Annual Groundwater Monitoring Report

Former JR Whiting Power Plant
Ponds 1 and 2 CCR Unit
Erie, Michigan

January 2018

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Prepared For
Consumers Energy Company

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Executive Summary

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) (the CCR Rule). The CCR Rule, which became effective on October 19, 2015, applies to the Consumers Energy Company (CEC) Pond 1 and Pond 2 (Ponds 1&2 CCR unit) at the former JR Whiting (JRW) Power Plant Site (the Site). Pursuant to the CCR Rule, no later than January 31, 2018, and annually thereafter, the owner or operator of a CCR unit must prepare an annual groundwater monitoring and corrective action report for the CCR unit documenting the status of groundwater monitoring and corrective action for the preceding year in accordance with §257.90(e).

TRC Environmental Corporation (TRC) prepared this Annual Groundwater Monitoring Report for the JRW Ponds 1&2 CCR unit on behalf of CEC. This Annual Report was prepared in accordance with the requirements of §257.90(e) and presents the monitoring results and the statistical evaluation of the detection monitoring parameters (Appendix III to Part 257 of the CCR Rule) for the November 2017 semiannual groundwater monitoring event for the JRW Ponds 1&2 CCR unit. This event is the initial detection monitoring event performed to comply with §257.94. As part of the statistical evaluation, the data collected during detection monitoring events are evaluated to identify statistically significant increases (SSIs) in detection monitoring parameters to determine if concentrations in detection monitoring well samples exceed background levels.

Potential SSIs over background limits were noted for pH in one or more downgradient wells for the November 2017 monitoring event. This is the initial detection monitoring event; therefore, it is the initial identification of a potential SSI over background levels. Verification resampling was performed in January 2018 in order to confirm or refute the potential. Based on the results of the verification resampling, the initial exceedance is not statistically significant; therefore, no SSIs are recorded for the initial detection monitoring event.

Since no confirmed SSIs over background limits were identified for any of the Appendix III parameters during the November 2017 monitoring event, CEC will continue with the detection monitoring program at the JRW Ponds 1&2 CCR unit in conformance with §257.90 - §257.94. The next semiannual monitoring event at the JRW Ponds 1&2 CCR unit CCR unit is scheduled for the second calendar quarter of 2018.

Section 1
Introduction

1.1 Program Summary

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) (the CCR Rule). The CCR Rule, which became effective on October 19, 2015, applies to the Consumers Energy Company (CEC) Pond 1 and Pond 2 (Ponds 1&2 CCR unit) at the former JR Whiting (JRW) Power Plant Site (the Site). The JRW Ponds 1&2 are monitored using a multiunit groundwater monitoring system (in accordance with 40 CFR §257.91). Pursuant to the CCR Rule, no later than January 31, 2018, and annually thereafter, the owner or operator of a CCR unit must prepare an annual groundwater monitoring and corrective action report for the CCR unit documenting the status of groundwater monitoring and corrective action for the preceding year in accordance with §257.90(e).

TRC Environmental Corporation (TRC) prepared this Annual Groundwater Monitoring Report (Annual Report) for the JRW Ponds 1&2 CCR unit on behalf of CEC. This Annual Report was prepared in accordance with the requirements of §257.90(e) and presents the monitoring results and the statistical evaluation of the detection monitoring parameters (Appendix III to Part 257 of the CCR Rule) for the November 2017 semiannual groundwater monitoring event for the JRW Ponds 1&2 CCR unit. This event is the initial detection monitoring event performed to comply with §257.94. The monitoring was performed in accordance with the *JR Whiting Monitoring Program Sample Analysis Plan* (SAP) (ARCADIS, 2016) and the updated *JR Whiting Monitoring Program Sample and Analysis Plan* (TRC, May 2017), and statistically evaluated per the *Groundwater Statistical Evaluation Plan* (Stats Plan) (TRC, October 2017). As part of the statistical evaluation, the data collected during detection monitoring events are evaluated to identify statistically significant increases (SSIs) of detection monitoring parameters compared to background levels.

1.2 Site Overview

The JR Whiting Plant is a former coal-fired power generation facility located in Erie, Michigan, on the western shore of Lake Erie (Figure 1). The plant began producing electricity in 1952 from Units 1 and 2, with Unit 3 beginning operation in 1953. The plant ceased operation in April 2016. Figure 1 is a site location map showing the facility and the surrounding area. Site features are shown on Figure 2.

The JR Whiting Ash Disposal Area is in three general locations of the site and is regulated/licensed under Michigan Part 115 of the Natural Resources and Environmental Protection Act (NREPA), PA 451 of 1994, as amended. This report focuses on the JRW Ponds 1&2 CCR unit.

Ponds 1&2 are located to the east of the plant and north of the discharge canal, were constructed in native clay soil and were used historically for wet ash sluicing. The ash disposal areas are contained by a series of perimeter dikes used as access roads upon which light utility trucks, large snowplows, and large haul trucks can be driven. The ponds are currently inactive, but up until April 2016, were maintained for occasional wet ash sluicing, serving as the backup system for dry ash handling and sump water discharge. Fly ash generated through the coal burning process was transported via sluiceways using water from the Inlet Channel and Fore Bay and disposed in the on-site ash ponds. On occasions when the ponds were used, the ash was sluiced to Pond 2 and flowed into Pond 1 through a connecting pipe within the berm separating the ponds. Surface water in Pond 1 discharged via a National Pollutant Discharge Elimination System (NPDES) permit to the plant's discharge channel. Before reaching the NPDES outfall, the sluiced CCR settled within the ash ponds, forming deposits that were excavated and maintained as required.

1.3 Geology/Hydrogeology

The JRW Ponds 1&2 CCR unit is located adjacent to Lake Erie. The subsurface materials encountered at the JR Whiting site are predominately clay-rich till. The surficial CCR fill material is underlain by approximately 40 to 50 feet of laterally extensive clay-rich till that acts as a natural hydraulic barrier across the site. Limestone bedrock is present beneath the till and is considered the uppermost aquifer at the site. Groundwater present within the uppermost aquifer is confined and protected from CCR constituents by the overlying clay-rich aquitard and is typically encountered around 50 feet below ground surface (ft bgs) in the limestone (beneath the till). Potentiometric surface elevation data from groundwater within the CCR monitoring wells exhibit an extremely low hydraulic gradient across the site with no apparent flow direction. There are minor differences in hydraulic head across the monitoring wells (ranging from zero up to 0.13 feet across the JRW Ponds 1&2 CCR unit from event to event from November 2016 through July 2017), indicating that the potentiometric surface is flat the majority of the time. In the few instances since November 2016 where a slight gradient was observed and calculable, the direction of the flow potential was slightly to the northwest (2 events) and to the east (one event).

Given that the hydraulic gradient is often so low, groundwater flow across the JRW Ponds 1&2 CCR unit is frequently incalculable and often stagnant. The most pronounced groundwater gradient between November 2016 and July 2017 was observed in December 19, 2016, which showed a slight horizontal gradient of approximately 0.00016 to the northwest across the JRW Pond 1&2 CCR unit.

Based on the hydrogeology at the Site, particularly the extremely low to non-existent gradient or lack of flow direction at the JR Whiting site in addition to the presence of 40 to 50 feet of laterally extensive clay-rich till that acts as a natural hydraulic barrier across the site, an intrawell statistical approach is recommended for detection monitoring as outlined in the Stats Plan.

Section 2
Groundwater Monitoring

2.1 Monitoring Well Network

A groundwater monitoring system has been established for the JRW Ponds 1&2 CCR unit, which established the monitoring well locations for detection monitoring. The detection monitoring well network for the JRW Ponds 1&2 CCR unit currently consists of six monitoring wells that are screened in the uppermost aquifer. The monitoring well locations are shown on Figure 2.

As discussed in the Stats Plan, intrawell statistical methods for JR Whiting were selected based on the geology and hydrogeology at the Site (primarily the presence of clay/hydraulic barrier, no apparent flow direction and lack of flow potential across the aquifer), in addition to other supporting lines of evidence that the aquifer is unaffected by the CCR unit (such as the consistency in concentrations of water quality data and similarities in concentrations in background and downgradient wells). An intrawell statistical approach requires that each of the downgradient wells doubles as the background and compliance well, where data from each individual well during a detection monitoring event is compared to a statistical limit developed using the background dataset from that same well. Monitoring wells JRW-MW-15001 through JRW-MW-15006 are located around the perimeter of the JRW Ponds 1&2 and provide data on both background and downgradient groundwater quality that has not been affected by the CCR unit (total of six background/downgradient monitoring wells).

As shown on Figure 2, monitoring wells JRW-MW-15007 through JRW-MW-15009 are used for water level measurements only. These wells were initially installed as potential background monitoring wells during the initial stages of characterizing the site. However, based on further hydrogeological characterization of the uppermost aquifer, an intrawell statistical approach was selected which does not rely on JRW-MW-15007 through JRW-MW-15009 for statistical evaluation.

2.2 Background Sampling

Background groundwater monitoring was conducted at the JRW Ponds 1&2 CCR unit from December 2016 through October 2017 in accordance with the SAP. Data collection included nine rounds (Rounds 1 through 9) of static water elevation measurements, analysis for parameters required in the CCR Rule's Appendix III and Appendix IV to Part 257, and field parameters (dissolved oxygen, oxidation reduction potential, pH, specific conductivity, temperature, and turbidity) from all six monitoring wells installed for the JRW Ponds 1&2 CCR unit, in addition to

JRW-MW-15007 through JRW-MW-15009. The Rounds 1 through 5 groundwater samples were analyzed by CEC's Laboratory Services in Jackson, Michigan. The Rounds 6 through 9 groundwater samples were analyzed by Pace Analytical Services, LLC (Pace). Background data are included in Appendix A Tables 1 through 3, where: Table 1 is a summary of static water elevation data (site-wide water level data from CCR program monitoring wells); Table 2 is a summary of groundwater analytical data compared to potentially relevant criteria; and Table 3 is a summary of field data.

In addition to the data tables, groundwater potentiometric elevation data are summarized for each background monitoring event in Appendix A Figure 1.

2.3 Semiannual Groundwater Monitoring

The semiannual monitoring parameters for the detection groundwater monitoring program were selected per the CCR Rule's Appendix III to Part 257 – Constituents for Detection Monitoring. The Appendix III indicator parameters consist of boron, calcium, chloride, fluoride, pH (field reading), sulfate, and total dissolved solids (TDS) and were analyzed in accordance with the SAP. In addition to pH, the collected field parameters included dissolved oxygen, oxidation reduction potential, specific conductivity, temperature, and turbidity.

2.3.1 Data Summary

The initial semiannual groundwater detection monitoring event for 2017 was performed on November 13, 2017, by TRC personnel and samples were analyzed by Pace in accordance with the October 2016 SAP. Static water elevation data were collected at all nine monitoring well locations. Groundwater samples were collected from the six detection monitoring wells for the Appendix III indicator parameters and field parameters. A summary of the groundwater data collected during the November 2017 event is provided on Table 1 (static groundwater elevation data), Table 2 (analytical results), and Table 3 (field data).

2.3.2 Data Quality Review

Data from each round were evaluated for completeness, overall quality and usability, method-specified sample holding times, precision and accuracy, and potential sample contamination. The data were found to be complete and usable for the purposes of the CCR monitoring program. Particular data non-conformances are summarized in Appendix B.

2.3.3 Groundwater Flow Rate and Direction

Groundwater elevation data collected during the most recent background sampling events showed that the hydraulic gradient for groundwater within the uppermost aquifer is often so low, groundwater flow across the Ponds 1&2 CCR unit is frequently incalculable and often stagnant. The most pronounced groundwater gradients observed on November 13, 2017, using well pairs JRW-MW-15003/JRW-MW-15001 and JRW-MW-15005/JRW-MW-15006, showed a very slight horizontal gradient of approximately 0.000043 ft/ft with no discernable overall flow direction across the Ponds 1&2 CCR unit. Using the highest hydraulic conductivity measured at the Ponds 1&2 monitoring wells of 20 feet/day (ARCADIS, 2016), and an assumed effective porosity of 0.1, this results in a groundwater flow rate of approximately 0.009 feet/day (approximately 3 feet/year). Groundwater elevations measured across the Site during the November 2017 sampling event are provided on Table 1 and are summarized in plan view on Figure 3.

The extremely low gradient and lack of general flow direction is similar to that identified in previous monitoring rounds since the background sampling events commenced in December 2016 and continues to demonstrate that the downgradient compliance wells are appropriately positioned to detect the presence of Appendix III parameters that could potentially migrate from the JRW Ponds 1&2 CCR unit.

Section 3
Statistical Evaluation

3.1 Establishing Background Limits

Per the Stats Plan, background limits were established for the Appendix III indicator parameters following the ninth round of background monitoring using data collected from each of the six established detection monitoring wells (JRW-MW-15001 through JRW-MW-15006). The statistical evaluation of the background data is presented in detail in Appendix C. The Appendix III background limits for each monitoring well will be used throughout the detection monitoring period to determine whether groundwater has been impacted from the JRW Ponds 1&2 CCR unit by comparing concentrations in the detection monitoring wells to their respective background limits for each Appendix III indicator parameter.

3.2 Data Comparison to Background Limits

The concentrations of the indicator parameters in each of the detection monitoring wells (JRW-MW-15001 through JRW-MW-15006) were compared to their respective statistical background limits calculated from the background data collected from each individual well (i.e., monitoring data from JRW-MW-15001 is compared to the background limit developed using the background dataset from JRW-MW-15001, and so forth). The comparisons are presented on Table 4.

The statistical evaluation of the November 2017 Appendix III indicator parameters shows potential SSIs over background for:

- pH at JRW-MW-15001, JRW-MW-15002, and JRW-MW-15004.

The initial observation of an indicator parameter concentration above the established background limits does not necessarily constitute a SSI. Per the Stats Plan, if there is an exceedance of a prediction limit for one or more of the parameters, the well(s) of concern can be resampled within 30 days of the completion of the initial statistical analysis for verification purposes. There were no SSIs compared to background for boron, calcium, chloride, fluoride, sulfate or TDS.

3.3 Verification Resampling

Verification resampling is recommended per the Stats Plan and the *USEPA's Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (Unified Guidance, USEPA, 2009) to achieve performance standards as specified by §257.93(g) in the CCR rules. Per the Stats Plan, if there is an exceedance of a prediction limit for one or more of the parameters, the well(s) of concern will be resampled within 30 days of the completion of the initial statistical

analysis. Only constituents that initially exceed their statistical limit (i.e., have no previously recorded SSIs) will be analyzed for verification purposes. As such, verification resampling was conducted on January 18, 2018, by TRC personnel. Groundwater samples were collected for pH (field reading) at monitoring wells JRW-MW-15001, JRW-MW-15002, and JRW-MW-15004 in accordance with the SAP. A summary of the groundwater data collected during the verification resampling event is provided on Table 5. The associated data quality review is included in Appendix B.

All of the pH verification results are within the prediction limits, consequently the initial SSIs from the November 2017 event are not confirmed. Therefore, in accordance with the Stats Plan and the Unified Guidance, the initial exceedance is not statistically significant and no SSIs will be recorded for the November 2017 monitoring event.

Section 4
Conclusions and Recommendations

Potential SSIs over background limits were noted for pH in one or more downgradient wells for the November 2017 monitoring event. This is the initial detection monitoring event; therefore, it is the initial identification of a potential SSI over background levels. Verification resampling was performed in January 2018 in order to confirm or refute the potential SSIs. Based on the results of the verification resampling, the initial exceedance is not statistically significant; therefore, no SSIs are recorded for the initial detection monitoring event. Additionally, as discussed in the statistical evaluation (Appendix C), it is recognized that due to lack of groundwater flow potential there is limited temporal independence in the background dataset, and, due to limitations on CCR Rule implementation timelines, the data sets are of relatively short duration for capturing natural temporal changes in the aquifer that may occur on a seasonal basis.

Since no confirmed SSIs over background limits were identified for any of the Appendix III parameters during the November 2017 monitoring event, CEC will continue with the detection monitoring program at the JRW Ponds 1&2 CCR unit in conformance with §257.90 - §257.94. The next semiannual monitoring event for the Ponds 1&2 CCR unit is scheduled for the second calendar quarter of 2018.

Section 5
References

ARCADIS. May 13, 2016. Summary of Monitoring Well Design, Installation, and Development. JR Whiting Electric Generation Facility – Erie, Michigan. Prepared for Consumers Energy Company.

ARCADIS. May 18, 2016. Electric Generation Facilities RCRA CCR Detection Monitoring Program. JR Whiting Monitoring Program Sample and Analysis Plan, Erie, Michigan. Prepared for Consumers Energy Company.

TRC Environmental Corporation. October 2016. Electric Generation Facilities RCRA CCR Detection Monitoring Program for the Ponds 1&2 and Pond 6 Areas. Sample and Analysis Plan. JR Whiting Monitoring Program – Erie, Michigan. Prepared for Consumers Energy Company.

TRC Environmental Corporation. December 2016. 2016 Monitoring Well Design, Installation, Development, and Decommissioning. JR Whiting Electric Generation Facility – Erie, Michigan. Prepared for Consumers Energy Company.

TRC Environmental Corporation. October 2017. Groundwater Statistical Evaluation Plan – Former JR Whiting Power Plant, Ponds 1 and 2, Erie, Michigan. Prepared for Consumers Energy Company.

USEPA. 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA facilities, Unified Guidance. Office of Conservation and Recovery. EPA 530/R-09-007.

Tables

Table 1
Summary of Groundwater Elevation Data – November 2017
JR Whiting Ponds 1 & 2 – RCRA CCR Monitoring Program
Erie, Michigan

Well Location	Ground Surface Elevation (ft)	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Depth (ft BGS)			Screen Interval Elevation (ft)			November 13, 2017	
										Depth to Water (ft BTOC)	Groundwater Elevation (ft)
Static Water Level Monitoring Wells											
JRW-MW-16007	579.47	582.32	Limestone	68.0	to	78.0	511.5	to	501.5	8.10	574.22
JRW-MW-16008	579.95	582.84	Limestone	68.0	to	73.0	512.0	to	507.0	8.61	574.23
JRW-MW-16009	579.90	582.59	Limestone	69.0	to	79.0	510.9	to	500.9	8.35	574.24
Ponds 1 & 2											
JRW-MW-15001	589.6	590.71	Limestone	78.0	to	88.0	511.6	to	501.6	16.38	574.33
JRW-MW-15002	590.6	592.31	Limestone	81.0	to	91.0	509.6	to	499.6	17.96	574.35
JRW-MW-15003	589.6	591.36	Limestone	81.0	to	91.0	508.6	to	498.6	17.01	574.35
JRW-MW-15004	590.8	592.52	Limestone	86.0	to	96.0	504.8	to	494.8	18.20	574.32
JRW-MW-15005	592.7	594.25	Limestone	86.0	to	96.0	506.7	to	496.7	19.91	574.34
JRW-MW-15006	590.3	592.01	Limestone	81.0	to	91.0	509.3	to	499.3	17.70	574.31

Notes:

Survey conducted by Sheridan Surveying Co., November 2015 (2015 wells), and November 2016 (2016 wells)

Elevation in feet relative to North American Vertical Datum 1988 (NAVD 88).

TOC: Top of well casing.

ft BTOC: Feet below top of well casing.

ft BGS: Feet below ground surface.

Table 2
Summary of Groundwater Sampling Results (Analytical) – November 2017
JR Whiting Ponds 1 & 2 – RCRA CCR Monitoring Program
Erie, Michigan

					Sample Location:	**JRW-MW-15001**	**JRW-MW-15002**	**JRW-MW-15003**	**JRW-MW-15004**	**JRW-MW-15005**	**JRW-MW-15006**
					Sample Date:	11/13/2017	11/13/2017	11/13/2017	11/13/2017	11/13/2017	11/13/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient					
Appendix III											
Boron	ug/L	NC	500	500	7,200	179	187	176	207	173	166
Calcium	mg/L	NC	NC	NC	500	128	137	114	103	90.5	102
Chloride	mg/L	250**	250	250	**50**	**51.9**	**50.6**	49.0	**52.5**	40.5	49.2
Fluoride	ug/L	4,000	NC	NC	NC	1,400	1,500	1,500	1,400	1,300	1,400
pH, Field	SU	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0	6.8	7.0	7.4	7.2	7.9	7.7
Sulfate	mg/L	**250****	**250**	**250**	500	**439**	**464**	**390**	**356**	**325**	**373**
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**934**	**832**	**758**	**686**	**644**	**700**

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.

NC - no criteria.

* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.

** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium and sulfate is the total dissolved solids criterion. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters, based on footnote {FF}.

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 3
Summary of Field Parameter Results – November 2017
JR Whiting Ponds 1 & 2 – RCRA CCR Monitoring Program
Erie, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
JRW-MW-15001	11/13/2017	0.34	32.4	6.8	1,131	12.08	3.94
JRW-MW-15002	11/13/2017	0.32	22.1	7.0	1,175	11.71	1.74
JRW-MW-15003	11/13/2017	1.70	-8.9	7.4	1,048	11.79	12.8
JRW-MW-15004	11/13/2017	0.28	-39.1	7.2	990	12.36	1.23
JRW-MW-15005	11/13/2017	2.76	-40.5	7.9	894	13.03	2.33
JRW-MW-15006	11/13/2017	0.49	-49.8	7.7	1,000	11.72	<1

Notes:

mg/L - Milligrams per Liter.

mV - Millivolts.

SU - Standard units.

umhos/cm - Micromhos per centimeter.

°C - Degrees Celcius.

NTU - Nephelometric Turbidity Unit.

Table 4
Comparison of Appendix III Parameter Results to Background Limits – November 2017
JR Whiting Ponds 1 & 2 – RCRA CCR Monitoring Program
Erie, Michigan

Sample Location:		JRW-MW-15001		JRW-MW-15002		JRW-MW-15003		JRW-MW-15004		JRW-MW-15005		JRW-MW-15006	
Sample Date:		11/13/2017		11/13/2017		11/13/2017		11/13/2017		11/13/2017		11/13/2017	
Constituent	Unit	Data	PL	Data	PL	Data	PL	Data	PL	Data	PL	Data	PL
Appendix III													
Boron	ug/L	179	251	187	229	176	219	207	271	173	256	166	240
Calcium	mg/L	128	182	137	185	114	162	103	143	90.5	127	102	144
Chloride	mg/L	51.9	54.4	50.6	54.5	49.0	55.5	52.5	54.7	40.5	44.0	49.2	52.1
Fluoride	ug/L	1,400	1,560	1,500	1,870	1,500	1,810	1,400	1,860	1,300	1,730	1,400	1,710
pH, Field	SU	**6.8**	7.4 - 8.1	**7.0**	7.3 - 7.8	7.4	7.4 - 8.2	**7.2**	7.4 - 7.9	7.9	7.7 - 8.4	7.7	7.1 - 9.0
Sulfate	mg/L	439	469	464	495	390	454	356	389	325	347	373	404
Total Dissolved Solids	mg/L	934	974	832	1,020	758	969	686	900	644	844	700	922

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

All metals were analyzed as total unless otherwise specified.

RESULT Shading and bold font indicates an exceedance of the Prediction Limit (PL) using the number of significant figures in the PL.

Table 5
Comparison of Verification Resampling Results to Background Limits
JR Whiting Ponds 1 & 2 – RCRA CCR Monitoring Program
Erie, Michigan

Sample Location:		JRW-MW-15001		JRW-MW-15002		JRW-MW-15004	
Sample Date:		1/18/2018		1/18/2018		1/18/2018	
Constituent	Unit	Data	PL	Data	PL	Data	PL
Appendix III							
pH, Field	SU	7.5	7.4 - 8.1	7.6	7.3 - 7.8	7.7	7.4 - 7.9

Notes:

SU - standard units; pH is a field parameter.

RESULT Shading and bold font indicates a confirmed exceedance of the Prediction Limit (PL).

Figures

BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

N

1 " = 3,000 '
1:36,000

0 3,000 6,000
FEET

TRC
1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
TRC - GIS

PROJECT:

CONSUMERS ENERGY COMPANY
JR WHITING POWER PLANT
ERIE, MICHIGAN

TITLE:

SITE LOCATION MAP

DRAWN BY:	J. PAPEZ
CHECKED BY:	S. HOLMSTROM
APPROVED BY:	V. BUENING
DATE:	OCTOBER 2017
PROJ. NO.:	269767-004
FILE:	269767-004-000SLM.mxd

FIGURE 1

E:\ConsumersEnergy\CCR_GW\2017_269767\269767-004-000SLM.mxd -- Saved By: JPAPEZ on 10/17/2017, 09:07:39 AM

LEGEND

- MONITORING WELL (STATIC WATER LEVEL ONLY)
- CCR UNIT MONITORING WELL

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 4/12/2017.
2. WELL LOCATIONS SURVEYED BY SHERIDAN SURVEYING CO. ON 11/19/2015.

N

0 500 1,000 Feet

1 " = 500 '

1:6,000

PROJECT:

CONSUMERS ENERGY COMPANY
JR WHITING POWER PLANT
ERIE, MICHIGAN

TITLE:

SITE PLAN
WITH CCR MONITORING WELL LOCATIONS

DRAWN BY:	J. PAPEZ	PROJ NO.:	269767-001
CHECKED BY:	S. HOLMSTROM		
APPROVED BY:	G. CROCKFORD		**FIGURE 2**
DATE:	NOVEMBER 2017		

TRC

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FILE NO.: 269767-004-001A.mxd

Plot Date: 11/30/2017, 14:32:38 PM by SMAJOR -- LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\269767-004-001A.mxd

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

TRC - GIS

TRC - GIS

Plot Date: 1/12/2018, 11:24:04 AM by SMAJOR -- LAYOUT: ANSI B(11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\269767-004-008.mxd

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

Whitewood Creek
Grand Blvd
Naples Dr
Amalfi Dr
22Nd St
75
Grodi Rd
Lake Erie
E Erie Rd

JRW MW-15002
574.35' (11/13/17)

JRW MW-16007
574.22' (11/13/17)

JRW MW-15001
574.33' (11/13/17)

POND 1

JRW MW-15003
574.35' (11/13/17)

JRW MW-16008
574.23' (11/13/17)

FORMER
JRW PLANT

RETIRED
FILL AREA 2

JRW MW-15006
574.31' (11/13/17)

POND 2

JRW MW-15004
574.32' (11/13/17)

DISCHARGE CHANNEL

RETIRED
FILL AREA 1

JRW MW-16009
574.24' (11/13/17)

JRW MW-15005
574.34' (11/13/17)

COAL PILE
AREA

LEGEND

- MONITORING WELL (STATIC WATER LEVEL ONLY)
- CCR UNIT MONITORING WELL

LABEL FORMAT

MONITORING WELL ID
GROUNDWATER ELEVATION FT MSL (MEASUREMENT DATE)
GROUNDWATER ELEVATION FT MSL (MEASUREMENT DATE)
etc...

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 4/12/2017.
2. WELL LOCATIONS SURVEYED BY SHERIDAN SURVEYING CO. ON 11/19/2015 AND 11/30/2016.

N

0 500 1,000 Feet

1 " = 500 '
1:6,000

PROJECT:
CONSUMERS ENERGY COMPANY
JR WHITING POWER PLANT
ERIE, MICHIGAN

TITLE:
GROUNDWATER POTENTIOMETRIC ELEVATION SUMMARY NOVEMBER 13, 2017

DRAWN BY:	S. MAJOR	PROJ NO.:	269767-004
CHECKED BY:	S. HOLMSTROM		
APPROVED BY:	V. BUENING		**FIGURE 3**
DATE:	JANUARY 2018		

TRC
1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trcsolutions.com

FILE NO.: 269767-004-008.mxd

Appendix A
Background Data

Table 1
Summary of Groundwater Elevation Data
JR Whiting – RCRA CCR Monitoring Program
Erie, Michigan

Well Location	Ground Surface Elevation (ft)	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Depth (ft BGS)			Screen Interval Elevation (ft)			Round 1				Round 2		Round 3		Round 4	
										November 21, 2016		December 19, 2016		January 24, 2017		March 8, 2017		April 12, 2017	
										Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)
Background																			
JRW-MW-16007	579.47	582.32	Limestone	68.0	to	78.0	511.5	to	501.5	7.58	574.74	8.28	574.04	7.14	575.18	6.78	575.54	6.18	576.14
JRW-MW-16008	579.95	582.84	Limestone	68.0	to	73.0	512.0	to	507.0	7.93	574.91	8.77	574.07	7.70	575.14	7.34	575.50	6.82	576.02
JRW-MW-16009	579.90	582.59	Limestone	69.0	to	79.0	510.9	to	500.9	7.70	574.89	8.53	574.06	7.43	575.16	7.09	575.50	6.54	576.05
Ponds 1 & 2																			
JRW-MW-15001	589.6	590.71	Limestone	78.0	to	88.0	511.6	to	501.6	--	--	16.55	574.16	15.57	575.14	15.22	575.49	14.68	576.03
JRW-MW-15002	590.6	592.31	Limestone	81.0	to	91.0	509.6	to	499.6	--	--	18.13	574.18	17.11	575.20	16.77	575.54	16.25	576.06
JRW-MW-15003	589.6	591.36	Limestone	81.0	to	91.0	508.6	to	498.6	--	--	17.11	574.25	16.18	575.18	16.24	575.12	15.32	576.04
JRW-MW-15004	590.8	592.52	Limestone	86.0	to	96.0	504.8	to	494.8	--	--	18.24	574.28	17.36	575.16	17.07	575.45	16.51	576.01
JRW-MW-15005	592.7	594.25	Limestone	86.0	to	96.0	506.7	to	496.7	--	--	19.96	574.29	19.12	575.13	18.79	575.46	18.22	576.03
JRW-MW-15006	590.3	592.01	Limestone	81.0	to	91.0	509.3	to	499.3	--	--	17.80	574.21	16.91	575.10	16.56	575.45	15.98	576.03

Notes:

Survey conducted by Sheridan Surveying Co., November 2015 (2015 wells), and November 2016 (2016 wells)

Elevation in feet relative to North American Vertical Datum 1988 (NAVD 88).

TOC: Top of well casing.

ft BTOC: Feet below top of well casing.

ft BGS: Feet below ground surface.

Table 1
Summary of Groundwater Elevation Data
JR Whiting – RCRA CCR Monitoring Program
Erie, Michigan

Well Location	Ground Surface Elevation (ft)	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Depth (ft BGS)			Screen Interval Elevation (ft)			Round 5 May 23, 2017		Round 6 June 27, 2017		Round 7 July 31, 2017		Round 8 September 5, 2017		Round 9 October 9, 2017	
										Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)
Background																			
JRW-MW-16007	579.47	582.32	Limestone	68.0	to	78.0	511.5	to	501.5	6.14	576.18	7.33	574.99	6.87	575.45	7.14	575.18	7.93	574.39
JRW-MW-16008	579.95	582.84	Limestone	68.0	to	73.0	512.0	to	507.0	6.66	576.18	7.84	575.00	7.41	575.43	7.63	575.21	8.41	574.43
JRW-MW-16009	579.90	582.59	Limestone	69.0	to	79.0	510.9	to	500.9	6.40	576.19	7.59	575.00	7.15	575.44	7.35	575.24	8.18	574.41
Ponds 1 & 2																			
JRW-MW-15001	589.6	590.71	Limestone	78.0	to	88.0	511.6	to	501.6	14.45	576.26	15.65	575.06	15.27	575.44	15.38	575.33	16.18	574.53
JRW-MW-15002	590.6	592.31	Limestone	81.0	to	91.0	509.6	to	499.6	16.00	576.31	17.18	575.13	16.83	575.48	17.00	575.31	17.80	574.51
JRW-MW-15003	589.6	591.36	Limestone	81.0	to	91.0	508.6	to	498.6	15.02	576.34	16.14	575.22	15.89	575.47	16.00	575.36	16.80	574.56
JRW-MW-15004	590.8	592.52	Limestone	86.0	to	96.0	504.8	to	494.8	16.20	576.32	17.33	575.19	17.05	575.47	17.10	575.42	18.00	574.52
JRW-MW-15005	592.7	594.25	Limestone	86.0	to	96.0	506.7	to	496.7	17.89	576.36	19.04	575.21	18.79	575.46	18.84	575.41	19.70	574.55
JRW-MW-15006	590.3	592.01	Limestone	81.0	to	91.0	509.3	to	499.3	15.71	576.30	16.77	575.24	16.55	575.46	16.68	575.33	17.50	574.51

Notes:

Survey conducted by Sheridan Surveying Co., November 2015 (2015 wells), and November 2016 (2016 wells)

Elevation in feet relative to North American Vertical Datum 1988 (NAVD 88).

TOC: Top of well casing.

ft BTOC: Feet below top of well casing.

ft BGS: Feet below ground surface.

Table 2
Summary of Analytical Results for Groundwater Samples
JR Whiting – RCRA CCR Monitoring Program
Erie, Michigan

					Sample Location:	JRW-MW-15001								
					Sample Date:	12/21/2016	1/24/2017	3/7/2017	4/12/2017	5/25/2017	6/28/2017	7/31/2017	9/5/2017	10/9/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient								
Appendix III														
Boron	ug/L	NC	500	500	7,200	197	185	208	195	190	237	168	167	171
Calcium	mg/L	NC	NC	NC	500	151	144	145	145	157	103	128	126	119
Chloride	mg/L	250**	250	250	**50**	45.4	45.2	44.8	44.4	44.5	49.1	**50.4**	**50.4**	49.8
Fluoride	ug/L	4,000	NC	NC	NC	1,170	1,230	1,300	1,190	1,120	1,200	1,400	1,400	1,400
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	6.5 - 9.0	7.55	7.4	7.4	7.6	7.6	8.12	7.61	7.54	7.43
Sulfate	mg/L	**250****	**250**	**250**	**500**	**399**	**399**	**396**	**401**	**401**	**375**	**442**	**433**	**435**
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**820**	**810**	**820**	**830**	**820**	**974**	**826**	**850**	**860**
Appendix IV														
Antimony	ug/L	6	6	6	130	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	ug/L	10	10	10	10	<1.0	<1.0	<1.0	<1.0	<1.0	3.2	<1.0	<1.0	<1.0
Barium	ug/L	2,000	2,000	2,000	670	14.0	18.0	17.0	16.0	16.0	17.3	15.8	16.1	15.9
Beryllium	ug/L	4	4	4	6.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	ug/L	5	5	5	3	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Chromium	ug/L	100	100	100	100	<1.0	3.0	2.0	1.0	1.0	<1.0	<1.0	<1.0	<1.0
Cobalt	ug/L	NC	40	100	100	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	1,170	1,230	1,300	1,190	1,120	1,200	1,400	1,400	1,400
Lead	ug/L	NC	4	4	29	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Lithium	ug/L	NC	170	350	440	64	56	62	56	57	61	63	62	59
Mercury	ug/L	2	2	2	0.20#	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Molybdenum	ug/L	NC	73	210	3,200	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Radium-226	pCi/L	5	NC	NC	NC	0.886	1.17	0.922	1.15	<0.415	1.22	0.877	1.43	1.37
Radium-226/228	pCi/L	5	NC	NC	NC	4.37	1.36	1.92	1.65	<0.728	1.69	<1.34	2.61	1.85
Radium-228	pCi/L	5	NC	NC	NC	3.48	<0.695	1.00	<0.651	<0.728	<0.590	<0.714	1.18	<0.948
Selenium	ug/L	50	50	50	5	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0
Thallium	ug/L	2	2	2	3.7	<2.0	<20	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.

NC - no criteria.

* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.

** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium and sulfate is the total dissolved solids criterion. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters, based on footnote {FF}. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

- If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
JR Whiting – RCRA CCR Monitoring Program
Erie, Michigan

					Sample Location:	JRW-MW-15002								
					Sample Date:	12/21/2016	1/24/2017	3/7/2017	4/12/2017	5/25/2017	6/28/2017	7/31/2017	9/5/2017	10/9/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient								
Appendix III														
Boron	ug/L	NC	500	500	7,200	198	192	220	198	195	193	190	183	171
Calcium	mg/L	NC	NC	NC	500	154	154	152	149	165	136	145	133	115
Chloride	mg/L	250**	250	250	**50**	41.2	43.5	41.2	42.6	42.7	47.3	49.4	49.4	48.5
Fluoride	ug/L	4,000	NC	NC	NC	1,300	1,320	1,490	1,240	1,200	1,300	1,600	1,700	1,500
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	6.5 - 9.0	7.58	7.5	7.6	7.6	7.6	7.36	7.64	7.50	7.52
Sulfate	mg/L	**250****	**250**	**250**	**500**	**422**	**444**	**424**	**429**	**427**	**406**	**469**	**459**	**461**
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**870**	**880**	**850**	**870**	**850**	**984**	**916**	**852**	**954**
Appendix IV														
Antimony	ug/L	6	6	6	130	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	ug/L	10	10	10	10	<1.0	2.0	1.0	<1.0	<1.0	<1.0	1.3	1.0	1.4
Barium	ug/L	2,000	2,000	2,000	670	11.0	12.0	12.0	11.0	11.0	10.5	11.1	10.1	9.9
Beryllium	ug/L	4	4	4	6.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	ug/L	5	5	5	3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20	<0.20	<0.20	<0.20
Chromium	ug/L	100	100	100	100	<1.0	<1.0	1.0	2.0	2.0	<1.0	<1.0	<1.0	<1.0
Cobalt	ug/L	NC	40	100	100	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	1,300	1,320	1,490	1,240	1,200	1,300	1,600	1,700	1,500
Lead	ug/L	NC	4	4	29	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Lithium	ug/L	NC	170	350	440	65	60	67	61	64	66	71	64	58
Mercury	ug/L	2	2	2	0.20#	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Molybdenum	ug/L	NC	73	210	3,200	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Radium-226	pCi/L	5	NC	NC	NC	0.941	1.43	1.10	1.51	1.75	1.16	1.82	1.47	2.46
Radium-226/228	pCi/L	5	NC	NC	NC	1.60	1.61	1.57	2.11	2.30	2.03	2.19	1.91	3.05
Radium-228	pCi/L	5	NC	NC	NC	0.659	<0.687	<0.581	0.600	<0.783	0.873	<0.776	<0.772	<0.851
Selenium	ug/L	50	50	50	5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Thallium	ug/L	2	2	2	3.7	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.

NC - no criteria.

* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.

** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium and sulfate is the total dissolved solids criterion. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters, based on footnote {FF}. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

- If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
JR Whiting – RCRA CCR Monitoring Program
Erie, Michigan

					Sample Location:	JRW-MW-15003								
					Sample Date:	12/21/2016	1/24/2017	3/7/2017	4/12/2017	5/25/2017	6/28/2017	7/31/2017	9/5/2017	10/9/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient								
Appendix III														
Boron	ug/L	NC	500	500	7,200	192	198	205	193	198	199	195	186	176
Calcium	mg/L	NC	NC	NC	500	149	133	131	126	139	117	119	113	108
Chloride	mg/L	250**	250	250	**50**	47.8	44.7	43.5	44.2	43.9	49.1	**51.2**	**50.4**	49.7
Fluoride	ug/L	4,000	NC	NC	NC	1,300	1,260	1,350	1,260	1,130	1,300	1,600	1,600	1,500
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	6.5 - 9.0	7.61	7.8	7.9	8.0	8.0	7.99	7.90	7.66	7.72
Sulfate	mg/L	**250****	**250**	**250**	**500**	**384**	**367**	**343**	**369**	**355**	**358**	**418**	**404**	**416**
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**800**	**760**	**750**	**760**	**750**	**924**	**802**	**778**	**870**
Appendix IV														
Antimony	ug/L	6	6	6	130	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	ug/L	10	10	10	10	<1.0	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium	ug/L	2,000	2,000	2,000	670	13.0	20.0	20.0	19.0	19.0	17.1	16.0	14.5	14.8
Beryllium	ug/L	4	4	4	6.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	ug/L	5	5	5	3	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Chromium	ug/L	100	100	100	100	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	3.7	<1.0	<1.0
Cobalt	ug/L	NC	40	100	100	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	1,300	1,260	1,350	1,260	1,130	1,300	1,600	1,600	1,500
Lead	ug/L	NC	4	4	29	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Lithium	ug/L	NC	170	350	440	58	51	51	48	55	53	50	54	54
Mercury	ug/L	2	2	2	0.20#	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Molybdenum	ug/L	NC	73	210	3,200	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Radium-226	pCi/L	5	NC	NC	NC	0.651	0.715	0.579	0.389	0.370	0.584	<0.667	1.69	<0.852
Radium-226/228	pCi/L	5	NC	NC	NC	1.63	0.715	0.879	0.588	1.13	1.56	<1.34	1.73	<2.04
Radium-228	pCi/L	5	NC	NC	NC	0.983	<0.638	<0.516	<0.484	0.759	0.972	<0.673	<0.941	<1.19
Selenium	ug/L	50	50	50	5	<1.0	<1.0	1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0
Thallium	ug/L	2	2	2	3.7	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.

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* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.

** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium and sulfate is the total dissolved solids criterion. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters, based on footnote {FF}. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

- If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
JR Whiting – RCRA CCR Monitoring Program
Erie, Michigan

					Sample Location:	JRW-MW-15004								
					Sample Date:	12/19/2016	1/25/2017	3/7/2017	4/12/2017	5/25/2017	6/28/2017	7/31/2017	9/5/2017	10/9/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient								
Appendix III														
Boron	ug/L	NC	500	500	7,200	247	228	235	217	226	206	203	184	192
Calcium	mg/L	NC	NC	NC	500	119	121	116	118	123	97.7	100	103	89.6
Chloride	mg/L	250**	250	250	**50**	42.8	45.5	44.6	44.6	43.1	48.4	**50.3**	49.8	49.8
Fluoride	ug/L	4,000	NC	NC	NC	1,230	1,330	1,330	1,170	1,040	1,300	1,600	1,600	1,500
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	6.5 - 9.0	7.54	7.6	7.7	7.7	7.7	7.55	7.84	7.66	7.66
Sulfate	mg/L	**250****	**250**	**250**	**500**	**315**	**326**	**320**	**328**	**322**	**319**	**356**	**358**	**368**
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**680**	**680**	**680**	**710**	**660**	**820**	**798**	**808**	**740**
Appendix IV														
Antimony	ug/L	6	6	6	130	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	ug/L	10	10	10	10	1.0	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium	ug/L	2,000	2,000	2,000	670	22.0	19.0	20.0	17.0	19.0	17.2	17.1	16.4	16.2
Beryllium	ug/L	4	4	4	6.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	ug/L	5	5	5	3	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Chromium	ug/L	100	100	100	100	<1.0	3.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0
Cobalt	ug/L	NC	40	100	100	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	1,230	1,330	1,330	1,170	1,040	1,300	1,600	1,600	1,500
Lead	ug/L	NC	4	4	29	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Lithium	ug/L	NC	170	350	440	47	46	46	39	45	45	47	49	45
Mercury	ug/L	2	2	2	0.20#	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Molybdenum	ug/L	NC	73	210	3,200	6.0	6.0	6.0	5.0	5.0	5.9	5.8	5.6	5.9
Radium-226	pCi/L	5	NC	NC	NC	0.719	0.816	0.452	0.809	0.556	0.749	1.91	0.646	1.06
Radium-226/228	pCi/L	5	NC	NC	NC	0.725	1.47	1.02	1.25	0.928	1.80	1.95	<1.42	2.36
Radium-228	pCi/L	5	NC	NC	NC	<0.517	0.650	0.566	0.439	<0.557	1.05	<0.860	<0.815	<1.31
Selenium	ug/L	50	50	50	5	<1.0	<1.0	1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0
Thallium	ug/L	2	2	2	3.7	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.

NC - no criteria.

* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.

** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium and sulfate is the total dissolved solids criterion. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters, based on footnote {FF}. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

- If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
JR Whiting – RCRA CCR Monitoring Program
Erie, Michigan

					Sample Location:	JRW-MW-15005								
					Sample Date:	12/22/2016	1/25/2017	3/7/2017	4/13/2017	5/25/2017	6/28/2017	7/31/2017	9/5/2017	10/9/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient								
Appendix III														
Boron	ug/L	NC	500	500	7,200	213	213	227	200	219	226	184	200	173
Calcium	mg/L	NC	NC	NC	500	111	110	103	99.3	112	90.2	87.1	89.9	88
Chloride	mg/L	250**	250	250	**50**	37.3	36.8	35.7	36.7	35.7	36.7	41.4	40.9	40.5
Fluoride	ug/L	4,000	NC	NC	NC	1,380	1,190	1,290	1,160	1,030	1,200	1,500	1,500	1,400
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	6.5 - 9.0	7.78	8.2	8.1	8.1	8.1	7.92	8.15	7.98	8.04
Sulfate	mg/L	**250****	**250**	**250**	**500**	**286**	**290**	**293**	**291**	**282**	**282**	**321**	**324**	**322**
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**620**	**620**	**610**	**630**	**620**	**844**	**614**	**636**	**710**
Appendix IV														
Antimony	ug/L	6	6	6	130	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	ug/L	10	10	10	10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium	ug/L	2,000	2,000	2,000	670	20.0	29.0	40.0	25.0	26.0	23.2	25.1	22.6	21.3
Beryllium	ug/L	4	4	4	6.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	ug/L	5	5	5	3	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Chromium	ug/L	100	100	100	100	2.0	2.0	<1.0	<1.0	2.0	<1.0	<1.0	<1.0	<1.0
Cobalt	ug/L	NC	40	100	100	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	1,380	1,190	1,290	1,160	1,030	1,200	1,500	1,500	1,400
Lead	ug/L	NC	4	4	29	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Lithium	ug/L	NC	170	350	440	49	47	46	43	47	46	45	49	50
Mercury	ug/L	2	2	2	0.20#	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Molybdenum	ug/L	NC	73	210	3,200	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Radium-226	pCi/L	5	NC	NC	NC	0.313	<0.308	<0.306	0.350	<0.356	0.658	0.271	<1.12	0.668
Radium-226/228	pCi/L	5	NC	NC	NC	<0.396	<0.403	0.920	0.640	0.770	1.46	<0.959	<1.82	1.41
Radium-228	pCi/L	5	NC	NC	NC	<0.396	<0.403	0.625	<0.338	0.537	0.799	<0.775	<0.700	<0.788
Selenium	ug/L	50	50	50	5	<1.0	<1.0	1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0
Thallium	ug/L	2	2	2	3.7	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.

NC - no criteria.

* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.

** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium and sulfate is the total dissolved solids criterion. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters, based on footnote {FF}. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

- If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
JR Whiting – RCRA CCR Monitoring Program
Erie, Michigan

					Sample Location:	JRW-MW-15006								
					Sample Date:	12/22/2016	1/25/2017	3/7/2017	4/13/2017	5/25/2017	6/28/2017	8/1/2017	9/6/2017	10/10/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient								
Appendix III														
Boron	ug/L	NC	500	500	7,200	204	201	213	194	205	216	169	181	177
Calcium	mg/L	NC	NC	NC	500	129	122	114	119	123	101	100	103	97.4
Chloride	mg/L	250**	250	250	**50**	40.5	40.8	39.4	40.2	41.6	45.4	47.0	47.3	46.6
Fluoride	ug/L	4,000	NC	NC	NC	1,200	1,150	1,120	1,060	1,140	1,200	1,500	1,500	1,400
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	6.5 - 9.0	7.85	**8.7**	8.4	8.1	8.2	7.78	8.08	7.77	7.62
Sulfate	mg/L	**250****	**250**	**250**	**500**	**335**	**344**	**336**	**334**	**327**	**336**	**373**	**380**	**372**
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**710**	**700**	**680**	**710**	**680**	**922**	**714**	**714**	**792**
Appendix IV														
Antimony	ug/L	6	6	6	130	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	ug/L	10	10	10	10	<1.0	1.0	1.0	<1.0	<1.0	1.0	1.1	<1.0	1.2
Barium	ug/L	2,000	2,000	2,000	670	26.0	30.0	28.0	26.0	28.0	26.8	24.8	24.0	25.8
Beryllium	ug/L	4	4	4	6.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	ug/L	5	5	5	3	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Chromium	ug/L	100	100	100	100	<1.0	2.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0
Cobalt	ug/L	NC	40	100	100	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	1,200	1,150	1,120	1,060	1,140	1,200	1,500	1,500	1,400
Lead	ug/L	NC	4	4	29	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Lithium	ug/L	NC	170	350	440	49	44	44	40	44	43	41	47	46
Mercury	ug/L	2	2	2	0.20#	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Molybdenum	ug/L	NC	73	210	3,200	<5.0	5.0	<5.0	<5.0	<5.0	5.0	5.1	<5.0	5.4
Radium-226	pCi/L	5	NC	NC	NC	0.420	0.554	0.541	0.399	<0.487	0.627	0.744	1.10	<0.761
Radium-226/228	pCi/L	5	NC	NC	NC	<0.718	0.815	1.03	0.985	<0.582	1.38	<1.38	1.41	<1.78
Radium-228	pCi/L	5	NC	NC	NC	<0.718	<0.472	0.485	0.586	<0.582	0.751	<0.834	<0.923	<1.02
Selenium	ug/L	50	50	50	5	1.0	<1.0	1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0
Thallium	ug/L	2	2	2	3.7	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.

NC - no criteria.

* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.

** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium and sulfate is the total dissolved solids criterion. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters, based on footnote {FF}. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

- If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
JR Whiting – RCRA CCR Monitoring Program
Erie, Michigan

						Sample Location:	JRW-MW-16007								
						Sample Date:	11/23/2016	12/20/2016	1/25/2017	3/8/2017	4/13/2017	5/25/2017	6/27/2017	8/2/2017	9/7/2017	10/10/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^		background									
Appendix III																
Boron	ug/L	NC	500	500	7,200		196	200	198	210	202	227	170	183	190	187
Calcium	mg/L	NC	NC	NC	500		138	135	136	138	138	152	126	121	120	117
Chloride	mg/L	250**	250	250	**50**		28.3	27.1	27.7	27.3	27.6	28.3	30.3	31.0	31.2	30.7
Fluoride	ug/L	4,000	NC	NC	NC		1,060	1,000	<1000	1,130	<1000	<1000	<1000	1,200	1,100	1,100
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	6.5 - 9.0		7.78	7.71	7.6	7.8	7.8	7.7	7.62	7.67	7.53	7.66
Sulfate	mg/L	**250****	**250**	**250**	**500**		**387**	**383**	**393**	**395**	**386**	**405**	**390**	**452**	**408**	**445**
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**		**750**	**740**	**750**	**740**	**770**	**770**	**920**	**988**	**918**	**888**
Appendix IV																
Antimony	ug/L	6	6	6	130		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	ug/L	10	10	10	10		1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium	ug/L	2,000	2,000	2,000	670		26.0	25.0	23.0	22.0	18.0	20.0	19.2	17.4	17.6	16.9
Beryllium	ug/L	4	4	4	6.7		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	ug/L	5	5	5	3		<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Chromium	ug/L	100	100	100	100		<1.0	<1.0	1.0	1.0	2.0	2.0	<1.0	<1.0	<1.0	<1.0
Cobalt	ug/L	NC	40	100	100		<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0
Fluoride	ug/L	4,000	NC	NC	NC		1,060	1,000	<1000	1,130	<1000	<1000	<1000	1,200	1,100	1,100
Lead	ug/L	NC	4	4	29		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Lithium	ug/L	NC	170	350	440		50	41	47	46	52	50	49	46	53	50
Mercury	ug/L	2	2	2	0.20#		<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Molybdenum	ug/L	NC	73	210	3,200		<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Radium-226	pCi/L	5	NC	NC	NC		0.548	0.700	0.742	0.326	0.471	0.446	<0.952	<0.882	0.766	<0.476
Radium-226/228	pCi/L	5	NC	NC	NC		0.792	1.13	0.742	0.495	0.540	0.536	<1.50	<1.63	<1.37	<1.14
Radium-228	pCi/L	5	NC	NC	NC		<0.328	<0.539	<0.508	<0.419	<0.49	<0.455	0.685	<0.747	<0.723	<0.660
Selenium	ug/L	50	50	50	5		<1.0	1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Thallium	ug/L	2	2	2	3.7		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.

NC - no criteria.

* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.

** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium and sulfate is the total dissolved solids criterion. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters, based on footnote {FF}. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

- If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
JR Whiting – RCRA CCR Monitoring Program
Erie, Michigan

						Sample Location:	JRW-MW-16008								
						Sample Date:	11/23/2016	12/20/2016	1/25/2017	3/7/2017	4/13/2017	5/25/2017	6/27/2017	8/2/2017	9/7/2017	10/10/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^		background									
Appendix III																
Boron	ug/L	NC	500	500	7,200		244	258	252	264	244	273	244	250	255	220
Calcium	mg/L	NC	NC	NC	500		150	144	148	148	142	155	134	138	130	118
Chloride	mg/L	250**	250	250	**50**		24.4	23.8	24.0	23.6	23.9	24.4	23.8	26.7	26.5	26.1
Fluoride	ug/L	4,000	NC	NC	NC		1,720	1,180	1,150	1,000	<1000	<1000	<1000	1,300	1,200	1,200
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	6.5 - 9.0		7.87	7.78	7.6	8.1	7.8	7.8	7.93	8.04	7.79	7.94
Sulfate	mg/L	**250****	**250**	**250**	**500**		**501**	**476**	**454**	**454**	**464**	**460**	**443**	**530**	**519**	**506**
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**		**900**	**860**	**840**	**860**	**850**	**850**	**1,100**	**1,020**	**894**	**1,040**
Appendix IV																
Antimony	ug/L	6	6	6	130		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	ug/L	10	10	10	10		1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium	ug/L	2,000	2,000	2,000	670		22.0	20.0	19.0	18.0	15.0	18.0	16.1	17.3	16.7	14.8
Beryllium	ug/L	4	4	4	6.7		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	ug/L	5	5	5	3		<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Chromium	ug/L	100	100	100	100		<1.0	<1.0	<1.0	1.0	1.0	1.0	<1.0	<1.0	<1.0	<1.0
Cobalt	ug/L	NC	40	100	100		<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0
Fluoride	ug/L	4,000	NC	NC	NC		1,720	1,180	1,150	1,000	<1000	<1000	<1000	1,300	1,200	1,200
Lead	ug/L	NC	4	4	29		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Lithium	ug/L	NC	170	350	440		53	48	52	50	51	51	50	49	54	48
Mercury	ug/L	2	2	2	0.20#		<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Molybdenum	ug/L	NC	73	210	3,200		6.0	6.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Radium-226	pCi/L	5	NC	NC	NC		0.333	<0.226	0.339	<0.425	0.528	<0.418	0.497	<0.715	1.05	0.819
Radium-226/228	pCi/L	5	NC	NC	NC		0.663	0.951	<0.640	<0.739	0.907	<0.585	1.27	<1.56	<1.64	1.68
Radium-228	pCi/L	5	NC	NC	NC		<0.422	0.802	<0.640	<0.739	<0.426	<0.585	0.768	<0.846	<0.718	0.864
Selenium	ug/L	50	50	50	5		<1.0	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0
Thallium	ug/L	2	2	2	3.7		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.

NC - no criteria.

* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.

** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium and sulfate is the total dissolved solids criterion. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters, based on footnote {FF}. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

- If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
JR Whiting – RCRA CCR Monitoring Program
Erie, Michigan

						Sample Location:	JRW-MW-16009								
						Sample Date:	11/22/2016	12/20/2016	1/25/2017	3/7/2017	4/13/2017	5/25/2017	6/27/2017	8/2/2017	9/7/2017	10/10/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^		background									
Appendix III																
Boron	ug/L	NC	500	500	7,200		260	284	283	296	284	305	284	240	272	234
Calcium	mg/L	NC	NC	NC	500		144	151	161	154	152	171	141	143	135	132
Chloride	mg/L	250**	250	250	**50**		33.6	33.1	33.9	33.3	33.1	34.5	34.1	38.0	38.0	37.7
Fluoride	ug/L	4,000	NC	NC	NC		1,080	1,090	1,150	1,150	<1000	<1000	<1000	1,300	1,200	1,100
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	6.5 - 9.0		7.85	7.82	7.6	7.6	7.8	7.8	7.61	7.90	7.71	7.81
Sulfate	mg/L	**250****	**250**	**250**	**500**		**478**	**494**	**540**	**521**	**517**	**534**	**497**	**607**	**567**	**560**
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**		**860**	**900**	**950**	**940**	**970**	**960**	**1,150**	**1,240**	**1,030**	**1,050**
Appendix IV																
Antimony	ug/L	6	6	6	130		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	ug/L	10	10	10	10		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium	ug/L	2,000	2,000	2,000	670		31.0	23.0	23.0	20.0	16.0	18.0	15.8	14.6	13.8	13.8
Beryllium	ug/L	4	4	4	6.7		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	ug/L	5	5	5	3		<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Chromium	ug/L	100	100	100	100		<1.0	<1.0	2.0	<1.0	1.0	3.0	1.5	<1.0	<1.0	<1.0
Cobalt	ug/L	NC	40	100	100		<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0
Fluoride	ug/L	4,000	NC	NC	NC		1,080	1,090	1,150	1,150	<1000	<1000	<1000	1,300	1,200	1,100
Lead	ug/L	NC	4	4	29		<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Lithium	ug/L	NC	170	350	440		48	53	54	54	54	54	56	55	54	52
Mercury	ug/L	2	2	2	0.20#		<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Molybdenum	ug/L	NC	73	210	3,200		8.0	7.0	6.0	5.0	<5.0	<5.0	5.0	<5.0	<5.0	5.1
Radium-226	pCi/L	5	NC	NC	NC		0.708	0.339	0.494	0.507	0.607	<0.391	<0.576	<0.851	0.937	0.676
Radium-226/228	pCi/L	5	NC	NC	NC		1.17	0.996	0.585	0.807	1.18	<0.512	<1.17	<1.57	1.66	<1.33
Radium-228	pCi/L	5	NC	NC	NC		<0.554	0.657	<0.522	<0.471	0.575	<0.512	0.612	<0.715	<0.989	<0.876
Selenium	ug/L	50	50	50	5		<1.0	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0
Thallium	ug/L	2	2	2	3.7		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.

NC - no criteria.

* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.

** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium and sulfate is the total dissolved solids criterion. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters, based on footnote {FF}. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

- If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 3
Summary of Field Parameter Results
JR Whiting – RCRA CCR Monitoring Program
Erie, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Background							
JRW-MW-16007	11/23/2016	0.16	-123.6	7.78	1077	11.20	8.37
	12/20/2016	1.12	-246.0	7.71	1960	9.97	<1
	1/25/2017	0.50	-145.9	7.60	562	11.10	<1
	3/8/2017	0.60	-58.7	7.80	1048	10.80	<1
	4/13/2017	0.20	-167.1	7.80	1025	12.10	8.10
	5/25/2017	0.10	-116.6	7.70	1063	12.50	3.00
	6/27/2017	0.21	35.2	7.62	754	13.79	4.14
	8/2/2017	0.20	49.8	7.67	877	15.38	3.43
	9/7/2017	0.20	-20.5	7.53	1024.4	14.40	1.55
	10/10/2017	0.25	-9.4	7.66	1020.1	14.66	2.24
JRW-MW-16008	11/23/2016	0.14	-121.0	7.87	1209	11.60	4.26
	12/20/2016	1.43	-262.0	7.78	2180	10.51	<1
	1/25/2017	0.50	-236.1	7.60	619	10.90	1.00
	3/7/2017	0.50	-195.3	8.10	1149	11.60	<1
	4/13/2017	0.00	-270.2	7.80	1132	12.00	2.5
	5/25/2017	0.60	-211.7	7.80	1157	12.80	<1
	6/27/2017	0.15	-151.8	7.93	920	13.76	3.51
	8/2/2017	0.13	-190.5	8.04	948	15.40	2.36
	9/7/2017	0.15	-277.9	7.79	1098.8	15.33	1.54
	10/10/2017	0.20	-233.3	7.94	1108.1	15.03	1.55
JRW-MW-16009	11/22/2016	0.18	-123.8	7.85	1154	11.60	5.62
	12/20/2016	1.37	-264.0	7.82	2280	9.91	<1
	1/25/2017	0.60	-111.2	7.60	675	10.30	<1
	3/7/2017	0.10	-139.0	7.60	1260	11.70	1.50
	4/13/2017	0.40	-106.6	7.80	1128	11.20	<1
	5/25/2017	0.10	-132.8	7.80	1260	13.00	<1
	6/27/2017	0.14	-162.1	7.61	1206	12.80	3.00
	8/2/2017	0.23	-83.0	7.90	1011	14.31	1.94
	9/7/2017	0.20	-175.4	7.71	1189.5	13.95	3.01
	10/10/2017	0.21	-152.4	7.81	1202.8	14.54	3.03

Notes:

mg/L - Milligrams per Liter.

mV - Millivolts.

SU - Standard Units.

umhos/cm - Micromhos per centimeter.

NTU - Nephelometric Turbidity Unit.

Table 3
Summary of Field Parameter Results
JR Whiting – RCRA CCR Monitoring Program
Erie, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Ponds 1&2							
JRW-MW-15001	12/21/2016	0.52	-137.0	7.55	1130	11.35	4.60
	1/24/2017	0.50	-132.9	7.40	1130	11.20	5.20
	3/7/2017	0.20	-129.3	7.40	1144	12.40	6.70
	4/12/2017	0.10	-119.1	7.60	1113	13.20	2.30
	5/25/2017	0.10	-117.4	7.60	1130	13.80	6.20
	6/28/2017	0.24	-133.3	8.12	842	13.19	3.10
	7/31/2017	0.99	-47.3	7.61	832	14.54	9.27
	9/5/2017	0.20	-164.5	7.54	1009	14.85	2.56
	10/9/2017	0.35	-88.0	7.43	1057.2	14.31	2.18
JRW-MW-15002	12/21/2016	0.75	-123.0	7.58	1170	10.58	4.80
	1/24/2017	0.50	-100.9	7.50	1177	10.90	6.40
	3/7/2017	0.60	-19.8	7.60	1175	12.50	<1
	4/12/2017	0.10	-87.3	7.60	1131	13.50	<1
	5/25/2017	0.10	-82.6	7.60	1178	13.70	201
	6/28/2017	0.20	-112.5	7.36	1108	12.90	6.60
	7/31/2017	0.57	-13.1	7.64	872	14.64	2.50
	9/5/2017	0.33	-87.1	7.50	1102.1	15.66	2.07
	10/9/2017	0.32	-70.0	7.52	1105.6	14.08	2.11
JRW-MW-15003	12/21/2016	0.55	-126.0	7.61	1110	11.55	4.30
	1/24/2017	0.50	-98.8	7.80	572	10.40	1.80
	3/7/2017	0.10	-152.9	7.90	1061	12.40	2.50
	4/12/2017	0.20	-118.2	8.00	1016	13.90	5.00
	5/25/2017	0.10	-112.8	8.00	1061	14.00	8.40
	6/28/2017	0.16	-75.9	7.99	846	13.18	2.89
	7/31/2017	0.68	-67.9	7.90	772	13.01	6.27
	9/5/2017	0.08	-103.7	7.66	985.3	13.04	3.24
	10/9/2017	0.16	-89.9	7.72	1019.2	13.22	3.59

Notes:

mg/L - Milligrams per Liter.

mV - Millivolts.

SU - Standard Units.

umhos/cm - Micromhos per centimeter.

NTU - Nephelometric Turbidity Unit.

Table 3
Summary of Field Parameter Results
JR Whiting – RCRA CCR Monitoring Program
Erie, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Ponds 1&2							
JRW-MW-15004	12/19/2016	2.03	-191.0	7.54	919	8.29	<1
	1/25/2017	0.60	-118.2	7.60	999	11.00	3.90
	3/7/2017	0.60	-52.1	7.70	987	13.00	<1
	4/12/2017	0.10	-124.9	7.70	978	13.50	1.90
	5/25/2017	0.10	-83.7	7.70	972	14.40	<1
	6/28/2017	0.20	-141.1	7.55	928	13.80	<1
	7/31/2017	0.43	-75.3	7.84	754	15.77	4.96
	9/5/2017	0.21	-123.2	7.66	937.5	15.48	1.48
	10/9/2017	0.38	-105.4	7.66	927.8	16.08	2.74
JRW-MW-15005	12/22/2016	0.59	-170.0	7.78	1460	12.37	<1
	1/25/2017	0.60	-112.7	8.20	899	11.00	7.80
	3/7/2017	0.20	-148.5	8.10	894	13.40	5.20
	4/13/2017	0.10	-137.9	8.10	889	11.80	<1
	5/25/2017	0.20	-146.6	8.10	893	14.60	<1
	6/28/2017	0.24	-164.1	7.92	848	14.70	2.90
	7/31/2017	0.36	-26.2	8.15	698	16.52	3.12
	9/5/2017	0.20	-146.0	7.98	859.1	15.53	1.46
	10/9/2017	0.31	-124.6	8.04	846.6	16.60	1.90
JRW-MW-15006	12/22/2016	0.92	-168.0	7.85	1640	10.84	<1
	1/25/2017	0.50	-169.4	8.70	990	10.40	9.30
	3/7/2017	0.60	-73.1	8.40	977	12.10	4.00
	4/13/2017	0.00	-174.8	8.10	979	11.60	1.10
	5/25/2017	0.10	-180.9	8.20	976	13.70	8.00
	6/28/2017	0.15	-170.8	7.78	941	13.90	1.00
	8/1/2017	0.52	16.8	8.08	743	14.35	2.89
	9/6/2017	0.16	-142.3	7.77	958.5	12.81	2.35
	10/10/2017	0.23	-65.9	7.62	948.1	14.65	1.89

Notes:
mg/L - Milligrams per Liter.
mV - Millivolts.
SU - Standard Units.
umhos/cm - Micromhos per centimeter.
NTU - Nephelometric Turbidity Unit.

TRC - GIS

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

Plot Date: 11/30/2017, 15:35:41 PM by SMAJOR -- LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\269767-004-007.mxd

LEGEND

- MONITORING WELL (STATIC WATER LEVEL ONLY)
- CCR UNIT MONITORING WELL

LABEL FORMAT

MONITORING WELL ID
GROUNDWATER ELEVATION FT MSL (MEASUREMENT DATE)
GROUNDWATER ELEVATION FT MSL (MEASUREMENT DATE)
etc...

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 4/12/2017.
2. WELL LOCATIONS SURVEYED BY SHERIDAN SURVEYING CO. ON 11/19/2015 AND 11/30/2016.

N

0 500 1,000 Feet

1 " = 500 '
1:6,000

PROJECT:
CONSUMERS ENERGY COMPANY
JR WHITING POWER PLANT
ERIE, MICHIGAN

TITLE:
GROUNDWATER POTENTIOMETRIC ELEVATION SUMMARY

DRAWN BY:	J. PAPEZ	PROJ NO.:	269767-001
CHECKED BY:	S. HOLMSTROM		
APPROVED BY:	V. BUENING		**FIGURE 1**
DATE:	NOVEMBER 2017		

TRC
1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trcsolutions.com

FILE NO.: 269767-004-007.mxd

Appendix B
Data Quality Review

Laboratory Data Quality Review
Groundwater Sample Event November 2017 (Round 10)
CEC JR Whiting

Groundwater samples were collected by TRC for the November 2017 sampling event. Samples were analyzed for anions, boron, calcium, and total dissolved solids by Pace Analytical located in Grand Rapids, Michigan. The laboratory analytical results are reported in laboratory report 464747.

During the November 2017 sampling event, a groundwater sample was collected from each of the following wells in the detection monitoring well network:

- JRW-MW-15001
- JRW-MW-15002
- JRW-MW-15003
- JRW-MW-15004
- JRW-MW-15005
- JRW-MW-15006

In addition, groundwater samples were collected from non-compliance monitoring wells (JRW-MW-16007, JRW-MW-16008 and JRW-MW-16009) which were submitted for analysis along with the Pond 1 and 2 area samples and are included for quality review purposes.

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Chloride, Fluoride, Sulfate)	EPA 300.0
Boron, Calcium	EPA 6020A, EPA 6010C
Total Dissolved Solids	SM 2540C

TRC reviewed the laboratory data to assess data usability. The following sections summarize the data review procedure and the results of the review

Data Quality Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Data Review (USEPA, 2017). The following items were included in the evaluation of the data:

- Sample receipt, as noted in the cover page or case narrative
- Technical holding times for analyses
- Data for method blanks, equipment blanks, and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field and equipment blanks are used to assess potential contamination arising from field procedures.

- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD). Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects.
- Reporting limits (RLs) compared to project-required RLs.
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes.
- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix.
- Data for laboratory duplicates, when available. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method.
- Overall usability of the data which addressed the following items:
  - Usability of the data if quality control (QC) results suggest potential problems with all or some of the data
  - Actions regarding specific QC criteria exceedances

Findings

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable, with the exceptions noted below. The discussion that follows describes the QA/QC results and evaluation.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation, are noted below.

- Appendix III constituents will be utilized for the purposes of a detection monitoring program.
- Data are usable for the purposes of the detection monitoring program.
- When the data are evaluated through a detection monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary:

- One equipment blank (EB-01) and one field blank (FB-01) were collected; total dissolved solids was detected in FB-01 and EB-01 at concentrations of 866 mg/L and 936 mg/L, respectively. The laboratory noted that four total dissolved sample containers were potentially switched in the laboratory and it is believed that this may have impacted samples EB-01, FB-01, Dup-01, and JRW-MW-16009, and offers an explanation as to why the FB-01 and EB-01 results were unexpectedly high and the Dup-01 and JRW-MW-16009 results were lower than expected based on historical data at those locations. However, the lab was unable

confirm the error. As a result, the reported total dissolved results that are ≤10 x the blank concentration (9,360 mg/L) are potential false positives or potentially biased high results. Total dissolved results for samples JRW-MW-15001, JRW-MW-15002, JRW-MW-15003, JRW-MW-15004, JRW-MW-15005, JRW-MW-15006, JRW-MW-16007, JRW-MW-16008, and JRW-MW-16009 are potentially impacted by the blank detections. Although there is a likely error in the JRW-MW-16009 and QA/QC samples, groundwater quality data from monitoring well JRW-MW-16009 is not evaluated as part of the detection monitoring program. Since the total dissolved results for the compliance samples (JRW-MW-15001 through JRW-MW-15006) are comparable with historical results, they are considered usable for the purposes of the detection monitoring program.

- Dup-01 corresponds to JRW-MW-15003; relative percent differences (RPDs) between the parent and duplicate sample were >20% for total dissolved solids. Potential uncertainty exists for total dissolved solids results for the field duplicate pair due to field duplicate variability. As noted above, the total dissolved solids sample containers may have been switched in the laboratory, which may have impacted the total dissolved results for Dup-01. Because the RPDs for the remaining parameters were <20%, sample precision is acceptable and data are usable for the purposes of verification resampling.
- Laboratory duplicate analyses were performed on samples JRW-MW-15001 and JRW-MW-16007 for total dissolved solids; RPDs were within QC limits.
- MS/MSD analyses were performed on sample JRW-MW-16007:
  - The boron recovery in the MS for batch 9787 was below the lower laboratory control limit. The boron results for samples analyzed in the same batch (Dup-01, EB-01, FB-01, JRW-MW-15001, JRW-MW-15002, JRW-MW-15003, JRW-MW-15004, JRW-MW-15005, JRW-MW-15006, JRW-MW-16007, JRW-MW-16008, and JRW-MW-16009) may be biased low.

Field Parameter Data Quality Review
Groundwater Sample Events January 2018 (Verification Resampling)
CEC JR Whiting

On January 18, 2018, TRC Environmental Corporation (TRC) collected groundwater samples at monitoring wells JRW-MW-15001, JRW-MW-15002, and JRW-MW-15004 to verify initial pH (field measured) results that were outside of the prediction limits during the September 2017 detection monitoring event. Prior to sample collection, groundwater was purged and stabilized using the low flow sampling methods followed during the September 2017 monitoring event in accordance with the *JR Whiting Monitoring Program Sample Analysis Plan* (SAP) (ARCADIS, 2016) and the updated *JR Whiting Monitoring Program Sample and Analysis Plan* (TRC, May 2017).

TRC routinely reviews the field parameter data to assess data usability. The following sections summarize the data review procedure and the results of this review.

Data Quality Review Procedure

The following items were included in the evaluation of the field parameter data:

- Review of sonde calibration data
- Confirm field parameters stabilization criteria were met
- Compare field parameters to historical data; and
- Overall usability of the data based on these items.

Findings

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable, with the exceptions noted below. The discussion that follows describes the QA/QC results and evaluation.

- Sonde calibration readings were within calibration range for all field parameters.
- Field parameters met stabilization criteria for 3 successive readings.
- Field parameter readings were comparable to historical data.
- Data are usable for purposes of verification resampling.

Appendix C
Statistical Background Limits

Technical Memorandum

Date: January 15, 2018

To: Michelle Marion, CEC
J.R. Register, CEC
Brad Runkel, CEC

From: Sarah Holmstrom, TRC
Darby Litz, TRC
Joyce Peterson, TRC

Project No.: 269767.0000 Phase 004, Task 004

Subject: Background Statistical Evaluation (R1-R9) – Consumers Energy, JR Whiting Ponds 1&2

Pursuant to the United States Environmental Protection Agency's (U.S. EPA's) Resource Conservation and Recovery Act (RCRA) Coal Combustion Residual rule ("CCR Rule") promulgated on April 17, 2015, the owner or operator of a CCR Unit must collect a minimum of eight rounds of background groundwater data to initiate a detection monitoring program and evaluate statistically significant increases above background (40 CFR §257.94). This memorandum presents the background statistical limits derived for Consumers Energy Company (CEC) Pond 1 and Pond 2 (Ponds 1&2) at the JR Whiting (JRW) Power Plant Site (the Site).

The JRW Ponds 1&2 CCR unit is located adjacent to Lake Erie. Groundwater present within the uppermost aquifer at the CCR unit is confined and protected from CCR constituents by the overlying clay-rich aquitard and is typically encountered around 50 feet below ground surface (bgs) in the limestone (beneath the till). Potentiometric surface elevation data from groundwater within the CCR monitoring wells exhibit an extremely low hydraulic gradient across the site with no apparent flow direction. Based on the hydrogeology at the Site, particularly the extremely low to non-existent gradient or lack of flow direction at the JRW site in addition to the presence of 40 to 50 feet of laterally extensive clay-rich till that acts as a natural hydraulic barrier across the site, an intrawell statistical approach is being implemented for detection monitoring. A series of six monitoring wells surrounds the two adjacent ponds and makes up the detection monitoring well network for the Ponds 1&2 CCR unit.

Following the baseline data collection period (November 2016 through October 2017), the background data for JRW Ponds 1&2 CCR unit were evaluated in accordance with the Groundwater Statistical Evaluation Plan (Stats Plan) (TRC, October 2017). Consideration was made regarding the independence

of each of these samples relative to horizontal time of travel within the aquifer. Based on the maximum hydraulic conductivity and highest measured potentiometric gradients to-date (from background monitoring Rounds 1 through 9), the horizontal travel time varies from 0 ft/year to approximately 1 ft/year. Monitoring wells at the site are constructed with 2-inch diameter PVC with 2-inches of sandpack around the screen within a 6-inch diameter borehole. Assuming groundwater was flowing continuously in one direction, the time of travel from one side of the borehole to the other is six months or more. Based on potentiometric data, it is more likely that groundwater proximal to the monitoring wells is stagnant or slightly moving back and forth across the borehole, potentially extending the residence time of groundwater in the vicinity of each monitoring well.

Due to the limitations on CCR Rule implementation timelines, the background data collection monitoring events for JR Whiting were timed at a frequency of 1 to 2 months apart to ensure the collection of the eight background samples prior to October 17, 2017. Based on this frequency, it is likely that the initial six rounds in the background data set represent limited temporal independence at this site, hence the low variability throughout the initial five to six rounds. This limited temporal variability can only be corrected with the collection of additional groundwater data, and the inclusion of the additional data in the background data set updated in the future, as long as data continue to show no impacts from the CCR unit.

The JRW site groundwater data are maintained within a database accessible through Sanitas™ statistical software. Sanitas™ is a software tool that is commercially available for performing statistical evaluation consistent with procedures outlined in U.S. EPA's Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities (Unified Guidance; UG). Within the Sanitas™ statistical program (and the UG), intrawell prediction limits were selected to perform the statistical calculation for background/baseline limits. Use of prediction limits is recommended by the UG to provide high statistical power and is an acceptable approach for intrawell detection monitoring under the CCR rule. Upper prediction limits (UPLs) were calculated for each of the CCR Appendix III parameters based on a single future value. The following narrative describes the methods employed and the results obtained and the Sanitas™ output files are included as an attachment.

The set of downgradient monitoring wells utilized for compliance in the JRW Ponds 1&2 CCR unit detection monitoring program includes JRW-MW-15001 through JRW-MW-15006. An intrawell statistical approach requires that each of the downgradient wells doubles as the background and compliance well, where data from each individual well during a detection monitoring event is compared to a statistical limit developed using the background/baseline dataset from that same well. The baseline evaluation included the following steps:

- Review of data quality reports for the baseline/background data sets for CCR Appendix III constituents;
- Graphical representation of the baseline data as time versus concentration (T v. C) by well/constituent pair;

- Outlier testing of individual data points that appear from the graphical representations as potential outliers;
- Evaluation of percentage of nondetects for each baseline/background well-constituent (w/c) pair;
- Distribution of the data; and
- Calculation of the intrawell UPL for each monitoring well for each Appendix III constituent data set (upper and lower prediction limits were calculated for field pH).

The results of these evaluations are presented and discussed below.

Data Quality

Data from each sampling round were evaluated for completeness, overall quality and usability, method-specified sample holding times, precision and accuracy, and potential sample contamination. The review was completed using the following quality control (QC) information which at a minimum included chain-of-custody forms, investigative sample results including blind field duplicates, and matrix spike and matrix spike duplicates (MS/MSDs) recoveries, and, as provided by the laboratory, method blanks, laboratory control spikes, laboratory duplicates. The data were found to be complete and usable for the purposes of the CCR monitoring program.

Time versus Concentration Graphs

The time versus concentration (T v. C) graphs (Figure 1) do not show potential or suspect outliers for the seven Appendix III parameters.

While variations in results are present, the graphs show consistent baseline data and do not suggest that data sets, as a whole, likely have overall trending or seasonality. However, as discussed above, due to lack of groundwater flow potential there is limited temporal independence in the background dataset and due to limitations on CCR Rule implementation timelines, the data sets are of relatively short duration for making such observations regarding overall trending or seasonality.

Outlier Testing

Because the baseline T v. C graphs (Figure 1) did not show potential outliers, outlier testing was not performed for the JRW baseline data sets. Had candidate values been present, the Dixon's Outlier Test in Sanitas™ would have been used to evaluate potential outlier removal.

Percentage of Nondetects

The baseline data sets for the Appendix III parameters for the six compliance monitoring wells at the JRW site did not include any nondetect values.

Distribution of the Data Sets

The distribution of the data sets is determined by the Sanitas™ software during calculation of the upper prediction limit. The Shapiro-Wilk test is used for samples sizes fewer than 50. Nondetect/censored data were not present in the data sets. If the data appear to be non-normal, mathematical transformations of the data may be utilized such that the transformed data follow a normal distribution (e.g., lognormal distributions). Alternatively, non-parametric tests may be utilized when data cannot be normalized. Table 1 summarizes the distributions determined by the Sanitas™ software.

Upper Prediction Limits

Table 1 presents the calculated UPLs (with one future event) for the baseline data sets. The UPL is calculated based on the distribution listed on the table. For nonnormal background datasets, a nonparametric prediction limit is utilized, resulting in the highest value from the background dataset as the UPL. The achieved confidence and/or coverage rates depend entirely on the number of background data points, and coverage rates for various confidence levels are shown in the Sanitas™ outputs for nonparametric prediction limits. Verification resampling (1 of 2) is recommended per the Stats Plan and UG to achieve the performance standards specified in the CCR rules.

Table 1
Summary of Baseline Data Distributions and Intrawell Upper Prediction Limits

WELL	CONSTITUENT	DISTRIBUTION	UPPER PREDICTION LIMIT – FROM SANITAS™
JRW-MW-15001	Boron	Normal	251
	Calcium	Normal	182
	Chloride	Normal	54.4
	Fluoride	Normal	1,560
	Field pH	Nonnormal	7.4 – 8.1*
	Sulfate	Normal	469
	Total Dissolved Solids	Nonnormal	974*
JRW-MW-15002	Boron	Normal	229
	Calcium	Normal	185
	Chloride	Normal	54.5
	Fluoride	Normal	1,870
	Field pH	Normal	7.3 – 7.8
	Sulfate	Normal	495
	Total Dissolved Solids	Normal	1,020

Table 1
Summary of Baseline Data Distributions and Intrawell Upper Prediction Limits

WELL	CONSTITUENT	DISTRIBUTION	UPPER PREDICTION LIMIT – FROM SANITAS™
JRW-MW-15003	Boron	Normal	219
	Calcium	Normal	162
	Chloride	Normal	55.5
	Fluoride	Normal	1,810
	Field pH	Normal	7.4 – 8.2
	Sulfate	Normal	454
	Total Dissolved Solids	Normal	969
JRW-MW-15004	Boron	Normal	271
	Calcium	Normal	143
	Chloride	Normal	54.7
	Fluoride	Normal	1,860
	Field pH	Normal	7.4 – 7.9
	Sulfate	Normal	389
	Total Dissolved Solids	Normal	900
JRW-MW-15005	Boron	Normal	256
	Calcium	Normal	127
	Chloride	Normal	44.0
	Fluoride	Normal	1,730
	Field pH	Normal	7.7 – 8.4
	Sulfate	Normal	347
	Total Dissolved Solids	Nonnormal	844*
JRW-MW-15006	Boron	Normal	240
	Calcium	Normal	144
	Chloride	Normal	52.1
	Fluoride	Normal	1,710
	Field pH	Normal	7.1 – 9.0
	Sulfate	Normal	404
	Total Dissolved Solids	Nonnormal	922*

* Nonparametric Prediction Limit

Attachments

Figure 1 – Background Concentration Time-Series Charts
Sanitas™ Output Files

Figures

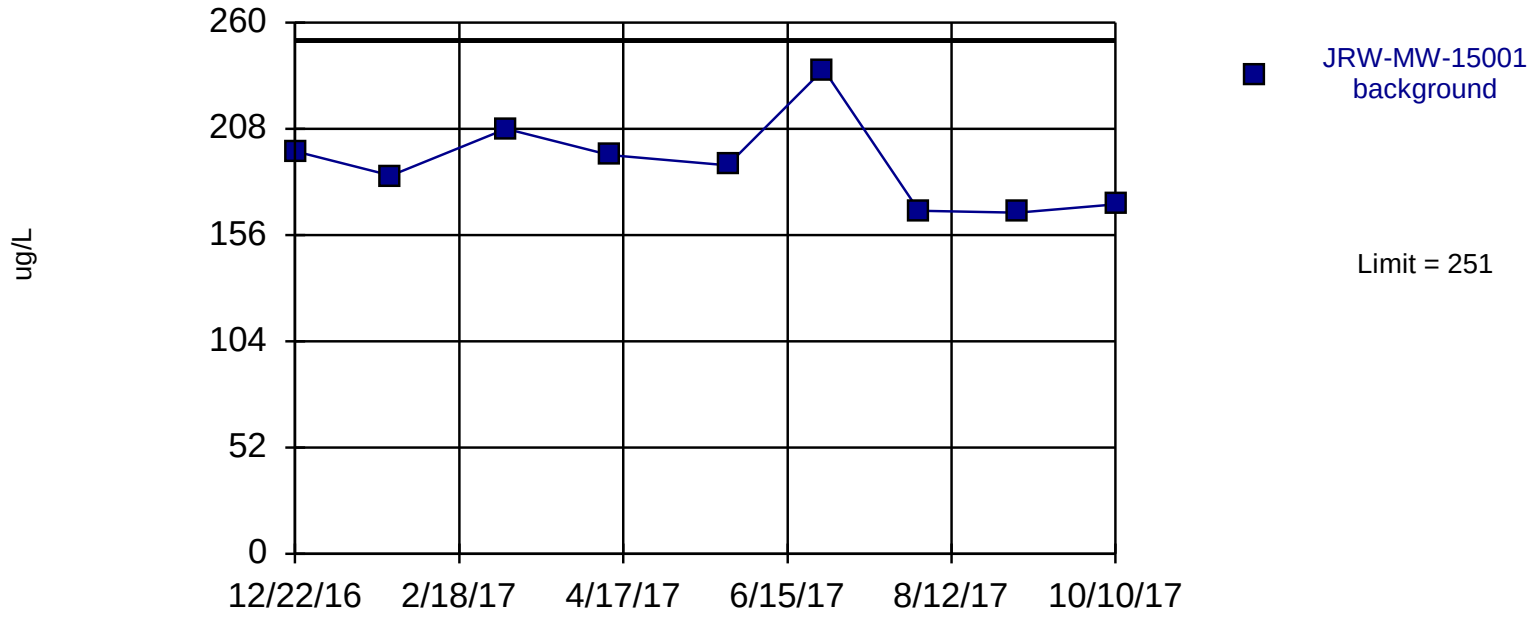
Figure 1
Background Concentration Time-Series Charts
JR Whiting - RCRA CCR Monitoring Program

P:\Clients\Consumers Energy\Whiting\Baseline 8\ProUCL_data_JR Whiting_20171116 jp.xlsx

Sanitas™ Output Files

Prediction Limit

Intrawell Parametric, JRW-MW-15001



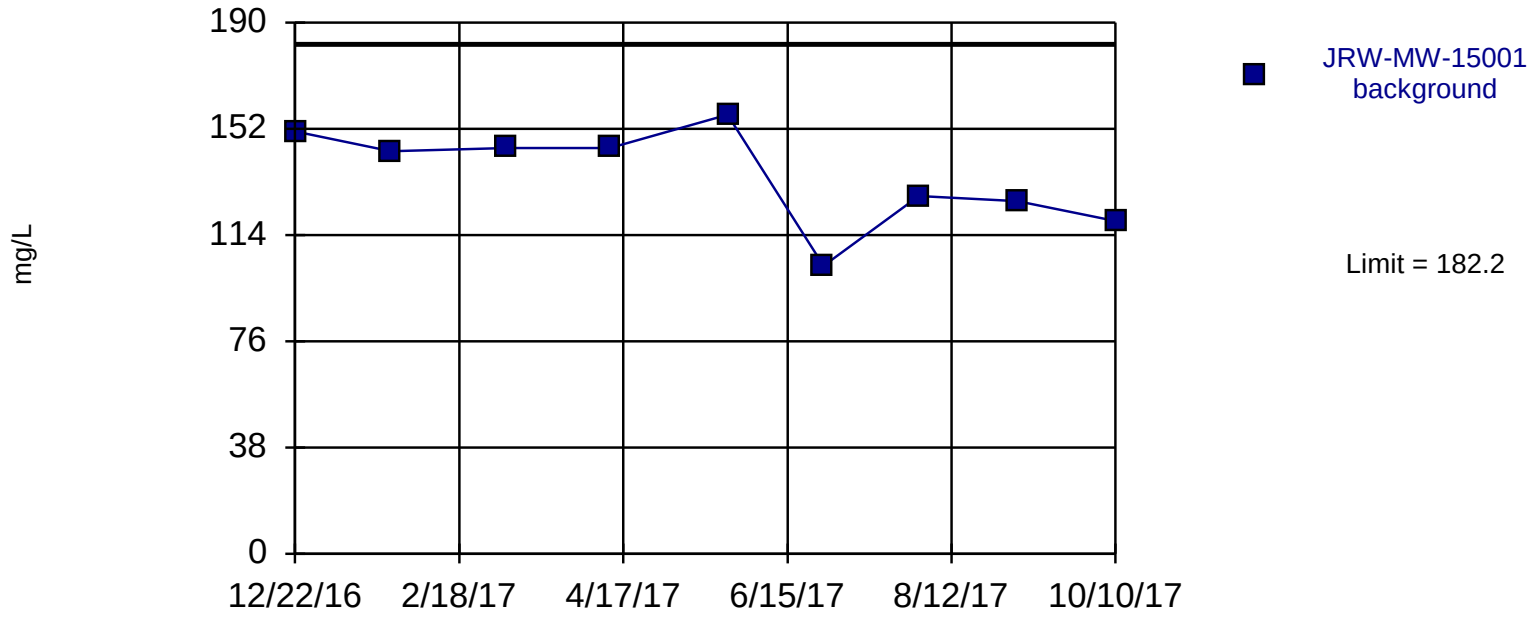
Background Data Summary: Mean=190.9, Std. Dev.=22.36, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9086, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Boron, Total Analysis Run 12/4/2017 4:27 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15001



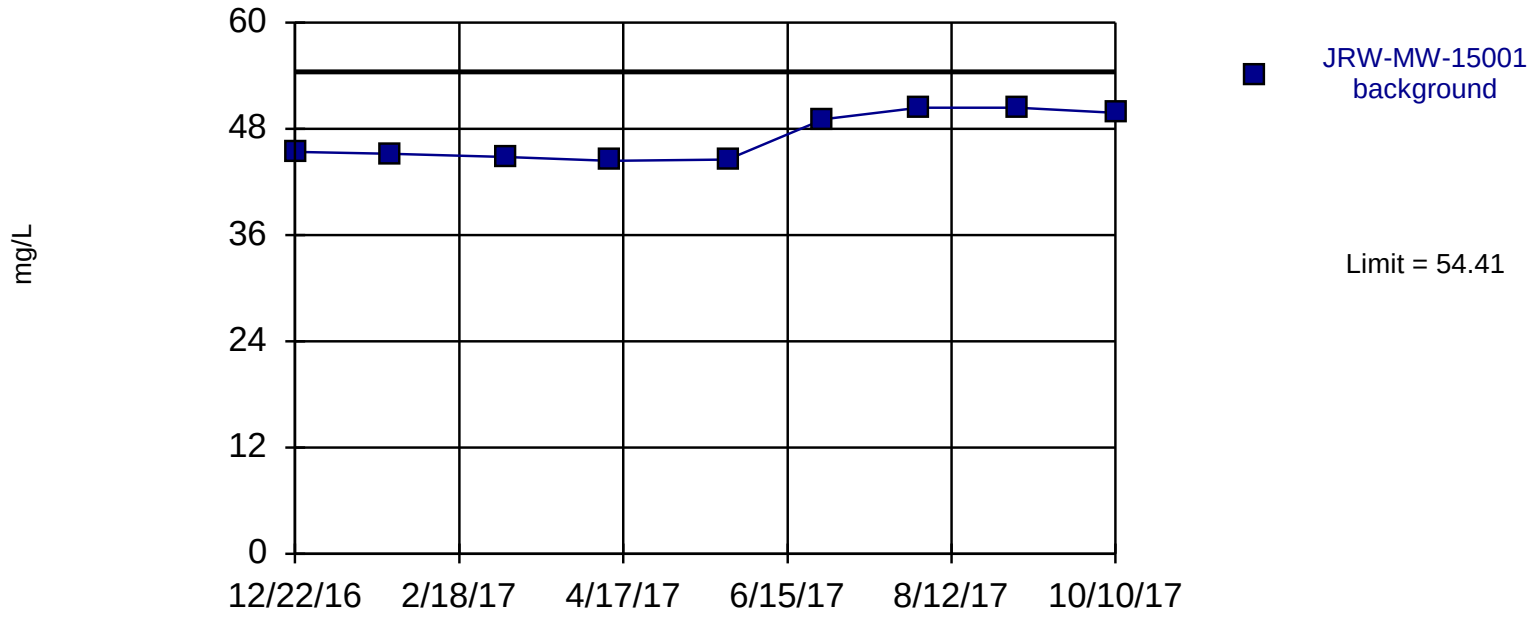
Background Data Summary: Mean=135.3, Std. Dev.=17.43, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9301, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Calcium, Total Analysis Run 12/4/2017 4:28 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15001



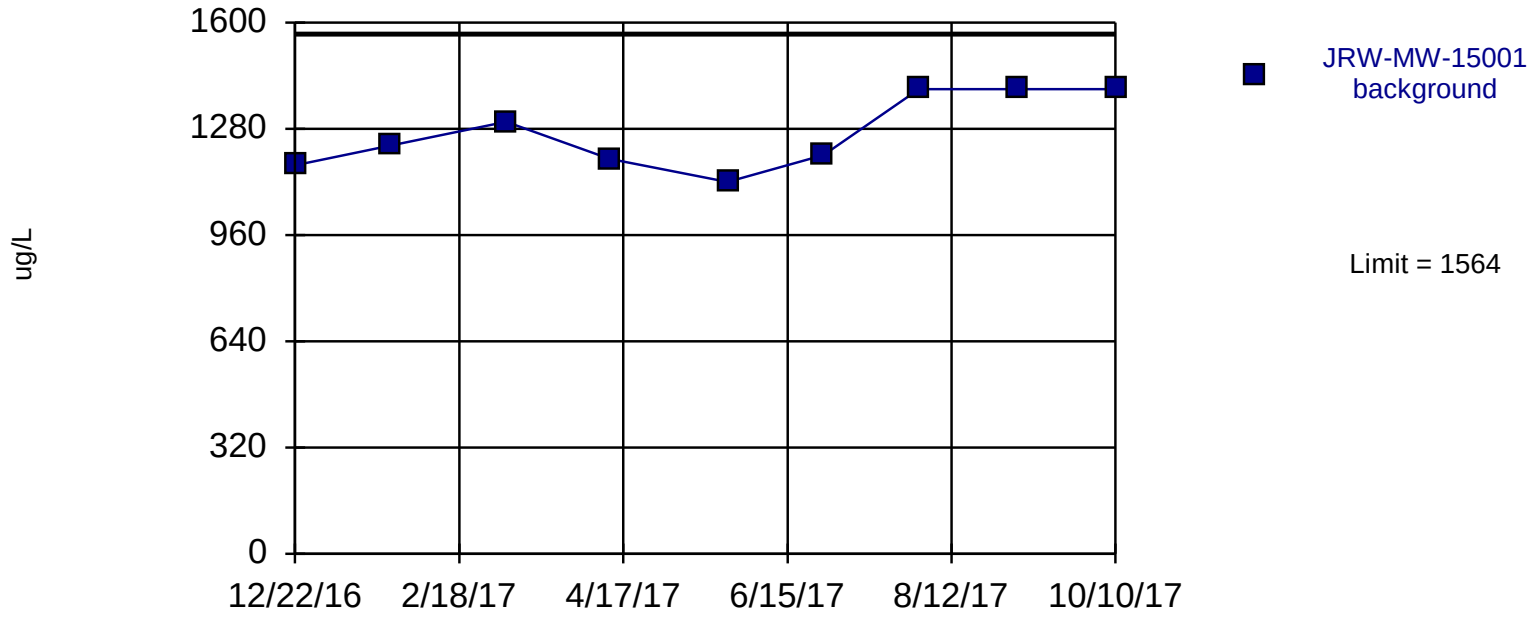
Background Data Summary: Mean=47.11, Std. Dev.=2.714, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7859, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Chloride Analysis Run 12/4/2017 4:29 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15001



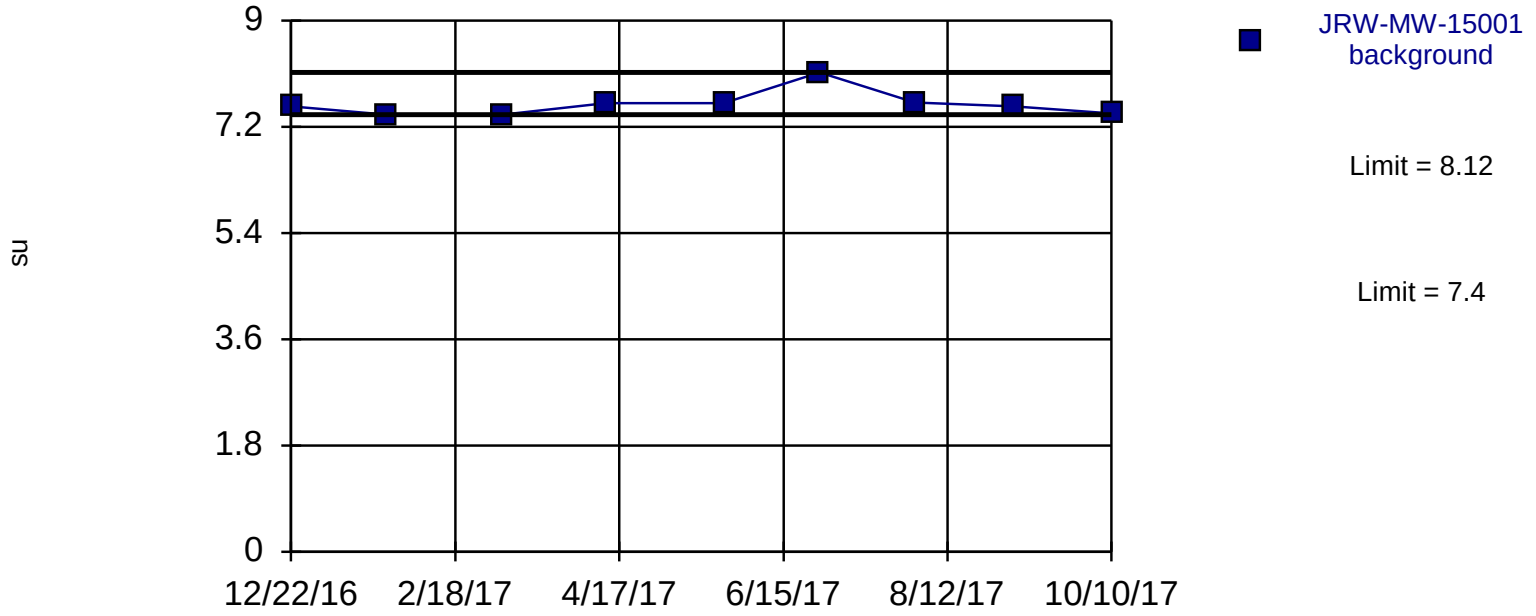
Background Data Summary: Mean=1268, Std. Dev.=110.1, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8701, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Fluoride Analysis Run 12/4/2017 4:29 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Non-parametric, JRW-MW-15001



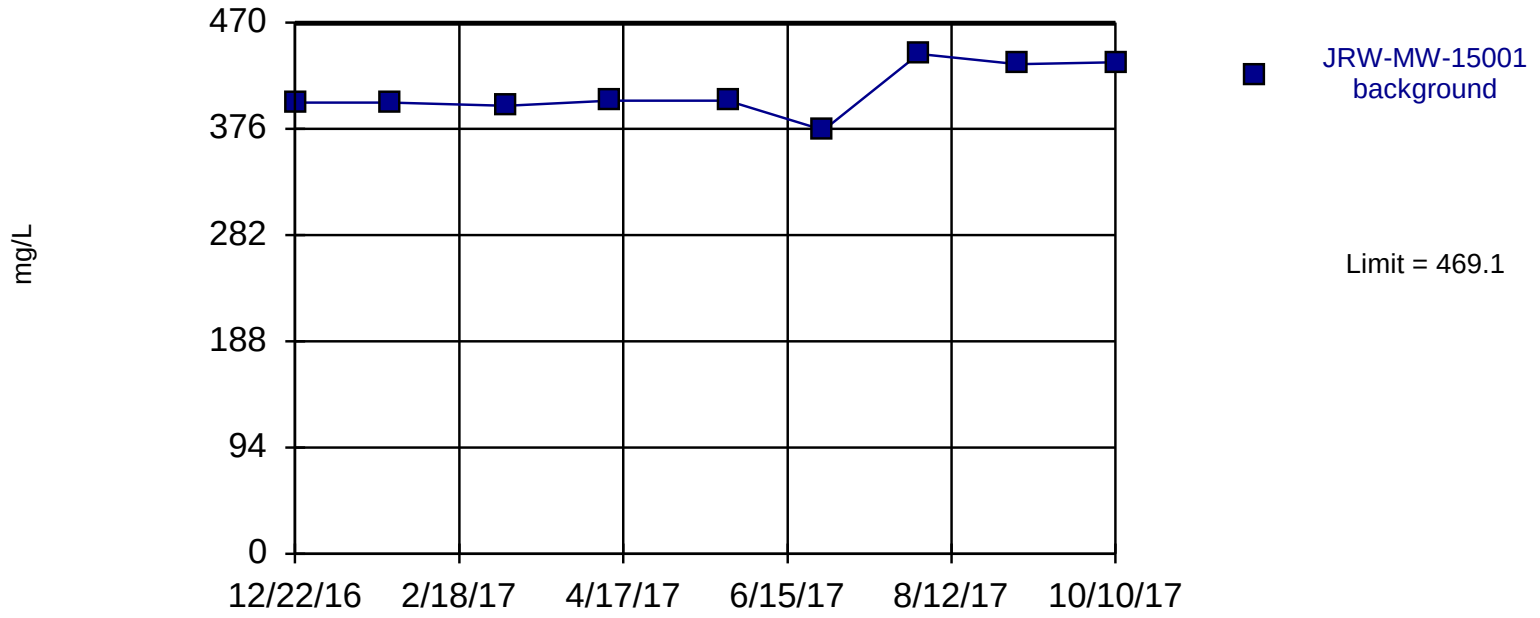
Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limits are highest and lowest of 9 background values. Well-constituent pair annual alpha = 0.07172. Individual comparison alpha = 0.03619 (1 of 2). Assumes 1 future value. Insufficient data to test for seasonality: data were not deseasonalized.

Constituent: pH, Field Analysis Run 12/4/2017 4:30 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15001



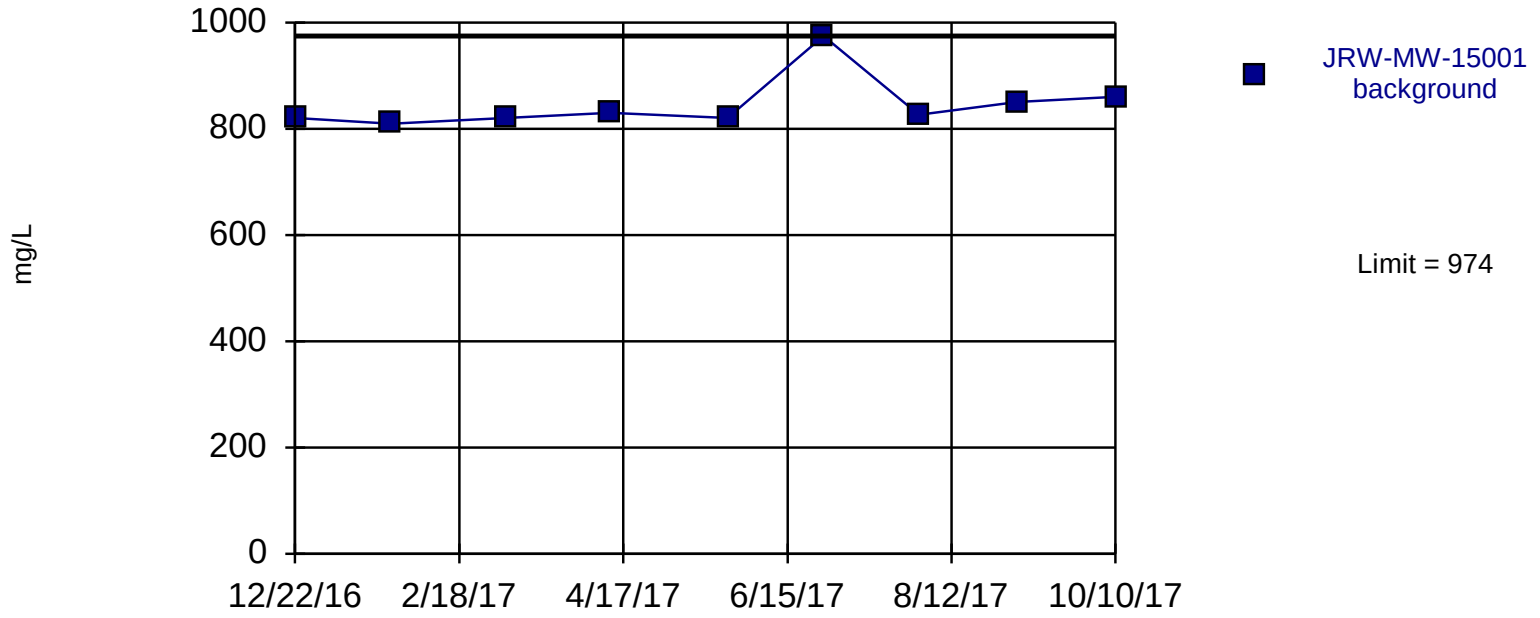
Background Data Summary: Mean=409, Std. Dev.=22.34, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8718, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Sulfate Analysis Run 12/4/2017 4:30 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Non-parametric, JRW-MW-15001



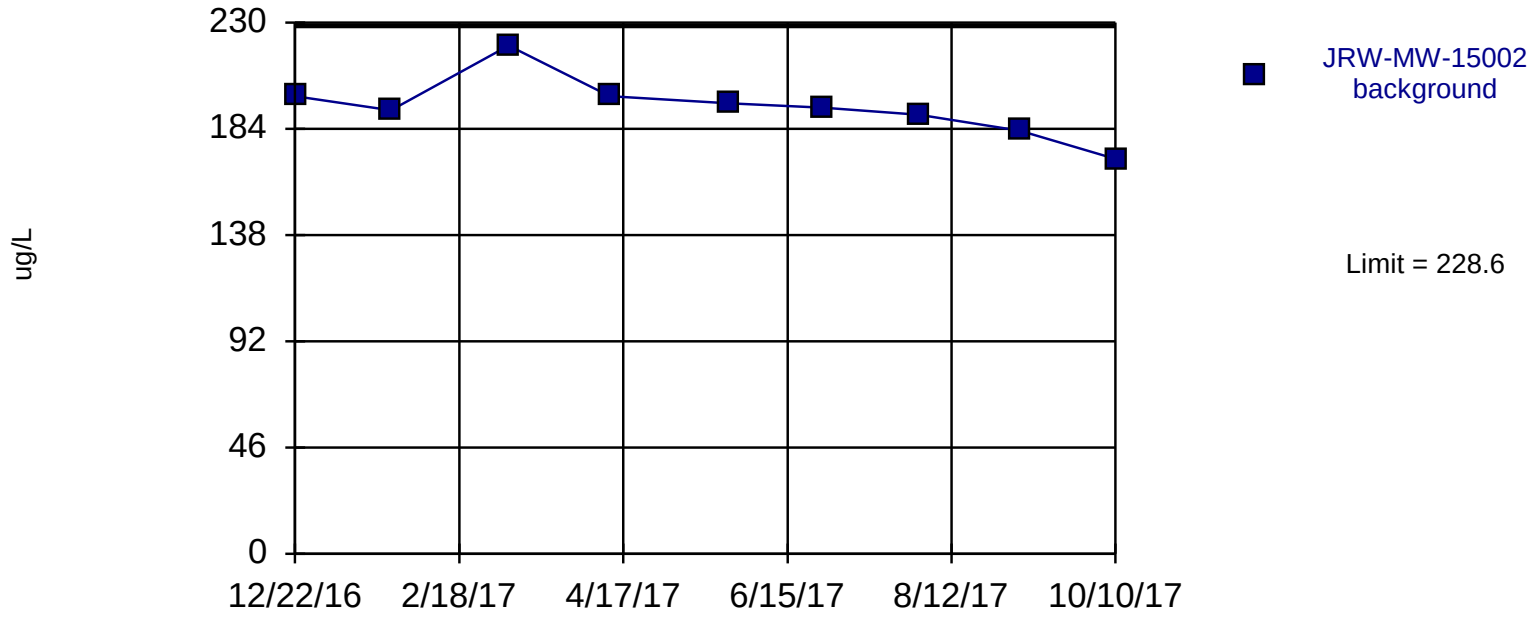
Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 9 background values. Well-constituent pair annual alpha = 0.03586. Individual comparison alpha = 0.01809 (1 of 2). Assumes 1 future value. Insufficient data to test for seasonality: data were not deseasonalized.

Constituent: Total Dissolved Solids, Dissolved Analysis Run 12/4/2017 4:30 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15002



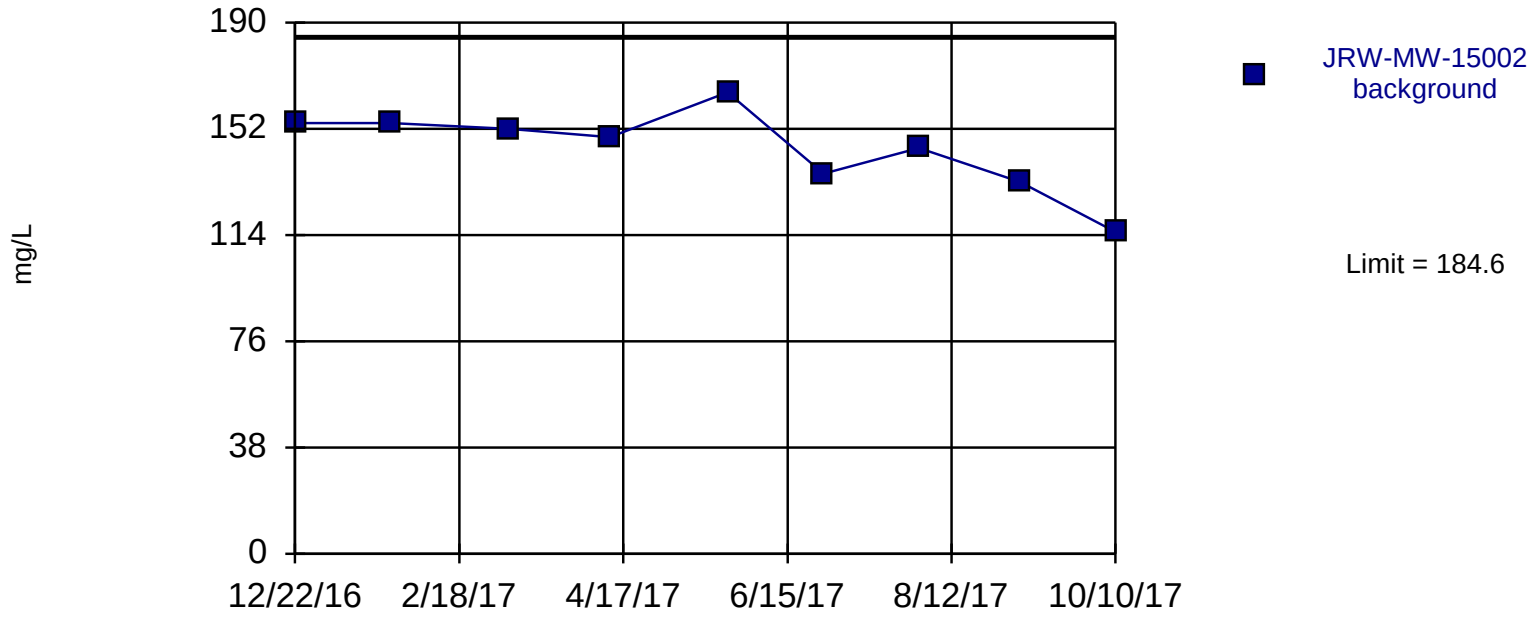
Background Data Summary: Mean=193.3, Std. Dev.=13.11, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9201, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Boron, Total Analysis Run 12/4/2017 4:35 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15002



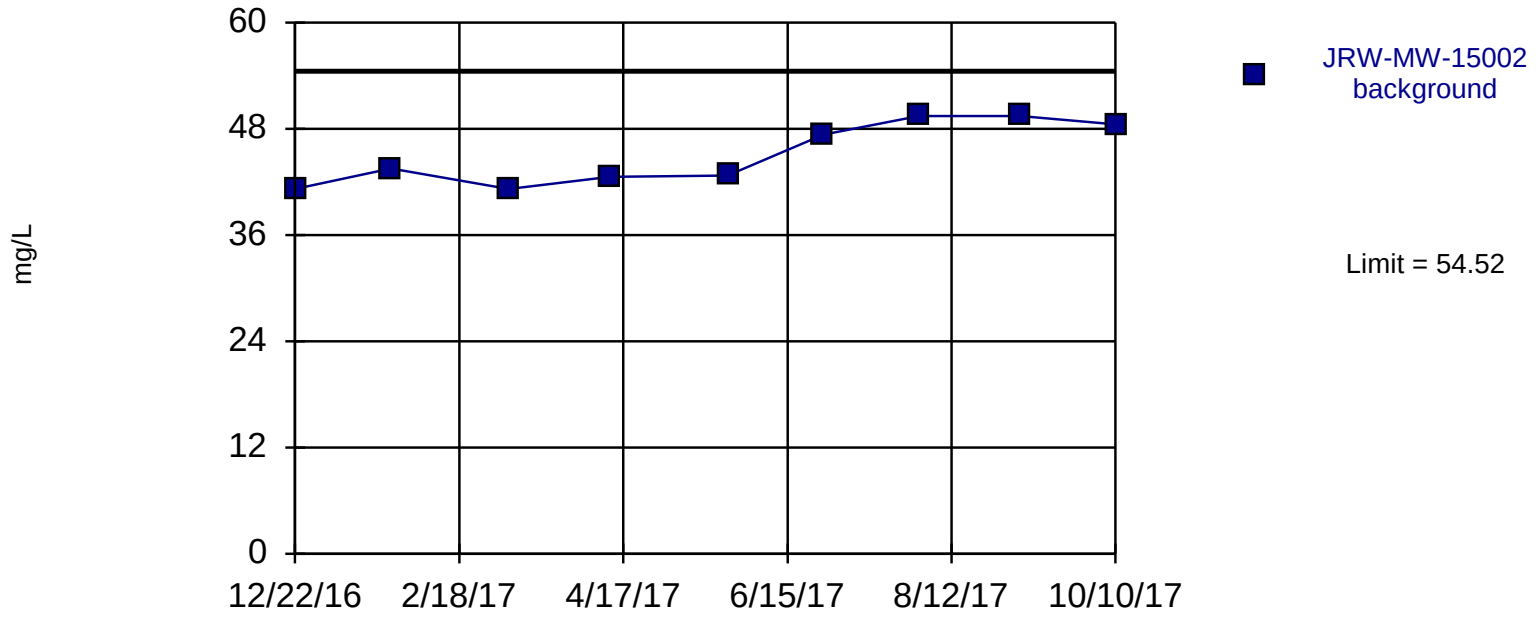
Background Data Summary: Mean=144.8, Std. Dev.=14.8, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9352, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Calcium, Total Analysis Run 12/4/2017 4:34 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15002



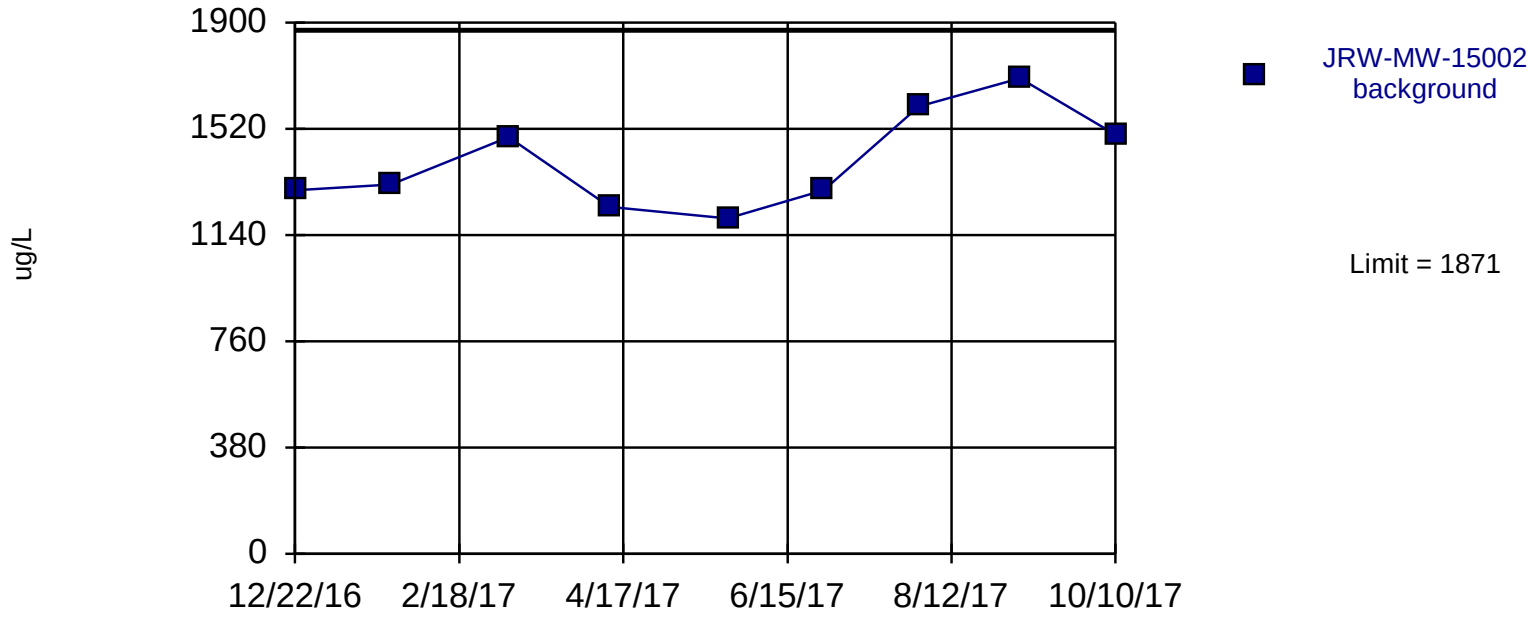
Background Data Summary: Mean=45.09, Std. Dev.=3.507, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8399, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Chloride Analysis Run 12/4/2017 4:33 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15002



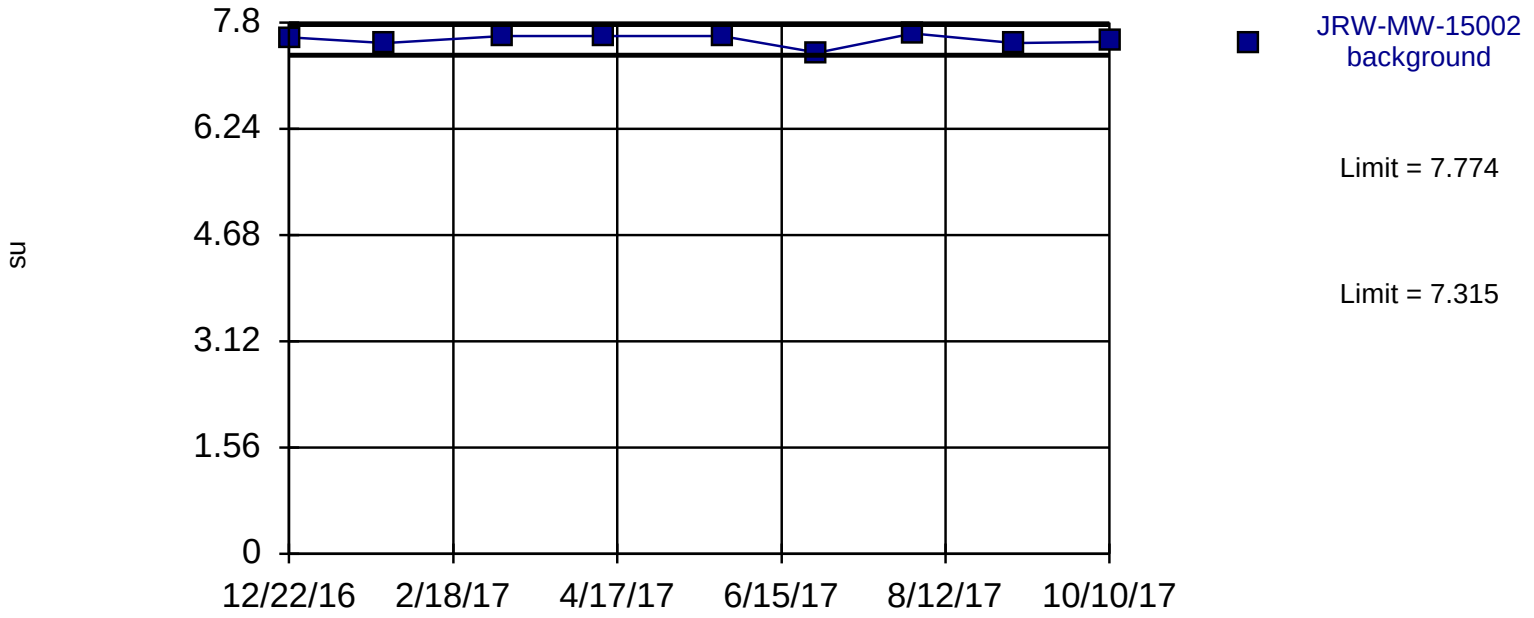
Background Data Summary: Mean=1406, Std. Dev.=173.1, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.916, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Fluoride Analysis Run 12/4/2017 4:33 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15002



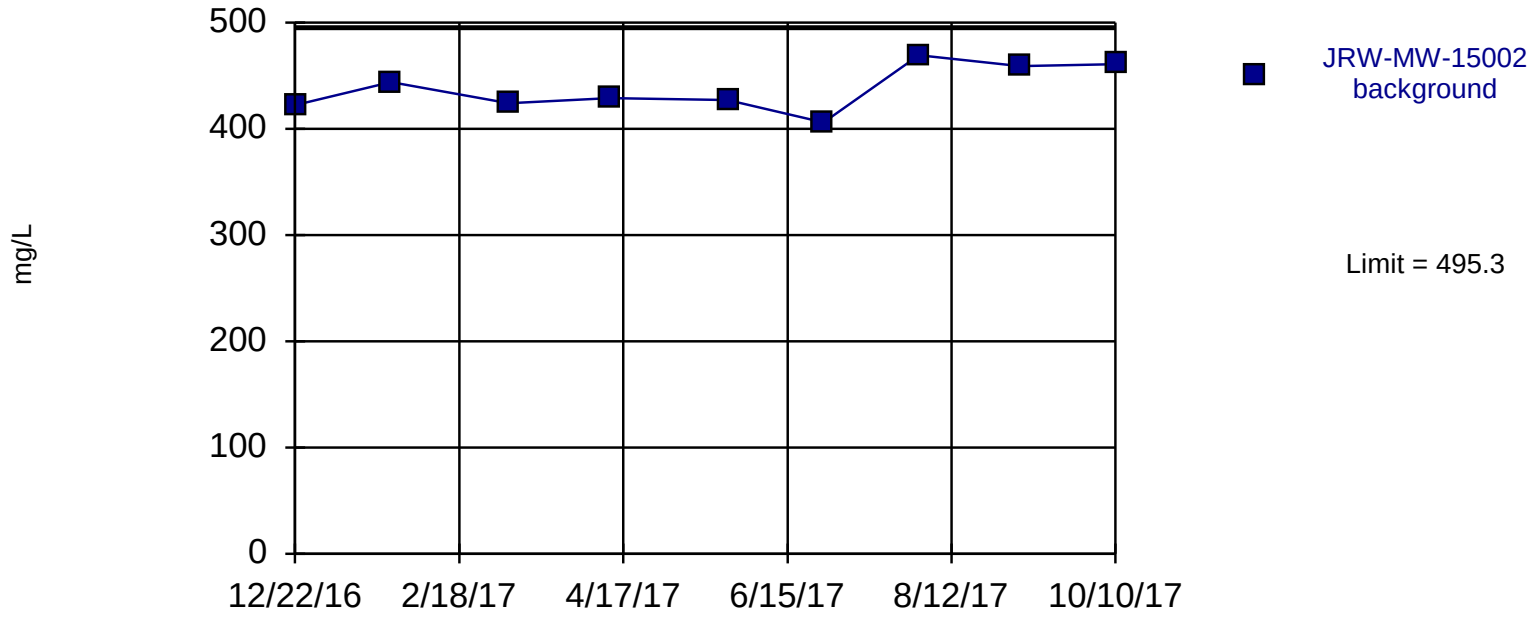
Background Data Summary: Mean=7.544, Std. Dev.=0.08531, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8667, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: pH, Field Analysis Run 12/4/2017 4:32 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15002



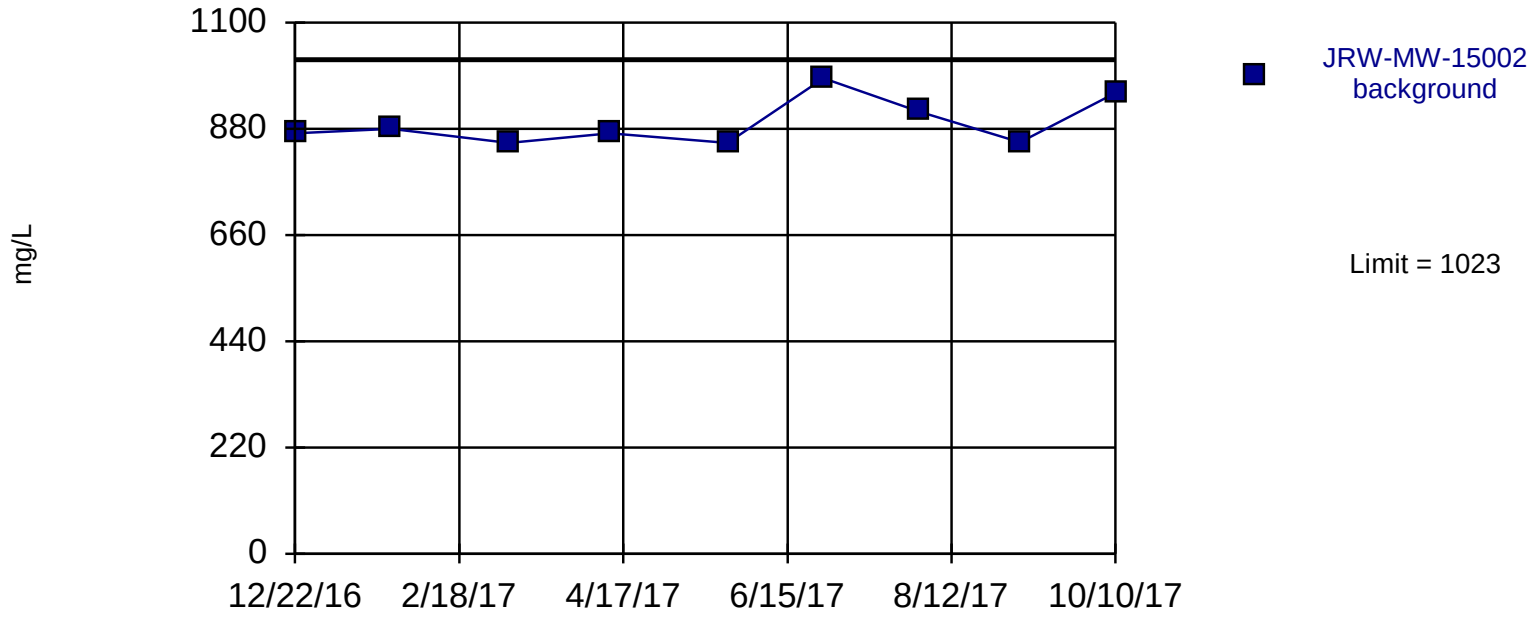
Background Data Summary: Mean=437.9, Std. Dev.=21.35, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9316, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Sulfate Analysis Run 12/4/2017 4:32 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15002



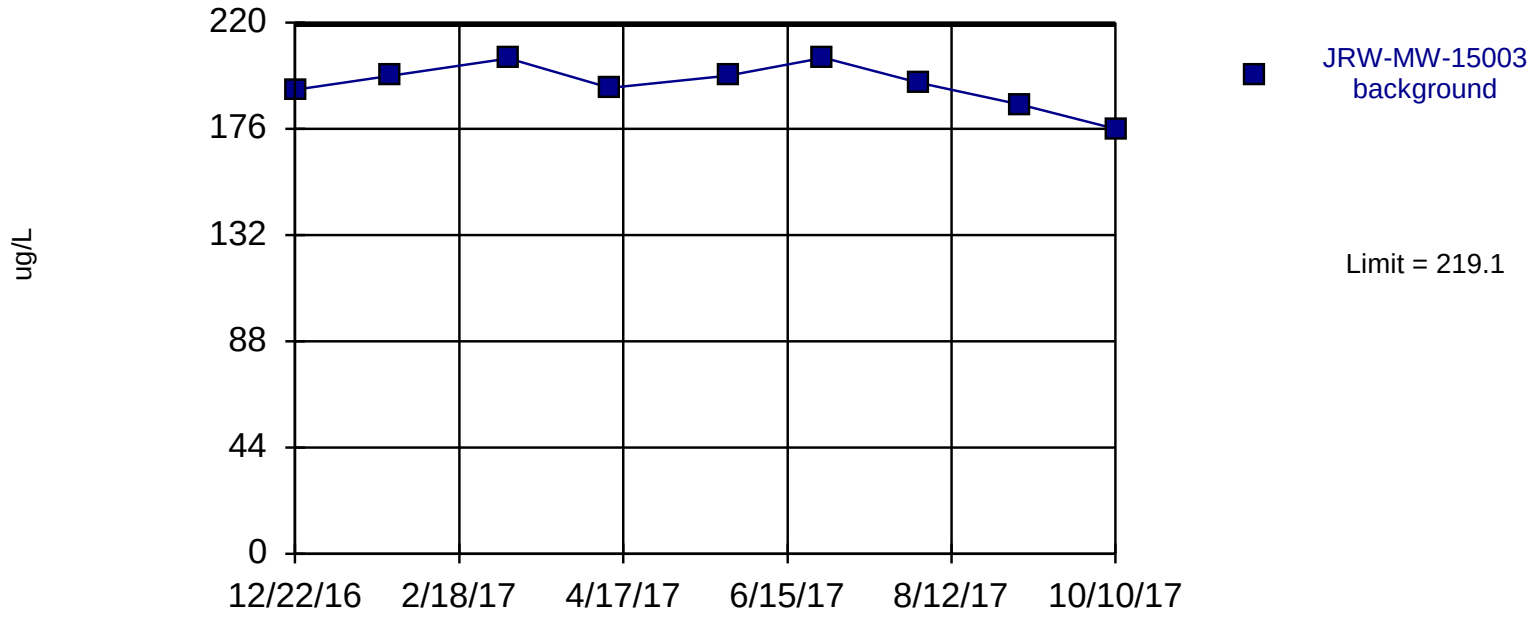
Background Data Summary: Mean=891.8, Std. Dev.=48.89, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8332, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Total Dissolved Solids, Dissolved Analysis Run 12/4/2017 4:31 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15003



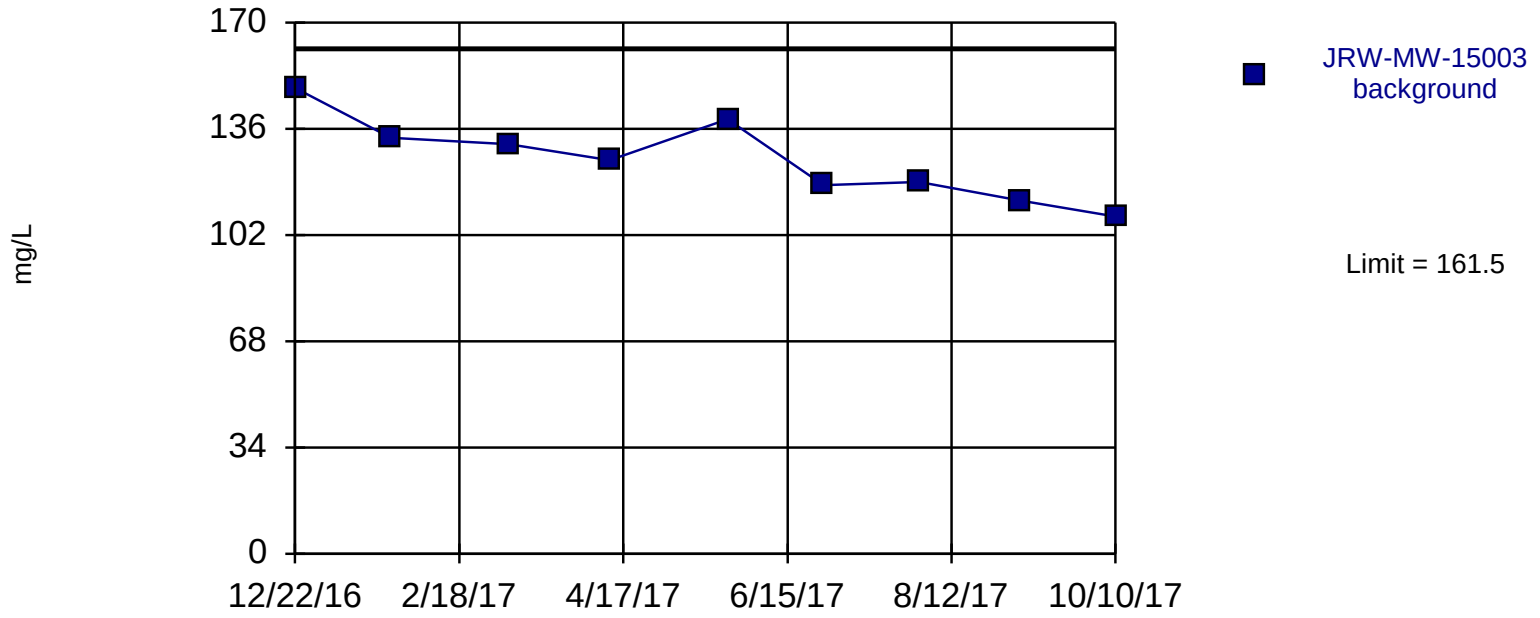
Background Data Summary: Mean=194.3, Std. Dev.=9.21, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9353, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Boron, Total Analysis Run 12/4/2017 4:36 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15003



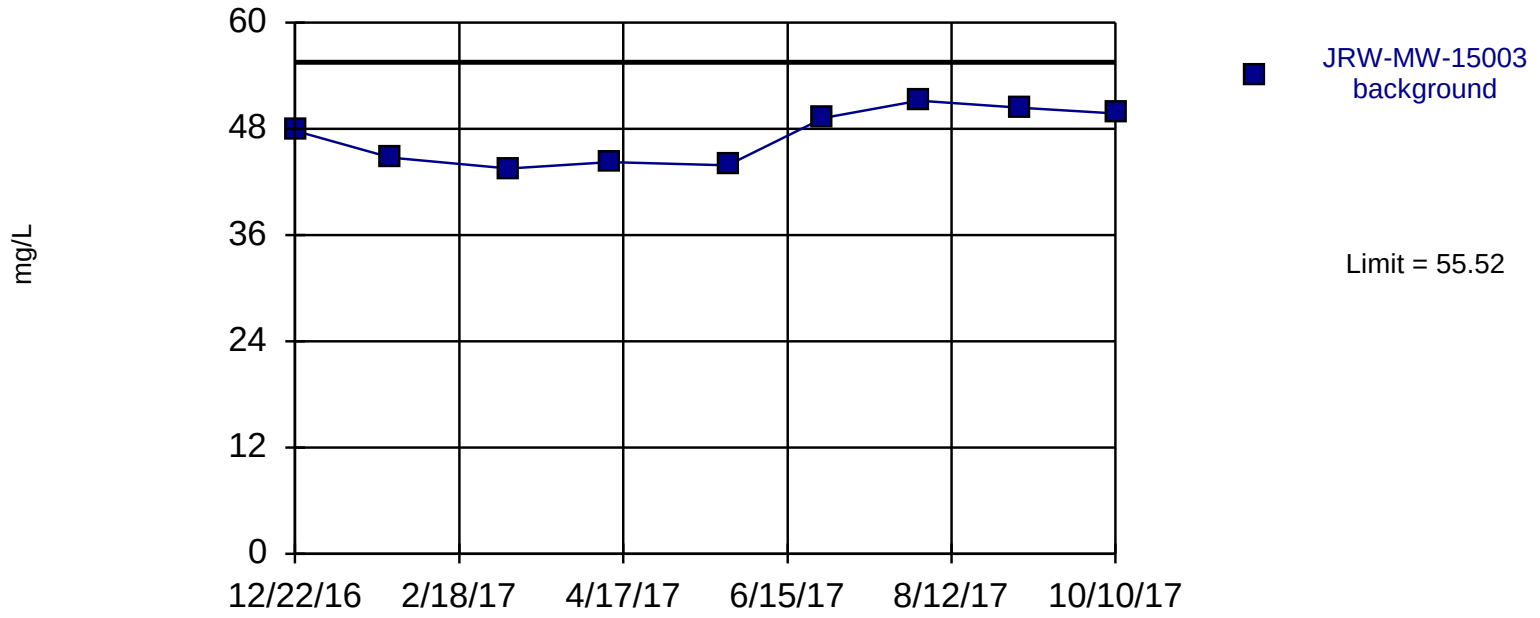
Background Data Summary: Mean=126.2, Std. Dev.=13.12, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9764, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Calcium, Total Analysis Run 12/4/2017 4:38 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15003



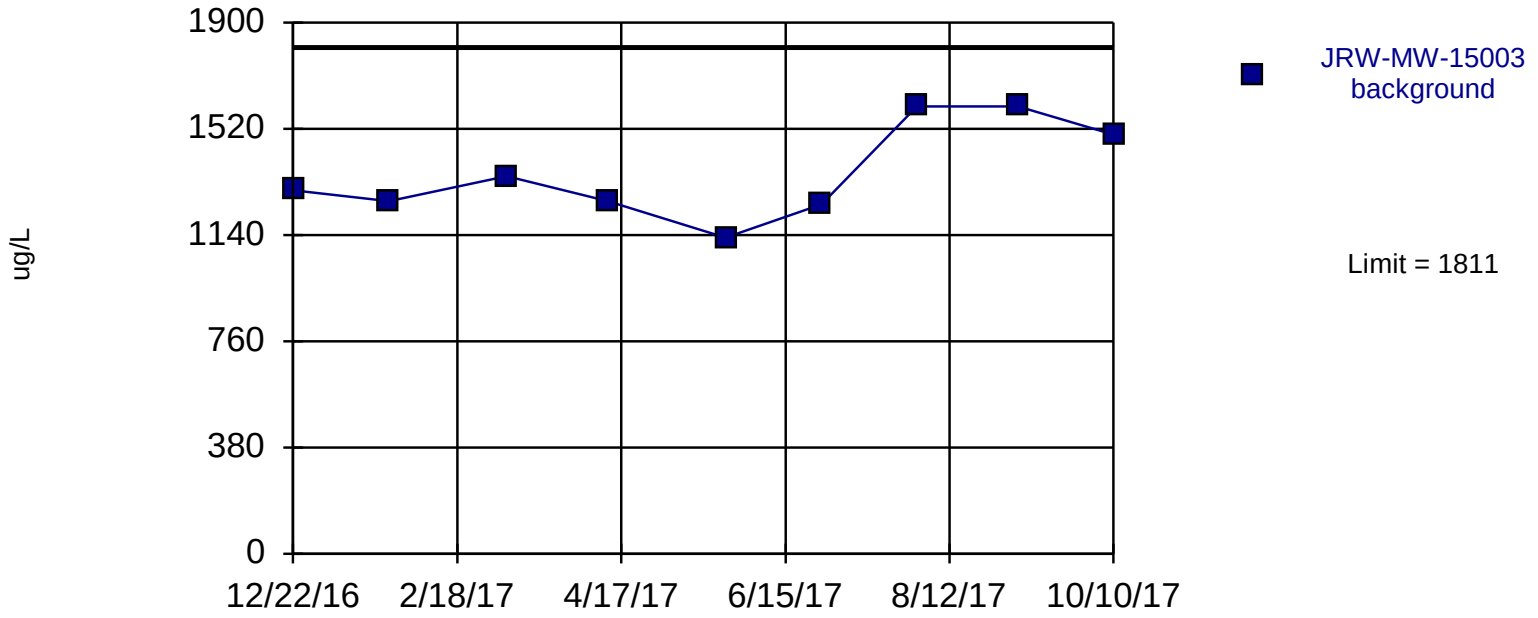
Background Data Summary: Mean=47.18, Std. Dev.=3.1, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8661, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Chloride Analysis Run 12/4/2017 4:39 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15003



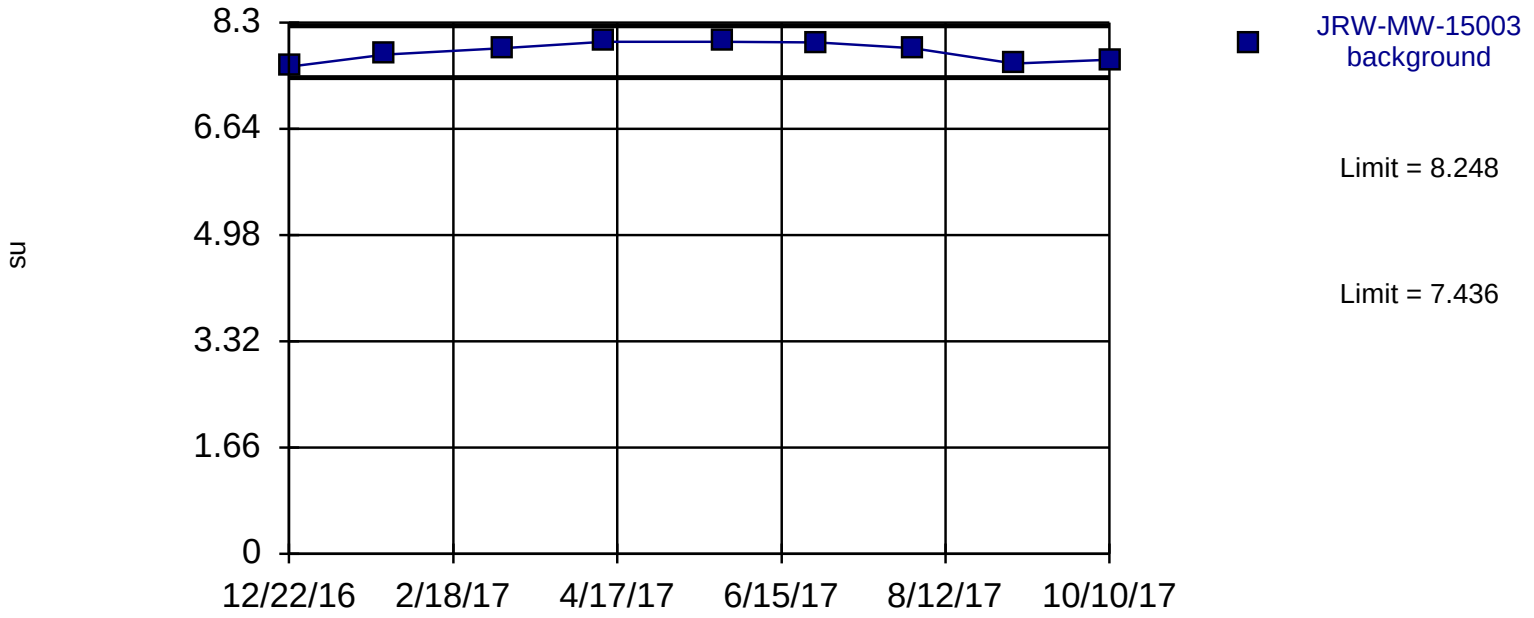
Background Data Summary: Mean=1361, Std. Dev.=167.1, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8909, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Fluoride Analysis Run 12/4/2017 4:40 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15003



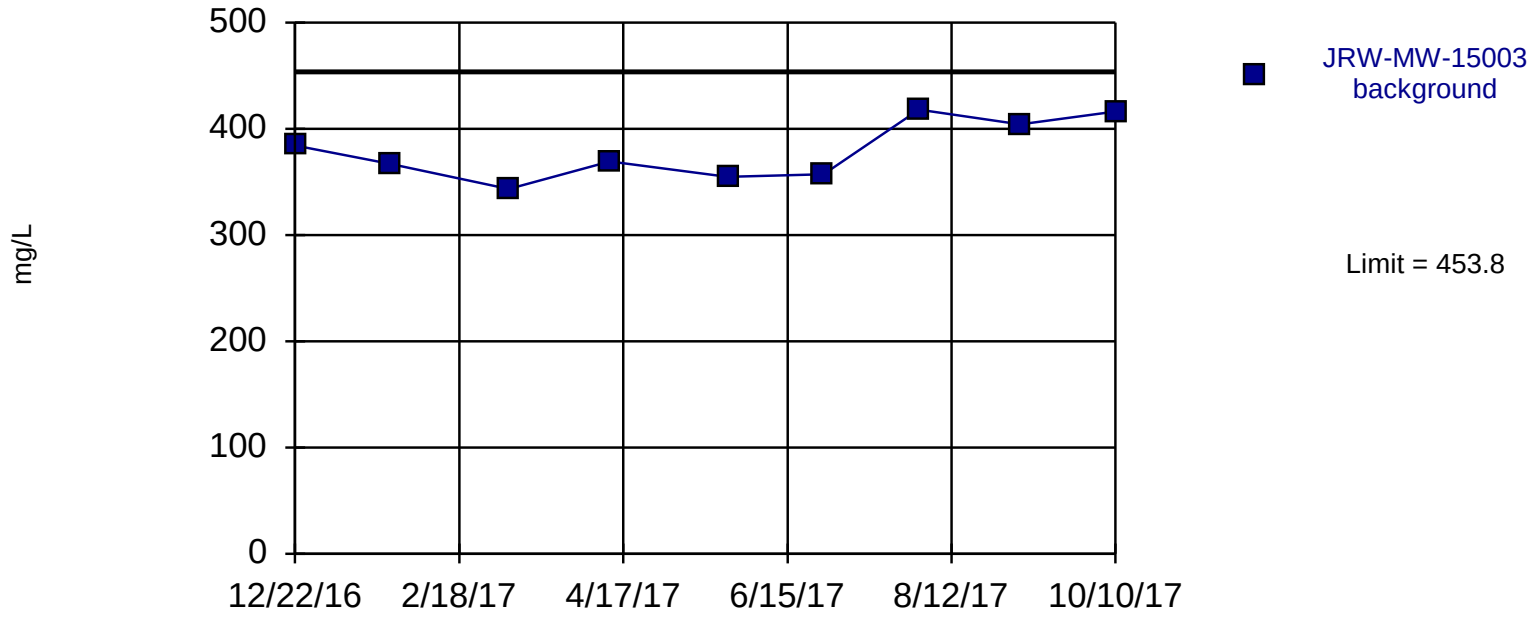
Background Data Summary: Mean=7.842, Std. Dev.=0.1509, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8905, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: pH, Field Analysis Run 12/4/2017 4:41 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15003



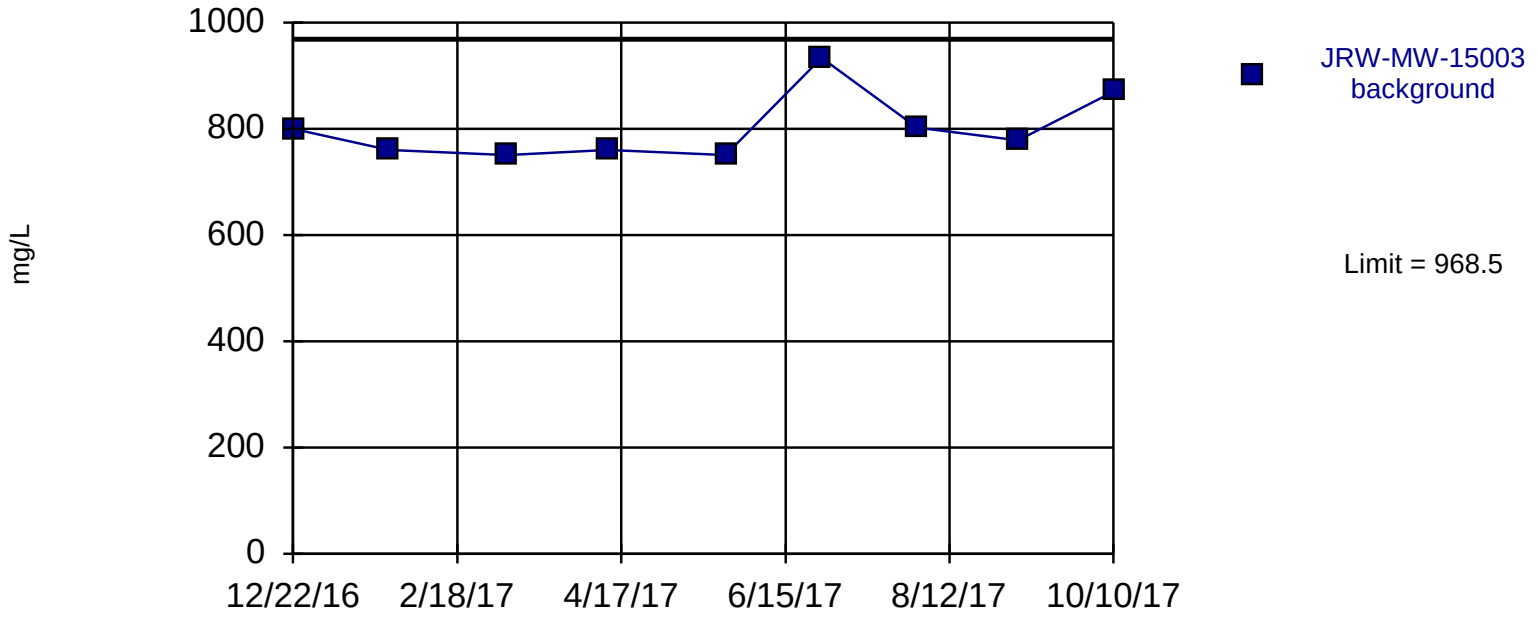
Background Data Summary: Mean=379.2, Std. Dev.=27.7, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9124, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Sulfate Analysis Run 12/4/2017 4:41 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15003



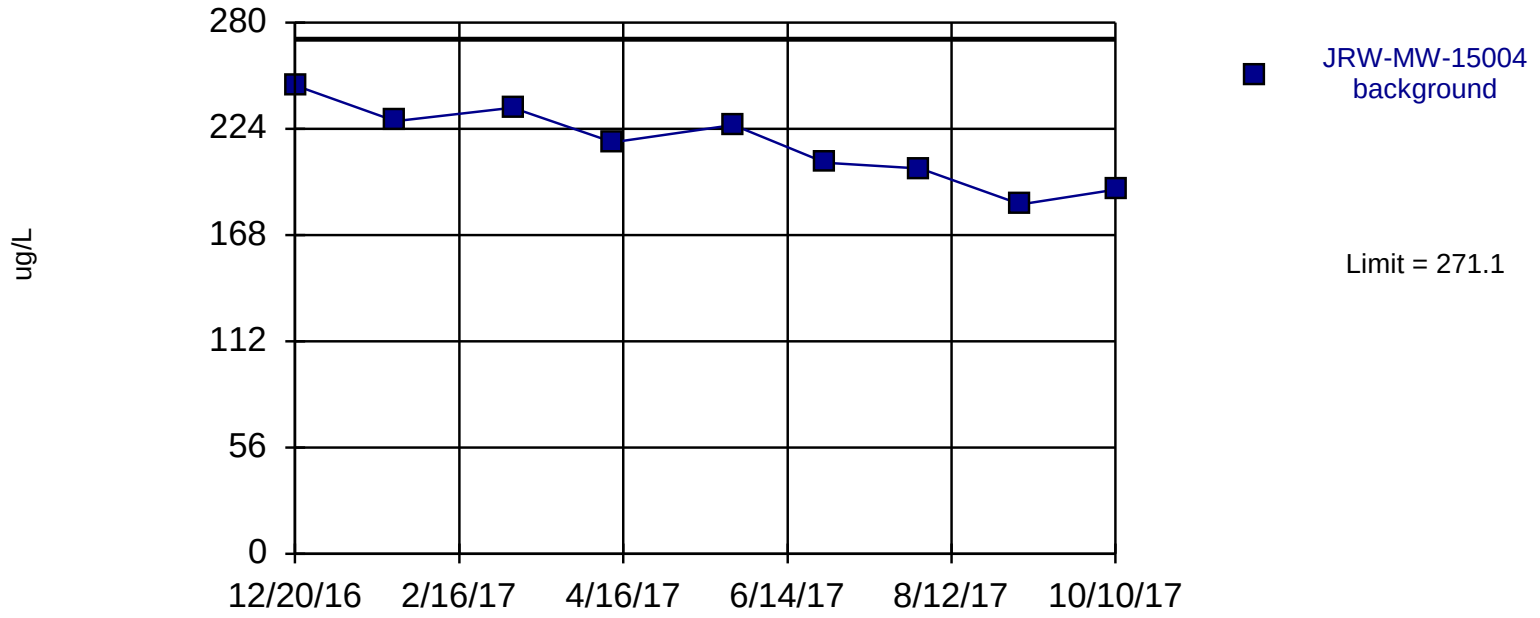
Background Data Summary: Mean=800.3, Std. Dev.=62.53, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8059, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Total Dissolved Solids, Dissolved Analysis Run 12/4/2017 4:42 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15004



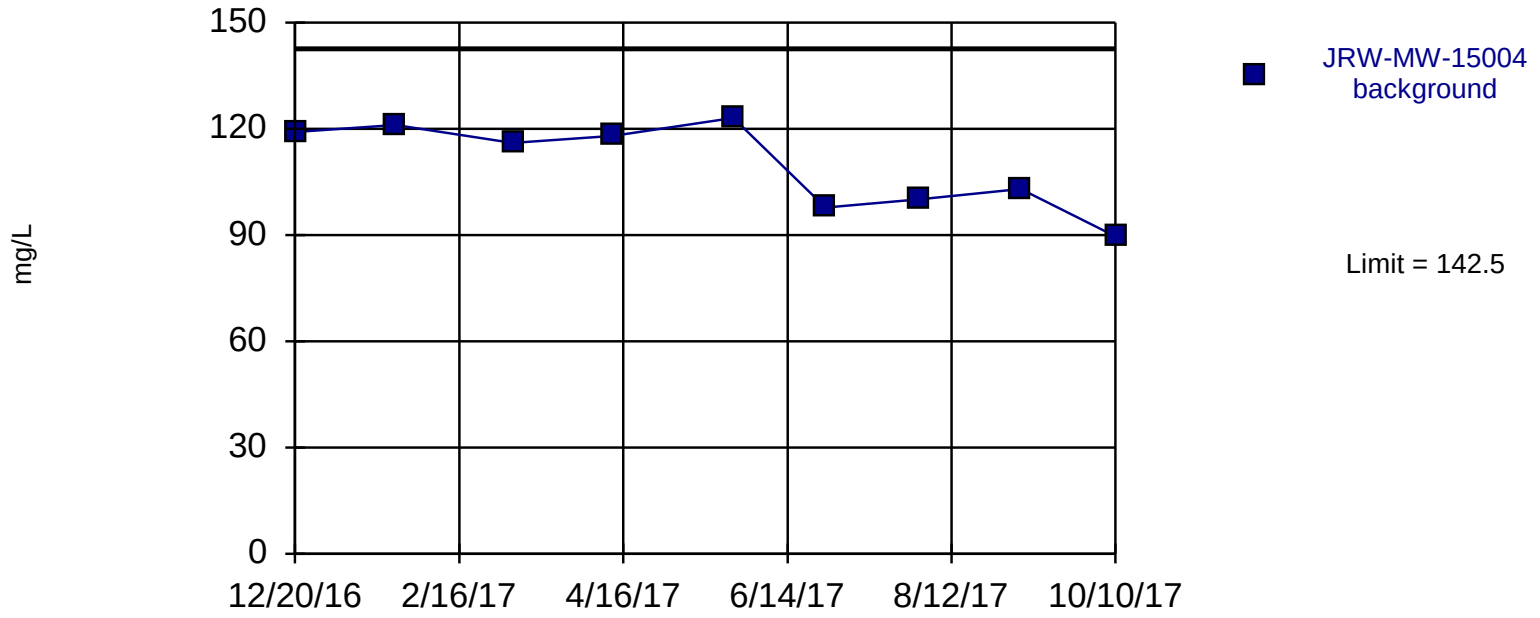
Background Data Summary: Mean=215.3, Std. Dev.=20.71, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9761, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Boron, Total Analysis Run 12/4/2017 4:48 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15004



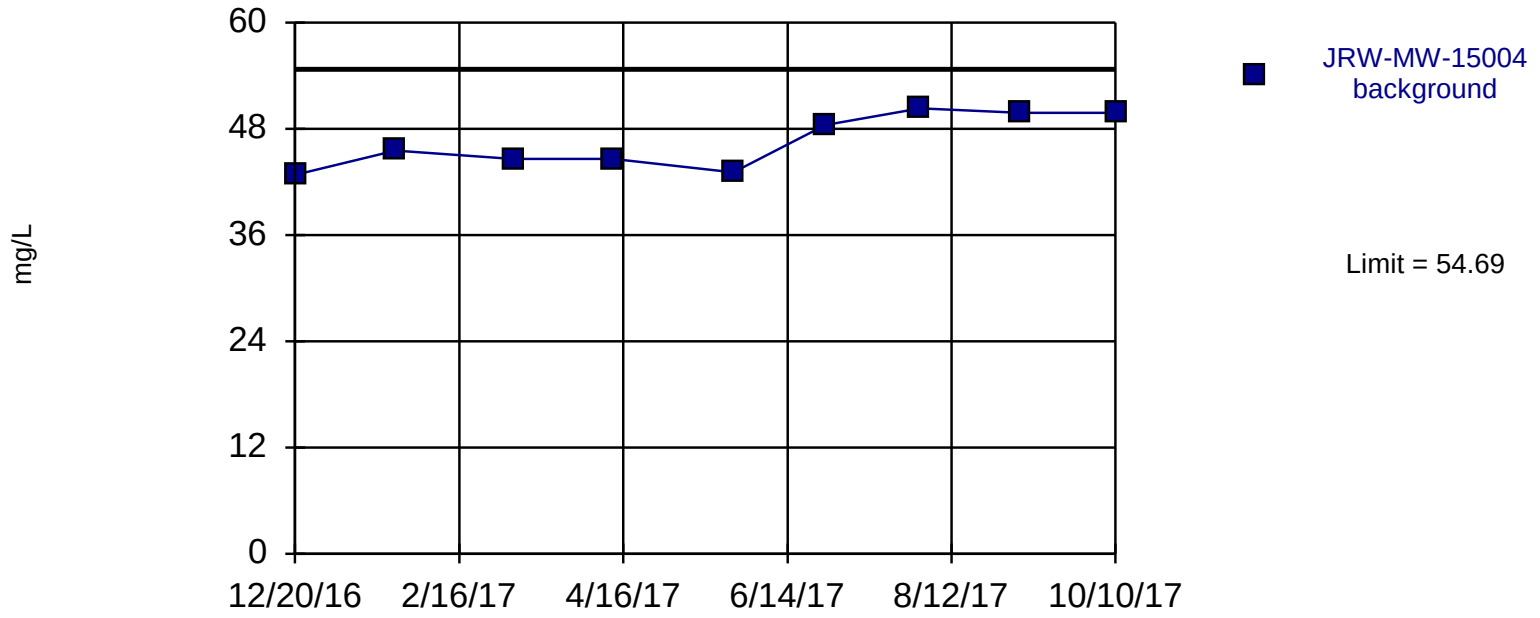
Background Data Summary: Mean=109.7, Std. Dev.=12.18, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8846, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Calcium, Total Analysis Run 12/4/2017 4:47 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15004



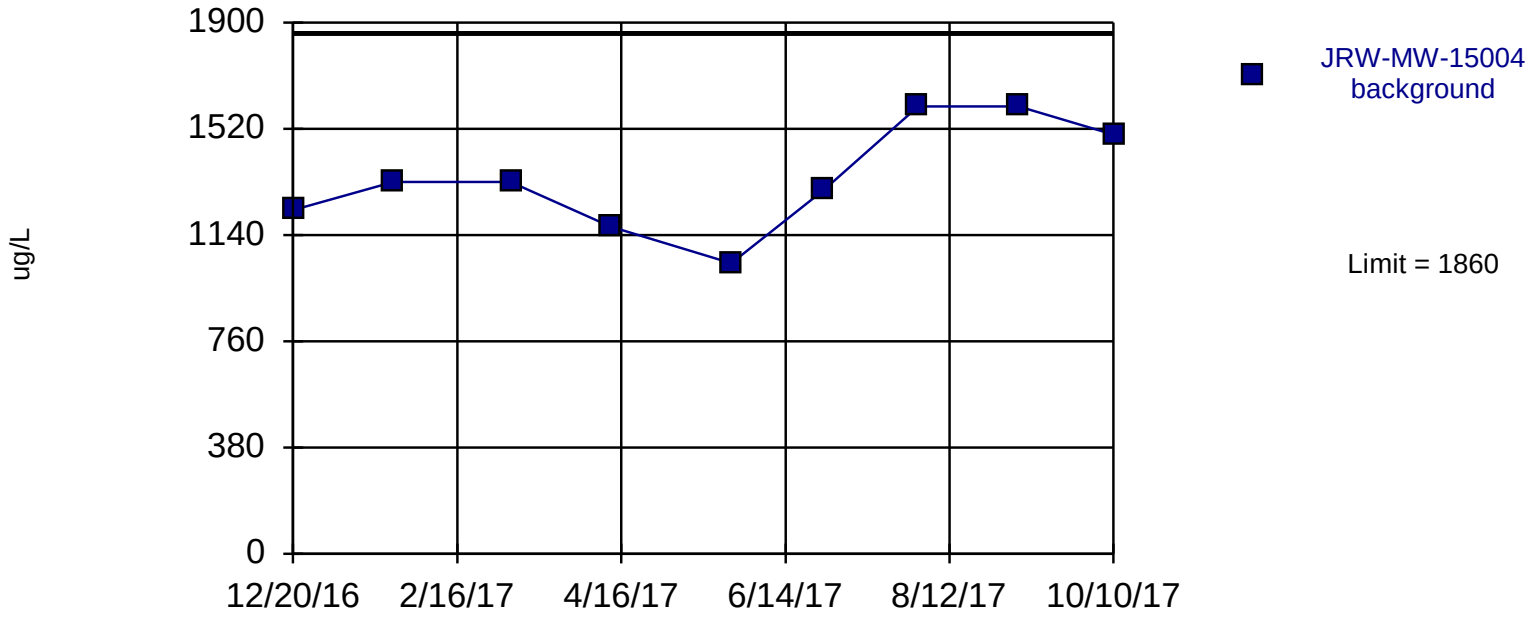
Background Data Summary: Mean=46.54, Std. Dev.=3.027, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8683, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Chloride Analysis Run 12/4/2017 4:47 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15004



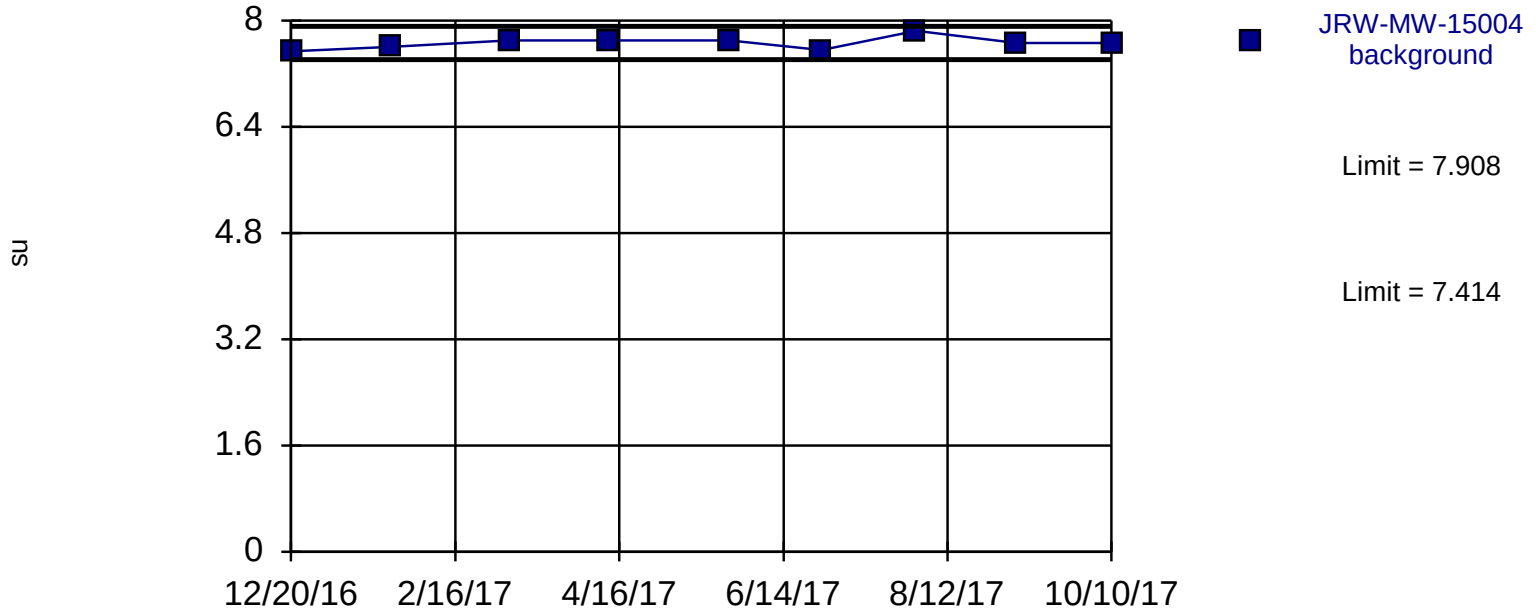
Background Data Summary: Mean=1344, Std. Dev.=191.5, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9408, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Fluoride Analysis Run 12/4/2017 4:46 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15004



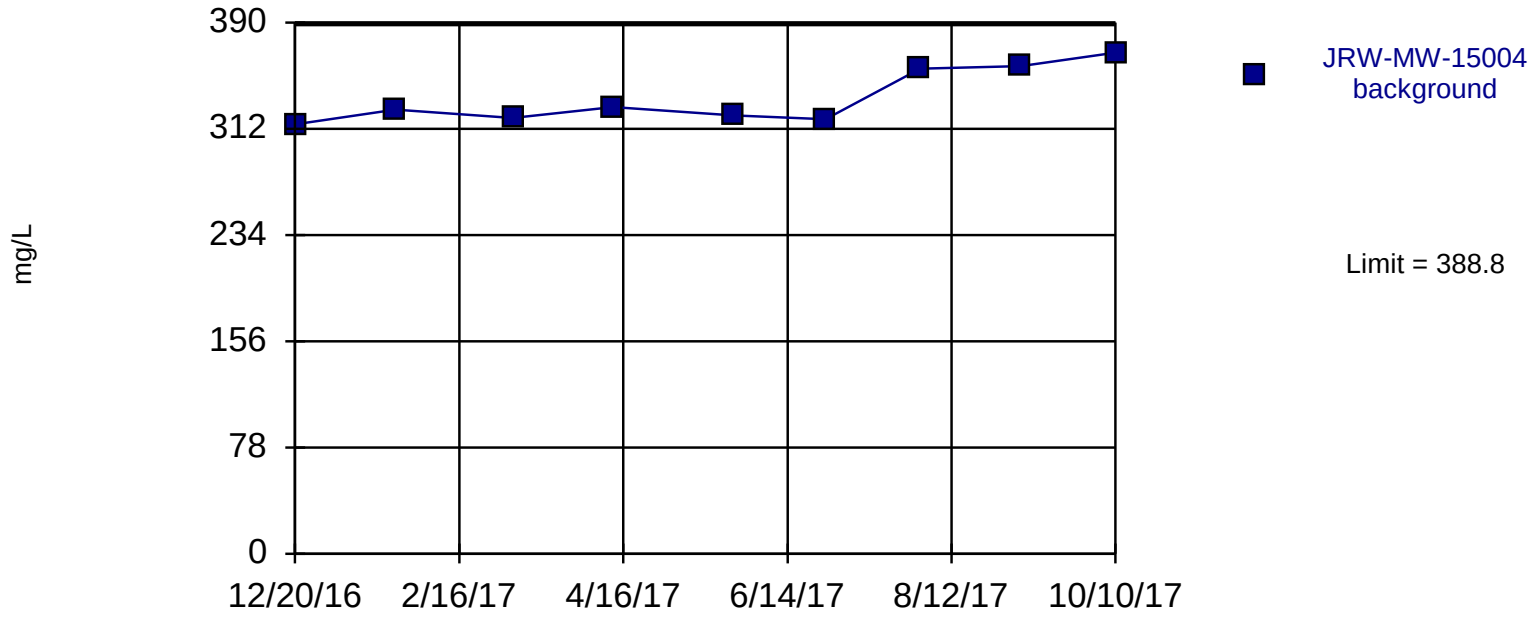
Background Data Summary: Mean=7.661, Std. Dev.=0.09171, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9203, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: pH, Field Analysis Run 12/4/2017 4:46 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15004



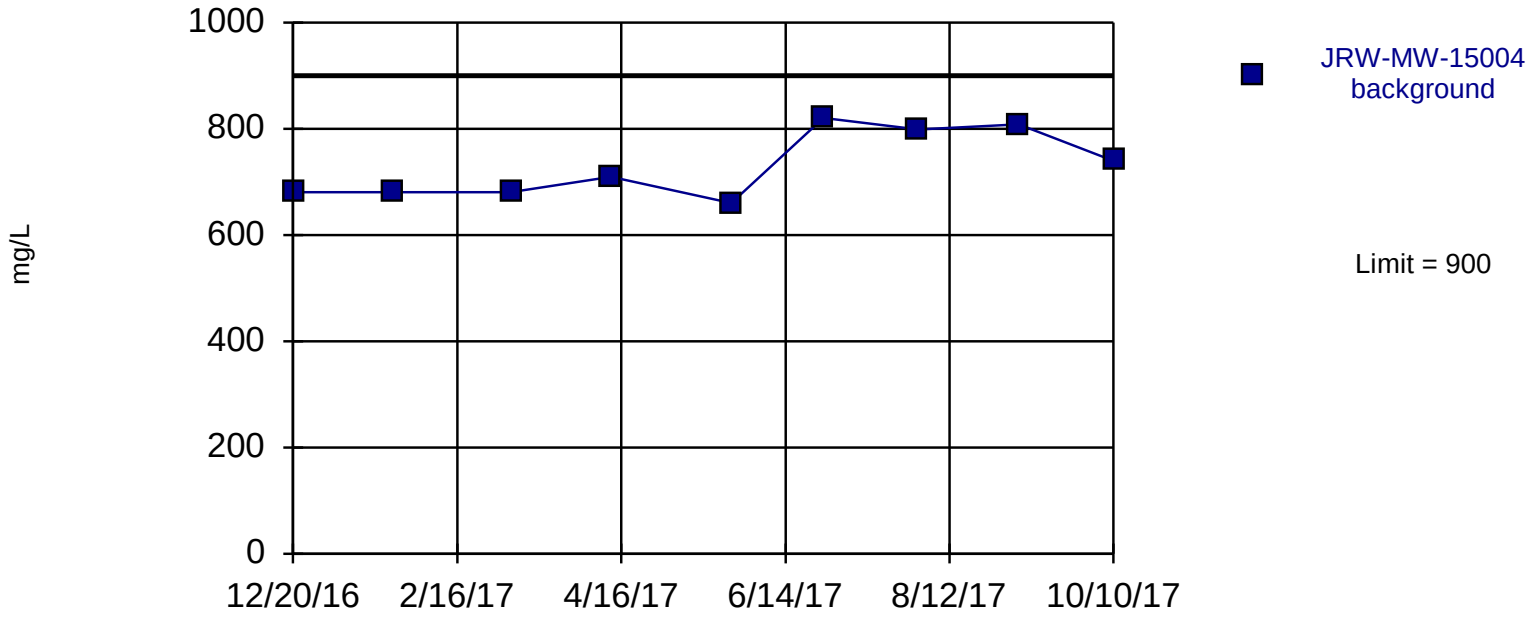
Background Data Summary: Mean=334.7, Std. Dev.=20.12, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8204, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Sulfate Analysis Run 12/4/2017 4:45 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15004



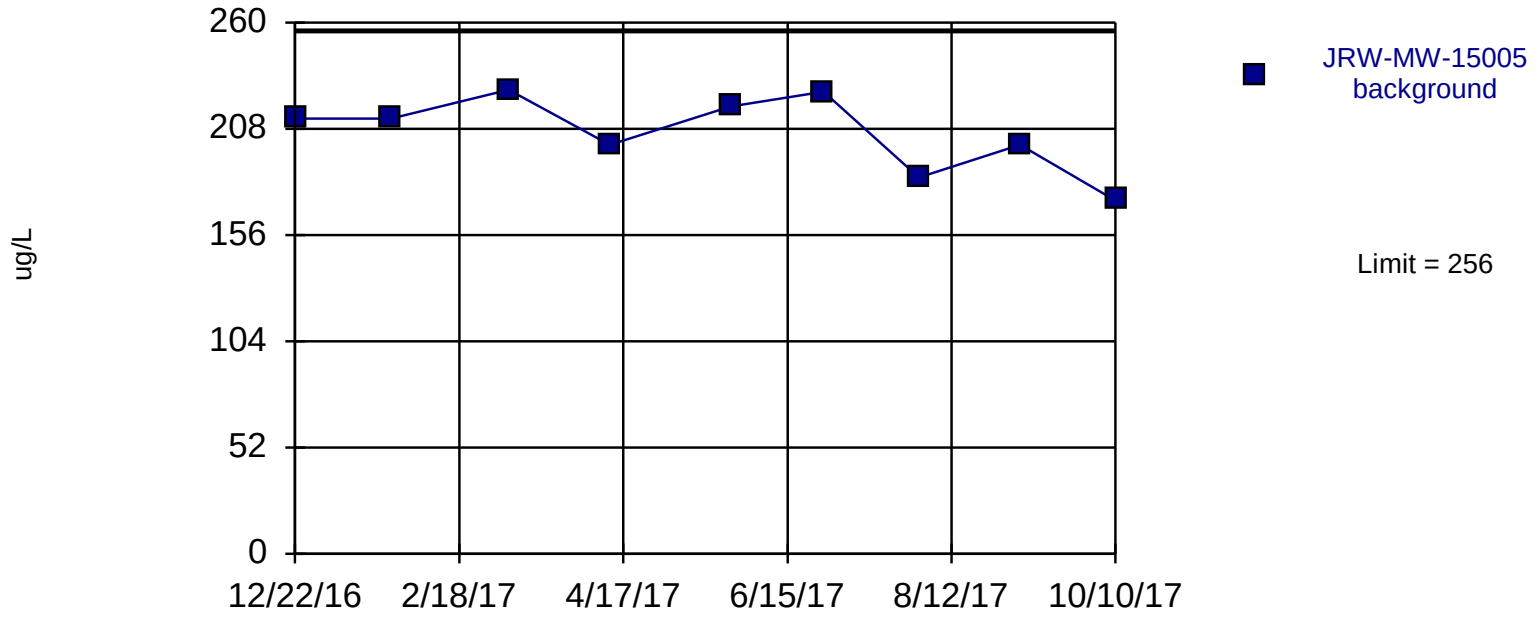
Background Data Summary: Mean=730.7, Std. Dev.=62.95, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8559, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Total Dissolved Solids, Dissolved Analysis Run 12/4/2017 4:45 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15005



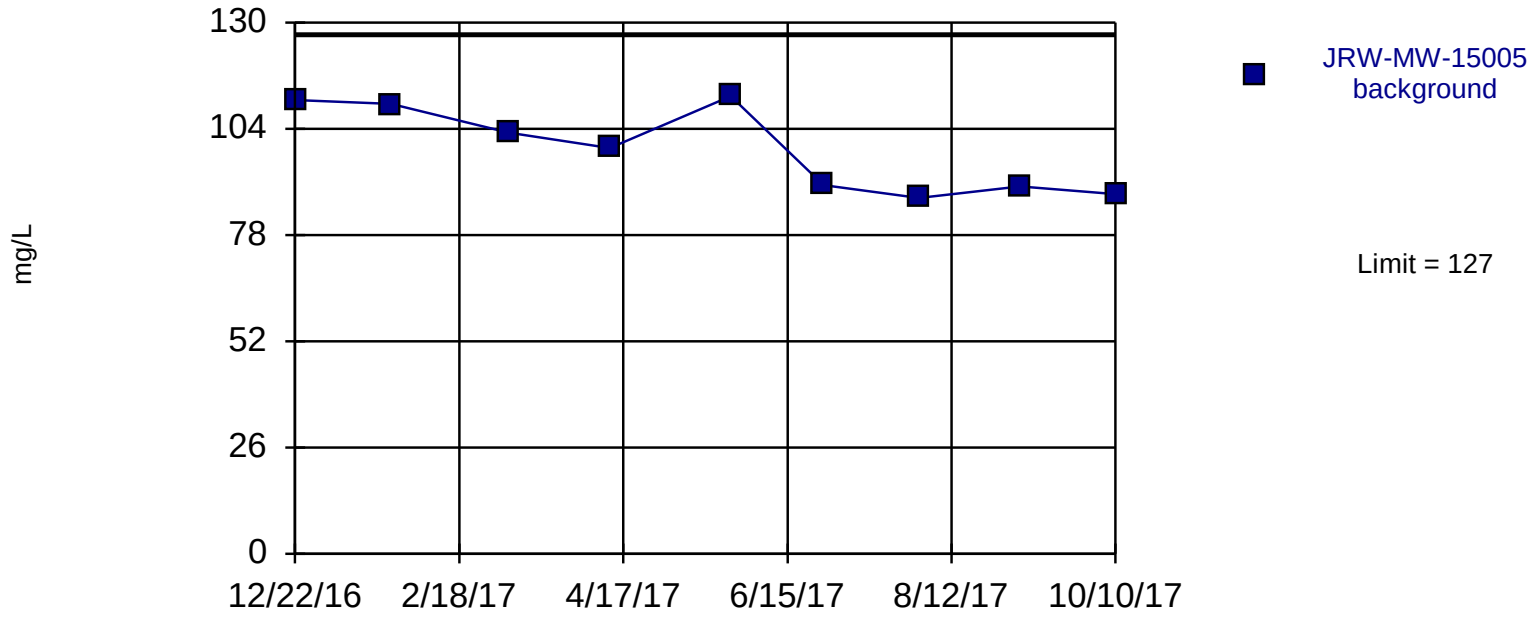
Background Data Summary: Mean=206.1, Std. Dev.=18.55, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9229, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Boron, Total Analysis Run 12/4/2017 4:48 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15005



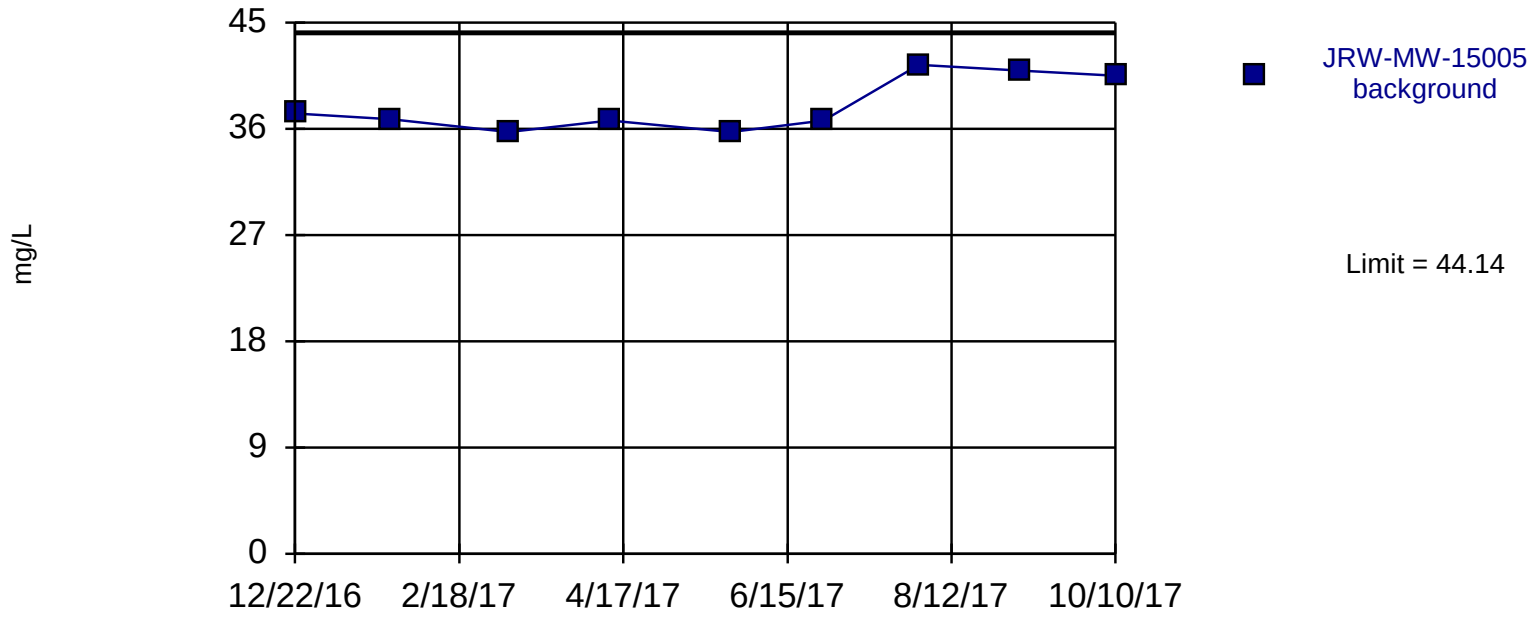
Background Data Summary: Mean=98.94, Std. Dev.=10.45, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8542, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Calcium, Total Analysis Run 12/4/2017 4:49 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15005



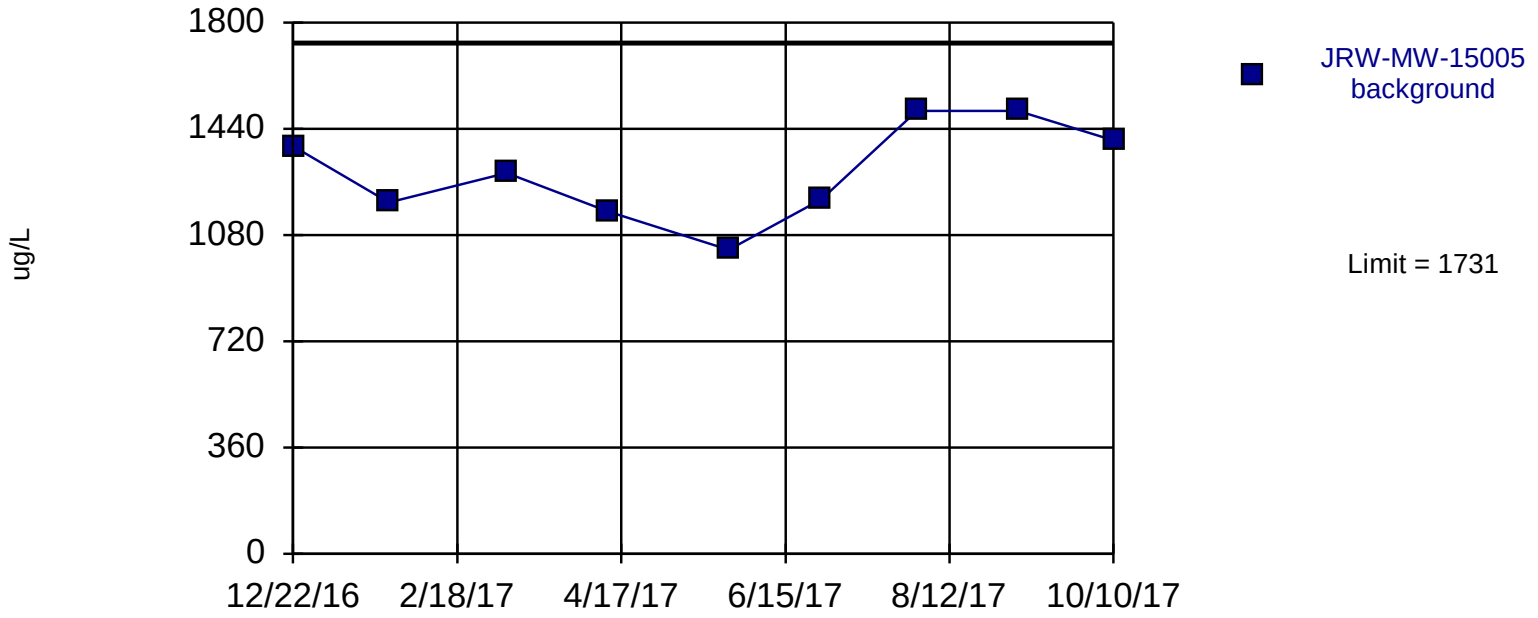
Background Data Summary: Mean=37.97, Std. Dev.=2.294, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8131, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Chloride Analysis Run 12/4/2017 4:49 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15005



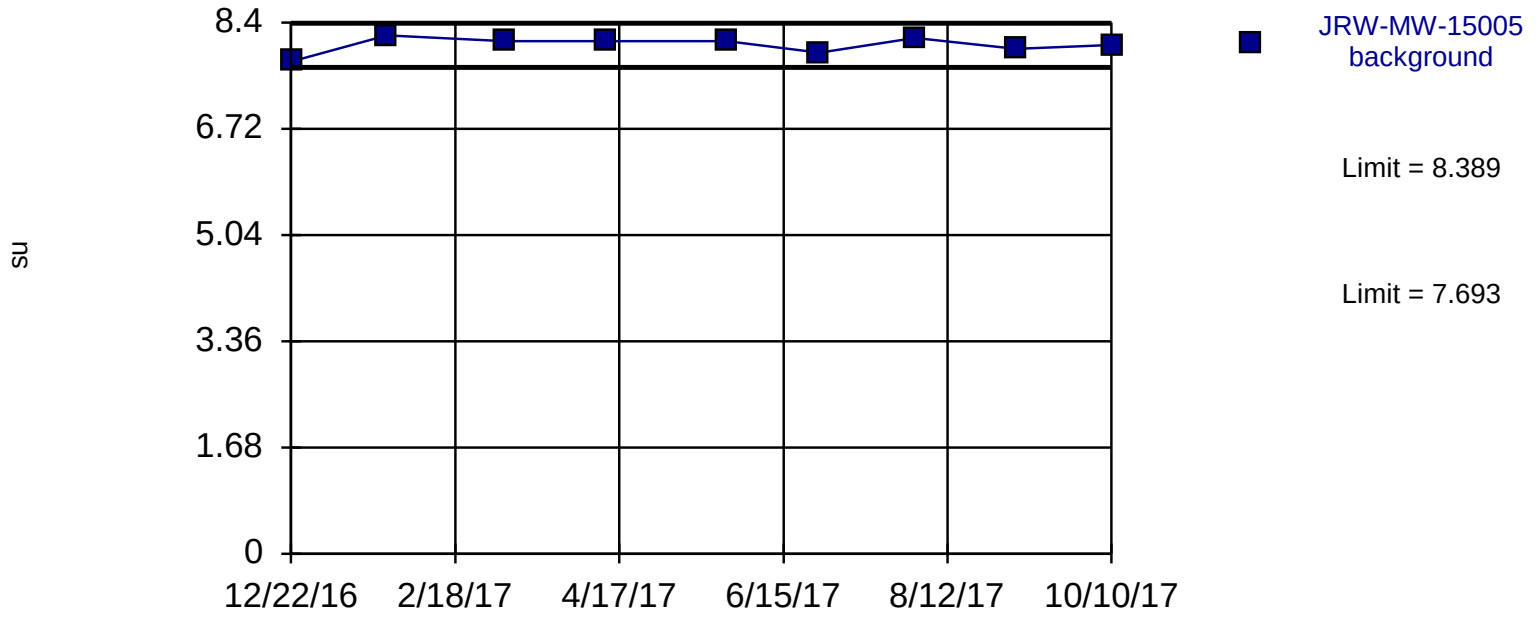
Background Data Summary: Mean=1294, Std. Dev.=162.3, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9417, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Fluoride Analysis Run 12/4/2017 4:50 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15005



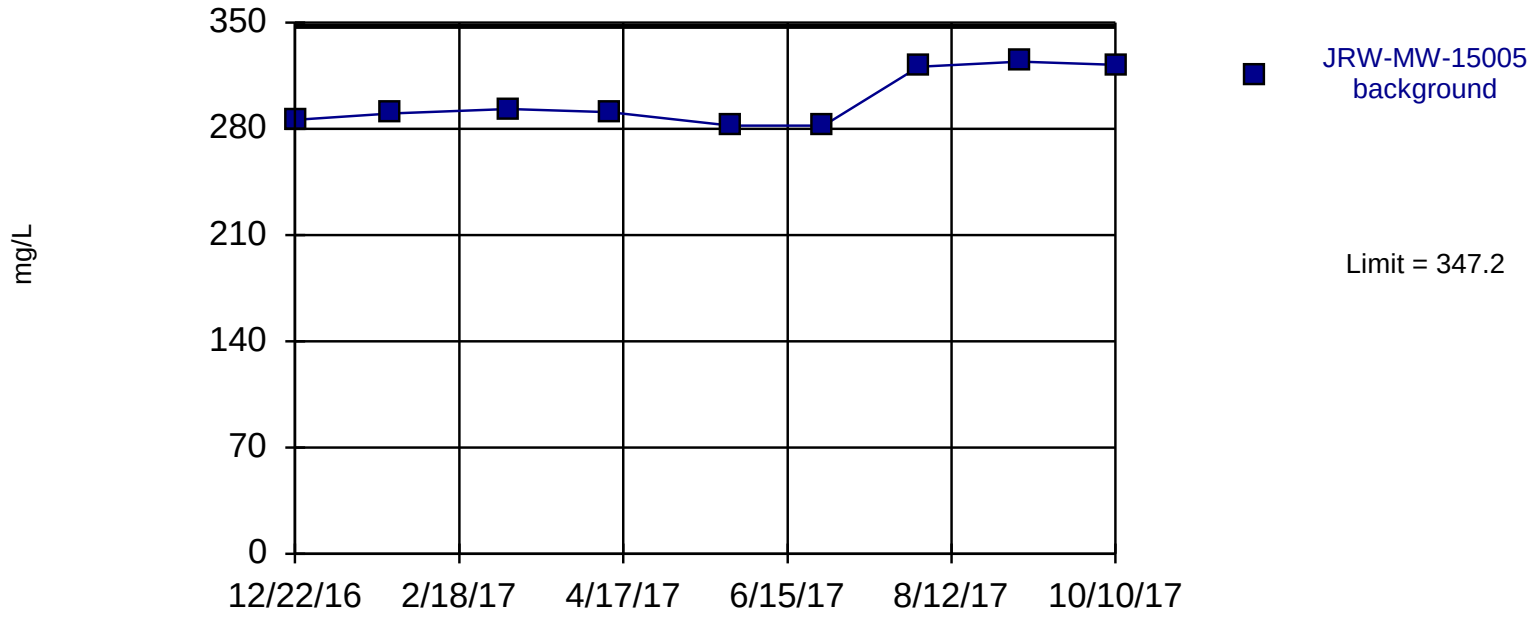
Background Data Summary: Mean=8.041, Std. Dev.=0.1295, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9204, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: pH, Field Analysis Run 12/4/2017 4:50 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15005



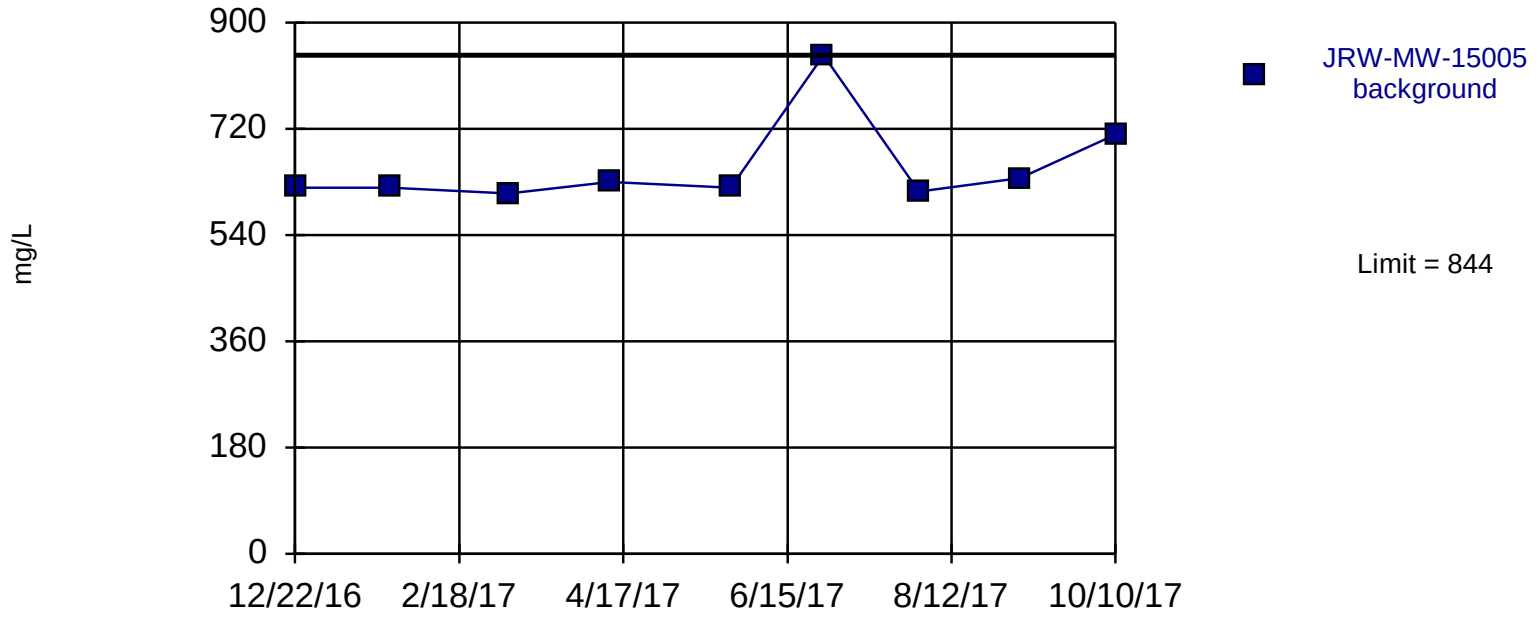
Background Data Summary: Mean=299, Std. Dev.=17.91, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7859, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Sulfate Analysis Run 12/4/2017 4:51 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Non-parametric, JRW-MW-15005



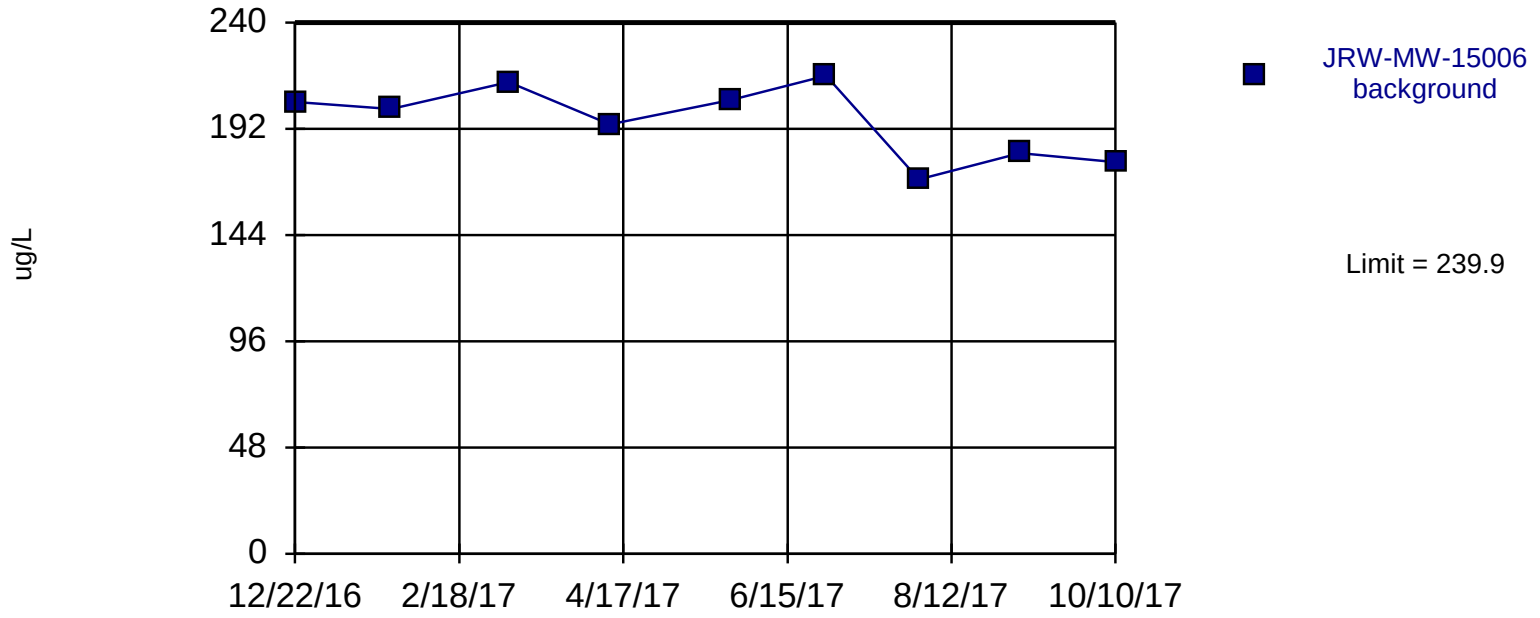
Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 9 background values. Well-constituent pair annual alpha = 0.03586. Individual comparison alpha = 0.01809 (1 of 2). Assumes 1 future value. Insufficient data to test for seasonality: data were not deseasonalized.

Constituent: Total Dissolved Solids, Dissolved Analysis Run 12/4/2017 4:51 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15006



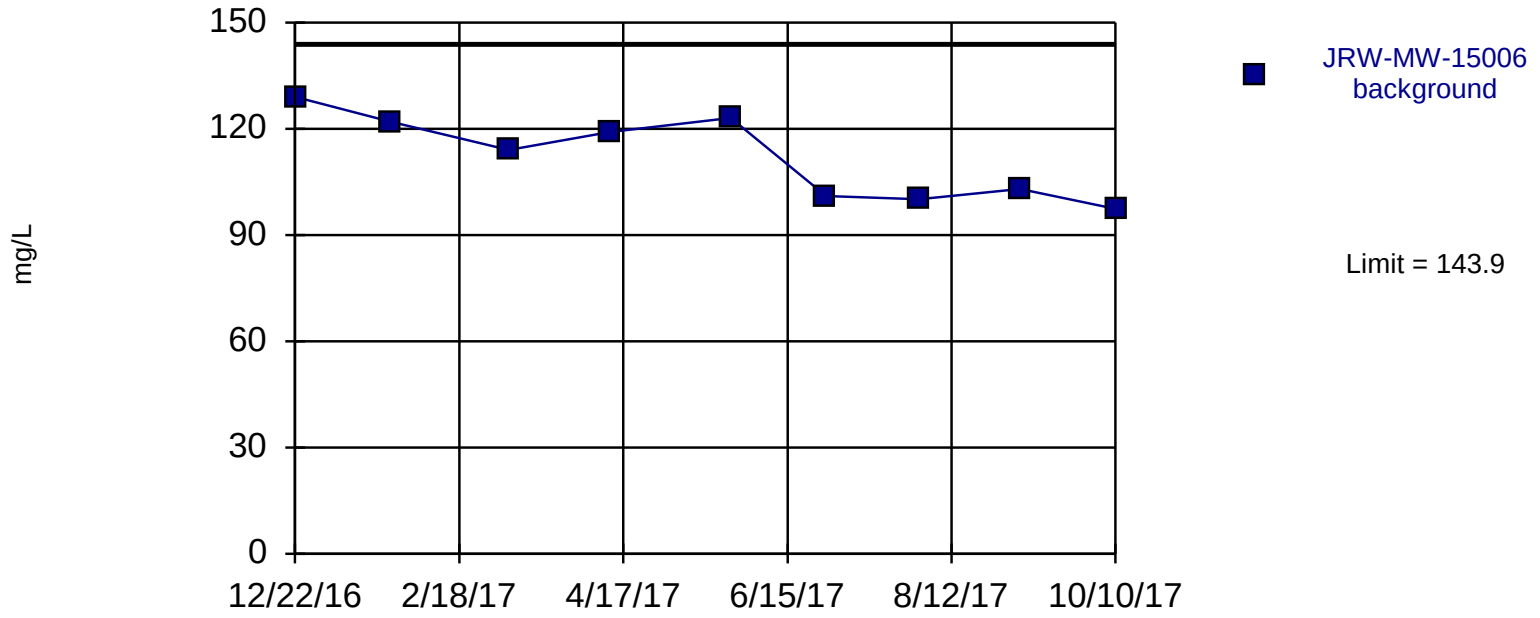
Background Data Summary: Mean=195.6, Std. Dev.=16.49, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9322, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Boron, Total Analysis Run 12/4/2017 4:55 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15006



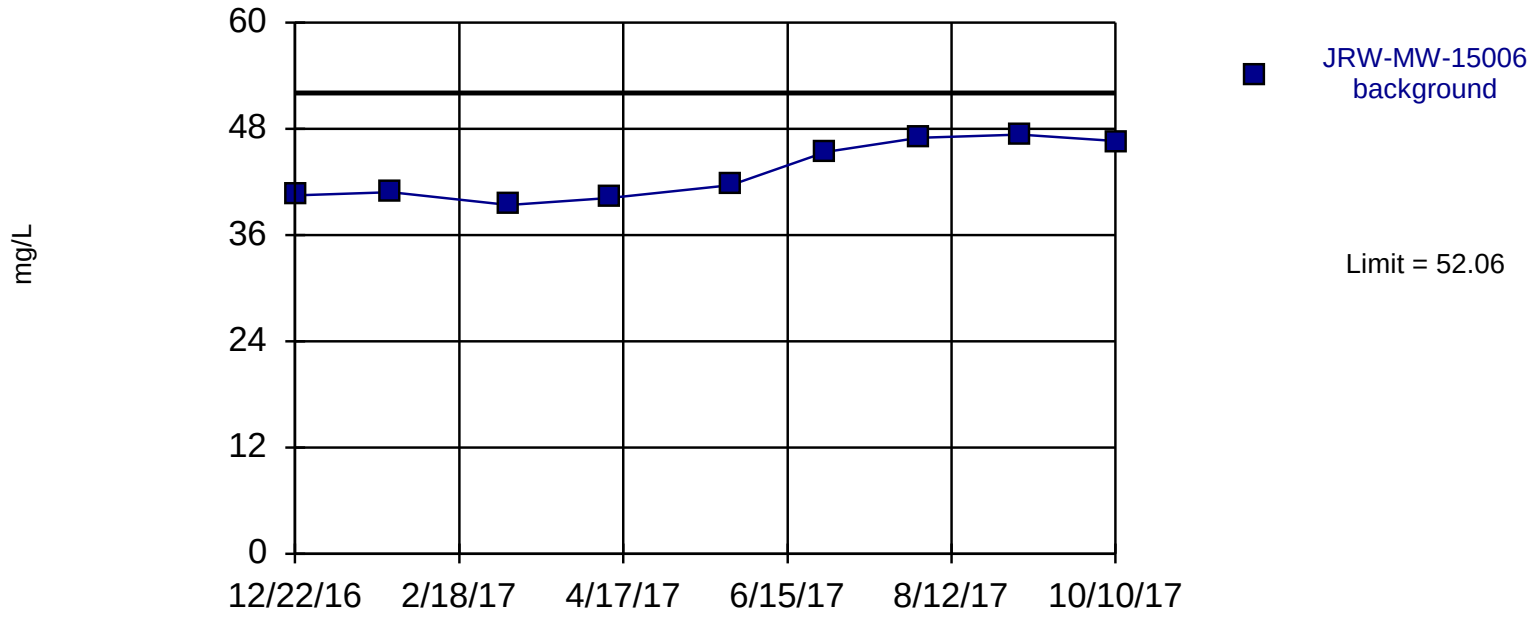
Background Data Summary: Mean=112, Std. Dev.=11.84, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8973, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Calcium, Total Analysis Run 12/4/2017 4:55 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15006



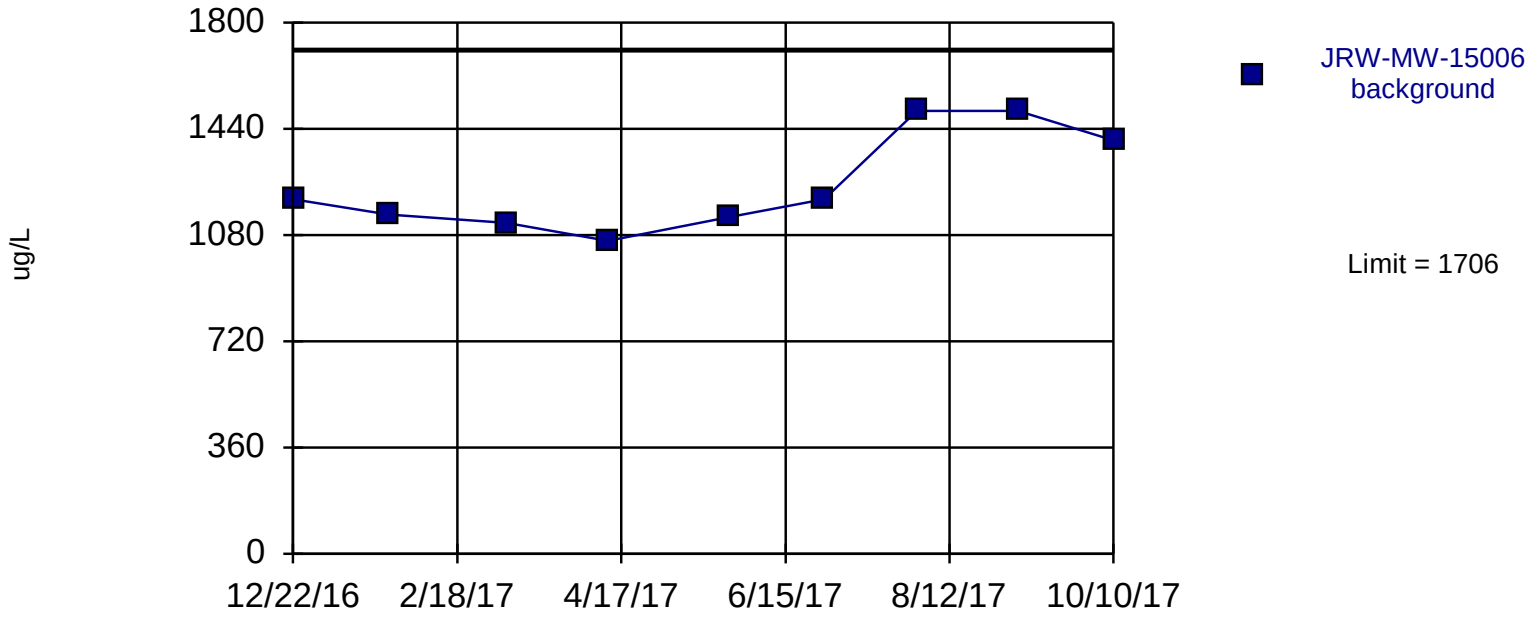
Background Data Summary: Mean=43.2, Std. Dev.=3.292, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.833, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Chloride Analysis Run 12/4/2017 4:54 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15006



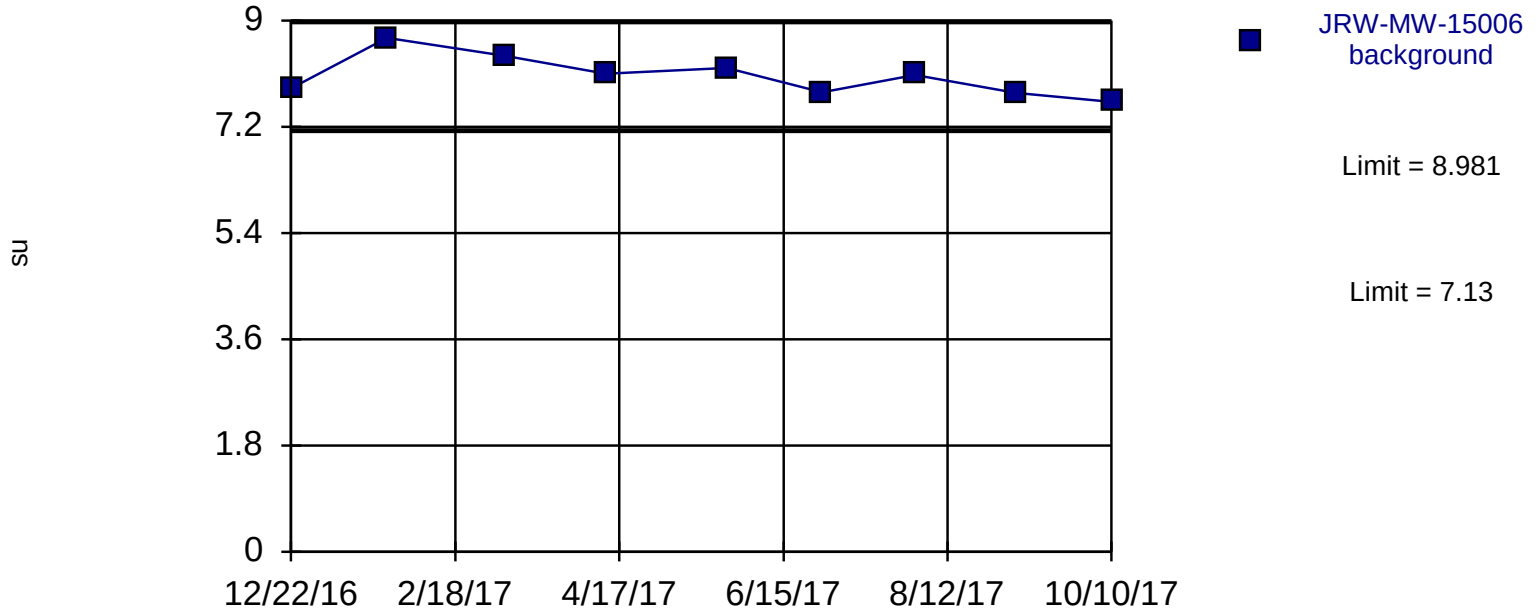
Background Data Summary: Mean=1252, Std. Dev.=168.7, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8448, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Fluoride Analysis Run 12/4/2017 4:54 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15006



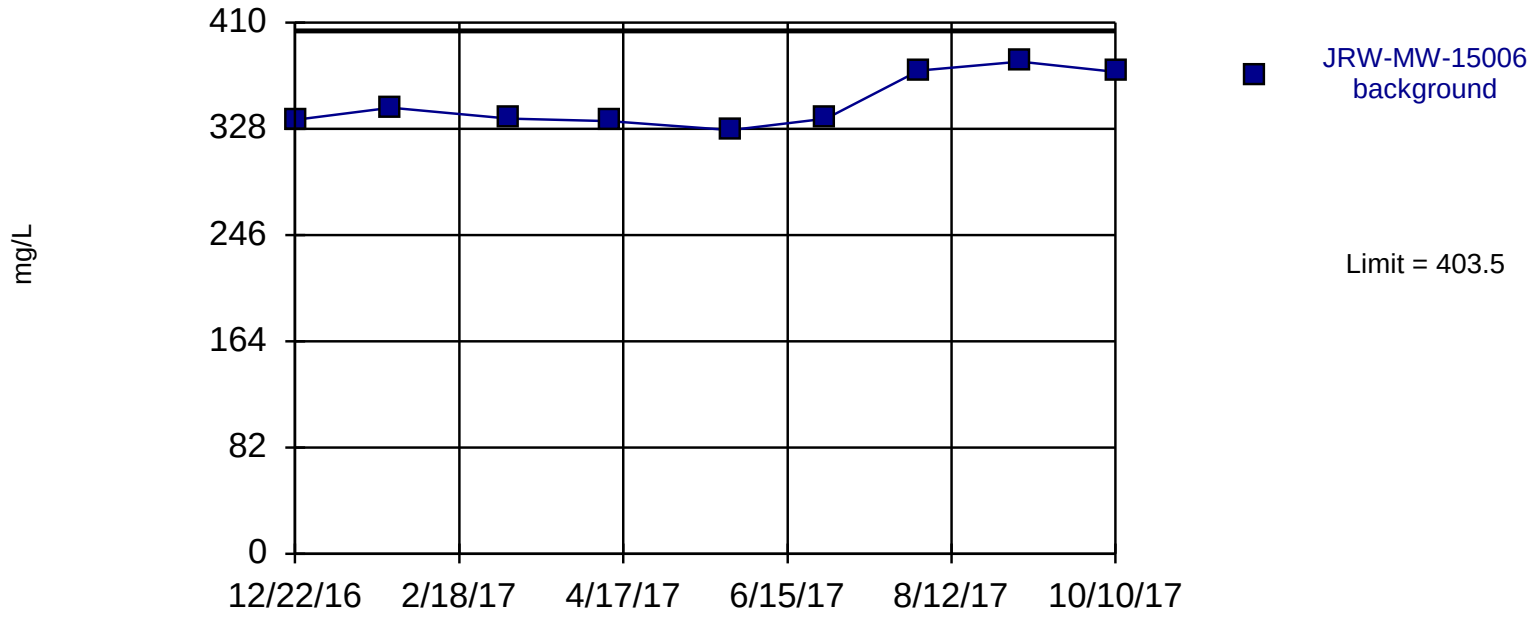
Background Data Summary: Mean=8.056, Std. Dev.=0.344, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9471, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: pH, Field Analysis Run 12/4/2017 4:53 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Parametric, JRW-MW-15006



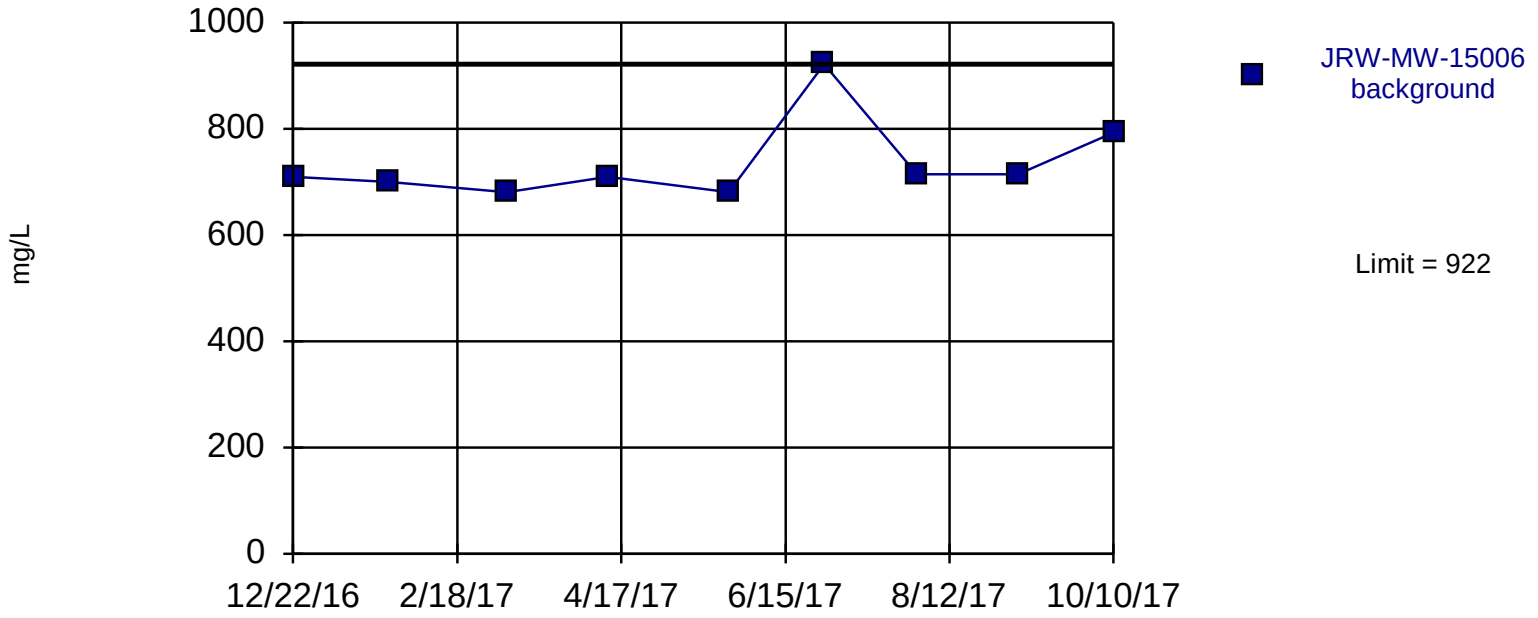
Background Data Summary: Mean=348.6, Std. Dev.=20.41, n=9. Insufficient data to test for seasonality: data were not deseasonalized. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8092, critical = 0.764. Kappa = 2.69 (c=7, w=6, 1 of 2, event alpha = 0.05132). Report alpha = 0.001254. Assumes 1 future value.

Constituent: Sulfate Analysis Run 12/4/2017 4:52 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas

Prediction Limit

Intrawell Non-parametric, JRW-MW-15006



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 9 background values. Well-constituent pair annual alpha = 0.03586. Individual comparison alpha = 0.01809 (1 of 2). Assumes 1 future value. Insufficient data to test for seasonality: data were not deseasonalized.

Constituent: Total Dissolved Solids, Dissolved Analysis Run 12/4/2017 4:52 PM

Client: Consumers Energy Data: JRW_Ponds 1_2_Sanitas