



October 14, 2016

Mr. Michael David, P.G.  
Tennessee Department of Environment and Conservation  
Division of Solid Waste Management  
Jackson Environmental Field Office  
1625 Hollywood Drive  
Jackson, Tennessee 38305

Dear Mr. David:

Subject: Third Quarter Assessment Monitoring Summary Report 2016  
Environmental Waste Solutions Landfill, Permit# IDL 03-0212  
CEC Project 142-059

Civil & Environmental Consultants, Inc. (CEC) has prepared this summary report for the Third Quarter Assessment Monitoring Event of 2016 at the Environmental Waste Solutions, LLC (EWS) Class II Landfill. In accordance with the Tennessee Solid Waste Regulations, CEC completed the Third Quarter Assessment Monitoring Event for MW-3 on August 18, 2016. The monitoring event was performed in general accordance with the site's Groundwater Quality Assessment Plan (GWQAP) approved by TDEC-DSWM on April 4, 2016. EWS entered the Assessment Monitoring Program as a result of chloride concentrations reported above the 250 mg/L EPA secondary drinking water standard at monitoring well MW-3 during the November 2015 Semi-Annual Monitoring Event.

As indicated in the approved GWQAP, the 3<sup>rd</sup> Quarter Sampling Event consisted of collecting a sample from MW-3 for chloride and additional leachate indicator parameter analysis. To maintain background information, a sample was also collected from upgradient monitoring well MW-1 during this event. Field parameters (temperature, pH, conductivity, dissolved oxygen, oxidation-reduction potential (ORP), and turbidity) were recorded at MW-1 and MW-3 during purging and sampling activities. Additionally, groundwater elevation data was collected from MW-1, MW-2, MW-3, MW-4, MW-5, TMW-1, TMW-2, and TMW-3 for potentiometric interpretation. Collected samples from MW-1 and MW-3 were analyzed for chloride, chemical oxygen demand (COD), alkalinity, bromide, nitrate, sulfate, ammonia, and a short list of ions (calcium, iron, magnesium, manganese, sodium, and potassium). ESC Lab Sciences, Inc. (ESC) completed the analysis and reported the results on August 30, 2016.

The results of the Third Quarter Assessment Monitoring Event of 2016 for MW-3 are summarized as follows:

- A statistically significant increase (SSI) was identified for the reported chloride concentration at MW-3 during this event. Chloride concentrations at MW-3 exhibited an increasing trend per the Mann-Kendall non-parametric trend procedure. The reported concentration of chloride at MW-3 (218 mg/L) did not exceed the 250 mg/L Secondary Drinking Water Standard, and was less than the concentrations reported during the Second Semi-Annual Monitoring Event in November 2015 (458 mg/L) and the supplemental re-sampling event (360 mg/L) in December 2015. However, the current reported concentration is higher than what was observed during the February 2016 (96.1 mg/L) and April 2016 (80.7 mg/L) sampling events. The chloride concentrations at MW-3 will continue to be closely monitored during future quarterly assessment monitoring events.
- Time series graphs prepared for MW-3 indicate a general increase in reported concentrations over the previous event for chloride, calcium, magnesium, manganese, potassium, sodium, and sulfate. However, the time series graph for nitrate showed a decrease in concentration.
- None of the parameters analyzed at MW-3 during the event exceeded the established Maximum Contaminant Levels (MCLs) or Non-Enforceable National Secondary Drinking Water Standards (2DWS) with the exception of iron and manganese concentrations reported in upgradient MW-1 and downgradient MW-3. Iron concentrations reported at MW-1 (17.8 mg/L) and MW-3 (0.394 mg/L) were above the 2DWS (0.3 mg/L). Manganese concentrations reported at MW-1 (0.977 mg/L) and MW-3 (0.996 mg/L) were above the 2DWS (0.05 mg/L). Since reported iron and manganese concentrations at upgradient MW-1 were reported at similar concentrations above the 2DWS, the iron and manganese concentrations reported at MW-3 are likely naturally occurring in local groundwater.

The field parameter values collected for MW-1 and MW-3 are presented in Table 1 – Groundwater Field Data, Appendix A. A summary of inorganic results are presented in Table 2 – Summary of Analytical Results, Appendix A. Time series graphs for the detected constituents and various indicator parameters analyzed for MW-3 are provided as Appendix B. The laboratory analytical data report and associated field information logs are included as Appendix C. Statistical analysis was not performed on the August 2016 data because it is not required for the current monitoring period. Statistical analysis will be performed during the fourth quarter monitoring period.

The Fourth Quarter 2016 Assessment Monitoring Event is tentatively scheduled for November 2016.

Mr. David - TDEC  
CEC Project 142-059  
Page 3  
October 14, 2016

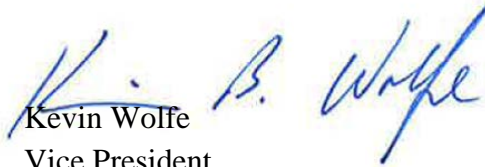
Should you have any questions or concerns, please do not hesitate to contact me at (615) 577-9328.

Sincerely,

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.



Michael Johnson  
Project Manager



Kevin Wolfe  
Vice President

Attachments: A - Potentiometric Map & Summary Tables  
B - Time Series & Statistical Analysis Plots  
C - Laboratory Analytical Report & Field Information Logs

cc: Chris White, EWS Camden



**Civil & Environmental  
Consultants, Inc.**

**3<sup>rd</sup> Quarter Groundwater Assessment Monitoring Report 2016**

**Environmental Waste Solutions Landfill  
200 Omar Circle  
Camden, Tennessee  
Benton County, TN  
Permit No. IDL 03-0212**

**For Submittal to:  
Tennessee Department of Environment and Conservation**

**Prepared by:  
Civil & Environmental Consultants, Inc.  
325 Seaboard Lane  
Suite 170  
Franklin, TN 37067**

Certification

I certify that I am a qualified groundwater professional who has received a baccalaureate or post-graduate degree in the natural sciences, and am licensed as a Professional Geologist in the State of Tennessee. I have sufficient training and experience in groundwater hydrology that enables me to make sound professional judgments regarding groundwater monitoring, contaminant fate and transport, and corrective-action.

I further certify that this report was prepared by me or by a subordinate working under my direction.

  
Michael Johnson, P.G.



10/13/16  
Date

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**APPENDIX A**  
**POTENTIOMETRIC MAP & SUMMARY TABLES**

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**Table 1**  
**Environmental Waste Solutions Camden Class II Landfill IDL 03-0212**  
**Field Parameters and Potentiometric Data - August 18, 2016**

Monitoring Well/ Piezometric Well	Date	Sample Time	Top of Casing Elevation (Feet MSL)	Bottom of Well Elevation (Feet)	Well Diameter (Feet)	Well Volume Gallons	Depth to Water (Feet)	Potentiometric Surface (Feet MSL)	Temperature (°C)	Conductivity (micromhos/cm)	pH (SU)	Dissolved Oxygen (mg/l)	Oxidation Reduction Potential (Millivolts)	Turbidity (NTU)
MW-1	8/18/2016	10:45	416.47	385.97	0.17	1.4	22.13	394.34	16.9	119.2	5.62	0.68	30.9	8.81
MW-2*	8/18/2016	NS	380.35	367.70	0.17	1.0	6.51	373.84	NS	NS	NS	NS	NS	NS
MW-3	8/18/2016	11:45	392.90	369.66	0.17	1.2	16.36	376.54	18.4	917.0	5.77	3.12	155.1	12.7
MW-4	8/18/2016	NS	381.47	357.25	0.17	2.2	11.28	370.19	NS	NS	NS	NS	NS	NS
MW-5	8/18/2016	NS	385.25	351.40	0.17	4.2	9.3	375.95	NS	NS	NS	NS	NS	NS
TMW-1**	8/18/2016	NS	381.19	348.99	0.085	1.1	5.52	375.67	NS	NS	NS	NS	NS	NS
TMW-2**	8/18/2016	NS	384.27	356.77	0.085	0.8	9.75	374.52	NS	NS	NS	NS	NS	NS
TMW-3**	8/18/2016	NS	381.37	353.37	0.085	0.8	8.61	372.76	NS	NS	NS	NS	NS	NS

Note 1: Top of Casing Elevations from survey by Civil & Environmental Consultants, Inc. on May 12, 2016.

Note 2: 3rd Quarter sampling for MW-1 and MW-3 only.

\* - MW-2 has been removed from monitoring network. Only water level and field parameters collected at MW-2.

\*\* - TMW locations are temporary monitoring wells installed as part of the groundwater quality assessment plan, only water levels were used for potentiometric interpretation.

NS= Not Sampled

NA= Not Applicable.

**Table 2**  
**Environmental Waste Solutions Camden Class II Landfill IDL 03-0212**  
**Inorganic Analytical Data -August 2016**

		MW-1		MW-3	
		8/19/2016		8/19/2016	
Parameter	MCL (mg/l)	Value (mg/l)	Qual	Value (mg/l)	Qual
Alkalinity	-	<b>48.3</b>		29.2	B
Ammonia Nitrogen	-	<b>0.104</b>	J	<b>0.758</b>	
COD	-	<b>11.2</b>		<10.0	
Bromide	-	<1.0		<1.0	
Chloride	250 <sup>2</sup>	<b>2.40</b>		<b>218</b>	
Nitrate	10	<0.1		<b>1.58</b>	
Sulfate	250 <sup>2</sup>	<b>3.51</b>	J	<b>95.7</b>	
Calcium	-	<b>3.09</b>		<b>51.5</b>	
Iron	0.3 <sup>2</sup>	<b>17.8</b>		<b>0.394</b>	
Magnesium	-	<b>2.61</b>		<b>24.0</b>	
Manganese	0.05 <sup>2</sup>	<b>0.977</b>		<b>0.996</b>	
Potassium	-	<b>1.05</b>		<b>32.3</b>	
Sodium	-	<b>3.14</b>		<b>84.2</b>	

Notes:

MCL: Maximum Contaminant Level Enforceable National Primary Drinking Water Standards

2: Non-Enforceable National Secondary Drinking Water Standard

Bold text indicates laboratory analytical detections above the practical quantitation level

Greyed text indicates detection above respective MCL

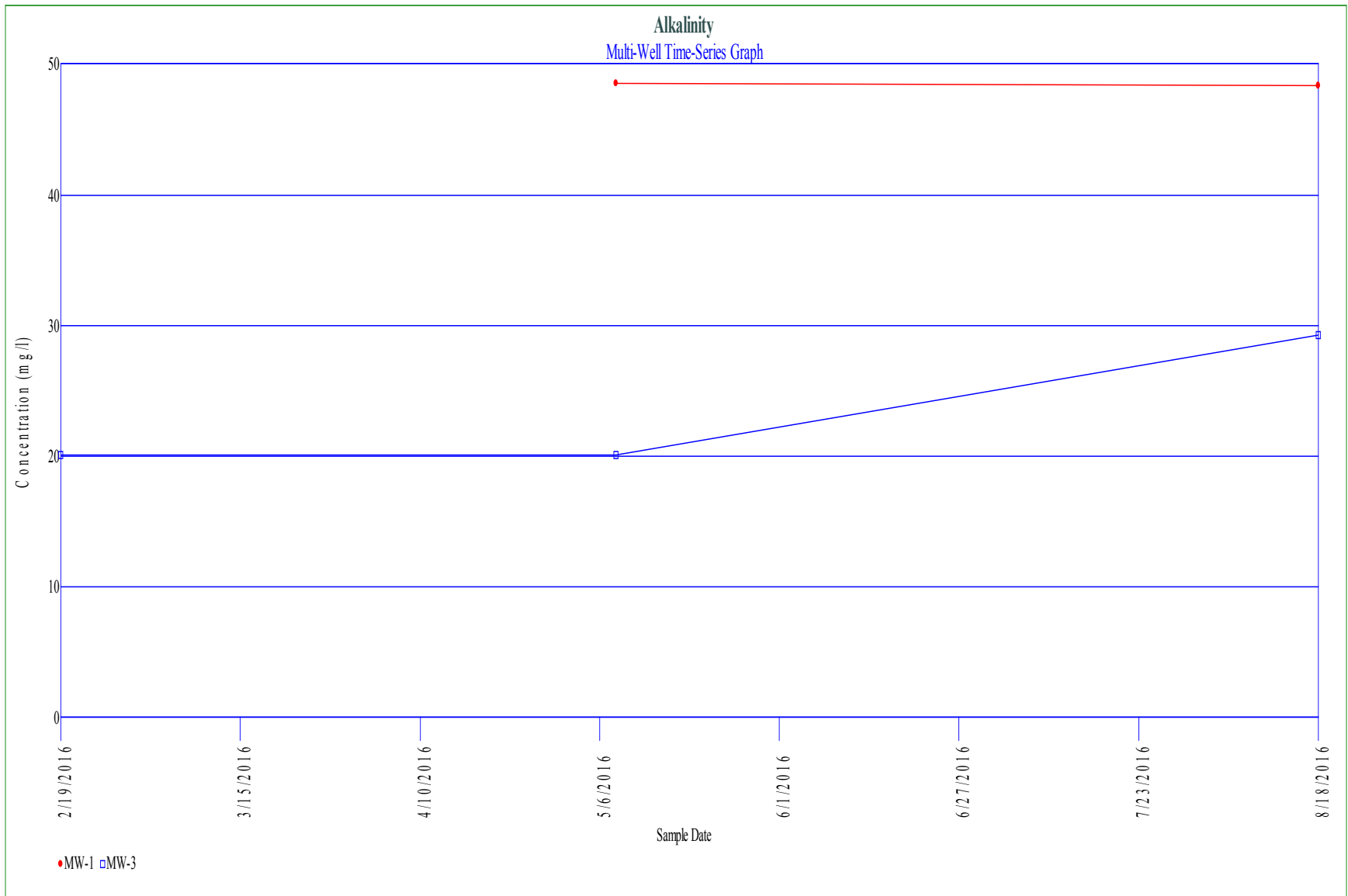
P1: (ESC)- Additional QC Info: The sample concentration is too high to evaluate accurate spike recoveries.

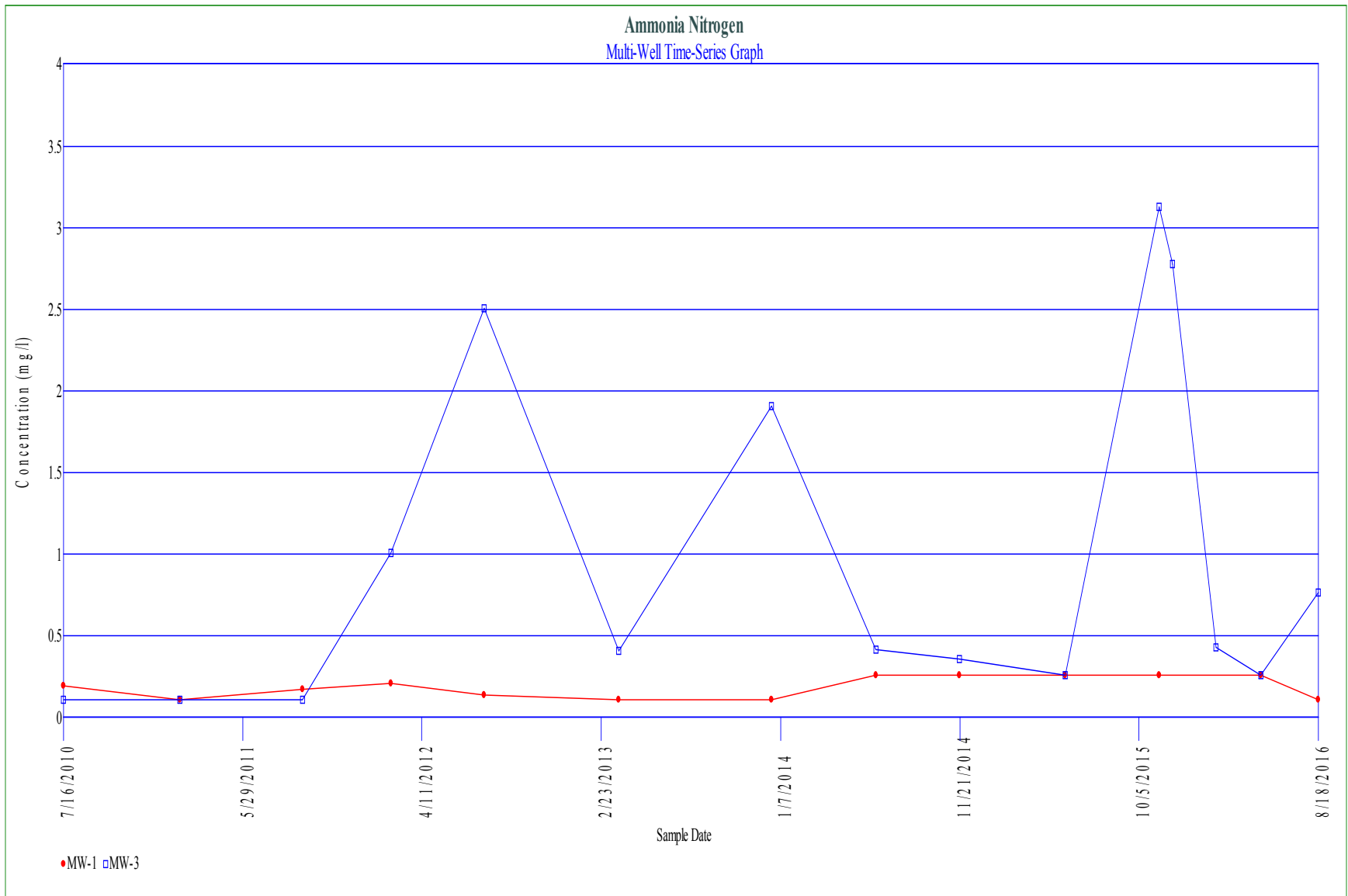


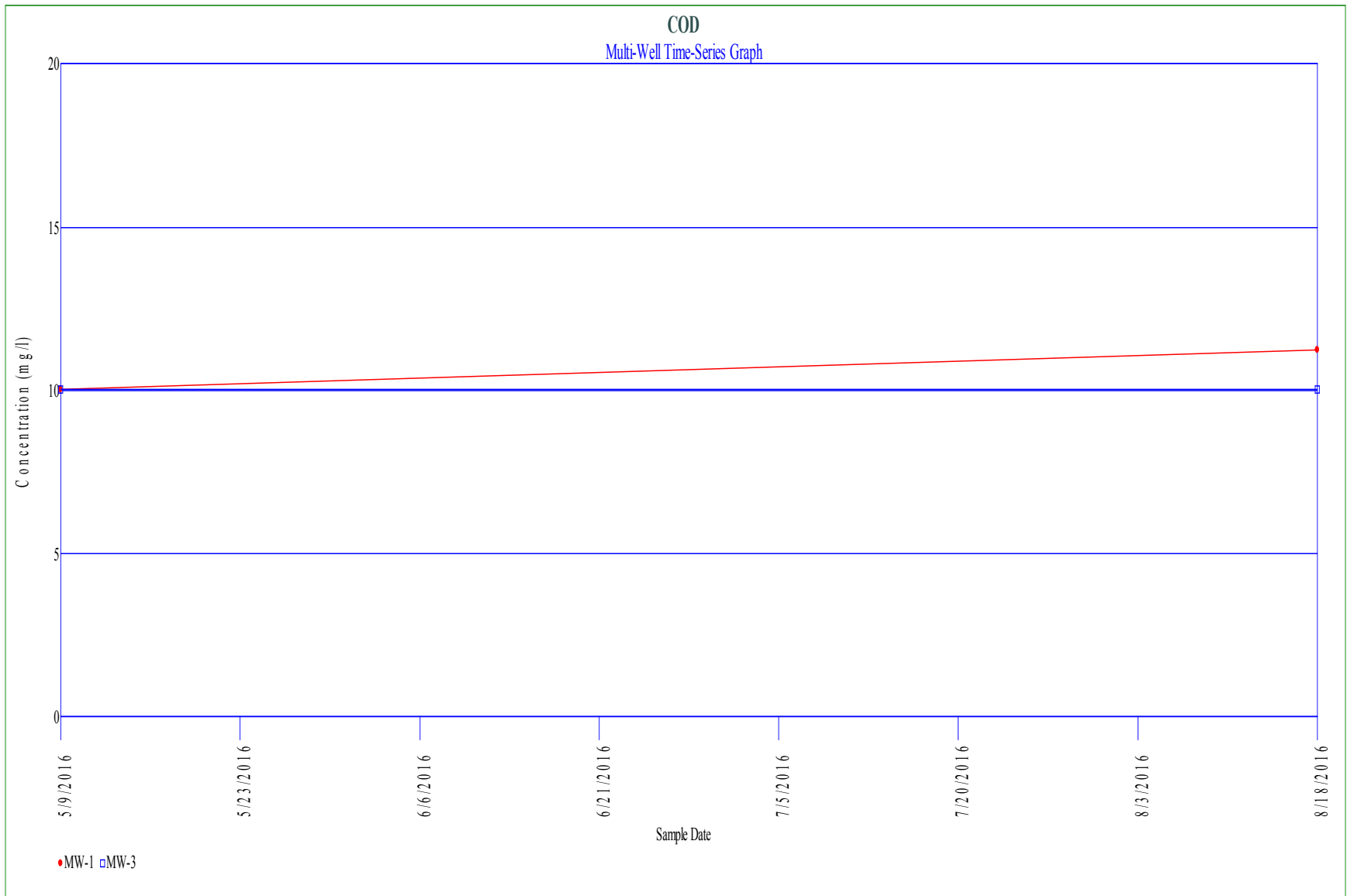
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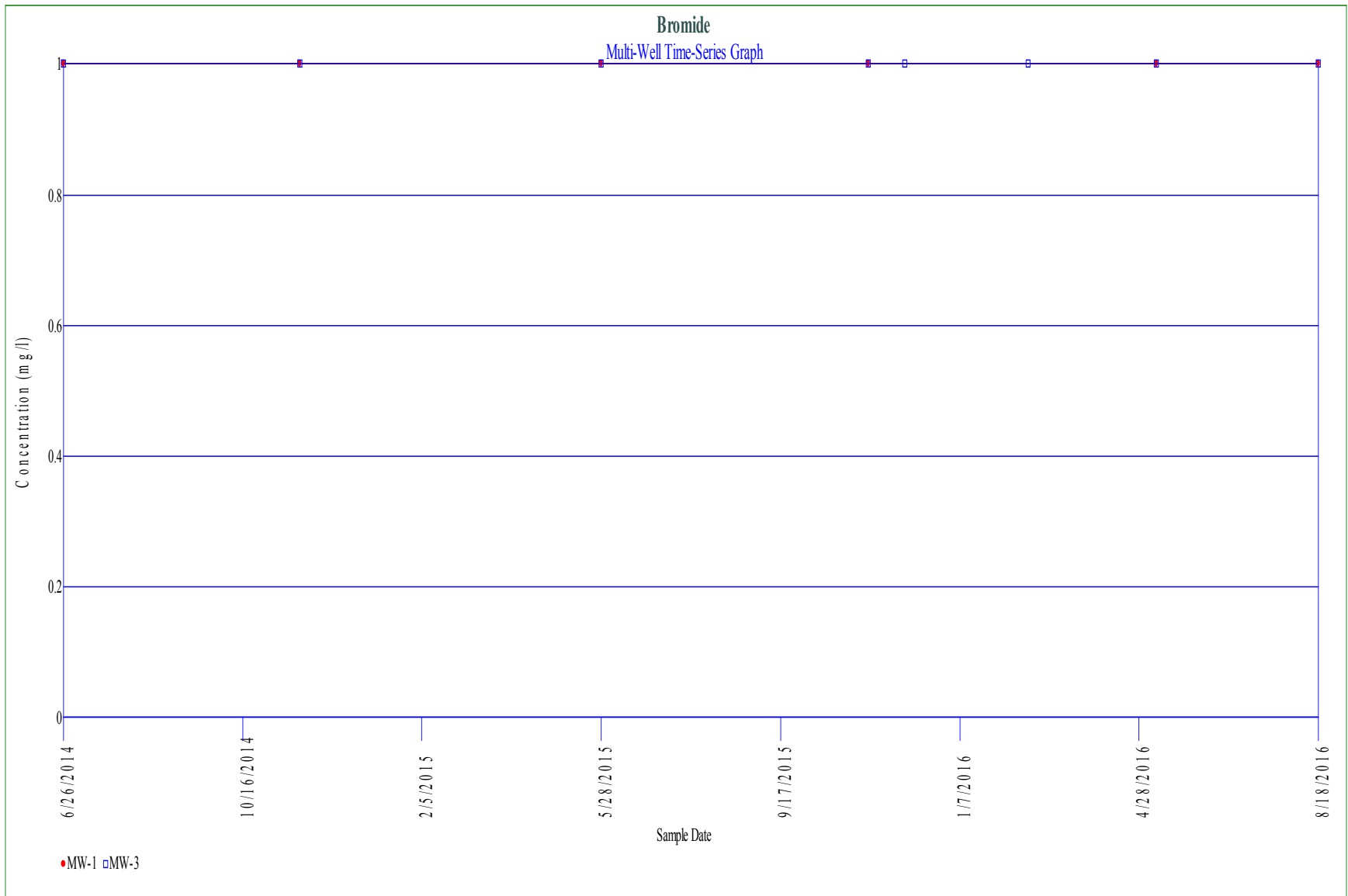
**APPENDIX B**  
**TIME SERIES & STATISTICAL ANALYSIS PLOTS**

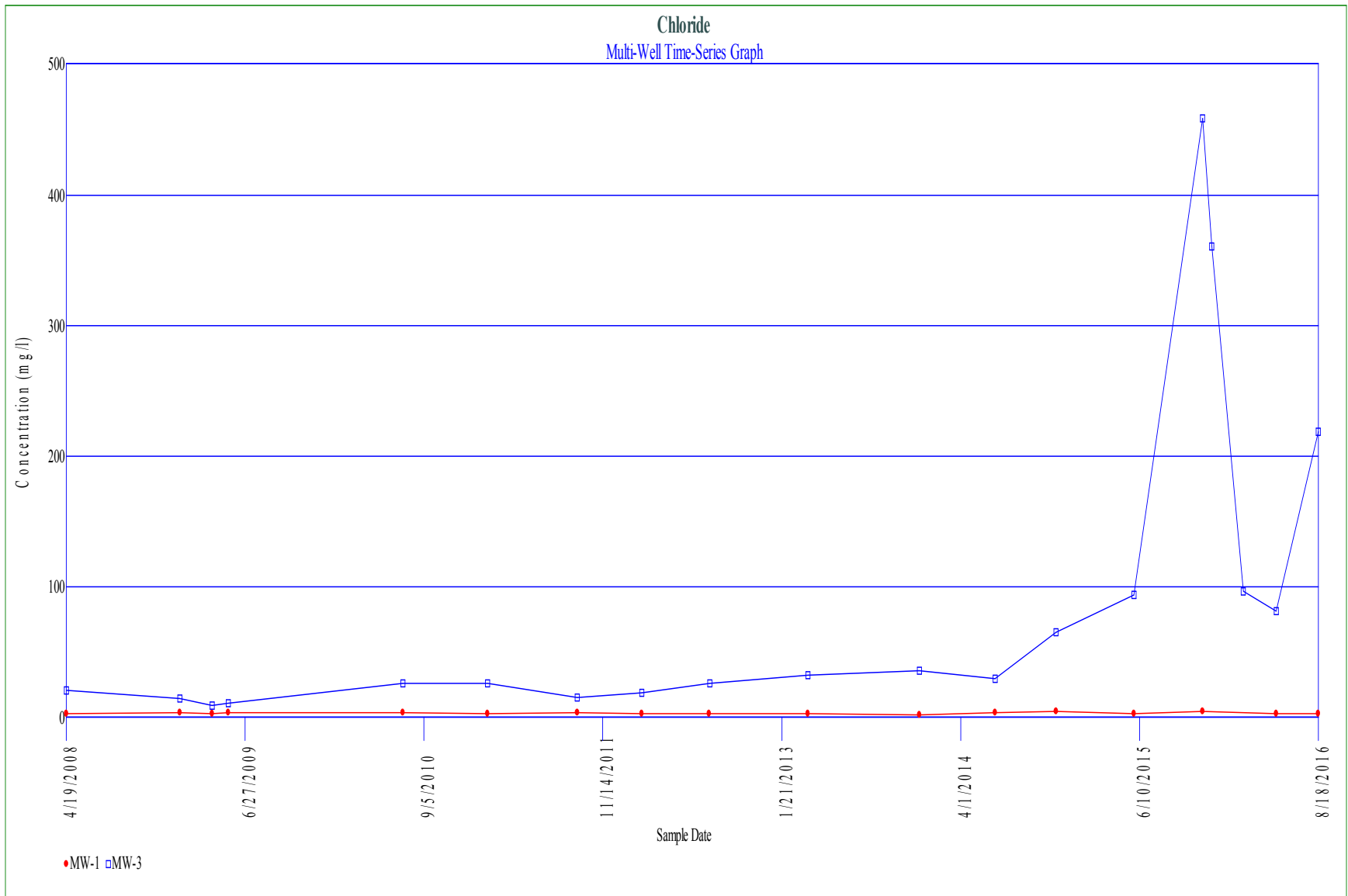
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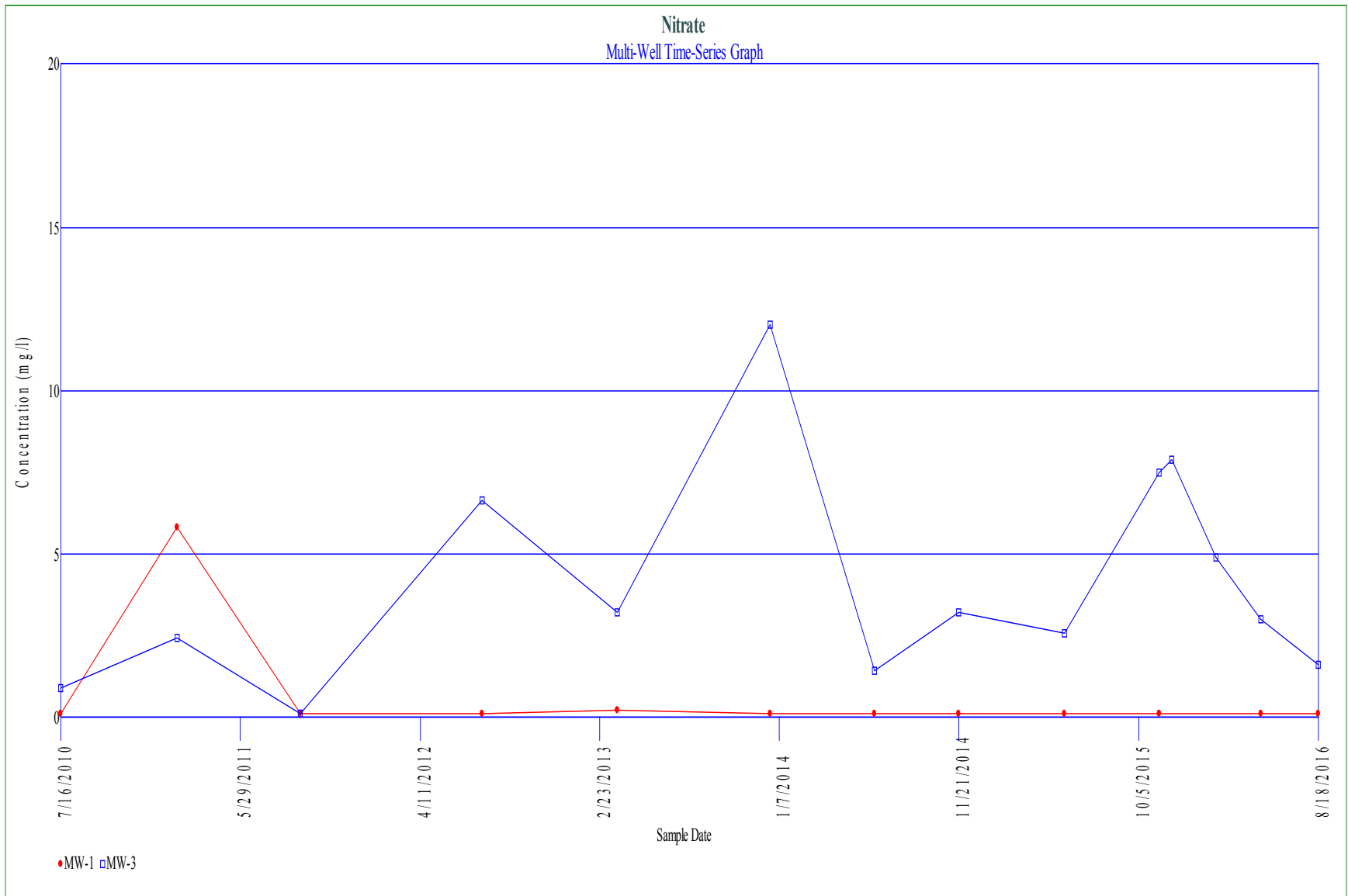






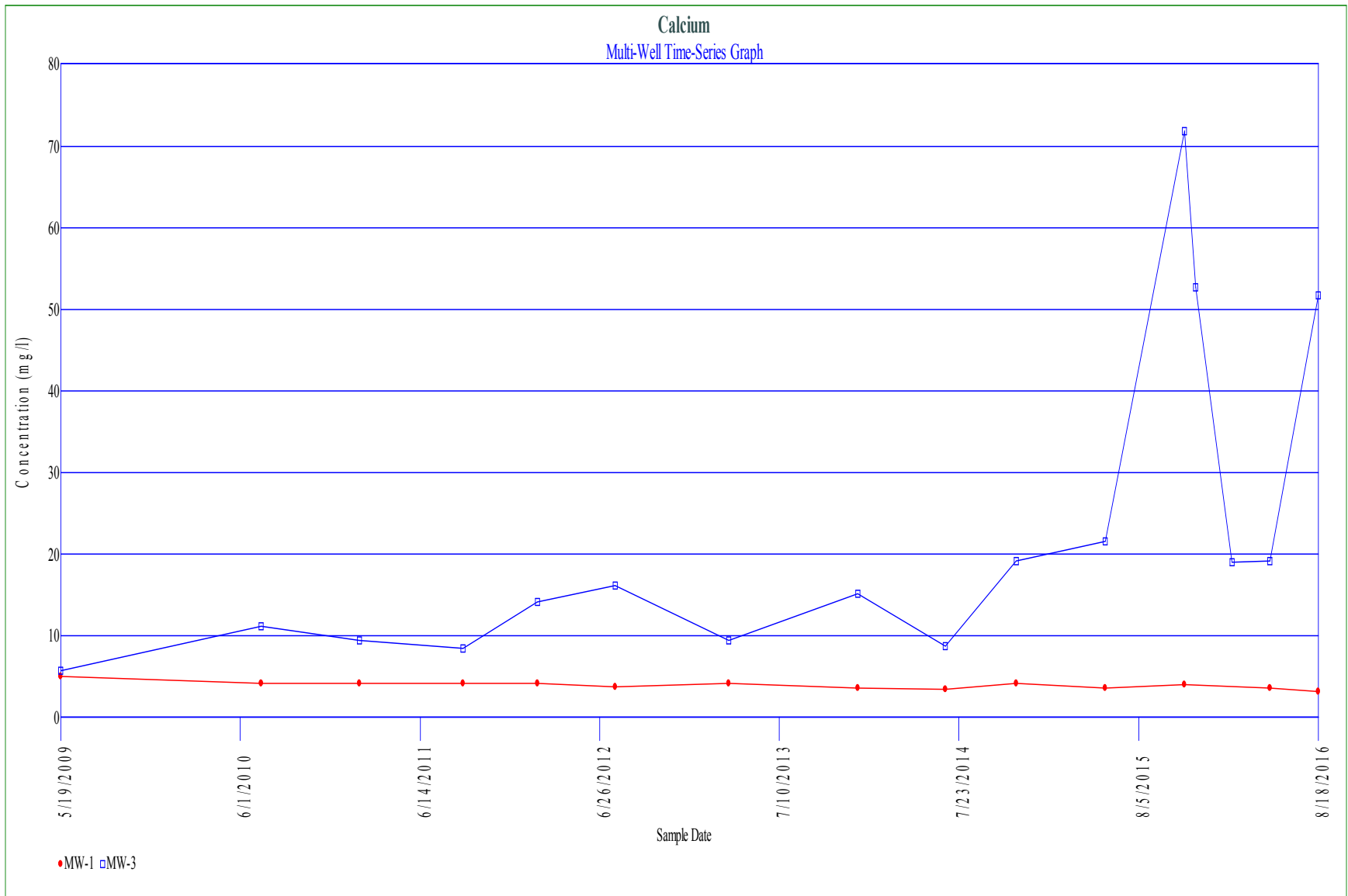


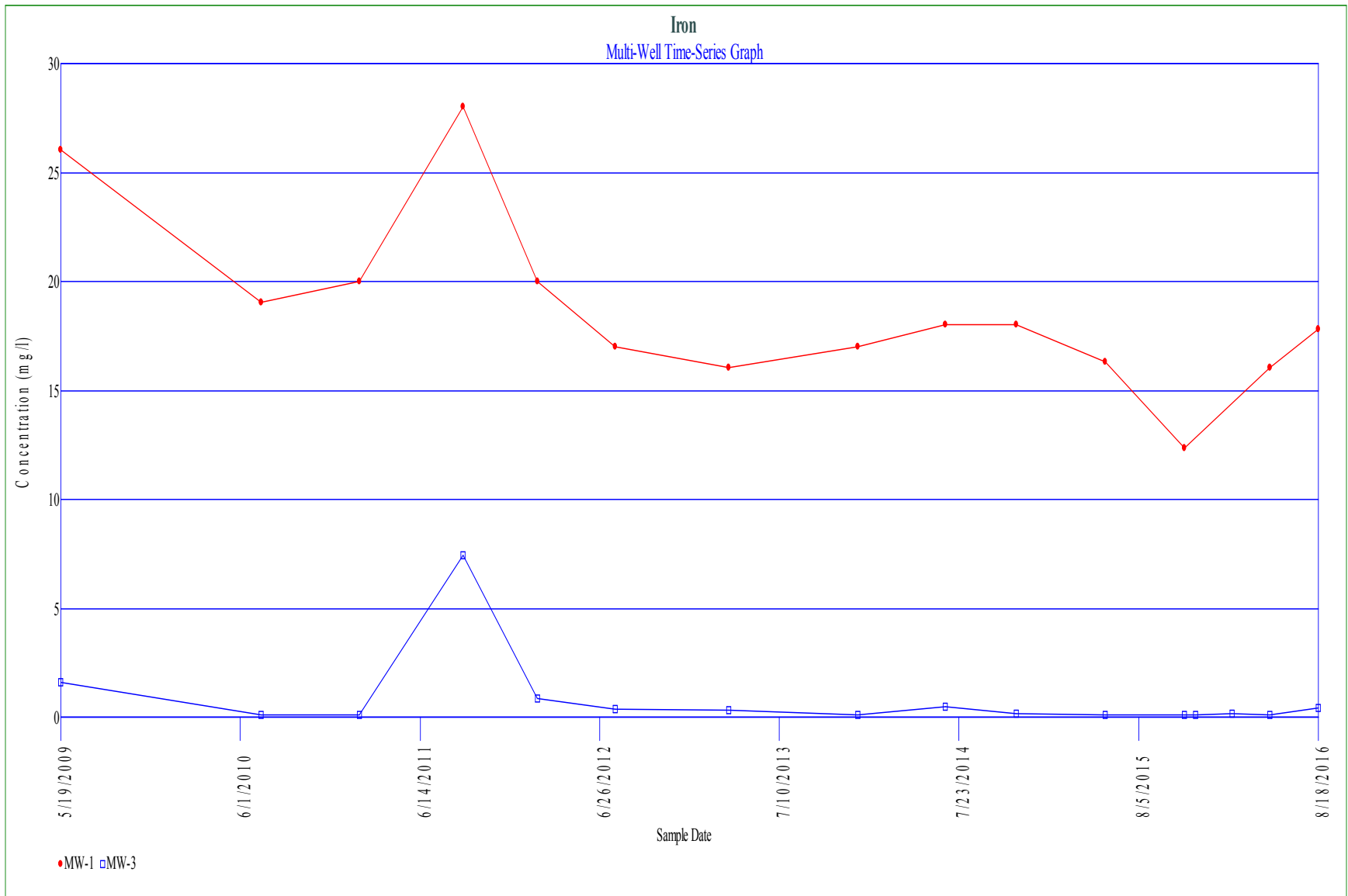


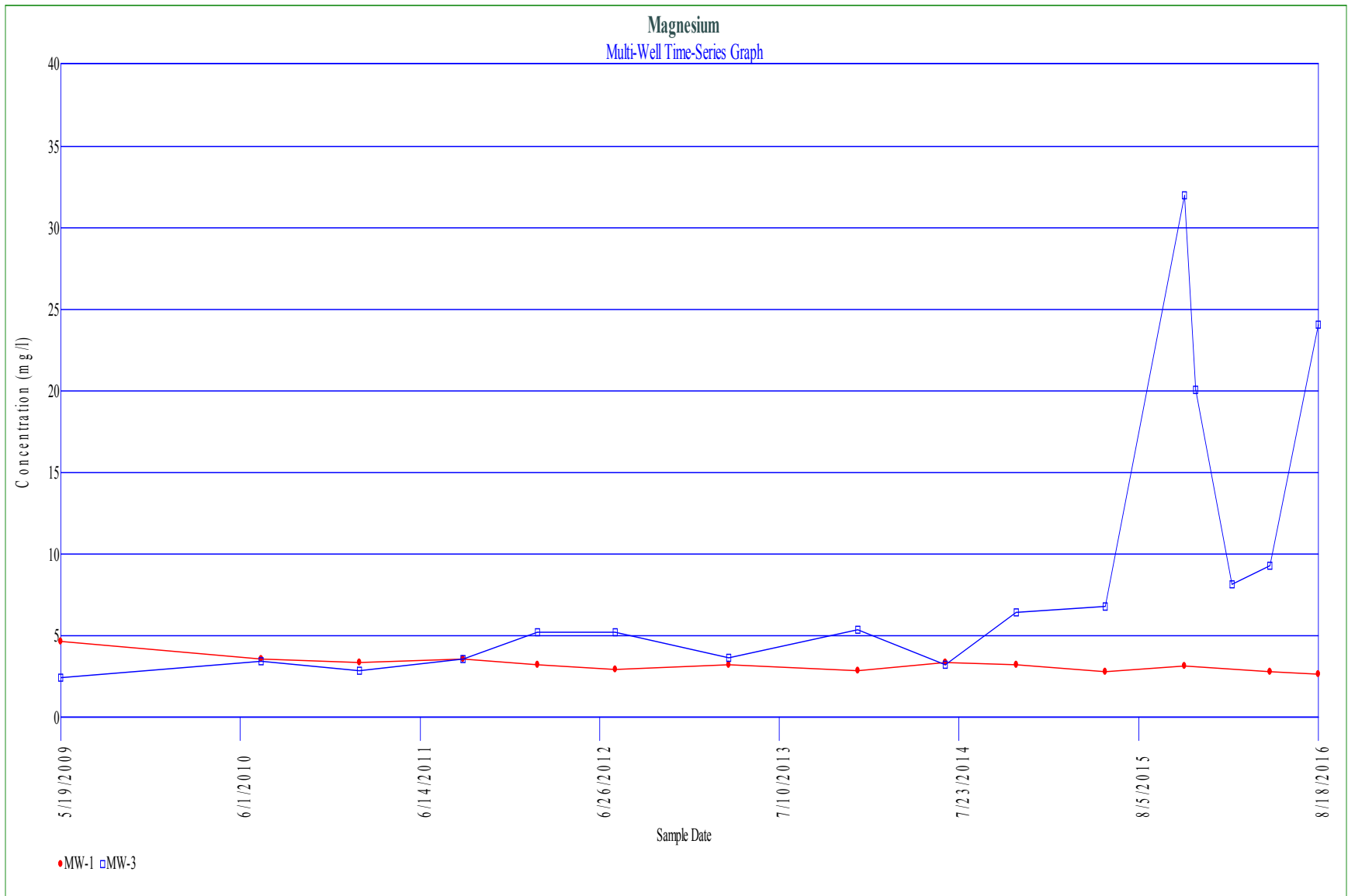


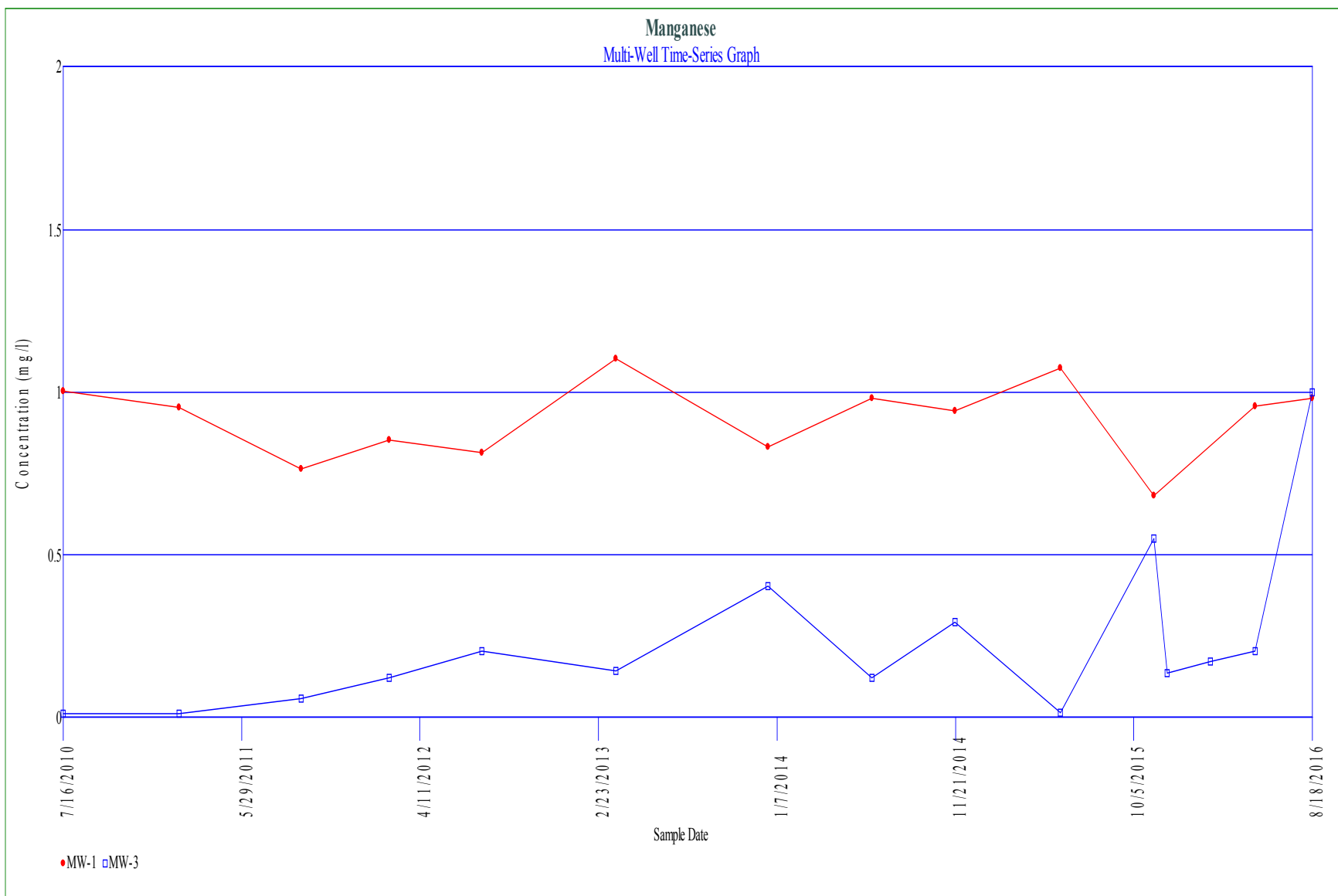


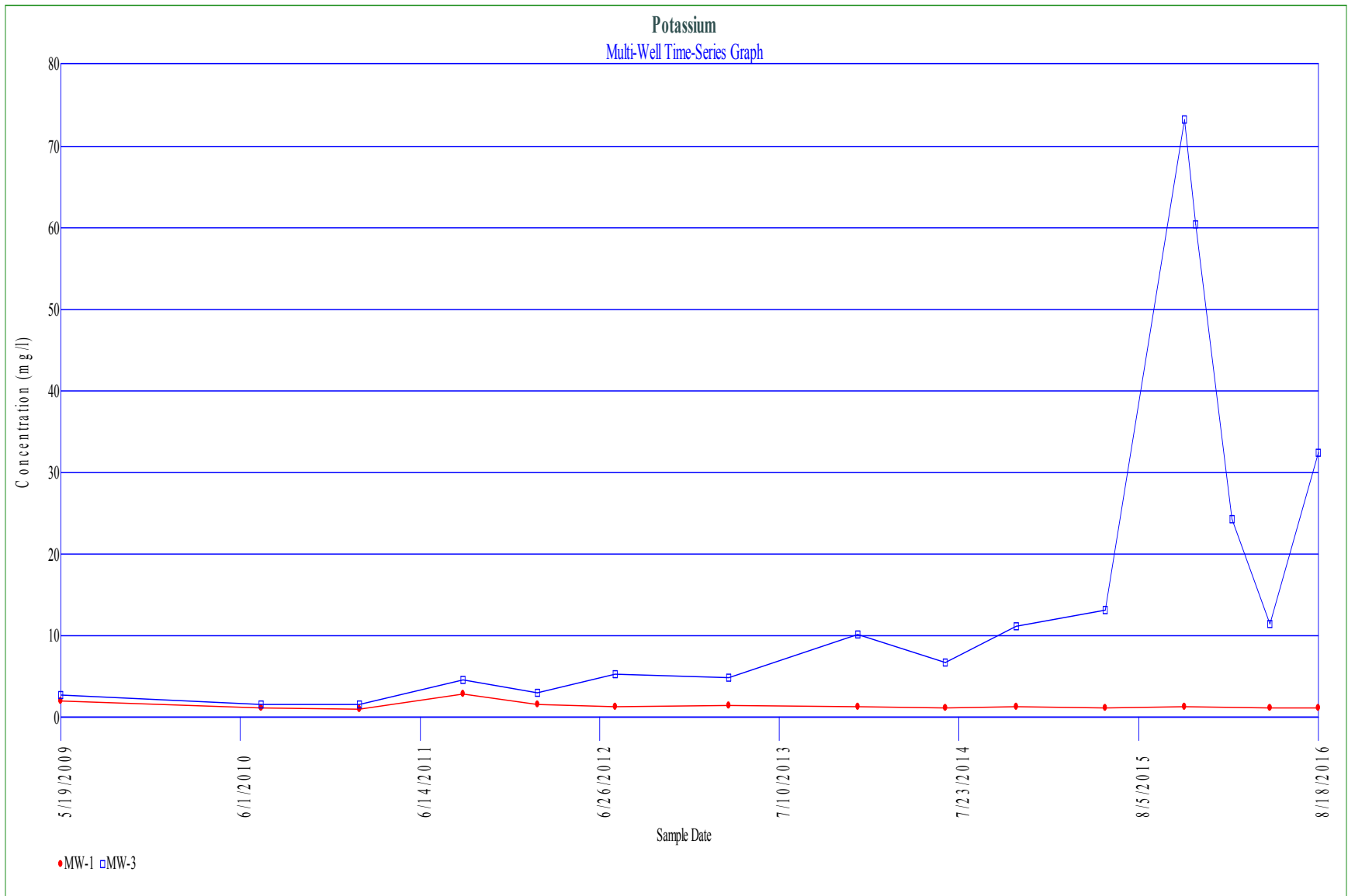


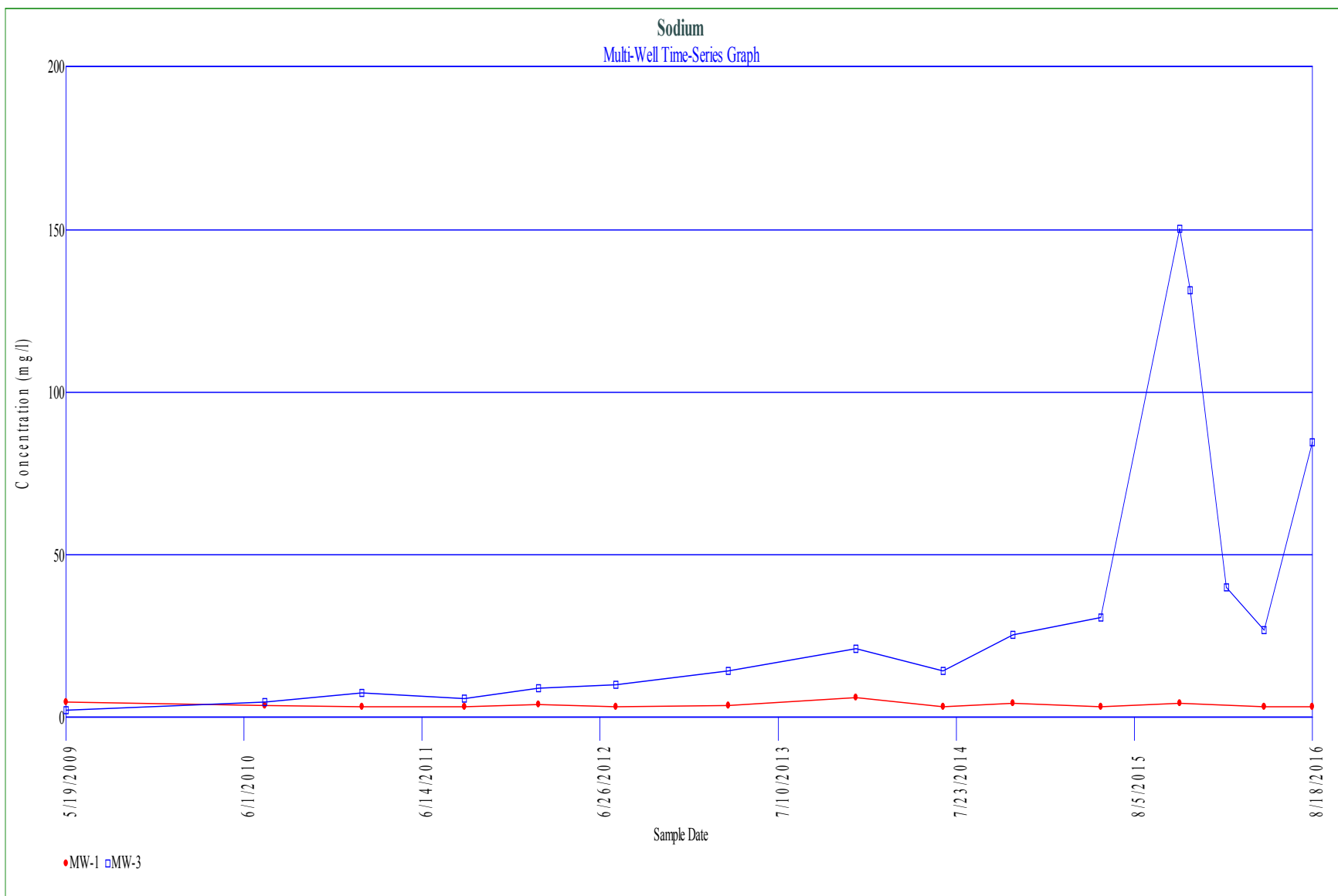


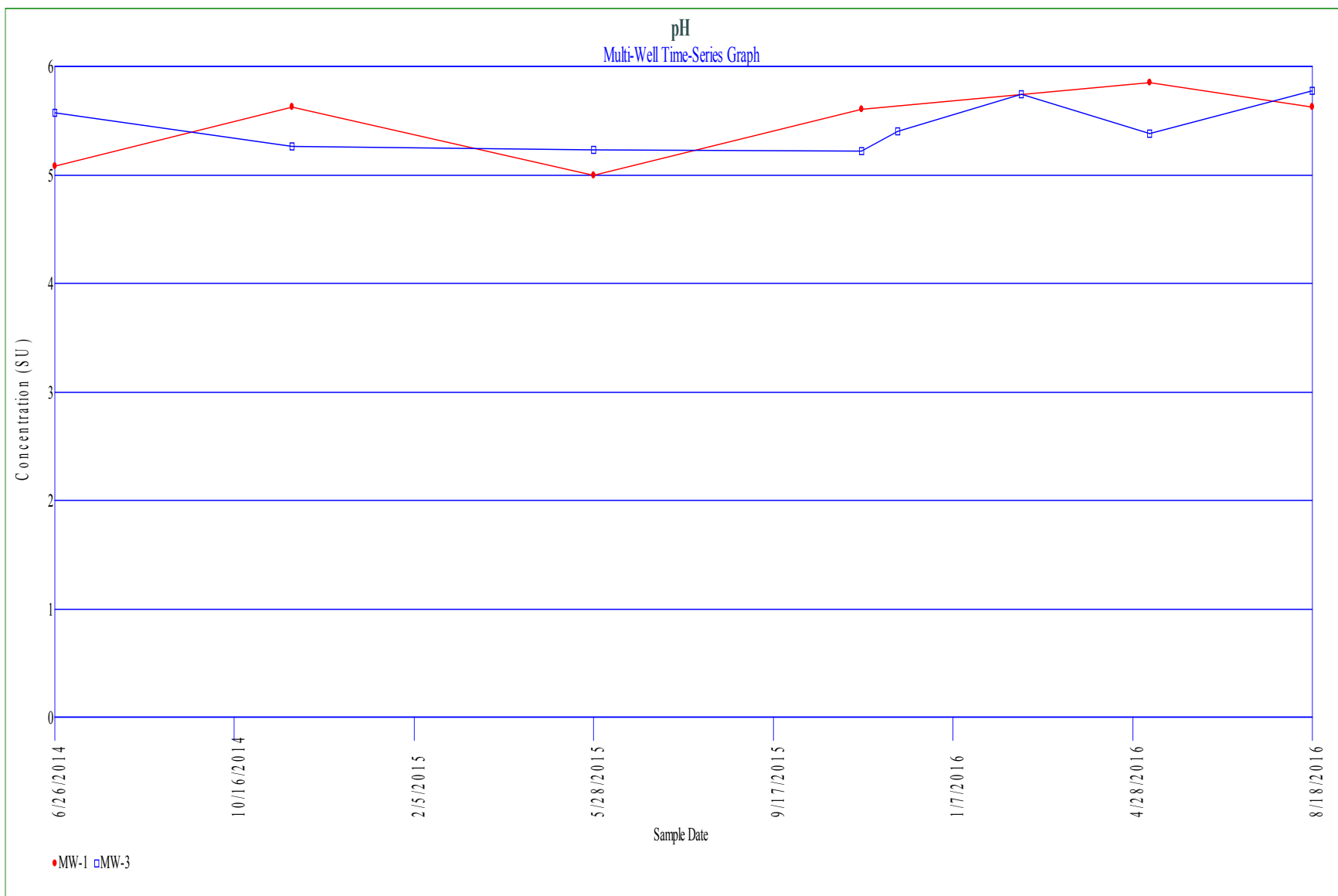


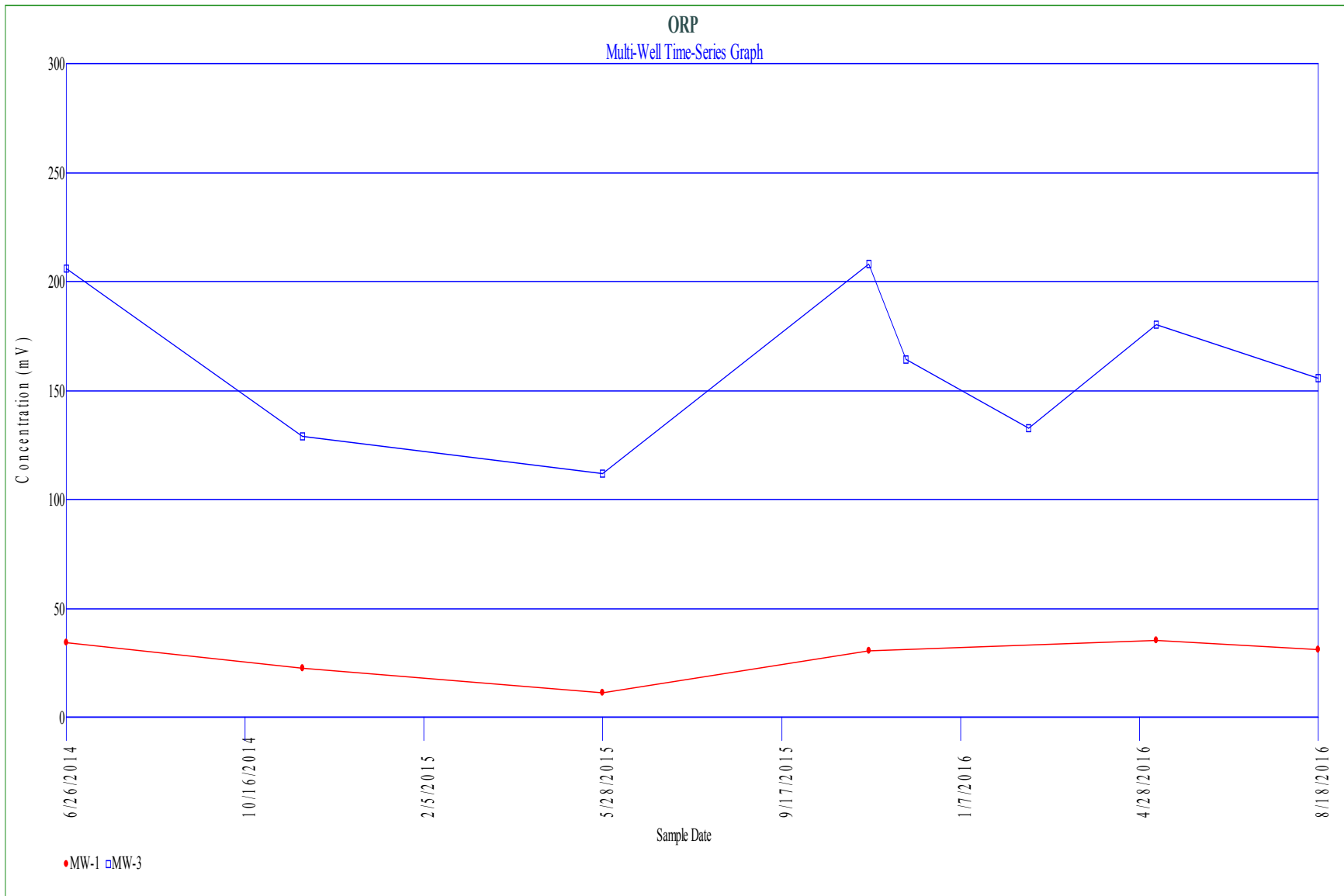




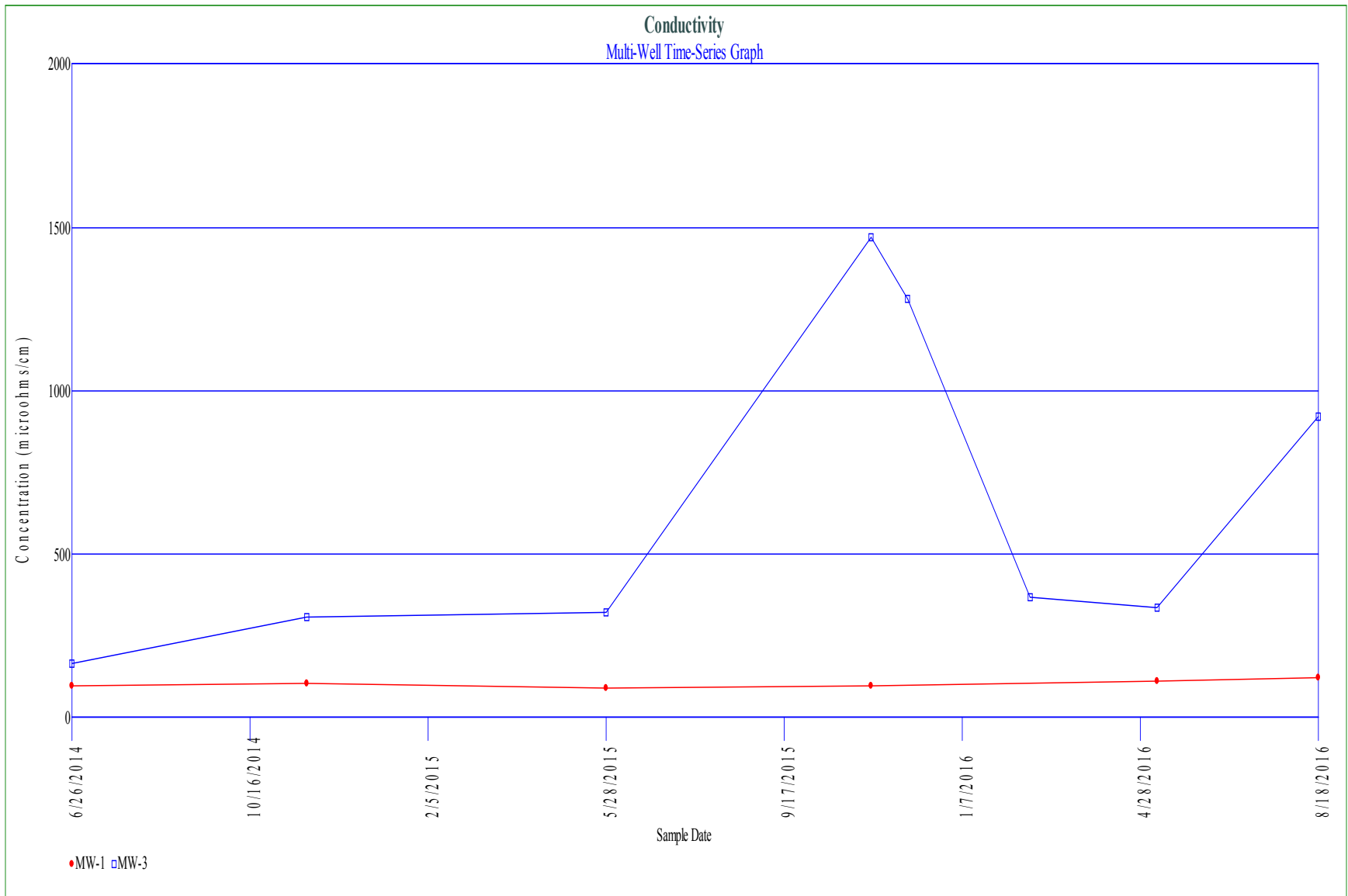


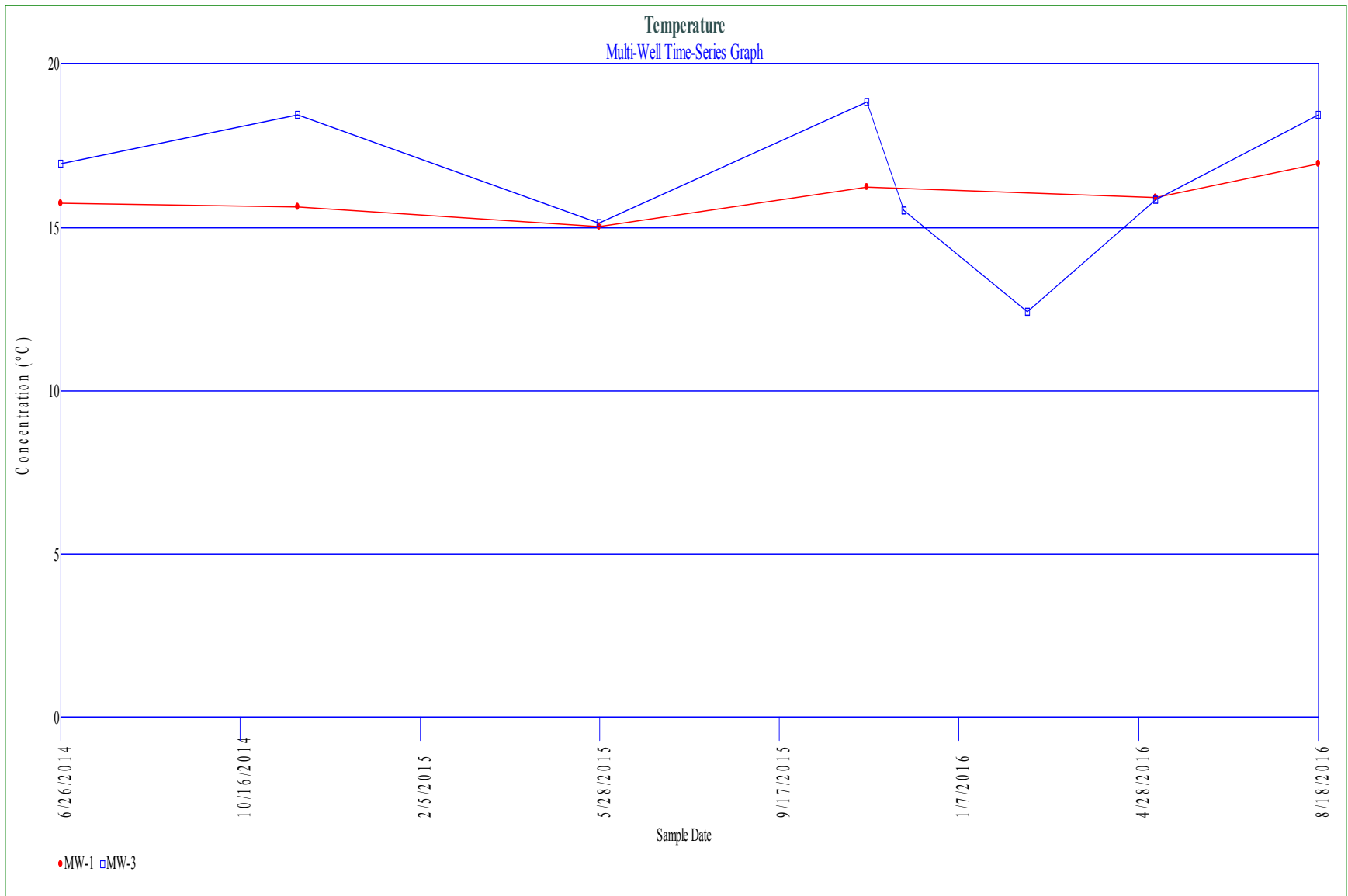


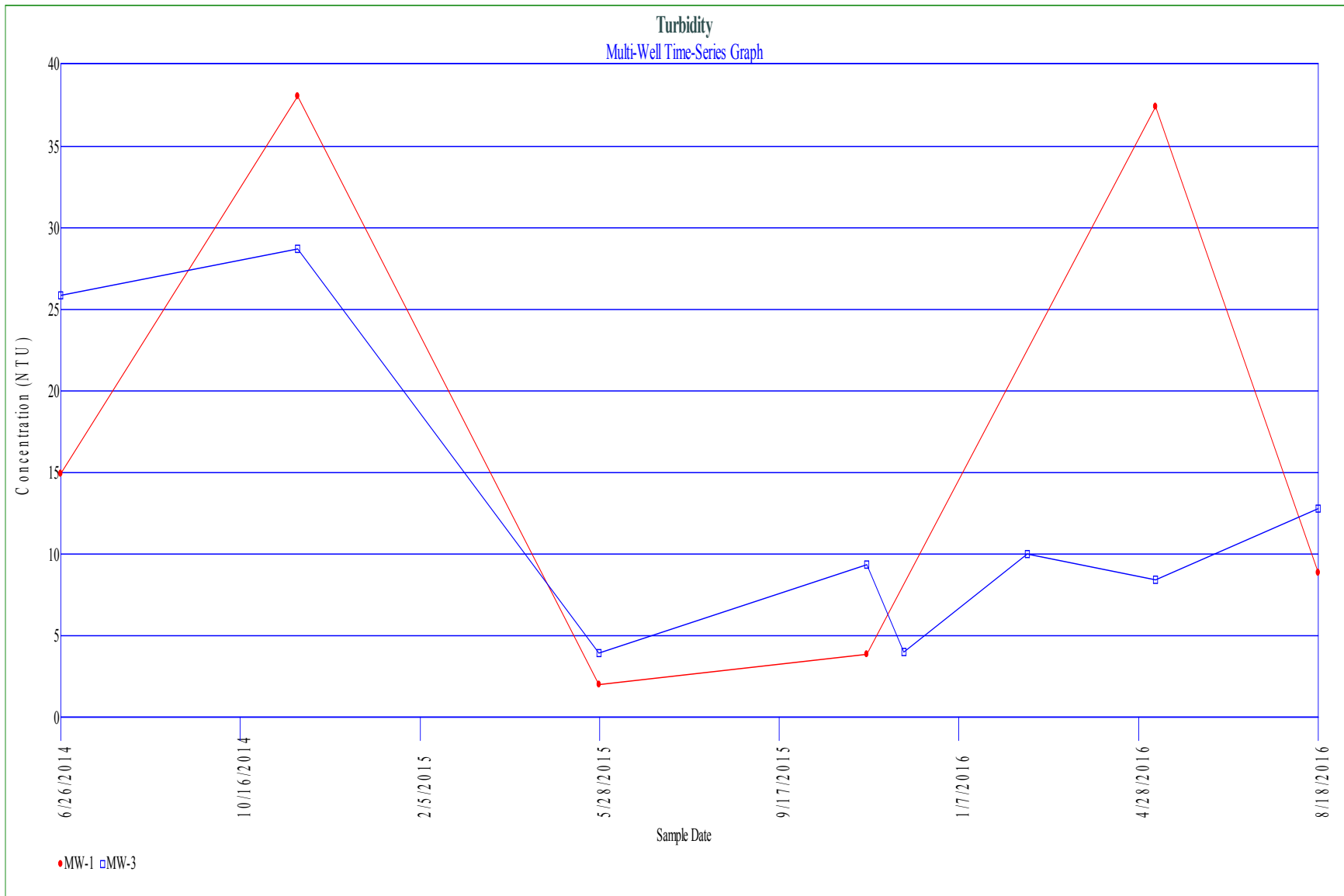


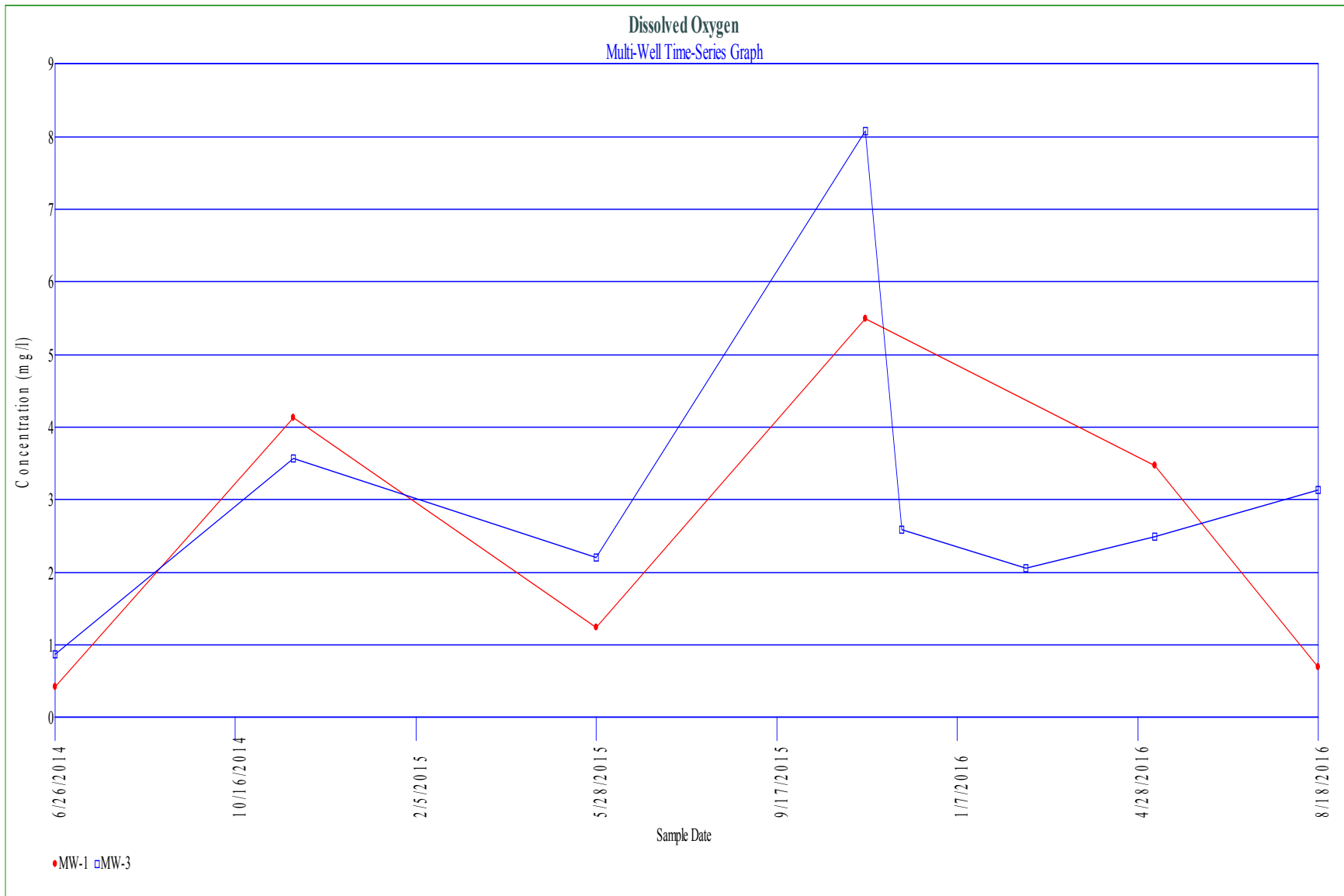












## Shapiro-Wilks Test of Normality

Parameter: Chloride

All Locations

Normality Test of Parameter Concentrations

Natural Logarithm Transformation

Non-Detects Replaced with 1/2 DL

K = 23 for 46 measurements

Sum of b values = 10.3575

Sample Standard Deviation = 1.61303

W Statistic = 0.916251

**5% Critical value of 0.945 exceeds 0.916251**

**Evidence of non-normality at 95% level of significance**

**1% Critical value of 0.927 exceeds 0.916251**

**Evidence of non-normality at 99% level of significance**

## Shapiro-Wilks Test of Normality

Parameter: Chloride

All Locations

Normality Test of Parameter Concentrations

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

K = 23 for 46 measurements

Sum of b values = 472.071

Sample Standard Deviation = 95.7906

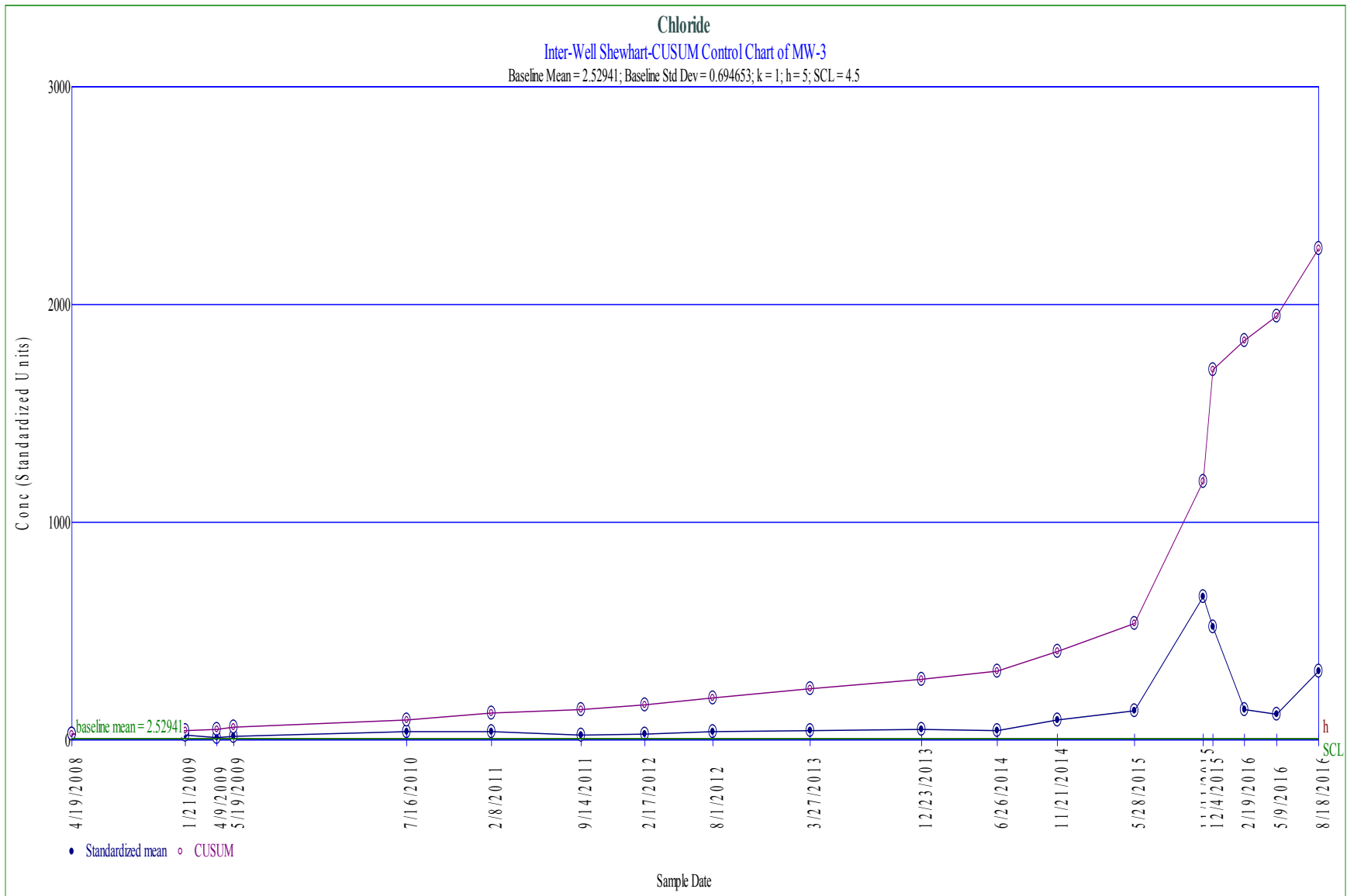
W Statistic = 0.539705

**5% Critical value of 0.945 exceeds 0.539705**

**Evidence of non-normality at 95% level of significance**

**1% Critical value of 0.927 exceeds 0.539705**

**Evidence of non-normality at 99% level of significance**



## Wilcoxon Non-Parametric Analysis (Inter-Well)

Parameter: Chloride

Location: MW-3

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total non detects is 0

Non detect rank is 0

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### Wilcoxon Ranks

Location	Date	Conc.	Rank
MW-1	4/19/2008	2	4
	1/21/2009	2.9	13
	4/9/2009	1.9	3
	5/19/2009	2.8	11
	7/16/2010	2.8	12
	2/8/2011	2.6	10
	9/14/2011	3.1	15
	2/17/2012	2.1	6
	7/31/2012	2.2	8
	3/27/2013	1.8	2
	12/23/2013	1.5	1
	6/26/2014	2.9	14
	11/21/2014	3.9	16
	5/28/2015	2.01	5
	11/11/2015	3.97	17
	5/9/2016	2.12	7
	8/18/2016	2.4	9

---

MW-3	4/19/2008	20	23
	1/21/2009	14	20
	4/9/2009	8.2	18
	5/19/2009	10	19
	7/16/2010	25	24
	2/8/2011	25	25
	9/14/2011	15	21
	2/17/2012	18	22
	8/1/2012	25	26
	3/27/2013	32	28
	12/23/2013	35	29
	6/26/2014	29	27
	11/21/2014	65	30



5/28/2015	92.8	32
11/11/2015	458	36
12/4/2015	360	35
2/19/2016	96.1	33
5/9/2016	80.7	31
8/18/2016	218	34

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The Wilcoxon Statistic is 323

The Expected value is 161.5

The Standard Deviation is 31.5581

The Z Score is 5.10169

The Standard Deviation adjusted for ties is 31.5581

The Z Score adjusted for ties is 5.10169

**5.10169 > 2.326 indicating statistical significance at 1% level**

**5.10169 > 2.326 indicating statistical significance at 1% level when adjusted for ties**

## Mann-Kendall Trend Analysis

Parameter: Chloride

Location: MW-3

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

95% Confidence Level

S Statistic = 146 - 22 = 124

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Tied Group Value	Members
1	25
	3

---

Time Period	Observations
4/19/2008	1
1/21/2009	1
4/9/2009	1
5/19/2009	1
7/16/2010	1
2/8/2011	1
9/14/2011	1
2/17/2012	1
8/1/2012	1
3/27/2013	1
12/23/2013	1
6/26/2014	1
11/21/2014	1
5/28/2015	1
11/11/2015	1
12/4/2015	1
2/19/2016	1
5/9/2016	1
8/18/2016	1

There are 0 time periods with multiple data

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A = 66

B = 0

C = 6

D = 0

E = 6

F = 0

a = 14706

$b = 52326$

$c = 684$

Group Variance = 813.333

Z-Score = 4.31291

Comparison Level at 95% confidence level = 1.65463 (upward trend)

**4.31291 > 1.65463 indicating an upward trend**

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**APPENDIX C**  
**LABORATORY ANALYTICAL REPORT & FIELD INFORMATION**  
**LOGS**

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## Civil & Environmental Consultants - TN

Sample Delivery Group: L854666  
Samples Received: 08/19/2016  
Project Number: 142-059  
Description: EWS Landfill  
Site: EWS  
Report To: Philip Campbell  
325 Seaboard Lane, Suite 170  
Franklin, TN 37067

Entire Report Reviewed By:



Jimmy Hunt

Technical Service Representative

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by ESC is performed per guidance provided in laboratory standard operating procedures: 060302, 060303, and 060304.



<b><sup>1</sup>Cp: Cover Page</b>	<b>1</b>	
<b><sup>2</sup>Tc: Table of Contents</b>	<b>2</b>	
<b><sup>3</sup>Ss: Sample Summary</b>	<b>3</b>	
<b><sup>4</sup>Cn: Case Narrative</b>	<b>4</b>	
<b><sup>5</sup>Sr: Sample Results</b>	<b>5</b>	
MW-1 L854666-01	5	
MW-3 L854666-02	6	
FIELD BLANK L854666-03	7	
<b><sup>6</sup>Qc: Quality Control Summary</b>	<b>8</b>	
Wet Chemistry by Method 2320 B-2011	8	
Wet Chemistry by Method 350.1	9	
Wet Chemistry by Method 410.4	10	
Wet Chemistry by Method 9056A	11	
Metals (ICPMS) by Method 6020	12	
<b><sup>7</sup>Gl: Glossary of Terms</b>	<b>13</b>	
<b><sup>8</sup>Al: Accreditations &amp; Locations</b>	<b>14</b>	
<b><sup>9</sup>Sc: Chain of Custody</b>	<b>15</b>	

# SAMPLE SUMMARY



## MW-1 L854666-01 GW

Collected by  
A. Baugh  
Collected date/time  
08/18/16 10:45  
Received date/time  
08/19/16 11:58

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Metals (ICPMS) by Method 6020	WG901121	1	08/23/16 16:22	08/24/16 20:39	JDG
Wet Chemistry by Method 2320 B-2011	WG901093	1	08/25/16 10:13	08/25/16 10:13	MCG
Wet Chemistry by Method 350.1	WG901260	1	08/24/16 12:02	08/24/16 12:02	ADH
Wet Chemistry by Method 410.4	WG900563	1	08/22/16 08:17	08/22/16 10:42	ADH
Wet Chemistry by Method 9056A	WG900710	1	08/20/16 09:11	08/20/16 09:11	CM

1  
Cp

2  
Tc

3  
Ss

4  
Cn

5  
Sr

6  
Qc

7  
Gl

8  
Al

9  
Sc

## MW-3 L854666-02 GW

Collected by  
A. Baugh  
Collected date/time  
08/18/16 11:45  
Received date/time  
08/19/16 11:58

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Metals (ICPMS) by Method 6020	WG901121	1	08/23/16 16:22	08/24/16 20:42	JDG
Wet Chemistry by Method 2320 B-2011	WG901093	1	08/25/16 10:20	08/25/16 10:20	MCG
Wet Chemistry by Method 350.1	WG901260	1	08/24/16 12:10	08/24/16 12:10	ADH
Wet Chemistry by Method 410.4	WG900563	1	08/22/16 08:17	08/22/16 10:42	ADH
Wet Chemistry by Method 9056A	WG900710	1	08/20/16 09:39	08/20/16 09:39	CM
Wet Chemistry by Method 9056A	WG900710	5	08/20/16 10:52	08/20/16 10:52	ADH

## FIELD BLANK L854666-03 GW

Collected by  
A. Baugh  
Collected date/time  
08/18/16 12:00  
Received date/time  
08/19/16 11:58

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Wet Chemistry by Method 9056A	WG900710	1	08/20/16 09:54	08/20/16 09:54	CM



All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. All MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Jimmy Hunt  
Technical Service Representative

- <sup>1</sup> Cp
- <sup>2</sup> Tc
- <sup>3</sup> Ss
- <sup>4</sup> Cn
- <sup>5</sup> Sr
- <sup>6</sup> Qc
- <sup>7</sup> Gl
- <sup>8</sup> Al
- <sup>9</sup> Sc





## Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Alkalinity	48.3		20.0	1	08/25/2016 10:13	<a href="#">WG901093</a>

1 Cp

2 Tc

## Wet Chemistry by Method 350.1

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Ammonia Nitrogen	ND		0.250	1	08/24/2016 12:02	<a href="#">WG901260</a>

3 Ss

4 Cn

## Wet Chemistry by Method 410.4

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
COD	11.2		10.0	1	08/22/2016 10:42	<a href="#">WG900563</a>

5 Sr

6 Qc

## Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Bromide	ND		1.00	1	08/20/2016 09:11	<a href="#">WG900710</a>
Chloride	2.40		1.00	1	08/20/2016 09:11	<a href="#">WG900710</a>
Nitrate	ND		0.100	1	08/20/2016 09:11	<a href="#">WG900710</a>
Sulfate	ND		5.00	1	08/20/2016 09:11	<a href="#">WG900710</a>

7 Gl

8 Al

9 Sc

## Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Calcium	3.09		1.00	1	08/24/2016 20:39	<a href="#">WG901121</a>
Iron	17.8		0.100	1	08/24/2016 20:39	<a href="#">WG901121</a>
Magnesium	2.61		1.00	1	08/24/2016 20:39	<a href="#">WG901121</a>
Manganese	0.977		0.00500	1	08/24/2016 20:39	<a href="#">WG901121</a>
Potassium	1.05		1.00	1	08/24/2016 20:39	<a href="#">WG901121</a>
Sodium	3.14		1.00	1	08/24/2016 20:39	<a href="#">WG901121</a>



## Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Alkalinity	29.2	B	20.0	1	08/25/2016 10:20	<a href="#">WG901093</a>

1 Cp

2 Tc

## Wet Chemistry by Method 350.1

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Ammonia Nitrogen	0.758		0.250	1	08/24/2016 12:10	<a href="#">WG901260</a>

3 Ss

4 Cn

## Wet Chemistry by Method 410.4

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
COD	ND		10.0	1	08/22/2016 10:42	<a href="#">WG900563</a>

5 Sr

6 Qc

## Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Bromide	ND		1.00	1	08/20/2016 09:39	<a href="#">WG900710</a>
Chloride	218		5.00	5	08/20/2016 10:52	<a href="#">WG900710</a>
Nitrate	1.58		0.100	1	08/20/2016 09:39	<a href="#">WG900710</a>
Sulfate	95.7		5.00	1	08/20/2016 09:39	<a href="#">WG900710</a>

7 Gl

8 Al

9 Sc

## Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Calcium	51.5		1.00	1	08/24/2016 20:42	<a href="#">WG901121</a>
Iron	0.394		0.100	1	08/24/2016 20:42	<a href="#">WG901121</a>
Magnesium	24.0		1.00	1	08/24/2016 20:42	<a href="#">WG901121</a>
Manganese	0.996		0.00500	1	08/24/2016 20:42	<a href="#">WG901121</a>
Potassium	32.3		1.00	1	08/24/2016 20:42	<a href="#">WG901121</a>
Sodium	84.2		1.00	1	08/24/2016 20:42	<a href="#">WG901121</a>



Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Bromide	ND		1.00	1	08/20/2016 09:54	<a href="#">WG900710</a>
Chloride	ND		1.00	1	08/20/2016 09:54	<a href="#">WG900710</a>
Nitrate	ND		0.100	1	08/20/2016 09:54	<a href="#">WG900710</a>
Sulfate	ND		5.00	1	08/20/2016 09:54	<a href="#">WG900710</a>

<sup>1</sup> Cp

<sup>2</sup> Tc

<sup>3</sup> Ss

<sup>4</sup> Cn

<sup>5</sup> Sr

<sup>6</sup> Qc

<sup>7</sup> Gl

<sup>8</sup> Al

<sup>9</sup> Sc



Method Blank (MB)

(MB) R3159227-3 08/25/16 10:00

Analyte	MB Result	MB Qualifier	MB MDL	MB RDL
Alkalinity	4.40	J	2.71	20.0

<sup>1</sup> Cp

<sup>2</sup> Tc

<sup>3</sup> Ss

<sup>4</sup> Cn

<sup>5</sup> Sr

<sup>6</sup> Qc

<sup>7</sup> Gl

<sup>8</sup> Al

<sup>9</sup> Sc

L854500-01 Original Sample (OS) • Duplicate (DUP)

(OS) L854500-01 08/25/16 10:35 • (DUP) R3159227-4 08/25/16 10:43

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
Alkalinity	235	215	1	9.00		20

L854810-04 Original Sample (OS) • Duplicate (DUP)

(OS) L854810-04 08/25/16 12:57 • (DUP) R3159227-9 08/25/16 13:05

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
Alkalinity	467	473	1	1.00		20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3159227-5 08/25/16 11:25 • (LCSD) R3159227-8 08/25/16 12:48

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
Alkalinity	100	109	115	109	115	85.0-115			5.00	20

L854500-11 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L854500-11 08/25/16 11:39 • (MS) R3159227-6 08/25/16 11:47 • (MSD) R3159227-7 08/25/16 11:54

Analyte	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
Alkalinity	100	382	381	380	0.000	0.000	1	80.0-120	J6	J6	0.000	20



Method Blank (MB)

(MB) R3158908-1 08/24/16 11:49

Analyte	MB Result	MB Qualifier	MB MDL	MB RDL
Ammonia Nitrogen	U		0.038	0.250

<sup>1</sup> Cp

<sup>2</sup> Tc

<sup>3</sup> Ss

<sup>4</sup> Cn

<sup>5</sup> Sr

<sup>6</sup> Qc

<sup>7</sup> Gl

<sup>8</sup> Al

<sup>9</sup> Sc

L854589-01 Original Sample (OS) • Duplicate (DUP)

(OS) L854589-01 08/24/16 11:55 • (DUP) R3158908-4 08/24/16 11:57

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
Ammonia Nitrogen	ND	0.000	1	0		20

L854808-01 Original Sample (OS) • Duplicate (DUP)

(OS) L854808-01 08/24/16 12:14 • (DUP) R3158908-6 08/24/16 12:16

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
Ammonia Nitrogen	0.452	0.454	1	0		20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3158908-2 08/24/16 11:51 • (LCSD) R3158908-3 08/24/16 11:52

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
Ammonia Nitrogen	7.50	7.58	7.59	101	101	90-110			0	20

L854666-01 Original Sample (OS) • Matrix Spike (MS)

(OS) L854666-01 08/24/16 12:02 • (MS) R3158908-5 08/24/16 12:08

Analyte	Spike Amount	Original Result	MS Result	MS Rec.	Dilution	Rec. Limits	MS Qualifier
Ammonia Nitrogen	10.0	ND	10.9	108	1	90-110	

L854841-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L854841-01 08/24/16 12:32 • (MS) R3158908-7 08/24/16 12:33 • (MSD) R3158908-8 08/24/16 12:35

Analyte	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
Ammonia Nitrogen	10.0	ND	10.6	10.5	106	105	1	90-110			1	20



Method Blank (MB)

(MB) R3158223-1 08/22/16 10:38

Analyte	MB Result	MB Qualifier	MB MDL	MB RDL
COD	U		3.00	10.0

<sup>1</sup> Cp

<sup>2</sup> Tc

<sup>3</sup> Ss

<sup>4</sup> Cn

<sup>5</sup> Sr

<sup>6</sup> Qc

<sup>7</sup> Gl

<sup>8</sup> Al

<sup>9</sup> Sc

L854285-01 Original Sample (OS) • Duplicate (DUP)

(OS) L854285-01 08/22/16 10:39 • (DUP) R3158223-4 08/22/16 10:39

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
COD	2030	1980	10	2.00		20

L854862-01 Original Sample (OS) • Duplicate (DUP)

(OS) L854862-01 08/22/16 10:43 • (DUP) R3158223-7 08/22/16 10:43

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
COD	54.7	54.7	1	0.000		20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3158223-2 08/22/16 10:38 • (LCSD) R3158223-3 08/22/16 10:38

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
COD	242	237	241	98.0	99.0	90.0-110			1.00	20

L854459-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L854459-01 08/22/16 10:39 • (MS) R3158223-5 08/22/16 10:39 • (MSD) R3158223-6 08/22/16 10:40

Analyte	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
COD	400	112	455	454	86.0	85.0	1	80.0-120			0.000	20



Method Blank (MB)

(MB) R3158455-1 08/20/16 07:59

Analyte	MB Result	MB Qualifier	MB MDL	MB RDL
	mg/l		mg/l	mg/l
Bromide	U		0.079	1.00
Chloride	U		0.0519	1.00
Nitrate	U		0.0227	0.100
Sulfate	U		0.0774	5.00

<sup>1</sup> Cp

<sup>2</sup> Tc

<sup>3</sup> Ss

<sup>4</sup> Cn

<sup>5</sup> Sr

L854666-01 Original Sample (OS) • Duplicate (DUP)

(OS) L854666-01 08/20/16 09:11 • (DUP) R3158455-4 08/20/16 09:25

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
	mg/l	mg/l		%		%
Bromide	ND	0.000	1	0		15
Chloride	2.40	2.40	1	0		15
Nitrate	ND	0.000	1	0		15
Sulfate	ND	3.43	1	2	J	15

<sup>6</sup> Qc

<sup>7</sup> Gl

<sup>8</sup> Al

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3158455-2 08/20/16 08:13 • (LCSD) R3158455-3 08/20/16 08:27

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
	mg/l	mg/l	mg/l	%	%	%			%	%
Chloride	40.0	38.6	38.5	96	96	80-120			0	15
Nitrate	8.00	7.90	7.88	99	98	80-120			0	15
Sulfate	40.0	39.3	39.0	98	97	80-120			1	15

<sup>9</sup> Sc

L854666-03 Original Sample (OS) • Matrix Spike (MS)

(OS) L854666-03 08/20/16 09:54 • (MS) R3158455-5 08/20/16 10:08

Analyte	Spike Amount	Original Result	MS Result	MS Rec.	Dilution	Rec. Limits	MS Qualifier
	mg/l	mg/l	mg/l	%		%	
Bromide	50.0	ND	46.9	94	1	80-120	
Chloride	50.0	ND	48.1	96	1	80-120	
Nitrate	5.00	ND	4.60	92	1	80-120	
Sulfate	50.0	ND	51.5	102	1	80-120	



Method Blank (MB)

(MB) R3159020-1 08/24/16 19:59

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Calcium	U		0.046	1.00
Iron	U		0.015	0.100
Magnesium	U		0.1	1.00
Manganese	U		0.00025	0.00500
Potassium	U		0.037	1.00
Sodium	U		0.11	1.00

- 1 Cp
- 2 Tc
- 3 Ss
- 4 Cn
- 5 Sr
- 6 Qc
- 7 Gl
- 8 Al
- 9 Sc

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3159020-2 08/24/16 20:03 • (LCSD) R3159020-3 08/24/16 20:06

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Calcium	5.00	4.91	5.07	98	101	80-120			3	20
Iron	5.00	5.17	5.18	103	104	80-120			0	20
Magnesium	5.00	5.20	5.29	104	106	80-120			2	20
Manganese	0.0500	0.0510	0.0507	102	101	80-120			1	20
Potassium	5.00	4.85	4.94	97	99	80-120			2	20
Sodium	5.00	5.13	5.25	103	105	80-120			2	20

L854671-05 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L854671-05 08/24/16 20:09 • (MS) R3159020-5 08/24/16 20:16 • (MSD) R3159020-6 08/24/16 20:19

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Calcium	5.00	127	130	129	67	54	1	75-125	V	V	1	20
Potassium	5.00	7.46	12.4	12.2	99	95	1	75-125			2	20
Iron	5.00	1.90	6.98	7.12	102	104	1	75-125			2	20
Magnesium	5.00	26.1	31.1	31.0	101	98	1	75-125			0	20
Manganese	0.0500	0.638	0.684	0.691	92	106	1	75-125			1	20
Sodium	5.00	7.17	12.4	12.4	104	104	1	75-125			0	20





Abbreviations and Definitions

SDG	Sample Delivery Group.
MDL	Method Detection Limit.
RDL	Reported Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
U	Not detected at the Reporting Limit (or MDL where applicable).
RPD	Relative Percent Difference.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Rec.	Recovery.

Qualifier	Description
B	The same analyte is found in the associated blank.
J	The identification of the analyte is acceptable; the reported value is an estimate.
J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.
V	The sample concentration is too high to evaluate accurate spike recoveries.

<sup>1</sup> Cp

<sup>2</sup> Tc

<sup>3</sup> Ss

<sup>4</sup> Cn

<sup>5</sup> Sr

<sup>6</sup> Qc

<sup>7</sup> Gl

<sup>8</sup> Al

<sup>9</sup> Sc



ESC Lab Sciences is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our "one location" design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be **YOUR LAB OF CHOICE**.  
 \* Not all certifications held by the laboratory are applicable to the results reported in the attached report.



## State Accreditations

Alabama	40660	Nevada	TN-03-2002-34
Alaska	UST-080	New Hampshire	2975
Arizona	AZ0612	New Jersey–NELAP	TN002
Arkansas	88-0469	New Mexico	TN00003
California	01157CA	New York	11742
Colorado	TN00003	North Carolina	Env375
Connecticut	PH-0197	North Carolina <sup>1</sup>	DW21704
Florida	E87487	North Carolina <sup>2</sup>	41
Georgia	NELAP	North Dakota	R-140
Georgia <sup>1</sup>	923	Ohio–VAP	CL0069
Idaho	TN00003	Oklahoma	9915
Illinois	200008	Oregon	TN200002
Indiana	C-TN-01	Pennsylvania	68-02979
Iowa	364	Rhode Island	221
Kansas	E-10277	South Carolina	84004
Kentucky <sup>1</sup>	90010	South Dakota	n/a
Kentucky <sup>2</sup>	16	Tennessee <sup>14</sup>	2006
Louisiana	AI30792	Texas	T 104704245-07-TX
Maine	TN0002	Texas <sup>5</sup>	LAB0152
Maryland	324	Utah	6157585858
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	109
Minnesota	047-999-395	Washington	C1915
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA
Nebraska	NE-OS-15-05		

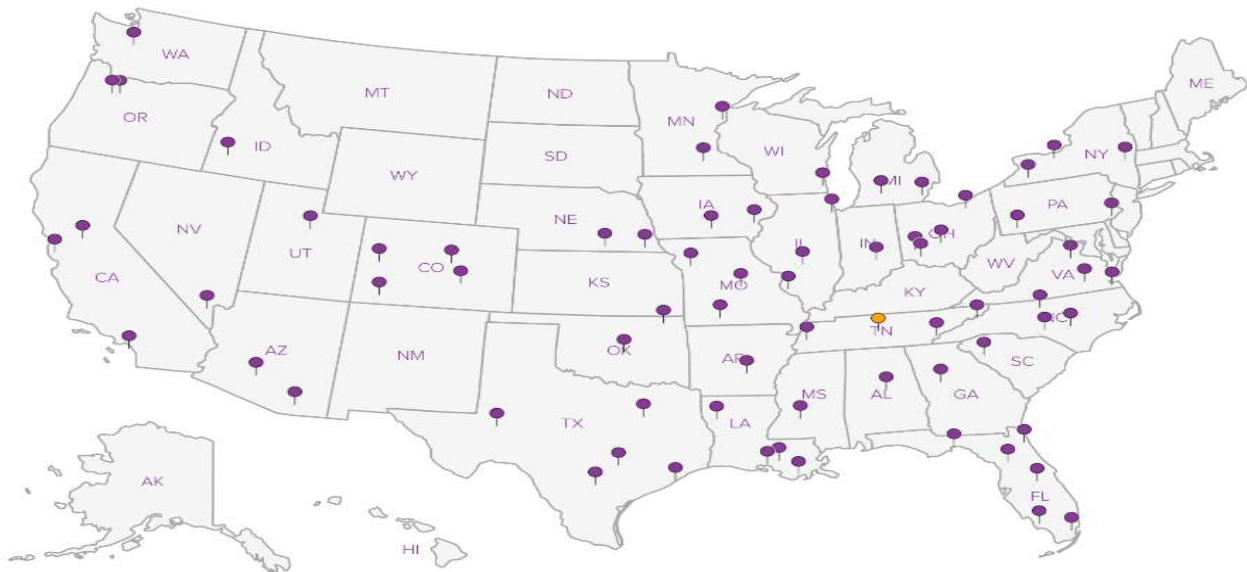
## Third Party & Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA	100789
A2LA – ISO 17025 <sup>5</sup>	1461.02	DOD	1461.01
Canada	1461.01	USDA	S-67674
EPA–Crypto	TN00003		

<sup>1</sup> Drinking Water <sup>2</sup> Underground Storage Tanks <sup>3</sup> Aquatic Toxicity <sup>4</sup> Chemical/Microbiological <sup>5</sup> Mold <sup>n/a</sup> Accreditation not applicable

## Our Locations

ESC Lab Sciences has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. **ESC Lab Sciences performs all testing at our central laboratory.**







L·A·B S·C·I·E·N·C·E·S

YOUR LAB OF CHOICE

# Cooler Receipt Checklist

Client: CEC SDG# 185466

Cooler Received/Opened On: 8-19-16 By Greg Dearmer

Temperature Upon Receipt: 33 °c  
Greg Dearmer  
(Signature)

Cooler Receipt Check List	Yes	No	N/A
Were custody seals on outside of cooler and intact?			/
Were custody papers properly filled out (ink, signed, etc.)?	/		
Did all bottles arrive in good condition?	/		
Were correct bottles used for the analyses requested?	/		
Was sufficient amount of sample sent in each bottle?	/		
Were correct preservatives used?	/		
Were all applicable sample containers checked for preservation? (Any samples not in accepted pH range noted on COC .)	/		
If applicable, was an observable VOA headspace present?			/
Non Conformance Generated? (If yes see attached NCF)		/	



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N·A·T·I·O·N·W·I·D·E



# GROUNDWATER MONITORING FIELD INFORMATION LOG

Civil & Environmental Consultants, Inc. 325 Seaboard Lane, Ste. 170 Franklin, Tennessee 37067 - 800-763-2326 - www.cecinc.com

## SITE AND MONITORING WELL DATA

FACILITY NAME	EWS	MONITORING WELL I.D.	MW-1
LOCATION	Camden, TN	TEMPERATURE & WEATHER	74 overcast
DATE & TIME	8/10/16 145	EVENT FREQUENCY	Semi-Annual
PURGE METHOD	Peristaltic Pump ✓	FIELD REPRESENTATIVE	Philip Campbell A. Baugh
TOTAL WELL DEPTH (feet)	30.5 MD-32.7	SAMPLING EQUIPMENT	Bailer ✓
DEPTH TO WATER (feet)	22.13	IS SAMPLE EQUIPMENT DEDICATED?	No
CASING DIAMETER (Inches)	2	DUPLICATE COLLECTED?	NO
WATER COLUMN (feet)		FIELD BLANK COLLECTED?	NO
PURGE VOLUME (gallons)		EQUIPMENT BLANK COLLECTED?	NO

## PURGE INFORMATION

Gallons Purged	Time (00:00)	Minutes Purged	°C	pH	Conductivity (µs/cm)	DO (mg/L)	ORP	NTU
0	1000	0	17.4	4.52	61.8	1.68	64.5	191
.75	1010	10	17.6	4.80	80.3	1.45	113.9	46.3
1.25	1015	15	17.1	5.10	82.4	2.48	93.0	27.6
2.25	1027	27	16.8	5.40	85.6	1.02	65.9	35.6
3.0	1032	32	16.9	5.29	93.2	1.08	52.5	26.4
3.75	1036	36	16.8	5.33	97.3	0.87	36.1	22.4
5.0	1040	40	16.9	5.62	119.2	0.68	30.9	8.81

## SAMPLE DATA

Gallons Purged	Time Collected (00:00)	Minutes Purged	°C	pH	Conductivity (µs/cm)	DO (mg/L)	ORP	NTU
5.0	1045	40	16.9	5.62	119.2	0.68	30.9	8.81
Sample Characteristics (Odor, Color)		Clear; slight odor		Preservatives Used		See COC		
Number of Containers		See COC		Sampler Signature		A. Baugh		

## WELL DATA

Number of Baffles	4	Well Cap Dedicated/In Place?	N/A
Well Clear of Weeds/Accessible?	yes	Fittings/Well Head Condition	N/A
Pad/Casing Quality	good	Lock Condition	good



# GROUNDWATER MONITORING FIELD INFORMATION LOG

Civil & Environmental Consultants, Inc. 325 Seaboard Lane, Ste. 170 Franklin, Tennessee 37067 - 800-763-2326 - www.cecinc.com

## SITE AND MONITORING WELL DATA

FACILITY NAME	EWS	MONITORING WELL I.D.	MW-3
LOCATION	Camden, TN	TEMPERATURE & WEATHER	75 Overcast
DATE & TIME	8/18/16 1115	EVENT FREQUENCY	Semi-Annual
PURGE METHOD	Peristaltic Pump ✓	FIELD REPRESENTATIVE	Philip Campbell A. Barylch
TOTAL WELL DEPTH (feet)	27 27.6	SAMPLING EQUIPMENT	Bailer ✓
DEPTH TO WATER (feet)	16.30	IS SAMPLE EQUIPMENT DEDICATED?	No
CASING DIAMETER (inches)	2	DUPLICATE COLLECTED?	No
WATER COLUMN (feet)		FIELD BLANK COLLECTED?	Yes
PURGE VOLUME (gallons)		EQUIPMENT BLANK COLLECTED?	No

## PURGE INFORMATION

Gallons Purged	Time (00:00)	Minutes Purged	°C	pH	Conductivity (µs/cm)	DO (mg/L)	ORP	NTU
0	1116	0	17.9	5.74	889	0.46	152.1	10.8
1.6	1126	10	17.6	5.51	711	1.24	178.1	39.6
3.2	1133	17	18.6	5.58	838	2.10	181.5	19.4
4.0	1140	24	18.8	5.62	867	2.53	180.4	27.0
5.0	1142	26	19.2	5.69	927	3.09	182.2	25.3
6.0	1148	32	18.4	5.77	917	3.12	155.1	12.7

## SAMPLE DATA

Gallons Purged	Time Collected (00:00)	Minutes Purged	°C	pH	Conductivity (µs/cm)	DO (mg/L)	ORP	NTU
6.0	1145	32	18.4	5.77	917	3.12	155.1	12.7
Sample Characteristics (Odor, Color)		Clear, odorless	Preservatives Used		See COC			
Number of Containers		See COC	Sampler Signature		A. Barylch			

## WELL DATA

Number of Baffles	4	Well Cap Dedicated/in Place?	No
Well Clear of Weeds/Accessible?	Yes	Fittings/Well Head Condition	N/A
Pad/Casing Quality	good	Lock Condition	good



# EQUIPMENT CALIBRATION LOG

## EQUIPMENT CALIBRATION FORM

NAME OF REPRESENTATIVE	A. Baugh
LOCATION	ELWS Camden, TN
DATE AND TIME	8/18/16
Equipment and Model # (ex. YSI Pro Plus 556)	YSI Pro Plus Quatro
Equipment Serial #	1

pH Calibration							
pH buffer Calibration Standard	Buffer solution exp. date	Pre-Cal Reading (S.U.)	ph mV Value	Accepted Range mV	Within Range? (Yes or No)	Post-Cal Reading (S.U.)	Calibrated? (yes/no)
4		4.03	190.4	160 to 180		4	Y
7		7.13	-22.5	+/-50		7.01	Y
10		6.01	-191.8	-160 to -180		10.0	Y

Temperature Calibration Check	
Cert. Thermometer Value (deg C)	Meter Value (deg C)
—	—

DO Calibration				
Actual Barometric Pressure	Barometric Pressure (mm Hg)	D.O. Value (% Saturated)	Unit reading (%)	% DO accepted?
—	—	—	—	—

Specific Conductivity Calibration				ORP Calibration			
Sp. Conductivity Calibration Standard buffer solution	Buffer solution exp. date	Pre Cal Reading (umhos)	Post Cal Reading (umhos)	ORP Calibration (mV)	Buffer solution exp. date	Pre Cal Reading (mV)	Post Cal Reading (mV)
1000 us/cm	11/16	170	1000				

Hach Model 2100P Turbidimeter Calibration						
Calibration verification Test performed and passed?	NTU Standard	Within Range? (Yes/No)	Measured Value	Stored?	Final Verification test passed? (Yes/No)	
Yes	20					
No	100					
Note: if verification passed, calibration not required	800					





8/18/16

EWS - Camden, TN  
3Q16 LW

48

915 - onsite; grab well keys from  
Scale house

- Grab 3 Gallons of Smelter liquid  
to return to CEC Lab. placed on ice

930 - Set up on MW-1

Trouble w/ WH meter will use alternate  
method.

- Purged w/ peristaltic; Sampled w/ bailer

<u>Well</u>	<u>Sample time</u>	<u>TD</u>	<u>DTW</u>
MW-1	1045	32.7	22.13
MW-3	1145	27.6	16.36
FB	1200	—	

1100 - Set up on MW-3

- purged using peristaltic; Sampled w/ bailer

1215 - Head offsite.

<u>Well</u>	<u>DTW</u>
MW-2	6.51
MW-4	11.28
MW-5	9.30
TMW1	5.52
TMW2	9.75
TMW3	8.61