

2018 ANNUAL METER TESTING REPORT
FOR
HARDIN COUNTY WATER DISTRICT NO. 2
5/8- x 3/4-INCH DISPLACEMENT METERS

CASE NO. 2016-00432

Hardin County Water District No. 2
Elizabethtown, KY

December 31, 2018

2018 ANNUAL METER TESTING REPORT

SECTION 1.0 EXECUTIVE SUMMARY

Hardin County Water District No. 2 (“HCWD2”) is filing this 2018 Annual Meter Testing Report as required by the Public Service Commission’s (“Commission”) Order dated March 22, 2018 in Case No. 2016-00432.

This 2018 Annual Meter Testing Report provides information for the following meter lots:

- 2006 Meters (meters which were installed during calendar year 2006), Year 12 Test Results
- 2007 Meters (meters which were installed during calendar year 2007), Year 11 Test Results
- 2008 Meters (meters which were installed during calendar year 2008), Year 10 Test Results

All meter lots passed at each flow rate using the relevant ANSI Standard.

SECTION 2.0 INTRODUCTION

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.

On December 29, 2016, HCWD2 filed an application with the Commission requesting a declaratory order that the sample testing of 5/8- x 3/4-inch meters older than 10 years in accordance with its sample meter testing plan (“Plan”) complies with the testing requirements of 807 KAR 5:066, Section 16(1). In the alternative, HCWD2 requested 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 the Plan. The case was assigned Case No. 2016-00432.

As part of HCWD2’s Plan, HCWD2 committed to submitting an annual report to the Commission detailing the test results. The report would include the sample test results for each year and detail whether each sample was accepted using approved statistical testing methods. The report would 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.

On March 22, 2018, the Commission issued a final order in Case No. 2016-00432. The Commission approved HCWD2's Plan with limited modifications and granted HCWD2 a deviation from the testing frequency requirements of 807 KAR 5:066, Section 16(1). The Commission also required HCWD2's annual reports of its sample testing to include the following:

1. The serial number, manufacturer, and model/form/type of each meter tested;
2. The date that each meter was tested;
3. The total water flow through the meter from the date it was placed in service through the date of sample testing as recorded at the time of testing;
4. Any raw data collected from each test necessary for the Commission to perform the calculations detailed in the ANSI/ASQ Standards or on which Hardin No. 2 relied in conducting or analyzing its sample testing;
5. The results of Hardin No. 2's calculations and an explanation of whether each sample was passed at each flow rate using the relevant ANSI/ASQ Standards;
6. An explanation of any abnormal meter results that were excluded or otherwise not used in determining whether a sample passed;
7. A detailed explanation, as discussed above, of the basics of excluding a meter or a group of meters from a sample group or replacing them, including the test results at each flow level for the excluded meter;
8. The total number of meters in a particular lot in service at the time Hardin No. 2 performed the sample testing; and
9. Any other information Hardin No. 2 has deemed relevant and necessary to review the accuracy of the meters tested.

This 2018 Annual Meter Testing Report provides information for the following meter lots:

- 2006 Meters (meters which were installed during calendar year 2006), Year 12 Test Results
- 2007 Meters (meters which were installed during calendar year 2007), Year 11 Test Results
- 2008 Meters (meters which were installed during calendar year 2008), Year 10 Test Results

All meter lots passed at each flow rate using the relevant ANSI Standard.

SECTION 3.0 2006 METERS, YEAR 12 TEST RESULTS

HCWD2 began performing the year 12 testing for meters it installed during calendar year 2006 (the “2006 meters”) in September 2018. At the time it performed the testing, HCWD2 had 510 12-year-old meters. HCWD2 followed the same procedure set forth in the ANSI Standard as it detailed in HCWD2’s Plan filed December 29, 2016. Following the procedure set forth in the ANSI Standard, HCWD2 again tested a sample size of 35 meters at maximum and intermediate flow rates and seven meters at minimum flow rates. All meters installed in 2006 were Sensus SR I meters.

(A) Meters Tested

The following 2006 meters were tested in year 12:

Test Results of 2006 Sample Meters - Year 12					
Serial No.	Maximum	Intermediate	Minimum	Total Water Flow	Testing Date
59510842	99.6	101		448,260.4	9/21/2018
59511044	99.3	99		597,383.5	9/21/2018
61012039	99.9	101		394,909.4	9/21/2018
33783497	99.9	100	98	613,142.7	9/21/2018
58857817	99.4	101		918,227.1	9/21/2018
59511144	99.9	101		629,776.8	9/21/2018
59511140	100.0	101	90	686,465.1	9/21/2018
59510887	100.3	100		721,541.4	9/24/2018
59510964	100.3	101		736,014.9	9/21/2018
58857768	99.8	101		709,878.9	9/24/2018
59510914	100.6	100		1,106,459.4	9/24/2018
58857886	99.8	101		846,196.2	9/24/2018
58857890	99.3	101		760,688.6	9/24/2018
59510754	100.3	99		868,016.5	9/24/2018
59510881	100.0	101	86	1,122,479.2	9/21/2018
58857837	99.7	101		524,050.8	9/21/2018
59511050	99.5	100		658,202.5	9/24/2018
59066913	99.9	100		608,064.0	9/24/2018
59510976	99.7	101	89	372,029.0	9/24/2018
59510998	99.8	100		644,737.7	9/24/2018
59510686	100.0	101		672,121.6	9/21/2018
69065098	100.1	101		283,056.2	9/21/2018

33783484	99.7	100	97	477,486.9	9/24/2018
33783498	99.7	100		409,699.6	9/24/2018
33783485	99.8	100		522,165.7	9/21/2018
32525655	100.0	100	97	553,380.7	9/24/2018
33325978	99.5	100		394,007.2	9/24/2018
33326016	99.1	100		376,671.4	9/24/2018
33783490	99.8	100		396,512.7	9/21/2018
33783502	99.6	100		585,769.4	9/21/2018
33783501	99.7	100		639,647.5	9/21/2018
33911465	99.5	100		423,939.4	9/21/2018
33911488	98.6	100	97	558,706.3	9/21/2018
33911464	99.8	101		411,276.7	9/21/2018
33911457	99.4	101		773,374.3	9/21/2018

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(B) Maximum Flow Test Results

Meters were tested at a maximum flow rate using the same procedure set forth in the ANSI Standard and detailed in HCWD2’s Plan filed December 29, 2016. Following the procedure set forth in the ANSI Standard, HCWD2 again tested a sample size of 35 meters at maximum flow rates. The sample was accepted.

ANSI Standard for Maximum Flow		
1	Sample Size: n	35
2	Sum of Measurements	3491.3
3	Sum of Squared Measurements	348266.9
4	Correction Factor (CF)	348262.2
5	Corrected Sum of Squares (SS)	4.747429
6	Variance (V)	0.13963
7	Estimate of Lot Standard Deviation	0.373671
8	Sample Mean	99.75143
9	Upper Specification Limit	101.5
10	Lower Specification Limit	98.5
11	Quality Index: QU (upper)	4.679437
12	Quality Index: QL (lower)	3.349009
ANSI Standard Table B-5 used to derive values below		
13	Est. of Lot Percent NcF above Upper	0.000%
14	Est. of Lot Percent NcF below Lower	0.012%
15	Total Est. Percent NcF in Lot (P)	0.012%
16	Max. Allowable Percent NcF (M)	5.580%
17	Acceptability Criterion (to accept, P<M)	Accepted

(C) Intermediate Flow Test Results

Meters were tested at an intermediate flow rate using the same procedure set forth in the ANSI Standard and detailed in HCWD2’s Plan filed December 29, 2016. Following the procedure set forth in the ANSI Standard, HCWD2 again tested a sample size of 35 meters at intermediate flow rates. The sample was accepted.

ANSI Standard for Intermediate Flow		
1	Sample Size: n	35
2	Sum of Measurements	3514
3	Sum of Squared Measurements	352818
4	Correction Factor (CF)	352805.6
5	Corrected Sum of Squares (SS)	12.4
6	Variance (V)	0.364706
7	Estimate of Lot Standard Deviation	0.603909
8	Sample Mean	100.4
9	Upper Specification Limit	101.5
10	Lower Specification Limit	98.5
11	Quality Index: QU (upper)	1.821467
12	Quality Index: QL (lower)	3.14617
ANSI Standard Table B-5 used to derive values below		
13	Est. of Lot Percent NcF above Upper	3.190%
14	Est. of Lot Percent NcF below Lower	0.033%
15	Total Est. Percent NcF in Lot (P)	3.223%
16	Max. Allowable Percent NcF (M)	5.580%
17	Acceptability Criterion (to accept, P<M)	Accepted

(D) Minimum Flow Test Results

Meters were tested at a minimum flow rate using the same procedure set forth in the ANSI Standard and detailed in HCWD2’s Response to Commission Staff’s Second Request for Information, Question No. 5 filed on June 5, 2017. Following the procedure set forth in the ANSI Standard, HCWD2 tested a sample size of seven meters at minimum flow rates. The sample was accepted.

1	Sample Size: n	7
2	Sum of Measurements	654
3	Sum of Squared Measurements	61248
4	Correction Factor (CF)	61102.286
5	Corrected Sum of Squares (SS)	145.71429
6	Variance (V)	24.285714
7	Estimate of Lot Standard Deviation	4.9280538
8	Sample Mean	93.428571
9	Lower Specification Limit	90
10	Quality Index: QL (lower)	0.6957252
ANSI Standard Table B-5 used to derive values below		
11	Est. of Lot Percent NcF (P)	25.030%
12	Max. Allowable Percent NcF (M)	30.500%
13	Acceptability Criterion (to accept, P<M)	Accepted

(E) Abnormal Meter Results

There were no abnormal meter results with respect to the 2006 meters. None of the meters in the sample group had been damaged.

SECTION 4.0 2007 METERS, YEAR 11 TEST RESULTS

HCWD2 began performing the year 11 testing for meters it installed during calendar year 2007 (the “2007 meters”) in October 2018. At the time it performed the testing, HCWD2 had 1,071 11-year-old meters. HCWD2 followed the same procedure set forth in the ANSI Standard as it detailed in HCWD2’s Plan filed December 29, 2016. Following the procedure set forth in the ANSI Standard, HCWD2 tested a sample size of 35 meters at maximum and intermediate flow rates

and seven meters at minimum flow rates. As set forth in HCWD2's Plan, HCWD2 selected the meters using a random, computerized process. All meters installed in 2007 were Sensus SR I meters.

(A) Meters Tested

The following 2007 meters were tested in year 11:

Test Results of 2007 Sample Meters - Year 11					
Serial No.	Maximum	Intermediate	Minimum	Total Water Flow	Testing Date
55527044	99.6	101		404,802.0	10/25/2018
61471216	99.4	100		274,084.2	10/25/2018
62388294	99.4	100		651,149.5	10/25/2018
72070208	99.8	99	96	319,011.7	10/25/2018
62388100	99.6	101		562,535.2	10/25/2018
58946445	99.8	100		525,665.4	10/25/2018
59067021	99.7	101	92	349,279.3	10/25/2018
58857691	100.1	100		693,744.2	10/26/2018
62103179	99.9	101		591,839.1	10/25/2018
61512281	100.4	100			
61512182	100.0	100		1,173,757.2	10/26/2018
62388301	100.1	100		601,128.2	10/25/2018
62388274	99.5	101	97	364,206.8	10/25/2018
61471178	99.1	100		359,655.8	10/25/2018
60697629	100.7	99		445,201.9	10/25/2018
60697616	100.0	101		696,840.4	10/25/2018
62238284	99.6	100		526,407.4	
62238187	99.9	101	91	249,650.3	
61512303	99.3	101		492,762.1	
60697510	102.0	100	96	347,393.1	
06434871	100.0	99		479,982.0	12/4/2018
59510926	100.1	100		534,733.8	
61471365	99.8	101		553,674.6	
61512258	100.5	100	95	636,666.0	
62388273	99.7	100		473,336.6	
62388217	99.6	101		465,147.2	
61512164	99.8	101		569,764.2	
61512227	99.5	101		677,899.9	
58946455	100.0	101		525,665.4	

61512275	99.7	101		585,897.0	
59788478	100.1	101		227,618.1	
61471193	100.1	101		572,371.6	
58346522	99.9	101		796,754.0	
61471282	98.7	101		854,303.7	
59495744	100.0	101	95	329,494.0	

(B) Maximum Flow Test Results

Meters were tested at a maximum flow rate using the same procedure set forth in the ANSI Standard and detailed in HCWD2’s Plan filed December 29, 2016. Following the procedure set forth in the ANSI Standard, HCWD2 again tested a sample size of 35 meters at maximum flow rates. The sample was accepted.

ANSI Standard for Maximum Flow		
1	Sample Size: n	35
2	Sum of Measurements	3495.4
3	Sum of Squared Measurements	349090.3
4	Correction Factor (CF)	349080.6
5	Corrected Sum of Squares (SS)	9.655429
6	Variance (V)	0.283983
7	Estimate of Lot Standard Deviation	0.532901
8	Sample Mean	99.86857
9	Upper Specification Limit	101.5
10	Lower Specification Limit	98.5
11	Quality Index: QU (upper)	3.061412
12	Quality Index: QL (lower)	2.568155
ANSI Standard Table B-5 used to derive values below		
13	Est. of Lot Percent NcF above Upper	0.050%
14	Est. of Lot Percent NcF below Lower	0.354%
15	Total Est. Percent NcF in Lot (P)	0.404%
16	Max. Allowable Percent NcF (M)	5.580%
17	Acceptability Criterion (to accept, P<M)	Accepted

(C) Intermediate Flow Test Results

Meters were tested at an intermediate flow rate using the same procedure set forth in the ANSI Standard and detailed in HCWD2’s Plan filed December 29, 2016. Following the procedure set forth in the ANSI Standard, HCWD2 again tested a sample size of 35 meters at intermediate flow rates. The sample was accepted.

ANSI Standard for Intermediate Flow		
1	Sample Size: n	35
2	Sum of Measurements	3516
3	Sum of Squared Measurements	353222
4	Correction Factor (CF)	353207.3
5	Corrected Sum of Squares (SS)	14.68571
6	Variance (V)	0.431933
7	Estimate of Lot Standard Deviation	0.657216
8	Sample Mean	100.4571
9	Upper Specification Limit	101.5
10	Lower Specification Limit	98.5
11	Quality Index: QU (upper)	1.58678
12	Quality Index: QL (lower)	2.97793
ANSI Standard Table B-5 used to derive values below		
13	Est. of Lot Percent NcF above Upper	5.380%
14	Est. of Lot Percent NcF below Lower	0.071%
15	Total Est. Percent NcF in Lot (P)	5.451%
16	Max. Allowable Percent NcF (M)	5.580%
17	Acceptability Criterion (to accept, P<M)	Accepted

(D) Minimum Flow Test Results

Meters were tested at a minimum flow rate using the same procedure set forth in the ANSI Standard and detailed in HCWD2’s Response to Commission Staff’s Second Request for Information, Question No. 5 filed on June 5, 2017. Following the procedure set forth in the ANSI Standard, HCWD2 tested a sample size of seven meters at minimum flow rates. The sample was accepted.

1	Sample Size: n	7
2	Sum of Measurements	662
3	Sum of Squared Measurements	62636
4	Correction Factor (CF)	62606.286
5	Corrected Sum of Squares (SS)	29.714286
6	Variance (V)	4.952381
7	Estimate of Lot Standard Deviation	2.2253946
8	Sample Mean	94.571429
9	Lower Specification Limit	90
10	Quality Index: QL (lower)	2.0542104
ANSI Standard Table B-5 used to derive values below		
11	Est. of Lot Percent NcF (P)	0.260%
12	Max. Allowable Percent NcF (M)	30.500%
13	Acceptability Criterion (to accept, P<M)	Accepted

(E) Abnormal Meter Results

There were no abnormal meter results with respect to the 2007 meters. None of the meters in the sample group had been damaged.

SECTION 5.0 2008 METERS, YEAR 10 TEST RESULTS

HCWD2 began performing the year 10 testing for meters it installed during calendar year 2008 (the “2008 meters”) in May 2018. At the time it performed the testing, HCWD2 had 1,416 10-year-old meters. HCWD2 followed the same procedure set forth in the ANSI Standard as it detailed in HCWD2’s Plan filed December 29, 2016. Following the procedure set forth in the ANSI Standard, HCWD2 tested a sample size of 50 meters at maximum and intermediate flow rates

and ten meters at minimum flow rates. All meters installed in 2008 were Sensus SR I meters.

(A) Meters Tested

The following 2008 meters were tested in year 10:

Test Results of 2008 Sample Meters - Year 10					
Serial No.	Maximum	Intermediate	Minimum	Total Water Flow	Testing Date
63030870	99.8	99		255,367.1	5/2/2018
62758922	100.1	100		529,633.4	5/2/2018
63490587	99.9	101		663,713.2	5/2/2018
63727202	100.5	100	95	288,174.9	5/2/2018
63030997	99.1	101		859,599.2	5/2/2018
62758767	99.7	99	97	754,322.4	5/2/2018
62758862	100.1	101		308,266.0	5/2/2018
62759051	100.4	101		485,848.6	5/2/2018
62758997	99.7	101		1,382,695.4	5/2/2018
61512277	100.2	101		345,477.7	5/2/2018
62758762	99.8	100	93	859,861.8	5/2/2018
62238230	99.7	100		394,703.5	5/2/2018
62758994	99.9	101	95	553,458.2	5/21/2018
63727192	100.8	101		1,052,759.1	5/7/2018
63727120	99.9	100		285,248.7	5/7/2018
63490419	99.5	101		400,321.6	5/14/2018
63727163	100.3	100	92	337,447.6	5/14/2018
63490705	99.3	100		199,816.3	5/14/2018
62758764	99.1	101		408,865.9	5/14/2018
63031098	99.0	100		537,953.2	5/14/2018
62758976	99.9	100		870,661.3	5/14/2018
63031082	99.6	101		546,102.2	5/14/2018
63727209	100.3	101	94	432,705.8	5/14/2018
63031081	99.7	100		153,662.8	5/14/2018
63030818	99.3	101		821,131.8	5/14/2018
62758815	99.8	100		307,192.0	5/14/2018
62326932	100.5	101		279,069.2	5/14/2018
62326921	99.7	100		571,222.9	5/14/2018
63727242	99.5	101	95	611,338.0	5/14/2018
62326926	100.2	101		323,163.9	5/14/2018

63727199	99.5	101		518,276.6	5/14/2018
63030817	99.0	100		208,399.9	5/14/2018
63031079	99.7	101		618,038.0	5/14/2018
63030897	99.3	101		919,772.0	5/16/2018
63490717	99.8	100		203,666.2	5/16/2018
63490687	99.6	100		300,626.7	5/16/2018
63031026	99.3	100	94	447,157.5	5/16/2018
63030886	99.5	99		220,532.6	5/16/2018
63727233	99.3	100		448,016.5	5/16/2018
63727166	100.6	100		699,236.5	5/16/2018
61471304	100.0	100		509,675.4	5/16/2018
63031054	100.1	101		339,045.4	5/16/2018
62758775	99.2	100		577,042.5	5/16/2018
63490432	99.0	101	95	337,443.7	5/16/2018
63727206	99.0	101		229,043.4	5/16/2018
63030837	99.2	99		598,235.0	5/16/2018
62758842	99.9	100	92	996,334.6	5/16/2018
63030851	99.6	99		345,495.3	5/16/2018
63490617	99.9	100		544,906.7	5/16/2018
63490507	99.6	100		167,825.8	5/16/2018

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(B) Maximum Flow Test Results

Meters were tested at a maximum flow rate using the procedure set forth in the ANSI Standard and detailed in HCWD2’s Plan filed December 29, 2016. Following the procedure set forth in the ANSI Standard, HCWD2 tested a sample size of 50 meters at maximum flow rates. For the 2006 and 2007 meter lots, HCWD2 has sample tested 35 meters at maximum flow rates. Because of the larger 2008 meter lot size, the ANSI Standard provides that 50 meters should be sample tested. The sample was accepted.

ANSI Standard for Maximum Flow		
1	Sample Size: n	50
2	Sum of Measurements	4986.4
3	Sum of Squared Measurements	497293.7
4	Correction Factor (CF)	497283.7
5	Corrected Sum of Squares (SS)	10.0008
6	Variance (V)	0.204098
7	Estimate of Lot Standard Deviation	0.451772
8	Sample Mean	99.728
9	Upper Specification Limit	101.5
10	Lower Specification Limit	98.5
11	Quality Index: QU (upper)	3.922332
12	Quality Index: QL (lower)	2.718185
ANSI Standard Table B-5 used to derive values below		
13	Est. of Lot Percent NcF above Upper	0.000%
14	Est. of Lot Percent NcF below Lower	0.241%
15	Total Est. Percent NcF in Lot (P)	0.241%
16	Max. Allowable Percent NcF (M)	5.210%
17	Acceptability Criterion (to accept, P<M)	Accepted

(C) Intermediate Flow Test Results

Meters were tested at a maximum flow rate using the procedure set forth in the ANSI Standard and detailed in HCWD2’s Plan filed December 29, 2016. Following the procedure set forth in the ANSI Standard, HCWD2 tested a sample size of 50 meters at maximum flow rates. For the 2006 and 2007 meter lots, HCWD2 has sample tested 35 meters at intermediate flow rates. Because of the larger 2008 meter lot size, the ANSI Standard provides that 50 meters should be sample tested. The sample was accepted.

ANSI Standard for Maximum Flow		
1	Sample Size: n	50
2	Sum of Measurements	5017.0
3	Sum of Squared Measurements	503427
4	Correction Factor (CF)	503405.8
5	Corrected Sum of Squares (SS)	21.22
6	Variance (V)	0.433061
7	Estimate of Lot Standard Deviation	0.658074
8	Sample Mean	100.34
9	Upper Specification Limit	101.5
10	Lower Specification Limit	98.5
11	Quality Index: QU (upper)	1.76272
12	Quality Index: QL (lower)	2.796039
ANSI Standard Table B-5 used to derive values below		
13	Est. of Lot Percent NcF above Upper	3.760%
14	Est. of Lot Percent NcF below Lower	0.181%
15	Total Est. Percent NcF in Lot (P)	3.941%
16	Max. Allowable Percent NcF (M)	5.210%
17	Acceptability Criterion (to accept, P<M)	Accepted

(D) Minimum Flow Test Results

Meters were tested at a minimum flow rate using the same procedure set forth in the ANSI Standard and detailed in HCWD2’s Response to Commission Staff’s Second Request for Information, Question No. 5 filed on June 5, 2017. Following the procedure set forth in the ANSI Standard, HCWD2 tested a sample size of ten meters at minimum flow rates. For the 2006 and 2007 meter lots, HCWD2 has sample tested seven meters at minimum flow rates. Because of the larger 2008 meter lot size, the ANSI Standard provides that ten meters should be sample tested. The sample was accepted.

1	Sample Size: n	10
2	Sum of Measurements	942
3	Sum of Squared Measurements	88758
4	Correction Factor (CF)	88736.4
5	Corrected Sum of Squares (SS)	21.6
6	Variance (V)	2.4
7	Estimate of Lot Standard Deviation	1.5491933
8	Sample Mean	94.2
9	Lower Specification Limit	90
10	Quality Index: QL (lower)	2.7110883
ANSI Standard Table B-5 used to derive values below		
11	Est. of Lot Percent NcF (P)	0.001%
12	Max. Allowable Percent NcF (M)	27.650%
13	Acceptability Criterion (to accept, P<M)	Accepted

(E) Abnormal Meter Results

There were no abnormal meter results with respect to the 2008 meters. None of the meters in the sample group had been damaged.

SECTION 6.0 CONCLUSION

As shown above, HCWD2’s 2018 Annual Meter Testing Report shows that the following meter lots passed at each flow rate using the relevant ANSI Standard:

- 2006 Meters, Year 12 Test Results

- 2007 Meters, Year 11 Test Results
- 2008 Meters, Year 10 Test Results

In 2019, HCWD2 will perform sample meter testing for the 2006, 2007, 2008, and 2009 meters and will file a 2019 Annual Meter Testing Report that shows the Year 13 test results for the 2006 meters, Year 12 test results for the 2007 meters, Year 11 test results for the 2008 meters, and the Year 10 test results for the 2009 meters.