

2021 ANNUAL METER TESTING REPORT
FOR
GRAYSON COUNTY WATER DISTRICT
5/8- x 3/4-INCH BADGER MODEL 25 METERS

CASE NO. 2019-00115

February 10, 2022

2021 ANNUAL METER TESTING REPORT

SECTION 1.0 EXECUTIVE SUMMARY

Grayson County Water District (“GCWD”) is filing this 2021 Annual Meter Testing Report as required by the Public Service Commission’s (“Commission”) Order dated April 28, 2020 in Case No. 2019-00115.¹

This 2021 Annual Meter Testing Report provides information for the following meter lots:

- 2006 Meters (meters which were installed during calendar year 2006), Year 15 Test Results
- 2007 Meters (meters which were installed during calendar year 2007), Year 14 Test Results
- 2008 Meters (meters which were installed during calendar year 2008), Year 13 Test Results

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

SECTION 2.0 INTRODUCTION

GCWD is a water utility located in Grayson County, Kentucky. On April 11, 2019, GCWD filed an application with the Commission requesting 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 Badger Model 25 meters 13 years of age and older in accordance with its sample meter testing plan (“Plan”). The case was assigned Case No. 2019-00115.

As part of GCWD’s Plan, GCWD 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 April 28, 2020, the Commission issued a final order in Case No. 2019-00115. The Commission approved GCWD’s Plan with limited modifications and granted GCWD a deviation from the testing frequency requirements of 807 KAR 5:066, Section 16(1). The Commission also required GCWD’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. An excel spreadsheet, with formulas intact, containing the raw data collected from each meter tested and showing the calculations detailed in the ANSI/ASQ Standards on which GCWD relied in conducting or analyzing its sample testing;
5. The results of GCWD’s calculations and an explanation of whether each sample was passed at each flow rate using the relevant ANSI/ASQ Standards;

¹ Pursuant to the Commission’s Order dated December 21, 2020 in Case No. 2020-00085, GCWD was relieved from testing requirements in 2020 and did not file a 2020 Annual Meter Testing Report. The Commission reinstated sample testing requirements by Order dated July 22, 2021 in Case No. 2020-00085.

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 GCWD performed the sample testing; and
9. Any other information GCWD has deemed relevant and necessary to review the accuracy of the meters tested.

This 2021 Annual Meter Testing Report provides information for the following meter lots:

- 2006 Meters (meters which were installed during calendar year 2006), Year 15 Test Results
- 2007 Meters (meters which were installed during calendar year 2007), Year 14 Test Results
- 2008 Meters (meters which were installed during calendar year 2008), Year 13 Test Results

All meter lots passed at each flow rate using the relevant ANSI Standard. Pursuant to the Commission’s Order dated April 28, 2020, GCWD has removed all of the meters that reached 15 years of age from service. As GCWD stated in its Application, GCWD is evaluating the data and will request that the Commission (1) extend the sample meter testing plan; (2) allow GCWD to replace meters on a 15-year cycle; or (3) approve another appropriate course of action.

SECTION 3.0 2006 METERS, YEAR 15 TEST RESULTS

GCWD performed the year 15 testing for meters it installed during calendar year 2006 (the “2006 meters”) in December 2021. At the time it performed the testing, GCWD had 7 15-year-old meters in service. GCWD followed the same procedure set forth in the ANSI Standard as it detailed in GCWD’s Plan filed April 11, 2019. Following the procedure set forth in the ANSI Standard, GCWD tested a sample size of 3 meters at maximum, intermediate, and minimum flow rates. All meters tested were Badger Model 25 meters. Pursuant to the Commission’s Order dated April 28, 2020 in Case No. 2019-00115, GCWD tested all meters pulled for maximum and intermediate flow rate testing at minimum flow rates.

(A) Meters Tested

The following 2006 meters were tested in year 15:

Test Results of 2006 Sample Meters - Year 15					
Serial No.	Maximum	Intermediate	Minimum	Total Water Flow	Testing Date
32579088	99.20	100.00	98.00	313,700.0	12/3/2021
32579085	98.80	101.00	97.00	623,367.0	12/3/2021
32579090	99.00	101.00	97.00	435,464.2	12/3/2021

(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 GCWD’s Plan filed April 11, 2019. Following the procedure set forth in the ANSI Standard, GCWD tested a sample size of three meters at maximum flow rates. The sample was accepted.

ANSI Standard for Maximum Flow		
1	Sample Size: n	3
2	Sum of Measurements	297.0
3	Sum of Squared Measurements	29403.08
4	Correction Factor (CF)	29403
5	Corrected Sum of Squares (SS)	0.08
6	Variance (V)	0.04
7	Estimate of Lot Standard Deviation	0.2
8	Sample Mean	99
9	Upper Specification Limit	101.5
10	Lower Specification Limit	98.5
11	Quality Index: QU (upper)	12.5
12	Quality Index: QL (lower)	2.5
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	0.000%
15	Total Est. Percent NcF in Lot (p)	0.000%
16	Max. Allowable Percent NcF (M)	7.590%
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 GCWD’s Plan filed April 11, 2019. Following the procedure set forth in the ANSI Standard, GCWD tested a sample size of three meters at intermediate flow rates. The sample was accepted.

1	Sample Size: n	3
2	Sum of Measurements	302.0
3	Sum of Squared Measurements	30402
4	Correction Factor (CF)	30401.33
5	Corrected Sum of Squares (SS)	0.666667
6	Variance (V)	0.333333
7	Estimate of Lot Standard Deviation	0.57735
8	Sample Mean	100.6667
9	Upper Specification Limit	101.5
10	Lower Specification Limit	98.5
11	Quality Index: QU (upper)	1.443376
12	Quality Index: QL (lower)	3.752777
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	0.000%
15	Total Est. Percent NcF in Lot (p)	0.000%
16	Max. Allowable Percent NcF (M)	7.590%
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 GCWD’s Plan filed April 11, 2019. Following the procedure set forth in the ANSI Standard, GCWD tested a sample size of three meters at minimum flow rates. The sample was accepted.

1	Sample Size: n	3
2	Sum of Measurements	292
3	Sum of Squared Measurements	28422
4	Correction Factor (CF)	28421.333
5	Corrected Sum of Squares (SS)	0.6666667
6	Variance (V)	0.3333333
7	Estimate of Lot Standard Deviation	0.5773503
8	Sample Mean	97.333333
9	Lower Specification Limit	90
10	Quality Index: QL (lower)	12.701706
ANSI Standard Table B-5 used to derive values below		
11	Est. of Lot Percent NcF	0.000%
12	Max. Allowable Percent NcF (M)	40.470%
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 14 TEST RESULTS

GCWD performed the year 14 testing for meters it installed during calendar year 2007 (the “2007 meters”) in October 2021. At the time it performed the testing, GCWD had 76 14-year-old meters in service. GCWD followed the same procedure set forth in the ANSI Standard as it detailed in GCWD’s Plan filed April 11, 2019. Following the procedure set forth in the ANSI Standard, GCWD tested a sample size of 7 meters at maximum and intermediate flow rates, and 3 meters at minimum flow rates. All meters tested were Badger Model 25 meters. Pursuant to the Commission’s Order dated April 28, 2020 in Case No. 2019-00115, GCWD tested all meters pulled for maximum and intermediate flow rate testing at minimum flow rates.

(A) Meters Tested

The following 2007 meters were tested in year 14:

Test Results of 2007 Sample Meters - Year 14

Serial No.	Maximum	Intermediate	Minimum	Total Water Flow	Testing Date
34107783	99.00	100.00	99.00	347,457.2	10/29/2021
34107749	99.20	100.00	101.00	649,309.7	10/29/2021
34107795	98.90	100.00	100.00	518,644.6	10/29/2021
34107762	98.90	101.00	100.00	737,420.4	10/29/2021
34107718	99.60	101.00	100.00	526,191.8	10/29/2021
34107724	99.40	101.00	99.00	696,047.8	10/29/2021
34107743	98.80	101.00	99.00	892,273.2	10/29/2021

(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 GCWD's Plan filed April 11, 2019. Following the procedure set forth in the ANSI Standard, GCWD tested a sample size of seven meters at maximum flow rates. The sample was accepted.

ANSI Standard for Maximum Flow

1	Sample Size: n	7
2	Sum of Measurements	693.8
3	Sum of Squared Measurements	68766.02
4	Correction Factor (CF)	68765.49
5	Corrected Sum of Squares (SS)	0.528571
6	Variance (V)	0.088095
7	Estimate of Lot Standard Deviation	0.296808
8	Sample Mean	99.11429
9	Upper Specification Limit	101.5
10	Lower Specification Limit	98.5
11	Quality Index: QU (upper)	8.037893
12	Quality Index: QL (lower)	2.069637
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	0.210%
15	Total Est. Percent NcF in Lot (p)	0.210%
16	Max. Allowable Percent NcF (M)	8.400%
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 GCWD’s Plan filed April 11, 2019. Following the procedure set forth in the ANSI Standard, GCWD tested a sample size of seven meters at intermediate flow rates. The sample was accepted.

ANSI Standard for Intermediate Flow		
1	Sample Size: n	7
2	Sum of Measurements	704.0
3	Sum of Squared Measurements	70804
4	Correction Factor (CF)	70802.29
5	Corrected Sum of Squares (SS)	1.714286
6	Variance (V)	0.285714
7	Estimate of Lot Standard Deviation	0.534522
8	Sample Mean	100.5714
9	Upper Specification Limit	101.5
10	Lower Specification Limit	98.5
11	Quality Index: QU (upper)	1.737198
12	Quality Index: QL (lower)	3.875288
ANSI Standard Table B-5 used to derive values below		
13	Est. of Lot Percent NcF above Upper	2.200%
14	Est. of Lot Percent NcF below Lower	0.000%
15	Total Est. Percent NcF in Lot (p)	2.200%
16	Max. Allowable Percent NcF (M)	8.400%
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 GCWD’s Plan filed April 11, 2019. Following the procedure set forth in the ANSI Standard, GCWD tested a sample size of three meters at minimum flow rates. The sample was accepted.

1	Sample Size: n	3
2	Sum of Measurements	298
3	Sum of Squared Measurements	29602
4	Correction Factor (CF)	29601.33333
5	Corrected Sum of Squares (SS)	0.666666667
6	Variance (V)	0.333333333
7	Estimate of Lot Standard Deviation	0.577350269
8	Sample Mean	99.33333333
9	Lower Specification Limit	90
10	Quality Index: QL (lower)	16.16580754
ANSI Standard Table B-5 used to derive values below		
11	Est. of Lot Percent NcF	0.000%
12	Max. Allowable Percent NcF (M)	40.470%
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 13 TEST RESULTS

GCWD performed the year 13 testing for meters it installed during calendar year 2008 (the “2008 meters”) in November and December 2021. At the time it performed the testing, GCWD had 1,053 13-year-old meters in service. GCWD followed the same procedure set forth in the ANSI Standard as it detailed in GCWD’s Plan filed April 11, 2019. Following the procedure set forth in the ANSI Standard, GCWD tested a sample size of 35 meters at maximum and intermediate flow rates and 7 meters at minimum flow rates. All meters tested were Badger Model 25 meters. Pursuant to the Commission’s Order dated April 28, 2020 in Case No. 2019-00115, GCWD tested all meters pulled for maximum and intermediate flow rate testing at minimum flow rates.

(A) Meters Tested

The following 2008 meters were tested in year 13:

Test Results of 2008 Sample Meters - Year 13

Serial No.	Maximum	Intermediate	Minimum	Total Water Flow	Testing Date
235123516	99.30	101.00	98.00	34,858.1	12/3/2021
234986564	98.60	101.00	98.00	2,322,475.6	12/1/2021
235123346	99.40	101.00	99.00	624,991.7	12/3/2021
235123423	99.40	100.00	99.00	287,523.4	12/3/2021
234824550	99.10	100.00	98.00	498,689.0	12/3/2021
234986519	98.80	101.00	99.00	744,001.9	12/1/2021
234986482	99.60	101.00	100.00	374,674.2	12/1/2021
234986585	99.30	100.00	98.00	530,986.4	12/3/2021
235123666	99.40	100.00	99.00	756,381.4	12/3/2021
235123401	99.30	101.00	99.00	584,428.8	12/1/2021
235123315	99.10	101.00	99.00	125,404.4	12/1/2021
234824517	99.20	100.00	98.00	870,950.4	12/1/2021
234986550	99.40	101.00	100.00	615,333.5	12/3/2021
234824501	99.80	101.00	97.00	321,322.9	12/1/2021
234824704	98.90	100.00	98.00	782,051.2	12/1/2021
234986351	99.50	101.00	100.00	101,136.6	12/3/2021
235123243	99.20	100.00	99.00	717,787.2	12/3/2021
235123128	99.20	101.00	99.00	834,511.6	12/3/2021
235123343	99.40	101.00	98.00	361,644.4	12/3/2021
234986393	98.80	100.00	97.00	286,027.2	11/12/2021
235123297	99.40	101.00	98.00	237,850.2	11/12/2021
235123535	99.60	101.00	100.00	392,433.9	12/1/2021
234986571	99.20	100.00	99.00	647,141.2	12/1/2021
234824746	98.90	100.00	96.00	799,360.0	11/12/2021
234824744	98.90	101.00	97.00	677,136.1	11/12/2021
234986454	99.00	101.00	98.00	667,096.8	11/12/2021
234986383	98.70	101.00	96.00	834,038.0	11/12/2021
235123355	99.60	100.00	100.00	183,543.9	12/3/2021
234824680	99.00	100.00	97.00	225,991.4	11/12/2021
235123628	99.10	100.00	97.00	8,567,285.4	12/1/2021
234986587	99.60	101.00	98.00	414,569.4	11/12/2021
234824582	99.60	100.00	97.00	817,752.8	12/1/2021
234824597	98.70	100.00	98.00	193,716.2	12/1/2021
234824752	98.60	100.00	97.00	309,275.7	12/1/2021
234986418	98.70	100.00	97.00	1,197,630.0	12/1/2021

(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 GCWD’s Plan filed April 11, 2019. Following the procedure set forth in the ANSI Standard, GCWD 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	3471.3
3	Sum of Squared Measurements	344287.2
4	Correction Factor (CF)	344283.5
5	Corrected Sum of Squares (SS)	3.676
6	Variance (V)	0.108118
7	Estimate of Lot Standard Deviation	0.328812
8	Sample Mean	99.18
9	Upper Specification Limit	101.5
10	Lower Specification Limit	98.5
11	Quality Index: QU (upper)	7.055693
12	Quality Index: QL (lower)	2.068048
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	1.680%
15	Total Est. Percent NcF in Lot (p)	1.680%
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 GCWD’s Plan filed April 11, 2019. Following the procedure set forth in the ANSI Standard, GCWD 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	3518.0
3	Sum of Squared Measurements	353618
4	Correction Factor (CF)	353609.3
5	Corrected Sum of Squares (SS)	8.742857
6	Variance (V)	0.257143
7	Estimate of Lot Standard Deviation	0.507093
8	Sample Mean	100.5143
9	Upper Specification Limit	101.5
10	Lower Specification Limit	98.5
11	Quality Index: QU (upper)	1.943855
12	Quality Index: QL (lower)	3.972225
ANSI Standard Table B-5 used to derive values below		
13	Est. of Lot Percent NcF above Upper	2.370%
14	Est. of Lot Percent NcF below Lower	0.000%
15	Total Est. Percent NcF in Lot (p)	2.370%
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 GCWD’s Plan filed April 11, 2019. Following the procedure set forth in the ANSI Standard, GCWD tested a sample size of 7 meters at minimum flow rates. The sample was accepted.

1	Sample Size: n	7
2	Sum of Measurements	686.00
3	Sum of Squared Measurements	67232
4	Correction Factor (CF)	67228
5	Corrected Sum of Squares (SS)	4
6	Variance (V)	0.6666667
7	Estimate of Lot Standard Deviation	0.8164966
8	Sample Mean	98
9	Lower Specification Limit	90
10	Quality Index: QL (lower)	9.797959
ANSI Standard Table B-5 used to derive values below		
11	Est. of Lot Percent NcF	0.000%
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 2008 meters. None of the meters in the sample group had been damaged.

SECTION 6.0 CONCLUSION

As shown above, GCWD’s 2021 Annual Meter Testing Report shows that the following meter lots passed at each flow rate using the relevant ANSI Standard:

- 2006 Meters, Year 15 Test Results
- 2007 Meters, Year 14 Test Results
- 2008 Meters, Year 13 Test Results