consistent with the results of tests performed by other Kentucky water utilities for which the Commission has granted deviations to maintain their 5/8- x 3/4-inch meters in service for 15 years without testing based upon the use of similar sample testing methodologies.⁶

18. Granting a deviation will not erode any protection for HCWD2 customers or limit the Commission's ability to ensure accurate billing for utility service. Under the Plan, HCWD2 will annually update the Commission with the results of testing, thereby providing the Commission the ability to actively monitor the results of the sample testing and address any results showing inaccuracies.

19. Requiring HCWD2 to wait until the end of the five-year period and thereafter request a deviation to extend meter service life without testing would reduce the estimated savings significantly.

Conclusion

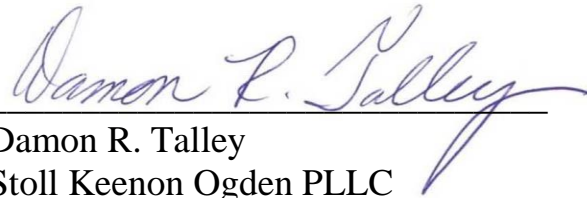
WHEREFORE, HCWD2 requests that the Commission enter an order declaring that HCWD2's sample meter testing plan satisfies the testing requirements of 807 KAR 5:066, Section 16(1) or, in the alternative, granting a deviation from 807 KAR 5:066, Section 16(1) such that over the next five (5) years

⁶ *In the Matter of: Joint Application of Warren County Water District, Simpson County Water District, and Butler County Water System, Inc. for a Deviation from Approved Meter Testing Program*, Case No. 2011-00220 (Ky. PSC Mar. 5, 2013) (granting a deviation to permit water meters to remain in service for 15 years without testing); *In the Matter of: Kentucky-American Water Company's Request for Permission to Deviate from 807 KAR 5:066, Section 16(1)*, Case No. 2009-00253 (Ky. PSC Oct. 5, 2011) (granting request for a deviation to test water meters every 15 years).

HCWD2 may conduct sample testing on all 5/8- x 3/4-inch meters that have been in service for 10 years or longer in lieu of testing each meter after it has been in service 10 years.

Dated: December 29, 2016

Respectfully submitted,



Damon R. Talley
Stoll Keenon Ogden PLLC
P.O. Box 150
Hodgenville, KY 42748-0150
Telephone: (270) 358-3187
Fax: (270) 358-9560
damon.talley@skofirm.com


Gerald E. Wuetcher
Mary Ellen Wimberly
Stoll Keenon Ogden PLLC
300 West Vine Street, Suite 2100
Lexington, Kentucky 40507-1801
Telephone: (859) 231-3000
Fax: (859) 259-3517
gerald.wuetcher@skofirm.com
maryellen.wimberly@skofirm.com

*Counsel for Hardin County Water District
No. 2*

COMMONWEALTH OF KENTUCKY)
) SS
COUNTY OF HARDIN)

The undersigned, Michael L. Bell, being duly sworn, deposes and states that he is the Chairman of Hardin County Water District No. 2, the Applicant in the above proceedings; that he has read this Application and has noted its contents; that the same is true of his own knowledge, except as to matters which are therein stated on information or belief, and as to those matters, he believes same to be true.

IN TESTIMONY WHEREOF, witness the signature of the undersigned on this December 27, 2016.



Michael L. Bell, Chairman
Hardin County Water District No. 2

Subscribed and sworn to before me by Michael L. Bell, in his capacity as Chairman of Hardin County Water District No. 2, on this December 27, 2016.



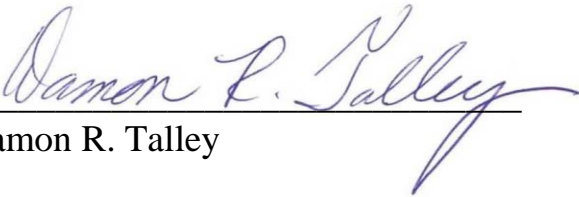
Notary Public, State at Large

Notary ID: 534422

My Commission expires: 6-9-2019

CERTIFICATE OF SERVICE

In accordance with 807 KAR 5:001, Section 8, I certify that Hardin County Water District No. 2's electronic filing of this Application is a true and accurate copy of the same document being filed in paper medium; that the electronic filing was transmitted to the Public Service Commission on December 29, 2016; that there are currently no parties that the Public Service Commission has excused from participation by electronic means in this proceeding; and that an original paper medium of this Application will be delivered to the Public Service Commission on or before January 4, 2017.



Damon R. Talley

EXHIBIT 1

SAMPLE METER TESTING PLAN

FOR

HARDIN COUNTY WATER DISTRICT NO. 2

5/8- x 3/4-INCH DISPLACEMENT METERS

Hardin County Water District No. 2
Elizabethtown, KY

December 20, 2016

SAMPLE METER TESTING PLAN

SECTION 1.0 INTRODUCTION

Hardin County Water District No. 2 (“HCWD2”) is a water utility located in Hardin County, Kentucky. Its territory includes all of Hardin County, except for the city of Radcliff and the northern part of Hardin County, and portions of Larue and Hart Counties. HCWD2 currently removes all meters after 10 years of service and replaces them with a new or rebuilt mechanical meter that the manufacturer represents will remain accurate for 15 years. The meters being replaced are also mechanical meters that the manufacturer represents will remain accurate for 15 years. New meters are tested by the manufacturer before being placed into service.

HCWD2 requests a declaratory order that the sample testing of 5/8- x 3/4-inch meters older than 10 years in accordance with this sample meter testing plan (the “Plan”) complies with the testing requirements of 807 KAR 5:066, Section 16(1). In the alternative, HCWD2 requests a deviation from the testing frequency requirements of 807 KAR 5:066, Section 16(1), in order to implement sample testing of 5/8- x 3/4-inch meters older than 10 years in accordance with this Plan. Statistical sample testing permits conclusions to be reached concerning an entire group of meters after actually testing only a small, but statistically significant, percentage of the total number in the group. By adopting this Plan, HCWD2 will maintain accurate meters while using its meters for a longer period of time, thus significantly reducing the costs associated with replacing meters on a 10-year cycle.

SECTION 2.0 RULES AND REGULATIONS

807 KAR 5:066, Section 15(2) requires “[a]ll new meters, and any meter removed from service for any cause . . . be tested for accuracy as specified herein prior to being placed in service.” The regulation includes a table with accuracy limits for maximum, intermediate, and minimum flow rates. For maximum and intermediate rates, the accuracy limit is 98.5-101.5. At a minimum flow rate, the accuracy limit is 95-101 for new and rebuilt meters. Repaired meters must meet a minimum flow rate accuracy limit of 90. The Commission has allowed extensions of meter testing

periods based on test results that judged minimum flow rates at a limit of 90%.¹ Under 807 KAR 5:066, Section 16(1), 5/8- x 3/4-inch meters may not remain in service without testing for longer than 10 years.

HCWD2 requests a declaratory order that sample testing in accordance with the Plan complies with the testing requirements of 807 KAR 5:066, Section 16(1). The Plan will meet the requirements of the regulation by testing a representative sample in accordance with the time period set forth in the regulation; no meter age group will remain in service for longer than 10 years without sample testing. HCWD2 will further ensure meter accuracy by annually sample testing each meter age group that is greater than 10 years old for at least the first 5 years of sample testing. Alternatively, HCWD2 requests a deviation from 807 KAR 5:066, Section 16(1)'s requirement that a meter may not remain in service for a period longer than 10 years without testing. Granting a declaratory order or deviation to allow HCWD2 to implement the Plan will ensure the accuracy of HCWD2's meters while also significantly reducing costs.

SECTION 3.0 PROCEDURE

HCWD2's statistical sample meter testing for intermediate and maximum flow rates will follow *American National Standard Institute ANSI/ASQ Z1.9-2003 (R2013) (Sampling Procedures and Tables for Inspection by Variables for Percent Nonconforming)* (hereinafter referred to as the "ANSI Standard"). The size of the sample will be determined by the ANSI Standard. HCWD2 will use an Excel spreadsheet, its billing system, or another computerized process to randomly select meters to be tested.

The **Acceptance Quality Limit ("AQL")** is defined as the quality level that is the worst tolerable product average when a continuing series of lots is submitted for acceptance sampling. This value is selected by the utility as recognition of the level of errors that are acceptable and is derived from **Table A-1**. HCWD2 has chosen to use an **AQL of 2.5**, unless otherwise required by the Commission,

¹ *In the Matter of: Joint Application of Warren County Water District, Simpson County Water District, and Butler County Water System, Inc. for a Deviation from Approved Meter Testing Program*, Case No. 2011-00220, Application at Appendix A (Ky. PSC June 28, 2011), *overruled on other grounds by Warren County Water District, et al. v. Commonwealth of Kentucky, Public Service Commission*, Civil Action No. 13-CI-401 (Ky. Franklin Cir. Ct. 2014); *In the Matter of: Kentucky-American Water Company's Request for Permission to Deviate from 807 KAR 5:066, Section 16(1)*, Case No. 2009-00253, Order at 6 (Ky. PSC Oct. 5, 2011).

because this AQL value has been used in other sample meter testing plans accepted by the Commission.²

Table A-1
AQL Conversion Table

For specified AOL values falling within these ranges			Use this AQL value
–	to	0.109	0.10
0.110	to	0.164	0.15
0.165	to	0.279	0.25
0.280	to	0.439	0.40
0.440	to	0.669	0.65
0.700	to	1.09	1.0
1.10	to	1.64	1.5
1.65	to	2.79	2.5
2.80	to	4.39	4.0
4.40	to	6.99	6.5
7.00	to	10.9	10.0

Under the ANSI Standard, the sample size is determined by the inspection level and lot size. Part A7 of the ANSI Standard states that **Inspection Level II** shall

² See, e.g., *In the Matter of: Application of Farmers Rural Electric Cooperative for Adoption of a Sample Meter Testing Program*, Case No. 2013-00186, Order at 4 (Ky. PSC Aug. 8, 2014); *In the Matter of: Application of Kenergy Corp. for Approval of Sample Meter Testing Plan*, Case No. 2010-00034, Order (Ky. PSC May 14, 2010); *In the Matter of: Application of Grayson Rural Electric Cooperative Corporation for a Deviation from 807 KAR 5:041, Section 15(3), Sample Master Meter Testing Program*, Case No. 2009-00103, Order (Ky. PSC Sept. 25, 2009); *In the Matter of: Application of Salt River Electric Cooperative Corporation to Adopt a Sample Meter Testing Program*, Case No. 2005-00536, Order (Ky. PSC Feb. 6, 2006); *In the Matter of: Application of Fleming-Mason Energy Cooperative for Approval to Adopt a Sample Meter Testing Plan*, Case No. 2004-00173, Order (Ky. PSC Aug. 25, 2004); *In the Matter of: The Application of Louisville Gas and Electric Company for Approval of a Permanent Statistical Meter Sampling Plan*, Case No. 2000-278 (Ky. PSC Nov. 7, 2001); *In the Matter of: The Application of Columbia Gas of Kentucky, Inc. for Authority to Implement a Permanent Statistical meter Sampling Plan for Residential, Industrial and Commercial Class meters and for Authority to Deviate from 807 KAR 5:006, Section 25(5)(b)*, Case No. 2000-429 (Ky. PSC Feb. 26, 2001).

generally be used. Unless otherwise required by the Commission, this level will be in effect for the HCWD2 program. Using the inspection level and lot size, **Table A-2** provides the Sample Size Code Letter that is referenced in **Table B-3**. The **AQL** and “Normal Inspection” portion of **Table B-3** is then used to determine the sample size for the lot.

The upper and lower accuracy limits of 807 KAR 5:066, Section 15(2) require the use of the **Double Specification Limit** method as outlined in the ANSI Standard. For each lot, calculations will be based on the Double Specification Limit Variability Unknown-Standard Deviation Method. **Example B-3** in the ANSI Standard demonstrates this calculation method when the same AQL value is used for the upper and lower limit.

[Remainder of page intentionally left blank]

Table A-2¹
Sample Size Code Letters²

Lot Size	Inspection Levels				
	Special S3 S4		General I II III		
2 to 8	B	B	B	B	C
9 to 15	B	B	B	B	D
16 to 25	B	B	B	C	E
26 to 50	B	B	C	D	F
51 to 90	B	B	D	E	G
91 to 150	B	C	E	F	H
151 to 280	B	D	F	G	I
281 to 400	C	E	G	H	J
401 to 500	C	E	G	I	J
501 to 1,200	D	F	H	J	K
1,201 to 3,200	E	G	I	K	L
3,201 to 10,000	F	H	J	L	M
10,001 to 35,000	G	I	K	M	N
35,001 to 150,000	H	J	L	N	P
150,001 to 500,000	H	K	M	P	P
500,001 and over	H	K	N	P	P

¹The theory governing inspection by variables depends on the properties of the normal distribution and, therefore, this method of inspection is only applicable when there is reason to believe that the frequency distribution is normal.

²Sample size code letters given in body of table are applicable when the indicated inspection levels are to be used.

Table B-3 Standard Deviation Method
 Master Table for Normal and Tightened Inspection for Plans Based on Variability Unknown
 (Double Specification Limit and Form 2—Single Specification Limit)

Sample Size Code Letter	Sample Size	Acceptance Quality Limits (normal inspection)											
		T	.10	.15	.25	.40	.65	1.00	1.50	2.50	4.00	6.50	10.00
		M	M	M	M	M	M	M	M	M	M	M	M
B	3	↓	↓	↓	↓	↓	↓	↓	↓	7.59	18.86	26.94	33.69
C	4	↓	↓	↓	↓	↓	↓	1.49	5.46	10.88	16.41	22.84	29.43
D	5	↓	↓	↓	↓	0.041	1.34	3.33	5.82	9.80	14.37	20.19	26.55
E	7	↓	0.005	0.087	0.421	1.05	2.13	3.54	5.34	8.40	12.19	17.34	23.30
F	10	0.077	0.179	0.349	0.714	1.27	2.14	3.27	4.72	7.26	10.53	15.17	20.73
G	15	0.186	0.311	0.491	0.839	1.33	2.09	3.06	4.32	6.55	9.48	13.74	18.97
H	20	0.228	0.356	0.531	0.864	1.33	2.03	2.93	4.10	6.18	8.95	13.01	18.07
I	25	0.250	0.378	0.551	0.874	1.32	2.00	2.86	3.97	5.98	8.65	12.60	17.55
J	35	0.253	0.373	0.534	0.833	1.24	1.87	2.66	3.70	5.58	8.11	11.89	16.67
K	50	0.243	0.355	0.503	0.778	1.16	1.73	2.47	3.44	5.21	7.61	11.23	15.87
L	75	0.225	0.326	0.461	0.711	1.06	1.59	2.27	3.17	4.83	7.10	10.58	15.07
M	100	0.218	0.315	0.444	0.684	1.02	1.52	2.18	3.06	4.67	6.88	10.29	14.71
N	150	0.202	0.292	0.412	0.636	0.946	1.42	2.05	2.88	4.42	6.56	9.86	14.18
P	200	0.204	0.294	0.414	0.637	0.945	1.42	2.04	2.86	4.39	6.52	9.80	14.11
		.10	.15	.25	.40	.65	1.00	1.50	2.50	4.00	6.50	10.00	
Acceptance Quality Limits (tightened inspection)													

All AQL values are in percent nonconforming. T denotes plan used exclusively on tightened inspection and provides symbol for identification of appropriate OC curve.

↓ Use first sampling plan below arrow; that is, both sample size as well as k value. When sample size equals or exceeds lot size, every item in the lot must be inspected.

In 2016, HCWD2 had 555 10-year-old meters. Table A-2 specifies a sample size code letter of “J” for samples of that size. Using the sample size code letter and an AQL of 2.5, Table B-3 shows that a sample size of 35 and an acceptability criterion of 5.58 should be used.

Inspection lots will consist of all meters of a certain age. In Year 1, the 10-year-old meters (those installed in 2006) were sample tested. In Year 2, the 10- and 11-year-old meters will be sample tested. This process will continue until the first group of meters reaches 15 years of age. Randomly selected meters from each lot will be tested by a Commission-certified technician using HCWD2's Commission-certified meter test bench. If any randomly selected meter is broken, damaged, frozen, or has been vandalized or tampered with, then that particular meter will be replaced by another random selection. If HCWD2 identifies any results that are extreme outliers from others in the sample, HCWD2 will investigate the cause of the outlier and, if the investigation determines that the cause of the outlier is rare, may discard the outlier for use in the sample testing. HCWD2 will report any outlier and explain why it was not used to determine the acceptability of the sample in its annual report to the Commission.

The sampled meters will be tested under three different flow rates: a maximum flow rate of 15 gallons per minute ("gpm"), an intermediate flow rate of 2 gpm, and a minimum flow rate of 1/4 gpm. Any tested meter that does not meet all of the flow rate standards in 807 KAR 5:066, Section 15 will be removed from service.

At intermediate and maximum flow rates, meter acceptance will be determined using the ANSI Standard. If the sample is not accepted under the ANSI Standard and a poorly performing sub-group can be identified for separation from the original control group, the deviate sub-group will be removed from service within a 6-month period. If, by removal of a specific sub-group of meters, HCWD2 can demonstrate that the original control group of meters now meets the applicability standard, the remaining meters in the original control group shall remain in service. If a deviate sub-group of meters cannot be identified to improve the control group's accuracy, HCWD2 will test and remove the entire control group of meters within 12 months once it has failed the applicable governing standard.

At the minimum flow rate, accuracy will not be determined using the ANSI Standard because the ANSI Standard does not effectively measure the accuracy of a meter lot when the accuracy limits are not equally above and below 100%. The ANSI Standard calculates the acceptance of the sample using the sample's mean and standard deviation. A perfect sample under the ANSI Standard would have a sample mean that falls equally between the upper and lower limits and a low standard deviation. For example, when using upper and lower limits of 90-101 with the ANSI standard, a sample would be more likely to be accepted if the samples were clustered around the middle of the upper and lower limits (95-96%)

than if the samples were nearer 100%. Accordingly, because the ANSI Standard favors less accurate meter values when using upper and lower limits that are not equally above and below 100%, it ineffectively determines the acceptance of low flow rates and should not be used. In the two cases where the Commission has accepted the results of sample testing for water meters, the water utilities have not used the ANSI Standard to determine the accuracy at minimum flow rates and have instead determined the acceptance of the sample using other measures.³

The Commission accepted the use of the means analysis test to determine accuracy at minimum flow rates in Case No. 2009-00253.⁴ In Case No. 2011-00220, it is unclear from the order or record what method was used to calculate the acceptability at minimum flow rates. Accordingly, HCWD2 will use the means analysis test to determine acceptability of a sample at minimum flow rates. HCWD2 will calculate the mean of the minimum flow rates of the sampled meters. If the mean is above 90% and less than 101%, the minimum flow rates will be accepted.⁵ Importantly, the accuracy of water meters at a low flow rate has a de minimis effect on revenue. A residential water meter in HCWD2's system operates in the minimum flow range only about 8.15% of the time.⁶ Given the small amount of water consumed at minimum flow rates and the infrequency with which users use water at minimum flow rates, very little revenue is lost if the meters run slow at minimum flow rates.

³ See *In the Matter of: Joint Application of Warren County Water District, Simpson County Water District, and Butler County Water System, Inc. for a Deviation from Approved Meter Testing Program*, Case No. 2011-00220, Application at Appendix A (Ky. PSC June 28, 2011), *overruled on other grounds by Warren County Water District, et al. v. Commonwealth of Kentucky, Public Service Commission*, Civil Action No. 13-CI-401 (Ky. Franklin Cir. Ct. 2014); *In the Matter of: Kentucky-American Water Company's Request for Permission to Deviate from 807 KAR 5:066, Section 16(1)*, Case No. 2009-00253, Order at 6 (Ky. PSC Oct. 5, 2011).

⁴ *In the Matter of: Kentucky-American Water Company's Request for Permission to Deviate from 807 KAR 5:066, Section 16(1)*, Case No. 2009-00253, Order (Ky. PSC Oct. 5, 2011).

⁵ The Commission has twice accepted the results of water meter sampling plans that determined the acceptance of meters at the minimum flow rate using accuracy limits of 90-101 to authorize meters to remain in service for 15 years without testing all meters. See *In the Matter of: Joint Application of Warren County Water District, Simpson County Water District, and Butler County Water System, Inc. for a Deviation from Approved Meter Testing Program*, Case No. 2011-00220, Application at Appendix A (Ky. PSC June 28, 2011), *overruled on other grounds by Warren County Water District, et al. v. Commonwealth of Kentucky, Public Service Commission*, Civil Action No. 13-CI-401 (Ky. Franklin Cir. Ct. 2014); *In the Matter of: Kentucky-American Water Company's Request for Permission to Deviate from 807 KAR 5:066, Section 16(1)*, Case No. 2009-00253, Order at 6 (Ky. PSC Oct. 5, 2011) (“Accuracy limits in percentages for . . . the minimum flow rate is 90-101.”) (emphasis added).

⁶ HCWD2 recorded data on 30 consecutive days from 19 data-loggers located throughout its distribution system in order to determine the volume of water consumed in each flow rate. As was used in Case No. 2011-00220, the flow ranges were measured at 1/2 gpm or less for the low flow, between 1/2 gpm and 6 gpm for the medium flow, and above 6 gpm for the high flow. Using at low flow rates around 8% of the time is consistent with the AWWA study used in Case No 2011-00220, which found that domestic water users used at a low flow rate about 7% of the time.

SECTION 4.0 FUTURE PLANS AND REPORTING PROCEDURES

This Plan seeks to verify that meters left in place beyond ten years are accurate and to determine a meter life that is appropriate. Because the manufacturer represents that HCWD2's meters remain accurate for 15 years and studies indicate that meter performance remains largely accurate until meters reach 15 years of age,⁷ HCWD2 seeks to first increase meter life to 15 years. At that time, it will return to the Commission and evaluate the possibility of further increasing meter life.

HCWD2 will submit an annual report to the Commission detailing the test results. The report will include the sample test results for each year and detail whether each sample was accepted at each flow rate using the ANSI Standard and means analysis test. The report will also include any abnormal meter results that were not used in determining the acceptability of the sample, along with an explanation of why the particular meter result was discarded.

SECTION 5.0 COST SAVINGS/CONCLUSION

A substantial reduction in cost will be achieved by implementing the Plan. Using the meters for an additional five years of their useful lives will allow HCWD2 to purchase fewer meters, thus creating significant savings without compromising meter accuracy. HCWD2 estimates that replacing meters on a 15-year cycle instead of a 10-year cycle will result in annual meter purchase savings of \$76,636.⁸ If HCWD2 were to continue replacing meters on a 10-year cycle, it would replace 5,749 meters over the next five (5) years. By extending the life of these meters from 10 to 15 years, HCWD2 will avoid making capital expenditures totaling **\$528,908** (5,749 meters x \$92.00 per meter = \$528,908). HCWD2 customers will benefit from these savings, as it will allow HCWD2 to delay future rate increases. The Franklin Circuit Court has found the savings associated with meter sampling plans important; in reversing Case No. 2011-00220, the court gave greater weight to cost savings over accuracy when there was no negative effect to customers.⁹

⁷ See Forester University, "Meter Accuracy Over Time," in Exhibit 1.

⁸ The calculation of annual meter purchase savings is included in Exhibit 2.

⁹ *Warren County Water District, et al. v. Commonwealth of Kentucky, Public Service Commission*, Civil Action No. 13-CI-401 (Ky. Franklin Cir. Ct. 2014). This case reversed Case No. 2011-00220 and allowed the utilities to test meters on a 21-year cycle because savings were greater than lost revenue, even though the meters were not within 807 KAR 5:066, Section 15(2)'s accuracy limits at 21 years. The court relied on KRS 278.210(4), which provides: "If a utility demonstrates through sample testing that no statistically significant number of its meters over-register above" the 2% margin of error in KRS 278.210(3), "the meter testing frequency shall be that which is determined by the utility to be cost effective."

APPENDIX A

2016

METER ACCURACY TEST RESULTS FOR 10-YEAR-OLD METERS

SAMPLE TESTED BY

HARDIN COUNTY WATER DISTRICT NO. 2

APPENDIX A-1

Test Results of 2016 Sample Meters

Serial No.	Maximum	Intermediate	Minimum
59510842	99.5	101	90
59511044	99.4	100	89
61012039	99.2	99	88
59510797	98.5	99	98
58857817	99.3	101	90
59511144	100.0	100	91
59511140	99.5	101	91
59510887	100.0	101	90
59510964	100.2	101	89
12596484	99.8	100	92
59510914	100.3	101	91
58857886	100.0	101	93
58857890	99.2	101	92
59510754	99.6	101	91
59510881	99.9	101	91
58857837	99.6	101	89
59511050	99.5	100	92
59066913	99.4	100	88
59510976	99.5	100	90
59510998	99.2	99	87
59510686	99.4	100	91
69065098	99.6	100	97
33783484	99.6	101	98
33783498	99.5	101	98
33783485	99.6	101	99
32525655	99.7	101	95
33325978	101.0	100	98
33326016	99.0	100	99
33783490	99.6	101	97
33783502	99.3	100	97
33783501	98.5	99	97
33911465	99.2	100	100
33911488	98.5	99	88
33911464	99.5	100	100
33911457	99.3	100	100

APPENDIX A-2

ANSI Standard Acceptance for Maximum Flow

1	Sample Size: n	35
2	Sum of Measurements	3482.9
3	Sum of Squared Measurements	346596.6
4	Correction Factor (CF)	346588.4
5	Corrected Sum of Squares (SS)	8.235429
6	Variance (V)	0.242218
7	Estimate of Lot Standard Deviation	0.492157
8	Sample Mean	99.51143
9	Upper Specification Limit	101.5
10	Lower Specification Limit	98.5
11	Quality Index: QU (Upper)	4.040523
12	Quality Index: QL (Lower)	2.055093
ANSI Standard Table B-5 used to derive values below		
13	Estimate of Lot Percent Nonconforming above Upper	0.000%
14	Estimate of Lot Percent Nonconforming below Lower	1.720%
15	Total Estimate Percent Nonconforming in Lot (P)	1.720%
16	Maximum Allowable Percent Nonconforming (M)	5.580%
17	Acceptability Criterion (to accept, P<M)	Accepted

APPENDIX A-3

ANSI Standard Acceptance for Intermediate Flow

1	Sample Size: n	35
2	Sum of Measurements	3511
3	Sum of Squared Measurements	352221
4	Correction Factor (CF)	352203.5
5	Corrected Sum of Squares (SS)	17.54286
6	Variance (V)	0.515966
7	Estimate of Lot Standard Deviation	0.718308
8	Sample Mean	100.3143
9	Upper Specification Limit	101.5
10	Lower Specification Limit	98.5
11	Quality Index: QU (Upper)	1.650705
12	Quality Index: QL (Lower)	2.525777
ANSI Standard Table B-5 used to derive values below		
13	Estimate of Lot Percent Nonconforming above Upper	4.720%
14	Estimate of Lot Perfect Nonconforming below Lower	0.407%
15	Total Estimate Percent Nonconforming in Lot (P)	5.127%
16	Maximum Allowable Percent Nonconforming (M)	5.580%
17	Acceptability Criterion (to accept, P<M)	Accepted

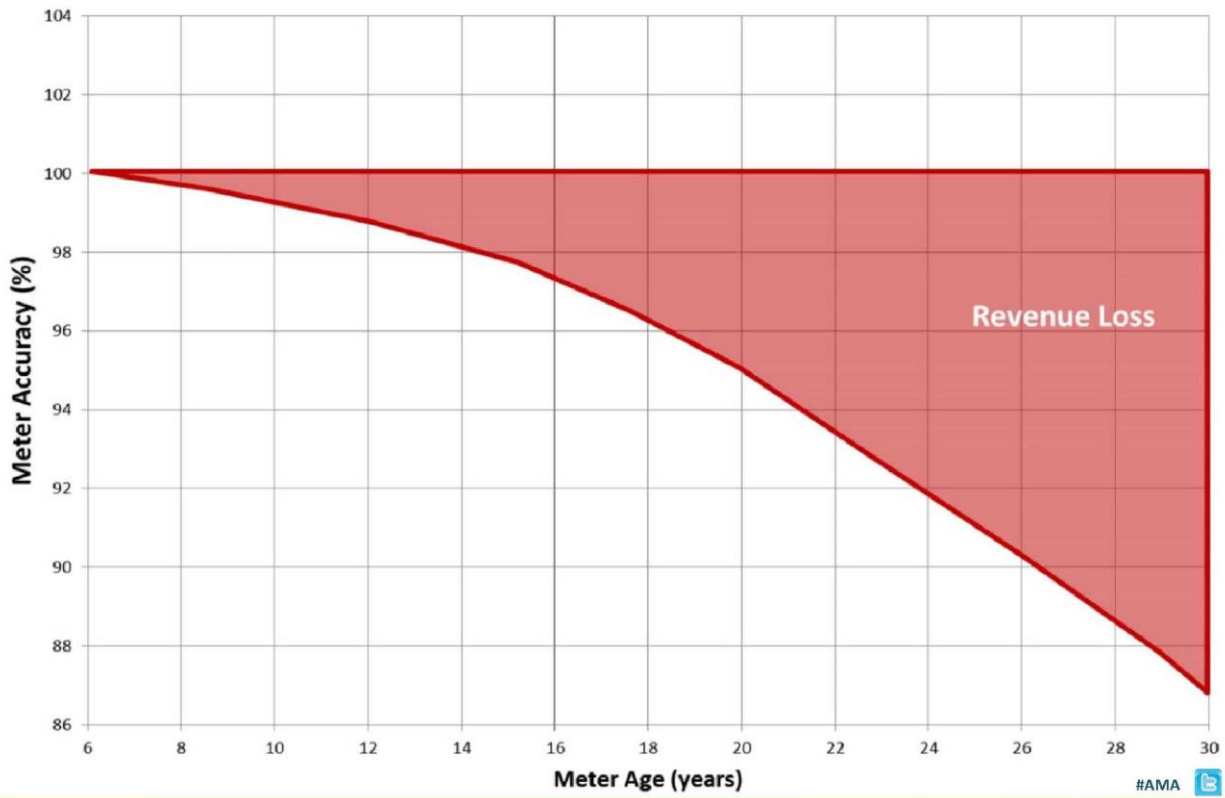
APPENDIX A-4

Means Analysis Test for Minimum Flow

Mean of 10-year-old meters	93.31%
Accepted?	Yes

EXHIBIT 1¹⁰

Meter Accuracy Over Time



Badger Meter | FORESTER UNIVERSITY | #AMA | Morrice Blackwell & Jason Wilson

¹⁰ *Implementing an Advanced Metering Analytics (AMA) Managed Solution*, Forester University (May 2016), available at <http://www.foresteruniversity.com/ProductDetails.aspx?ProductID=2063>.

EXHIBIT 2

Estimate of Annual Meter Purchase Savings From Moving to a 15 Year Replacement Program

Meter Capital Cost Savings

Number of 5/8- x 3/4-Inch Meters in System (Approximate)	25,000	
Number Replaced Annually Over a 10 Yr. Change-Out Cycle		2,500
Number Replaced Annually Over a 15 Yr. Change-Out Cycle		<u>1,667</u>
Annual Reduction in Number of Meters Purchased		833
Cost of Meter		<u>\$92</u>
Annual Meter Capital Cost Savings		\$76,636